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Extended AM1000/500 Installation Manual

HAMILTON

RANGEMASTER AM1000

#21-903
ANT



AM1000
Transmitter



Mount Bracket
Kit AM1000BR



AM1000BR



Select the
mount you
need for your
1 1/4" mast at
Radio Shack
or other anten-
na store.



To Studio

AM1000WR 100'
or 2 pair #22
shielded wire to
connect power and
audio

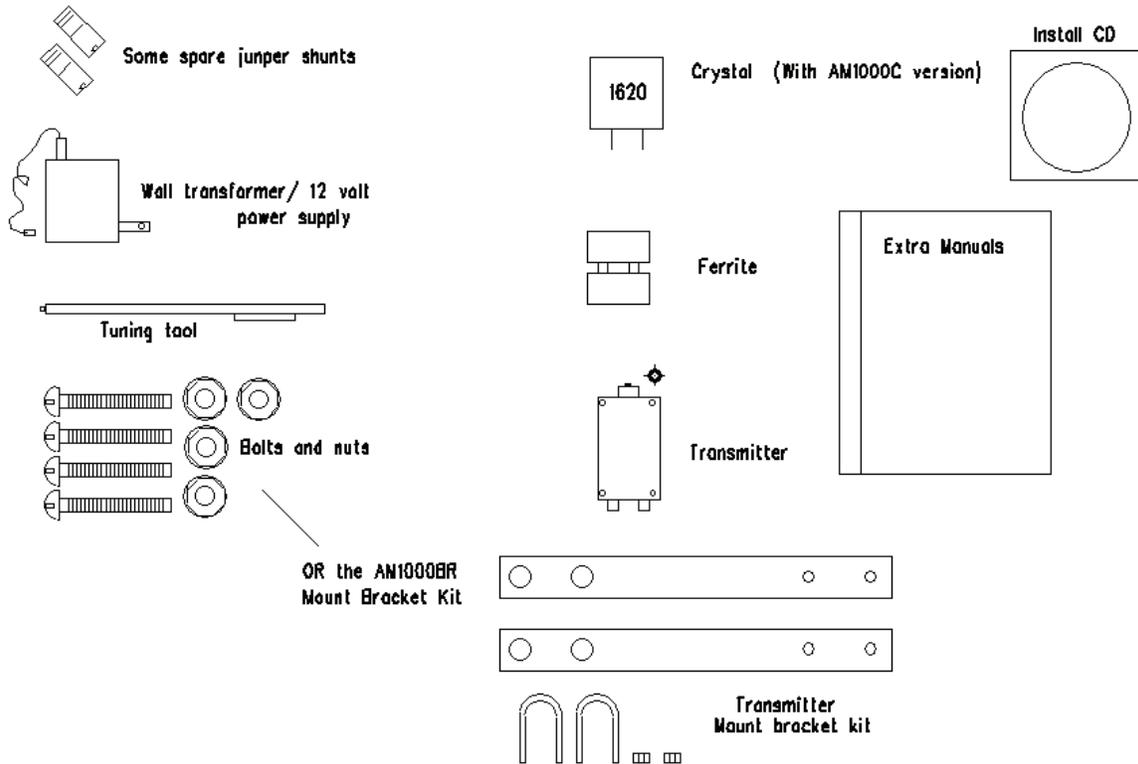
1. Getting ready/ Things you may need

First of all make sure you have the items/tools need to complete the job. Along with the right tools you may need the items shown below.

Please note that changes or modifications not expressly approved by RangeMaster for compliance could void the user's authority to operate the equipment.

This unit is meant to be installed by someone who has some radio/technical background, a technician. If you don't feel qualified to install this unit yourself contact a local radio/TV shop. They may be able to help. Also if you have a friend who is a Ham radio operator they may be able to help you.

The goal of a successful installation is to achieve 1/2 mile range if the unit is near ground level. Within this 1/2 mile the signal should be clear and easy to hear. There may be some static mixed in, but the message being played should be clear. Up to a mile range and further may be possible if you have a good site and have the unit higher.



Tools needed could be small flat and large flat screwdriver, wire cutter and stripper, mallet to pound ground rod in, (A jack hammer can put a ground rod down in a couple of minutes if you can get one) hammer, tools to install mast mount, (you may need a hammer drill and masonry bits to attach the mount to masonry) ,large Phillips screwdriver, Wrench set, Ratchet set, medium adjustable wrench, hacksaw, level, knife, torch for soldering, electrical type solder. Drill may be needed depending on the situation as you install and mount the wires.

You may require other various hardware depending on your installation situation, mostly for routing and fastening the ground and audio/power wires. Wire nuts, silicone for weather proofing, tie wraps (cable ties), electrical tape, spare batteries, any test equipment you may need. The AM500 is generally the Same as the AM1000 except it may not have the digital link feature installed.

It is a good idea if possible to have on hand cables that may be needed, cable adapters, ect.

Important!! A Very Large Part of the Time spent Installing the Transmitter Often will be running back and forth to the hardware store to buy items that you find you need!! Try to have everything you need when you get there!!

1.1 Some addition Items

Item	Vendor	Aprox Cost	Notes
AM1000C AM1000A Transmitter	RangeMaster		Depends on discount Outdoor transmitter "C" version is crystal and "A" version is agile (set frequency with switches)
AM1000BR mount bracket	RangeMaster		Mounts transmitter to 1 1/4 " mast
AM1000WR 100" wire	RangeMaster		2 pair (one pair for power, the other for audio) #22 with shield. Wire should not be bigger then .25" diameter, the weatherproof cable grip opening in the box is .25" Can Use Cat 5 Wire Also
AM1000ANT 102" whip antenna	RangeMaster		Standard Citizens band whip antenna, with 5/8 x 24 base. Available at Radio Shack (21-903) or any CB shop.
Ground Rod 4 foot	Radio Shack	\$13	Radio Shack 15-530
Ground Rod 8 Foot	Lowes or	\$10	Used to ground electrical meters, 5/8 x 8" copper
Ground Rod wire clamp	Lowes or Home Depot	\$4	Connect wire to Ground Rod (All connections must be soldered with electrical type rosin core solder using torch or tightly clamped and then weather-proofed.
Ground wire	Lowes or Home Depot	\$30-40	Use #12-#10, the bigger wire (10) will give better performance but will be harder to work with. 500ft roll. Insulated is fine.
Wire mounting hardware	Lowes or Home Depot	\$15	Think about how you are going to mount the ground wire, it needs to be tied down (mounted to the side of the building or pole) so it won't move (see instructions)
15-891 Eaves mount	Radio Shack	\$16	Or any antenna store
15-893 Vent mount	Radio Shack		
15-517 Tripod mount	Radio Shack	\$33	
15-886 Wall mount	Radio Shack		
15-839 Chimney mount	Radio Shack	\$25	
15-889 roof mount	Radio Shack		
15-885 Wall mount	Radio Shack	\$20	
15-863 10' 1 1/4 mast	Radio Shack	\$18	10' long mast to mount the transmitter. There is also a 5'
Guy wire supplies	Antenna store		If needed
VOM meter	RangeMaster or Radio Shack	\$10-30	If you don't have one get one from Radio Shack. Needed for tuneup.
Audio Adapter			May be needed if you need to convert unbalanced audio to balanced (see instructions) (Item#)555-8485 http://www.mcmelectronics.com/
Power supply 16 VDC	RangeMaster	Free	Included with the AM1000.
Tuning tool	RangeMaster	Free	Needed for tuneup
Complete instructions	RangeMaster	Free	Manual with installation video

2. Starting the Installation

Talk over the project with the customer. Find out when you will have access to the building. Before you start be sure you have a complete understanding with the customer:

Where the transmitter will go

Where the transmitter could go if the first choice will not work

Where the studio is to go

Other places the studio could go.

How the wire will be run

There is a possibility of installing without a wire, but this will not be talked about in this manual

While you are helping to pick these locations you need to look at how hard it will be to connect the wire between the transmitter and studio. Keep in mind that when you leave you want to have the wire neatly placed and attached.

2.1 Picking the Grounding for the transmitter

Picking the ground to use can be the most important part of the job. The ground that you use will determine the range you get. You may be able to get by using the ground rod that is already installed at the electrical meter/ phone pole/ or existing metal waterpipe or sewer connection, or you may need to add/install your own ground. You often need to pick the transmitter location based on the ground you are going to use.

The AM ground in an AM system is critical, not only for system performance, but also often for lightning protection. The goal is to provide a low resistance connection to the local Earth, less than 25 ohms if possible, less than 5 ohms is ideal. The ground resistance in an area will be determined by your ground system and:

- Moisture content of soil
- Mineral content of soil
- Soil type

Soil contaminants

In general the higher the moisture content, the lower the resistivity will be.

