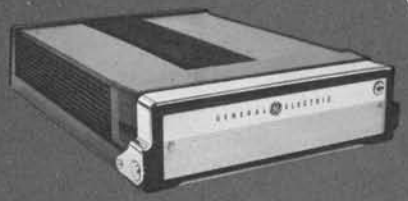
Parks + Recreation
PO#R 93949
1970

MOBILE RADIO

MT74TAS33

MASTR
PROGRESS LINE
Professional Series

MAINTENANCE MANUAL



Mobile Radio

Control Unit

25—50 MHz,
35- and 100-Watt

**TWO-WAY FM
MOBILE COMBINATIONS**

LBI-3627E

Speaker

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
35-Watt Transmitter	ET-54-A, B
100-Watt Transmitter	ET-55-A, B
Receiver	ER-39-C, D
Control Unit	EC-59-A
35-Watt Power Supplies	
12-Volt	4EP37B10
6/12-Volt	4EP37C10
12/28-Volt	4EP37D10
100-Watt Power Supply	4EP37A10
Five-Watt Speaker	4EZ16A15
Microphone	4EM25A10
25-50 MHz Antenna	
Base, Spring & Cable	4033101-G1
Whip	7491074-P1
Loading Coil (25-33 MHz)	4KY9A1
Fuse Assembly (12-volt)	
Medium Power Transmitter (ET-54-A,B)	19B216021-G2
High Power Transmitter (ET-55-A,B)	19B216021-G3
Fuse and Relay Assembly	
6-Volt	7487952-G20
28-Volt	7487952-G19
Mounting Frame	19C303430-G1
Mounting Hardware	
Trunk-Mount	19A121626-G2
Front-Mount	19A121626-G1
Battery Cables	
12- or 28-Volt	7147499-G6
6-Volt	7147499-G5
Trunk-Mount Power Cable	
12-Volt	19C303601-G2
6-Volt	19C303606-G1
28-Volt	19C303603-G2
Front-Mount Power Cable	
12-Volt	19C303601-G1
6-Volt	19C303607-G1
28-Volt	19C303603-G1
Trunk-Mount Control Cable (18-Foot)	
One-Frequency	19C303626-G1
Multi-Frequency	19C303626-G3
Ignition Switch Cable	
12-Volt	19A121454-G1
6- or 28-Volt	19A121454-G2
Microphone Bracket	7141414-G2
Key	5491682-P8
Alignment Tools	
Hex Slug Type	4038831-P2
Slotted Screw Type	4033530-G2

OPTIONS

Trunk-Mount Spacer Kit, Option 7082	19A121884-G1
23-Foot, 12-Volt Power Cable, Option 7083	19C303601-G3
23-Foot Control Cable	
One-Frequency, Option 7084	19C303626-G2
Multi-Frequency, Option 7085	19C303626-G4

SPECIFICATIONS *

DIMENSIONS (H x L x W)				
Trunk-Mount		3-7/8" x 19" x 13-5/8"		
Front-Mount		3-7/8" x 19-7/8" x 13-5/8"		
WEIGHT		33 pounds		
BATTERY DRAIN		35 WATTS		100 WATTS
Receiver	At 13.8 VDC	At 6.6 VDC	At 28 VDC	At 13.8 VDC
Standby (Squelched)	50 mA	2.0 amps	350 mA	50 mA
Standby (Un-Squelched)	700 mA	3.5 amps	730 mA	700 mA
Transmitter Filaments on (Squelched)	900 mA	4.5 amps	950 mA	1.5 mA
Transmitter	At 13.6 VDC	At 6.4 VDC	At 28 VDC	At 13.8 VDC
	9 amps	21.0 amps	5.4 amps	23.0 amps
DUTY CYCLE		Transmit: 20% (one minute on, four minutes off)		
		Receive: Continuous		
OPERABLE TEMPERATURE RANGE		-30°C (-22°F) to +60°C (+140°F)		

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

DESCRIPTION

General Electric MASTR Progress Line Mobile Radio Combinations are attractively styled, ruggedly constructed units that are designed to meet the most stringent requirements in the field of two-way FM radio.

The MASTR combination is contained in a "slide-rail" mounting frame and is designed for either Front-Mount or Trunk-Mount installations. The radio is tamperproof when locked in the mounting frame. When unlocked, the unit can be easily pulled out of the frame for servicing.

Both the transmitter exciter board and the receiver are fully transistorized. Silicon transistors are used throughout for added responsibility.

In many installations, battery drain in standby operation is so low (only 50 milliamps in 12-volt systems) that the radio never has to be turned off.

