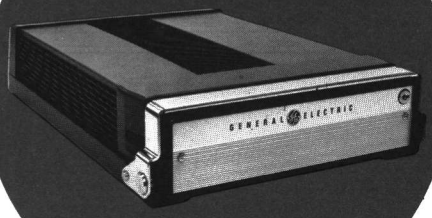
MOBILE RADIO

# MASTR
## PROGRESS LINE
## *ROYAL PROFESSIONAL*

## MAINTENANCE MANUAL



MOBILE RADIO


CONTROL UNIT

132-174 MHz, 35-WATT

**TWO-WAY FM MOBILE COMBINATIONS**

LBI-3920C


SPEAKER

DF-9013

GENERAL ELECTRIC

# TABLE OF CONTENTS



ILLUSTRATIONS



**WARNING**

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

# EQUIPMENT INDEX

| EQUIPMENT | MODEL OR TYPE NUMBER |
|---|---|
| Transmitter | ET-85-A |
| Receiver | ER-41-C |
| Control Unit | EC-59-A |
| Power Regulator | EP-58-A |
| Five-Watt Speaker | 4EZ20A10 |
| Microphone | 4EM25A10 |
| 132-470 MHz Roof-Mount Antenna | 4EY12A13 |
| Fuse Assembly<br>15-Amp Fuse | 19B216021-G4<br>1R11-P4 |
| Mounting Frame | 19C303430-G1 |
| Mounting Hardware<br>Trunk Mount<br>Front Mount | <br>19A121626-G2<br>19A121626-G1 |
| Battery Cables | 7147499-G6 |
| Power Cable<br>Trunk Mount<br>Front Mount | <br>19C303601-G2<br>19C303601-G1 |
| Trunk-Mount Control Cable (18-Foot)<br>One-Frequency<br>Multi-Frequency | <br>19C303626-G1<br>19C303626-G3 |
| Ignition Switch Cable | 19A121454-G1 |
| Microphone Bracket | 7141414-G2 |
| Key | 5491682-P8 |
| Alignment Tools<br>Hex Slug Type<br>Slotted Screw Type | <br>4038831-P2<br>4033530-G2 |

# OPTIONS

| EQUIPMENT | MODEL OR TYPE NUMBER |
|---|---|
| Carrier Control Timer, Option 7348 | 19A127875-G2 |
| Trunk-Mount Spacer Kit, Option 7082 | 19A121884-G1 |
| 23-Foot, 12-Volt Power Cable, Option 7083 | 19C303601-G3 |
| 23-Foot Control Cable<br>One-Frequency, Option 7084<br>Multi-Frequency, Option 7085 | <br>19C303626-G2<br>19C303626-G4 |

## SPECIFICATIONS*

| | |
|---|---|
| DIMENSIONS (H X W X D) | |
| Trunk-Mount | 3-3/4" x 13-1/2" x 19" |
| Front-Mount | 3-3/4" x 13-1/2" x 19-7/8" |
| WEIGHT | 52 pounds |
| BATTERY DRAIN | |
| Receiver (at 13.8 VDC) | |
| Standby (Squelched) | 200 milliamperes |
| Standby (Unsquelched) | 1.2 amperes |
| Transmit (at 13.6 VDC) | 10.5 amperes |
| DUTY CAPABILITY | Continuous |
| OPERABLE TEMPERATURE RANGE | -30°C to +60°C (-22°F to +140°F) |

*These specifications are intended primarily for use by the serviceman. Refer to the appropriate Specification Sheet for complete specifications.

