

MFJ

80/160 Meter High Efficiency Matching Network

Model MFJ-2910

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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For your safety and product enjoyment please read all of the instructions before trying to use the equipment.

Proper RF and lightning grounding is needed for proper operation of the antenna.

CAUTION

When working with the antenna always watch out for high voltage lines. Do not install the antenna anywhere that there is a chance the antenna may come in contact with electrical lines.

Do not install the antenna anywhere there is a chance that the antenna will fall on your neighbor's property.

Do not touch or allow anything to come in contact with the antenna or tuning unit while transmitting. High RF voltages are generated during transmit.

MFJ-2910 160 and 80 Meter Loading Coil Assembly

Introduction

The MFJ-2910 is designed to be used with the MFJ-2990 43 foot vertical antenna to resonate the antenna on 80 and 160 meters bringing the impedance within the range that an antenna tuner can handle. It is designed to handle up to 1.5KW PEP on all of the amateur bands from 160 to 6 meters. When running CW, RTTY, or other high duty cycle modes reduce the power to 750W average output.

Theory of Operation

On 40 meters and up the antenna is *around* 200 ohms resistance with some reactance for most of the amateur bands. A 4:1 balun reduces the impedance to *around* 50 ohms, usually less than a 4:1 SWR at the radio, which is within the range of most external automatic antenna tuners. On 80 and 160 meters the impedance is much lower and highly capacitive. Add in the 4:1 balun and the impedance is outside the range of just about any antenna tuner. The circuit uses a series and shunt coil circuit to transform the impedance to around 200 ohms on each band allowing the balun to transform the impedance to 50 ohms on both 80 and 160 meters. A relay switch network was designed to select the coils and taps to make it work on all of the bands. On 160 meters all of the relays are de-energized. Because of the very high voltages that are produced a unique isolation scheme was developed to prevent arc over in the relays. On 80 meters relays are energized with -12 volts bypassing the 160 meter loading coil and changing the shunt tap to properly match the load. On 40 meters and up several more relays are energized with +12 volts bypassing the 80 meter coils.

At least 4 ground wires of 1/8 to 1/4 wavelength at the lowest frequency is recommended and more for each of the other bands. The better the ground the better the radiated signal will be. There are a number of articles in the Amateur magazines on grounding and are worth finding and reading. Lightning grounding per the NEC code is also recommended.

Operation at high power produced very high voltages across the insulator. A base was developed to take the place of the original insulators using a fiberglass sleeve producing an insulated base that will withstand the voltages developed. An arc gap is built into the board to help protect the unit from excessive voltages that may damage the relays.

Because of the high voltages avoid placing the antenna where people or animals could come in contact with it. Also do not let weeds or bushes come in contact with the antenna. It is strongly suggested to put some sort of non metallic protection around the antenna be installed to prevent unintentional contact.

Tools

- 3/8 nut driver or wrench.
- 1/2" box end or adjustable wrench
- #1 Phillips Screw Driver
- #2 Phillips Screw Driver
- Long Tape Measure

Antenna Assembly and Mounting

The instructions are assuming that the antenna has not been assembled or has been taken down to add these new components. Some of the hardware will be reused and the support pipe driven into the ground is already installed. If the antenna has not been taken down then the antenna will have to be taken down so the new base can be installed and the antenna re-measured. If you are assembling the MFJ-2990 with the MFJ-2910 for the first time read the MFJ-2990 instructions and follow them up to the point of installing the ABT-65 mounting base.

While the antenna is down check the hardware and clean any corrosion from the points that the pipes are clamped together using steel wool or fine sand paper.

When working with the antenna always watch out for high voltage lines. Do not install the antenna anywhere that there is a chance the antenna may come in contact with electrical lines.

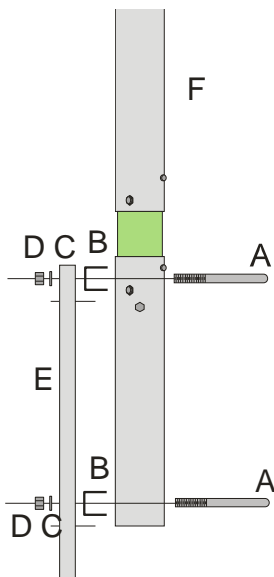
Do not install the antenna anywhere there is a chance that the antenna will fall on your neighbor's property.

