

144MHz 10W BOOSTER **IC-ML1**

INSTRUCTION MANUAL

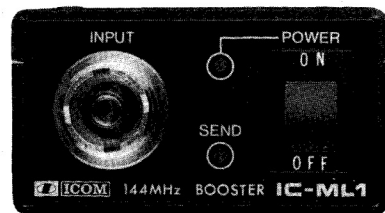


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PROFILE

When this booster is connected to hand-held transceivers, IC-2A/2AT/2E, it will increase the output from 2.3 watts to 10 watts.

SMALL SIZE, LIGHT WEIGHT

Because of its small size and light weight, the amplifier can be mounted easily in a small space in a car. The DC voltage for T/R switching control is superimposed on the RF coaxial cable. This permits the amplifier to be controlled by connection of the coaxial cable from the transceiver only. Unlike the carrier control method, no cutoff of initial transmissions occurs.

APC CIRCUIT

When the collector current drains are over those specified, the APC circuit functions to inactivate the booster to protect the final stage transistor.

DIRECT CIRCUIT

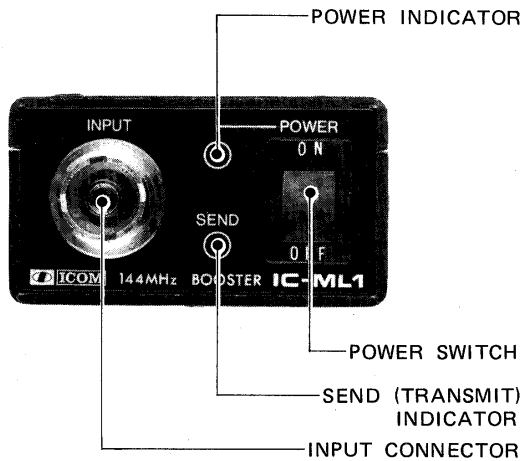
When the power switch of the booster is turned to the OFF position, the amplifier circuit is bypassed and the 2.3 watts output of the transceiver is fed directly to the antenna.

SPECIFICATIONS

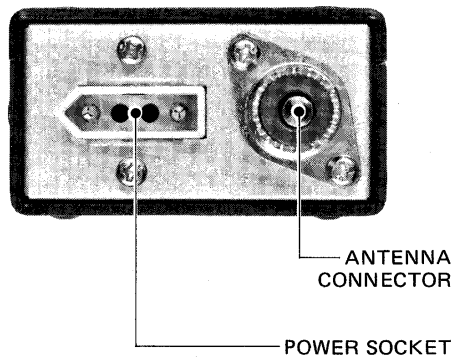
Number of Semiconductors	:	Transistors	6
		Diodes	10
		IC	1
Frequency Coverage	:	144 ~ 148MHz	
Acceptable Modulation	:	FM	
Power Supply Requirements	:	13.8V DC \pm 15% Negative Ground 3A Max.	
Current Drain	:	Approx. 2.0A at 10W Output	
		Approx. 30mA at stand by	
Drive Power Requirements	:	2.3 Watts	
Output Power	:	10 Watts	
Input Impedance	:	50 Ω Unbalanced	
Output (Load) Impedance	:	50 Ω Unbalanced	
Dimensions	:	35mm (H) x 63mm (W) x 160mm (D)	
Weight	:	Approx. 320g	
Accessories	:	Power Cord	1
		Coaxial Cable	1
		Fuse (5A)	2
		Mobile Mounting Bracket	1
		Gimp Screw	4
		Flat Washer	12
		Mounting Screw	8
		Mounting Screw's Nut	4

PARTS DESIGNATION

FRONT PANEL



REAR PANEL



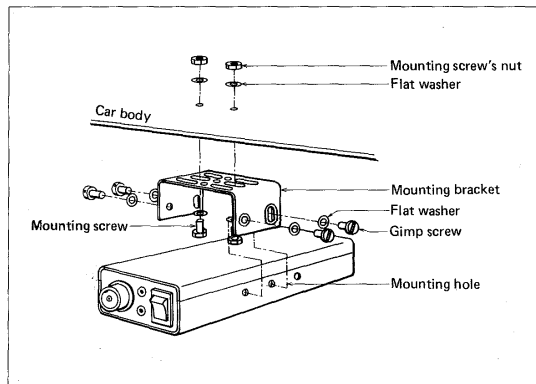
PRE-OPERATION

LOCATION

Where you place the booster in your automobile is not critical and should be governed by convenience and accessibility. Since the unit is so compact, many mobile possibilities present themselves. In general, the mobile mounting bracket will provide you with some guide as to placement. Any place where it can be mounted with metal screws, bolts, or pop-rivets will work. For fixed station use, the power supply should be designed to produce 3 amps for the booster.