## COMBINATION NOMENCLATURE

| 1st Digit | 2nd Digit | 3rd Digit | 4th Digit | 5th Digit | 6th Digit | 7th Digit | 8th & 9th Digits |
|---|---|---|---|---|---|---|---|
| Mechanical Package | Operating Voltage | RF Power Output Range | Channel Spacing | Mounting | Number of Freq. | Options | Frequency Range |
| **M** Mobile Unit | **S** 12-VDC unit Neg. Gnd. | **5** 16-38 watts | **5** 25 kHz | **T** Trunk Mount Mobile | **A** 1-Freq.T 1 Freq.R | **S** Standard | **55** 132-150.8 MHz |
| | | | | **F** Front Mount Mobile | **B** 2-Freq.T 1-Freq.R | **U** Channel Guard (71.9 - 156.7 Hz) | **66** 150.8-174 MHz |
| | | | | | **C** 2-Freq.T 2-Freq.R | **V** Channel Guard (162.2 - 203.5 Hz) | |
| | | | | | **D** 1-Freq.T 2-Freq.R | **P** UHS Receiver | |
| | | | | | **E** 3-Freq.T 3-Freq.R | **G** UHS Receiver & Channel Guard (162.2 - 203.5 Hz) | |
| | | | | | **F** 4-Freq.T 4-Freq.R | | |

## DESCRIPTION

MASTR Progress Line Royal Professional mobile radio combinations are highly reliable, ruggedly constructed units that are designed to meet the most stringent requirements in the field of two-way radio. The radios are fully transistorized - using silicon transistors for added reliablity. Since no tubes are used, the Royal Professional is ready to transmit at full power the instant the radio is turned on.

No high-voltage power supply is required as the highest voltage in the radio is supplied by the vehicle battery. A power regulator assembly provides regulated voltages for the transmitter exciter and receiver, and contains sensing and control circuitry for protection of the transmitter output transistors.

All major modules and tuning adjustments are accessible from the top of the radio (see Figure 1). Centralized metering jacks in the transmitter and receiver permit simplified alignment and trouble-shooting.

### TRANSMITTER

The transmitter assembly consists of a transistorized exciter and power amplifier assembly. The standard transmitter may be equipped with:

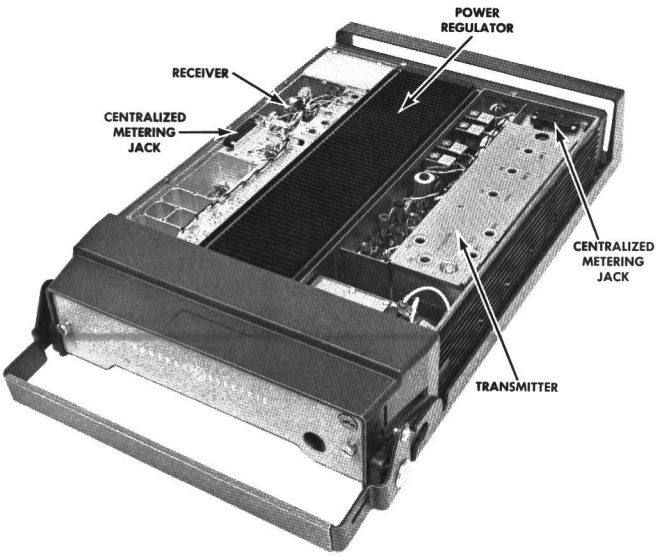



Figure 1 - Module Layout

- One through four frequencies
- Channel Guard (tone squelch)
- Carrier Control Timer Option

### RECEIVER

The fully transistorized receiver is completely contained in an aluminum casting, which provides excellent electrical shielding and reduces the effects of vibration. The standard receiver may be equipped with:

- One through four frequencies
- Channel Guard (tone squelch)

### POWER REGULATOR

The transistorized mobile power regulator was designed for operation in a 12-volt, negative-ground vehicle system only and provides regulated supply voltages for the transmitter exciter and receiver. The power regulator also contains circuitry to protect the transmitter PA stages against sudden increases in battery voltages, excessively high temperatures or a shorted or open antenna.

### CONTROL UNITS

The Control Unit is used for both Front-Mount and Trunk-Mount installations. In Front-Mount applications, the Control Unit is attached to the front panel of the two-way radio. In Trunk-Mount applications, the Control Unit is mounted on the underside of the instrument panel near the operator.

## INITIAL ADJUSTMENT

After the MASTR Two-Way Radio has been installed (as described in the INSTALLATION Manual), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radio-telephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form NP270303) has been filled out and attached to the transmitter.

### TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes loading the power amplifier into

the antenna, and checking the frequency and modulation. For the complete transmitter adjustment, refer to the ALIGNMENT PROCEDURE in the MAINTENANCE MANUAL for the transmitter.

NOTE

The Royal Professional Two-Way radio was designed for operation in 12-volt, negative ground vehicle systems only. Failure to observe battery polarity when connecting power cables will cause a fuse to blow.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes zeroing the receiver to the system operating frequency, and matching the antenna transformer to the antenna. For the Receiver Initial Adjustment Producedure, refer to the FRONT END ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the receiver.

## OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the STBY-ON-OFF switch to the STBY (Standby) position if you are not expecting any calls but wish to monitor other calls, or to the ON position if you expect to have to answer calls. The green light stays off in the STBY position to save battery power.
2. Turn the SQUELCH control clockwise (to the right) as far as possible.
3. Adjust the VOLUME control until the "hissing" sound is easily heard, but is not annoyingly loud.
4. Now, slowly turn the SQUELCH control counterclockwise (to the left) until the "hissing" sound just fades out.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the STBY-ON-OFF switch to the ON position.
2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal (or softer) voice. Release the button as soon as the message has been given. The red signal light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

## MAINTENANCE

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the maintenance checks listed on following page.

TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe standard test procedures which the serviceman can use to compare the actual performance of the transmitter or receiver against the specifications of the unit when shipped from the factory.

In addition, specific troubleshooting procedures are available to assist the serviceman in troubleshooting the transmitter, receiver and power regulator.

For best results in servicing the Two-Way Radio, the TEST PROCEDURES should be used in conjunction with the TROUBLESHOOTING PROCEDURES. Both sheets are listed in the Table of Contents of the applicable Maintenence Manual.

RE-INSTALLATION

The Royal Professional mobile combination operates in 12-volt, negative ground vehicle systems only! If the radio is ever moved to a different vehicle, always check the battery polarity and voltage of the new system before using the radio.

CAUTION

Do not install the Royal Professional in a vehicle system using a circuit breaker. The radio must be operated in a system protected by a 15-amp quick blow fuse (similar to GE Fuse Assembly 19B216021-G4 and fuse 1R11-P4).

| MAINTENANCE CHECKS | INTERVAL 6 Months | INTERVAL As Required |
|---|---|---|
| CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. | X | |
| ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. If the alternator or generator voltage is excessive, indicator lights, etc., may burn out periodically. This condition is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. | | X |
| MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws, and parts to make sure that nothing is working loose. | X | |
| ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result. | X | |
| ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to the applicable ALIGNMENT PROCEDURE and Troubleshooting Sheet for typical voltage readings. | | X |
| FREQUENCY CHECK - Check transmitter frequency and deviation as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months, and once a year thereafter. | | X |

## NOISE SUPPRESSION

After completing the initial adjustment of the transmitter and receiver, the serviceman should determine whether additional noise suppression is required. The Following information should assist the serviceman in identifying and eliminating undersirable noise interference.

### Ignition Noise

Ignition moise sounds like a "popping" sound in the speaker, whose frequency varies with engine speed while a weak signal is being received. This type of interference is generated by the spark plugs, distributor and any poor connections in the high-voltage system which might cause arcing. Ignition noise may be identified by noting that the noise disappears as soon as the ignition switch is turned off.

1. If the vehicle does not have a resistance lead from the coil to the center of the distributor cap, disconnect the lead at the distributor and cut the lead so that a Cable-Type Suppressor may be inserted in it close to the distributor. Screw the cut ends of the lead into the suppressor.

**NOTE**

A resistance lead operates as a very effective noise suppressor as long as there are no breaks anywhere along its length. Never cut the lead to insert a suppressor. A loose knot is often tied in the lead to prevent excess flexing, which might break the conductor.

