MOBILE RADIO

MAINTENANCE MANUAL

PORTABLE TEST SET MODEL 4EX3A10
COMBINATION NUMBERS TM11 and TM12

SPECIFICATIONS *

Description	Portable meter for aligning and troubleshooting two-way radios which have centralized metering facilities. For servicing equipment without centralized metering, test set can be used as 20K ohm-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 (20 kilohms 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	With test cable connected to receiver
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 (+32°F to +122°F)	
	Test Set	Optional Case
Size (L x W x H)	12.8" x 3.4" x 5.1"	13.5" x 6" x 6.2"
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.

GENERAL ELECTRIC

Maintenance Manual LBI-3491E

EX-3-A

TABLE OF CONTENTS

ILLUSTRATIONS

COMBINATION NUMBER INDEX

COMBINATION NUMBER	USED WITH
TM11 Includes: 4EX3A10 with 19A122432-G2 Cable and Test Probe Assembly.	PORTA-MOBIL, MASTR Progress Line Professional and Executive Series, and MASTR Mobile Telephone systems.
TM12 Includes: 4EX3A10 with 19A122432-G1 and G2 Cable and Test Probe Assemblies.	PORTA-MOBIL, MASTR Progress Line Professional and Executive Series, MASTR Mobile Telephone systems, and IMTS Mobile Telephone systems.

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 4EX3A10 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 ohm-per-volt DC voltmeter.

The off-center zero on the meter scale permits both positive and negative discriminator voltages to be measured, with changing polarity. At the same time it preserves maximum scale lengths, so that readings can be easily and accurately made.

The steel case of the Test Set has a carrying handle and four rubber feet, to 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 right end of the set.

CARRYING CASE (Optional)

A meter, two-section 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. The 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.

OPERATION

All controls on the Test Set are conveniently located on the front panel. The microphone jack and the AUDIO test jacks are located on the right end of the set beneath the 32-pin test cable jack.

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 decal 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 and Royal Executive 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", 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 and Royal Executive 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 and MASTR Executive 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 F1L 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 and Royal Executive 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 a 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

While servicing transmitters, the transmitter can be easily keyed by pressing the XMTR TEST switch.

AUDIO Jacks

While the Test Set connected to a transmitter, the AUDIO test jacks provide a convenient place to connect an audio oscillator for modulating the transmitter. This facilites 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.

Microphone Jack

The microphone jack on the end of the Test Set provides a convenient place 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 this jack.

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 metering 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.

*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.

1. Remove the back plate from the Test Set.

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 approx. 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.

