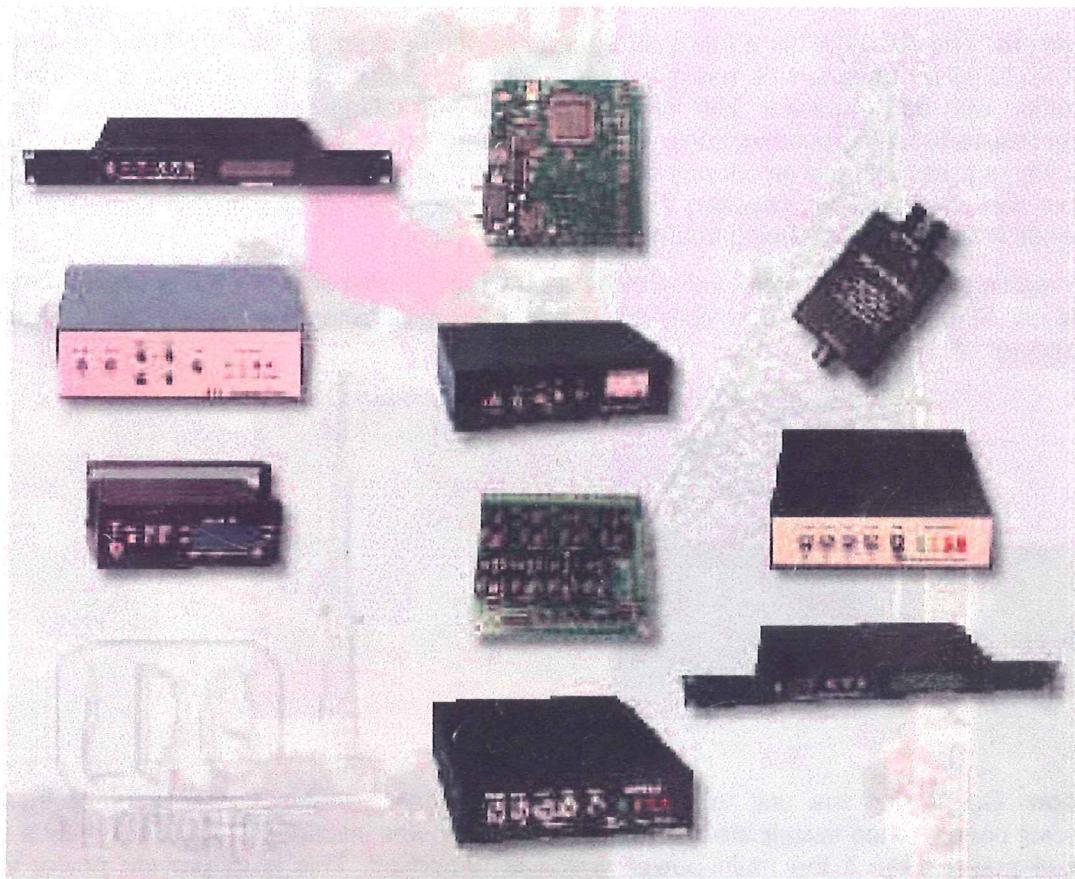


# AT-11 MP

## Automatic Antenna Tuner Kit

### Manual Ver 2.2G



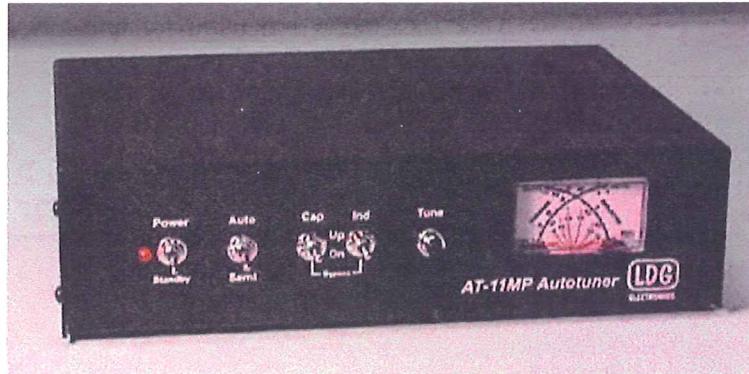
**LDG Electronics**

1445 Parran Road, PO Box 48

St. Leonard MD 20685-2903 USA

Phone: 410-586-2177 Fax: 410-586-8475

[ldg@ldgelectronics.com](mailto:ldg@ldgelectronics.com) [www.ldgelectronics.com](http://www.ldgelectronics.com)



**Introduction:** The AT-11MP is a full-featured auto or semi automatic antenna tuner designed for HF (1.8 to 30 MHz) transceivers using between 5 to 150 watts. The tuner uses a switched "L" configuration with 256 capacitor, 256 inductor and Hi/Lo-Z settings to provide over one hundred and thirty thousand tuning combinations. The tuning range is 0 to 3900 pf and 0 to 20 uH. The "L" network works great with just about any coax fed antenna (dipole, vertical, beam, etc). Users with long wires can install a balun between the tuner and the antenna. Tuning time is between 0.1 and 6.0 seconds with the average being about 2.5 seconds.

A cross reading dual needle meter will provide an indication of SWR while RF is present and DC power is on. Since the power is actually calculated in the processor, the meter does not function with the power off.