Have help on hand to raise the antenna. It is not very heavy but is very awkward requiring help to guide the antenna and bolt it in place. Also have the hardware on hand while raising the antenna for minimal delay in mounting the antenna to the mounting pipe.

1. Remove the existing 80-AV6160-1 balun. It will not be reused with the MFJ-2910.
2. Remove the U clamps on the existing ABT-65 mount assembly. The hardware and mount assembly will be reused to reinstall the MFJ-2910.
3. Slide the new base assembly over the existing bottom section of the MFJ-2990 till it bottoms out against the insulator. Put on one of the 2-3/8" hose clamps (J) on the top end of the base and tighten down to grab the antenna securely.



4. Re-measure the antenna and if needed adjust the antenna sections to 43 foot or whatever is desired for the portion of the band you operate. Measure from the bottom of the top aluminum tube on the base to the top of the antenna.
5. Place a 2-3/8" hose clamp right above the top screws on the top part of the base and adjust till snug enough to not slip below the screws.
6. Place another 2-3/8" hose clamp on the bottom pipe on the base about half way up the bottom base and tighten so that it will not slip off during assembly and erection.
7. Assemble the mounting plate to the base using the U clamps (A), Mast Saddles (B), nuts and lock washers (C&D) as shown in the diagram. Tighten securely to prevent slippage. Make sure the ground screw on the bottom section of the base is pointing to the left or right, not into the mounting plate.



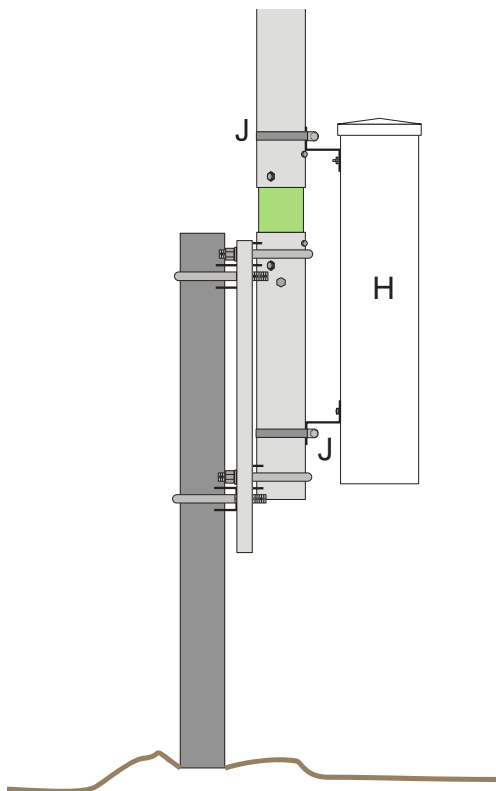
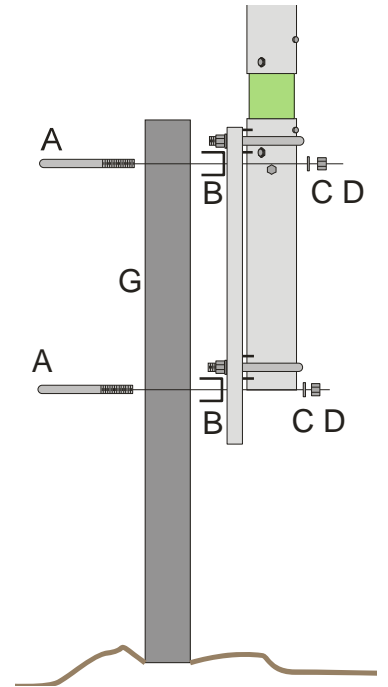
Item	Description	Part Number
A	5/16 SS U Bolt*	101405
B	Mast Saddle	758-9198
C	5/16 SS Split Ring Lock Washer*	10119
D	5/16 SS Nut*	10118
E	Mounting Plate*	172734
F	Base Assembly	
G	Mounting Pipe**	
H	Tuning Unit	
J	2-3/8 Hose Clamps	745-3128S

* Items included with MFJ-2990 Antenna.

