Mpac
Test Set

MODEL 1037

MODEL 1037-R

Instruction Manual

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CONTENTS

SECTION 1

GENERAL DESCRIPTION

1.1 SCOPE

This publication is a serviceman's instruction manual which describes the MPAC Models 1037 and 1037-R test sets. This manual includes sections on general description, operation, maintenance, parts lists, and drawings.

1.2 INTRODUCTION

The Models 1037 and 1037-R test sets are designed primarily for testing the MPAC series of two-way radios, including mobiles, base stations, repeaters, and desk top units. The Model 1037 also can be utilized for bench testing other two-way radios such as the Aerocom series. The 1037 is a portable unit which is housed in its own plastic case. The 1037-R is a rack mounted unit which can be installed in any 19-inch (48.26 cm) rack. (The 1037-R is factory installed when ordered as an integral part of an MPAC base or repeater station.)

The test set has a multiposition selector switch which allows rapid alignment of MPAC radios by electrically connecting the test set voltmeter to the various radio test points. The voltmeter features 10 megohms high impedance, a 0 to 1 milliampere movement to assure accuracy on all ranges, and a 0 to 30 volts dc range. A polarity reversal switch is also provided. A microphone connector and a PTT pushbutton provide facilities for keying an MPAC transmitter. An internal oscillator provides a variable level 10.7 MHz signal for troubleshooting and alignment.

The test set is completely self contained, including an interconnect cable for MPAC radios, test leads, and an internal mercury battery. Optional accessories include the M-32 microphone and E-43 rf output cable.

1.3 SPECIFICATIONS

Voltmeter impedance	10 Megohms
Voltmeter ranges	0.3, 1.5, 3.0, 15.0, and 30 volts dc.
Rf output	.05 volt rms
Rf stability	$\pm$0.005%
Power source	Internal 8.4-volt mercury battery

1.4 DIMENSIONS AND WEIGHTS

	1037		1037-R	
Height	7.0 in	17.78 cm	3.5 in	8.89 cm
Width	8.0 in	20.32 cm	17.0 in*	43.18 cm*
Depth	4.0 in	10.16 cm	3.0 in	7.62 cm
Weight	3.1 in	2.33 kg	2.4 lb	1.30 kg

*Width with mounting tabs is 19 in/48.26 cm.

1.5 CIRCUIT DESCRIPTION

a. Voltmeter

The dc voltmeter consists of a 0 to 1 milliampere dc meter driven by a CA3130 operational amplifier whch amplifies the voltage. The op-amp circuitry is over range protected to 30 volts dc by its input dividers. The voltmeter ranges are derived from a 10:1 voltage divider from pin 3 to ground, and a gain divider which operates between pins 2 and 6. The meter has an accuracy of 5% or better at fullscale voltage deflection.

b. Oscillator

The 10.7 MHz oscillator consists of transistors Q101 and Q102. Q101 is a 2N3646 emitter coupled crystal oscillator and Q102 is an MPS6514 emitter follower. The output level of Q102 is controlled by 1K potentiometer R110. The oscillator frequency is controlled by air capacitor C102 which is variable from 1 to 10 picofarads.

SECTION 2

OPERATION

The controls, connectors, and operating procedures for the 1037 and the 1037-R are identical.

2.1 CONTROLS AND CONNECTORS

a. TEST POINT SELECTOR
The test point selector switch is used in conjunction with the VM/TEST pushbutton and test cable to select the MPAC radio test point to be monitored.

b. D.C. VOLTS
The dc volts switch selects any one of five dc voltage ranges.

c. R.F. LEVEL
The level control turns the 10.7 MHz oscillator on and off and controls the oscillator output voltage.

d. PTT
The PTT pushbutton keys the MPAC transmitter.

e. BATT TEST
The battery test pushbutton tests the voltage of the internal battery.

f. POL
The polarization pushbutton reverses the input polarity to the voltmeter circuitry.

g. VM/TEST
With the voltmeter/test pushbutton depressed (TEST), the selected MPAC radio test point is monitored by the voltmeter through the test cable. With the pushbutton released (VM), voltages are measured with test leads connected to the red and black test jacks.

H. OFF ON
The on/off pushbutton turns the test set on (pushbutton depressed) and off (pushbutton released).

i. MIC
The microphone connector connects the optional M-32 microphone to the test set for keying the MPAC transmitter.

j. Test Jacks
The red (+) and black (-) test jacks connect the test leads to the voltmeter.

k. 10.7 MHz OUTPUT
The 10.7 MHz output jack is the connector for the 10.7 MHz oscillator output. The optional E-43 output cable, if provided, connects the 10.7 MHz signal to the unit being tested.

1. Test Cable Connector
The female test cable connector connects the MPAC radio to the test set through the test cable.

2.2 OPERATING PROCEDURES

a. Preliminary Checks

The following two checks must be performed before taking any measurements with the voltmeter.

(1) Zero Meter Deflection

Zero the meter pointer by adjusting the screw, located in the lower center portion of the meter, until the pointer is directly over the zero mark.

(2) Battery Test

Press the BATT TEST pushbutton to check the condition of the battery. Replace the battery if the meter pointer does not stay within the green area while the pushbutton is held depressed.

b. Test Set/MPAC Radio Connections

(1) Perform the preliminary checks just described.

(2) Set the D.C. VOLTS switch to 15.

CAUTION

The D.C. VOLTS switch must stay set at 15 until the appropriate test point has been selected, at which time the desired dc voltage may be set.

(3) Turn off the R.F. LEVEL by rotating the control counterclockwise until a click is heard.

(4) Set the TEST POINT SELECTOR switch to 13.

(5) Turn on the test set by depressing the OFF ON pushbutton. Depress the VM/TEST pushbutton (TEST).

(6) Connect the test cable to the test set cable connector. If provided, connect the optional M-32 microphone to the MIC. jack and the optional E-43 rf output cable to the 10.7 MHz OUTPUT jack.

(7) Connect the other end of the test cable to test socket J4 (normally) of the MPAC radio.

(8) Connect the BLACK clip lead to the radio PTT line at pin 33 on the master interconnect PC board and the RED clip lead to the MIC audio line at pin 22 on the master interconnect PC board. The clip leads are used in conjunction with the test set PTT pushbutton.

