number until you are satisfied with your *FAIL-SAFE* settings. Each time you complete *FAIL-SAFE* setup, the new settings you create will replace any existing settings.

ACCESSORIES
Aileron extension cables, Y-harness, switch harness, and numerous other accessories as well as a

SPECIFICATIONS:

SIZE:	**1.69"L X 1.14"W X 0.77"H**
WEIGHT:	**0.89 OZ.**
DESIGN:	**SINGLE CONVERSION, SUPER HETERODYNE**
CHANNELS:	**1-4**
MAIN CONTROL:	**10 BIT MICROPROCESSOR (1024 RESOLUTION)**
SPECIAL FUNCTIONS:	**S.M.A.R.T. DECODING**
	PROGRAMMABLE FAIL SAFE CHANNELS 1-4
MODULATION:	**FM / PPM (PULSE POSITION MODULATION)**
FREQUENCY:	**R/C SURFACE CHANNELS 61 THROUGH 90 (75 MHz)**
ULTIMATE BANDPASS:	**± 9 KHz @ >60 dB DOWN**
USABLE SENSITIVITY:	**> -94 dBm**
OPERATING VOLTAGE:	**+3.5V TO +10V DC LIMITED ONLY BY SERVO REQUIREMENTS**
LEGAL USE:	**MEETS AMA GUIDELINES**

FMA LIMITED WARRANTY ON WARLOCK RECEIVER PRODUCTS

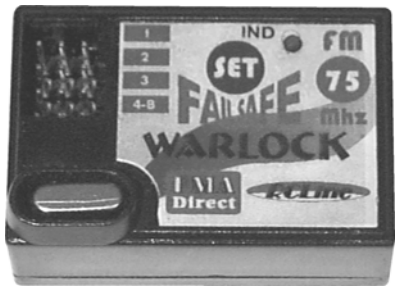
FMA, Inc. warrants this receiver to be free of manufacturing defects for the term of 90 days from the date of purchase. Should any defects covered by this warranty occur, the receiver shall be repaired or replaced with a unit of equal performance by FMA, Inc., or an authorized FMA service station.

LIMITS AND EXCLUSIONS
This warranty may be enforced only by the original purchaser, who uses this receiver in its original condition as purchased, in strict accordance with the WARLOCK owner's manual. Receivers returned for warranty service to an FMA service center will be accepted for service when shipped post-paid, with a copy of the original sales slip or warranty registration form, to the service station advised by FMA, Inc.

THIS WARRANTY DOES NOT APPLY TO

1. Consequential or incidental losses resulting from the use of this receiver.
2. Damage resulting from accident, crashes, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
3. Damage from failure to follow instructions supplied with the product.
4. Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
5. Damage resulting from repair, adjustment, or any alteration to product by any one other than an authorized FMA technician.
6. Installation or removal charges, or damage caused by improper installation or removal.

CALL (301) 831-8980 FOR INFORMATION ABOUT SERVICE AND WARRANTY REPAIRS.



WARLOCK

4 CHANNEL FM UNIVERSAL RADIO CONTROL RECEIVER WITH FAILSAFE

OWNER'S MANUAL

NOTE: PLEASE READ MANUAL COMPLETELY BEFORE OPERATION

INTRODUCTION:

Thank you for purchasing the FMA Direct / RCLine WARLOCK FM, UNIVERSAL, *FAIL-SAFE* receiver. WARLOCK receivers are designed to provide years of trouble-free operation in the most demanding surface environments. Fully crystal-interchangable using all major brand, single conversion factory crystals (including Futaba, JR, and Airtronics), the WARLOCK is compatible with all standard FM transmitters on 75 MHz. Microprocessor controlled at 10 bit, 1024 resolution, the WARLOCK is the first of its kind to offer *S.M.A.R.T.* decoding and true *FAIL-SAFE* operation.

What is *S.M.A.R.T.* decoding? It's a new technology that stands for: *S*elective, *M*icroprocessor-controlled, *A*dvanced, *R*adio *T*ransmission decoding. It works like PCM, only better! It costs much less to produce and it works with any standard FM / PPM transmitter. Why is it better? It's better for two reasons:

1) Standard FM or PPM information is much simpler to decode than PCM information because it contains less data and it always has a similar, repeating pattern. PPM is based on pulse-width information and the number of pulses would be as few as four for a 3 channel transmitter. PCM is based on digital data streams of "1's" and "0's", or "bits". At 1024 resolution, PCM must transmit 10 bits for *every transmitter channel!* So with PPM, it's easier *and faster* for a microprocessor to sense when there are errors within the transmission (interference) and to prevent the servos from "seeing" these errors. Can you imagine how difficult it would be for a microprocessor to determine if there was an incorrect bit in a PCM transmission?