MOBILE INSTALLATION

Install the booster as shown in the drawing using the mobile mounting bracket. The three mounting holes on the side of the amplifier allow adjustable mounting. Using the center and the rear holes will move the amplifier forward, while using the center and forward holes will move the amplifier to the back of the holder. The transceiver and booster may be separated by a distance of about one meter. Therefore, it is possible to place the transceiver near the driver's seat and place the booster under the seat.



POWER REQUIREMENTS

The booster is supplied ready to operate from any regulated 13.8V DC, 3 ampere, negative ground source. An automobile 12 volt, negative ground, system is usually more than adequate. Some note must be taken, however, of the condition of the vehicle's electrical system. Items such as a low battery, worn generator/alternator, poor voltage regulator, etc., will impair operation of your booster as well as the vehicle. High noise generation or low voltage delivery can be traced to these deficiencies. If an AC power supply is used with your booster, make certain it is adequately regulated for both voltage and current. Low voltage while under load will not produce satisfactory results from your booster. Output power will be greatly impaired. Caution against catastrophic failure of the power supply should be observed.

CAUTION: Excessive Voltage (above 15VDC) will cause damage to your booster.
Be sure to check source voltage before plugging in the power cord.

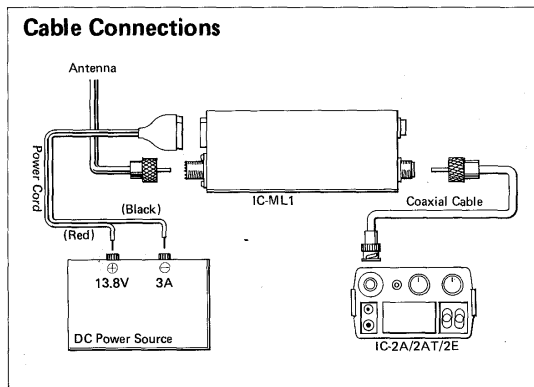
Included with your booster is a DC power cable with plug attached. The Red Wire is positive (+), the Black, negative (-). If your mobile installation permits, it is best to connect these directly to the battery terminals. This arrangement eliminates random noise and transient spikes sometimes found springing from automotive accessory wiring. If such an arrangement is not possible, then any convenient B+ lead in the interior of the vehicle and the negative frame can be utilized. Remember, the unit operates on a negative ground system only; it cannot be used in a positive ground automobile. After making your connections, simply insert the plug into your booster.

ANTENNA

The most important single item that will influence the performance of any communication system is the antenna. For that reason, a good, high-quality, gain antenna of 50 ohms impedance is recommended, fixed or mobile. In VHF as well as the low bands, every watt of ERP makes some difference. Therefore, 10 watts average output plus 3dB of gain antenna equals 20 watts ERP, presuming low VSWR of course. The few more dollars invested in a gain type antenna is well worth it. When adjusting your antenna, whether mobile or fixed, by all means follow the manufacturer's instructions. There are some pitfalls to be aware of. For example, do not attempt to adjust an antenna for lowest VSWR when using a diode VSWR meter not engineered for VHF applications. Such readings will invariably have an error of 40% or more. Instead, use an in line watt meter similar to the Drake WV-4, Bird Model 43 or Sierra Model 164B with VHF cartridge.

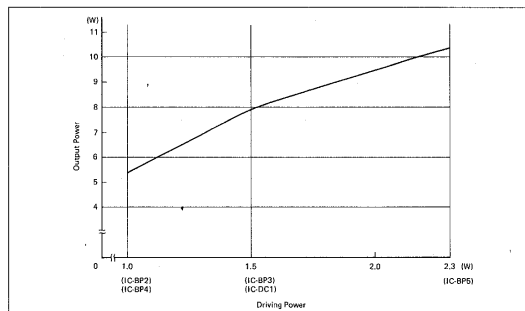
Further, when adjusting a mobile antenna, do so with the motor running preferably above normal idling speed. This will insure proper voltage level to the booster.