CAUTION

To prevent accidental keying of the transmitter, disconnect the wires normally connected to pins 33 and 22.

c. Test Point Selector

The TEST POINT SELECTOR switch numbers correspond to test socket J4 pin numbers in the MPAC radios. As the switch is rotated, the voltmeter is connected to the corresponding test point. The appropriate pin numbers are shown in the MAINTENANCE sections of the respective MPAC instruction manuals.

See the CAUTION in Item b.(2) of this section.

d. Transmitter Keying

Key the MPAC transmitter by depressing the PTT pushbutton. If the optional M-32 microphone is connected to the MIC. jack, the transmitter can be keyed by depressing the microphone button.

e. 10.7 MHz Output

The 10.7 MHz output level is controlled by the R.F. LEVEL control. Turn on the R.F. LEVEL and the test set to provide voltage to the 10.7 MHz oscillator.

f. Test Jacks and Voltmeter

To use the test set as a high impedance voltmeter, connect the test leads to the red (+) and black (-) test jacks. Turn on the test set and release the VM/TEST pushbutton (VM). Use the D.C. VOLTS switch and meter scales as with any conventional voltmeter.

The voltmeter and 10.7 MHz output may be used to service a variety of two-way radios.

SECTION 3

MAINTENANCE

The following procedures must be performed with the 1037 removed from its case or the 1037-R removed from its rack.

3.1 BATTERY REPLACEMENT

Replace the battery whenever the meter pointer does not stay within the green area (6 to 9 volts) when the BATT TEST pushbutton is held depressed.

(a) Turn off the test set.

(b) Remove the rf shield to gain access to the battery.

(c) Replace the battey with a Mallory Type TR146 (or equivalent) 8.4 volt mercury battery.

3.2 10.7 MHz OSCILLATOR ALIGNMENT

(a) Turn on the test set and R.F. LEVEL. Do not remove the rf shield.

(b) Connect a suitable frequency counter to the 10.7 MHz OUTPUT jack.

(c) Adjust C102, accessible through the rf shield, for 10.700 MHz.

3.3 VOLTMETER ALIGNMENT

(a) Turn on the test set. Do not remove the rf shield.

(b) Set the D.C. VOLTS switch to 1.5 and zero the meter pointer.

(c) Set the VM/TEST pushbutton to VM (pushbutton released).

(d) Ground the red (+) test jack to the black (-) test jack.

(e) Adjust ZERO potentiometer R110 (accessible through the rf shield) until a very slight positive meter movement is detected. The pointer should rest on the upper edge of the zero mark.

(f) Remove the ground wire from the red test jack.

(g) Set the D.C. VOLTS switch to 15.

(h) Apply calibrated +15 volts dc to the red test jack.

(i) Adjust CALIBRATE potentiometer R115 (accessible through the rf shield) for full scale meter deflection.

SECTION 4

REPLACEABLE PARTS

1037 MASTER
(1939-1037-101, Rev. L)

1037-R MASTER
(1939-1037-105, Rev. C)

SYMBOL *	DESCRIPTION	PART NUMBER
	Test Set PC Board	1939-1037-102
	Test cable assembly	1939-1037-103
	Capacitors	
C13	Elec., 220 uF, 6.3V	1518-2209-017
C14	Disc cer., stable, .001 uF	1506-1004-001
C15	Disc cer., stable, .002 uF	1506-2004-001
	Connectors	
J01	Test cable	2108-0000-020
J02	Rf (10.7 MHz output)	2111-0000-002
J03	Microphone	2105-0000-019
J04	Banana, black (-)	2104-0000-002
J05	Banana, red (+)	2104-0000-001
	Resistors	
R20	Precision, 10M, 1/2W, ±1%	4706-1008-001
R21	Precision, 100K, 1/2W, ±1%	4706-1006-005
R25/S05	Potentiometer/switch, wire wound, 1K	4741-1004-001
R24	Resistor	Factory select
	Switches	
S01	Wafer, 23-position	5110-0000-019
S02, S03, S06, S07, S08	Pushbutton, DPDT, 5-select	5141-0000-086
S04	Wafer, 5-position	5112-0000-006
	Meter, dc volt	2901-0000-005
	Test lead assembly	2905-0000-001
	Battery, mercury, 8.4V, Mallory Type 146 (or equivalent)	4053-0000-001
	Knobs, voltage selector and rf attenuator	2409-0000-034
	Knob, test point selector	2409-0000-035
	Cable, RG174/U (1037-R)	6050-0000-003
	Mounting bracket (1037-R)	1408-0659-030
	Shield, rf	1412-1037-022
	Assembly drawing (1037)	D1037-024
	Schematic diagram	D1037-001

* For complete symbol, precede all numbers with "1" (e.g., C14=C114).

TEST SET PCB
(1939-1037-102, Rev. M)

SYMBOL *	DESCRIPTION	PART NUMBER
	Capacitors	
C01	Silver mica, 6.8 pF	1513-6801-005
C02	Variable, air, 1-10 pF	1574-1002-001
C03	Silver mica, 24 pF	1513-2402-001
C04	Silver mica, 160 pF, ±5%	1513-1603-001
C05	Silver mica, 560 pF, ±5%	1513-5603-008
C06	Disc cer., 4.7 pF	1501-4701-001
C07, C08, C09, C12	Disc cer., 100 nF, 12V	1505-1006-005
C10	Silver mica, 820 pF, ±5%	1513-8203-001
C11	Disc cer., 470 pF	1502-4703-001
C14	Elec., 220 uF, 16V	1518-2209-018
C16	Disc cer., stable, .001 uF	1506-1004-001
CR01	Diode, silicon, 1N4148	4803-0000-004
IC01	IC, CA3130S	4850-0000-013
L01	Choke, rf, 430 uH	1823-4303-002
	Silicon Transistors	
Q01	MPS3646	4811-0000-005
Q02	MPS6514	4811-0000-012
	Resistors	
All fixed resistors are carbon, 1/4W, ±5% unless otherwise designated.		
R01	18K	4764-1805-001
R02	15K	4764-1505-001
R03	680 ohms	4764-6803-001
R04	22K	4764-2205-001
R05	33K	4764-3305-001
R06	1K	4764-1004-001
R07	22M, 1/2W, ±5%	4762-2208-001
R08	10M, 1/2W, ±5%	4762-1008-001
R09, R11, R12, R22	10K, 1/2W, ±5%	4762-1005-001
R10	Potentiometer, PC mount, 100K	4735-1006-001
R13	820 ohms, 1/2W, ±5%	4762-8203-001
R14	Precision, 7K, 1/2W, ±1%	4706-7004-001
R15	Potentiometer, PC mount, 250 ohms	4735-2503-001
R16	Metal film, 1.5K, 1/4W, ±1%	4774-1504-001
R17	Precision, 1.2K, 1/2W, ±1%	4706-1204-001
R18, R19	Precision, 150 ohms, 1/2W, ±1%	4706-1503-002
R23	100 ohms	4764-1003-001

* For complete symbol, precede all numbers with "1" (e.g., C01=C101).

