

# LAFAYETTE

## 10 METER AMATEUR BAND TRANSCEIVER

### MODEL HE-50 A

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## OPERATING AND INSTALLATION INSTRUCTIONS

### SPECIFICATIONS

#### RECEIVER

Superheterodyne receiver covering the entire 10 meter (28 to 29.7 Mc) amateur radio service. Built-in noise limiter control with improved full wave automatic and adjustable noise limiter and full AVC. Illuminated channel tuning dial with planetary vernier tuning. An "S" meter calibrated in S units allows measurements of incoming signal strength. The meter is wired with a switch to enable monitoring of final transmitter amplifier wattage.

- SENSITIVITY: . . . . . 1 microvolt.
- SELECTIVITY: . . . . . 3 KC at 6db down.
- IMAGE REJECTION: . . . . . 45 db.
- I.F. FREQUENCY: . . . . . 1650 KC.
- NOISE GATE LIMITER: . . . . . adjustable type
- AUDIO OUTPUT: . . . . . 3 Watt, 3½" Alnico V Speaker

#### TRANSMITTER

- POWER: . . . . . Power input of 12 watts to the final Straight-through class C 2E26 RF amplifier.
- FREQUENCY: . . . . . 3 switch selected transmit position Supplied with crystal for one frequency. Widely tuned for full efficiency on entire 10 meter band.
- MICROPHONE: . . . . . Hand held ceramic microphone with 2 position slide switch; Position one—microphone in receive position; Position two—microphone in push to talk position. Spring release switch.
- ANTENNA MATCHING: . . . . . 30 to 100 ohms.

#### CONTROLS

- R.F. PEAKING CONTROL
- VOLUME ON-OFF
- PLANETARY TUNING
- NOISE LIMITER CONTROL . . . . . adjustable type
- CRYSTAL SELECTOR . . . . . 2 crystal controlled fixed transmitting frequencies plus a position for an external V.F.O.
- RF METER INDICATOR: . . . . . 2 position switch controlled. Position one—reads Transmitter plate output current. Position two—"S" meter with built-in zero adjustment control.
- SPOT SWITCH: . . . . . Crystal calibrator to check calibration of receivers frequency dial.

Operates on 117 VAC and 12 volts DC, with proper supplied cables. Battery operated cable internally fused.

- POWER CONSUMPTION: . . . . . 117 Volts AC 60 cycles
- 60 Watts Receive
  - 85 Watts Transmit
  - 12.6 Volts D.C.
  - 6 Amps Transmit
  - 4.5 Amps Receive

SIZE: . . . . . 5½" H x 12½" W x 8" D.

**ANTENNA TUNE CONTROL** — This adjustment is used for loading the Transmitter into the antenna.

The Lafayette Model HE-50A transceiver is a combination transmitter and receiver designed for use in the 10 meter (28 to 29.7 Mc) amateur radio service. Designed to meet the Federal Communications Commission (FCC) requirements, the unit will provide economical and reliable radio communication in its intended application if installed and operated in accordance with instructions contained herein.

The transmitter may be operated on any frequency in the 10 meter amateur phone band (28 to 29.7 Mc). Provision has been made for front panel insertion of 2 crystals into the unit, any one of which may be selected by means of a 3 position selector switch. Crystals covering any frequency within the 10 meter amateur band can very easily be inserted into the unit. A VFO may be inserted into a socket on the front panel, selected by the selector switch. Crystal controlled and plate modulated, the transmitter delivers a power input of 12 Watts to the final RF amplifier.

The receiver utilizes a sensitive superheterodyne circuit with 3 I.F. dual tuned transformers and incorporates a built-in noise limiter circuit with full wave automatic series noise limiting and full AVC. An adjustable tuned RF Bandpass stage precedes the detector for added sensitivity and selectivity, and to keep RF radiation to a minimum. The receiver tunes the entire 10 meter band. The receiver also incorporates an "S" meter for recording the signal strength of the desired signal. A spotting switch is incorporated which permits the operator to set the receivers tuning dial to the exact frequency upon which you are transmitting. A variable "Pi" network is incorporated that permits matching to any type of antenna.