2) Because there is much less data in a PPM transmission, the band-width of the receiver can be greatly reduced and the receiver can be made much more narrow-band. It is always better to keep the receiver design as narrow-band as possible to help alleviate the need for *FAIL-SAFE*. Most PCM designs do the opposite, they rely on *FAIL-SAFE* to mask the fact that the receiver is more open to RF interference.

In actual performance terms, *S.M.A.R.T.* decoding provides improved radio reception over standard and PCM decoding methods, improves range, and resorts to *FAIL-SAFE* much less often than PCM. But just in case interference becomes overwhelming, the *FAIL-SAFE* capabilities in the WARLOCK are fully programmable on any one or all of the four channels.

FMA, Inc.
9607 Dr. Perry Road - Unit 109
Ijamsville, MD 21754

FMA Direct

PACKAGE CONTENTS:

1. FMA Direct / RCLine WARLOCK FM, 4 channel, Universal *FAIL-SAFE* receiver
2. Owner's Manual
3. Programming Quick Reference

PREPARATION:

- **COMPATIBILITY - POWER, SERVO, AND SPEED CONTROLLER CONNECTION**

  WARLOCK receivers support Futaba, JR, Hitec batteries, servos and speed controllers, Airtronics products equipped with the new "Z TYPE" connectors, as well as other brands that use standard polarity (NEGATIVE, PLUS, SIGNAL). WARLOCK receivers *are not* compatible with "OLD STYLE" Airtronics connectors that use reverse power polarity (PLUS, NEGATIVE, SIGNAL).

  WARNING: IF YOU INTEND TO INTERFACE AIRTRONICS BATTERIES / SERVOS / SPEED CONTROLLERS THAT USE "OLD STYLE" (PRE-"Z TYPE") AIRTRONICS CONNECTORS TO THE WARLOCK, YOU MUST UPDATE THE CONNECTORS TO THE CURRENT INDUSTRY STANDARD POLARITY (SEE FIGURE 1) AND PROPER INDUSTRY STANDARD SHELL THICKNESS. YOU MAY READILY CONVERT YOUR EXISTING "OLD STYLE" AIRTRONICS CONNECTORS TO CURRENT STANDARDS 1) BY INSTALLING APPROPRIATE ADAPTERS OR 2) BY REMOVING THE OLD CONNECTORS AND PINS AND REPLACING THEM WITH FMA PART NUMBER SEASSYJ. EACH SEASSYJ CONTAINS ONE JR COMPATIBLE MALE SHELL AND 3 FEMALE PINS. YOU WILL NEED TO CRIMP THE PINS AND SOLDER THEM TO THE WIRES OF YOUR EXISTING EQUIPMENT AND PLUG THEM INTO THE SHELL PROVIDED. MAKE CERTAIN THAT THE RED WIRE (+V) GOES TO THE CENTER PIN AS ILLUSTRATED IN FIGURE 1. FMA WILL NOT ACCEPT RESPONSIBILITY FOR ANY ATTEMPT TO USE "OLD STYLE" AIRTRONICS CONNECTORS WITH WARLOCK RECEIVERS THAT DO NOT HAVE THE POLARITY CHANGED TO INDUSTRY STANDARDS.

TABLE 1 SERVO / SPEED CONTROLLER PLUG ORIENTATION

EQUIPMENT BRAND	1	2	3
FUTABA	BLK	RED	WHT
JR	BRN	RED	ORG
HITEC	BLK	RED	YLW

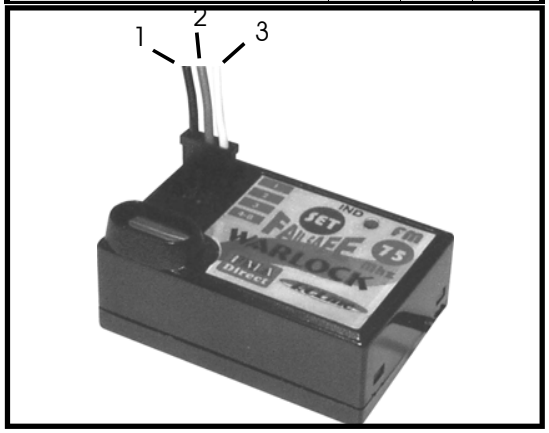


Figure 1 - Model 201FM Shown

- **TRANSMITTER COMPATIBILITY**

  All WARLOCK receivers support full crystal interchangability using any standard, single conversion, factory crystal from Futaba, JR or Airtronics. Make certain the installed receiver crystal and the transmitter are the same brand so that the FM frequency shift of the transmitter will match the receiver.