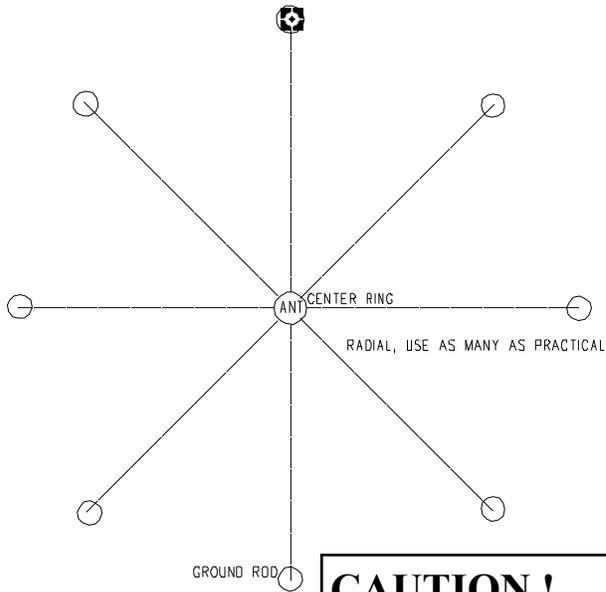
What you are trying to do is make an electrical connection to the earth over a broad area. What that means is if you have multiple rods keep them at least 6 feet apart, don't concentrate on just a small area of dirt. For example don't place 10 rods in a 2 foot circle. The more yard area you can cover with your system the better. A 20 foot diameter circle would keep the rods about 6 feet apart. Keeping the system spread out allows the currents to flow more efficiently.

Working with different installation sites you have to be creative in making a good ground. You may find existing structures and/or items that can help you connect to the Earth. A buried tank, deep well casing, metal fence, Metal tube lawn sprinkler system, all can be useful.

- Sand and gravel, even when wet can make a poor ground.
- Use corrosion resistant connectors when possible
- Solder (electrical type solder) all connections or be sure all connections are bright and shiny & then tightly clamped.
- You can use an Earth resistance meter to check the resistivity value of your system. Also see the troubleshooting manual.
- If you are connecting to a utility water pipe, connect to it within 5 feet of where it comes in from the dirt. This keeps someone else from coming in later and putting in non-conductive pipe, making your ground useless.
- Sodium bentonite can be used to enhance a ground.
- If you are using ground radials, they should be as long as your antenna is high to be effective.

Try to use the moistest dirt possible. For example if there is an air conditioning system, install a rod where the condensate drips. Look to see where the rain comes off the roof to find moist areas. Look for any creeks or ponds. Running a long wire to a creek or pond far away may not be effective, the ground system needs to be in the area of the antenna. Or you can possibly install the transmitter in the area of any great natural ground.

Be sure all your connections are good. The wire should be bright and shiny (use steel wool if you need to) and then tightly clamped and/or soldered with torch and electrical solder and then weatherproofed with silicon



CAUTION !

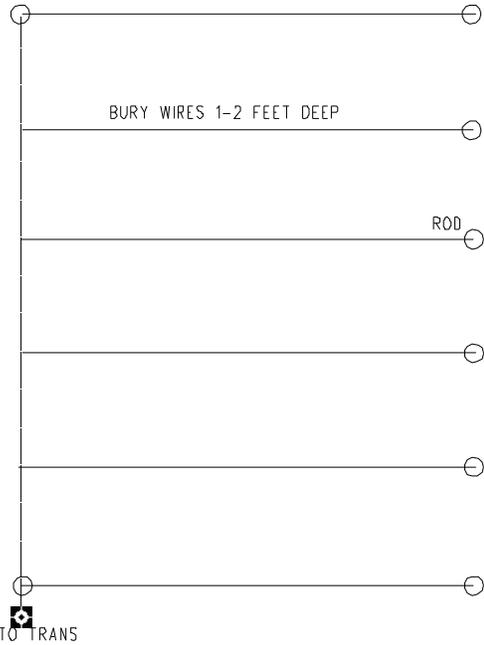
So look over the site, sometimes it will help to get pictures before you get there. It can be possible to use the HVAC “boxground” connection, for an “Earth” ground. This connect will connect to the electrical ground rod. Don’t try to connect to this yourself unless you are qualified, there are dangerous voltages inside of the HVAC panel that can ***kill you***. Call an electrician to make this connection. Sometimes there may be a water pipe or other metal pole leading into the ground you can use. You need to be creative with grounding sometimes. I once used a deep well. I connected to the cast iron sleeve that went into the ground and had great range. The iron sleeve was metal and went deep into the ground. The more metal / dirt contact the better. Note that the ground wires to the transmitter need to be clamped down so they will not move. Do not connect to ***gas lines*** or other unsafe objects in any way



CAUTION

Generally the deeper your rod, the lower the resistivity will be.

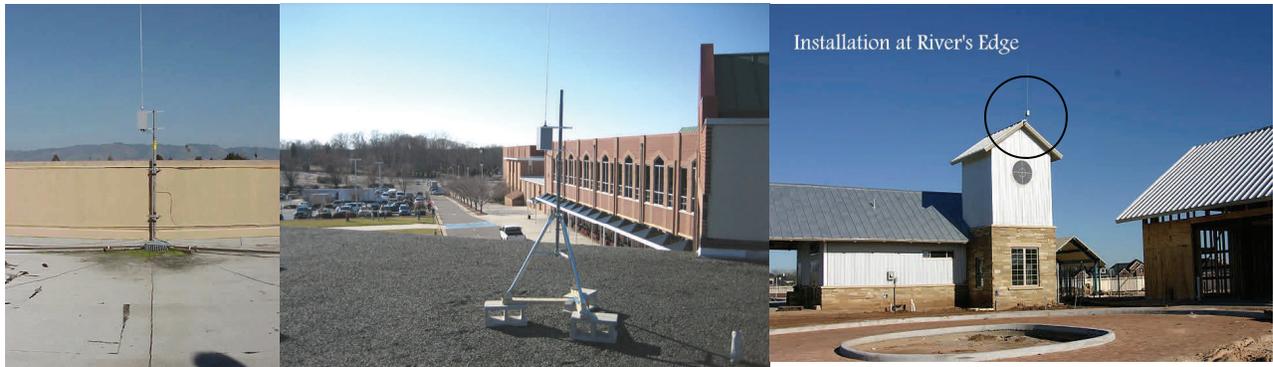
Bury any horizontal wires, the more ground/dirt contact the better. Just an inch or two below the surface will do. You can use a flat blade shovel to create a “trench” that the wire can be laid into. This works well with lawns. It is best to bury your rods entirely if possible to avoid anyone tripping over them, the lawn mower hitting them, ect. Some will bury any metal that will not corrode (tin cans, ect) in the area to help.



The type of trench ground system above can work well with sandy/dry soil.

2.2 Finding a place for the Transmitter

Transmitter location is also very important and will determine your range. You want the transmitter to generally be the highest thing in the area if possible, but you still need to be able to get to it to make adjustments. The antenna that screws into the top needs to be in the open air, not up against anything, especially metal. It is best if the antenna is above surrounding man made things. Natural things like trees should not be a problem, however don’t let branches, leaves actually touch the antenna.





Do you see how the transmitter is mounted right next to the house? It is not above all buildings, the antenna is not in the open air, also look at the antenna, it is right up against the siding!! NO!!

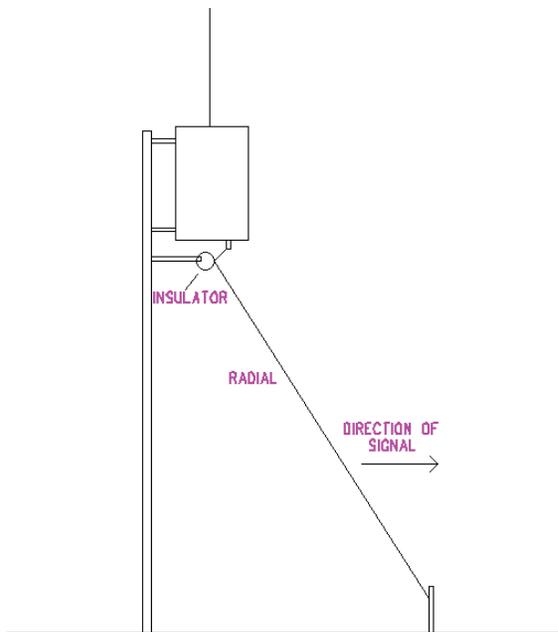
Even if this does work a little, range will be very low in the direction of the house.

This transmitter needs to be moved up so that the antenna is entirely above the top roof line, preferably at or near the peak of the roof.

NO!!!NO!!!

CAUTION!

2.3 Using Ground Radials



We have referred to buried radials earlier. In general for a radial to be effective the length should be more than the height of the antenna tip is from the ground. A radial is just a wire going from a center ground rod outward.

Elevated radials

First of all be aware that elevated radials do increase radiation, and may not be approved should you be inspected by the FCC

Note the direction of increased signal. More than one radial can be used.