#### POWER SUPPLIES

The HE-50A may be operated from a 117 volt 60 cycle AC source or from a 12 volt DC battery source.

**117V 60 Cycle AC Source:** An AC line cord, terminated at one end with a normal AC plug and at the other with an 8-pin socket, is supplied with the Transceiver. The 8-pin socket should be connected to the matching plug on the transceiver before inserting the AC plug into the wall outlet.

**12V DC Source:** The battery cable supplied is terminated at one end with a 8-pin socket and at the other end with an external inline fuse holder terminating into a cigarette lighter plug. The 8-pin socket should be connected to the matching plug on the transceiver. It does not matter which polarity of the battery is grounded since inserting the other end of the cable into the lighter receptacle automatically connects the cable to the "Hot" (Ungrounded) terminal of the battery.

## ANTENNA INSTALLATION

The most important single factor determining optimum transmission is the antenna. The antenna chosen should be selected for each transceiver on the basis of the application involved.

### FIXED ANTENNA INSTALLATION

For short range communication, an inexpensive base load type of antenna or spiral whip antenna will be adequate. An antenna of the "ground plane" type will provide greater, more reliable coverage. Both of these types are essentially non-directional and are ideal for applications involving fixed-to-mobile operation.

The directional "beam" type of antenna with ant. rotator may be used to extend the range of the Transceiver and will provide reliable communication over an unusually long range or under adverse weather conditions. Because of their directional properties these antennas are ideal for point-to-point communication, that is, from fixed station to another. A good 4 or 5 element beam is recommended.

The range of the transceiver also has a direct bearing on the height of the antenna used. Regardless of the type chosen, always locate the antenna as high as possible. It is important therefore, to choose a location for the transceiver that is favorable to your antenna location. A long lead-in cable will introduce a certain amount of power loss and should be avoided where possible unless the antenna location justifies its use. Up to 25 feet of cable lead-in may be used if it permits a favorable antenna location.

Wherever possible, use a good water pipe ground. In most cases this will provide greatly improved operation.

### MOBILE ANTENNA INSTALLATION

The type of antenna best suited for mobile service is a vertically polarized whip antenna. In any mobile installation (Cars, trucks, boats, etc.), an antenna system that is non-directional has to be used. Other factors likely to offset performance are lack of a good earth ground and ignition interference. However, the base-load type whip antenna will normally provide good results for short-range communications. Greater range and more reliable operation can be obtained with a full quarter-wave vertical whip antenna. Both of these types of antennas use the metal body of the vehicle as a "ground plane". If the transceiver is not mounted to any metal surface, it will be necessary to run a separate ground wire from the unit to a good metal ground in the vehicle. If installed in a boat the transceiver will not operate at maximum efficiency without a ground plate, unless your vessel has a steel hull. However, before installing the transceiver, consult a qualified marine technician regarding an adequate grounding system.

### ANTENNA CONNECTIONS

The antenna lead-in cable, RG-58/U, should be terminated with a UHF type PL-259 connector. The receptacle, SO-239, located on the transceiver accepts this type of connector.

### IGNITION INTERFERENCE

Engine ignition interference in a car or truck should not present a serious problem. The suppression carried out on vehicles equipped with a standard broadcast radio will normally suffice. However, if an ignition interference problem is present, any skilled auto radio repairman should be able to correct it for you.

Electrical noise from engines and other electrical equipment aboard a boat or vessel can render your transceiver useless. The worst offender will be the ignition system of gasoline engine powered boats. Generators on both gasoline and diesel engines, auxiliary generators, electric motors on refrigerators, bilge pumps, fans, etc., must be filtered for quiet radio reception.

Unfortunately, there is no hard and fast rule for the elimination of noise. It is best to attack the problem systematically. The ignition system can be filtered by the use of a "spark shield" made to fit most common gasoline marine engines. These shields are easily

installed and can be removed for spark plug and point servicing in less than a minute.

Auxiliary generators are quieted down by condenser installations. Condensers of the highest quality, in metal cans, should be used. We recommend that a capacity of 1.0 mfd be used. These are of greater capacity than the condensers normally used in automobile radio installations. The same condensers can be used to filter the other motors. Condensers are installed at the generator armature terminal or, in extreme cases, directly on each brush holder. The metal can is connected to the generator frame. Never connect a condenser to the field terminal of a generator.