TEST SET PCB
(CONTINUED)

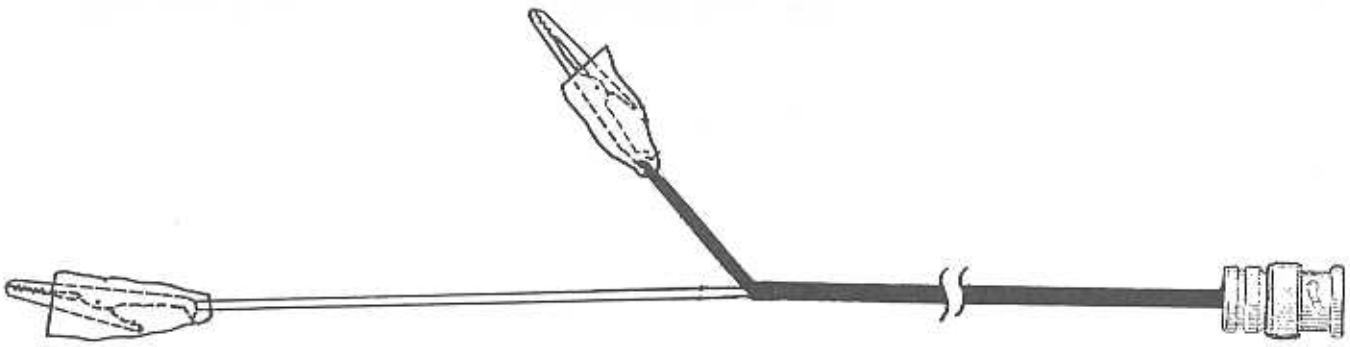
SYMBOL	DESCRIPTION	PART NUMBER
Y01	Crystal, 10.7 MHz	2307-0002-001
	Clip, battery holder	2142-0000-018
	Clip, battery terminal	2142-0000-019
	Pin, male	2150-0000-010
	Assembly drawing	C1037-021
	Schematic diagram	D1037-001

TEST CABLE
(1939-1037-103, Rev. C)

QUANTITY	DESCRIPTION	PART NUMBER
1	Header	1404-1037-015
1	Cover, header	1412-1037-016
1	Connector	2108-0000-003
1	Hood, connector	2108-0000-005
1	Cable, 19-conductor, 4 ft.	6051-1037-017
2	Clip, alligator	2142-0000-020
1	Boot, red	2142-0000-021
1	Boot, black	2142-0000-022
	Assembly drawing	6051-1037-018

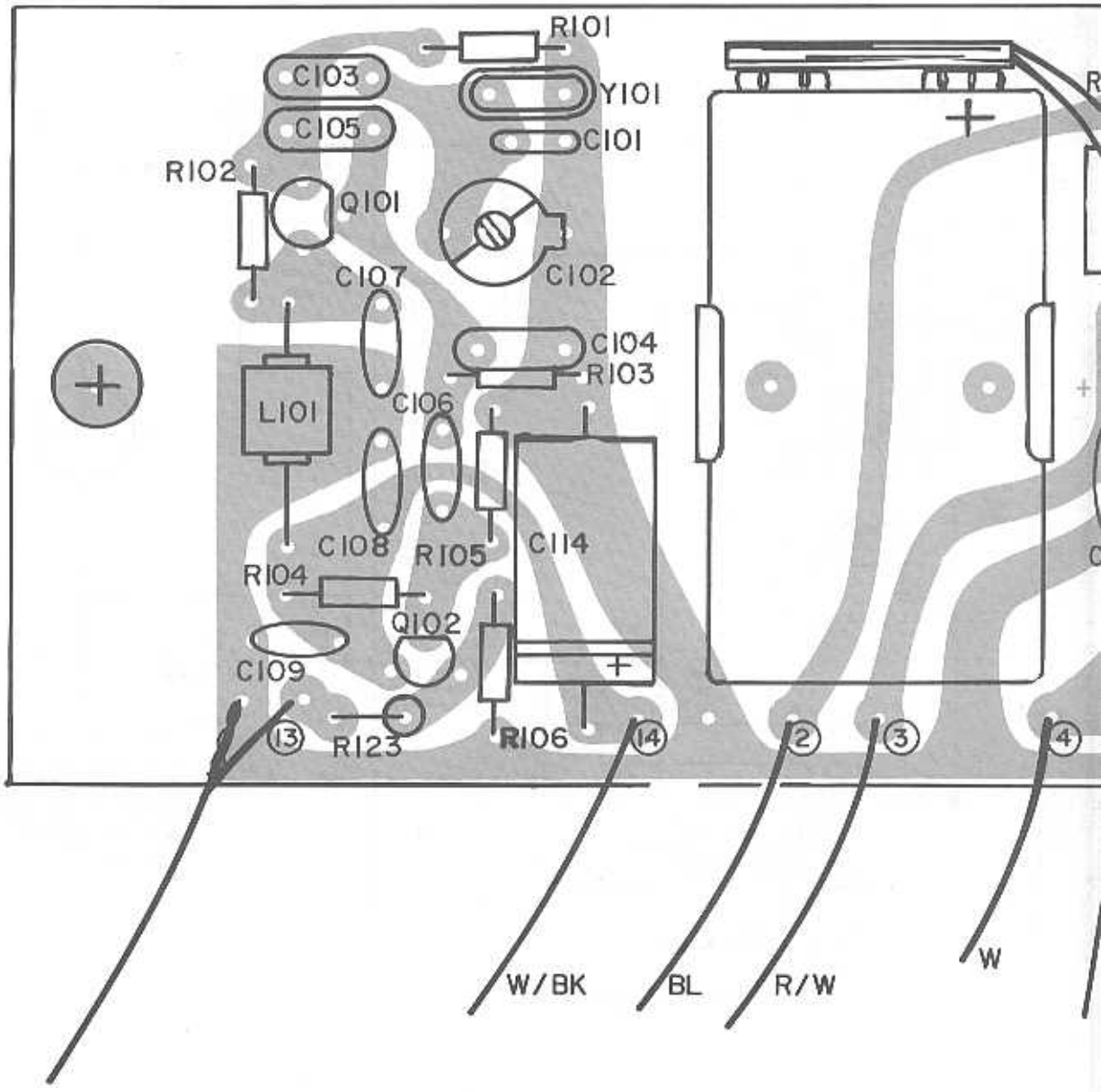
OPTIONAL E-43 RF OUTPUT CABLE
(1939-1037-107, Rev. A)