The RF coaxial connector on the rear chassis mates with a standard PL-259 connector. Some models may have metric threads. In any event, the RF connector will mate with almost any PL-259 connector if care is taken to seat them properly.



TRANSCEIVER

This booster is designed for the IC-2A/AT/2E, hand held transceivers, and to put out 10 watts output power with 2.3 watts driving power. Thus, it is recommended to use the IC-BP5 (10.8V 450mA) power pack with the transceiver. When using other power packs, such as IC-BP2, BP3, BP4 or DC1, the output power will be reduced as per the chart.



OPERATION

Make sure both power switches of the transceiver and booster are in the OFF position, then connect the power cord, coaxial cable etc., as the drawing shown on page 6.

Now your transceiver is ready to use. When you turn ON the power switch of the transceiver, a noise or audio will be heard from the speaker showing that the set is in receive. If you switch to transmit from this condition, the 2.3 watts output of the transceiver is directly applied to the antenna.

When the POWER Switch of the booster is placed in the ON position with the transceiver in receive, the POWER indicator LED (green) will light showing that the booster is powered. In the receive mode, the antenna is connected directly to the transceiver.

If the transceiver is switched to transmit, the SEND (TRANSMIT) indicator LED (red) will light indicating that the booster is also switched to transmit. In this case, an amplified output of 10 watts is applied to the antenna.

APC CIRCUIT

If the final collector current becomes high due to antenna trouble or poor matching etc., the APC circuit will work and turn OFF the SEND indicator LED. In this condition, the booster will not switch ON (to the transmit state), thus protecting the power amplifier transistor. When the APC circuit is activated, the transceiver output is directly fed to the antenna. This prevents communications from being completely interrupted even when there is a problem.

However, set the POWER Switch to the OFF position and then check the antenna and feeder and remove any trouble before continuing operation.

THEORY OF OPERATION

POWER AMPLIFIER CIRCUIT

The 2.3 watts input from the transceiver is fed to the base of Q1 through T/R switching diode, D2, and after being amplified by Q1, and harmonics suppressed by an M-derived filter, applied to the external antenna through switching diode, D4, as a 10 watts output with very little spurious. C11 and R3 ~ 6 provided in the input circuit controls driving power to give 10 watts output.

DIRECT CIRCUIT

The transceiver is directly connected to the external antenna through L9, C28, C4 and L1, when the booster is switched OFF, when the APC circuit is activated, or when in the receive mode.

APC CIRCUIT

The APC circuit of this amplifier works only against over current because a final stage transistor of high puncture resistance is used.

The voltage drop of R23 connected to the collector of Q1 switches Q6 and is applied to the APC control circuit to effect detection.

APC CONTROL, T/R SWITCHING CIRCUIT

APC is controlled by a flip-flop composed of two sets of NAND gates. This is usually reset in the receive mode and Pin 10 of IC1 is brought to a HIGH level. In the transmit mode, Pin 3 of IC1 is brought to a LOW level, Q2, Q4, and Q5 are turned ON. Thus the T/R Switching diodes D2 and

D4 are turned ON and the power amplifier circuit will work. At the same time, the SEND indicator LED is lit.

If the APC circuit operates, Pin 11 of IC1 is brought to a LOW level and Q4 is cut out, T/R Switching diodes D2, and D4 deactivate, causing a direct connection to the antenna.

VOLTAGE CHARTS

NOTE: Measuring instrument is a 50K Ω /V multimeter.

TR No.	TRANSMIT			RECEIVE			REMARKS
	BASE	COLLECTOR	EMITTER	BASE	COLLECTOR	EMITTER	
Q 1	-0.1	12.8	GND	0	13.8	GND	
Q 2	4.7	5.3	5.4	5.0	0	5.4	
Q 4	0.8	0.5	GND	0	13.8	GND	
Q 5	13.0	13.8	13.8	13.8	0	13.8	
Q 6	12.0	12.8	12.8	13.8	13.8	13.8	
Q 7	5.4	10.2	4.7	5.4	10.2	4.7	