The voltage regulator on the larger generators is frequently a source of troublesome noise. Before attempting any filtering on the regulator, have the unit cleaned and adjusted by an expert. If noise is still present, install condensers on the armature terminal of the regulator. Again, do not put a condenser on the field terminal.

Another, more infrequent source of noise is caused by the rotation of the propeller shaft in its various bearings. This rotation causes static electricity discharge. If noise is present when the vessel or boat is underway but goes away when you throw the engine out of gear, you most probably have "shaft noise". This noise can usually be eliminated by installing phosphor bronze "fingers" in such a way as to allow wiping contact with the shaft. The finger is then connected to the engine block with a heavy wire.

Diesel engines have no ignition system and therefore need no shields. The generators must be filtered just as they are for gasoline engines.

Other electrical accessories such as fans, bilge pumps, electric toilets, fresh water system motors, etc., are also a possible source of noise. These units can be noise suppressed by means of condensers.

### MOBILE INSTALLATION OF TRANSCEIVER

Before installing the transceiver in a car, truck, boat, etc., be sure to choose a location which is convenient to the operating controls, and will not interfere with the normal functions of the driver. The transceiver may be mounted to the underside of the instrument panel or dashboard of a car, truck, etc., by means of the carrying handle, that is supplied with the transceiver. Remove the two rubber bumpers from the handle to provide mounting holes. Two self threading screws are provided for this. If additional back support is required, provision has been made for the use of a perforated steel strap. Cut and bend the perforated strap to the desired shape, attaching one end to the firewall and the other end to the self threading screw projecting from chassis rear. The 12V D.C. power input cable is terminated with a plug which may be inserted directly into the cigarette lighter socket on a car or truck. A 10 Amp fuse is incorporated as part of this cable. In a more permanent installation the plug should be removed and the cable connected to main battery source. A convenient place to make this connection would be the ignition switch. In this manner the power input to the transceiver would be controlled by the position of the ignition key. This will prevent unauthorized persons from using the transceiver and also prevent the transceiver from being left on. It is imperative that the "hot" or center lead of this plug is connected to the ignition switch. If this wire is reversed, the fuse in the vehicle will blow.

### MAXIMUM POWER TRANSFER TO ANTENNA

With antenna disconnected, insert recommended dummy antenna (See sketch) into antenna receptacle.

Set transceiver to the transmitting position. Set METER switch to the 1p position. With a small screw driver adjust antenna output condenser (C2), see license label for location, fully tight then back out a 1/2 turn. Adjust antenna tank condenser (C1) for minimum reading (best dip) of the 1p meter or maximum brilliance of the lamp. Re-adjust C2 condenser for a meter reading of approximately 60 to 65 MA. Then re-adjust C1 condenser for maximum lamp brilliance or minimum (best dip) reading of meter. These adjustments are done from the front panel.

## TECHNICAL SECTION

The following information is supplied for the use of a technician in servicing the transceiver.

### TYPICAL TUBE SOCKET VOLTAGES

VOLTAGES MEASURED TO CHASSIS WITH VTVM (RCA VOLTOHMIST OR EQUIVALENT) AND ARE POSITIVE EXCEPT WHERE NOTED.

TRANSMITTER TUNED AND LOADED, WITH NO SIGNAL INPUT TO RECEIVER.

ALL MEASUREMENTS TAKEN WITH 117 VOLTS A.C. 60 CYCLE INPUT.

