MFJ

Super Battery Booster

Model MFJ-4416

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

MFJ ENTERPRISES, INC.

300 Industrial Park Road
Starkville, MS 39759 USA
Tel: 662-323-5869 Fax: 662-323-6551

VERSION 0A

TABLE OF CONTENTS

TOPIC		PAGE
1.	**TABLE OF CONTENTS**	2
2.	**LIST OF FIGURES AND TABLES**	2
3.	**INTRODUCTION AND FEATURES**	3
4.	**TYPICAL SPECIFICATIONS**	4
5.	**SYSTEM CONTROLS AND INDICATORS**	4
	a. TOP INPUTS AND OUTPUTS	4
	b. SIDE PANEL CONTROLS AND INPUTS	5
6.	**INTERNAL HEADER AND VOLTAGE CONTROL**	6
7.	**THEORY OF OPERATION**	7
8.	**TYPICAL EFFICIENCY**	8
5.	**MFJ-4416 EASY-START INSTRUCTIONS**	9
6.	**IN CASE OF DIFFICULTY**	10
7.	**TECHNICAL ASSISTANCE**	10

LIST OF FIGURES

Figure 1	Top Inputs and Outputs	4
Figure 2	Side A Controls and Indicators	5
Figure 3	Side B Jack	5
Figure 4	Internal Headers and Voltage Adjust	6
Figure 5	Block Diagram	7
Figure 6	Schematic Diagram	11

INTRODUCTION & FEATURES

INTRODUCTION

The MFJ-4416 Super Battery Booster is designed with the serious mobile operator in mind. In the mobile environment low battery voltage can cause output signal distortion, output power problems and even transceiver resetting. This low voltage occurs in two ways. First – even low resistance wiring can result in noticeable voltage drop. And second when you turn off your vehicle or remove a typical battery from the charger, the battery voltage can drop from the nominal 13.8 volts to 12 volts after a short period of time. With this in mind the MFJ-4416 Super Battery Booster corrects all of these problems. With its high efficiency boost regulator circuitry, it will maintain the desired 13.8 volts at up to 25 amps peak from voltages as low as 9 volts.

FEATURES

Choice of Input and Output Connections: No need to fumble around looking for connectors. The MFJ-4416 gives you a choice of Anderson PowerPole™ connectors or 5-way binding posts on the input and output.

Adjustable Output Voltage: User adjustable output voltage. Factory set at 13.8 volts this voltage is adjustable anywhere from 12 to 13.8 volts. When setting the voltage at 12 volts, input voltages greater than 12 volts pass through, but the efficiency is greater. Typically saving over 30 watts in heat dissipation during transmit.

Selectable Minimum Input Voltage: You have the choice of the minimum input voltage the MFJ-4416 will operate on. Set from the factory at 10 volts you can select 9 or 11 volts. This keeps you from possibly over discharging your battery and damaging it. It is even latchable so once the voltage drops the Boost Regulator stop until you remove the power from the unit.

Audio Alert Feature: When enable instantly alerts you when the input voltage drops below the preset level.

RF Sampling Port: Feed RF from your radio's antenna line with a "T" connector and the unit will automatically sense when the high current demands of transmitting are required so no regulator switching efficiency penalties are incurred during receive.

RUGGED CONSTRUCTION - Attractive all-metal cabinet, conservative component selections ensure solid performance for years to come. Fully covered by MFJ's "No Matter What" one year limited warranty.

SYSTEM CONTROLS AND INDICATORS

TYPICAL SPECIFICATIONS

Output Current……25 Amps Peak
Output Voltage ……13.8 Volts at 9-13.8 volts input.

Before attempting to operate your MFJ-4416, please read the manual thoroughly. It contains important details about setting up your unit to obtain the best performance.

Top Inputs and Outputs:

Figure 1: MFJ-4416 Top Inputs and Outputs

1. 5-Way High Power Binding Post Negative Input.

2. Anderson PowerPole™ Negative Input.

3. Anderson PowerPole™ Positive Input.

4. 5-Way High Power Binding Post Positive Input.

5. 5-Way High Power Binding Post Positive Output.

6. Anderson PowerPole™ Positive Output.

7. Anderson PowerPole™ Negative Output.

8. 5-Way High Power Binding Post Negative Output.