**Operation:** Connecting the unit to 12 Volts DC will initialize the microprocessor. Both meter needles will bounce once to indicate the power up process was initiated. The unit will draw a small amount of power even if the main power switch is turned off. This is to provide power to the memory circuits that will allow the last tuned position to be recalled. Placing the Power/Standby switch to the on (up) position will light the red LED and the meter backlighting. The unit is now ready for operation. Turning the unit off by the front panel Power switch places the tuner into Standby. During standby, the tuning section is in bypass. Turning the unit back on will set the tuning section to the settings acquired before being in Standby.

The Auto/Semi switch controls how the tuning process will be evoked. In Auto mode (Auto/Semi toggle switch in Auto), the tuner will seek a 1.5 match (or better) anytime the SWR rises above 3.0. In Semi mode (Auto/Semi toggle switch in Semi), the tuner will seek a match only when the Tune push button is pressed. Both modes require that more than 5 watts of RF power be present. If the Tune button is pressed and there is less than 5 watts of power, both meter needles will bounce once to indicate that there was not enough RF to tune properly.

The Capacitor and Inductor Up and Down switches are used for fine-tuning the inductors and capacitors and can be used in either, Auto or Semi mode. Pressing either of the Up switches will increment that tuning section until it reaches the maximum range. When the maximum value is reached, both meter needles will bounce. Conversely, pressing either of the Down switches will decrement that tuning section until it reaches the minimum range. When the minimum value is reached, both meter needles will bounce.

Besides starting the tuning process, the Tune push button has some other functions. Pressing the Tune button and Cap Up switch at the same time (with no RF applied) will cause the Hi/Lo-Z relay to move to the Hi-Z position. The forward power meter needle will bounce to indicate the change. Pressing the Tune button and Cap Down switch at the same time (with no RF present) will cause the Hi/Lo-Z relay to move to the Lo-Z position. The reverse power meter needle will bounce to indicate the change. The user may manually operate the Hi/Lo-Z relay, but the processor will overwrite the setting when the tune algorithm is invoked.

Pressing both Cap and Ind Down switches at the same time will reset the processor and place all relays in a bypass position.

Pressing the Tune push button and the Ind Up button will turn on the audio feedback feature (if installed). Pressing the Tune push button and the Ind Down button will turn off the audio. When an eight-ohm speaker is connected to J4, an LM386 amplifier is installed at U4 and audio is turned on, audio feedback will provide an indication of the SWR level. The feedback is a series of one to five beeps where one beep is an indication of SWR below 1.5, two indicates SWR between 1.5 and 2.0, three indicates SWR between 2.0 and 2.5, four indicates SWR between 2.5 and 3.0, and five indicates SWR above 3.



The back panel has SO-239s for connecting UHF type connectors to the antenna and transmitter. A coaxial power jack with center positive is used to provide DC power to the tuner. The jack mates with a 5.5 OD, 2.5 ID coaxial power plug. Between 11 and 15 volts DC can be used. The power supply must be able to provide up to 0.5 amps.

On the back panel is the Radio Interface. This works with radios that are compatible with the Icom AH-4 and Alinco EDX-2. When connected to a compatible radio, it enables the "Tune" button on the radio. Pressing the Tune button on the radio will cause the radio to temporarily switch modes to CW, transmit 10 watts and start the AT-11MP tuning cycle. Once the tuning cycle is complete the AT-11MP will signal the radio that the tuning is complete and the radio will return to the previous mode and power settings. Note that only control signals are used in the radio interface. Power and ground must still be provided through the AT-11 MP coaxial power jack. Also be sure to power the AT-11MP on first, then the radio to allow the radio to know that a remote tuner is present.

Also on the back panel is the connection to the AT-11 remote unit. The remote allows for control of most of the front panel functions. The remote consists of the Auto/Semi switch, the Cap and Ind up and down switches, the Tune push button, the green 1.5 swr LED and the red Tuning in progress LED. The remote connects to the AT-11MP via a 9-conductor shielded cable with female DB-9 connectors on each end. The remote is supplied with a 10-foot cable. The user may provide other cable lengths. Cable lengths of up to 100 feet have been reported to work with no problems.

When the remote is connected to the AT-11MP, most front panel functions will work in parallel. For example, the user may start the tuning cycle by pressing the Tune push button on the front panel of the AT-11MP or the remote panel. In the case of the auto/semi switch, if either switch is in the auto position, the tuner will be in the auto mode.

**Operational Notes:** Most tuning situations with the AT-11MP is very straightforward. With the tuner in the Semi mode, simply transmit a continuous carrier and momentarily press the tune button. The tuner will find the best match and stop tuning.

Note that even though the tuner can handle 150 watts, it must be tuned with reduced power. If your radio has an automatic "foldback" circuit, you will not have to lower the power manually. A foldback circuit will lower the power of the radio whenever the SWR is high. Typically, most solid state radios have foldback circuits. Tube radios and most Ten-Tec radios do not lower the power when the SWR is high. In these cases, the power should be lowered to approximately 25 watts before tuning is started.

In either mode (Auto or Semi), if power (either RF or +12) is removed after the tuning cycle starts, but before it finishes, the tuning will stop. The resultant tune will be undetermined; it may or may not be a match.

