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tions you need only maintain peak meter readings of 30% or so to be well understood. At greater ranges or under difficult operating conditions you might find it advantageous to speak so as to maintain 40-50% meter readings (the equivalent of full modulation). On Johnson transceivers and other high quality sets audio compression and clipping prevent overmodulation and increase the average "talk-power".

FIELD STRENGTH MEASUREMENT

The Transceiver Tester indicates the relative strength of strong received signals. A typical mobile five watt Citizens Radio transmitter should provide good meter readings at distances of up to about 100 feet from the transmitter and at about the same height off the ground as the transmitter antenna. A base station antenna, particularly a "gain" type, tends to direct most of the transmitter signal out at the same height as its vertical radiator. This tendency might prevent you from obtaining a field strength reading from close in under the antenna, but you might be able to get a good reading by moving away from the antenna.

RF POWER/SWR MEASUREMENT

The Transceiver Tester incorporates functions permitting measurement of RF power into the dummy load, relative RF power into the antenna and antenna SWR. Any of these functions is selected by rotating the FUNCTION switch to RF POWER/SWR, then setting the yellow rocker switch to ANTENNA or DUMMY ANT. and the gray rocker switch to SWR or RF POWER.

A directional coupler is used for RF power and SWR measurements in the Johnson Transceiver Tester. The directional coupler is very efficient and can be left in the transmission line indefinitely with negligible power loss.

Incorrect METER ADJUST settings cause incorrect readings in other modes. When a reading does not seem correct,

check the METER ADJUST control setting before making other checks.

When checking SWR in mobile installation, first move the vehicle to a location at least 50 feet away from other vehicles, buildings, wires, etc. While measuring, keep doors and trunk closed and keep persons away from the antenna.

The Johnson Transceiver Tester, like any directional coupler (or SWR bridge) measures the radio frequency (RF) voltage at the antenna jack on a scale that indicates power into a 50 ohm load. It is to be expected that your antenna does not present exactly a 50 ohm load to the transmitter, and that the load varies between channels 1 and 23. Any SWR condition, for example, can result in false readings, either higher or lower than true power output.

If your antenna system has a high SWR condition you should correct the situation which results in the SWR condition. Any good quality antenna should be tunable to a 1.5:1 or better SWR condition if you follow the manufacturer's directions carefully. If you cannot tune out a high SWR at the antenna, check the transmission line for a broken wire or corroded or damaged connections. Check the antenna location. Your SWR condition might be improved by moving the antenna to a location free of obstructions or objects which might detune the antenna, such as tree limbs, overhanging eaves, etc. Even the most innocent appearing object, metallic or otherwise, can sometimes cause difficulty.

If antenna tuning or relocation fails, or the antenna cannot be relocated, you can use a Johnson CB Matchbox, part no. 250-0849-001. Mounting the matchbox as near the antenna as possible gives best results. The Johnson CB Matchbox can be used to reduce any SWR up to 5:1 to 1.5:1 or less.

The Transceiver Tester RF Power scale is calibrated from 0-6 watts. The dummy antenna can withstand eight watts contin-

uous carrier with 100% modulation, or 12 watts continuous carrier with no modulation (you can transmit up to 15 watts into the dummy antenna for a few seconds, allowing time between transmissions for the dummy antenna to cool, but such operation can destroy the dummy antenna if too high a power is applied or for too long a time.)

