MOBILE RADIO

MAINTENANCE MANUAL

PORTABLE TEST SET MODEL 4EX3A11

COMBINATION NUMBERS TM 11, 12, 13, 16, AND 17

SPECIFICATIONS *

Description	Portable meter for aligning and troubleshooting two-way radios which have centralized metering facilities. In addition, the test set can be used as 20 K ohms-per-Volt voltmeter	
Meter used in test set	3-1/2" panel meter with jeweled pivot, off-center zero	
Sensitivity	-10 and +50 microamperes full scale. External resistance added to make useable sensitivity -0.2 and +1.0 Volt full scale (at 20 K ohms-per-Volt).	
Internal resistance	1370 ohms ±15%	
Damping factor	32 nominal	
Response time	1.4 seconds nominal	
Accuracy	±3% of full scale	
Overload protection	Meter movement protected by diodes	
Centralized metering functions	With test cable connected to transmitter (Exciter in MASTR II Executive II and Custom MVP Equipment).	With test cable connected to receiver (IFAS or IF-DET Assembly in MASTR II Executive II and Custom MVP Equipment).
Test selector	Selects 1 of 11 circuits to be metered	
Range selector	Selects 1-Volt or 3-Volt meter range	
Polarity switch	Reverses meter polarity	
High Sensitivity Switch	Provides a 100-millivolt full scale meter range	
DISCriminator	----	Reverts meter from test circuits "B" - "K" to measure discriminator
XMTR TEST **	Keys transmitter	----
AUDIO jacks	For connecting audio signal generator to modulate xmtr	For connecting rcvr output to audio voltmeter or distortion analyzer
MIKE jack	For keying or voice-modulating xmtr with mike or handset and monitoring rcvr with handset	For monitoring rcvr with handset
DC voltmeter functions	Using test probes	
Range selector	Selects 1, 3, 15, 30, 100, 300 or 1000-Volt meter range (with test selector in "VM" position)	
Polarity switch	Reverses polarity of meter	
Operating temp range	0°C to +50°C (+30°F to +122°F)	
	Test Set	Optional Case
Size (H x W x D)	5.1" x 12.8" x 3.4"	6.2" x 13.5" x 6.0"
Weight	4.5 pounds	3.0 pounds

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

**In MASTR II, Executive II and Custom MVP, these functions are available from the red plug of the test cable plugged into System Board independent of the black metering plug.

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

COMBINATION NUMBER INDEX

COMBINATION NUMBER		USED WITH
TM11	Includes: 4EX3A11 with 19D402466G1 Cable and Test Probe Assembly	Porta-Mobil, MASTR Professional, MASTR Imperial, Executive Series and MTS.
TM12	Includes: 4EX3A11 with 19D402466G1 & G2 Cables and Test Probe Assembly	Porta-Mobil, MASTR Professional, MASTR Imperial, Executive Series, MTS and IMTS
TM13	Includes: 4EX3A11 with 19D402466G2 Cable and Test Probe Assembly	IMTS
TM16	Includes: 4EX3A11 with 19D416576G1 Cable and Test Probe Assembly	MASTR II
TM17	Includes 4EX3A11 with 19D402466G1, and 19D416576G1 Cables and Test Probe Assembly	Porta-Mobil, MASTR Professional, MASTR Imperial, Executive Series, MTS and MASTR II

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.

DESCRIPTION

Test Set Model 4EX3A11 is designed to facilitate servicing General Electric Two-Way Radios. For equipment with centralized metering facilities, a Test Cable connects the Test Set to the transmitter or receiver being serviced. For equipment which does not employ centralized metering, the set may be used as a 20,000 ohms-per-Volt DC voltmeter.

The off-center zero on the meter scale permits both positive and negative discriminator voltages to be measured, without changing the polarity. At the same time it preserves maximum scale lengths, so that readings can be made easily and accurately.

The steel case of the Test Set has a carrying handle and four rubber feet, which protect surfaces on which it is laid. All controls are located on the front panel; test jacks (except for the test probe jacks) are located on the ends of the set.

CARRYING CASE (Option 7445)

A two section metal carrying case is available for storing and carrying the Test Set. The set slides into the front section of the case, where it is protected from shock by rubber pads. A test cable can be left connected to the meter, draped over the dividing partition, and stored in the rear section of the case with the test probes. Space is also available for storing additional test cables.

OPERATION

All controls on the Test Set are conveniently located on the front panel. The microphone jack and the AUDIO test jacks for MASTR Professional, MASTR Imperial, Executive Series, MASTR Mobile Telephone systems, and IMTS Mobile Telephone systems are located on the right end of the set beneath the 32-pin test cable jack. The microphone jack and the AUDIO test jacks for MASTR II Executive II and Custom MVP are located on the left end of the set.

NOTE

Before transporting the Test Set, always place the RANGE SELECTOR switch in the OFF position to damp the meter movement.

CENTRALIZED METERING

When servicing two-way radios with centralized metering jacks, connect the proper test cable from the Test Set to the metering jack on the transmitter or receiver. The TEST SELECTOR switch can then be used to select the circuit which is to be metered. A label is normally provided near the centralized metering jacks to indicate which circuits are metered with the TEST SELECTOR switch in positions "A" through "K". Alignment instructions for transmitters and receivers with centralized metering also indicate the metering positions to be used.