** Not Supplied in the Kit

8. Place the antenna such that the bottom end of the mounting plate is against the mounting pipe. One person should hold the mounting plate down against the ground and the support pipe and the other person walk the antenna up. As the antenna goes up the base will have a tendency to kick up till the weight of the antenna is pushing it down. **Watch out for power lines and obstructions above in the path the antenna will take going up.**

9. Once the antenna is vertical clamp the mounting plate to the support pipe using the U clamps (A), Mast Saddles (B), nuts and lock washers (C&D) as shown in the diagram to the right. Lift up on the antenna some to bring the insulator even with the top of the support pipe. Tighten down the U clamps securely to prevent slippage.



10. Mount the tuning unit to the base. Note this will be done several times during tune up both with and without the cover. Loosen the hose clamps at the bottom of the base. Slide the top clamp up some. Place the top mounting bracket of the tuning unit against the mast above the insulator and above the top screw. Slide down the hose clamp and tighten down to hold the tuning unit. Slip the bottom hose clamp over the bottom mounting bracket on the tuning unit and tighten down. The tuning unit should be on the opposite side of the antenna from the support pole.

11. Run the coaxial cable to the SO239 connector on the bottom of the tuning unit.

12. Attach the ground wires to the base. Either to the ground screw on the base or to one of the many empty holes on the mounting plate.

Tune Up

1. Remove the tuning unit from the mast and remove the cover by taking off the two nuts holding the top mounting bracket, the two screws holding the bottom mounting bracket, the middle screw, and the self tapping screw holding the bottom cover to the case. Slide the cover off of the PC Board.
2. Mount the top mounting bracket back on the PC Board using the nuts just removed.
3. Mount the bottom bracket using the spacer bracket and the screws just removed. The spacer bracket is used to take up the space of the cover and allow for proper tightening of the bottom bracket screws.
4. Mount the assembly back on the antenna mast.
5. Tuning of the assembly is best done with an antenna analyzer such as an MFJ259B or other device to measure the SWR or impedance without putting power to the antenna. If using a transmitter and SWR meter, be VERY careful to not touch the tuning unit or antenna while transmitting because even with low power testing high voltages will be generated. Also touching the antenna will detune the antenna making any antenna analyzer readings wrong.

DO NOT TOUCH THE TUNING UNIT WHILE TRANSMITTING!

