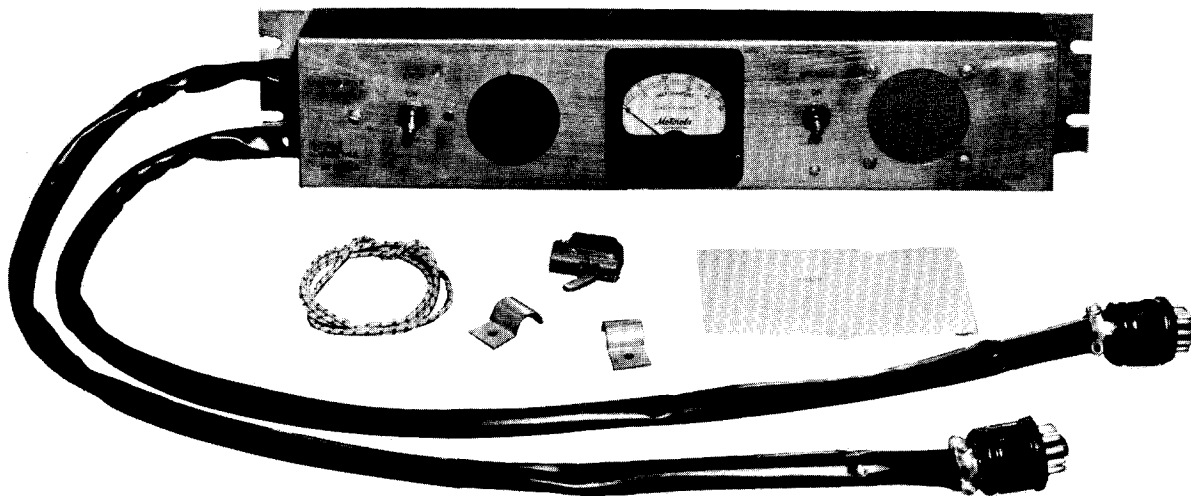


UNIVERSAL METERING KIT

MC522



1. DESCRIPTION

Motorola Model TU139A Universal Metering Chassis Kit is designed for application in Motorola base station models which do not incorporate standard "in-place" metering facilities. It is particularly suited for weatherproof, outdoor type cabinet installations. The unit incorporates complete metering and control facilities essential to tuning and checking the receiver and transmitter at the immediate location. Metering is accomplished by means of a 0-50 microammeter in series with a resistor. This combination is used for checking grid voltage, plate voltage and plate current. The specific circuits to be measured are accessible through metering receptacles on Motorola transmitter and receiver chassis. The metering chassis incorporates a rotary selector switch and attached cables and plugs which connect into the metering receptacles on the radio equipment chassis. The meter face has two graduated scales, 0-50 microamperes and 0-250 milliamperes. The microampere scale is used for all receiver

meter readings and all transmitter meter readings except power amplifier plate current which is read on the 0-250 milliampere scale. A chassis mounted speaker and a transmitter "on-off" switch are also incorporated to facilitate receiver monitoring and transmitter actuation for local test purposes.

The basic components and circuitry of the TU139A are built onto a strip type chassis which may be mounted on any standard 19" base station rack. In normal installations, the chassis is mounted directly above the transmitter or receiver. The metering cables need only be connected to the METER receptacles of the receiver and transmitter (exciter in 65 & 100 watt models) when the unit is initially installed. Specific design permits the transmitter (exciter) and receiver circuits to be metered alternately without repositioning the meter cables. (NOTE: For two receiver stations, the receiver metering cable must be alternately connected from one receiver to the other depending upon which receiver is being



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tested. In 65 & 100 watt stations the transmitter metering cable must alternately be connected between the exciter and final amplifier depending upon which one is being tested. The metering cables are of sufficient length to accommodate these connections.)

A spdt front door interlock switch is supplied with the metering chassis to insure that the transmitter will not be inadvertently keyed by the metering chassis XMTR "ON-OFF" switch when the cabinet door is closed. When the TU139A Universal Metering Chassis Kit is incorporated in a base station cabinet, this interlock should be installed in place of the standard spst interlock switch which is normally used in the cabinet. The new interlock switch "breaks" the local XMTR ON-OFF circuit when the front door is closed and the transmitter remote control circuit when the door is open.