In tubed MASTR Professional and Executive transmitters, the PA plate current can be measured by placing the TEST SELECTOR switch in position "G" and the RANGE SELECTOR switch in the "TEST 1" position. The PA plate voltage can be measured by moving the RANGE SELECTOR switch from the TEST 1 to the 1000 (Volt) position.

NOTE

Since many transmitters designed for centralized metering are adjusted for a PA PLATE loading of 0.7 Volt (position "G"), a red mark has been provided on the meter scale at this reading.

In MASTR Royal Professional, MASTR Imperial, MASTR II, Royal Executive, Executive II and Custom MVP transmitters, the PA current can be metered by placing the TEST SELECTOR switch in position "G" and pressing the HIGH SENSITIVITY switch. The PA voltage (Vcc) can be measured by placing the TEST SELECTOR switch in "G" position, the POLARITY REVERSING switch in the "-" position, and the RANGE SELECTOR switch in the 15 (Volt) position.

CAUTION

Do not press the HIGH SENSITIVITY switch when metering tubed transmitters. This may apply the high B+ directly across the meter, damaging the Test Set. Use the HIGH SENSITIVITY switch only where directed in Royal Professional, MASTR Imperial, MASTR II, Royal Executive, Executive II and Custom MVP Maintenance Manuals.

Range-Selector Switch

In TEST 1 position, this switch sets the meter range for 1 Volt full scale; in TEST 3 position, it sets the range for 3 Volts. For centralized metering, this switch should normally be in the TEST 1 position.

Polarity-Reversing Switch

If the needle on the meter should deflect to the left end of the scale, this switch can be used to reverse the polarity of the meter and bring the reading on-scale. While metering PORTA-MOBIL, MASTR Executive,

MASTR II, Executive II, Custom MVP and Imperial equipment, it should normally be in the "+" position; for MASTR Professional equipment it should normally be in the "-" position. It may be necessary to switch the polarity of the meter while checking FIL voltage, depending upon whether the radio is installed in a vehicle with a positive-ground or negative-ground battery.

High Sensitivity Switch

This switch permits the driver and PA current to be metered in Royal Professional, Royal Executive, MASTR II, Executive II, Custom MVP and MASTR Imperial transmitters.

With the range selector switch in the 1-Volt position, pressing the high sensitivity switch (S6) bypasses R1 (16.2K ohms) and R2 (2430 ohms) with potentiometer R9 (25-500 ohms) and R10 (390 ohms). The lower resistance in the meter input circuit permits 100-millivolt full scale meter reading.

DISCriminator Switch

Pushing the DISC button instantly switches the meter from test positions "B" through "K" back to the discriminator circuit (position "A"). This feature eliminates the need for a second meter to monitor the discriminator voltage.

XMTR TEST Switch

When servicing a transmitter, the transmitter can be easily keyed by pressing the XMTR TEST switch.

AUDIO Jacks

While the Test Set is connected to a transmitter, the AUDIO test jacks, on each end of the set, provide a convenient place to connect an audio oscillator for modulating the transmitter. This facilitates setting transmitter modulation levels. With the Test Set connected to a receiver, the receiver audio output can be measured across the AUDIO test jacks.* An audio voltmeter or distortion analyzer can be easily connected here for receiver quieting or SINAD measurements. Note that these jacks are properly spaced to accept a standard dual-banana plug, and are labeled for MASTR and MASTR II (including Executive II and Custom MVP).

Microphone Jack

The microphone jacks on the ends of the Test Set provide convenient places to connect a microphone or handset for keying or voice-modulating a MASTR transmitter. The audio output of the receiver can also be monitored by a handset connected to these jacks.

DC VOLTMETER MEASUREMENTS

To use the Test Set as a DC voltmeter, just place the TEST SELECTOR switch in the "VM" position. Use the RANGE SELECTOR switch to select the desired voltage range: 1, 3, 15, 30, 100, 300 or 1000 Volts. Connect the test probes to the red and black jacks beneath the meter on the front of the Test Set.

With the polarity-reversing switch in the "+" position, the red test probe jack will be positive and the black jack will be negative. To quickly change the polarity of the test probes, just flip the switch to the "-" position.

CIRCUIT ANALYSIS

The voltage range desired is selected by RANGE SELECTOR switch S3, which connects meter M1 to TEST SELECTOR switch S2 through a series string of precision resistors (R3 through R8). S3 switches the positive and negative sides of the meter to eleven floating pins on S2, which selects the circuit to be metered.

Diodes CR1 and CR2 limit the meter overload to approximately six times the rated current of the meter, with less than 0.5% full-scale compression. As a 1-Volt instrument, the meter is protected for a 1000 to 1 overload. However, under this condition, one or more of the meter resistors may be damaged.

CAUTION

Due to the lower resistance in the meter circuit, the meter is more susceptible to damage when using the high sensitivity (HS) switch. Always check the meter reading before pressing the high sensitivity switch.

DISASSEMBLY

To service the Test Set, simply remove the four screws holding the rubber feet and lift off the back plate.