In some extreme tuning cases, the power needle may waver while transmitting a continuous carrier. This indicates that the tuner is near the tuning limits. You may be able to find a slightly better tune with the manual adjustment toggle switches. Sometimes reducing power will provide a better reading.

If reducing the RF power improves performance of the tuner, there may be RF getting into the tuner through the DC power or ground system. Placing RF chokes on the DC line or RF line may help reduce the RF interference. This problem may show up more when using the AT-11 remote unit or a radio interface. Again, RF chokes can be placed on the line to reduce interference.

In the presence RF getting into the tuner, it is possible that the processor may lock up. In this case the red LED and meter light will be on, but there may be little or no control. By removing, then re-inserting the power plug on the rear panel, the processor will be reset and operation should be returned to normal. If the problem persists, take corrective measures as mentioned above to remove the RF from getting into the tuner.

**Performance:** The actual performance from the small package will surprise you. It really tunes a lot of antennas to a lot of places! Here are some of the actual test results.

A 40-meter dipole (at 30 feet) would tune just about anywhere from 3.1 to 30 MHz! We had some problems at 19 and 28 MHz finding a 1.5 match. The AT-11MP usually found a 2.0, and then we had to use the manual switches to get below 1.5.

Next, an Antron-99 (at 40 feet) would again tune just about anywhere from 30 to 7 MHz. The auto mode worked great the whole time. We just dialed down the band and the AT-11MP would kick in whenever the SWR went over 3.0.

Then we tried out the unit on a 3-element tri-band (20,15,10) at 70 feet. It would tune any of the ham bands (including WARC) except 160 and 80. We had some problems finding a match around 27.200 MHz, but got around it by moving to 27.000, letting the AT-11MP find a match, then moving back to 27.200.

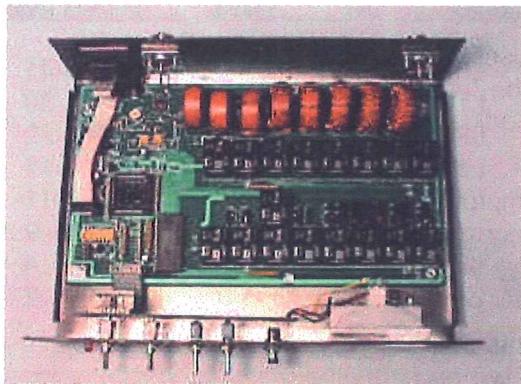
We've tried many other antennas with similar good results. There may be a place or two that your antenna (dipole, inverted-Vee, vertical, beam, etc.) won't tune. Also, the farther away from resonance you try to tune, the harder time the tuner will have. The AT-11MP will tune a 10 meter vertical to 80 meters, but your performance will not be that great (you can't get something for nothing).

For mobile operation, we find that a base or mid-loaded whip such as a Hamstick, Hamwhip, or Hustler Resonator the tuner will find a match for the band that the antenna is cut for, plus one band and minus one band. For example, a 20 meter antenna will usually tune 40, 20 and 15 meters (WARC bands included). A 102" CB whip will usually not tune anything except 10 and 15 meters.

We have received many reports of use with other antennas from our customers. Our web site has many actual comments about individual performance.

For balanced lines and random wires, you may get better performance by using a 4 to 1 or 6 to 1 balun between the antenna and tuner. The optional RBA-1 4 to 1 balun is a good choice for an external balun to match balanced lines or random wires.

The SWR bandwidth (usable bandwidth of 1.5 SWR without retuning) averaged about 200 kHz. Not surprisingly, the bandwidth was smaller on the lower frequencies (about 75 kHz on 80 meters) and larger on higher frequencies (about 400 kHz on 10). Insertion loss was highest on 10 meters at about 0.1 db.



**Service:** If you have a problem with your LDG Product (kit or assembled unit), please call or e-mail us and we will gladly try to resolve the problem. If we can identify the suspect component, and you are able to install it, we will ship the component directly to you at no charge for warranty repairs, cost plus shipping for non-warranty repairs.

If return for repair is needed, wrap and package your unit to protect from damage. Include a note (or print our on-line return form) with your name, address, phone number, e-mail, and a brief description of the problem. Ship the unit to us prepaid and insured for the retail value. (LDG Electronics Inc. is not responsible for units lost or damaged in shipping).

For non-warranty repairs, the average repair cost is \$50.00. This covers most small parts. We will contact you with the cost for repairing your return. The customer is responsible for paying return shipping on non-warranty repairs. We will turn the unit around as quickly as we can. Repairs can take up to 6 weeks.

Future upgrades will be available for about \$10 with 68HC11 chip trade in. Upgrade information is usually available on our web site.

**Feedback:** We encourage everyone who uses the AT-11MP to drop us a note (card, letter or e-mail) to let us know how well it works for you. We're also always on the lookout for photographs of the AT-11MP in use. We frequently place pictures that we receive into the LDG Newsletter or on our Web site ([www.ldgelectronics.com](http://www.ldgelectronics.com)).

**Building the Kit:** Before getting the soldering iron out, go through all of the parts in the kit and familiarize yourself with each component and its placement. Most of the parts are common, but a few of them may be new to some builders. There are just over 100 parts and 300 solder connections, so take your time.

You will first wind the inductors on the eight T-106 toroids (they are red and just over an inch in diameter). Take care not to drop them; they will break. Using the #18 wire provided, you will wind eight of them. Save the left over wire for later. It is used for connections on the SO-239s.