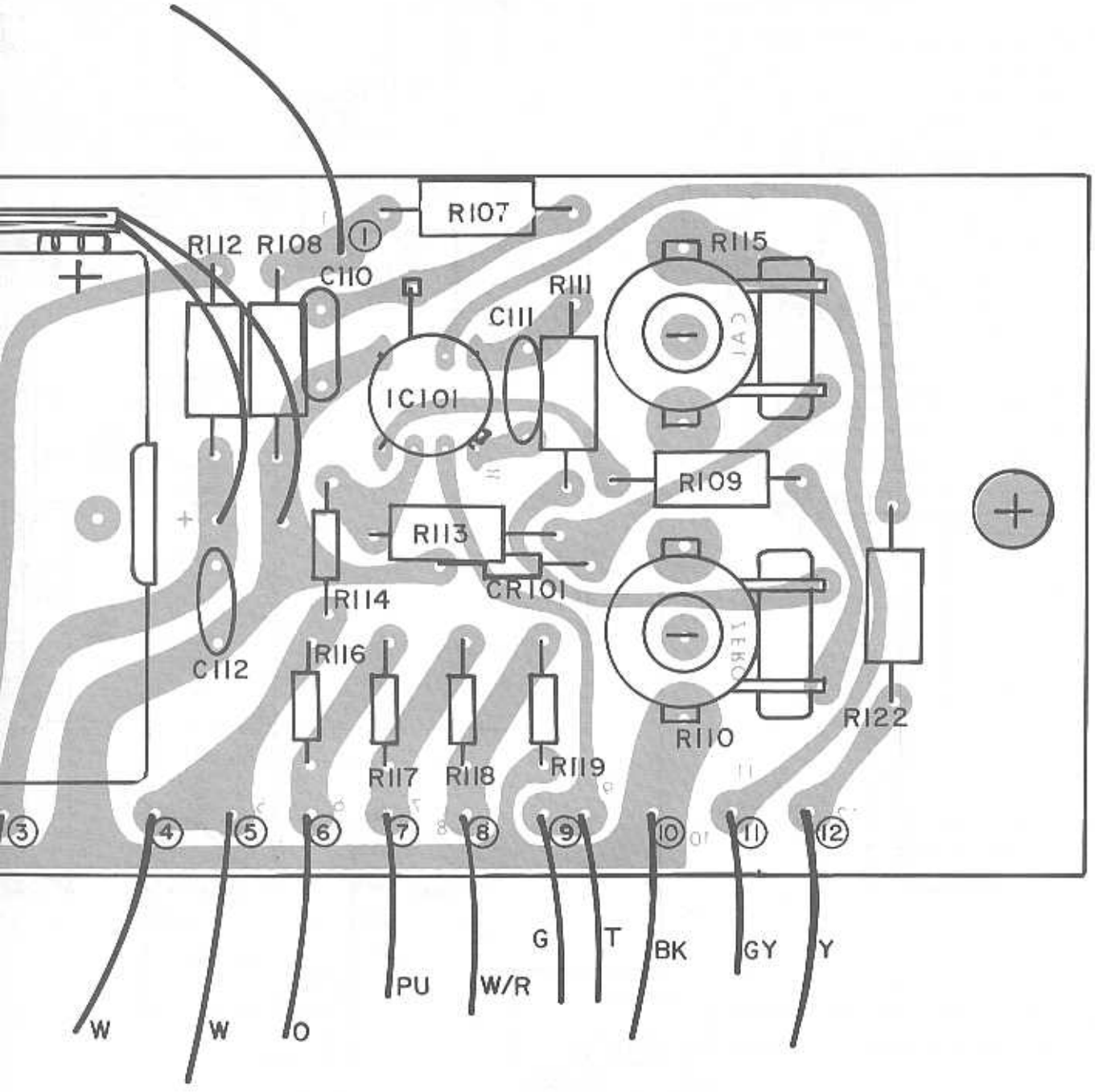
QUANTITY	DESCRIPTION	PART NUMBER
1	Connector, BNC	2111-0000-016
2	Clip, alligator	2142-0000-020
1	Boot, red	2142-0000-021
1	Boot, black	2142-0000-022
1	Cable, coaxial, RG58A/U	6050-0000-011