CALIBRATION PROCEDURE

If meter M1 is ever replaced, potentiometer R9 must be reset according to the following procedure.

1. Remove the back plate from the Test Set.

* In PORTA-MOBIL receivers before Rev. A, the LO side of the receiver audio output will appear at the AUDIO HI jack on the Test Set and the HI side will appear at the AUDIO LO jack.

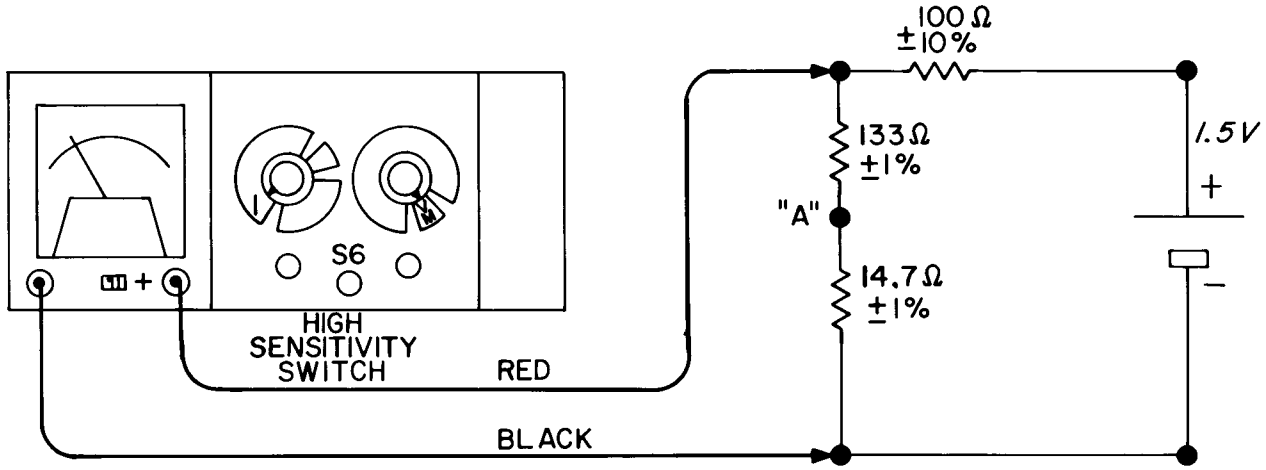


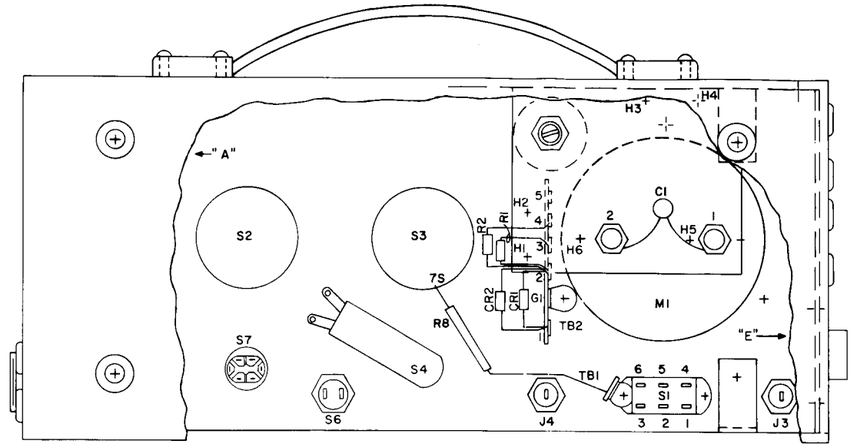
Figure 1 - Calibration Setup

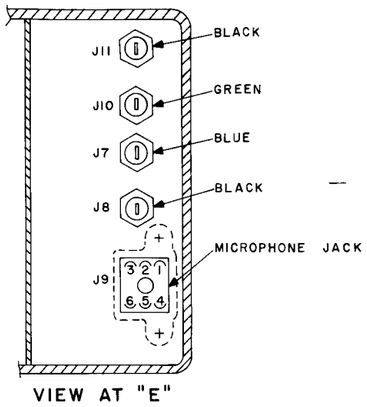
2. Place the Test Selector switch in the VM position, the Meter Sensitivity switch in the 1-Volt position, and the Polarity switch in the "+" position.

3. Connect the three calibration resistors and a fresh 1-1/2-Volt "D" cell as shown in Figure 1.

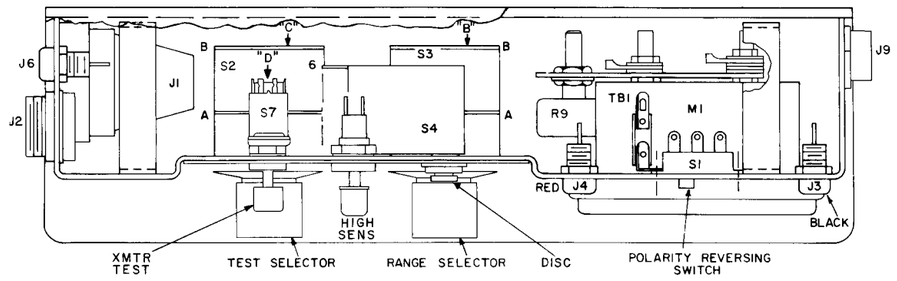
4. Apply the test probes as shown and note the exact meter reading (should be approximately 90 on the top meter scale).