Refer to picture for winding methods, and to the winding chart for lengths of wire and number of turns. For consistency, we count one turn when the wire passes through the center of the toroid.

Winding Chart

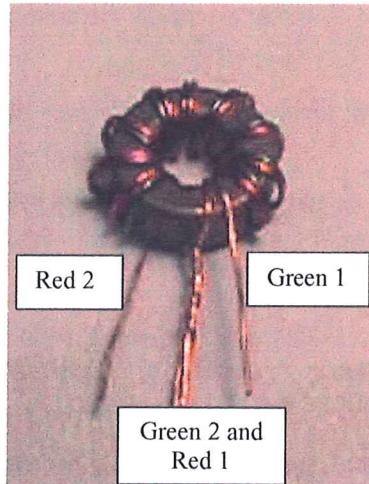
Inductor	uH	Turns	Inches needed
L8	10.0	26	41
L7	5.0	18	30
L6	2.5	13	22
L5	1.25	9	17
L4	.59	6	11
L3	.39	4	9
L2	.22	2 bottom	4
L1	.11	1 bottom	2

Example L2

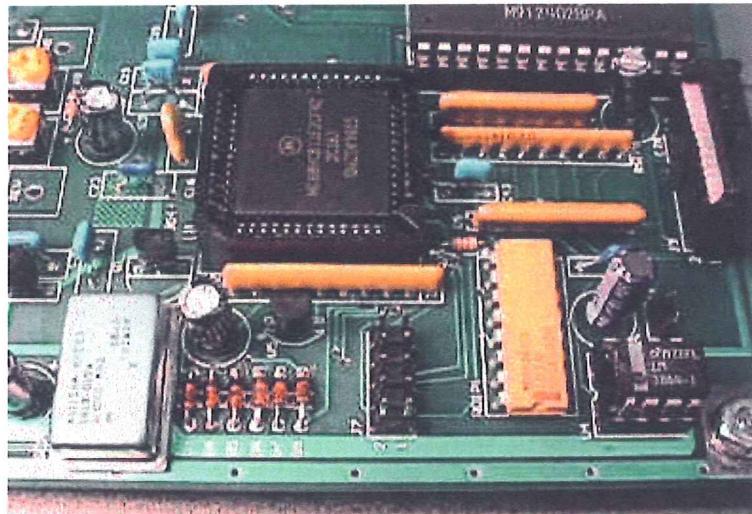
Example L3-L8  
(this is L4)



- \_\_\_ Using the winding chart, cut a 42-inch length of wire for L8. Hold about one inch in one hand with the toroid and wind the wire around the toroid (as shown in picture on previous page) for 26 turns. You should space the wires evenly around the toroid as you wind them. Once you have completed winding L8, trim both ends to one half inch and scrape away the insulation from them. Do not install L8 until later.
- \_\_\_ In a similar manner, wind L7 through L3, using the winding chart for lengths and turns. Trim and scrape thermaleze coating from #18 wire. The thermaleze wire cannot be soldered unless the thermaleze coating is scraped off.
- \_\_\_ Wind L2 as shown in the picture on previous page.
- \_\_\_ Wind L1 by just passing the wire through the toroid and bending it down on each side.
- \_\_\_ Wind T1 with 10 turns using the red and green #28 gauge wire. T1 is the small, black toroid just under one half inch in diameter. See the picture below and wind this in bifilar fashion by using two lengths of wire and winding them at the same time. It doesn't matter if you twist them or wind them side-by-side. Note: you must wind this in the direction shown in the picture below.
- \_\_\_ Now scrape the insulation from the ends of all four wires. Connect the green 2 wire to the red 1 wire and twist together. You will now have three leads: the red wire on the left, the twisted pair, and the green wire on the right. Do not install T1 yet.

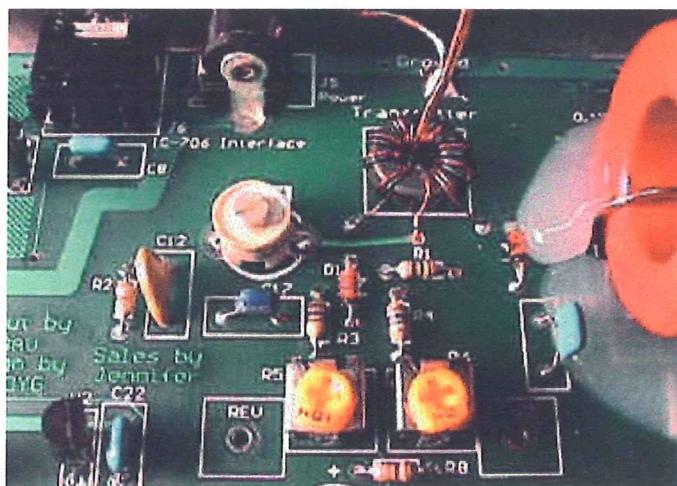


You will now install (locate, place, and solder in place) the parts on the Main PC Board. Use the silkscreen layout in the back of this manual to assist in locating where parts are to be installed. Parts are installed and soldered in order of height, from shortest to tallest.