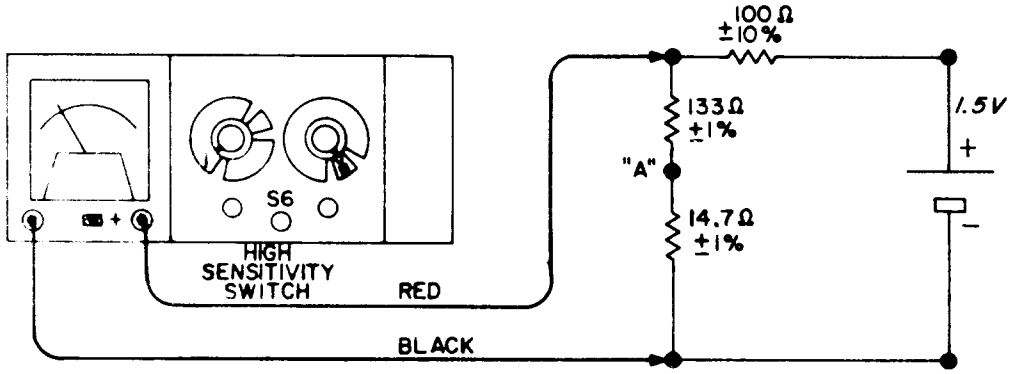
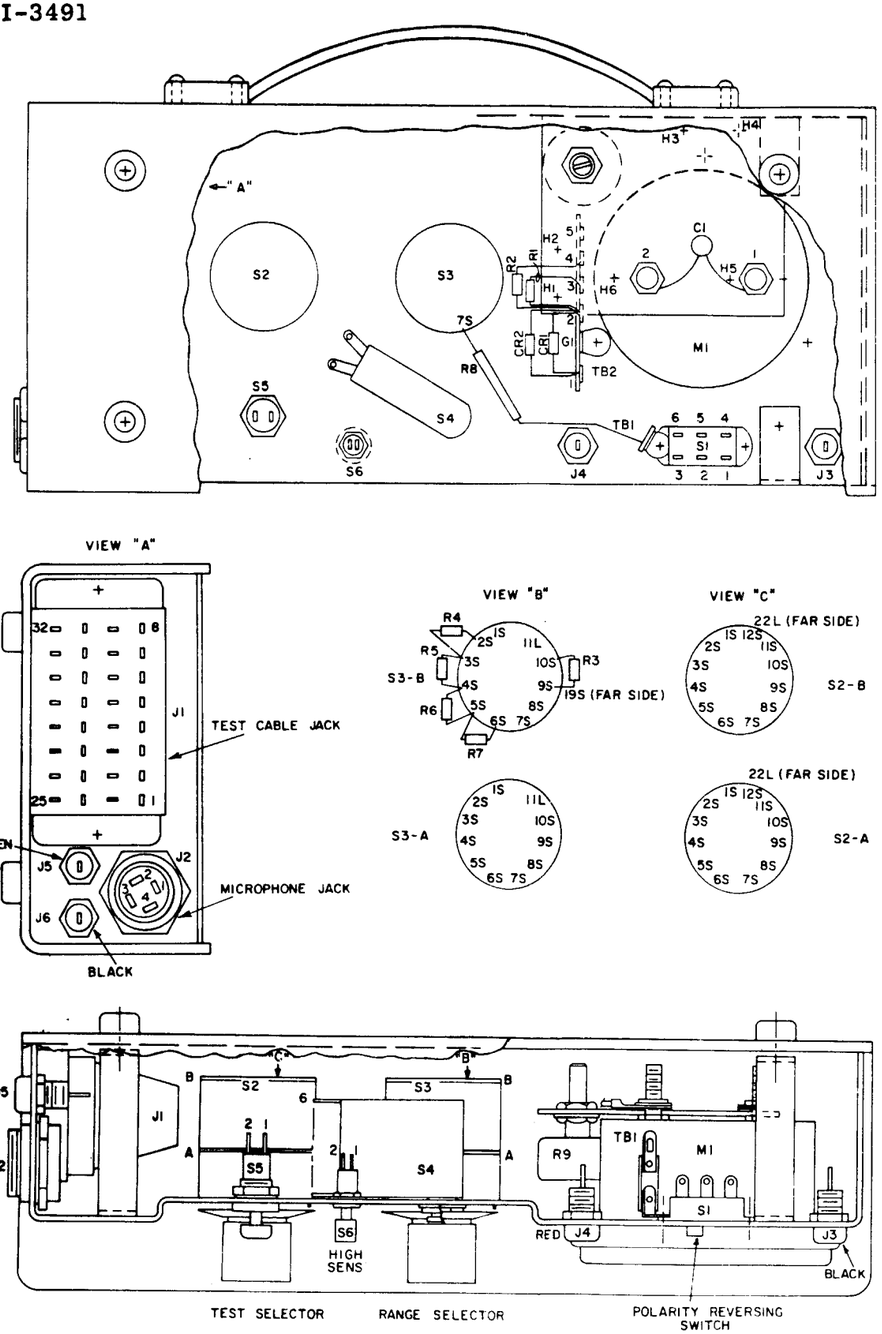