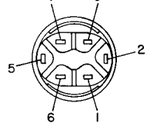
5. Now move the positive test probe to point "A" (junction of 133-ohm and 14.7-ohm resistors). Then, hold down the HIGH SENSITIVITY switch and adjust R9 for the exact reading obtained in Step 4. Repeat Steps 4 and 5 until meter readings are the same, and replace the back plate.





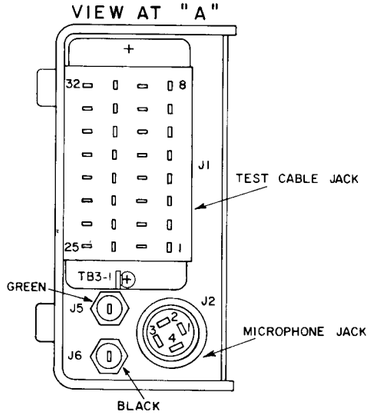
VIEW AT "E"



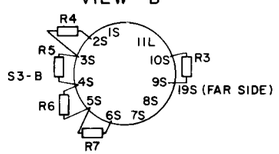


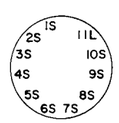
VIEW AT "D"

VIEW AT "A"

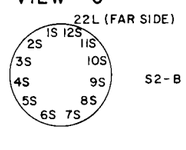


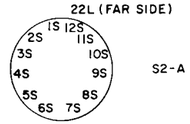
VIEW "B"



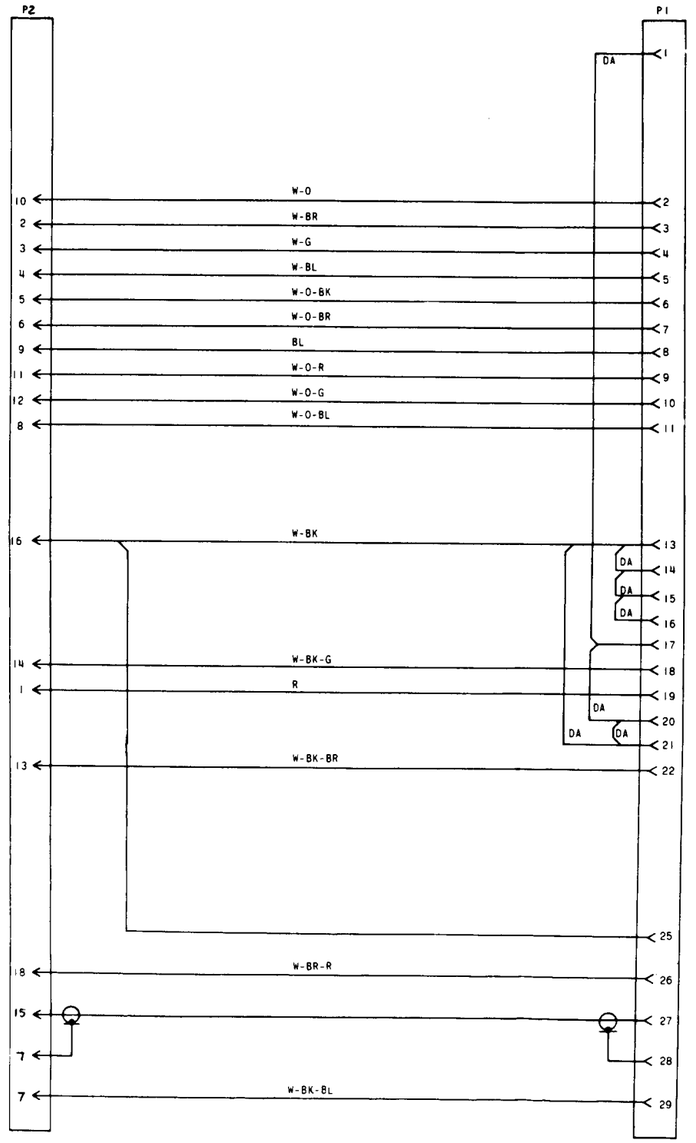


VIEW "C"

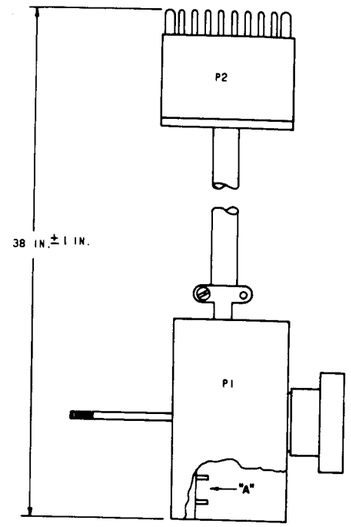


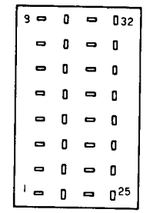


(19D417474, Rev. 0)



W1





VIEW "A"