The TU139A Universal Metering Chassis lends itself readily for installation in 25-50 mc, 70-88 mc, 72-76 mc, 152-174 mc, 406-470 mc and 890-960 mc base station equipment with only slight modifications to accommodate specific application.

CAUTION

Only a metering chassis having a suffix of -1 or higher (such as TU139A-1, etc.) may be used with 890-960 mc equipment. The earlier Model TU139A (without a suffix number) does not have the circuitry for metering the 890-960 mc equipment. The model number and suffix are stamped on the metering chassis.

The metering kit includes all the necessary hardware and cables for standard installation. The TU139A Chassis is not included as part of standard base station models except in the 890-960 mc and 450-470 mc community repeater stations, and 406-420 mc 65/100 w broadband base stations, and must be ordered separately if desired.

2. APPLICATION

The TU139A Metering Chassis Kit is designed specifically for use in Motorola weatherproof-type (outdoor) base stations to provide built-in test and alignment facilities. It can be used with both single- and two-receiver station models. The chassis is standard size (19" long x 3-1/2" wide x 3-1/2" deep overall) and can be mounted on any standard 19" rack. The metering functions of this unit provide readings equivalent to those obtained with Motorola P-8501 and TU546 Series Portable Test Sets.

This unit can be adapted for use in all Motorola base stations which employ receivers and transmitters incorporating 11-contact metering receptacles.

The TU139A is readily adaptable to fixed installation on the maintenance shop test bench as an "in place" test facility.

3. OPERATIONAL FEATURES

Model TU139A metering facilities provide the following basic functions:

- a. **SPEAKER:** Provides local monitoring of receiver output.
- b. **SPEAKER ON-OFF:** ON position - connects speaker across receiver output. OFF - position connects 3 ohm load across receiver output.
- c. **XMTR ON-OFF:** Provides transmitter keying control from immediate location, except in 406-420 mc 65/100 w broadband base stations.
- d. **FRONT DOOR INTERLOCK:** Door open - prevents transmitter actuation by remote control. Door closed - disables local XMTR ON-OFF switch.
- e. **METER SELECTOR SWITCH AND METER:** Provides measurement of transmitter and receiver circuits. Specific circuits measured for various selector switch positions are outlined in table on page 6.

4. UNPACKING AND INSPECTION

Use care when unpacking and handling this equipment. Open the shipping carton and carefully remove the individually packaged components. Check contents to be sure all items have been included.

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

The TU139A Universal Metering Chassis Kit consists of the following items:

- a. One metering chassis complete with receiver and transmitter connecting cables.

b. One coin envelope containing:

(1) 3 ft length of YEL-GRN wire terminated on each end with solder lugs, Part No. 1V831464.

(2) Six mounting screws, Part No. 3S119944..

(3) Two cable clamps, Part No. 42A50105.

(4) One spdt front door interlock switch, Part No. 40A831462.

(5) Two neoprene sleeves, Part No. 37K61348.

5. INSTALLATION

WARNING

Be sure primary power is disconnected from the cabinet before proceeding with installation.

a. Terminal Board Connections

IMPORTANT

Two jumpers are connected into the metering circuits when the chassis is shipped from the factory. Jumpers **MUST** be changed as required for any specific installation.

The exact terminal board connections for each specific type of application are detailed in the APPLICATION TABLE which appears on Schematic Diagram 63D849664.

Make the necessary circuit modifications as required before installing the TU139A Metering Chassis.

(1) Jumper Identification

Refer to Schematic Diagram 63D849664-C

Terminal Board TB1 has five screw-type terminals. This board is mounted on the inside of the chassis. Terminal number identification is not stamped on this board. Terminal numbers are assigned arbitrarily for convenience in identifying these terminals. The terminal board, as viewed from the rear, is numbered from left to right. The jumpers are described as follows:

(a) JU1 is a bare wire which is secured between terminals 2 and 3 when the TU139A Metering Chassis is shipped from the factory.

(b) JU2 (To make this connection, connect the bare wire between terminals 3 and 4.)

(c) JU3 is a short bare wire which is connected from terminal 4 to a ground lug (as shipped from the factory).

(d) JU4 (To make this connection, connect the bare wire jumper between terminals 1 and 2.)