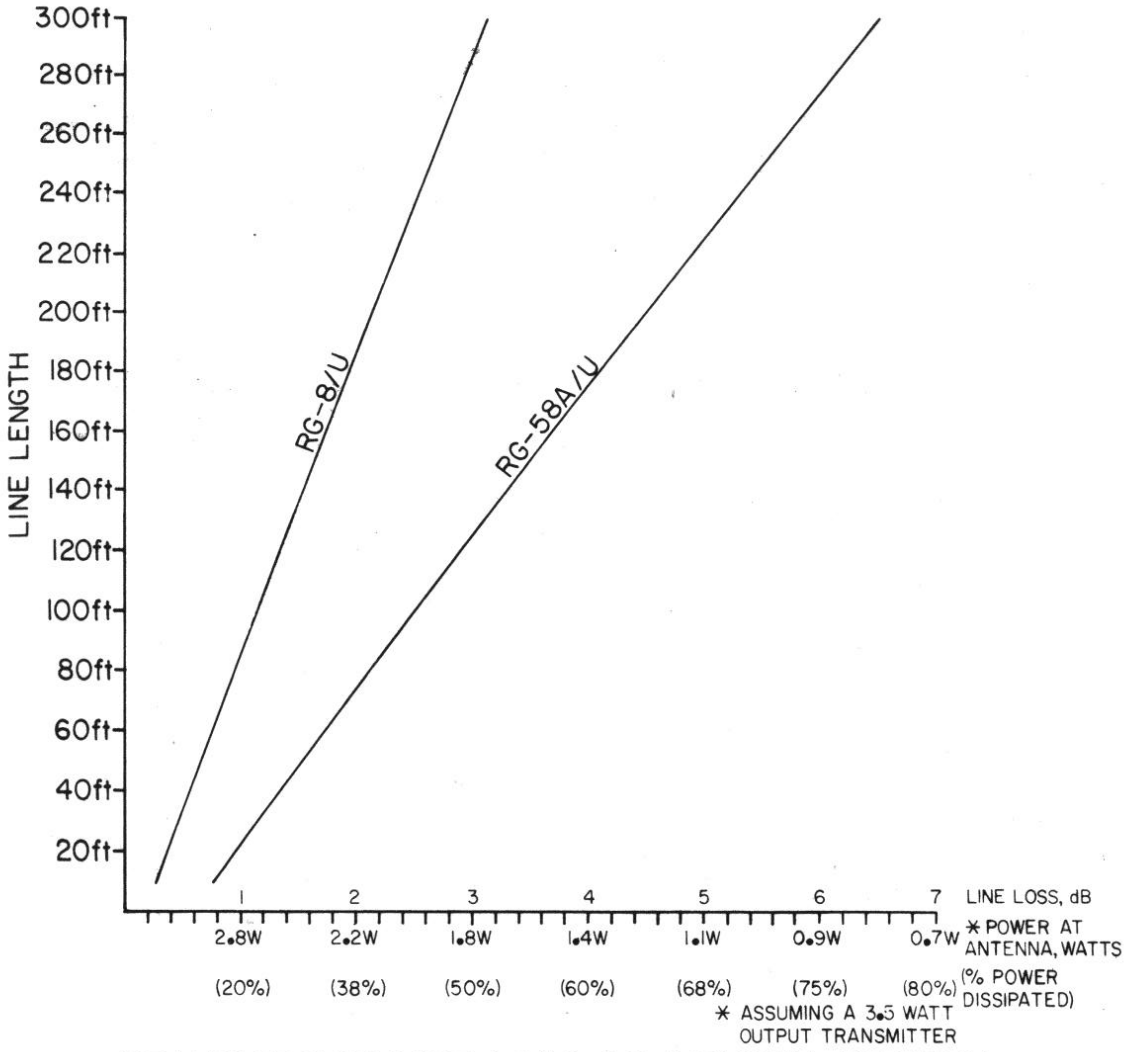
To Read Power Output of a High Power Transmitter:

The Transceiver Tester can be used to measure RF power up to 50 watts if a good 50 ohm dummy antenna rated at 50 watts or more, and a low power (less than six watts) transmitter are available.

Connect the high power dummy antenna to the Transceiver Tester ANTENNA jack. Connect the lower power transmitter to the Transceiver Tester XMIT jack and measure true RF power into the internal DUMMY ANT. Next, depress the yellow rocker switch to ANTENNA. While keying the low power transmitter, turn the METER ADJUST control counterclockwise (CCW) until the meter reads 1/10 of the true power output just measured. Connect the high power transmitter to the XMTR jack and read indicated power output. Actual power output is 10 times the indicated power output. CAUTION: Make certain that the yellow rocker switch is depressed to ANTENNA and that the METER ADJUST control has been backed off counterclockwise before keying the high powered transmitter.

Refer to the following graph to determine your power at the antenna if you know true power output at the Transceiver Tester. For example, if you use a 200 foot run of RG-58/AU cable, line loss is 5 dB, or 68% of transmitter power. Switching to RG-8/U cable will reduce line loss to 2.2 dB (38%). Lower loss cable than RG-8/U is available, at higher cost.

Another important factor to consider when using long runs or high loss transmission line is that not only is effective transmitter power reduced considerably when using high loss cable, but the effective receiver sensitivity is also reduced.



TRANSMISSION LINE LOSS VS LENGTH AT 27MHz
RG-8/U, RG-58A/U
FIGURE 2

Checking SWR in High Loss Lines:

To check SWR of an antenna where line loss is several dB, connect the Transceiver Tester at the antenna end of the transmission line if possible. This is because losses in the transmission line tend to reduce the indicated SWR and make it appear to be better at the transceiver than it really is, making antenna tuning more difficult. In this situation it is convenient to have two persons adjust the antenna, one at the antenna and one at the transceiver. Use a pair of good quality portable transceivers (such as Johnson Messenger 109's) on a different channel than the base station to coordinate the operation. Use good portable sets to help avoid problems such as receiver overload or adjacent channel interference when the base station is transmitting.