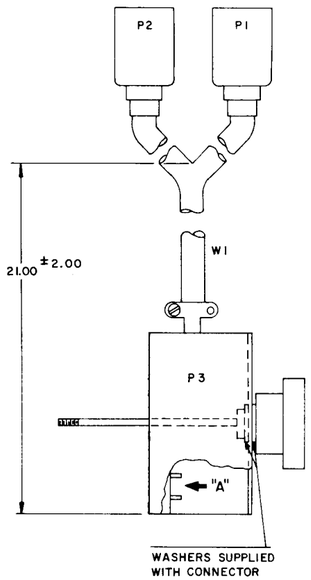
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

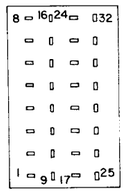
(19D402466, Rev. 3)

OUTLINE DIAGRAM

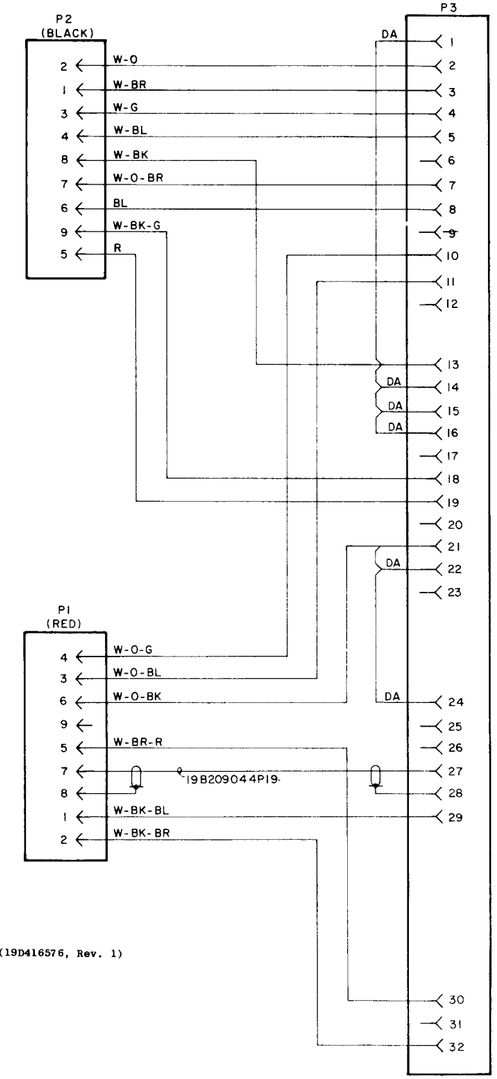
TEST SET MODEL 4EX3A11 AND
TEST CABLE 19D402466G1

TEST CABLE 19D402466G1 (for PORTA-MOBIL, MASTR Progress Line Professional and Executive Series, and MASTR MTS)





IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



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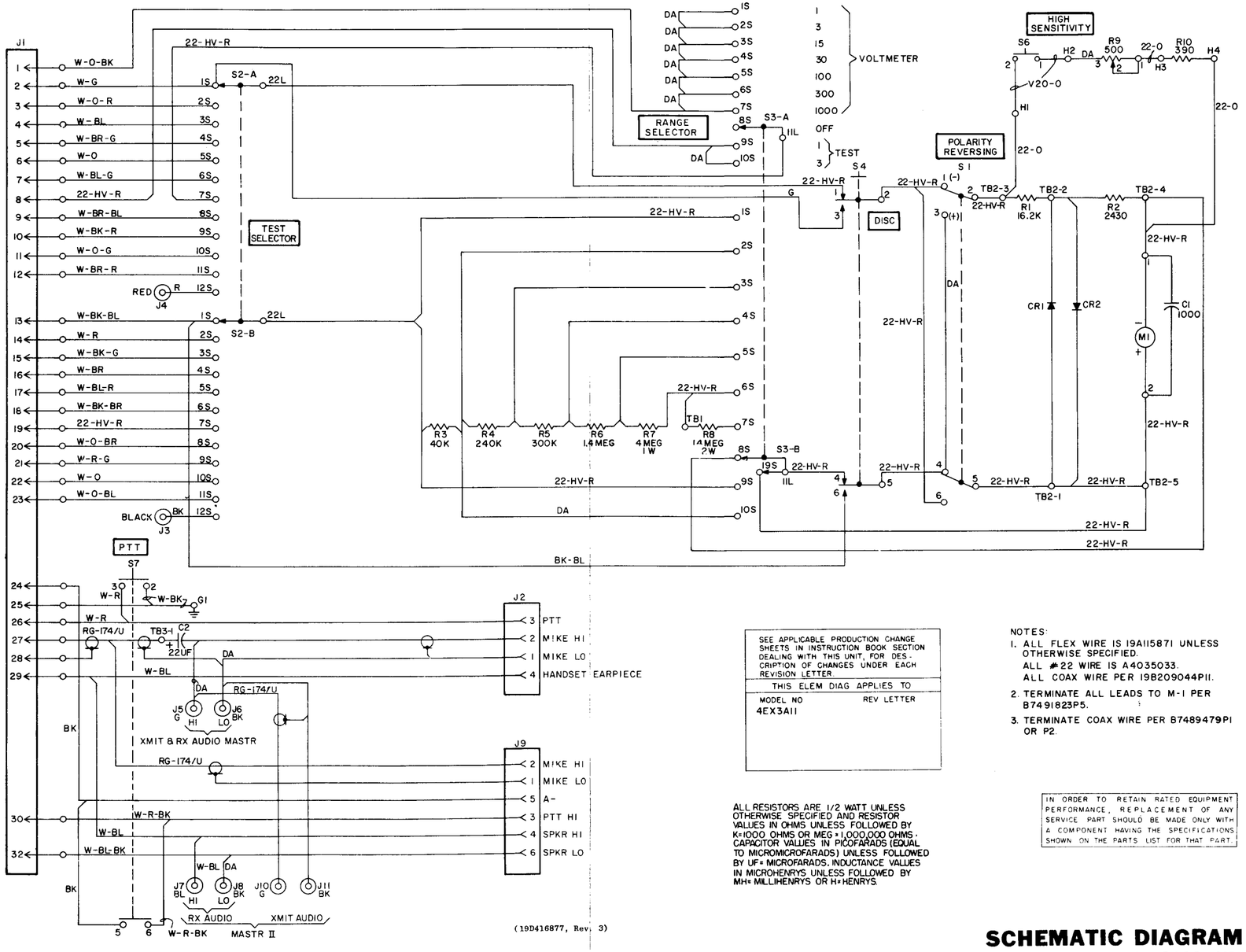