Buried radials

There should be no problem with the FCC concerning buried radials, metal in the dirt does not radiate.

For more Information see the Legal section.

3. Installing the Control Wire

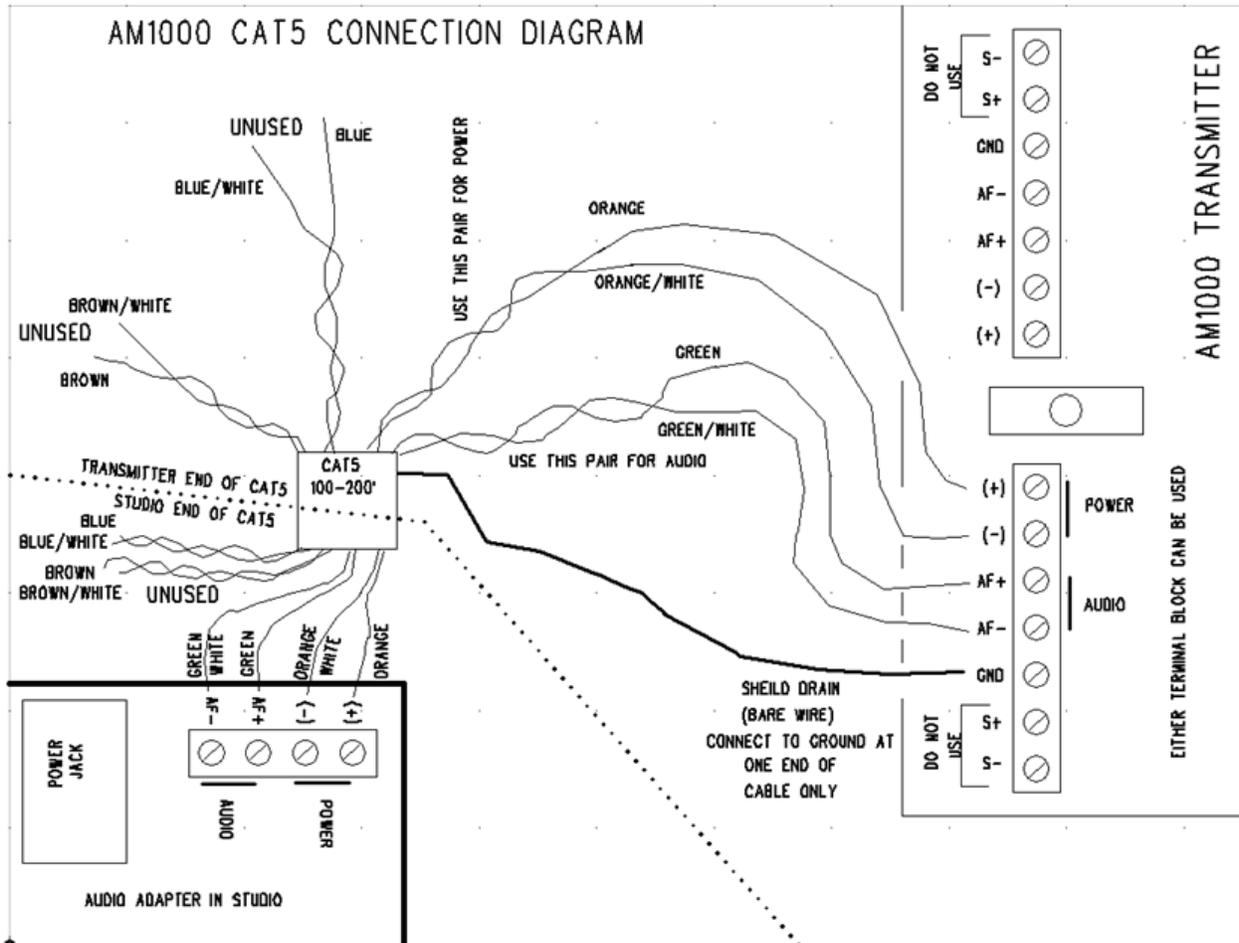
This is the wire that connects between the studio and transmitter. The kind of wire used is important. We recommend 2 pair, #22, shielded, UV protected, outdoor wire. Several hundred feet can be used with a voltage drop of 1-2 volts at the most.

Belden 8723 is the 2 pair #22 wire we recommend. Cat 5 outdoor shielded wire can also be used, though it is smaller, #24.

Connect the Shield drain (ground connection) at one end of the cable only, usually the transmitter end. There is a terminal marked GND that can be used to ground the shield drain.

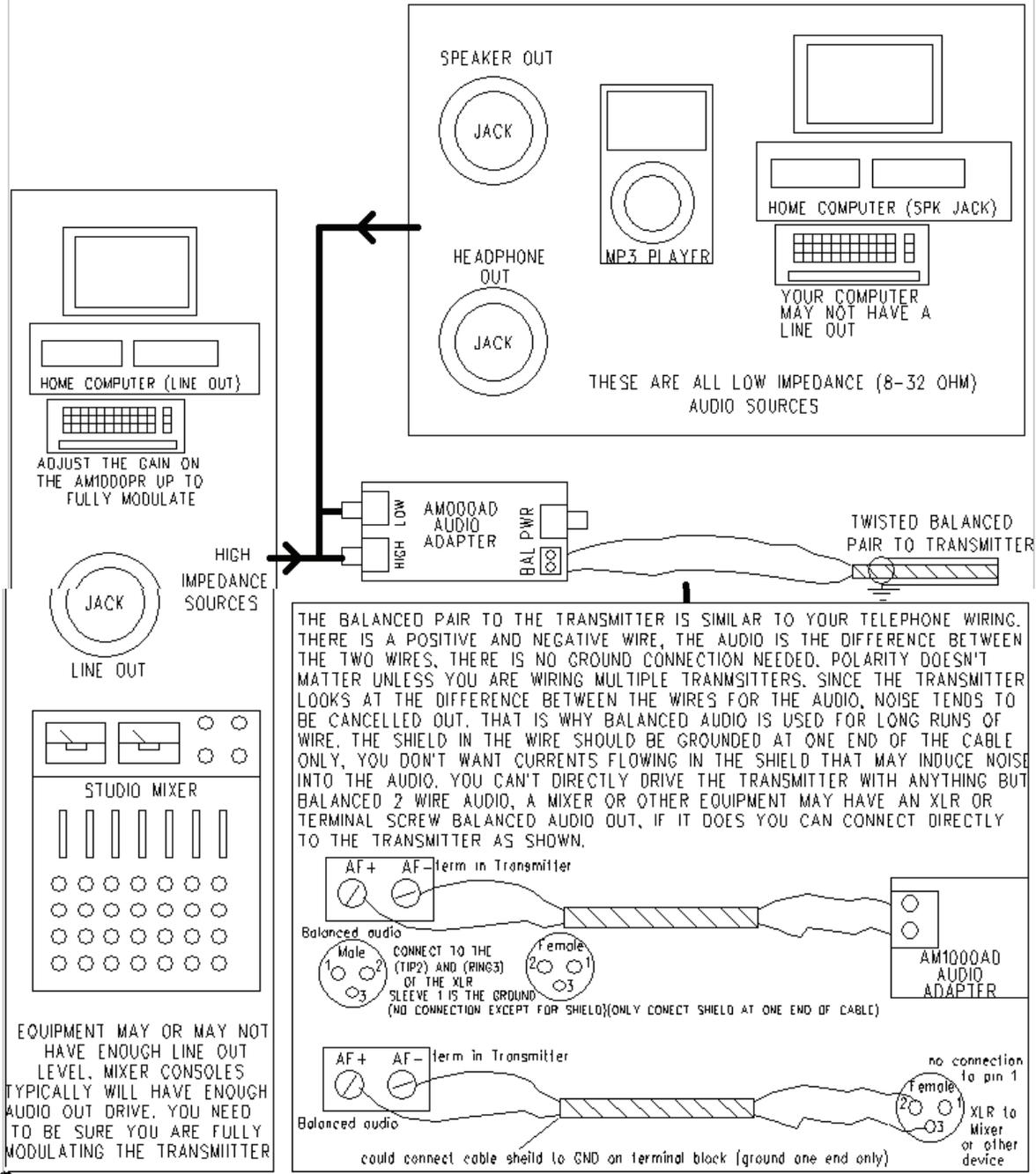
Good grounding is important for safety lightning protection, be sure to follow any national and/or local electrical grounding codes.