STATION TESTS

In case of communication failure between two stations in a system, you can quickly determine which station is in trouble.

With the Transceiver Tester connected in the transmission line, you can determine whether the trouble lies within the transmitter, receiver or antenna system. Check RF power and percent modulation to determine if the transmitter is working. Check receiver operation with an audio modulated signal from the signal generator. Check SWR to determine if the antenna system is normal.

Remember that the Johnson warranty and that of most other manufacturers is voided by repairs or modifications by unauthorized persons. The network of over 500 Johnson Warranty Service Centers stands ready to assist you with any necessary repairs to Johnson equipment. Consult the classified section of your telephone directory under Radio Communications Equipment, or consult your E. F. Johnson dealer or distributor, for the nearest E. F. Johnson Warranty Service Center. A list of the E. F. Johnson authorized Warranty Service Centers is also packed with the transceiver.

Transceiver Modifications to Use the Transceiver Tester As An S-Meter

The Transceiver Tester S-meter function permits monitoring of received signal strength with properly modified transceivers. Following are instructions which outline conversion of Johnson transceivers to permit use of the Transceiver Tester S-meter function. Conversion of transceivers of other manufacture can be accomplished experimentally.

We recommend that this modification be performed by a qualified serviceman unless the owner is proficient in wiring techniques. Note that the warranty is voided by incorrect wiring.

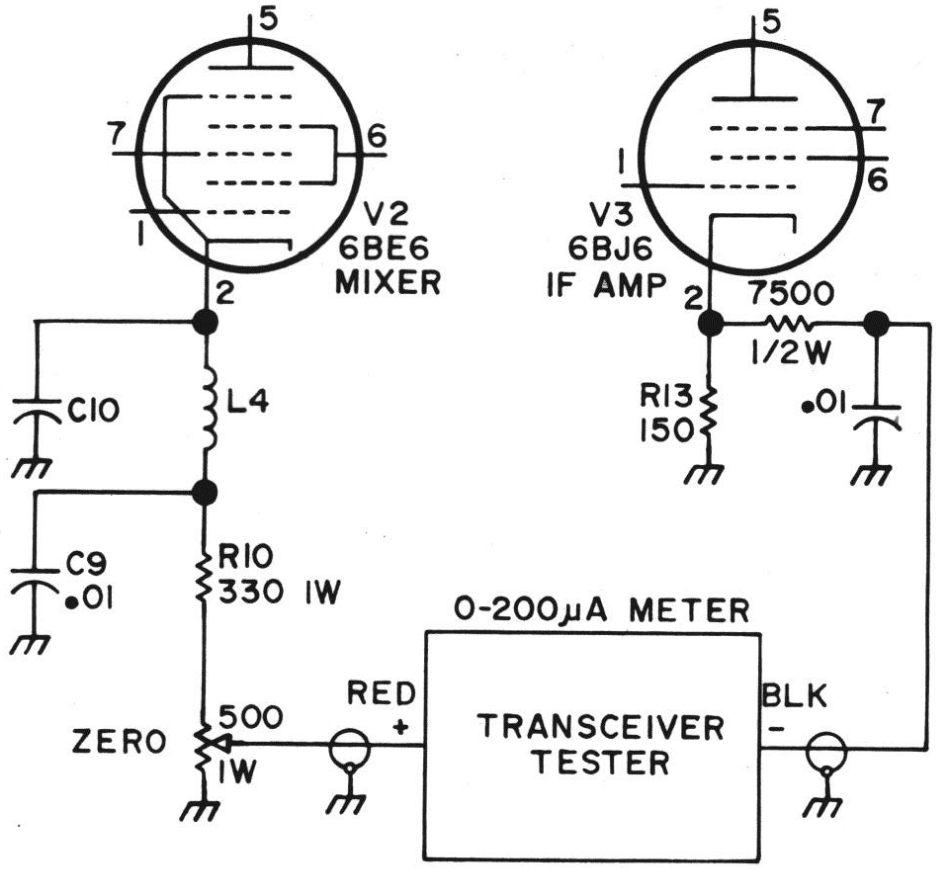
Parts added can be mounted on a piece of perforated board, then mounted in a small box, such as a "mini-box". If space inside the radio permits, the S-meter parts can be mounted internally.