SYMBOL, TUBE TYPE AND FUNCTION	TYPE OF OPERATION	PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1 - 12BA6 R.F. AMPLIFIER	RECEIVE	-15V	0	FIL	FIL	160V	55V	.45		
	TRANSMIT	-.45V	0	FIL	FIL	175	80	.15		
V2 - 6EA8 MIXER - OSCILLATOR	RECEIVE	127	-.65	65	FIL	FIL	22	0	0	-.3
	TRANSMIT	125	-3.8	93	FIL	FIL	44	0	0	-3.2
V3 - 12BA6 1ST. I.F. AMPLIFIER	RECEIVE	-.05	0	FIL	FIL	180	78	.88		
	TRANSMIT	-.65	0	FIL	FIL	200	195	0		
V4 - 6EA8 2ND. I.F. AMPLIFIER / MICROPHONE AMP.	RECEIVE	45	0	90	FIL	FIL	195	1.5	0	-.6
	TRANSMIT	45	-.3	163	FIL	FIL	196	.35	0	-.63
V5 - 6CN7 NOISE LIMITER A.F. AMPLIFIER	RECEIVE	-.05	-.05	.05	FIL	FIL	0	-.5	58	0
	TRANSMIT	-.2	0	-.05	FIL	FIL	0	-.55	55	0
V6 - 6AG5 AUDIO OUTPUT AND MODULATOR	RECEIVE	0	11	FIL	FIL	255	205	0		
	TRANSMIT	0	10.5	FIL	FIL	230	203	0		
V7 - 6EA8 CRYSTAL OSCILLATOR DOUBLER/DOUBLER	RECEIVE	200	-.92	200	FIL	FIL	205	0	0	-.88
	TRANSMIT	65	-4.1	145	FIL	FIL	160	0	.05	-.2
V8 - 2E26 R.F. POWER OUTPUT	RECEIVE			FIL	260		-.45		FIL	
	TRANSMIT			FIL	165		-.225		FIL	

2E26 PLATE VOLTAGE MEASURED AT POINT MARKED  $\Psi$  RECEIVE 250 V  
TRANSMIT 220 V

## REMOVING THE LAFAYETTE HE-50 A FROM CABINET FOR SERVICING

1. Remove the (2) screws holding the front panel to the top shell.
2. Remove the (2) screws, on each side piece, holding bottom base to top shell.
3. Slide shell upward to remove top shell.
4. Remove the (4) screws, on cabinet bottom, holding the chassis to the bottom plate.
5. Remove bottom base plate.

## TRANSCIEVER ADJUSTMENTS AND CALIBRATION

The following adjustment is to be made every time a new crystal, whose frequency is more than 0.5 Mc than the replaced crystal, is inserted into the front panel crystal holder.

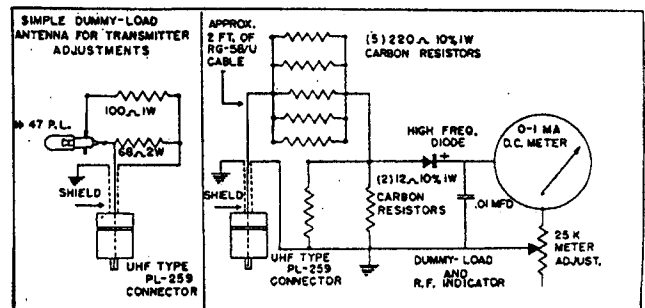
### ADJUSTING THE TRANSMITTER

When tuning up the transmitter, do so only with a dummy antenna. A simple dummy load antenna for transmitter adjustments is shown in sketch. NOTE: For those with access to the proper equipment, and knowledge of its use, the following information is provided. Maximum efficiency of power transfer to the antenna can be achieved if a 52 ohm, non-inductive load, capable of dissipating at least 15 watts, is connected to the antenna input socket. With a suitable R.F. voltmeter measure the voltage drop across the 52 ohm load. Alternately readings of output can be taken with a SWR bridge or RF voltmeter, while loading directly into the proper antenna.

1. Adjust crystal selector knob to position No. 1 or #2 position in which the 7.150 Mc crystal has been installed.
2. Insert dummy load antenna into antenna input socket, or R.F. voltmeter.
3. Push and hold in position the microphone slide button for transmitting.
4. Adjust antenna condenser (C2) fully tight, then back out  $\frac{1}{2}$  turn.
5. Adjust oscillator doubler coil slug (L1) for maximum RF voltmeter reading or maximum lamp brilliance.