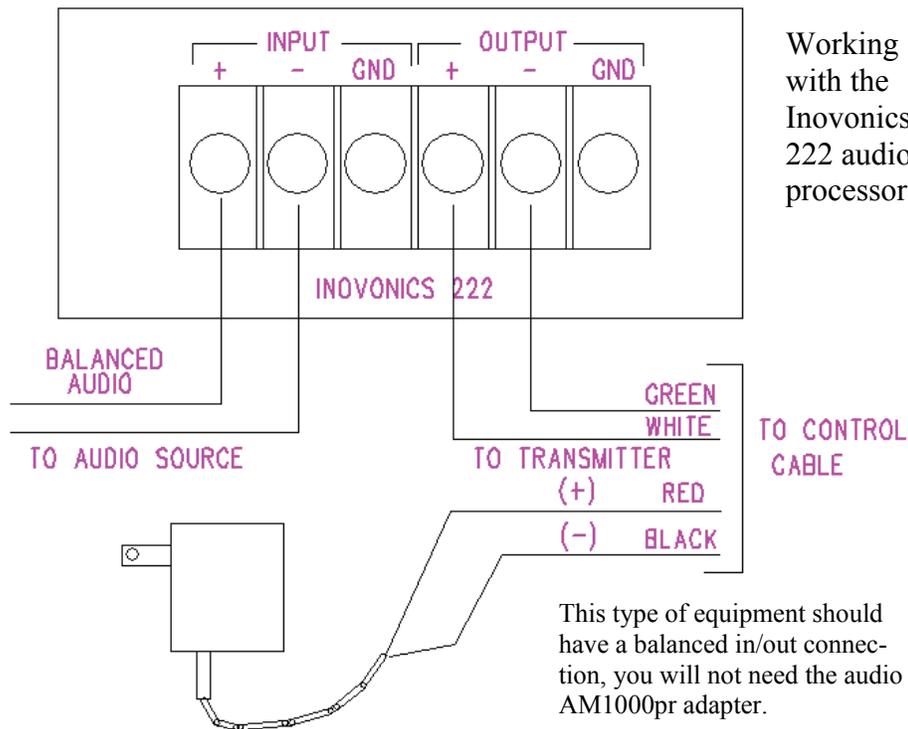
Using Cat 5 shielded outdoor wire



4. Studio Connections and settings

We have found the most common cause of low range is the audio setup, even more common than grounding problem. Not enough audio power (volume) and/or an impedance mismatch. If your station is not as loud as other stations in your area without distortion then there is a problem in the audio chain.





Working with the Inovonics 222 audio processor

Connections for balanced audio in. These connections should be the same for other audio processors.

From the audio source, if the connector is an XLR connector you would use pins 2&3. Pin 1 is ground, don't use that. If the connector for the balanced audio to the 222 is a 1/4" stereo jack use the tip and ring connections, again don't use the ground (sleeve).

The goal here is to get the proper level to the input of the 222 and to the transmitter.

Input: Connect your audio source as explained. You should be able to see some indication on the Peak limit and Pre - emphasis LED indicators as you adjust the input gain. Be sure they are on. If you cannot get any indication with the input gain all the way up then remove the cover (with the 222 unplugged) and set the (input range select) to the low position (marked L on the board). You should be able to get an indication now, if not check to see if you have an input signal.

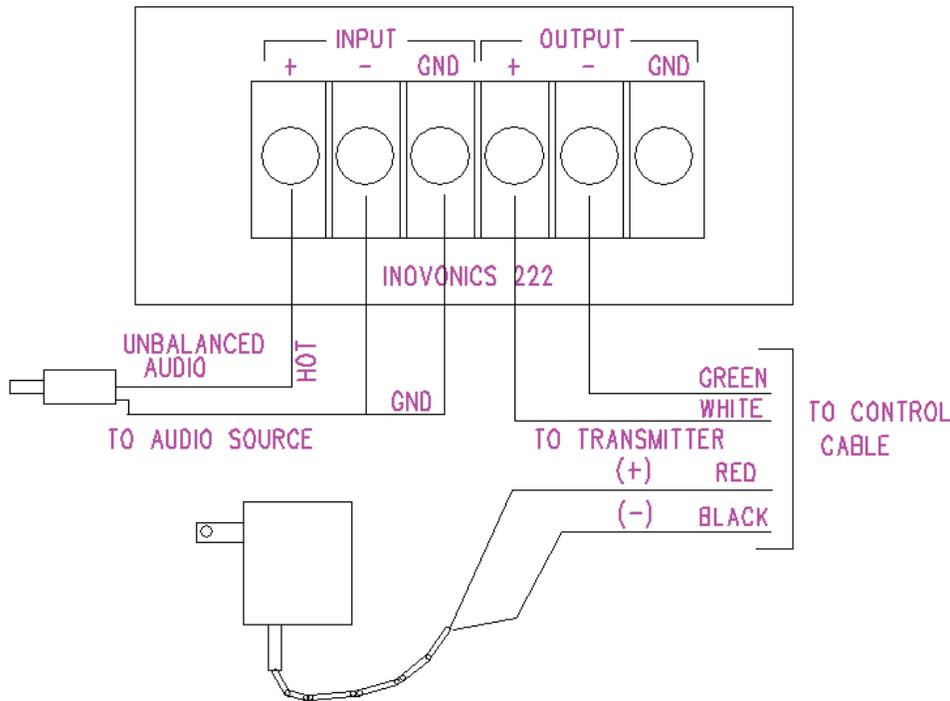
Once you have the audio material showing on the indicators, then try to connect the transmitter. Depending on where the audio gain is on the transmitter unit you may or may not be able to get good sound at this point. If you cannot get good sound in the entire range of the 222 output level control then check the transmitter audio gain, it should be 1/2 to fully clockwise, it is preferable not to have it lower than 1/2 way. If you are way over driven try turning the transmitter audio gain down a bit, you may need to turn it down to almost off if you are getting too much drive from the 222. Adjust 222 output level and Transmitter level for good sound from a test radio. Be careful about having a radio too close to the transmitter, it can be overloaded. Try to get the audio level as high as you can.

If you have an unbalanced input signal to the 222 (hot and ground, single wire with shield) then connect the ground or shield of the input signal cable to the ground input, the (+) 222 input terminal goes to your center conductor. Connect the (-) input terminal to the ground.

Don't solve the gain problem by just turning down the input control, you will get good sound but the 222 will not operate properly. You should be able to see the lights come on as the music peaks if you have the limit and/or pre emphasis controls on.

Balanced audio is two twisted wires, the signal exists as a difference voltage between the two wires. There is no ground. If there is a ground, it is there just for shielding.

Unbalanced audio is a signal with a ground reference, usually a center wire with a outer ground, like a RCA jack, or coax cable. The center is the signal (hot) while the outer is the (ground) reference and shield.



Here is the 222 wire diagram showing the input in the unbalanced method.

This could be a 1/8 jack plugged into a computer sound card for example.

When using the control cable Ferrite if the hole is to big try to loop the cable through twice. The ferrite installs on the audio cable just outside the transmitter box.



#555-8466 <http://www.mcmelectronics.com/>

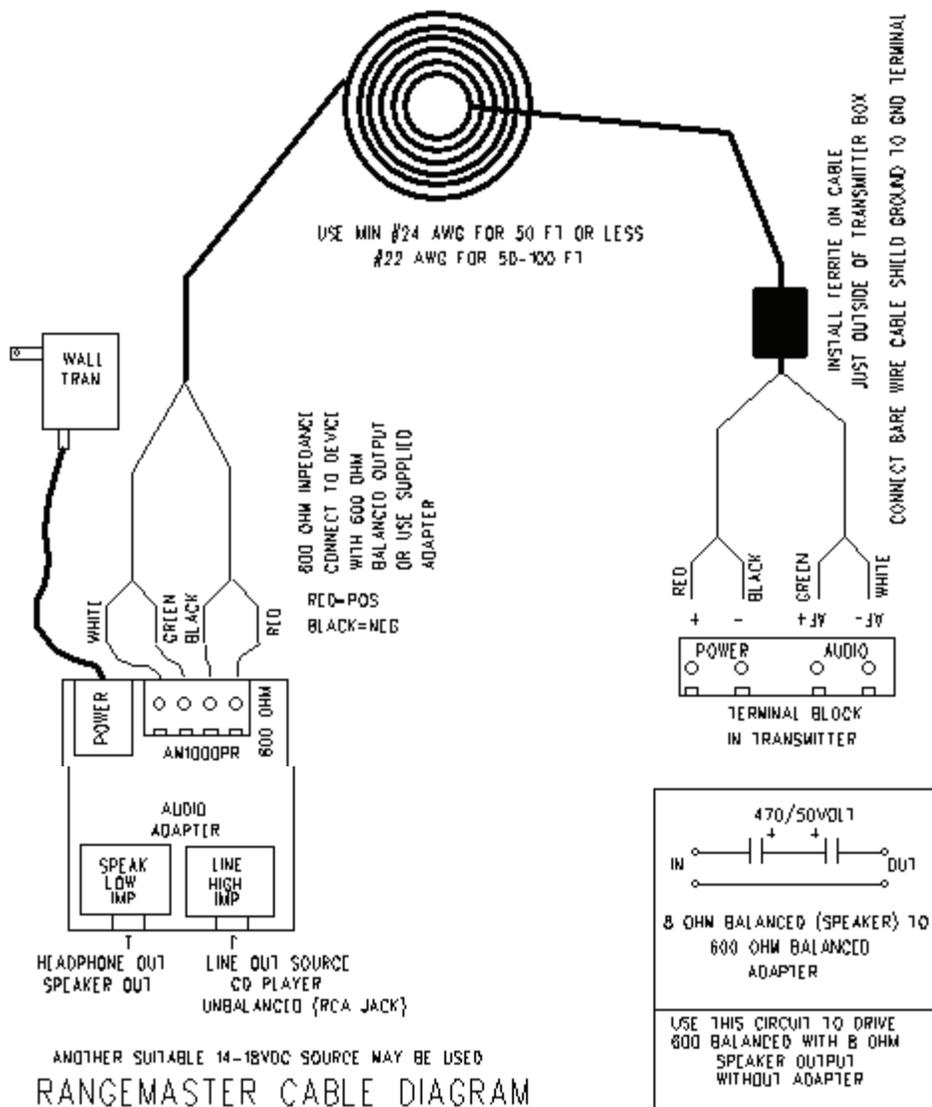
Part of the BLOX series, this compact adaptor combines the L/R line level audio signal from standard consumer audio equipment, and converts it to an XLR balanced mic level output. Additionally, a variable attenuator allows control of the output volume level.