Parts placement is not critical but it is a good practice to keep RF leads short and direct. Use coaxial cable (subminiature RG174/U is most convenient) to connect the S-meter circuit to the Transceiver Tester. Use tip plugs (Johnson part no. 105-0302-001, red, and 105-0303-001, black) and jacks (Johnson part no. 105-0802-001, red, and 105-0803-001, black) to permit easy cable connection to or removal from the transceiver. Refer to the applicable Johnson service manual for transceiver parts location. These are available from the E. F. Johnson Company Customer Service Department at $3.00 each.

GENERAL OPERATION (Cont'd)

Messenger I

Description	Johnson Part No.
Change:	
R10 from 820 ohm to 330 ohm ±10% 1/2 W	569-1006-331
Add:	
Resistor, 7.5 K ohm ±5% 1/2 W	569-1003-752
Potentiometer, 500 ohm	022-1194-001
Capacitor, 0.01 μF ceramic disc	510-3005-103



Messenger I

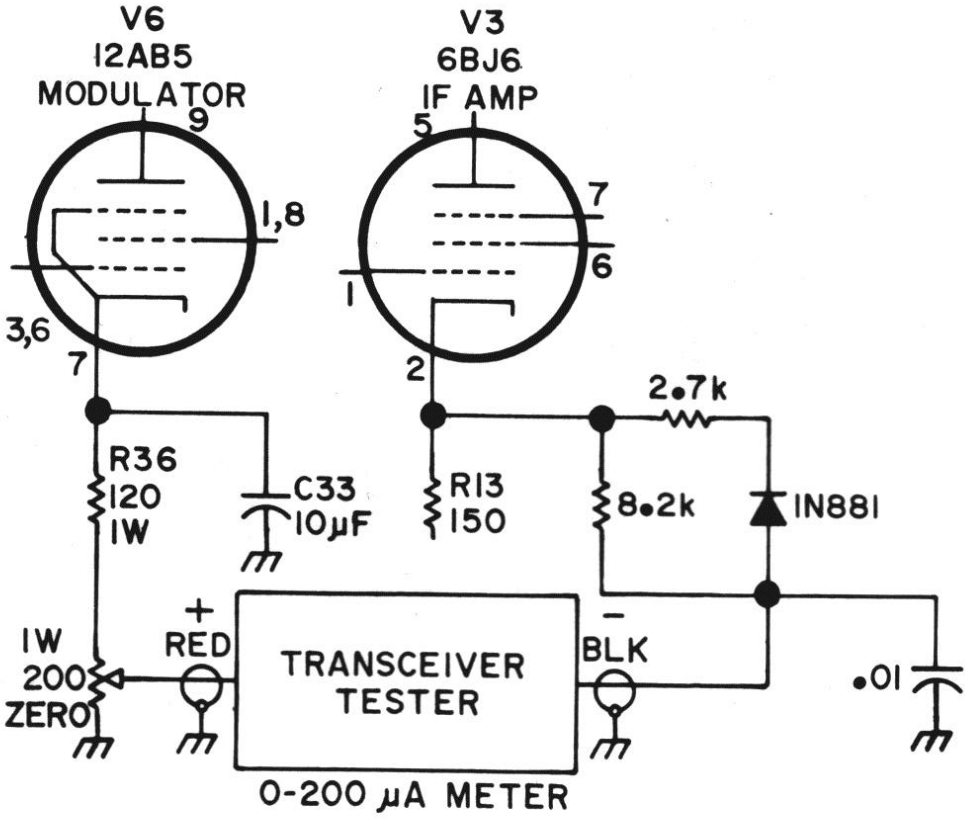
Messenger II

Change:

R36 from 330 ohm to 120 ohm ±10% 1 W	569-1006-000

Add:

Resistor, 8.2 K ohm ±5% 1/2 W	569-1003-822
Resistor, 2.7 K ohm ±5% 1/2 W	569-1003-272
Potentiometer, 200 ohm	022-1577-001
Capacitor, 0.01 μF ceramic disc	510-3005-103
Diode, 1N881	523-1000-881