2. Check to see that:
   - --the distributor points and condenser are in good condition.
   - --the high-voltage leads from the distributor are not broken and are making good contact at each end.
   - --the spark plugs have clean, dry insulators and their electrodes are clean and properly adjusted.
   - --the timing has been properly adjusted.

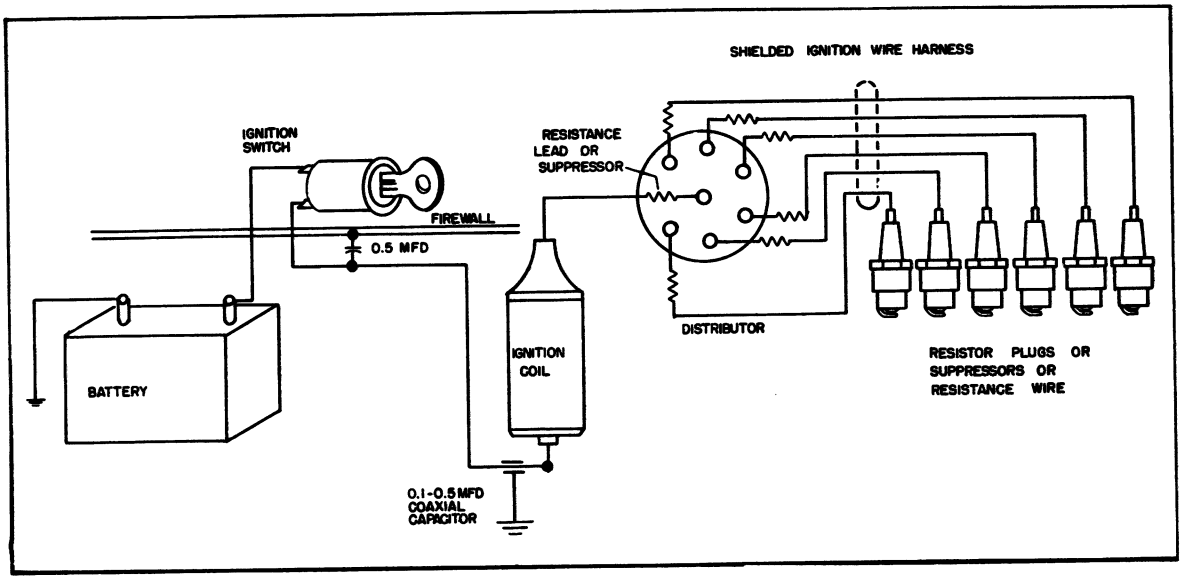



Figure 2 - Ignition Circuit with Noise Suppression Components (RC-547A)

3. Use a 0.5-mFd by-pass capacitor to by-pass the battery lead to the ignition coil. Mount the capacitor under a screw which will provide a good ground and connect the capacitor lead to the terminal of the coil which is connected to the ignition switch.

4. Remove the ignition coil and its mounting bracket. Clean paint from coil (where the bracket mounts), from the bracket and from the engine block. Remount the coil so as to obtain a good ground for the coil case.

5. If the vehicle has been driven 30,000 or 40,000 miles or more, the cap and rotor of the distributor will probably need replacing. This will not only reduce ignition noise, but also improve the overall performance of the engine.

6. High-voltage ignition wires can become capacitively coupled to the low-voltage systems, causing ignition noise to appear in the low-voltage system. This coupling can be minimized by separating the high- and low-voltage leads, or if necessary, separately shielding the leads.

7. If one of the ignition leads happens to have the critical length for radiating at the receiver's frequency, the noise can be reduced by changing the length of the lead. A noise source of this type is not common and can only be found by using a noise meter or by trial and error.

8. If the preceding steps fail to reduce ignition noise to a satisfactory level, it may be necessary to install resistance-type spark plugs, individual suppressors on each spark plug, or a shielded ignition wire harness.

## Generator Noise

Generator noise shows up as a high-pitch "whine", the pitch of which varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise on the receiver. Generator noise will continue as long as the engine turns, lowering in pitch as the engine slows down.