(19D416877, Rev. 3)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EX3A11	

NOTES:
1. ALL FLEX WIRE IS 19A115871 UNLESS OTHERWISE SPECIFIED.
   ALL #22 WIRE IS A4035033.
   ALL COAX WIRE PER 19B209044P11.
2. TERMINATE ALL LEADS TO M-1 PER B7491823P5.
3. TERMINATE COAX WIRE PER B7489479P1 OR P2.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

TEST CABLE 19D416576G1 (FOR MASTR II, EXECUTIVE II AND CUSTOM MVP)

SCHEMATIC DIAGRAM

TEST SET MODEL 4EX3A11 AND TEST CABLE 19D416576G1

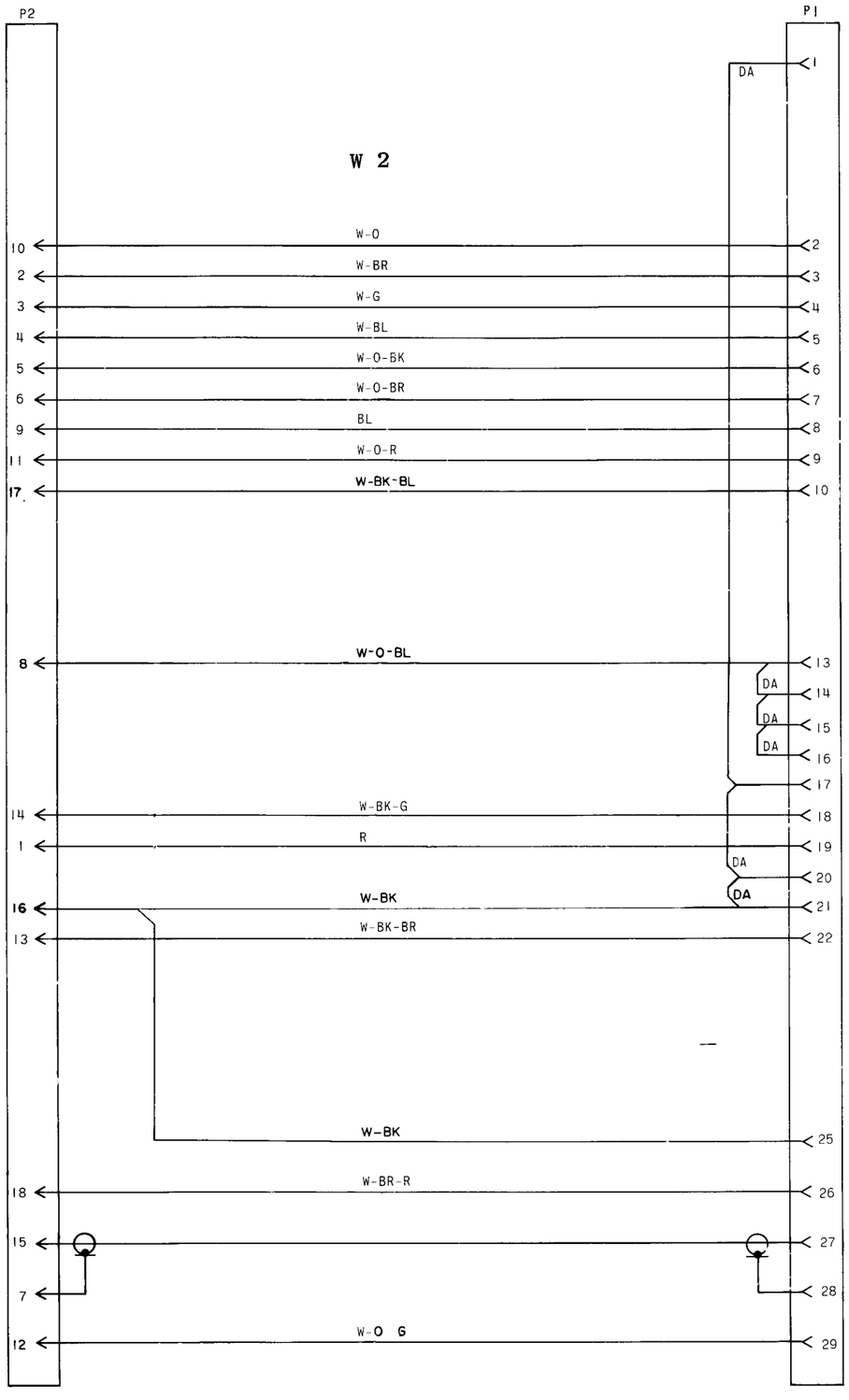
PARTS LIST

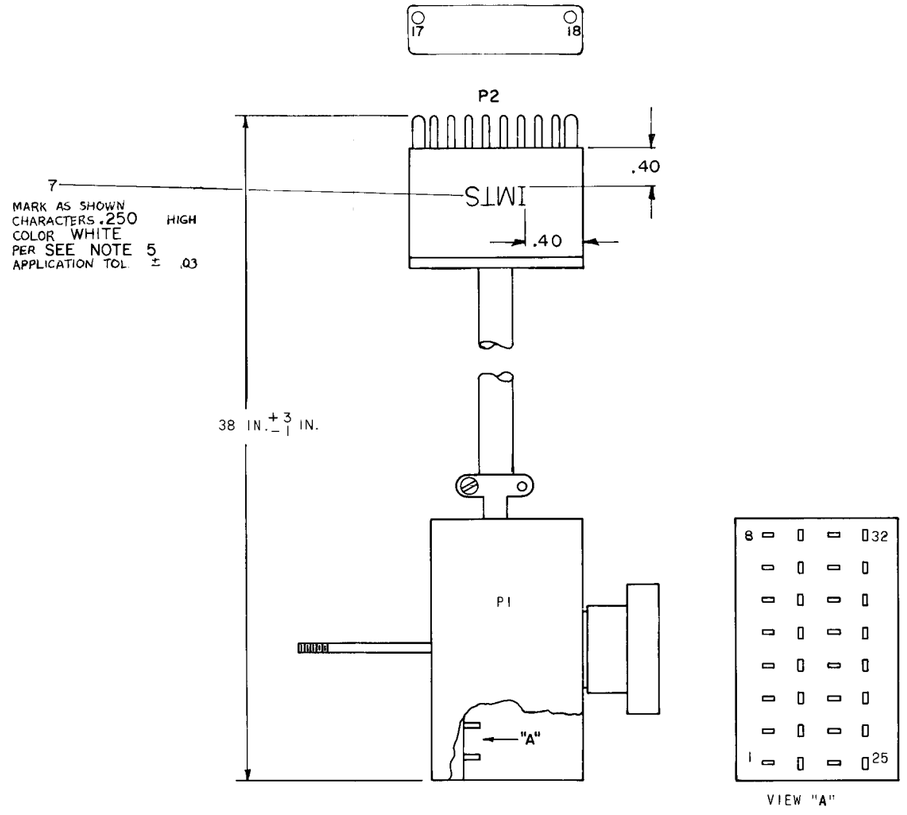
LBI-4455C

TEST SET
MODEL 4EX3A11

SYMBOL	GE PART NO.	DESCRIPTION
		*- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	5494922P1	Silicon; sim to Type 1N456.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19C307126P2	Connector: 32 male contacts, black phenolic, 9 amps at 125 VRMS; sim to Elco 01-2232-122-004-101.
J2		Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-PN4F-1000.
	19A116061P4	Lockwasher.
	19A116061P5	Nut, knurled.
J3	19B209152P3	Jack, tip: black nylon body; sim to EF Johnson 108-903.
J4	19B209152P2	Jack, tip: red nylon body; sim to EF Johnson 108-902.
J5	19B209152P4	Jack, tip: dark green nylon body; sim to EF Johnson 108-904.
J6	19B209152P3	Jack, tip: black nylon body; sim to EF Johnson 108-93.
J7	19B209152P8	Jack, tip: dark blue nylon body; sim to EF Johnson 108-910.
J8	19B209152P3	Jack, tip: black, sim to E.F. Johnson 108-903.
J9	19B219627G1	Connector: 6 contacts.
J10	19B209152P4	Jack, tip: dark green nylon body; sim to EF Johnson 108-904.
J11	19B209152P3	Jack, tip: black nylon body; sim to EF Johnson 108-903.
		- - - - - - - - - - METERS - - - - - - - - - -
M1	5491869P11	Meter, panel: special scale, -10/0/+50 µa, 1370 ohms ±15% movement; sim to GE Type DO-91.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	19C314256P31622	Metal film: 16,200 ohms ±1%, 1/2 w.
R2	19C314256P32431	Metal film: 2430 ohms ±1%, 1/2 w.
R3	19C314256P34002	Metal film: 40,000 ohms ±1%, 1/2 w.
R4	19C314256P32403	Metal film: .24 megohm ±1%, 1/2 w.
R5	19C314256P33013	Metal film: 301,000 ohms ±1%, 1/2 w.