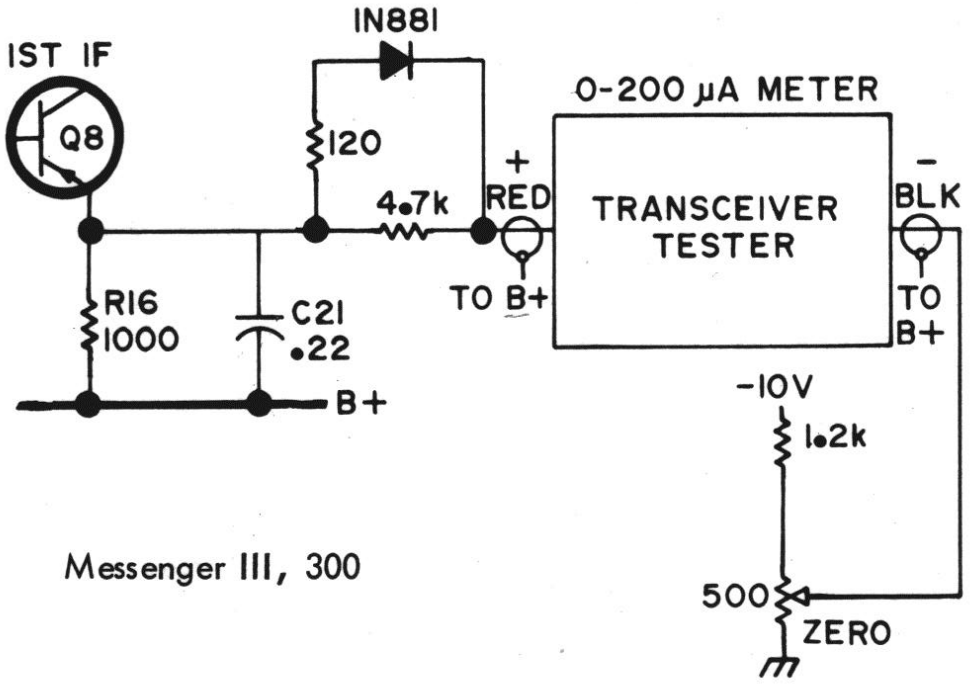
Messenger II

GENERAL OPERATION (Cont'd)

Messenger III, 300

Add:

Resistor, 4.7 K ohm ±5% 1/4 W	569-1001-472
Resistor, 120 ohm ±5% 1/4 W	569-1001-121
Resistor, 1.2 K ohm ±10% 1/4 W	569-1002-122
Potentiometer, 500 ohm	562-0004-501
Diode, 1N881	523-1000-881