The above can be a useful item, stereo in, then the item mixes your stereo to mono and sends it to an XLR out. Be sure to have an XLR jack handy so you can wire this to the 222

- Rugged extruded housing
- Dual RCA male input connections
- XLR male output
- Input impedance: 8Kohm
- Output impedance: 580ohm
- Max input level: +24dBm (3.3V)
- Nominal attenuation: 24dB

The Inovonics audio processor is a special audio processor made especially for a AM transmitter. It has special circuitry that enables it to drive the transmitter over 100% modulation without distortion, resulting in more range and louder sound. This is called asymmetrical modulation, because this processor allows the audio to be non-symmetrical

Am type audio processor and better ground are the two legal ways to increases the radio range.



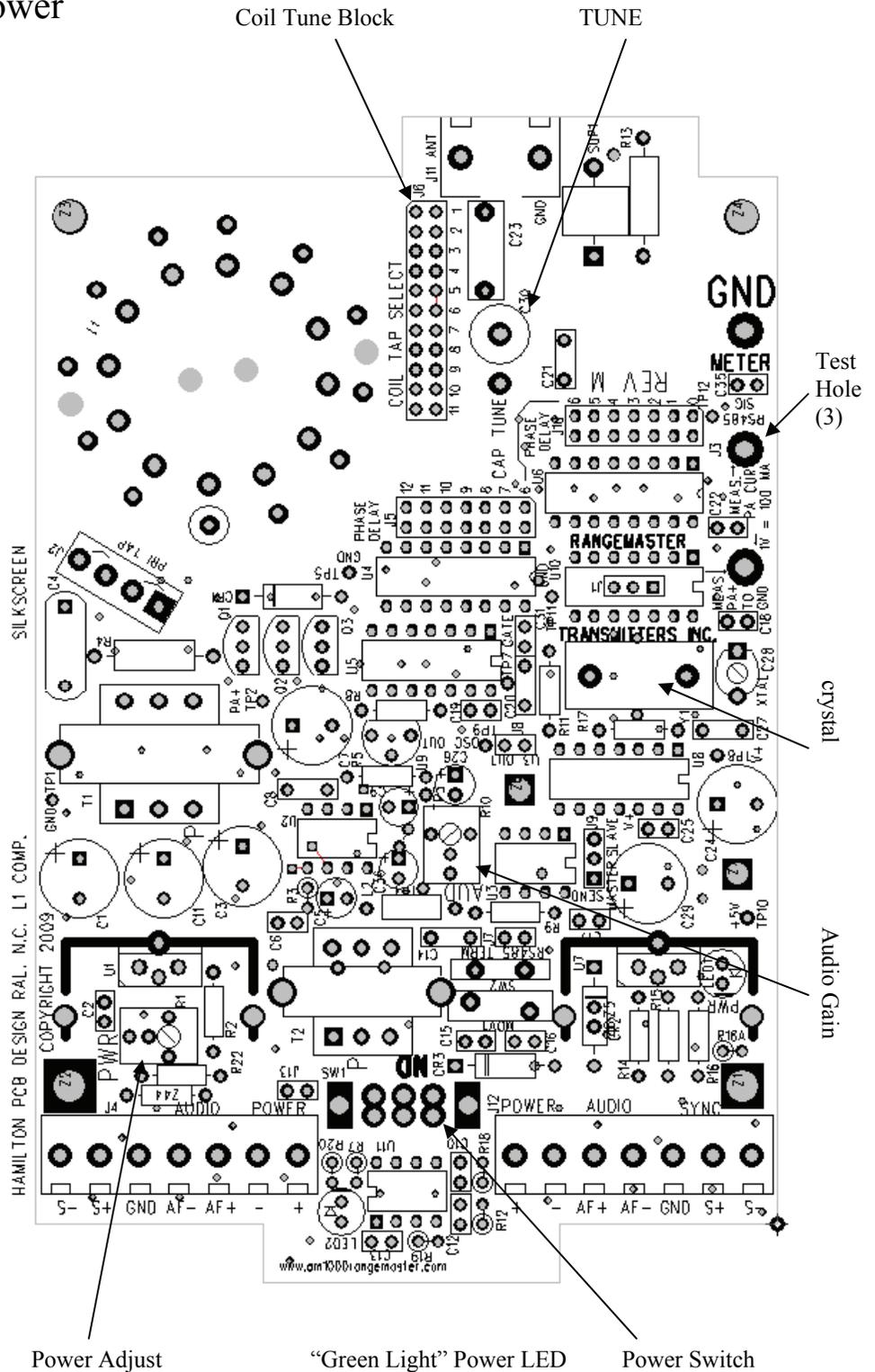
Wire diagram for the transmitter system. There are two terminal blocks, either can be used. Not shown is the cable shield drain connection, connect it to the GND terminal on the terminal block in the transmitter.

Be careful not to connect the power or audio to the (S+) or (S-) terminals, these are used for another function (RS485 sync).

5. Tuning and setting Power

Be sure power is ON (LED should be lit) Turn Audio Gain all the way down (counter clockwise) Be sure to turn it back up when you are done. There are 3 test hole pads on the unit (see diagram). Take a standard voltmeter that is set to DC 5-20 volts and plug it into the bottom and top test hole pads. The black lead will go to the test hole pad closest to the mounting hole (Ground) (Top). Next move the jumper shunt on the "COIL TUNE" jumper block one at a time to find the one that gives the highest meter reading or highest power amp voltage. Be sure that only one jumper is used at a time. Leave this jumper on the highest meter reading and proceed. If you find two areas of the jumper block that give a peak reading one of them may be an harmonic. Chose the position closest to the center of the jumper block range. If you are not seeing a good meter reading then rotate the PWR control until you do, or check your meter.

Now take the tuning tool and rotate "TUNE" to obtain a peak reading of the meter. When the meter peaks you are tuned. Be sure to stay away from the antenna while tuning. If you are too close to the antenna your body will affect where it tunes. Keep in mind that you need to see a peak. The meter should rise and fall as you are turning. If you just turn it clockwise or counter clockwise all the way and the meter goes up until the capacitor can't be turned anymore then it is not tuned. Practice if you need to until you get the feel of finding the "peak" voltage. You will get the most power with the least capacitance of the tuning cap that you can get to tune (counter clockwise). You may find that 2 jumper positions will tune. If so use the one that tunes with the "TUNE" in the most counter clockwise or least capacitance position. This will give you the best range and circuit performance.



Setting the Power is easy, simply turn the PWR control until the LED goes green! See the next page for the manual method using the chart. Only set the power with the audio all the way down! When the audio is up the light will flash mostly red.

VOLTAGE

E

BOTTOM AND TOP TEST JACKS

READINGS NEEDED THAT PRODUCE 100 MILLIWATTS

Please Note!! Do not use this manual method, for reference only!! Simply rotate power control until you get the “green light”!!