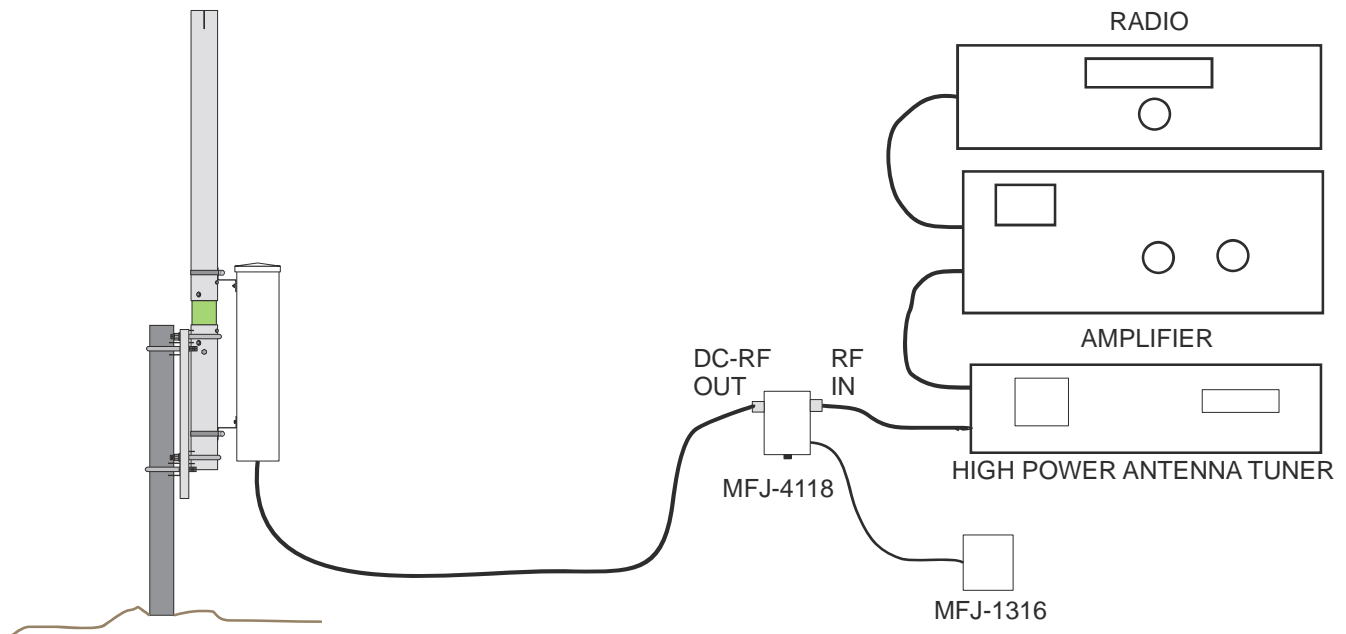
6. Connect up a short jumper cable from the tuning unit to the MFJ-4118 dual polarity bias T RF/DC OUT/IN connector. Connect a jumper cable from the other connector on the bias T to the analyzer or SWR meter. Connect power from an *isolated* power supply such as an MFJ-1316 AC Adapter to the DC input port of the tap.

NOTE: The cover will affect the tuning some between the cover off and on. Tune about 25KHz to 50KHz lower than the final desired tuning range.

7. Turn the Bias T to DC⁻ turning on the relays for the 80M section. Adjust the top of the shunt tap for the portion of the 80M band you want to operate. Tuning at 3.70MHz with the cover off should allow you to tune up the antenna anywhere on the band with an external antenna tuner. Internal to the radio antenna tuners may not have enough range to tune to the band edges. The top tap adjusts the frequency range and the bottom tap adjusts the impedance at resonance. They are interactive but an SWR of 1.5 to 1 should be obtainable. The exact placement of the taps will depend on the ground system and other things in the area such as houses, gutters, trees and so on.
8. With the bias T OFF on 160 meters check the SWR/Impedance of the antenna in the area that you will operate. Tuning at 1.85MHz with the cover off should allow you to tune up the antenna anywhere on the band with an external antenna tuner. Internal to the radio antenna tuners may not have enough range to tune to the band edges. The tap on the 160M loading coil will tune the place in the band to operate and the shunt tap will adjust the impedance at resonance. They are interactive but an SWR of 1.5 to 1 should be obtainable. The exact placement of the taps will depend on the ground system and other things in the area such as houses, gutters, trees and so on.
9. Once the tuning is complete reassemble the tuning unit in the cover. Remove the screws, nuts mounting brackets and spacer bracket. Slide the board/coil assembly into the cover till the top screws come through their cover holes. Put on the mounting bracket and the nuts loosely for the moment. Slip the bottom around to where the bottom screw holes line up with the screw holes in the spacers then start the screws with the mounting bracket on it till they just catch the threads. Slip the bottom cover in till the slots bottom out with the screws. It should be in the plastic cover about a half inch and the self tapping screw hole comes close to lining up with the hole in the cover. Tighten down the screws and nuts. Put in the self tapping screw holding the bottom cover to the cover.
10. Mount the tuning unit to the antenna and check the tuning to make sure the unit did not shift too much during assembly.