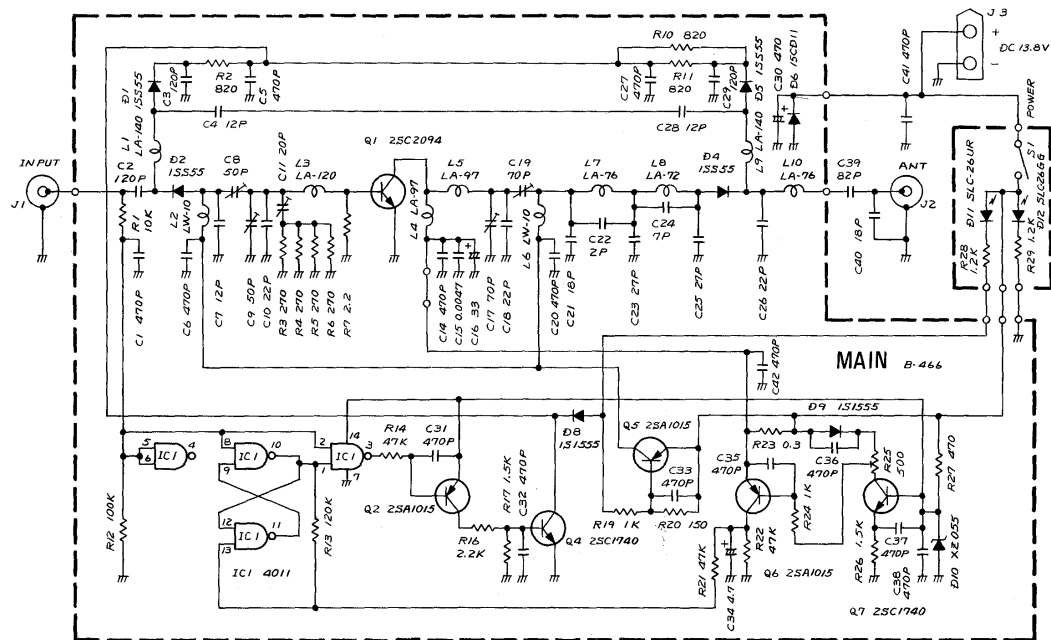
IC No.	PIN No.														REMARKS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
IC 1	5.4	3.7	0	0	3.7	3.7	GND	3.7	0	5.4	0	5.4	6.0	5.4	Transmit
	0	3.7	5.4	0	3.7	3.7	GND	3.7	5.4	0	5.4	0	6.0	5.4	APC actuates
	5.4	0	5.4	5.4	0	0	GND	0	0	5.4	0	5.4	6.0	5.4	Receive

SCHEMATIC DIAGRAM

144MHz 10W MOBILE BOOSTER

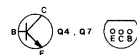
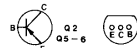
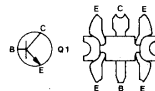
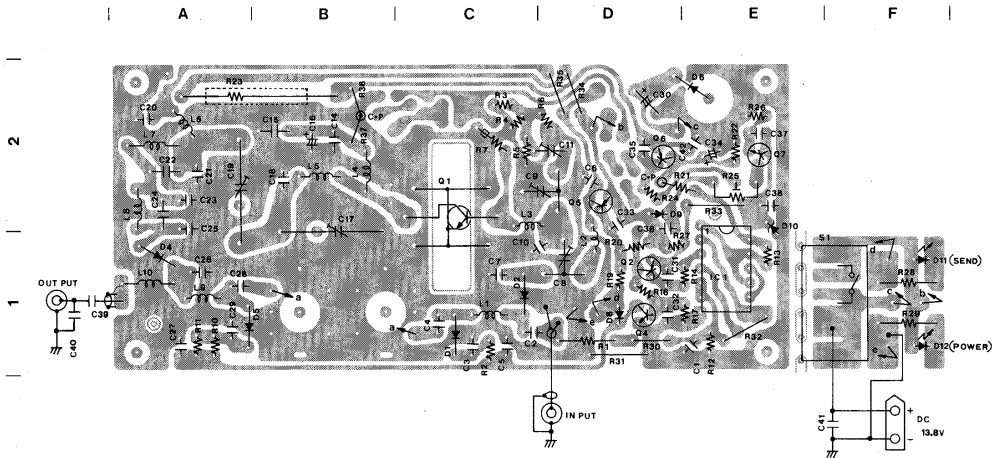
IC-ML1

SCHEMATIC DIAGRAM



Some components subject to change for an improvement without notice.

P.C. BOARD LAYOUT





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