SYSTEM CONTROLS AND INDICATORS

Side A Controls and Indicators:

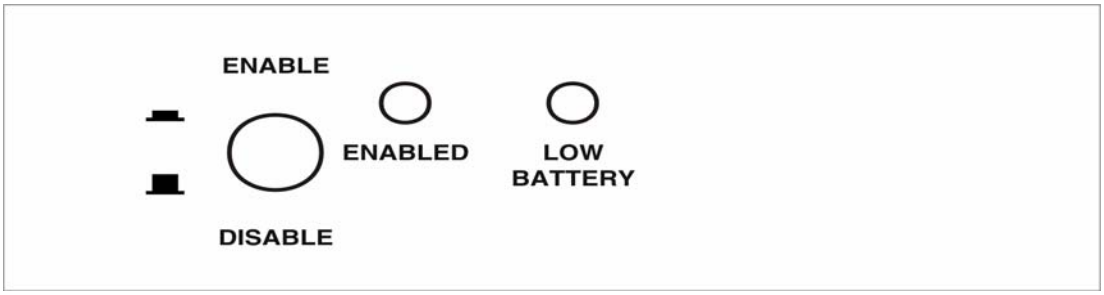

Figure 2: MFJ-4416 Side A Controls and Indicators

1. Enable/Disable: This switch allows the RF Sense feature to be disabled. When in the Enabled position the Switching Regulator is always on.
2. Enabled LED: This LED is illuminated when the Switching Regulator is enabled either through the RF Sense feature or the Enabled/Disabled Switch is in the Enabled position.
3. Low Battery LED: The LED Illuminates the low voltage trip threshold has been crossed. If the latching feature is enabled the MFJ-4416 must be removed from the input voltage source and allowed to discharge to reset the cutout.

Side B Controls and Indicators:

Figure 3: MFJ-4416 Side B Jack

1. RF Enable Jack: This Jack allows RF to be fed from your transceiver. It will sense the RF and turn the Boost Regulator on and off. This will help conserve power during receive when the boost is often not necessary.

INTERNAL HEADER AND CONTROL

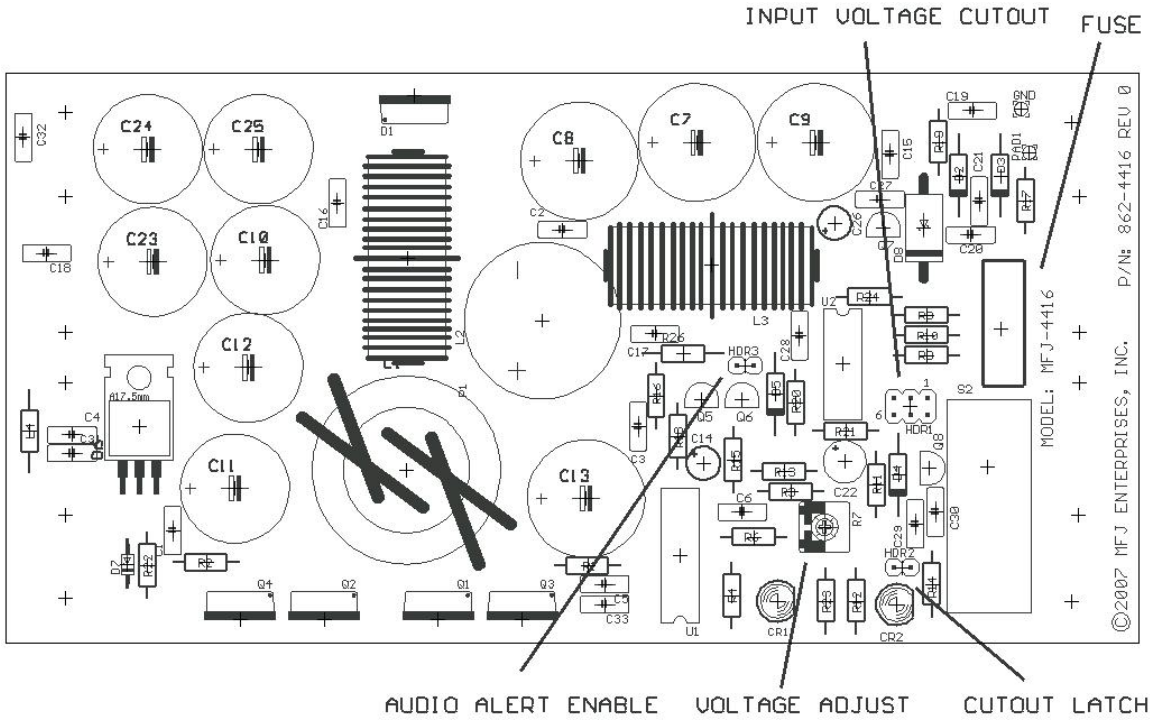

Figure 4: MFJ-4416 Internal Header and Voltage Control

Input Voltage Cutout: This is where you set the input voltage cutout. Default is 10 volts when jumpered across 3-4. To set the cutout at 11 volts move this jumper to 5-6. For 9 volts cutout move this jumper to 1-2.

