feature of FMA Direct receivers. Reducing antenna length *will* reduce range, however. Proceed carefully, removing only a short amount at a time and be certain to ground range check the receiver with each incremental reduction in antenna length. **NEVER CUT THE ANTENNA SHORTER THAN 18 INCHES!** A special note to helicopter pilots concerning standard FM receivers and antenna placement: FMA Direct receivers are tested thoroughly in all types of aircraft including helicopters. Helicopters often create a challenge because they generate RF noise and heavy vibration from fast-moving parts. In order to improve reception in a helicopter, it is recommended that you route the antenna of the receiver as far away from the tail boom as possible. This is particularly true of carbon-fiber booms. Nylon push rod material mounted to the underside of the skids provides a good channel through which to route the antenna. When hooking up a servo to your receiver, use TABLE 1 and FIGURE 1 to check its plug wire color orientation.

- **RANGE TEST**
  To assure proper performance, the Fortress 2000 series receiver must 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 stick 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.

- **ACCESSORIES:**
  Aileron extension cables, Y-harness, switch harness, and numerous other accessories as well as a full line of servos, batteries, and chargers are available for use with your FMA receiver either direct or from your local FMA dealer.

FMA LIMITED WARRANTY ON RADIO RECEIVER PRODUCTS

FMA, Inc. warrants this receiver to be free of manufacturing defects for the term of one year 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 Fortress 2000 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) 668-7614 FOR INFORMATION ABOUT SERVICE AND WARRANTY REPAIRS.

FORTRESS 2000

8 CHANNEL FM UNIVERSAL RADIO CONTROL RECEIVER

OWNER'S MANUAL

NOTE: PLEASE READ MANUAL COMPLETELY BEFORE OPERATION

INTRODUCTION:

Thank you for purchasing the FMA Direct Fortress 2000 FM receiver. Fortress 2000 receivers are designed to provide years of trouble-free operation. You may fly your Fortress 2000 in anything from sport models to helicopters to IMAA legal quarter scale aircraft with complete confidence. Available in two models, the Fortress 2000 supports either Futaba/JR or "Old Style" Airtronics servo connector polarity. These high-performance designs incorporate the latest advancements in RF technologies available to the R/C industry. Superior RF mixer technology and advanced circuitry for detecting and amplifying PPM information enable the Fortress 2000 to out-perform other single and dual conversion designs presently offered. Heavy-duty, SMT construction on a single, glass-epoxy P.C. board provides outstanding reliability. New, universal operation makes user-programmable shift switching a snap. This means that the same FM receiver can now be programmed to operate with any FM transmitter regardless of the direction of the FM shift.

SPECIFICATIONS:

SIZE:	**2.18"L X 1.68"W X 0.82"H**
WEIGHT:	**1.0 OZ.**
DESIGN:	**DUAL CONVERSION, SUPER HETERODYNE**
CHANNELS:	**1-8**
MODULATION:	**FM / PPM (PULSE POSITION MODULATION)**
FREQUENCY:	**R/C CHANNELS 00 THROUGH 60 - U.S. LEGAL 50, 53, 72 MHz**
ULTIMATE BANDPASS:	**± 8.5 KHz @ >55 dB DOWN**
USABLE SENSITIVITY:	**> -95 dBm**
3OIP:	**+12 dBm**
OPERATING VOLTAGE:	**+3.5V TO +26V DC LIMITED ONLY BY SERVO REQUIREMENTS**
LEGAL USE:	**MEETS AMA GUIDELINES/FCC 1999 RADIATION REQUIREMENTS**

FMA, Inc.
5716A Industry Lane
Frederick, MD 21704
Sales: (800) 343-2934 -Technical: (301) 831-8980

FMA Direct

* FCC Information: FCC ID: KH8-T2000 - This device complies with Part 15 of the Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept interference received, including interference that may cause undesired operation.

PACKAGE CONTENTS:

1. FMA Direct Fortress 2000 FM, 8 channel, Universal PPM receiver
2. Dealer or factory-installed channel crystal (if purchased with unit)
3. Owner's Manual
4. Programming Quick Reference

PREPARATION:

- **COMPATIBILITY - POWER AND SERVO CONNECTION**

Fortress 2000 receivers are available in two models. Part number **201FM** (pictured in Figure 1) is designed for use with all standard servo connectors and supports Futaba, JR, Hitec servos, and Airtronics servos equipped with the new "Z TYPE" connectors, as well as other brands that use standard polarity (GROUND, PLUS, SIGNAL). Part number **201FM** is identifiable by the Futaba polarity "key" that appears at all servo inputs on the top of the receiver case. Model **201FM** receivers *are not* compatible with "OLD STYLE" Airtronics connectors that use reverse power polarity (PLUS, GROUND, SIGNAL). Part number **201AFM** *is* designed specifically to support "OLD STYLE" Airtronics connectors *only*. **201AFM** is identifiable by the Airtronics polarity "key" that appears in the top of the receiver case. If you are unsure which model receiver you have, contact FMA Direct immediately. See warning below. It is possible at any time to have your 201AFM converted to a 201FM by the factory at a minimal charge.