SERVICING

The MASTR transmitter, receiver and power supply consist of one-piece modules that can be easily removed from the splash-proof mobile case. All major modules and tuning adjustments are accessible from the top of the unit.

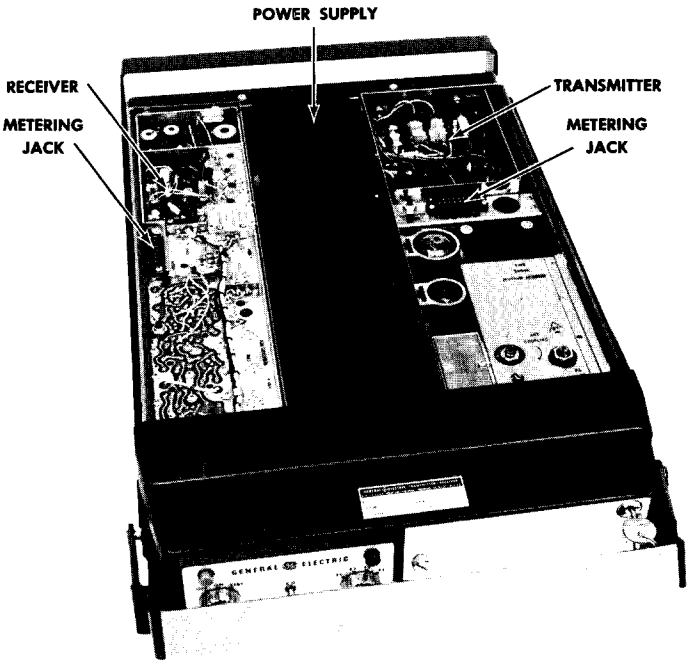


Figure 1 - Module Layout for MASTR Progress Line

Both the transmitter and receiver are equipped with centralized metering jacks for simplified alignment and troubleshooting.

The transmitter and receiver modules may be used interchangeably in mobile and station installations. No modifications are required when transferring the units from one type of operation to another.

TRANSMITTER

The transmitter assembly consists of the transistorized exciter board and the power amplifier section. The 30-watt transmitter uses only two tubes in the power amplifier; the 100-watt transmitter uses only three tubes. The standard transmitter may be equipped with:

- One through four frequencies
- Channel Guard (to eliminate nuisance calls)

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
- Noise Blanker

POWER SUPPLIES

Four different transistorized power supplies are available for MASTR mobile combinations. In the medium power range (35-watt), power supplies are available for the following positive or negative ground vehicle systems:

- 12-Volts
- 6/12-Volts
- 12/28-Volts

The high power 100-watt supply will operate in a 12-volt positive or negative ground vehicle only.

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 Radiotelephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form ECP-82) has been filled out and attached to the Control Unit or other suitable location near the Control position.

TRANSMITTER ADJUSTMENT

The initial adjustment for the transmitter includes loading the power amplifier into the antenna, and checking the frequency and modulation. For the initial Adjustment procedure, refer to the ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the transmitter.

NOTE

Battery polarity must be observed when the two-way radio is installed. No damage will occur to the unit if the power cable connections are accidently reversed, as long as the unit is not keyed. However, connecting the yellow and black ignition switch leads to the wrong polarity will cause the inline fuse in the yellow lead to blow. Always check to see if the receiver is operating properly before keying the transmitter.

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 Procedure, 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 (LBI-3525). 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 lights stay 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 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. Let the unit warm up for 30 seconds.

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 in chart on the following page.

TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe 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

MAINTENANCE CHECKS	INTERVAL	
	6 Months	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	
GENERATOR AND REGULATOR - The generator and voltage regulator should be maintained periodically to keep the generating system within safe and economical operating limits. If generator voltage is excessive, tubes, lights, etc., may burn out prematurely. 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	
RELAY CONTACTS - Examine the contacts of the relay. Where relay contacts carry little or no current, the contacts do not clean themselves and an insulating coating is apt to form. When contacts become coated, remove the film with a suitable solvent applied with a non-metallic brush, such as a toothbrush. Current-carrying contacts are subject to pitting and should be burnished from time to time. Dust and particles should be removed by a clean, dry, non-metallic brush.		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

procedures are available to assist the serviceman in troubleshooting the transmitter, receiver and power supply.

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 Maintenance Manual.

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 undesirable noise interference.

Ignition Noise

Ignition noise 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 can be identified by noting that it 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.

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 the 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-pitched "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.