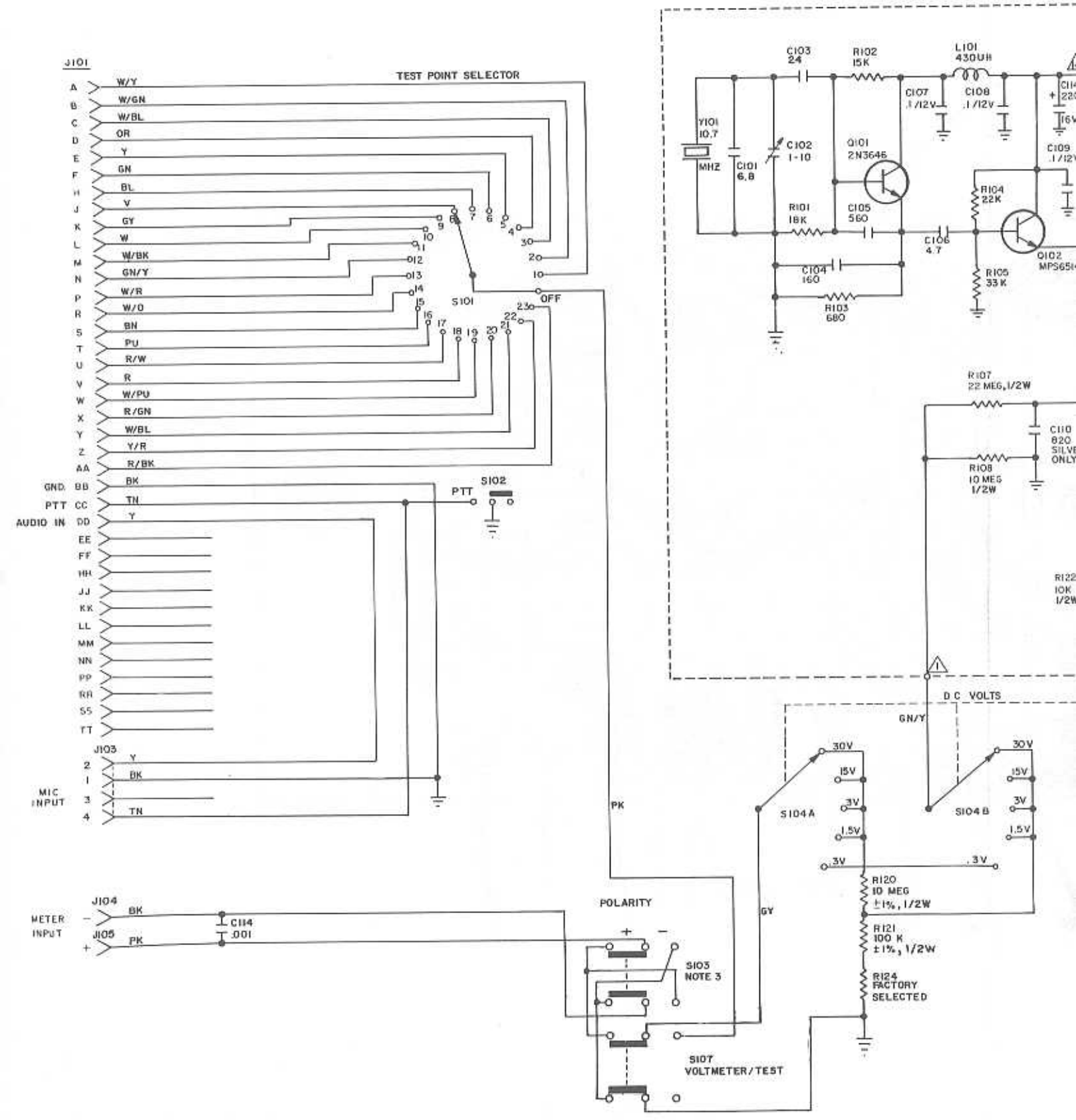
SECTION 5

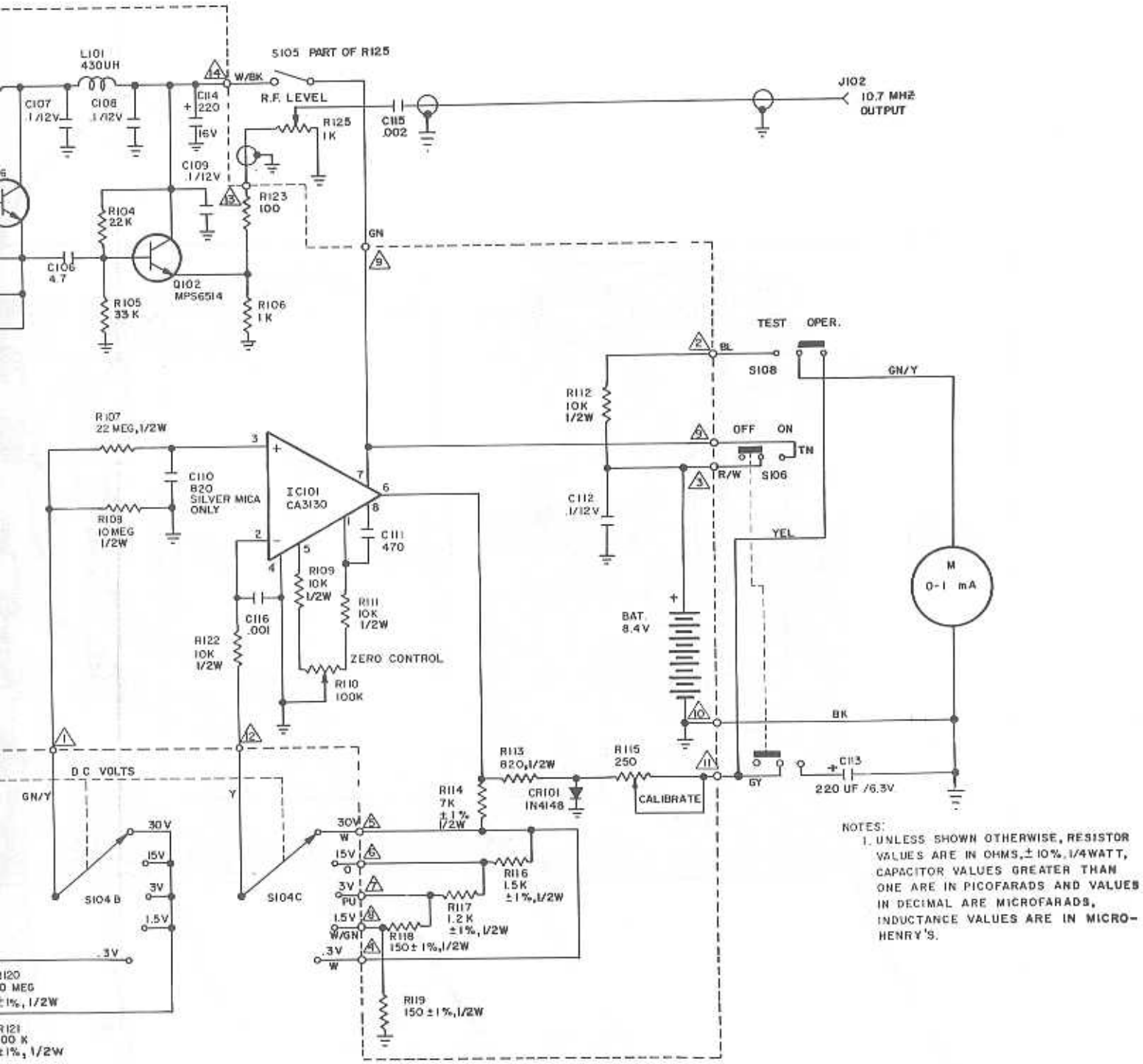
DRAWINGS


R101
C103
Y101
C105
C101
R102
Q101
C107
C102
C104
R103
L101
C106