Voltage Adjust: This trimpot sets the output voltage. Set from the factory at 13.8 volts this level is adjustable from 12 to 13.8 volts.

Audio Alert Enable: This jumper enables the audio alert. Any time the voltage drops below the level set by the input voltage cutout you will be alerted by the Piezo buzzer. To disable remove the jumper.

Cutout Latch: When jumpered the Boost Regulator IC will be shutdown anytime the voltage drops below the level set by the Input Voltage Cutout. It will remain shutdown until the input voltage is removed from the unit. Default not jumpered.

THEORY OF OPERATION

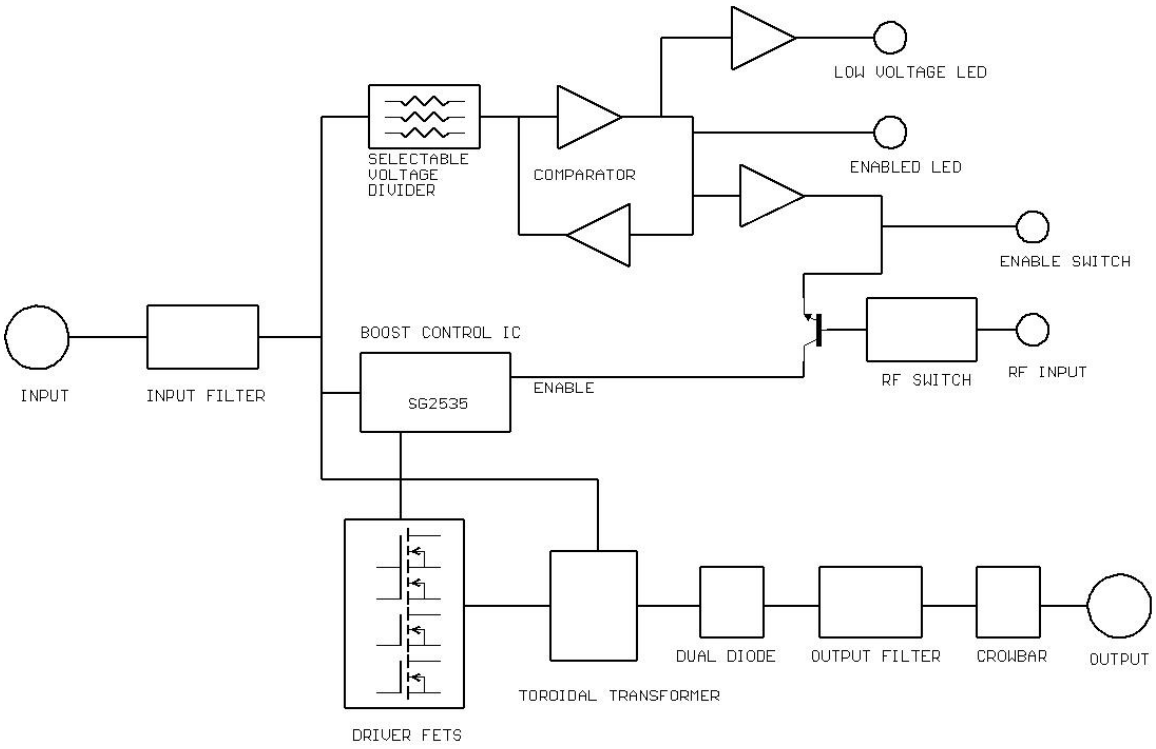

Figure 5: MFJ-4416 Block Diagram

Refer to Figure 3 and the schematic Figure 6 for the discussion of the theory of operation. The input voltage passes through an input filter consisting of L3 and three 4700 uf capacitors. This helps keep switching transients from appearing on the input line of the unit. This filtered positive voltage is then fed to the center tap of the primary and the secondary of the switching toroidal transformer L1. When the unit is disabled this voltage appears on the output of the unit less the voltage drop across the dual diode D1. When enabled the secondary voltage of the toroidal transformer is the input voltage plus the voltage of the transformer primary windings. By doing it this way the transformer only needs to supply the difference of the output voltage and the battery voltage. This reduces the power requirements of the transformer and switching FETs. The output is then rectified by the Dual Diode D1. Output filtering consists of L2 and six 4700 uf capacitors. This 28,200 uf of output filtering helps ensure the output is clean from switching transients. The output is protected by a crowbar circuit consisting of a 15 volt zener diode D7 and the SCR D6. When a voltage higher than 15 volts is sensed, the SCR is triggered shorting the output to ground to protect your equipment from damage in the event of a problem. There are 2 inputs for enabling the unit. The first is a simple switch that turns the unit on and allows it to continuously run. The second is a RF switch

consisting of rectifier diodes D2 and D3 that sample the RF being fed to the unit. When the RF is sensed then the switch consisting of Q7 and Q5 turn on to take the Enable Input of the regulator IC low turning it on. The last section of the MFJ-4416 is the Low Voltage Detection circuit. This circuit uses on of three selectable voltage dividing resistors to sample the input voltage. When the voltage drops below a pre-determined level it takes the comparator's output high. If the jumper is placed on the Latching Header then this high level is then inverted and fed back into the input of the comparator which holds the comparators output high. Reset of the low voltage disconnect is accomplished by disconnecting the input voltage.