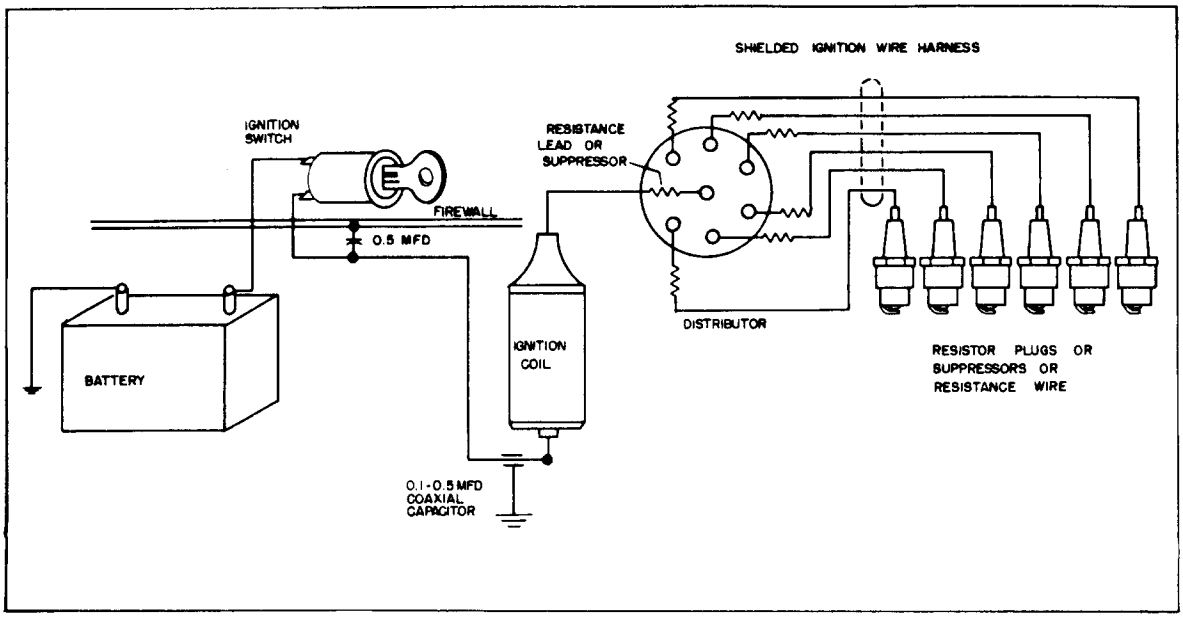


Figure 2 - Ignition Circuit with Noise Suppression Components

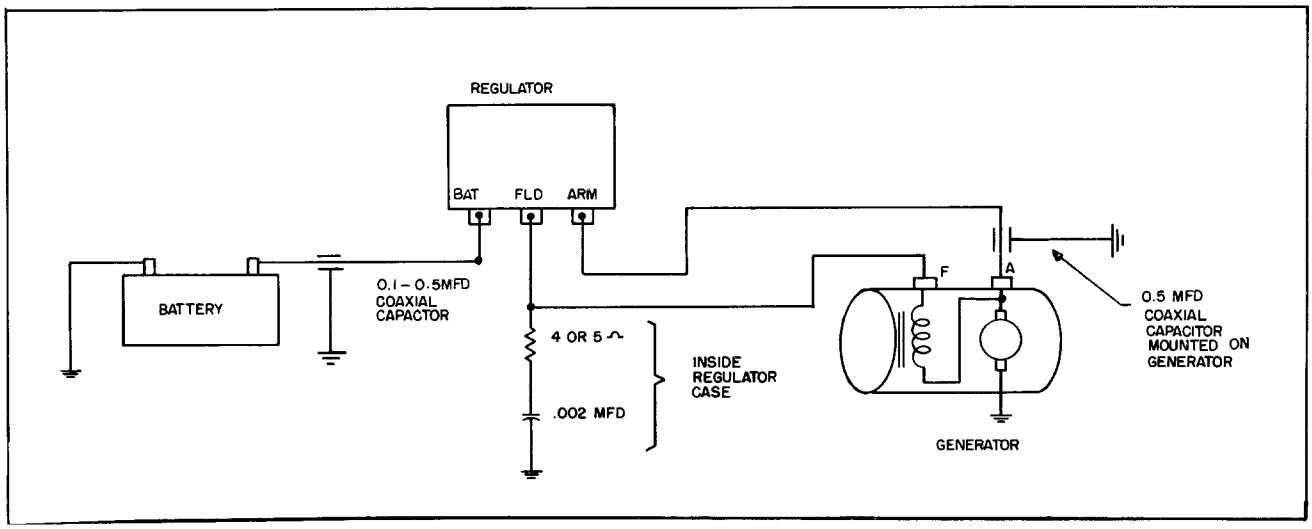


Figure 3 - Generator Circuit with Noise Suppression Components

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-mFd 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.

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 irregular "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.