(2) Application of Unit as Shipped

The TU139A Metering Kit as shipped from the factory is jumpered for application with 450 - 470 mc (does not include 65 & 100 watt base stations), 406-420 mc 65/100 w broadband base stations and 890-960 mc equipment. For 25-50 mc, 70-88 mc, 72-76 mc, 152-174 mc, and 65 or 100 watt 406-470 mc applications, the changes indicated in the APPLICATION TABLE on the schematic diagram must be made prior to installing this unit.

Two optional hook-ups for use in 890-960 mc applications are provided as follows:

(a) Single Channel Push-to-talk Service

The transmitter ON-OFF switch is wired parallel with the microphone push-to-talk circuit and is, therefore, in series with the rear door interlock switch on the cabinet. The transmitter may be operated when the front door of the cabinet is open, but the rear door must be closed. Furthermore, in push-to-talk systems, if the switch is left in the ON position and the front door is closed, the transmitter will be automatically turned off permitting the transmitter to be operated only from an external remote control console connected to the station's termination and fuse panel. This automatic turn-off feature prevents the transmitter from being inadvertently left in the ON position.

(b) Continuous Carrier or Multiple Channel Service

For continuous carrier service the transmitter ON-OFF switch operates completely independent of the cabinet door interlock switches. Thus, the transmitter r-f carrier is not interrupted by opening the cabinet doors.

In reference to Intercabling Diagram 63C849663 the YEL-GRN lead from the transmitter ON-OFF switch is connected to terminal #16 of the associated power supply terminal board. For further information refer to NOTE 5 on the attached Schematic Diagram 63D849664.

CAUTION

As the door interlock switches do not turn "off" the transmitter, **HIGH VOLTAGES ARE PRESENT AT ALL TIMES.** Extreme caution must be observed to avoid hazardous electrical shocks.

b. Install the Metering Chassis

(1) Mount the metering chassis in the cabinet immediately above the transmitter in all stations except 65 & 100 models where the metering chassis is mounted above the receiver. Secure the chassis to the frame utilizing the hardware provided with the equipment.

(2) Plug the receiver metering cable into the **METER** receptacle on the receiver chassis.

(3) Plug the transmitter metering cable into the **METER** receptacle on the transmitter chassis.

c. Install the New Interlock Switch

The interlock switch assembly is not used in 890-960 mc applications, 406-420 mc broadband base stations, or in "compa-stations."

(1) Remove the spst front door interlock switch from the base station cabinet. Retain the mounting screws.

(2) Mount the new spdt switch onto the cabinet using the mounting screws previously removed.

NOTE

Refer to switch detail on schematic diagram for switch terminal identification.

(3) On 450-470 mc stations (except 65 & 100 models)-connect the BLK-BLU lead to terminal 2 of the interlock switch. On 406-420 & 450-470 mc 65 & 100 watt stations connect the YEL-GRN lead from the remote control or multiple "PL" chassis to terminal 2 of the interlock switch. On all other stations - connect the GRAY lead to terminal 2 of the switch.

(4) On 450-470 mc stations (except 65 & 100 watt stations)-connect the two YEL-GRN leads to terminal 3 of the interlock switch. On 406-420 & 450-470 mc 65 & 100 watt stations connect the BLK-BLU lead from the rear door interlock to terminal number 3 of the interlock switch. On all other stations-connect the RED-ORG lead to terminal 3 of the switch.

(5) Connect the YEL-GRN wire which is supplied with the metering chassis, from the right hand terminal post of the five contact terminal board TB1 on the metering chassis to terminal 1 of the newly installed interlock switch.

d. Cable Dress

Dress all cables and wires neatly into place and secure the metering cables along the side of the rack frame with the cable clamps and hardware provided.

The installation is now complete and the unit is ready for test purposes.

e. Bench Applications

The TU139A may be installed on a bench as a universal test instrument for metering various Motorola transmitters and receivers. For such installation, it is recommended that jumpers JU1, JU2, and JU3 be replaced with spst toggle switches. In this manner, the required jumpers may be removed from the circuit by de-actuating respective switches. The XMTR "ON-OFF" switch may be connected to the "push-to-talk" circuit on the power supply to turn "on" and "off" the transmitter.

6. PRE-OPERATIONAL TEST

a. Local Speaker

(1) Place XMTR ON-OFF switch in OFF position.

(2) Apply primary power to cabinet.