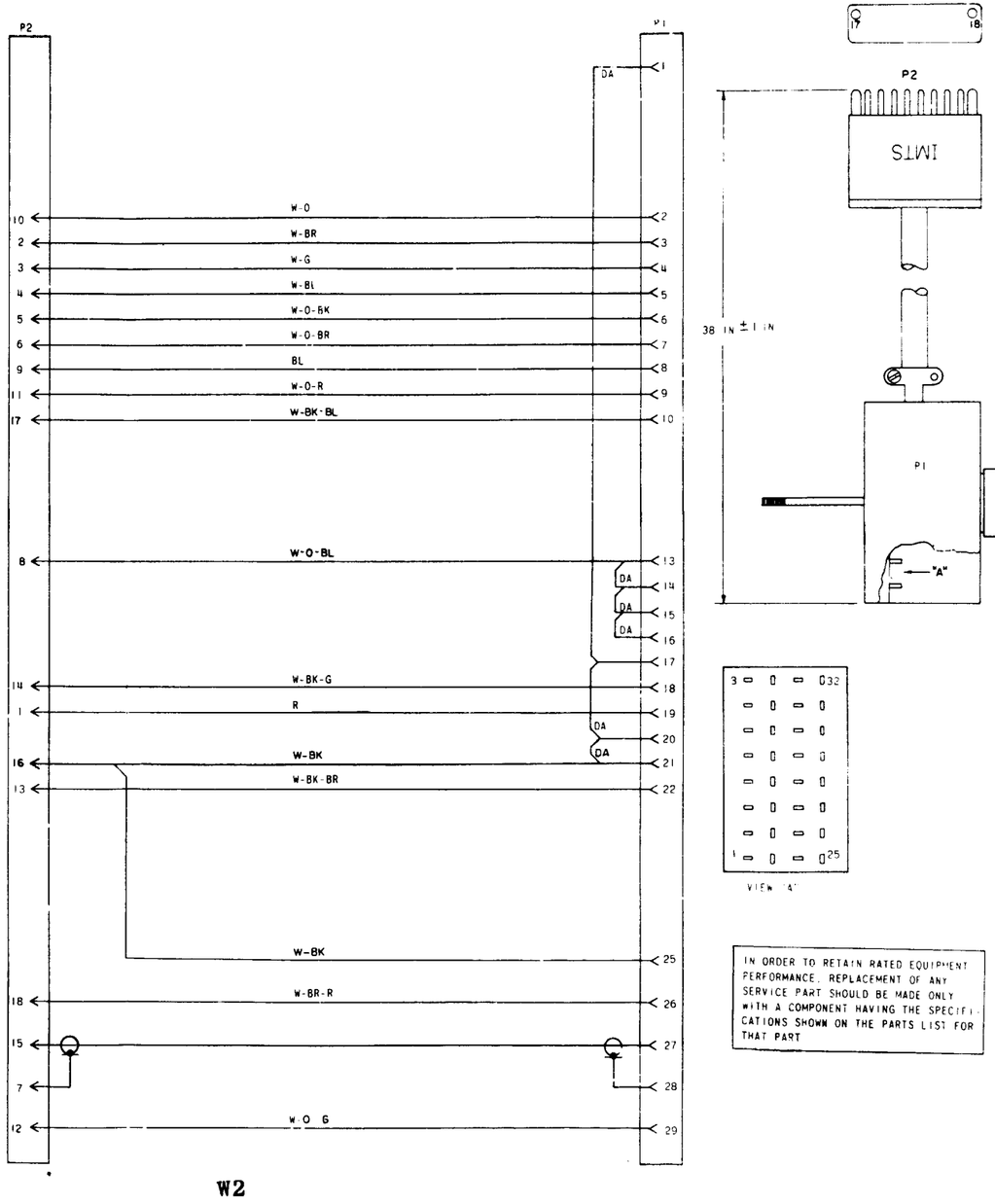
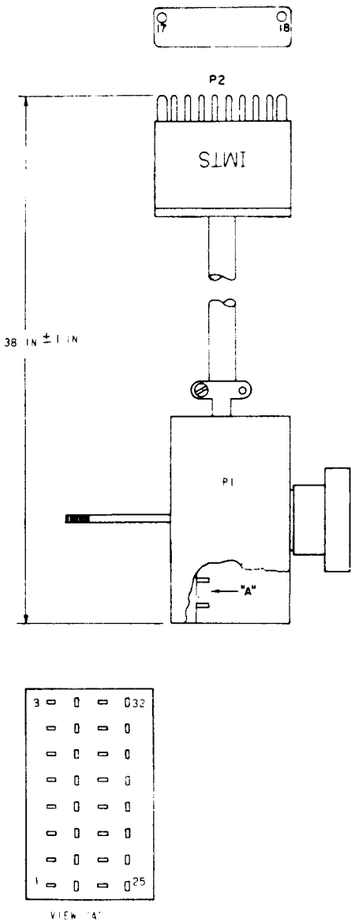