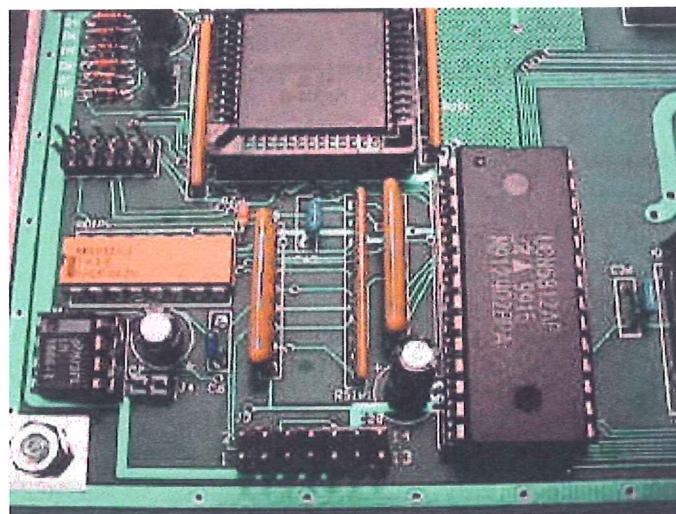


- \_\_\_\_ Install all of the resistors, R1-4, 7-8. Most of the resistors are 1/8 watt and may be hard to read. Use an ohmmeter to verify the values if you have trouble identifying them.  
R1, 3-4 - 150 ohm - brown-green-brown  
R2, 7 - 3.3K ohm - orange-orange-red  
R8, 10 - 10K ohm – brown-black-orange
- \_\_\_\_ Install the 1N4148 diodes, D1, 2, 4-9. Note: arrow on the silkscreen “” shows you the direction of the black band on the diode.
- \_\_\_\_ Install the larger 1N4001, D3. Note: arrow on the silkscreen “” shows you the direction of the silver band on the diode.
- \_\_\_\_ Install the 10K 10 Pin SIP resistor, RSIP1 -- markings on SIP “101C103 919”. Be sure to note the orientation of the SIP resistor. A small line (or dot) on the side with writing denotes pin 1 on the SIP. Pin 1 on the board has a box drawn around it.
- \_\_\_\_ Install the 10K 10 Pin SIP resistors, R2R1 & R2R2 – markings on SIP – 10X-R2R-103. Be sure to note the orientation of the SIP resistor. A small line (or dot) on the side with the writing denotes pin 1 on the SIP. Pin 1 on the board has a box drawn around it.
- \_\_\_\_ Install T1. It lies flat against the PC Board and the #18 wire from the SO-239 will pass through the center (you will install this later). You may wish to use a small amount of silicon RTV or hot glue to hold T1 in place, but wait until after the unit is tested before applying it in case there are problems.
- \_\_\_\_ Install the 10K 16 Pin DIP, RDIP1 – markings on DIP – “MDP1603 103G”. Note the orientation – notch on DIP matches silkscreen. No socket is required for this component.
- \_\_\_\_ Install the socket for U1, 52 Pin PLCC socket. Note the orientation of the socket. The flattened corner goes in the upper left, toward the oscillator. Do not install U1 (the 68HC11) until later.
- \_\_\_\_ Install the socket for U3, 28 Pin DIP socket. Note the orientation of the socket. Match the notch on the silkscreen with the notch on the socket. Do not install the U3 (the UCN5812) until later.

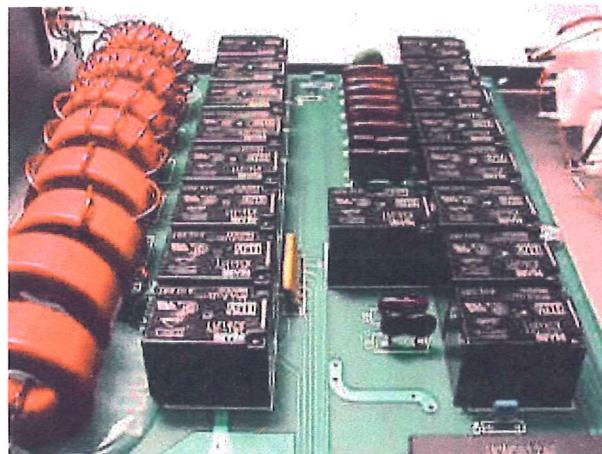
- \_\_\_ Install the socket for U4, 8 Pin DIP socket. Note the orientation of the socket. Match the notch on the silkscreen with the notch on the socket. Also note that the LM386 (U4) chip is not supplied.