6. Adjust doubler coil slug (L6) for maximum RF voltmeter reading or maximum lamp brilliance.
7. Adjust TANK condenser (C1) for maximum lamp brilliance or minimum reading (best dip) of front panel Ip meter.
8. Adjust C2 condenser for Ip meter reading of approximately 60 to 65 Ma.
9. Adjust C1 condenser for maximum lamp brilliance or minimum (best dip) of Ip meter.
10. After above adjustments have been made, switch the microphone button momentarily to receive position, and then back to transmit. If the lamp will not light, or the RF voltmeter has a minimum reading, repeat adjustments. Use care in performing these adjustments, so that maximum oscillator drive is obtained with stability.

NOTE: Before making any adjustments set the crystal coil slug (L1)  $\frac{1}{2}$  way in; Doubler coil slug (L6) all the way out; Tank condenser (C1)  $\frac{3}{4}$  way out. Meter switch on Ip position.



### ADJUSTING THE RECEIVER I.F. SECTION

1. Turn volume control fully "ON". Max. clockwise position. Turn noise limiter control fully counterclockwise.
2. Turn RF peaking knob so that RF peaking variable condenser (C3) is half meshed.
3. Connect an A.C. voltmeter, having a 2.5 volt scale, between chassis and speaker voice coil lug near side of chassis, (or Pin #5 of microphone socket on chassis).
4. Connect a signal generator to Pin #7 of the V2 Mixer tube 6EA8 Low side of generator to chassis. High side of generator, through a 0.1 Mfd condenser to pin #2.
5. Adjust signal generator to 1650 Kc and peak I.F. transformers T3-T2-T1 for maximum gain on output meter.
6. The signal generator, modulated 30% with 400 cycles, should have an output as low as possible when making these adjustments.

### ADJUSTING THE RECEIVER R.F. SECTION

1. Follow paragraphs 1-2-3- under adjusting the receiver I.F. section.
2. Connect a signal generator, that has the 10 meter band spread out, so that the peaking frequencies may be directly read. If possible, a crystal controlled signal generator is more desirable. The signal generator is to have a 52 ohm output impedance and is to be connected to the antenna input receptacle.
3. Set meter switch to "S" position.
4. Adjust signal generator to 28.5 Mc and peak the top and bottom slugs of L3 for maximum gain on S meter.
5. The signal generator, modulated 30% with 400 cycles, should have an output as low as possible when making these adjustments.

The receiver alignment is now complete. Do not change the adjustment of L2 in the input circuit as this is factory set for proper operation of the transmitter.

## T.V. INTERFERENCE TRAP

This transceiver contains a built-in series-resonant trap (L5) in shunt with the antenna output receptacle. When tuned correctly, it suppresses television interference in the transmitting position. If when transmitting, the transmitter causes excess TV interference this trap may be tuned to help remove this effect.

Turn on a TV receiver that you can see from your transmitting location, and tune to one of the three lower TV channels that has a station operating in your vicinity. If you notice a "cross-hatch" or "wavy-line" pattern on the screen while you are transmitting, it will be necessary to adjust the RF trap coil slug screw, (L5) in rear of cabinet, to eliminate or minimize this interference. This will usually only be necessary when the transmitter antenna is located near the TV antenna, or that of a neighbor. This coil slug screw is located between the antenna input jack and the power input cable receptacle.

## DESCRIPTION OF CONTROLS

**VOLUME CONTROL AND POWER SWITCH:** — Varies the sound output from the loudspeaker. Also incorporates an on-off switch at the most counterclockwise end of rotation.

**TUNING CONTROL** — Tuning is accomplished in the same manner as when using a standard broadcast band radio. Note: Receiver tuning has no effect on the frequency of transmission. The tuning control knob operates the illuminated dial scale and tuning condenser through a reduction drive to insure ease and accuracy in the selection of stations. When tuning, it is advisable to rock both the tuning knob and the RF peaking knob for best sensitivity.

**CRYSTAL SELECTOR SWITCH**—Note that there are 3 positions on the crystal selector marked VFO, 1, 2. Selecting the No. 1 position will set the transmitter to the frequency of the crystal (Fundamental x 4) in the No. 1 crystal socket on the front panel, etc.

When the selector is in the VFO position, the frequency of the transmitter is controlled by the VFO plugged in the VFO socket on the front panel.