Setup

1. Use a coaxial cable that will handle the planned power with a minimum loss. Good quality cable such as RG-8, Belden 9913, or Times Wire and Cable LMR-400 will work fine. RG-58 is not designed to handle the legal limit power and is not recommended when running high power.
2. Run the coax from the antenna to the house. A DC PASS lightning surge protector such as the MFJ-272 that is properly installed and grounded is recommended at the building entrance. From there run the coax to the operating location.
3. The MFJ-4118 Bias T is installed at the operating position to allow you to switch bands. The coax to the antenna is connected to the RF-DC SO-239 connector on the Bias T.
4. The other SO-239 is then connected to the antenna tuner output.
5. Wire the antenna tuner, amplifier and radio according to their instruction manuals.
6. Connect an AC Adapter to the MFJ-4118 Bias T. An adapter such as the MFJ-1316 will power the MFJ-2910 properly. Do not use a power supply that has the negative terminal grounded. The MFJ-2910 requires a floating supply that can have either positive or negative to ground. The station supply will not work because your radio, amplifier and tuner will be grounded at the case to the negative terminal of the supply.



Operation

The basic MFJ-2990 and other antennas of the 43 ft tall variety require an antenna tuner for proper operation. The impedance is *around* 200 plus a reactive component depending on the ground system and objects in the near area. The Balun of the MFJ-2990 transforms the impedance to *around* 50 ohms (usually less than 4:1 SWR). The MFJ-2910 on 40 meters and up operates the same as an unmodified MFJ-2990. On 80 and 160 meters the tuning box will tune the antenna so the output is about 50 ohms at resonance. Toward the band edges the SWR will go up requiring an antenna tuner to cover the whole band.

1. For operation on 160 meters switch the slide switch to the middle OFF position turning off all relays.
2. For operation on 80 meters slide the switch to DC- applying a minus voltage on the MFJ-2910, switching the relays to 80M mode.
3. For operation on 40 meters and up slide the switch to DC+, applying a positive voltage on the MFJ-2910, switching the relays to 40M mode. This mode connects the internal balun to the antenna and bypassing the coils.
4. Once selecting the band of operation tune up the antenna using the instructions supplied with the tuner using low power. Once the tuner is tuned up you can transmit with high power.

Mounting Pipe Installation:

The mounting pipe should consist of a 4-foot length (minimum) of thick-walled (1/8" minimum) galvanized steel pipe with an outside diameter of 2". Do **NOT** use aluminum, as aluminum will corrode in short order. Dig a 1 foot diameter hole deep enough to accommodate 2.5 feet of pipe and a few inches of gravel at the bottom for drainage. 18" of pipe should extend above ground level. These are minimum requirements in that a longer pipe, deeper mounting hole, and larger diameter hole is better – especially if your ground soil is somewhat unstable (moves due to freezing/thawing or moisture content). Set the pipe on the gravel and pour concrete around the pipe until the concrete is level with the ground. Use a level to ensure that the pipe is straight. Allow 8-10 hours for the concrete to set. Always follow local building codes where required by law.

Parts List

Existing items with MFJ-2990:

Antenna Mast assembly (with stainless steel hose clamps)

80-AV6160-1 Balun (not reused)

ABT-65 Mounting Kit with:

U Clamps (4)

Mast Saddle (2)

Mounting Plate

Nuts (8)

Lock Washers (8)

ABS Insulators (2 not reused)

Included Items:

MFJ-2910 Tuning Unit

MFJ-2910 High Power Insulated Base

MFJ-4118 Dual Polarity Bias T

758-9198 Mast Saddle (2)

745-3128S 2-3/8 Stainless Steel Hose Clamps (3)

Suggested Accessories:

MFJ-1316 AC Adapter

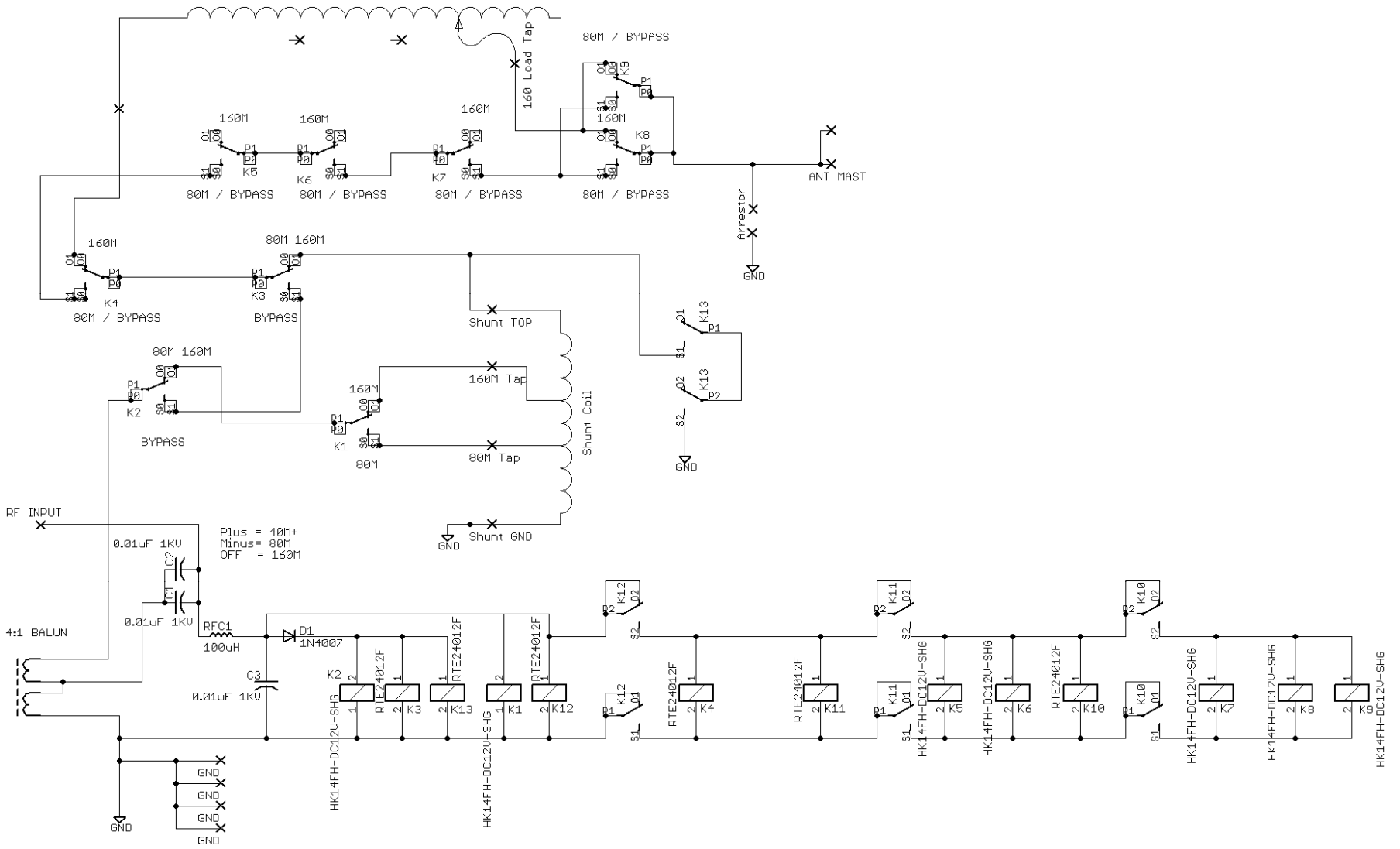
MFJ-272 High Power Lightning Surge Protector

MFJ-1934 4 Foot Ground Rods

Ground Wire and grounding clamps

If working with another type of 43 ft vertical other than the MFJ-2990 check the hardware for compatibility with the MFJ-2910. The bottom tube on the MFJ-2990 is 2.00 in od which slips into the MFJ-2910 base. Other antennas may use different diameter tubing. The ABT-65 is available if needed.

SCHEMATIC DIAGRAM



NOTES:

FULL 12-MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, of forgery shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$12.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **\$8.00** personal check, cashiers check, or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (662) 323-5869.
5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned**. Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense un-repaired.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
9. This warranty is given in lieu of any other warranty expressed or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 300 Industrial Park Rd, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase and a telephone number.
12. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.



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