- \_\_\_ Install the .01uf SIP capacitors, C3-5 and10. Note: a small line (or dot) on the side with the writing denotes pin 1 on the SIP. Pin 1 on the board has a box drawn around it.
- \_\_\_ Install the .01uf monolithic capacitors, C6, 8, 13, 15, 17-27, 29-30, 43.
- \_\_\_ Install the ceramic capacitors, C12, 16 100pf 1KV (usually yellow).
- \_\_\_ Install U2, the 78L05. Note the orientation – flat side towards C22.
- \_\_\_ Install Q1 & 2 the 2N3904 transistors. Note the orientation – flat side matches silkscreen.
- \_\_\_ Install the variable resistors (100K pots), R5 and R6.
- \_\_\_ Install the trimmer capacitor, C1 (placement above C17). Note that C1 has two pins that are common (connected). They should go in the two holes on the PC board that are connected together with a trace.
- \_\_\_ Install the 8 MHz Oscillator, OSC1. Three of the corners are rounded and one corner is squared on the oscillator. The squared corner is pin 1. Pin one on the PC board is marked with a square solder pad.
- \_\_\_ Install the Silver Mica tuning capacitors, C31 15pf, C32 30pf, C33 62pf, C34 120pf, C35 & 36 470pf, C37 & 38 1000pf, C39 & 40 2000pf, C41 & 42 3900pf.
- \_\_\_ Install the electrolytic capacitors, C7, 14 10uf radial and C9, 28 1uf radial. Note the polarity. Negative is marked on the side of the cap and positive is marked on the silkscreen.
- \_\_\_ Install the 2 x 7 header, J3. Solder the shorter ends of the pins to the PC Board.
- \_\_\_ Install the 1 x 2 header, J4. Solder the shorter ends of the pins to the PC Board.



- \_\_\_\_ Install the power jack, J5.
- \_\_\_\_ Install the 1/8" stereo jack, J6.
- \_\_\_\_ Install the 2 x 5 header, J7

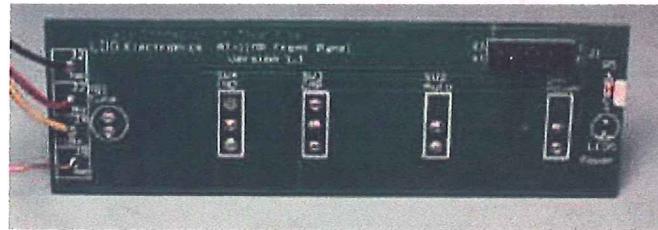


- Install the relays K1-K17. Be careful not to bend the pins over pushing them into place.
- \_\_\_\_ Install the inductors, L1-L8, on the PC Board. Note that the mounting holes are offset slightly on L3-L8 to help keep the inductors straight after installation. Make sure the insulation is scraped off the ends of the wires on each inductor. Push in each inductor until the windings touch the PC Board. The #18 wire is stiff enough to support L3-L8, but RTV or hot melt glue may be needed for L1 and L2 to hold them in place. In you plan to use the unit in a mobile application, you should use the RTV or hot melt glue on all inductors. Glue after the unit has been tested successfully.
  - \_\_\_\_ Cut two pieces 1 3/4 inches long of the left over #18 gauge wire. Scrape the insulation off of both ends of each wire so they can be soldered. Install one through the hole in T1 and solder this from beneath the circuit board. Install the other one to the PC Board next to L8. You will attach both of these to the center pin of the S0-239s after mounting the main PC Board in the enclosure.

- Cut two pieces 1 1/2 inches long of the left over #18 gauge wire. Scrape the insulation off the wires so they can be soldered. Crimp the terminal lugs onto one end of each of the wire, and attach the other ends to the PC Board at J1 & J2. You will attach the terminal lugs to the S0-239 mounting screw in the final assembly.

You are finished with the assembly of the main PC Board. Proceed with the assembly of the front panel PC Board.

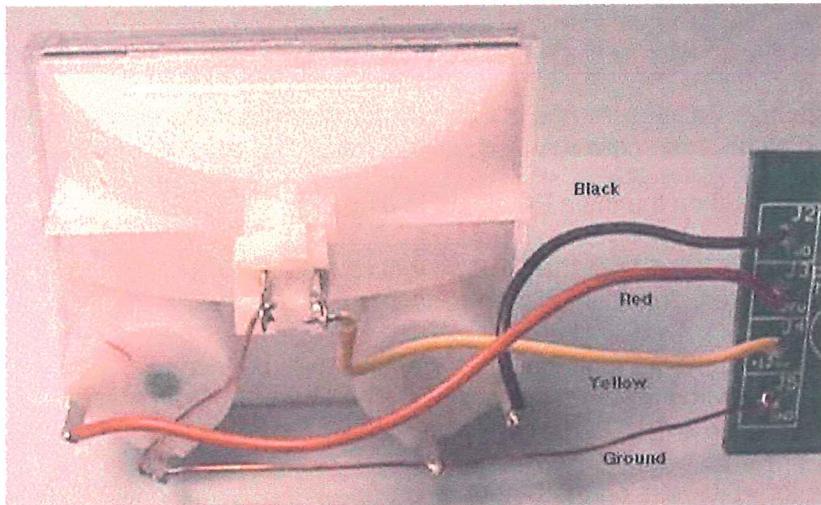
- Install the 14-pin header, J1, with 0.1 inch spacing to the side of the front panel PC Board that has the white silkscreen. Install the shorter ends of the header into the PC Board and solder.
- Install the 4.7K Resistor, R5 (yellow-violet-red), on the silkscreen side of the PC Board and solder.
- Un-wrap the chassis of the enclosure (the one with the white silkscreen writing on it) and put the 4 rubber feet on the bottom. Take care not to cover the holes that are there. These are used when mounting the PC Board in the chassis.