R6	5495948P515	Deposited carbon: 1.4 megohm ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R7	5496945P558	Deposited carbon: 4 megohms ±1%, 1/2 w; sim to Texas Instrument CD1R.
R8	5496955P568	Deposited carbon: 14 megohms ±1%, 2 w; sim to Texas Instrument CD2R.
R9	2R73P46	Variable, composition: 500 ohms ±20%, 2.25 w; sim to Allen-Bradley Type J.
R10	3R77P391J	Composition: 390 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S1	4038269P1	Slide: DPDT, 1 amp at 125 VAC, 0.5 amp at 125 VDC; sim to UID Electronics SW122.
S2	19C307113P2	Rotary: 2 sections, 2 poles, 12 positions, non-shorting contacts; sim to Oak 235585-K2.
S3	19C307113P1	Rotary: 2 sections, 2 poles, 10 positions, non-shorting contacts; sim to Oak 235584-K2.
S4	5491286P4	Push button (black): DPDT, momentary contact, 2 form C contacts, 3 amps at 120 VAC; sim to Switchcraft 4006.
S6	19B209165P4	Push button (white): SPST, normally open; sim to Grayhill 30YY2045-2.
S7	19A116887P1	Push button (red): DPDT, momentary contact; sim to Grayhill 46-232.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7487424P22	Miniature, phen: 1 terminal.
TB2	7775500P56	Phen: 6 terminals.
		- - - - - - - - - - MISCELLANEOUS - - - - - - -
	19B205872G1	High Sensitivity Board. (Includes R9, R10, S6).
	19C303609G1	Chassis Assembly. 8.5 x 10.75 x 4.7 inches, gray chromate coated steel.
	19B204802P1	Cover: 11 x 4.73 x 3.06 inches, gray aluminum.
	19A115081P2	Bumper: 0.5 x 0.25 x 0.125 inches, black rubber; sim to Atlantic Rubber 1308.
	19A115431P1	Knob, set screw: 1.525 x 0.937 x 0.905 inches, black styrene, aluminum insert; sim to Raytheon DS90-3-2. (Used with S2 and S3).
	19B201944P3	Handle, bow: 7.562 x 0.85 x 0.281 inches, black vinyl; sim to Philadelphia Handle 4825.
	19B201074P306	Tap screw, Phillips Pozidriv®: No. 6-32 x 3/8. (Secures rubber bumpers).
	7115130P9	Lockwasher: sim to Shakeproof 1220-2. (Part of S2, S3).
	7115130P11	Lockwasher: sim to Shakeproof 1222-1. (Part of S5, S6).
	7165075P2	Hex nut, brass: No. 3/8-32. (Part of S3, S3).
	4033394P1	Nut, knurled. (Used with S6).
	19B200525P187	Rivet: .123 dia. (Secures handle).