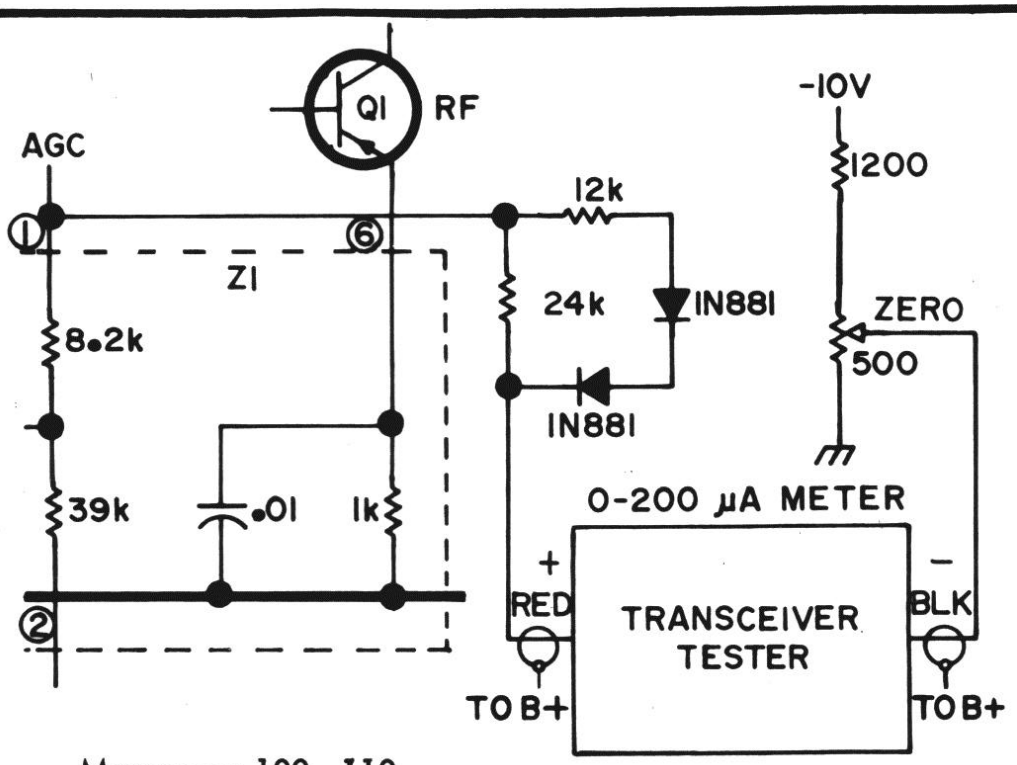


Messenger III, 300

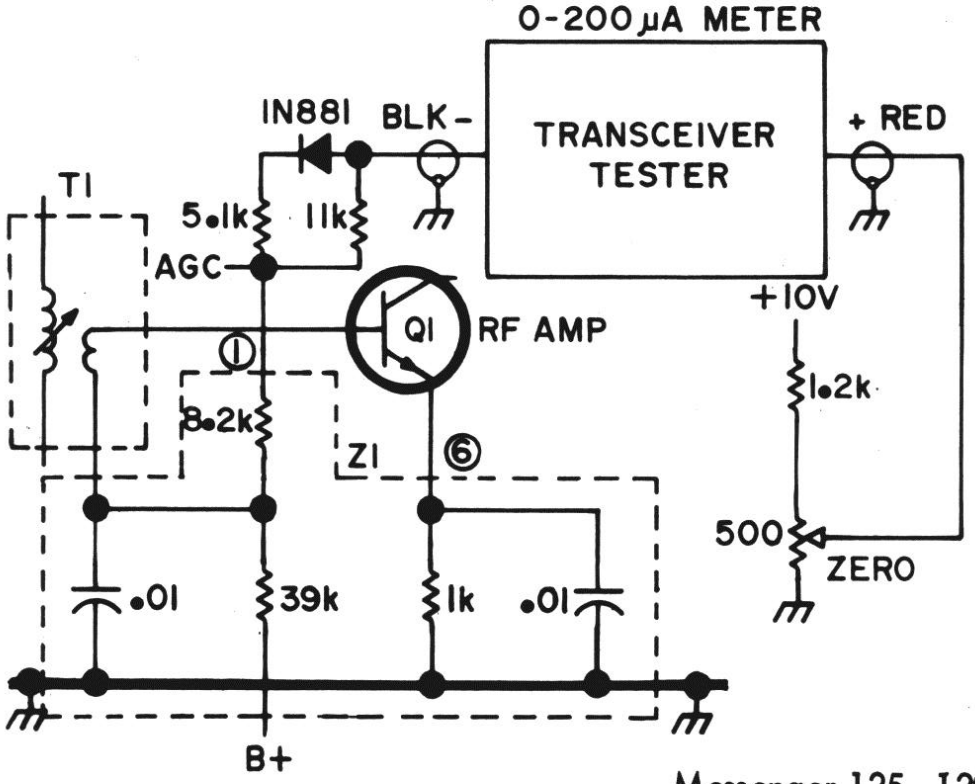
Messenger 100, 110

Add:

Resistor, 24 K ohm ±5% 1/4 W	569-1001-243
Resistor, 12 K ohm ±5% 1/4 W	569-1001-123
Resistor, 1.2 K ohm ±10% 1/4 W	569-1002-122
Potentiometer, 500 ohm	562-0004-501
Diode (2) 1N881	523-1000-881



Messenger 100, 110



Messenger 125, 120

GENERAL OPERATION (Cont'd)

Messenger 125, 120

Add:

Resistor, 11 K ohm ±5% 1/4 W	569-1001-113
Resistor, 5.1 K ohm ±5% 1/4 W	569-1001-512
Resistor, 1.2 K ohm ±10% 1/4 W	569-1002-122
Potentiometer, 500 ohm	562-0004-501
Diode, 1N881	523-1000-881

After connecting the transceiver, test for normal transceiver functioning with and without the S meter. Adjust the potentiometer added for zero with the transceiver turned on and with no received signal.

PARTS LIST

PRINTED MATERIAL

	Operating Manual	002-0116-001
	Warranty Card	041-0419-017

ASSEMBLIES

ASY1	Front panel rivited assembly	023-2870-001
	Includes:	
J1	Coaxial connector	142-0101-002
J2	Same as J1	
J6	Phono jack	515-1026-001
J7	Same as J6	
XY1	Crystal socket	515-5201-001
ASY2	Battery holder &switch assembly	023-2871-001
	Includes:	
SW5	Switch	583-3004-503
MP5	Battery holder	537-9013-001
ASY3	Housing assembly	023-2873-001
ASY4	Lead assembly-quick disconnect	023-2558-007