Typical efficiency at +13.8VDC output and +12VDC output are shown in the tables below.

Typical Efficiency – Output set to +13.8V

Vin	Iin	Vout	Iout	Eff
13.0	27.8A	13.8V	24.00	92%
12.0V	30A	13.8V	24.00	90%
12.5V	20A	13.8V	17A	94%
12.5V	25A	13.8V	21A	91%
11.5V	23A	13.8V	17A	91%
11.5V	27A	13.8V	21A	93%
*11.2V	28A	13.8V	21A	92%
10.5V	26.5A	13.8V	17A	90%
10.0V	20.2A	13.8V	13.8A	94%

*Limited by the input 30-amp fuse

Typical Efficiency – Output set to +12V

Vin	Iin	Vout	Iout	Eff
14V	21.5A	12.9V	22.5A	96%
13V	22.5V	12.1V	21A	87%
12V	24.5	12V	21A	86%
11V	27.9A	12V	21A	82%
10V	24.9A	12V	18A	87%

EASY START INSTRUCTIONS

1. Prepare input and the output cables for the MFJ-4416. It is recommended to use #12 or larger wire for both the input and output cables. The MFJ-5535M cable is available for the output side for use with most HF radios, and the MFJ-5512 M cable is available for most VHF/UHF radios.

2. Prior to connecting the radio and battery, plug the input and the output cables in to the MFJ-4416 and ensure the polarity is correct.

3. If using the RF sense feature, you need to tap into your antenna lead. Normally this is accomplished with a UHF "T" connector. You will also need a cable to go from the "T" connector to the MFJ-4416. This cable should be less than $1/16^{th}$ wavelength long at your highest frequency of operation.

4. Plug the output of the MFJ-4416 into your radio and then attach the input to your battery.

5. You are now ready to operate. If not using the RF sensed switching, depress the enable switch.

TECHNICAL ASSISTANCE

IN CASE OF DIFFICULTY

[ ] Low Voltage Disconnect trips under high demand conditions. This can be caused by 2 things. First ensure your battery is charged. A discharged battery will recover voltage under low current conditions, but once current is drawn it will immediately drop below the cutout voltage. Second, ensure the wiring on the input side of the unit is adequate for the current being drawn and the lengths of the cable run.

[ ] Enable LED fails to illuminate. Ensure that you are either feeding RF from the radio into the unit or the Enable/Disable switch is depressed.

TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or is your problem is not solved by reading the manual, you may call *MFJ Technical Service* at **662-323-0549** or the *MFJ Factory* at **662-323-5869**. You will be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technician may ask.

You can also send questions by mail to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, MS39759; by Facsimile (FAX) to 662-323-6551; or by email to techinfo@mfjenterprises.com. Send a complete description of your problem, an explanation of exactly how you are using your unit , and a complete description of your station.