	4033394P3	Nut, knurled. (Used with S3, S4).
		- - - - - - - - ASSOCIATED CABLES - - - - - - - -
W1		CABLE ASSEMBLY MASTR II 19D416576G1
P1 and P2		(Part of 19D416574P1 cable).
P3	19C307126P1	Connector: 32 female contacts, black phenolic, 9 amps at 125 VRMS, with blue phenolic knob and blue steel hood; sim to Elco 01-4232-107-001-101.
	19D416574P1	Cable: approx 2 feet long. Includes P1 and P2).
W1		CABLE ASSEMBLY PORTA MOBIL. MASTR PRO. EXEC and MTS 19D402466G1
P1	19C307126P1	Connector: 32 female contacts, black phenolic, 9 amps at 125 VRMS, with blue phenolic knob and blue steel hood; sim to Elco 01-4232-107-001-101.
P2	19C303568P1	Connector: includes 18 pin plug cable, approx 36 inches long.
W2		CABLE ASSEMBLY IMTS 19D402466G2
P1	19C307126P1	Connector: 32 female contacts, black phenolic, 9 amps at 125 VRMS, with blue phenolic knob and blue steel hood; sim to Elco 01-4232-107-001-101.
P2	19C303568P1	Connector: includes 18 pin plug cable, approx 36 inches long.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	NP243568	Nameplate.
	19B204835G1	Test Probe Assembly: Red test lead.
	19B204835G2	Test Probe Assembly: Black test lead.
		CALIBRATION RESISTORS (Not Part of Test Set)
	5495948P17	Resistor, deposited carbon: 14.7 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
	5495948P113	Resistor, deposited carbon: 133 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
	3R77P101K	Resistor, composition: 100 ohms ±10%, 1/2 w. (brown-black-brown-silver bands).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES





(1)

NOTES:

1. APPLIED PRACTICES A4031623 & A4032777.
2. TAPE UNDER CABLE CLAMP OF P1 TO INSURE GOOD GRIP.
3. TERMINATE COAX WIRE PER B7489479P1 OR P2.
4. ALL DA BUS WIRE IS 19A115060P26.
5. STAMP WITH: MARKEM MARKING COMPOUND
   HM7153
   IVORY

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D402738, Rev. 2)

TEST CABLE 19D402466G2
(FOR IMTS MOBILE SYSTEMS)

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

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.

DF-10008

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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