ANTENNA

ANT1	Antenna, telescoping	501-0010-001

BATTERY

BT1	Battery, 9V, NEDA 1604	503-1001-001

CAPACITORS

C1	0.0022μ F, ±20%, 500VW, ceramic disc	510-3004-222
C2	1.0μ F, ±20%, 35VW, tantalum	510-2045-109
C3	0.0022μ F, ±20%, 500VW, ceramic disc	510-3004-222
C4	Same as C3	
C5	Same as C3	
C7	0.0022μ F, ±20%, 500VW, ceramic disc	510-3004-222
C8	Same as C7	
C9	0.12μ F, ±10%, 250VW, flat foil	510-1003-124
C10	Same as C9	
C11	0.01μ F, ±20%, 50VW, Y5U, ceramic disc	510-3002-103
C12	430pF, ±5%, 200V, N080, ceramic disc	510-3016-431
C14	33pF, ±5%, 200V, NPO, ceramic disc	510-3013-330
C15	68pF, ±5%, 200V, NPO, ceramic disc	510-3013-680
C16	0.0022μ F, ±20%, 500VW, ceramic disc	510-3004-222
C17	5.1 pF ±5%, 200V, NPO ceramic disc	510-3013-519
C18	0.01μF, ±20%, 50V, ceramic disc	510-3002-103
C19	330 pF ±5%, 1KV, N1500	510-3041-331

DIODES

D1	Silicon	523-0006-002
D2	Germanium, IN67A	523-1000-067
D3	Same as D2	
D4	Same as D2	
D5	Same as D2	

HARDWARE

HW	Screw, 4-40 x 1/4 RH, (sw2,3,5-6, housing-4)	011-0011-008
HW	Lockwasher, #4 internal tooth, NPB, (Meter-4)	029-0116-003
HW	Nut, hex 4-40 x 3/16, (Meter-4)	012-0163-003
HW	Lockwasher, 1/4 internal tooth, (J3-1) (SW1-1)	029-0410-003

JACKS

J1	Coaxial connector, SO-239	142-0101-002
J2	Same as J1	
J3	Jack, monitor	515-2001-002
J4	Terminal, rib loc, black, (S meter)	105-1043-001
J5	Terminal, rib loc, red, (S meter)	105-1042-001
J6	Phono plug, RCA type	515-1020-001
J7	Same as J6	

INDUCTORS

L1	Inductor, 470 mH, ±10%	542-8001-001

METER

M1	Meter, 0-200 microampere DC	554-0014-004

KNOBS

MP2	Knob, 11/16 push-on, indexed	547-0008-006

BATTERY

MP4	Connector, battery	515-9017-001
MP5	Holder, battery	537-9013-001

PC BOARD

PC1	Printed circuit board	035-0121-001

TRANSISTORS

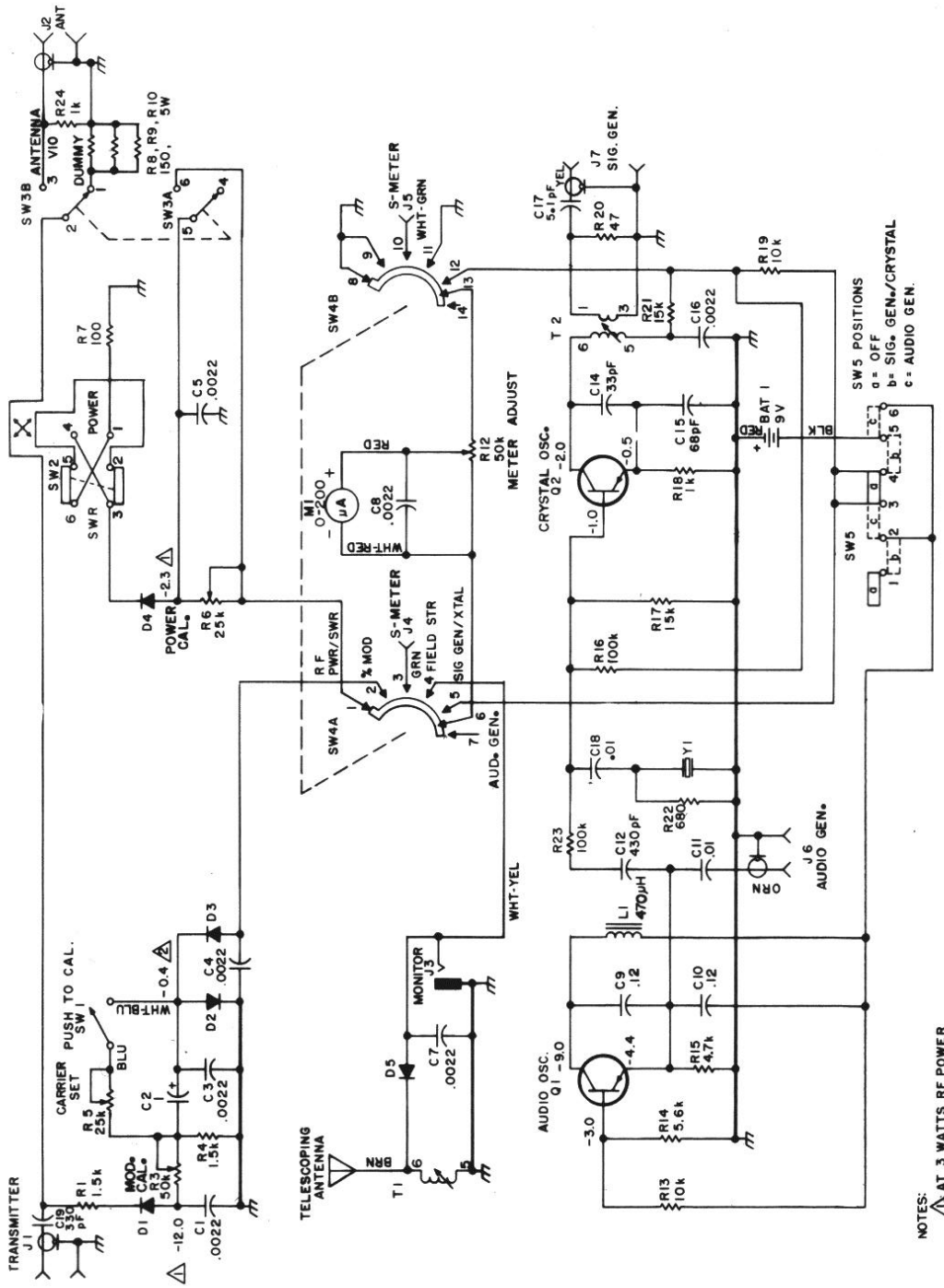
Q1	Transistor, 3017	576-0003-017
Q2	Same as Q1	