The transmitter is normally supplied with a crystal for 28.6 Mc (Fundamental frequency x 4), already installed in front panel crystal holder No. 1. Therefore the other selector positions cannot be used until additional crystals are installed. All crystals must be of the fundamental type and be within .01% accuracy. The use of any other type of crystal may result in illegal (Off-frequency) operation. The transmitting frequency will be the fundamental crystal frequency stamped on the crystal case multiplied by 4.

**NOISE LIMITER CONTROL** — is used to reduce excessive noise (such as that caused by auto ignition or other disturbances) in those cases where this characteristic type noise is greater in intensity than the received signal. The use of this control may reduce slightly the over-all sensitivity of the receiver.

**RF PEAKING CONTROL** — This control is used to adjust the receiver for maximum gain and sensitivity. When tuning the RF Peaking knob for maximum gain it is advisable to rock both the tuning knob and the RF Peaking control for best sensitivity.

**TRANSMITTER OUTPUT TANK CONTROL**— The Tank Condenser is to adjust the Transmitter for maximum output.

**SPOT SWITCH** — When the spot switch is in the "ON" position the operator can adjust the tuning dial to the transmitted frequency. Set meter switch to "S" position and tune in internal crystal generated frequency for maximum gain on S meter.

Before using this unit to check for spot frequency it is advisable to keep transceiver on approximately 15 minutes. By this time the temperature correction components will become stable.

**VFO POWER JACK** — Located in the rear and it's used for powering Lafayette's HE 62 10 Meter V.F.O.

## TRANSMITTING

Be sure that the proper power supply cable has been connected to the transceiver as instructed earlier, and that the unit has an adequate ground (if not mounted to a metal surface). One of the antenna systems discussed earlier should be connected. Plug the microphone into the jack provided on the extreme right of panel.

To transmit, slide the button on the side of the microphone toward the cable and hold it in that position. Talk directly into the end of the microphone. Release the button to receive. The transceiver will not function as a receiver unless the button is released.

1. Turn the transceiver on; and set the tuning control to the frequency on which you desire to operate. The tuning dial will be illuminated indicating power has been applied to the unit. The "Spot" switch may be used if you desire to receive on the same frequency that is being transmitted.

2. Set CRYSTAL SELECTOR SWITCH to the required position for transmission on the desired frequency. Positions on Selector switch correspond to position numbers on crystal sockets on front panel.

3. Set the METER SWITCH to the position marked "Ip". The meter will read when the microphone button is in the transmit position. This reading will be an indication of the final plate input power of the transmitter.

4. Hold the microphone 4 to 8 inches away and speak in a normal tone of voice, shouting will not increase the strength of your signal. Speak clearly and slower than you would normally. As you speak into the microphone you will notice that the meter needle will "Flicker", giving an indication that the speech amplifier and modulator circuits are operating properly. Release the microphone button at the completion of your message.

5. To record the signal strength of the desired received signal set the METER switch to the position marked "S". The meter dial is calibrated in "S" units. The tuning control can be used with the meter as a very fine tuning meter. Since the transmitter when operating cuts off the receiver, the meter in the "S" position will read full scale. It is advisable to keep the meter switch in the Ip position unless in receiving a signal strength reading is being checked.

6. An external Variable Frequency Oscillator may be connected using the VFO socket on the front panel. Crystal selector switch is to be in the VFO position.

## INSTALLATION OF CRYSTALS

The transceiver is normally supplied with a crystal for 28.6 Mc (Fundamental x 4) already installed in front panel crystal holder No. 1. Additional crystals may be inserted in crystal holder No. 2. These are selected by the corresponding positions of the crystal selector switch. All crystals must be of the fundamental type and be within .01% accuracy. The use of any other type of crystal may result in illegal (Off-frequency) operation. The transmitting frequency will be the fundamental frequency of crystal stamped on the crystal case x 4.

## TUBE REPLACEMENT

If tube replacement becomes necessary, all tubes can be made accessible by removing the top shell cover. Remove the two screws from the top of the front panel and then remove the two screws on each side of the top shell. Slide shell upward to remove shell from bottom plate. Do not remove any other screws from the case as a shock hazard is present if the base plate is removed. The replacement tube must have the same type number as the original. A tube location diagram can be found on the license label on the bottom of the base plate. Replace shell, side mounting screws and front panel screws.