(3) Place SPKR ON-OFF switch in ON position.

(4) Unsquench the receiver using the SQUELCH control on the Remote Control Chassis.

(5) Check for receiver noise. If speaker and receiver are operating properly, receiver noise will be heard.

(6) Place SPKR ON-OFF in OFF position. If the switch is functioning properly, the speaker should be disconnected from the circuit.

(7) Place SPKR ON-OFF switch in ON position and re-squelch receiver as desired.

b. Interlock (Not used in 890-960 mc applications 406-420 mc 65/100 w broadband base stations, or "compa-stations")

(1) Place XMTR ON-OFF switch in ON position.

(2) Check that transmitter is actuated with front door open.

(3) Open rear door.

(4) Check that transmitter becomes de-actuated.

(5) Close rear door. Transmitter should become re-energized.

(6) Close front door.

(7) Check that transmitter becomes de-actuated again.

(8) Return XMTR ON-OFF switch to OFF position and close both front and rear doors.

(9) Have remote operator test keying functions for normal remote control operation. (NOTE: With cabinet doors closed, the XMTR ON-OFF switch should not affect remote control operation in any way.)

c. Metering Circuit

(1) Ascertain that XMTR ON-OFF switch is in OFF position.

(2) Check receiver metering circuits by observing meter indications for positions R1 through R8 of the meter selector switch. Refer to RECEIVER instructions for specific readings.

(3) Place the XMTR ON-OFF switch in ON position.

(4) Check transmitter metering circuits by observing metering indications for position T2 through PO of the meter selector switch. Refer to TRANSMITTER instructions for specific readings. (NOTE: positions T2 and PO used only with 450-470 mc transmitters.)

TABLE OF CIRCUIT SELECTOR SWITCH FUNCTIONS

(NOTE - Readings are for voltage unless otherwise noted)

| METER SWITCH POSITION | UNIT UNDER TEST | FREQUENCY RANGE OF EQUIPMENT (MC) | | | | | | | | | CIRCUIT MEASURED |
|-----------------------------|-----------------------|-----------------------------------|---|-------|-------|----------|----------|----------|----------------------------|---------|---------------------------------------|
| | | 25-54 | | 70-88 | 72-76 | 144-174 | 450-470 | 406-470 | | 890-960 | |
| | | STD & PL | | | | STD & PL | STD & PL | STD & PL | 65/100 W BROAD- BAND | | |
| R1 | RCVR | X | X | X | X | X | | | | | 2nd IF -4 grid |
| | RCVR | | | | | | X | | X | X | 2nd IF -3 grid |
| R2 | RCVR | | | | | | | X | | | 2nd IF -2 grid |
| | RCVR | X | X | X | X | X | X | X | X | X | 1st limiter grid |
| R3 | RCVR | X | X | X | X | X | | | | | 2nd limiter grid |
| | RCVR | | | | | | X | | X | X | oscillator grid |
| R4+ | RCVR | | | | | | | X | | | multiplier grid |
| | RCVR | X | X | X | X | X | X | X | X | X | Discriminator bal- ance (positive) |
| R4- | RCVR | X | X | X | X | X | X | X | X | X | Discriminator bal- ance (negative) |
| R5 | RCVR | X | X | X | X | X | X | X | X | X | Discriminator input |
| R6 | RCVR | X | X | X | X | X | | X | | X | 1st oscillator grid |
| | RCVR | | | | | | X | | X | | Oscillator Multi- plier -1 grid |
| R7 | RCVR | X | X | X | X | X | | X | | | B+ |
| | RCVR | | | | | | X | | X | X | Oscillator Multi- plier -2 grid |
| R8 | "G" RCVR | X | X | X | X | X | | X | | | (No connection) |
| | "A" RCVR | X | | | X | X | | | | | "X" Filament (6 V) |
| | RCVR | | | | | | X | | X | X | (No connection) |
| T2 | XMTR | X | X | X | X | X | | | | | (No connection) |
| | XMTR | | | | | | | | X | X | 2nd tripler grid |
| | XMTR | | | | | | X | | | | Oscillator grid |
| | XMTR | | | | | | | X | | | 2nd doubler grid |
| T3 | XMTR | | | X | | | | | X | X | 1st doubler grid |
| | XMTR | X | | | | | X | | | | 2nd doubler grid |
| | XMTR | | | | | | | X | | | 3rd doubler grid |
| | XMTR | | X | | X | | | | | | 1st tripler grid |
| | XMTR | | | | | X | | | | | Tripler grid |