Figure 1 - Calibration Setup



(19C303705, Rev. 3)





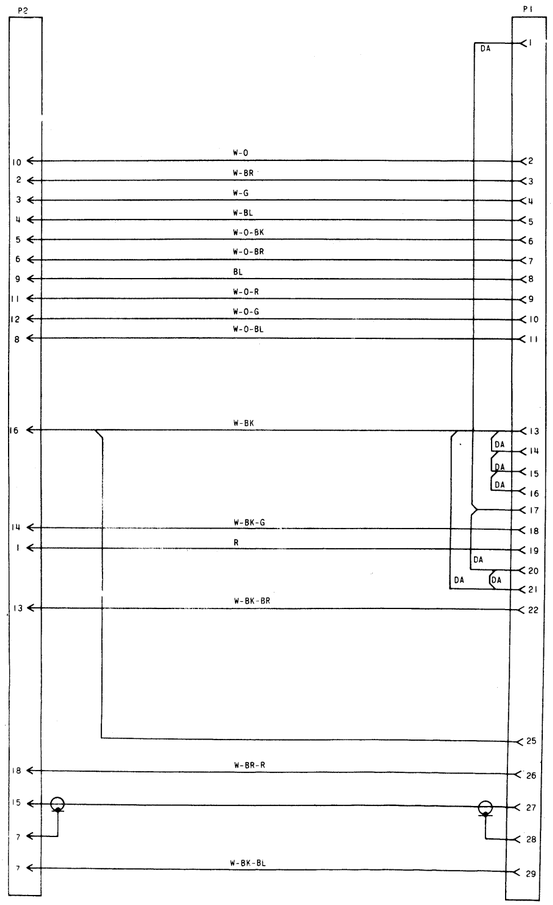
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART

TEST CABLE 19D402466-G2 (for IMTS Mobile Systems)

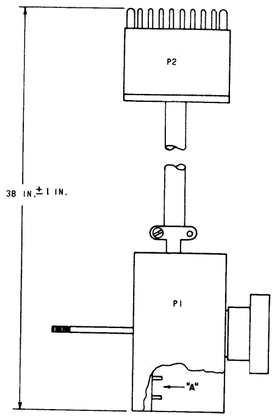
(19D402738, Rev. 1)