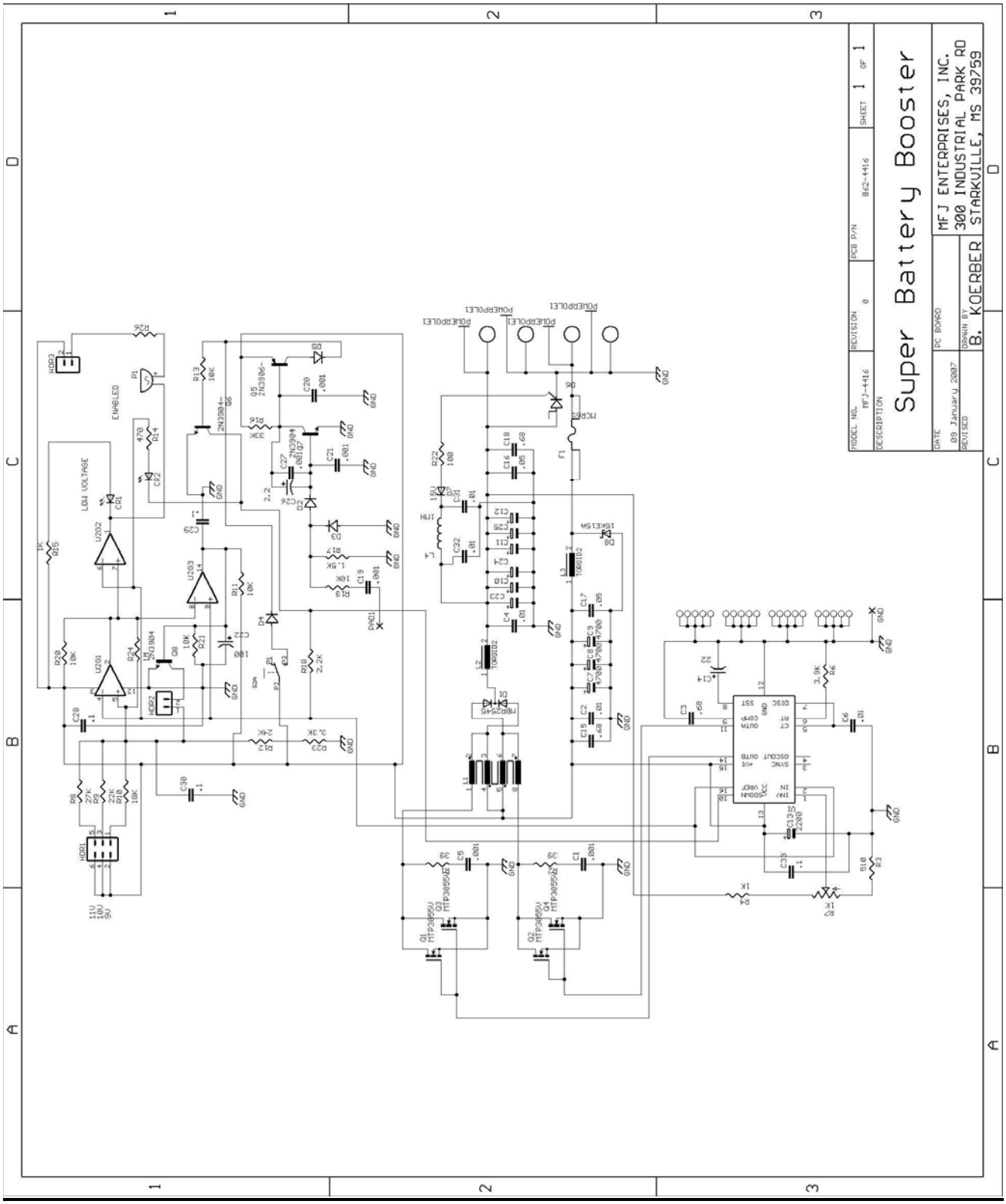

Figure 6: Schematic Diagram

LIMITED 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, or 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 under warrantee provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **$8.00** covering postage and handling.

3. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling the Service Department at 662-323-0549 or the MFJ Factory at 662-323-5869.

4. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.

5. 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 unrepaired.

6. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.

7. **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.

8. This warranty is given in lieu of any other warranty expressed or implied.

9. 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.

10. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to:

MFJ Enterprises, Inc.,
300 Industrial Park Road
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.

11. This warranty gives you specific rights, and you may also have other rights which vary from state to state.