TABLE OF CIRCUIT SELECTOR SWITCH FUNCTIONS (CONT'D)

(NOTE - Readings are for voltage unless otherwise noted)

| METER SWITCH POSITION | UNIT UNDER TEST | FREQUENCY RANGE OF EQUIPMENT (MC) | | | | | | | | | CIRCUIT MEASURED |
|-----------------------|-----------------|-----------------------------------|---|-------|-------|----------|----------|----------|---------------------|---------|---------------------------------------|
| | | 25-54 | | 70-88 | 72-76 | 144-174 | 450-470 | 406-470 | | 890-960 | |
| | | STD & PL | | | | STD & PL | STD & PL | STD & PL | 65/100 W BROAD-BAND | | |
| T4 | XMTR | | | | | | | | X | | 2nd doubler grid |
| | XMTR | X | | | | | X | | | | 3rd doubler grid |
| | XMTR | | | | | | | X | | | tripler |
| | XMTR | | X | | X | | | | | | 2nd tripler grid |
| T5 | XMTR | | | X | | X | | | | X | 2nd doubler grid |
| | XMTR | X | X | X | X | X | | | | | doubler-driver grid |
| | XMTR | | | | | | X | | X | X | Tripler-driver grid |
| | XMTR | | | | | | | X | | | Intermediate power amplifier |
| T6 | XMTR | X | | X | X | X | X | X | X | X | Power amplifier grid |
| PA | XMTR | X | X | X | X | X | X | X | X | X | Power amplifier plate (plate current) |
| PO | XMTR | | | | | | | X | | | oscillator grid |
| | XMTR | X | | X | X | X | | | X | | (No connection) |
| | XMTR | | | | | | X | | | X | Antenna circuit (Relative RF output) |
| B+ | XMTR | | | | | | | X | | | B+ |
| | XMTR | X | X | X | X | X | X | | X | X | Transmitter PA |

TABLE OF CIRCUIT SELECTOR SWITCH FUNCTIONS FOR USE WITH 406-420 & 450-470 MC FINAL AMPLIFIERS

(NOTE - Readings are for voltage unless otherwise noted)