RESISTORS

R1	1.5 KΩ, ±10%, 1/2watt	569-1004-152
R3	Potentiometer, 50KΩ, ±20%	562-0026-002
R4	1.5KΩ, ±10%, 1/2 watt	569-1004-152
R5	Potentiometer, 25KΩ, ±30%, 1/8 watt	562-0004-253
R6	Same as R5	
R7	100 Ω, ±10%, 1/2 watt	569-1004-101
R8	150 Ω, ±10%, 5 watt, non-inductive	569-0003-151
R9	Same as R8	
R10	Same as R8	
R12	Potentiometer, 50KΩ, ±20%	562-0026-002
R13	10 KΩ, ±10%, 1/2 watt	569-1004-103
R14	5.6 KΩ, ±10%, 1/2 watt	569-1004-562

R15	4.7 KΩ, ±10%, 1/2 watt	569-1004-472
R16	100 KΩ, ±10%, 1/2 watt	569-1004-104
R17	15 KΩ, ±10%, 1/2 watt	569-1004-153
R18	1 KΩ, ±10%, 1/2 watt	569-1004-102
R19	10 KΩ, ±10%, 1/2 watt	569-1004-103
R20	47 Ω, ±10%, 1/2 watt	569-1004-470
R21	15 KΩ, ±10%, 1/2 watt	569-1002-153
R22	680 Ω, ±10%, 1/2 watt	569-1004-681
R23	100 KΩ, ±10%, 1/2 watt	569-1004-104
R24	1 KΩ ±10%, 1/2 watt	569-1004-102
	SWITCHES	
SW1	Push button, SPST, No(push-to calibrate)	583-4007-001
SW2	Rocker, DPDT, gray, (RF Power/SWR)	583-3004-502
SW3	Rocker, DPDT, yellow, (Antenna/Dummy Ant)	583-3004-501
SW4	Wafer, 2 pole 6 position (Function)	583-2011-002
SW5	Rocker, 3PDT, white (Off/ Sig. Gen./Aud. Gen.)	
	TRANSFORMER	
T1	Transformer, RF	592-5014-002
T2	Same as T1	
	MISCELLANEOUS	
XY1	Crystal socket, large	515-5201-001
XY2	Terminal, rib loc , black	264-0003-001
	Transmit crystal	519-0011-001/ 023

Final three digits designate channel number.



TRANSCEIVER TESTER SCHEMATIC DIAGRAM (FOR UNITS WITH "C" MODEL DESIGNATOR ON SERIAL NUMBER STICKER)

Part No. 002-0116-001 6-75EFJ Printed in U.S.A.