- Install the 2 SPST on-off toggle switches (SW1 & SW2) in the chassis in the power and the auto positions. Remove the nut and one washer from the switch. Place the switch in the hole with the 2 prongs toward the bottom. Then replace the lock washer and nut on the switch. You may need to re-align the switches later, so don't tighten yet.
- Install the 2 SPDT momentary switches (SW3 & SW4) in the chassis in the Cap and the Ind positions. Remove the nut and the lock washer from the switch and save for later. Remove the flat washer and discard it. Place the switch in the hole and then place the lock washer and nut on the switch. You may need to re-align the switches later, so don't tighten yet.
- Install the push button switch (PB1) in the chassis in tune position. Remove the nut and washer from the switch. Place the switch in the hole and place the washer and nut on the switch. Be sure the solder terminals of the switches are aligned one on top of the other. You may need to realign the switches later, so don't tighten yet.
- Place the LED in the Front Panel PC Board, LED 5 Red. Place it in the side that does not have silkscreen. Be sure to place the ground leg down. The ground leg of the LED is the one with the notched plastic next to it. Do not solder it at this time.
- Install the Front Panel PC Board on the switches. The side without the white silkscreen will be placed on the solder terminals of the switches. Gently push the PC Board onto the switches. The LED should slide into the hole in the chassis next to the power switch. Once you have checked the alignment, solder the switches to the PC Board. Tighten the nuts on the switches at this time. Next, slide the LED into the chassis and solder the legs to the PC Board. Clip the legs of the LED. (See picture page 12)

Power Meter Assembly (see picture)

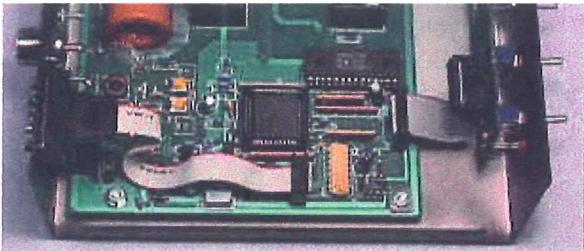
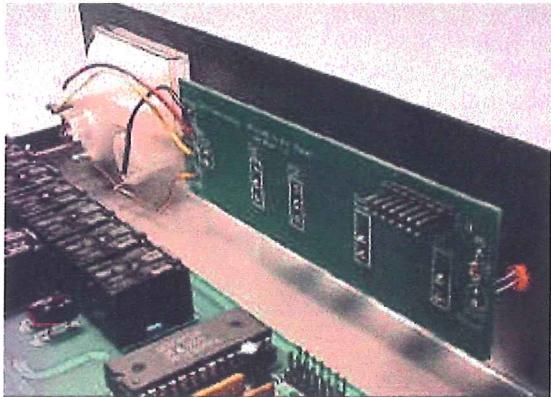
- \_\_\_ Install the ground wire on the meter (#22 bare wire, 4  $\frac{1}{2}$  long). The ground wire will connect to 3 terminals, the light and both negative terminals of each meter element to J5 on the FP PC Board.
- \_\_\_ Install the yellow, red and black wires. The yellow wire connects the other light terminal to J4 on the FP PC Board. The red wire connects the forward meter element positive terminal to J3 on the FP PC Board. The black wire connects the reflected meter element positive terminal to J2 on the FP PC Board.



- \_\_\_ Install the L Bracket loosely to the chassis with a 4-40  $\frac{1}{2}$  screw. Place the meter in the opening of the chassis and position the bracket against the back of the meter and tighten screw.

You are now ready to mount the AT-11MP main PC Board in the chassis.

- \_\_\_ Install the AT-11MP PC Board in the chassis using the #4 hardware: five 1/4" screws, five lock washers and five nuts. Place the PC Board in the chassis on the standoffs with the toroids towards the rear. Place one lock washer on each mounting hole in PC Board and then screw in 1  $\frac{1}{4}$  screw into each standoff. Do not drill out the holes in the PC Board.
- \_\_\_ Install the SO-239s onto the standoffs on the back panel of the chassis using the #4 hardware. Place one lock washer and one nut on the top standoff of each SO-239. Attach the terminal lugs from J1 and J2 to the bottom standoffs of both the SO-239s and place one lock washer and one nut on each and tighten all.
- \_\_\_ Install the ground bolt. Use the #6 hardware. Refer to the diagram on page 15.
- \_\_\_ Install U1 (the 68HC11) by carefully pressing it into place in its socket. Note that U1 has a flattened corner that should match the socket.
- \_\_\_ Install U3 (the UCN5812) by carefully pressing it into place in its socket. Note that U3 has a notch that should match the socket.



- \_\_\_\_ Install the ribbon cable to J3 on the main PC Board to J1 on the FP PC Board. See picture.
- \_\_\_\_ Remove the two mounting bolts from the DB9 connector and place into the chassis back panel. Replace the bolts and tighten. Install the ribbon cable to J7.
- \_\_\_\_ Plug in the power and turn the unit on. The needles will bounce one time when power is connected. Move toggle switch up to Power position. The Power LED and the meter backlight will turn on.
- \_\_\_\_ As an option, check for +5.0 volts on the output of U2 (the 78L05). The output is the pin closest to the oscillator. Current draw should be around 50 mA (anything from 40 to 60 mA is acceptable).
- \_\_\_\_ Set R5 and R6 to the center position.
- \_\_\_\_ Connect the transmitter and antenna (or dummy load) to the proper ports.
- \_\_\_\_ With a voltmeter on test point REV (to the left of R5), and about 10 watts applied to a dummy load or resonant antenna, tune C1 for minimum DC voltage. The voltage should be just about 0.0 volts (0.1 is OK). You MUST use a 50-ohm load (either dummy or resonant antenna) to properly do the alignment.
- \_\_\_\_ Raise the power to 100 watts and watch the forward needle on the power meter. Adjust R6 to read 100 watts on the forward meter. Be sure to start R6 from its lowest value.
- \_\_\_\_ Position R5 to the same physical position as R6.