C108
R105
C114
R104
Q102
C109
13
R123
R106
14
2
3
4
W/BK
BL
R/W
W



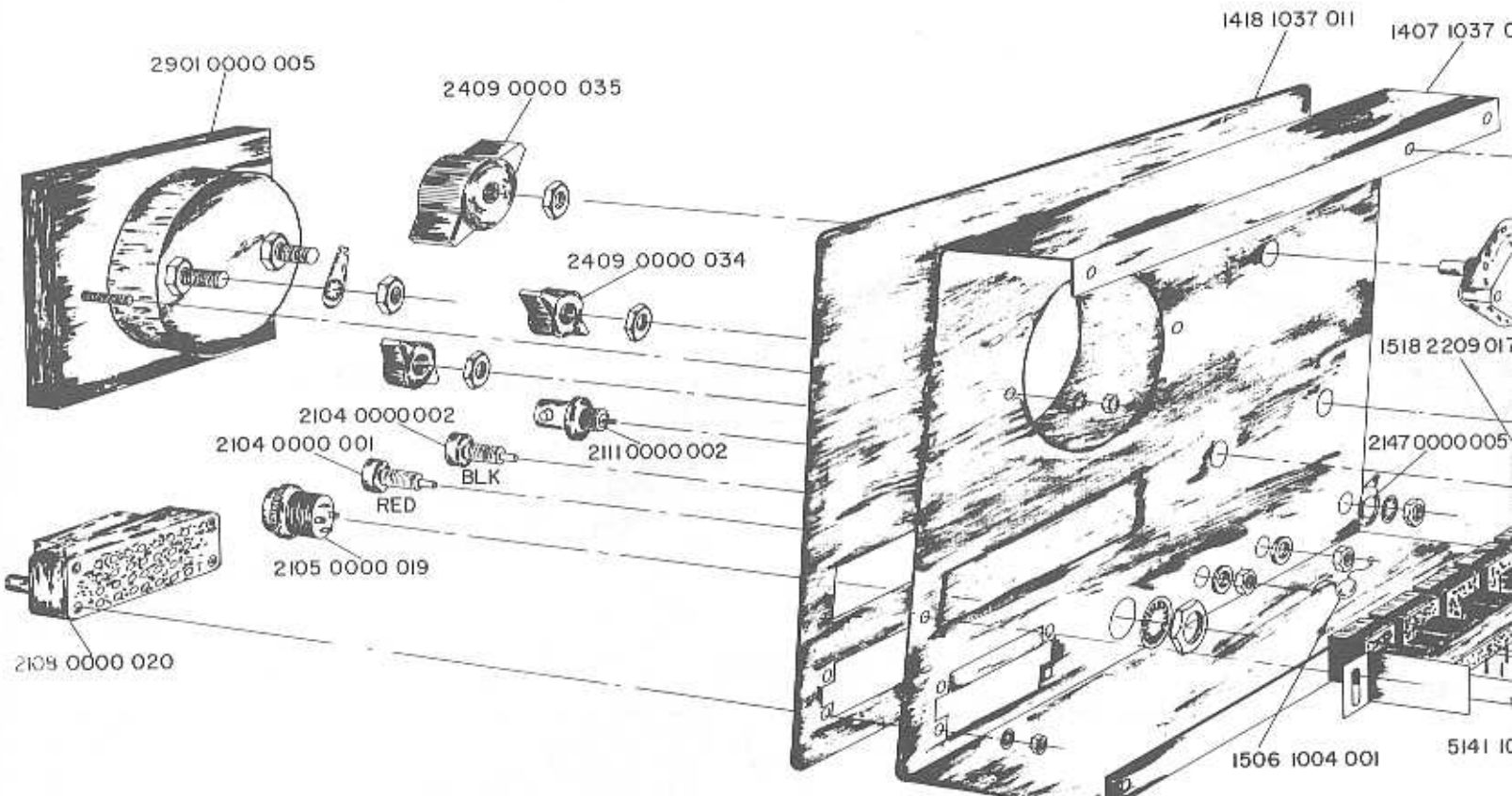
Test set PCB assembl
C1037-021 (A)
(See parts list 1939-1