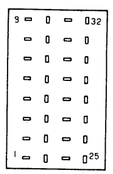
OUTLINE DIAGRAM

TEST SET MODEL 4EX3A10 AND
IMTS TEST CABLE 19D402466-G2



W1





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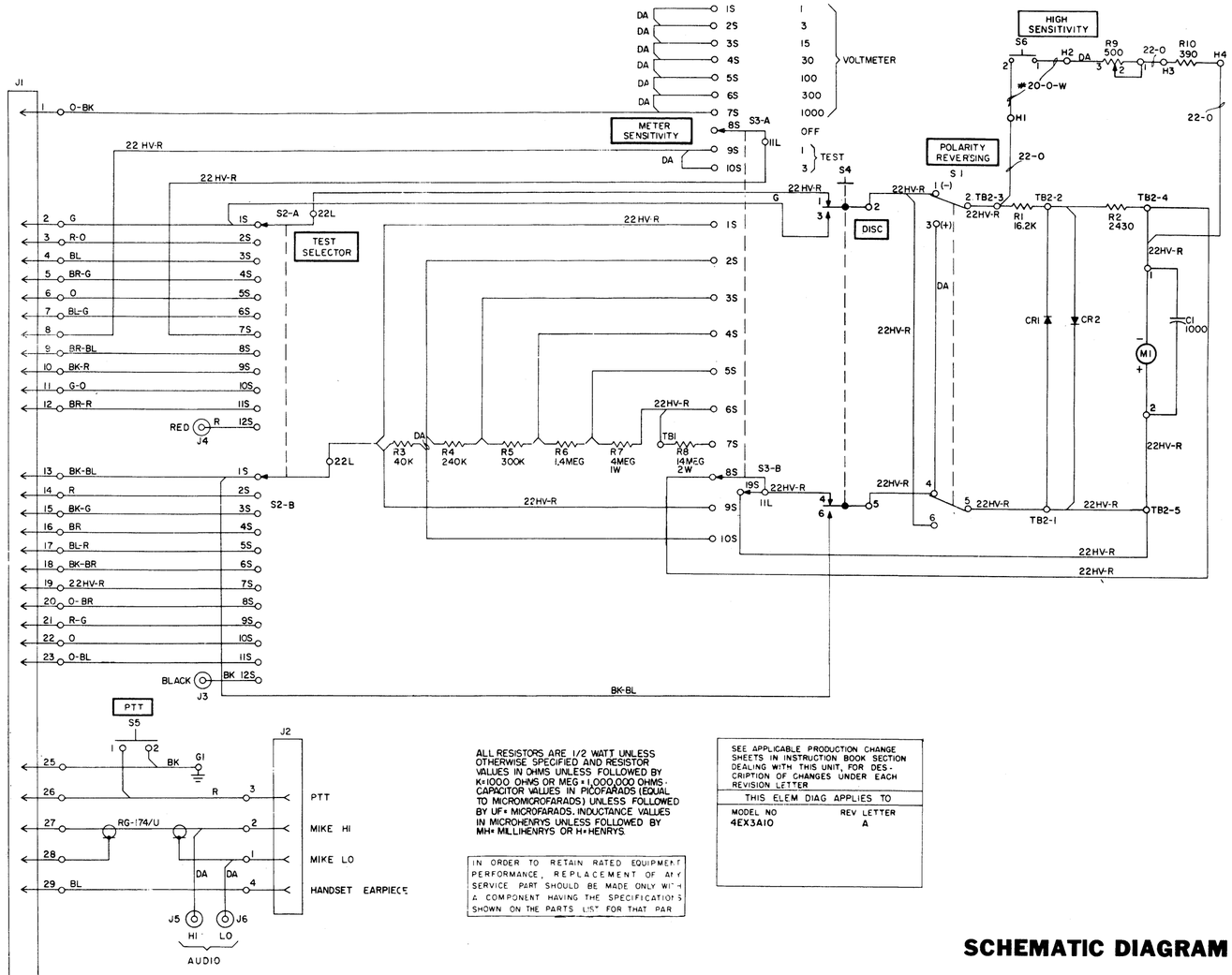
(19D402466, Rev. 3)

TEST CABLE 19D402466-G1 (for PORTA-MOBIL, MASTR Progress Line Professional and Executive Series, and MASTR MTS)



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.