- **INSTALLATION**

  Care should be taken when installing your receiver to isolate the electronics from vibration and shock. If possible, wrap the receiver in 3/8" thick foam rubber. Restrain the foam-packed receiver using double-sided tape, Velcro or a rubber band if necessary. Extend the antenna to its full length. Do not coil the antenna up or range will be shortened. When hooking up servos and speed controllers to your receiver, use TABLE 1 and FIGURE 1 to check proper plug wire color orientation.

- **RANGE TEST**

  To assure proper performance, the WARLOCK series receiver should be range tested with the "host" transmitter. The major reason for this important test is that over time, all R/C transmitters are susceptible to de-tuning and frequency "drift". To ensure the utmost in secure RF reception, current technologies for narrow-banding used in FMA designs can actually place a higher demand on transmitters. Power level and frequency accuracy of your transmitter are more important than ever before. Therefore, for the initial range check and in rare cases when you suspect degradation of performance from your R/C system, FMA would like to suggest the following guidelines: Begin by placing the receiver on a cardboard box or another non-metallic surface to elevate it about 2 feet off the ground. Connect only one servo and the battery direct. Do not install a switch harness for the initial range test because switch harnesses are often the cause of poor range. Perform the range test with the receiver antenna fully extended VERTICALLY into the air on a dowel rod or the like, and the transmitter antenna collapsed. Apply power and walk away from the receiver moving one control on the transmitter. You should obtain at least 200 feet of line-of-sight ground range if everything is operating properly. If any loss of servo control occurs, the system must be calibrated by an FMA service station. CALL (301) 831-8980 for FMA Direct technical assistance. In certain cases, the FMA service station may ask you to send in your transmitter along with your receiver.

***FAIL-SAFE* FEATURE**

- **OVERVIEW**

  The *FAIL-SAFE* feature of the WARLOCK is fully programmable and can be setup independantly on any one or all four receiver channel servo outputs, one at a time. Out of the box, the WARLOCK is factory setup with *FAIL-SAFE* turned off on all channels. With *FAIL-SAFE* turned off, the WARLOCK will maintain the last valid servo positions should the receiver lose radio contact with the transmitter. With *FAIL-SAFE* activated on any one or all four of the servo outputs, the WARLOCK will position the servos to your user pre-programmed positions in the event of radio failure or heavy interference. Following are the steps required for programming individual *FAIL-SAFE* servo settings on any of the four servo outputs.

- ***FAIL-SAFE* PROGRAMMING PREPARATION**

  1. Make certain battery power, all servos, and speed controllers are connected to the unit as per Table 1 and Figure 1.
  2. Make sure your transmitter and power pack / receiver battery packs are fully charged.
  3. *CAUTION: If the WARLOCK is installed in a car, before you attempt FAIL-SAFE programming of the WARLOCK, elevate the vehicle's wheels above the bench so that it cannot go anywhere when the wheels spin.*
  4. Turn both transmitter and receiver battery power on.
  5. Verify that you have control on all channels.

- ***FAIL-SAFE* PROGRAMMING**

  1. Press and hold the *FAIL-SAFE* "SET" button located on the top of the WARLOCK for approximately one second until the RED LED indicator begins flashing rapidly. Release the button. You are now in *FAIL-SAFE* programming mode. NOTE: If you continue to hold the *FAIL-SAFE* "SET" button for approximately five seconds, the RED LED indicator will flash rapidly for a short time, and then begin to flash slowly. This will automatically RESET the *FAIL-SAFE* feature to factory settings whereby *FAIL-SAFE* is turned off on all channels.
  2. While in *FAIL-SAFE* programming mode, press the "SET" button as many times as the channel number you wish to program. For example, if you wish to program a *FAIL-SAFE* servo setting on throttle, and throttle is channel three on the WARLOCK, press the "SET" button three times.
  3. The throttle servo will now move left and right for three seconds indicating that channel three is ready to accept a new *FAIL-SAFE* setting.
  4. When the servo stops moving, the RED LED indicator will flash quickly for five seconds. During this five seconds, position and hold the transmitter throttle to the point where you want the servo positioned in the event of radio failure or heavy interfernce. *Important: As you hold the throttle in the correct position, press the "SET" button again. FAIL-SAFE* programming for this channel is now complete. You may test your new *FAIL-SAFE* setting by switching the transmitter off. The servo will automatically travel to the position you saved. *Note: If you do not press the "SET" button within the five second interval, FAIL-SAFE for that channel will be set to OFF.*
  5. You may repeat steps 1 through 4 as many times as you require and for any channel