TABLE 1 SERVO PLUG ORIENTATION

SERVOBRAND	1	2	3
FUTABA	BLK	RED	WHT
JR	BRN	RED	ORG
HITEC	BLK	RED	YLW
AIRTRONICS (201AFM ONLY!)	RED	BLK	BLK

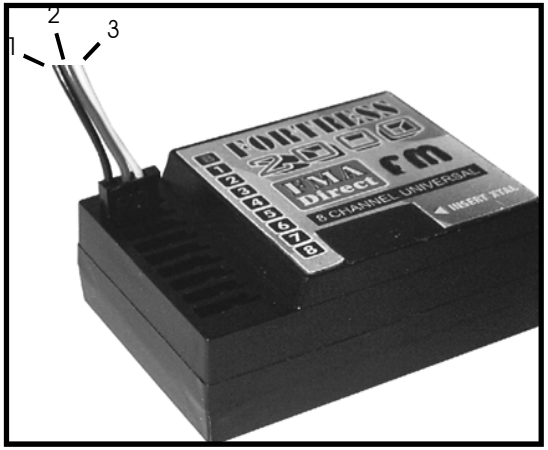

Figure 1 - Model 201FM Shown

WARNING: IF YOU INTEND TO INTERFACE AIRTRONICS SERVOS THAT USE "OLD STYLE" (PRE-"Z TYPE") AIRTRONICS CONNECTORS TO THE FORTRESS 2000, YOU MUST EITHER 1) MAKE CERTAIN YOU ARE USING A MODEL 201AFM RECEIVER OR 2) UPDATE THE CONNECTOR 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 SERVO 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 PART NUMBER 201FM RECEIVERS THAT DO NOT HAVE THE POLARITY CHANGED TO INDUSTRY STANDARDS. LIKEWISE, FMA WILL NOT ACCEPT RESPONSIBILITY FOR ANY ATTEMPT TO USE "STANDARD" SERVO CONNECTORS WITH PART NUMBER 201AFM.

- **COMPATIBILITY - PROGRAMMING THE FORTRESS 2000 FOR OPERATION WITH YOUR FM TRANSMITTER**

1. All Fortress 2000 receivers support full crystal interchangability using FMA Direct Fortress series crystals. Contact your local FMA Direct dealer or call FMA Direct to obtain the correct Fortress series crystal for operation with your transmitter frequency.
2. Designed for the utmost in reliability and compatibility, the new series of receivers from FMA Direct are the first to incorporate user-programmable FM shift compatibility with any standard FM/PPM transmitter currently being sold. User programmable through a series of 5 dip switches, the same receiver can now operate with positive or negative FM shift transmitters. So if you have a Futaba and a JR transmitter with you at the field on different R/C channels, and one channel is already in use, you can simply plug in the correct receiver crystal, change the settings of the dip switches using a small screw driver and you're ready to fly!
3. In general, 72 MHz Fortress 2000 receivers are shipped compatible with "negative", Futaba type frequency modulation (FM) - also termed "high-going-low" modulation. JR and Airtronics transmitters incorporate "positive" or "low-going-high" frequency modulation. At Ham band (50 and 53 MHz), all current R/C transmitters incorporate "positive" modulation so, in general, Ham frequency Fortress 2000 receivers are shipped compatible with "positive" modulation. If you are using JR or Airtronics equipment on 72 MHz, you may need to adjust the DIP switch settings on the Fortress 2000 before the receiver will "listen" to your transmitter.
4. In order to program the Fortress 2000 receiver to a different FM shift, refer to the Programming Quick Reference included with your receiver. The DIP switches are located on the top of the P.C. board. Carefully remove the black tape that seals the top and bottom of the case together and set it aside until you have completed programming the receiver. As shown in Figure 2, there are two banks of DIP switches mounted on the top of the P.C. board. The first bank contains *four* switches that are factory set and are not to be adjusted by anyone other than an FMA Direct technician. These four switches determine the servo polarity for the receiver.

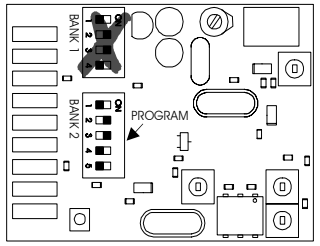

Figure 2

NOTE: ADJUSTING THESE FOUR SWITCH POSITIONS COULD RESULT IN DAMAGE TO THE RECEIVER AND SERVOS NOT COVERED BY WARRANTY!

The second bank of DIP switches contains *five* switches. Each switch is labeled 1, 2, 3, 4, 5 and the word ON is identified on the other side of the switch array. These are the switches that control the FM shift of the receiver. Use a small jeweler type flat screw driver to change the switches from one state to another. On the Programming Quick Reference provided, identify your transmitter brand and the frequency band of the transmitter/receiver combination (i.e. 72, 53, 50 MHz) on which you fly. Correlate this information to the proper diagram and set the DIP switches at the positions shown. There are only two settings which work. If one setting doesn't work, the other one will. Please note, the black square on the diagram indicates the switch position! Replace the black tape that seals the top and bottom of the case together.

- **INSTALLATION**

Care must be taken when installing your receiver to isolate the electronics from vibration. Do this by wrapping the receiver in 3/8" thick foam rubber. Restrain the foam-packed receiver using Velcro or a rubber band if necessary.

NOTE: FAILURE TO USE FOAM RUBBER AS DESCRIBED ABOVE DURING INSTALLATION VOIDS PRODUCT WARRANTY.

Extend the antenna to its full length. Do not coil the antenna up or range will be shortened. If you are installing the Fortress 2000 in a small aircraft and you require a shorter antenna, you may cut off a portion of the 39.75" antenna without de-tuning the receiver; a unique