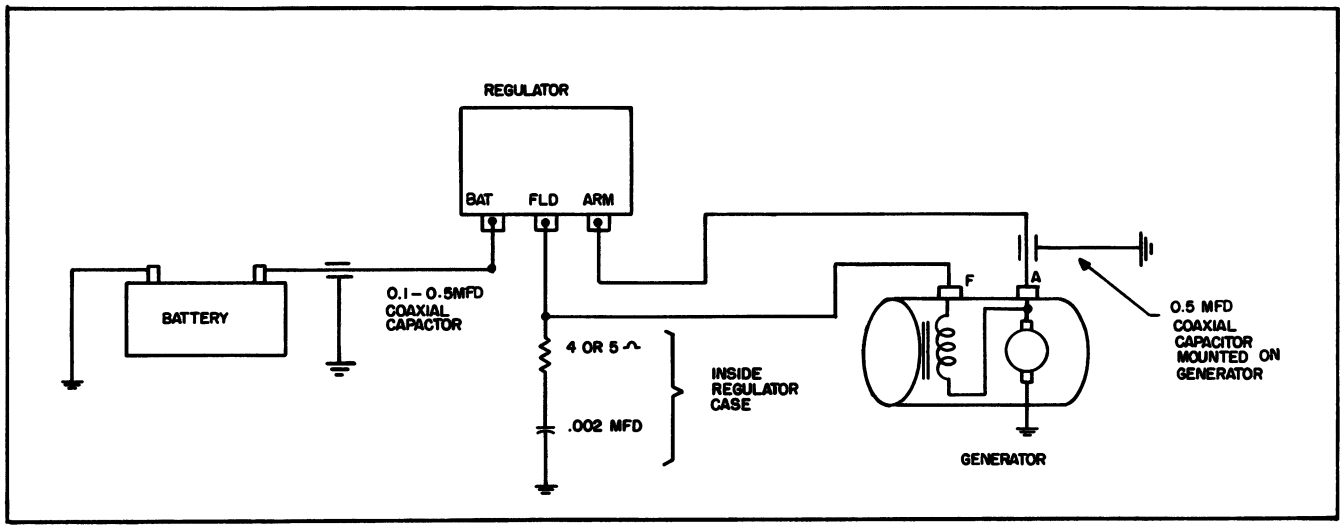
By-pass the armature terminal on the generator to ground with a 0.5-mFd, 40 or 50-amp coaxial capacitor. Be sure to scrape the area where the capacitor is to be mounted, so that its case will be well grounded.

**CAUTION**

Do not by-pass the field terminal (F), as this will damage the voltage regulator contacts.

## Generator Regulator Noise

Generator regulator noise shows up as a "raspy" sound which is generated by the contacts in the regulator and radiated by the leads coming out of the regulator. If suppression of regulator noise is necessary, connect a 5-ohm resistor in series with a .002-,Fd capacitor from the field terminal (F) of the regulator to ground. If possible, these components should be mounted inside regulator case. The battery terminal (BAT) and armature terminal (ARM) can be by-passed to ground with 0.5-mFd capacitors.




(RC-548A)

Figure 3 - Generator Circuit with Noise Suppression Components

**CAUTION**

If the regulator is opened to install the capacitor or resistor, remember that one wrong connection or shorted wire can damage the regulator or generator.

Gauge noise produces a "hissing" or "crackling" sound. Tapping the face of each gauge while the engine is running usually shows up which gauge is at fault. By-pass the gauge lead to ground with a 0.5-mFd capacitor, connected close to the sensing element.

## Static and Arcing Noise

The following suggestions may help to cure other unusual types of interference:

1. Use bonding braid to electrically bond the hood and each corner of the engine block to the vehicle's frame. Scrape paint and dirt from bonding points to obtain a good ground.
2. Treat noisy tires with anti-static powder.
3. Use front-wheel static collectors for irregulator "popping" noise which disappears when the brakes are applied.
4. Use heavily graphited penetrating oil on the exhaust pipe and muffler supports if they are producing noise.

## ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

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# MAINTENANCE MANUAL

**LBI-3920**

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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