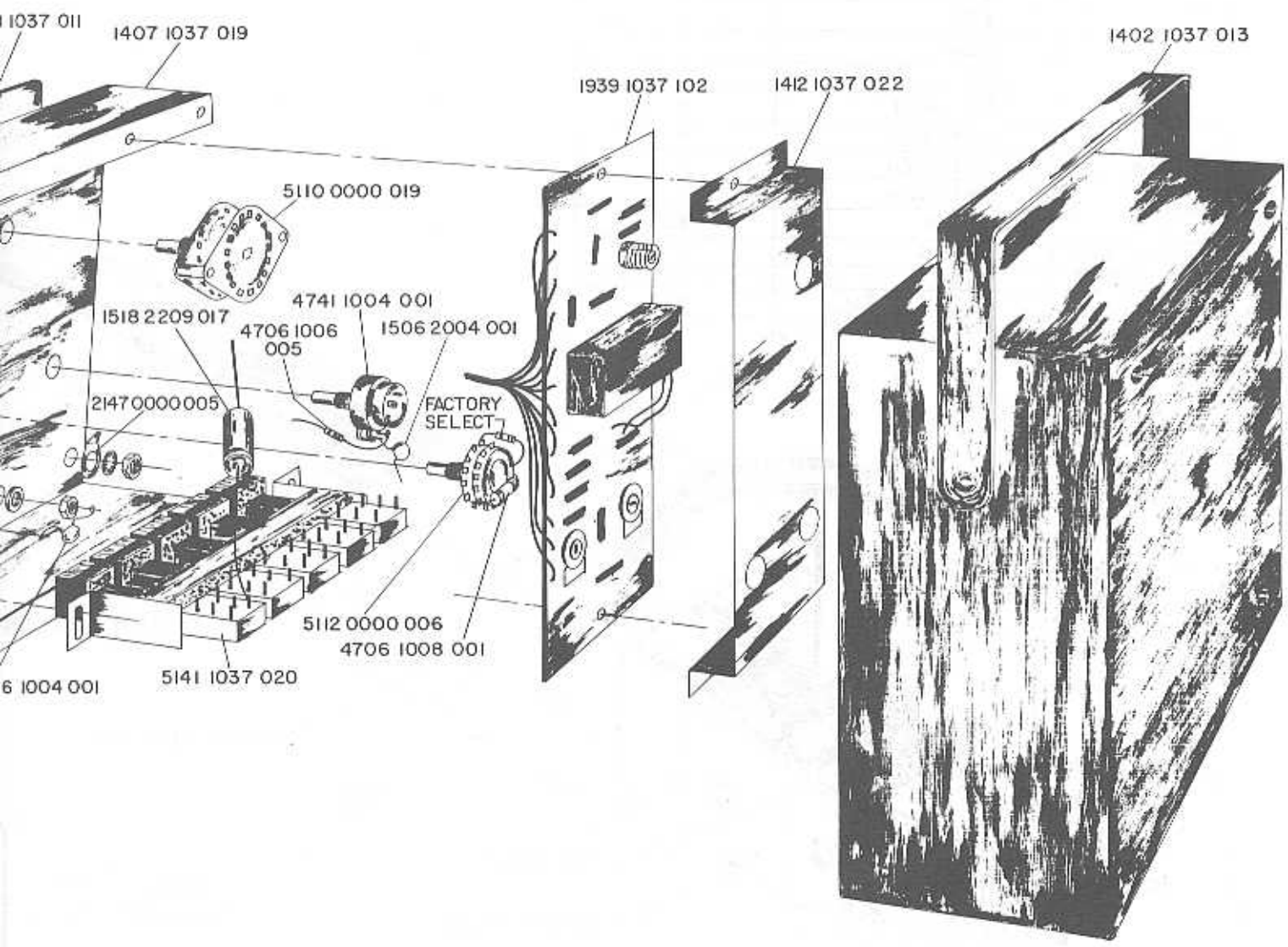

J101
TEST POINT SELECTOR
A W/Y
B W/GN
C W/BL
D OR
E Y
F GN
H BL
J V
K GY
L W
M W/BK
N GN/Y
P W/R
R W/O
S BN
T PU
U R/W
V R
W W/PU
X R/GN
Y W/BL
Z Y/R
AA R/BK
GND BB BK
PTT CC TN
AUDIO IN DD Y
EE
FF
HH
JJ
KK
LL
MM
NN
PP
RR
SS
TT
S101
OFF
S102
PTT
J103
MIC INPUT
2 Y
1 BK
3
4 TN
J104
METER INPUT
BK
J105
PK
C114 .001
POLARITY
S103 NOTE 3
S107 VOLTMETER/TEST
PK
GY
C103 24
R102 15K
L101 430UH
C107 .1/12V
C108 .1/12V
Y101 10.7 MHZ
C101 6.8
C102 1-10
Q101 2N3646
C109 .1/12
R104 22K
R101 18K
C105 560
C106 4.7
Q102 MPS65
C104 160
R105 33K
R103 680
R107 22 MEG, 1/2W
C110 820 SILV ONLY
R108 10 MEG 1/2W
R122 10K 1/2W
D C VOLTS
GN/Y
30V
15V
3V
1.5V
S104A
S104B
.3V
R120 10 MEG ±1%, 1/2W
R121 100 K ±1%, 1/2W
R124 FACTORY SELECTED



NOTES:
1. UNLESS SHOWN OTHERWISE, RESISTOR VALUES ARE IN OHMS, ± 10%, 1/4 WATT, CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS AND VALUES IN DECIMAL ARE MICROFARADS, INDUCTANCE VALUES ARE IN MICRO-HENRY'S.