1.0	1.00
1.1	.910
1.2	.840
1.3	.770
1.4	.720
1.5	.670
1.6	.630
1.7	.590
1.8	.560
1.9	.530
2.0	.500
2.1	.480
2.2	.455
2.3	.435
2.4	.420
2.5	.400
2.6	.385
2.7	.370
2.8	.360
2.9	.345
3.0	.335
3.1	.325
3.2	.315
3.3	.305
3.4	.295
3.5	.285
3.6	.280
3.7	.270
3.8	.265
3.9	.255
4.0	.250
4.1	.245
4.2	.240
4.3	.233
4.4	.228
4.5	.223
4.6	.218
4.7	.213
4.8	.210
4.9	.205
5.0	.200
5.1	.197
5.2	.193
5.3	.189
5.4	.186
5.5	.183
5.6	.180
5.7	.177
5.8	.174
5.9	.171

I

CURRENT

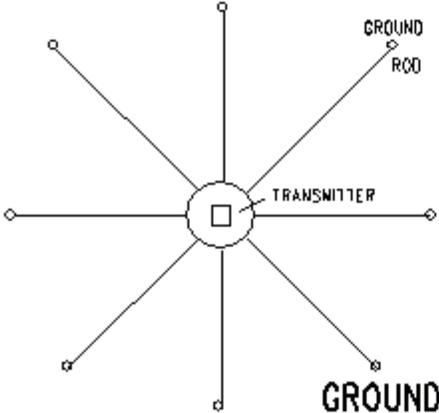
MIDDLE AND BOT TEST JACKS

1.00 VOLT EQUALS 100 MILLI AMPS AC-TUAL CUR-

The manual method involves simply involves taking 2 voltage readings and referring to the power chart in this manual. Adjust the power pot until you are at the legal power level. Turn the audio pot all the way down. Take your voltage reading, take this reading with the meter leads in the same position as when you were tuning. Now place your Black (negative) test lead in the bottom test hole pad & your Red (Positive) test lead in the middle test hole pad. This will measure your Current. Your power should not exceed 100 milliwatts or .1 Watt to comply with FCC rules (Part 15). See the conversion table supplied for different combinations of Voltage and Current that equal 100 milliwatts. The “Power Adjust” works just like a volume control. Clockwise is more power and counter clockwise is less. Again with the AM1000T “Green light” simply adjust Power level control until the LED is green.

6. Trying to get good Range

See the website for more information.

 <p>SEE THE PAPER ON GROUNDING ON THE WEBSITE DOWNLOAD PAGE</p> <p>GROUND RADIALS</p>	<p>GOOD GROUNDING IS A LOW RESISTANCE CONNECTION TO THE EARTH. THE LOWER THE RESISTANCE, THE BETTER YOUR PERFORMANCE. LAYING OUT RADIALS AS SHOWN CAN HELP. GROUND RODS CAN BE VERY EFFECTIVE WHEN THE SOIL IS MOIST NEAR THE SURFACE. THE MORE METAL/DIRT CONTACT YOU HAVE, THE BETTER YOUR CONNECTION TO EARTH. WHEN THE DIRT IS MOIST, THE CONNECTION IS MUCH MORE EFFECTIVE. GROUND RODS CAN BE EFFECTIVE TO POKE DOWN INTO MOIST DIRT WHEN MOISTURE IS WITHIN REACH, SOME WILL WATER THEIR GROUND AREAS. LOOK FOR NATURALLY WET AREAS.</p> <p>IF THERE IS NO MOISTURE NEAR THE SURFACE THEN THE MOST METAL/DIRT CONTACT POSSIBLE, ANYWHERE POSSIBLE THE WAY TO GO RADIAL WIRES CAN BE BURIED JUST BELOW THE DIRT SURFACE.</p>	
<p>ONE OF THE BEST WAYS TO GET MORE RANGE TO TAKE ADVANTAGE OF THE AM1000'S ABILITY TO BE MODULATED +130%, THERE ARE MANY AUDIO PROCESSORS ON THE MARKET THAT WILL DO THIS. THE CHEAPEST IS THE INNOVONICS 222. SEE INOVON.COM THE OPTIMOD IS ALSO AN EXCELLENT UNIT. ANOTHER TIP FOR GETTING GOOD RANGE IS TO OVER MODULATE A BIT.</p>		<p>FOR GOOD RANGE DONT INSTALL THE TRANSMITTER NEXT TO ANY MAN MADE OBSTRUCTIONS. IT IS BEST IF THE ANTENNA HAS A CLEAR "VIEW" OF SURROUNDING AREA.</p> <p>USUALLY THE AM1000C IS A BETTER CHOICE FOR THE SERIOUS. THE ACCURACY WILL HELP YOU, AND WILL PREVENT HETERODYNING TONES WITH DISTANT STATIONS ON THE SAME FREQUENCY.</p>
<p>Section 15.219 Operation in the band 510 - 1705 kHz.</p> <p>(a) The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed 100 milliwatts.</p> <p>(b) The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3 meters.</p> <p>(c) All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.</p> <p>Always cooperate with the FCC and follow FCC law.</p>		
<p>ANOTHER TRICK IS TO KEEP IN MIND THAT ANY CONDUCTOR IN THE AIR THAT ISN'T GROUNDED WILL CARRY YOUR SIGNAL. HIGH TENSION POWER LINES CAN CARRY YOUR SIGNAL FAR IF YOU CAN INDUCE YOUR SIGNAL INTO THEM. EVEN YOUR BACKYARD CLOTHESLINE CAN ACT AS A RADIATOR IF IT IS METAL WIRE AND HAPPENS TO BE INSULATED AT THE ENDS. YOUR SIGNAL CAN BE PICKED UP AND RE-RADIATED. KEEP THIS IN MIND & LOOK FOR CONDUCTORS LIKE THIS WHEN LOOKING FOR A SITE FOR YOUR LOW POWER TRANSMITTER.</p>		
<p>ANOTHER HINT IS WATER. YOUR SIGNAL WILL CARRY WELL OVER OPEN WATER.</p>		
<p>ANOTHER THING YOU CAN DO IS TUNE THE UNIT USING FIELD STRENGTH INSTEAD OF THE USUAL METHOD THAT JUST MAXIMIZES THE TUNE VOLTAGE. THIS METHOD WILL GET A LITTLE MORE RANGE IF YOU CAN FIND SOME SORT OF FIELD STRENGTH INDICATOR. IT MAY BE POSSIBLE TO USE A GOOD QUALITY RADIO WITH A METER.</p>		
<p>TO GET GOOD RANGE.</p> <ol style="list-style-type: none"> 1- GOOD GROUND 2- LOW NOISE FLOOR ON BAND 3- USE AN AUDIO PROCESSOR. 3- GOOD TRANSMITTER PLACEMENT 	<p><i>The 3-meter combined length specified in Section 15.219(b) refers to the length of all radiating elements. Attaching the ground lead to an ungrounded radiating object, or the addition of a ground screen, will cause the effective length of radiating elements to exceed 3 meters, in violation of Section 15.219(b).</i></p> <p>NOISE FLOOR HAS A LOT TO DO WITH RANGE. YOU CAN TELL IF YOU HAVE A QUIET BAND BY DOING SOME LISTENING ON A GOOD QUALITY RADIO. YOU SHOULD HEAR A QUIET HISS, NO ELECTRICAL NOISES</p>	

The transmitter should sound as loud as others on the dial, if it doesn't there is a problem. It may be an audio impedance mismatch, or the level may need to be turned up. If the audio level isn't high enough you won't get good range, audio is a gate on the power, keep your audio turned up as high as you can.

We have found the most common cause of low range is the audio setup, even more common than grounding problems. Not enough audio power (volume) and/or an impedance mismatch. If you are using an 8 ohm (low impedance) output which would be a headphone or speaker output you may need to find a way to use a line level output. An impedance mismatch will lower the audio level and reduce the fidelity, and may cause distortion. If you have a line out type source it needs to go to the high impedance jack on your audio adapter. In either case if you can't get the audio loud enough so it is as loud as other stations in your area without distortion then there is a problem in the audio chain.

To get more Range:

Try to locate the transmitter near something that will reradiate the RF energy such as high tension power lines. The signal will tend to follow lakes and rivers. Use as high a audio level as you can. Get the unit as high as you can but not so high you can't safely get to it to tune it.

Most of the time low range is a problem with the ground. (see the troubleshooting manual) if you can remove your ground and not see a difference in the tune voltage or range then the ground is likely the problem. If when you are tuning the "Cap Tune" you don't see much movement of the meter, then you probably have a poor ground.

Placement of the Transmitter is important, keep it away from metal and other objects.

One way to look at it is that the antenna is the (plus) of the battery and the ground is the (negative) of the battery. To get good radio current flow (from the antenna to the ground) you need the antenna to be placed so that the radio waves can flow out from it without being blocked. And the ground needs to have low resistance.

If when you are standing at the antenna you have a high wall to the North for example, you probably will not get good range in that direction. Distant objects will have little effect though if they are higher, if the transmitter was on a one story house and there was a two story house 200 meters away, then the signal would not be affected much.

If there is a lot of electrical noise in the area you may have range problems. You can listen to a test radio and usually tell how quiet the band is, listen for a quiet "hiss". If you hear nasty hum, sparking, ect , then that is a indication of high noise.

It will be harder to get good range in metro city areas, as they are usually noisy with radio interference.

Watch out for high power microwaves, they can blank out the AM dial. If there is a radar dish nearby you can forget good AM radio reception.

See trouble shooting manual for more troubleshooting information!