Note: if you can't get 100 watts out of your radio, use 50 watts and adjust R5 and R6 for the proper readings on the meter.

Congratulations! The AT-11MP is now ready to be put on the air.

	<b>List #</b>	<b>Part Description</b>	<b>Qty</b>
[ ]	PC Board	AT-11MP V2.2G PC Board	1
[ ]	L1-8	Iron Toroid T106-2	8
[ ]	T1	Ferrite Toroid FT37-43	1
[ ]	Wire	#18 Polyurethane	12'
[ ]	Wire	#28 Red	8"
[ ]	Wire	#28 Green	8"
[ ]	U1	68HC811E2CFN, Program V1.4	1
[ ]	U2	78L05	1
[ ]	U3	UCN5812	1
[ ]	RDIP1	10K 16 Pin DIP (MDP1603 103G)	1
[ ]	OSC1	8.0 Mhz Oscillator	1
[ ]	Socket 1, U1	52 Pin PLCC	1
[ ]	Socket 3, U3	28 Pin DIP Socket	1
[ ]	Socket 4, U4	8 Pin DIP Socket	1
[ ]	Cable	2 1/2" 14 pin ribbon cable w/2 IDCs	1
[ ]	D1-2, 4-9	1N4148	8
[ ]	D3	1N4001 1A/50V or 1N4007	1
[ ]	Q1-2	2N3904	2
[ ]	K1-17	NT-73 Relay	17
[ ]	RSIP1	10K 10 pin SIP	1
[ ]	R2R1-2	R2R 10 pin SIP	2
[ ]	R1,3-4	150 1/8w resistor brown-green-brown	3
[ ]	R2,7	3.3K 1/8w resistor orange-orange-red	2
[ ]	R8, 10	10K 1/8w resistor brown-black-orange	2
[ ]	R5-6	100K pots	2
[ ]	C1	3.5-13pf Trimmer Capacitor	1
[ ]	C6,8,13,15,17-27,29-30,43	0.01 uf 50V Mono capacitor	18
[ ]	C12, 16	100pf 1KV capacitor	2
[ ]	C7,14	10 uf 35V or 50V radial capacitor	2
[ ]	C9,28	1 uf 35V or 50V radial capacitor	2
[ ]	C3-5,10	.01 SIP Cap 50V	4
[ ]	C31	15pf, SM	1
[ ]	C32	30pf, SM	1
[ ]	C33	62pf, SM	1
[ ]	C34	120pf, SM	1
[ ]	C35-36	470pf, SM	2
[ ]	C37-38	1000pf, SM	2
[ ]	C39-40	2000pf, SM	2
[ ]	C41-42	3900pf, SM	2
[ ]	J5	Male PC board power jack	1
[ ]	J6	1/8" Stereo jack	1
[ ]	J3	2 x 7 Header	1
[ ]	J4	1 x 2 Header	1
[ ]	J7	2 x 5 Header	1
[ ]	J1-2	SO-239 Connector	2
[ ]	P1	Female power plug	1
[ ]	Cable	Power Cable	1
	<b>List #</b>	<b>Part Description</b>	<b>Qty</b>
[ ]	Enclosure	AT-11MP Enclosure	1
[ ]	FP PC Board	AT-11MP Front Panel PC Board V1.1	1
[ ]	R5	4.7K 1/8w resistor yellow-violet-red	1
[ ]	J1	2 x 7 Header	1
[ ]	SW1, 2	SPST Toggle switch	2

[ ]	SW3,4	SPDT Momentary switch	2
[ ]	PB1	Push switch	1
[ ]	LED5	Red LED 5mm	1
[ ]	Meter	Dual Needle Meter	1
[ ]	Wire	#24 Insulated Wire Red	4"
[ ]	Wire	#24 Insulated Wire Yellow	3"
[ ]	Wire	#24 Insulated Wire Black	2 1/4"
[ ]	Wire	#22 Bare Wire	4 1/2"
[ ]	Bracket	#616 Uni Bracket	1
[ ]	Cable	DB9 - 10 Pin IDC Cable	1
[ ]	Screw	#4 Phillips head 1/4" screw	5
[ ]	Screw	#4 1/2" Phillips screw	1
[ ]	Screw	#6 Black phillips enclosure screw	4
[ ]	Lock Washer	#4 Lock Washer	9
[ ]	Nuts	#4 Hex nuts	4
[ ]	Terminal Lug	#4 18 gauge terminal lug	2
[ ]	Feet	Rubber Bumpon	4
[ ]	Screw	#6 5/8" Screw	1
[ ]	Nuts	#6 Hex nut	1
[ ]	Lock Washer	#6 Lock washer	2
[ ]	Flat washer	#6 Flat washer	2
[ ]	Wing Nut	#6 Wing nut	1
[ ]	Terminal Lug	#6 18 gauge terminal lug	1

## AT-11MP Mounting Diagrams

Ground Bolt mounting