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
4EX3A10	A

(19D402451, Rev. 4)

SCHEMATIC DIAGRAM

TEST SET MODEL 4EX3A10 AND TEST CABLE 19D402466-G1

PARTS LIST

LBI-3492C

TEST SET
MODEL 4EX3A10

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	5494922P1	Silicon; sim to 1N456.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19C307126P2	Connector: 32 contacts, black phenolic, 15 amps at 75 VRMS; sim to Elco 01-2232-122-004-000.
J2	7117934P2	Connector, chassis: 4 female contacts; sim to Amphenol Type 91-PC4F.
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 108-903.
		- - - - - - - - - - METERS - - - - - - - - -
M1	5491869P11	Meter, panel: special scale, -10/0/+50 μa, 1370 ohms ±15% movement; sim to GE Type DO-91.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	5495948P321	Deposited carbon: 16,200 ohms ±1%, 1/2 w; sim to Texas Instruments Type CD1/2MR.
R2	5495948P238	Deposited carbon: 2430 ohms ±1%, 1/2 w; sim to Texas Instruments Type CD1/2MR.
R3	5495948P901	Deposited carbon: 40,000 ohms ±1%, 1/2 w; sim to Texas Instruments Type CD1/2MR.
R4	7774319P123	Deposited carbon: .24 megohm ±1%, 1/2 w; sim to IRC Type DCC.
R5	5495948P447	Deposited carbon: 301,000 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
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. Added by REV A.
R10*	3R77P391J	Composition: 390 ohms ±5%, 1/2 w. Added by REV A.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S1	4038269P1	Slide: DPDT, 0.75 amps at 28 VDC; sim to United Dynamics 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, 3 amps at 120 VAC, non-inductive; sim to Switchcraft 4006.
S5	19B209165P1	Push button (red): SPST, normally open; sim to Grayhill 30-17R.
S6*	19B209165P4	Push button (white): SPST, normally open; sim to Grayhill 30-17R. Added by REV A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P46	Phen: 2 terminals.
TB2	7775500P213	Phen: 6 terminals.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	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 S3 and S5).
	19B201944P3	Handle, bow: 7.562 x 0.85 x 0.281 inches, black vinyl; sim to Philadelphia Handle 4825.
		CABLE AND TEST PROBE ASSEMBLIES 19A122432G1, G2
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19D402466G1	Cable Assembly (Used in 19A122432G2 only).
P1	19C307126P1	Connector: 32 contacts, black phenolic, 15 amps at 75 VRMS, with blue phenolic knob and blue steel hood; sim to Elco 01-4232-107-001-004.
P2	19C303568P1	Connector Assembly. Includes 18-pin Lexan connector, 38-inch cable, with black butyrate cap.
W2	19D402466G2	Cable Assembly (Used in 19A122432G1 only).
P1	19C307126P1	Connector: 32 contacts, black phenolic, 15 amps at 75 VRMS, with blue phenolic knob and blue steel hood; sim to Elco 01-4232-107-001-004.
P2	19C303568P1	Connector Assembly. Includes 18-pin Lexan connector, 38-inch cable, with black butyrate cap.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	NP243568	Nameplate.
	19B204835G1,G2	Test Probe Assemblies. Includes the following:
	4038147P1	Plug: red molded phenolic body; sim to HH Smith 382. (Used in 19B204835G1 only).
	4038147P2	Plug: black molded phenolic body; sim to HH Smith 382. (Used in 19B204835G2 only).
	4032795P2	Plug, tip: red molded nylon sleeve, 10 amps at 2500 VRMS; sim to EF Johnson 108-302. (Used in 19B204835G1 only).
	4032795P3	Plug, tip: black molded nylon sleeve, 10 amps at 2500 VRMS; sim to EF Johnson 108-303. (Used in 19B204835G2 only).
	4035432P1	Wire: stranded, 4 feet, vinyl covered (red). No. 18. (Used in 19B204835G1 only).
	4035432P2	Wire: stranded, 4 feet, vinyl covered (black). No. 18. (Used in 19B204835G2 only).
		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).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit inculdes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To provide a 100 millivolt full scale range for servicing Royal Professional and Royal Executive transmitters. Added R9, R10 and S6.