7. Better radio reception

One of the toughest places to get radio reception is inside an office building. Construction materials like bricks and metal, and noise from computers and other electronics can all combine to make radio reception almost impossible for you. Besides the construction of the building, you sometimes have to account for your location in a building as well. I used to work at a corner desk in a windowless room on the 14th floor of a Manhattan office building. We were allowed to listen to music while we worked, but we quickly found that a radio was useless. The simplest way to improve radio reception is to put a radio in a window. If you can't do that, however, you still have several options. You can simply wrap a few turns of wire around a radio, and then run the wire to a window. Another option is to purchase one of the many AM Band amplifiers available, see Amazon.com. One is the AM1000 Antenna.

Radio Noise Problems & Possible Solutions

It is best to eliminate the interference at its source. Here's a list of possible solutions:

- The most obvious is to turn off the offending device.
- Try a battery operated radio to see if the interference is coming in from the AC 120v line or through the air or both.
- Turn off the circuit breakers to see if the noise stops. If it does then you know it is something in your house. Turn off one circuit at a time to isolate where it is coming from.
- Use a battery operated radio as a direction finder. Turn the radio until the loudest noise is heard and the front and back of the radio will point to the noise origin.
- Carry a radio around the neighborhood and see if you can find the origin of the noise. Ask other neighbors if they have problems (with radio noise obviously).
- If a power pole is suspected, call the utility company and they will check the area and possibly wash the insulators. Dirty power pole insulators are sometimes a cause of difficult-to-find radio interference.
- If you have a hum in your receiver from AC line noise sometimes grounding can reduce the hum greatly. Unfortunately most receivers except stereo receivers do not have a ground connection. Finding a good earth ground may also be difficult.

Radio Noise Problems & Possible Solutions

Annoying buzzes are many times transmitted through an AM radio.

Here is a check-off list of the most likely causes:

- Dimmer switch.
- Fluorescent light
- Computer
- "Touch lamp" type light fixture (even when turned off)
- Automatic on and off night lights.
- Outdoor yard lights which come on automatically.
- Electronic bug and pest controllers.
- A light bulb that is about to burn out.
- A faulty electrical switch of any kind.
- A nearby television set.
- A store that has a fluorescent light or a public recreation room that has fluorescent lights located near you.
- Blinking bulbs of all kinds such as Christmas tree lights.
- If you live in an apartment a neighbor's dimmer switch could be the culprit.
- Scanners of all types.
- Dirty insulators on a nearby power pole allowing arcing.
- Electric blanket.
- Smoke detectors that run from AC current (battery operated is OK).

8. General Specifications

We stock crystals 1590Khz 1600Khz 1610Khz 1620Khz 1630Khz 1640Khz 1650Khz 1660Khz 1670Khz 1680Khz 1690Khz 1700Khz but can order other channels.

Am1000C is the crystal controlled model Am1000A is the frequency agile model (set channel with switches, no crystal needed)

Outdoor Box Size

4.65" x 3.64" x 8.65" High (11" including ant. mount)

Mount holes are at 8.03" x 3.23" centers (#10 screw) Outdoor unit weight 2.85lb

Stainless Antenna .75lb Standard 102" CB whip 3/8 x 24 base

Allow 1lb for 2 mounting bracket bars.

Operating range -40 - +60 C

Outdoor box is .25" thick fiberglass construction

Stability Am1000C +/- 2 Hz Am1000A +/- 10 Hz

12-18 VDC at .1 AMP

Audio Sensitivity Adjustable from -10db to 0 Gain

9. FCC information

See the website for current FCC information

Generally the Spirit of the Part 15 law seems to be not to cause interference to a licensed station. We here at RangeMaster follow FCC law. Of course you should follow FCC law and fully cooperate with the FCC. Here is subpart 15.219:

"Section 15.219 Operation in the band 510 - 1705 kHz.

(a) The total input power to the final radio frequency stage (exclusive of filament or heaterpower) shall not exceed 100 milliwatts.

(b) The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3meters.

(c) All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions."

Another legal issue is station identification. Here is the rule on that issue : (Title47 Sec. 73.3550) Users of non licensed, low-power devices operating under part 15 of this chapter may use whatever identification is currently desired, so long as propriety is observed and no confusion results with a station for which the FCC issues a license. Please note that FCC regulations do not allow an antenna in excess on 3 meters in length, currently any ground wire can be considered part of this antenna length calculation.

A typical encounter with the FCC would entail just a phone call from them asking for your certification number. Most of the time (as long as you are using a certified transmitter) they won't even come by to inspect your installation. You don't want to be using an uncertified transmitter (especially a kit) if you get a call from the FCC. It is a good idea to broadcast your contact information at least hourly so that in case the FCC wants to contact you they can easily. Also you can leave a package at the transmitter site where it can easily be seen containing the certification information, in case the FCC should visit when no one is present.

When you go on the air with a part 15 do not contact the FCC to let them know of your operation, they don't want you to. They have no way to deal with the information. They will find you if they need to. We have had many contacts through the years with the FCC, if you get a visit just be honest and open, I have found they are easy to get along with and pleasant unless they feel that you are trying to pull some sort of trick on them. Like I said before most of the time a site visit shouldn't be necessary, but if it is be open and honest, if there is problem honestly present your side. If they want you to change something to bring you into compliance they will give you a paper describing what needs to be done and then return in 30 – 60 days to check to see if the change has been done. We have never heard of one of our transmitters being shut down because of improper installation, the agent has always given the customer time to fix any issue and has allowed them to continue to operate.

Please be aware that even if your equipment is properly installed and passes an FCC inspection, you might still be the subject of a complaint from a nearby broadcast station or member of the general public. Inappropriate or frivolous complaints are filed with the FCC regularly.

RangeMaster may offer advice on how to install a transmitter, but the customer is responsible for rule compliance.

The FCC is an independent governmental agency, answerable only to congress, we cannot guarantee and/or we cannot be held responsible for what the FCC may do or decide in any particular situation.

The 3-meter combined length specified in Section 15.219(b) refers to the length of all radiating elements. Attaching the ground lead to an unshielded radiating object, or the addition of a ground screen, will cause the effective length of radiating elements to exceed 3 meters, in violation of Section 15.219(b).

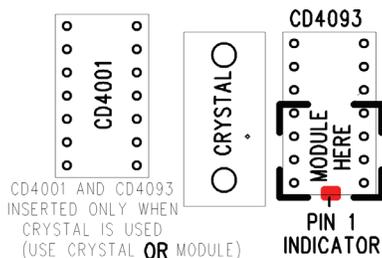
10. Converting from agile module to crystal

Reverting back to the crystal First remove the AM1000F module, remove the two nylon screws and gently rock the AM1000F to remove it from the socket. You can leave the two nylon standoffs if you want or they can be removed from the bottom. Install the CD4001 U8 chip being careful to place the notched end down as shown. Be sure all pins are in the socket. Now you can install the crystal in the Y1 socket area. In later models you also need to install U10 CD4093.

10a Module—Crystal

When changing the Module replace as shown being careful of the pin one polarity. To change from crystal to module remove CD4001 CD4093 and install module as shown. It may be necessary to add a jumper from the module pin 4 to the CD 4093 pin 5 if your board is not Module ready.

To change from Module to crystal remove Module, add CD4001 and CD4093 as shown and install crystal. Do not install crystal and module at the same time.



11. Certification

COPY

FEDERAL COMMUNICATIONS
COMMISSION
WASHINGTON, D.C. 20554

COPY

**GRANT OF EQUIPMENT
AUTHORIZATION
Certification**

Hamilton PCB Design
134 Wind Chime Ct. P.O. Box 20594,
Raleigh, NC 27619
United States

Date of Grant: 07/17/1998

Application Dated: 05/08/1998

Attention: Keith Hamilton

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: NWXAM1000

Name of Grantee: Hamilton PCB Design

Equipment Class: Part 15 Low Power Communication Device Transmitter

Notes:

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
37	15C	1.2 - 1.71			

37: This device has shown compliance with new rules adopted under Docket 87-389 and is not affected by Section 15.37, transition rule.

Mail To:

9805218315166002

12. Using tuning computer

When transmitter is turned on, the computer will start in Power Set mode if there is a shunt in J13 (Power is set last).