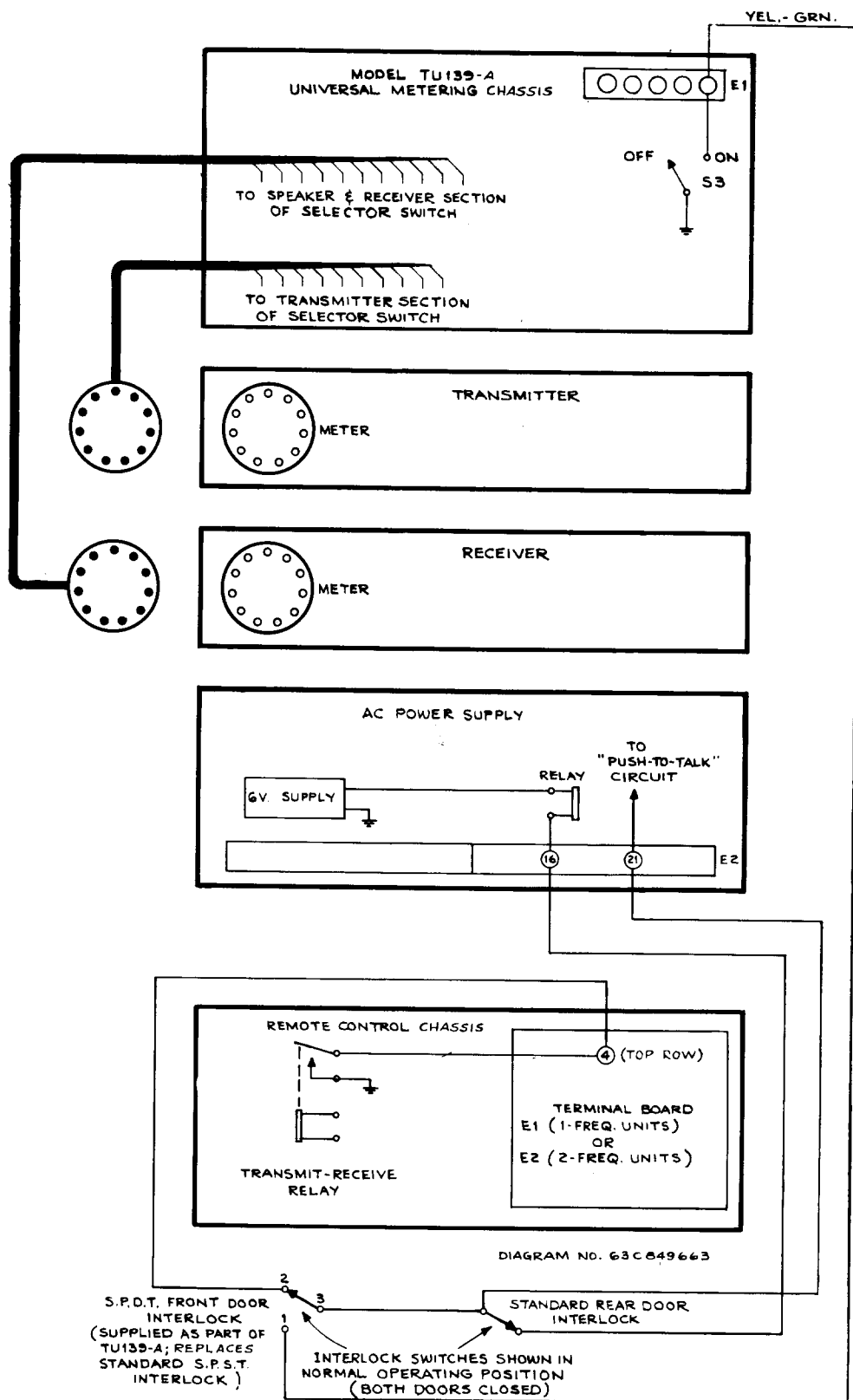
| METER SWITCH POSITION | UNIT UNDER TEST | CIRCUIT MEASURED |
|-----------------------|-----------------|-----------------------|
| T6 | FINAL AMPLIFIER | Power amplifier grid |
| PA | FINAL AMPLIFIER | Power amplifier plate |
| PO | FINAL AMPLIFIER | (No connection) |
| B+ | FINAL AMPLIFIER | B+ |

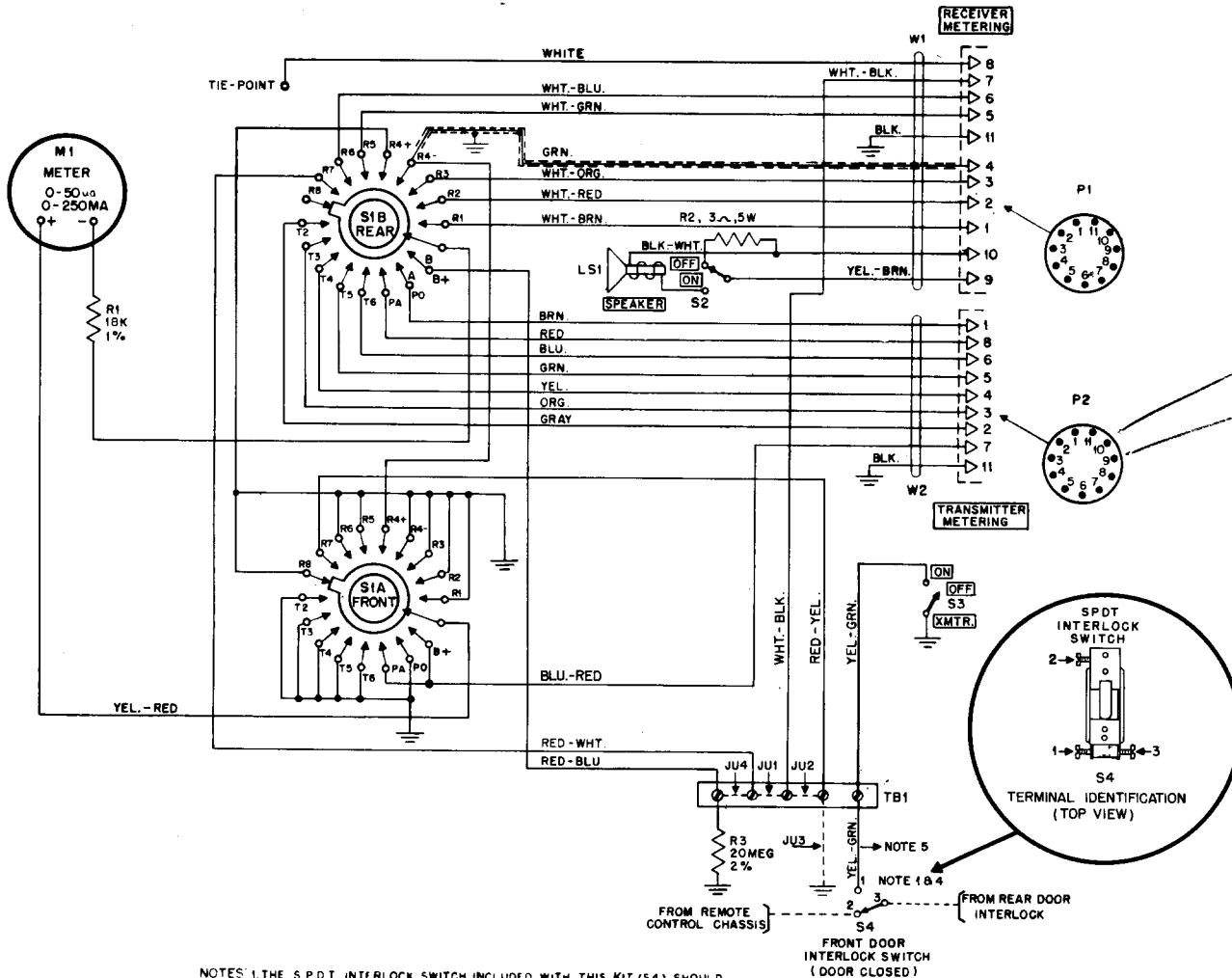
NOTE

For nominal meter readings which should be obtained under normal operating conditions, refer to the RECEIVER and TRANSMITTER sections of the standard instruction manual for the equipment being metered. Model TU139A meter positions and readings will correspond to respective meter positions and readings for the P-8501 or TU546 Series Test Sets. Meter readings as stipulated in the standard manual for the Test Set will be applicable for the TU139A as well.

If these measurements are made while a Receiver Shield and Filter Kit is used in conjunction with the receiver, some of the readings may be slightly lower than normal. If in question, temporarily plug the meter cable assembly directly into the meter receptacle on the receiver chassis.

REAR VIEW OF CABINET





- NOTES: 1. THE SPDT INTERLOCK SWITCH INCLUDED WITH THIS KIT (S4) SHOULD BE INSTALLED IN PLACE OF THE STANDARD SPST FRONT DOOR INTERLOCK SWITCH NORMALLY USED ON BASE STATION MODELS. DASHED LEADS ARE PART OF STANDARD BASE STATION CABLING.
2. JUMPERS MUST BE ARRANGED FOR SPECIFIC APPLICATION BEFORE INSTALLING; OTHERWISE, DAMAGE TO THE METER WILL RESULT.
3. REFER TO THE JUMPER TABLE BELOW FOR PARTICULAR JUMPERS EMPLOYED FOR VARIOUS APPLICATIONS.
4. INTERLOCK SWITCH NOT USED WITH 70-88 MC, 890-960 MC BASE STATION, COMPA-STATION AND 65/100 W BROADBAND BASE STATION.
5. YEL-GRN LEAD NORMALLY CONNECTED TO TERM. 21 OF ASSOCIATED POWER SUPPLY EXCEPT WHEN UNINTERRUPTED CARRIER SERVICE IS REQUIRED. CONNECT TO ALTERNATE TERM. 16 INSTEAD OF TERM. 21 AS SHOWN WHEN CONTINUOUS CARRIER SERVICE IS REQUIRED.

| MODEL TABLE | | |
|-------------|--------|--------------------------------|
| MODEL | SUFFIX | DESCRIPTION |
| TU139A | 1 | UNIVERSAL METERING CHASSIS KIT |