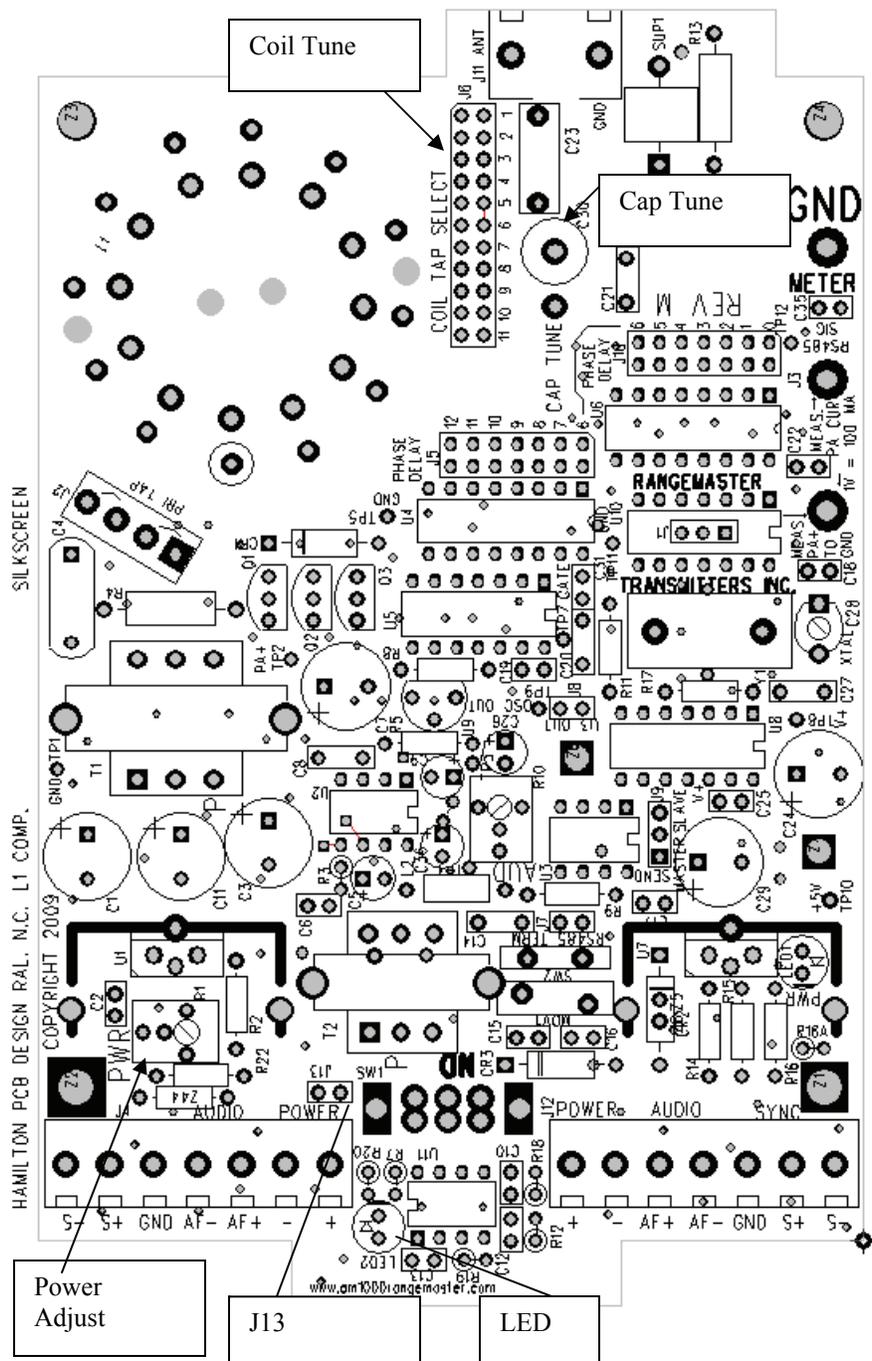
When you are tuning you will get better readings with the power all the way down (Power Adjust counter clockwise). Also it will help if the Cap Tune (10 turn device) is about in the middle of it's range (5 turns in from either way). Please note the tuning function is an alternative to using a meter.

To go to the Coil Tune program (first tuning step) turn transmitter on with shunt in J13, wait 1-2 seconds, remove J13 shunt, then replace shunt back into J13. Please note you can preferably use a voltmeter.

To use the Coil Tune program simply move the shunt on the Coil Tune jumper block, and then remove J13, if the voltage is higher the LED will be green, if lower the LED will be red. Then immediately replace J13 shunt. At this point you can move the Coil Tune shunt if you wish again and take another reading with J13. If the LED goes blank (It is starting Cap Tune program) just turn power off/on with J13 in, then move J13 out/in.

Be sure to have your hands away from antenna and coil areas when you remove J13 to take a reading, otherwise you may get confusing readings.

The goal in tuning is to peak the voltage, or to arrive at the peak possible voltage using the Coil Tune shunt and tuning tool on the Cap tune.



To go to the Cap Tune program just leave the shunt in J13 for 15 seconds, the LED will turn off. Take the shunt off J13 (and then replace shunt onto J13) and you are in the Cap Tune program.

To find the peak voltage using this program you need to get used to working with the program. As the voltage is steady or going up the LED will remain green, it will however tell you when the voltage is going down, and how fast. Turning the Cap Tune more quickly will give more red blinks as the voltage goes down.

When the voltage is dropping quickly the LED will be solid red, when the voltage is dropping slowly the LED will tend to blink red. Of course as the voltage is going up (which is what you want) the LED will remain green.

So rotate the Cap Tune left or right, whichever way the LED stays green, until it starts to go red. Then rotate Cap Tune the other way until the LED blinks red again. You should find as you rotate both directions that you can turn about one full turn either way or so before the LED starts to blink red, leave the Cap Tune in the middle of the green range and you are tuned!

Just keep in mind the LED blinks/goes red as the voltage is going down, and the goal is to keep the voltage going up until you find a peak.

An Alternative to using this program is to use the other Red LED (inside the black heatsink) as an indicator. Turn the power down until you can just barely see the LED light, then you should be able to use this LED as a Voltage indicator, the LED will get brighter as the voltage goes up. This will only work if the LED is dim.

You may find using a voltmeter quicker, but if you don't have a voltmeter handy this program will do the job.

Once you have tuned turn the transmitter off, then back on with a shunt in J13. This will put the computer in Power Set mode.

Simply rotate the Power Adjust to light the LED green for .1 watt legal power level.

Example tuning:

Coil Tune shunt is on position 3

Coil Tune program running (see earlier instructions)

Move Coil Tune shunt to position 4

Remove J13, LED is green (voltage is going up)

Replace J13

Move Coil Tune shunt to position 5

Remove J13, LED is green (voltage is going up)

Replace J13

Move Coil Tune shunt to position 6

Remove J13, LED is red (voltage is going down)

Replace J13

Move Coil Tune shunt to position 5

Remove J13, LED is green (voltage is going up)

Replace J13

Move Coil Tune shunt to position 4

Remove J13, LED is red (voltage is going down)

Replace J13

Move Coil Tune shunt to position 5

Remove J13, LED is green (voltage is going up)

Replace J13

Coil Tune position 5 has the highest voltage.

Leave the shunt in J13 for 15 seconds (LED blanks, then remove J13) to move to Cap Tune program where you continue peaking the voltage with the Cap Tune control. When the voltage goes down the LED will go red, when the voltage goes down fast the LED will be solid red, when falling slowly the LED will be blinking RED.

Please note that changes or modifications not expressly approved by RangeMaster for compliance could void the user's authority to operate the equipment.

This unit is meant to be installed by someone who has some radio/technical background, a technician. If you don't feel qualified to install this unit yourself contact a local radio/TV shop. They may be able to help. Also if you have a friend who is a Ham radio operator they may be able to help you.

Do not use any antenna except the whip antenna recommended (radio shack 21-903), a heavier or stiffer antenna can cause premature failure of the supporting structure.

Please be aware that even if your equipment is properly installed and passes an FCC inspection, you might still be the subject of a complaint from a nearby broadcast station or member of the general public. Inappropriate or frivolous complaints are filed with the FCC regularly. RangeMaster may offer advice on how to install a transmitter, but the customer is responsible for rule compliance.

The customer is responsible to be sure the installation is properly maintained and should have the assembly inspected monthly by a competent technician, or more often if warranted, for example in windy areas the box should be checked for signs of mechanical stress/failure. Any part of the assembly that is not in proper order should be corrected immediately. The equipment does contain surge protection, but this circuitry will only operate if/when the equipment has been properly grounded.

This protection circuitry will not help in the event of a large nearby surge or strike.

Limitation of Warranty:

The Warranty stated above is the only warranty applicable to this product. All other warranties, express or implied (including all implied warranties of merchantability or fitness for a particular purpose) are hereby disclaimed. No verbal or written information given by Rangemaster Transmitters, Inc. its agents, or employees, shall create a guarantee or in any way increase the scope of this warranty.

Repair or Replacement as provided under the warranty is the exclusive remedy of the customer/installer. This product is intended to be installed and maintained by a competent radio technician. Rangemaster Transmitters, Inc. shall not be liable for incidental or consequential damages resulting from the use of this product or arising out of any breach of any express or implied warranty on this product. this disclaimer of warranties and limited warranty on this product are governed by the state of North Carolina, except to the extent prohibited by applicable law, any implied warranty of merchantability or fitness for a particular purpose on this product is limited to the applicable warranty period set forth above.

The Installers listed on the website are independent from RangeMaster, Inc. , we make no guarantees concerning the suitability or performance of a particular Installer. We will however remove an installer from the website if we receive an unresolved complaint.