DIAGRAM NO. 63D849664

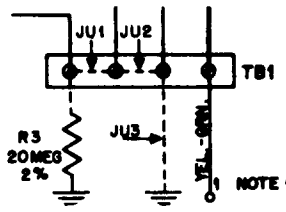
| STATION FREQ (SEE NOTE 2) | CIRCUIT ARRANGEMENT | | | |
|------------------------------|---------------------|------|------|------|
| | JU-1 | JU-2 | JU-3 | JU-4 |
| 25-54 MC | OMIT | USE | OMIT | USE |
| 72-76 MC | OMIT | USE | OMIT | USE |
| 144-174 MC | OMIT | USE | OMIT | USE |
| 450-470 MC * | USE | OMIT | USE | OMIT |
| 70-88 MC | OMIT | USE | OMIT | USE |
| 890-960 MC | USE | OMIT | USE | OMIT |
| 406-470 MC ** | OMIT | USE | OMIT | USE |
| 406-420 MC *** | USE | OMIT | USE | OMIT |

- * 18-20 & 250 WATT STATIONS.
- ** 65 & 100 WATT STATIONS.
- *** 65/100 WATT BROADBAND BASE STATIONS

PREVIOUS REVISIONS LISTED
ON BACK OF THIS DIAGRAM

Model TU139A Universal
Metering Chassis Kit
Schematic Diagram
Motorola No. 63D849664-C4
9/23/64

REVISIONS

| DIAG. ISSUE | CHASSIS AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION |
|-------------|------------------------|-------------|---|------------------------------|
| C | TU139A-1 | S1 | WAS 40B822398 | XMTR METERING |
| | | | RED-BLU LEAD ADDED | S1B-B TO TB1-GRN |
| | | | BLU-RED LEAD ADDED | S1A-PO TO S1A-PA |
| | | | NOTES 4 & 5 ADDED | NOTES |
| | | TB1 | WAS 31A831388 (4 TERM.) | |
| | | JU4 | ADDED JUMPER ARRANGEMENT WAS AS SHOWN BELOW | |
| | | |  | |
| C1 | TU139A-1 | | 25-54 MC STATION FREQ WAS 25-50 MC 144-174 MC STATION FREQ WAS 152-174 MC | APPLICATION TABLE |
| C2 | TU139A-1 | | *18-20 & 250 W STATIONS | APPLICATION TABLE |
| C3 | | | ** 65 & 100 W STATIONS ADDED | |
| C4 | TU139A-1 | | *** 65/100 W BROADBAND BASE STATIONS ADDED | APPLICATION TABLE AND NOTE 4 |

PARTS LIST for Schematic Diagram 63D849664-C4

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|--|
| LS1 | 50K801757 | <u>SPEAKER</u> , magnetic: impedance 3.2 ohm; 2-1/2" |
| M1 | 52B892096 | <u>METER</u> , ammeter: range, 0 to 50 micro-ampere and 0 to 250 milli-ampere; 3" x 3-1/8" case |
| P1 | 28B813576 | <u>CONNECTOR</u> , plug: male 11 contact; polarized round molded black phenolic base; does not incl 15A483149 SHELL, connector; which must be ordered separately; To Receiver Metering Connector; p/o W1 |
| P2 | | same as P1 except To Transmitter Metering Connector; p/o W2 |
| R1 | 6A892470 | <u>RESISTOR</u> , fixed: carbon film; 18K $\pm 1\%$; 1/2 w; ins |
| R2 | 17K82839 | wire wound; 3 ohm $\pm 10\%$; 5 w; ins |
| R3 | 6K892455 | carbon film; 20 megohm $\pm 2\%$; 2 w |
| S1 | 40B867723 | <u>SWITCH</u> , rotary: 2 pole; 18 position; consisting of: |
| S1A | | 1 pole, 18 position; Front Sect. |
| S1B | | 1 pole, 18 position; Rear Sect. |
| S2 | 40K811753 | toggle: S. P. D. T.; Speaker |
| S3 | 40A482097 | toggle: S. P. S. T.; XMTR |
| S4 | 40A831462 | interlock: S. P. D. T.; Front Door |
| TB1 | 31A835165 | <u>BOARD</u> , terminal: 5 screw terminals |
| W1 | 1V832873 | <u>CABLE ASSEMBLY</u> , special purpose: Receiver Metering; incl miscellaneous wire leads and ref part P1 |
| W2 | 1V852371 | special purpose: Transmitter Metering; incl miscellaneous wire leads and ref part P2 |