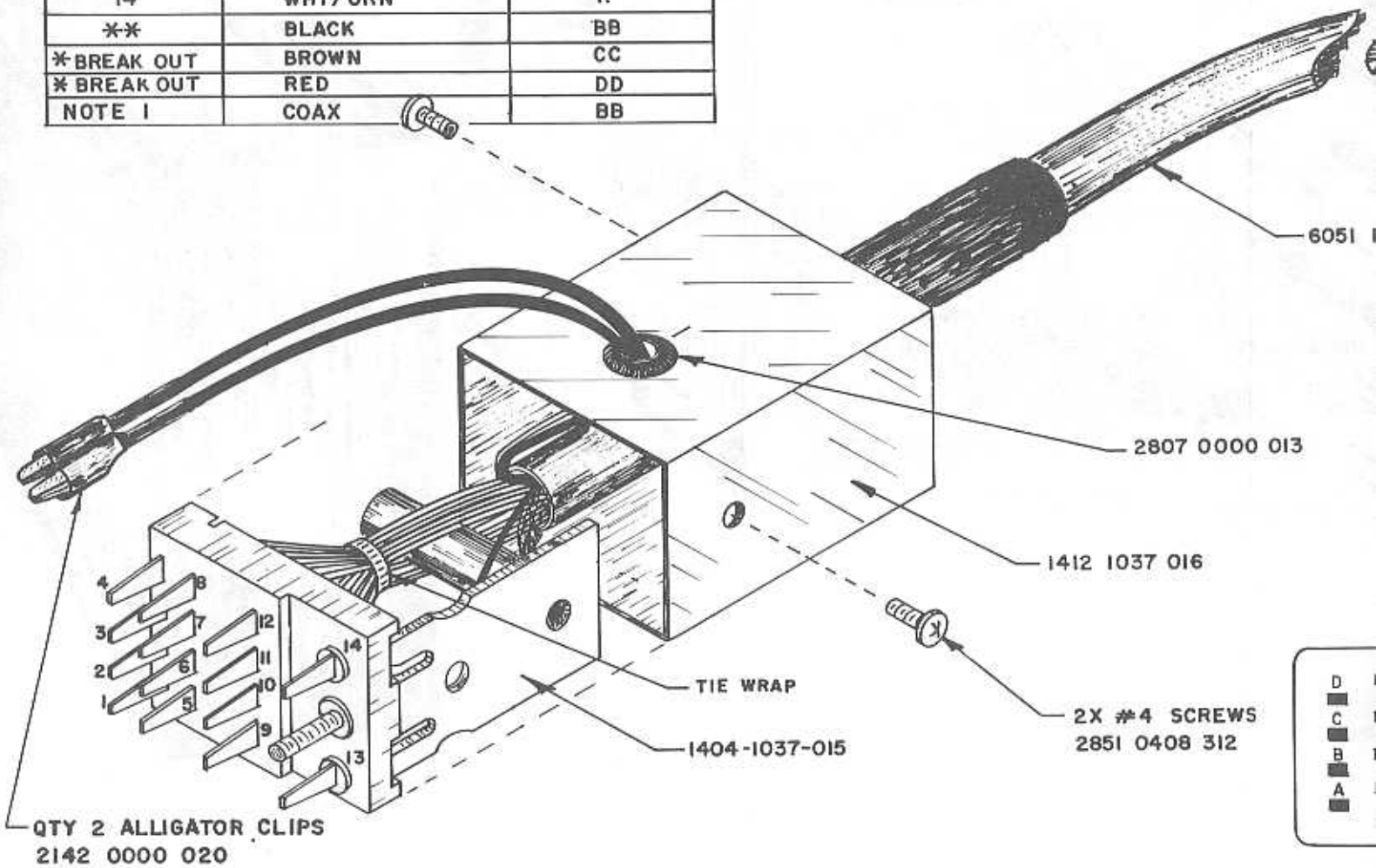
Test set schematic
D1037-001 (C)
(See parts lists 1939-1037-101
and 1939-1037-105)

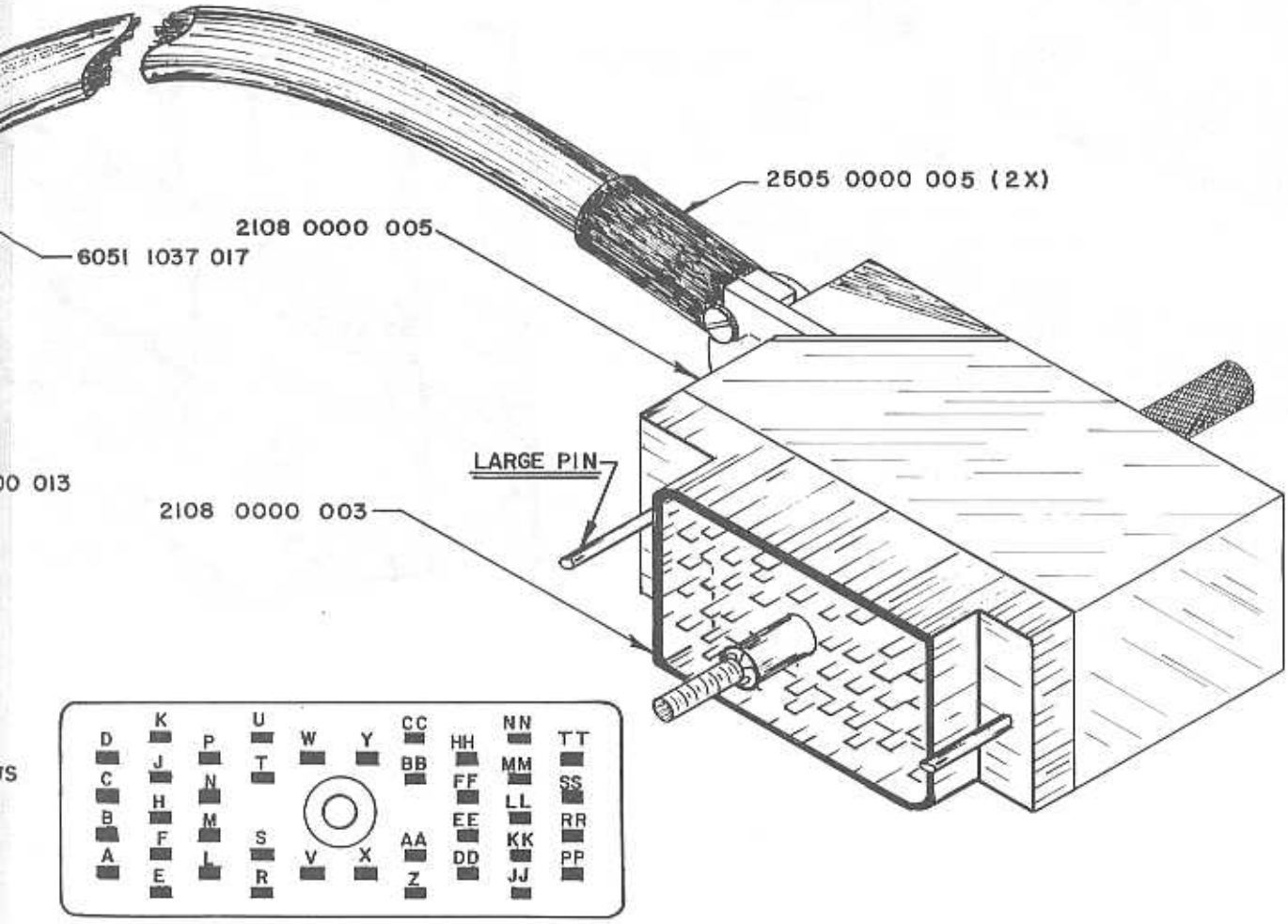

1418 1037 011
1407 1037 0
2901 0000 005
2409 0000 035
2409 0000 034
1518 2209 017
2104 0000 002
2104 0000 001
BLK
RED
2111 0000 002
2147 0000 005
2105 0000 019
2109 0000 020
1506 1004 001
5141 1



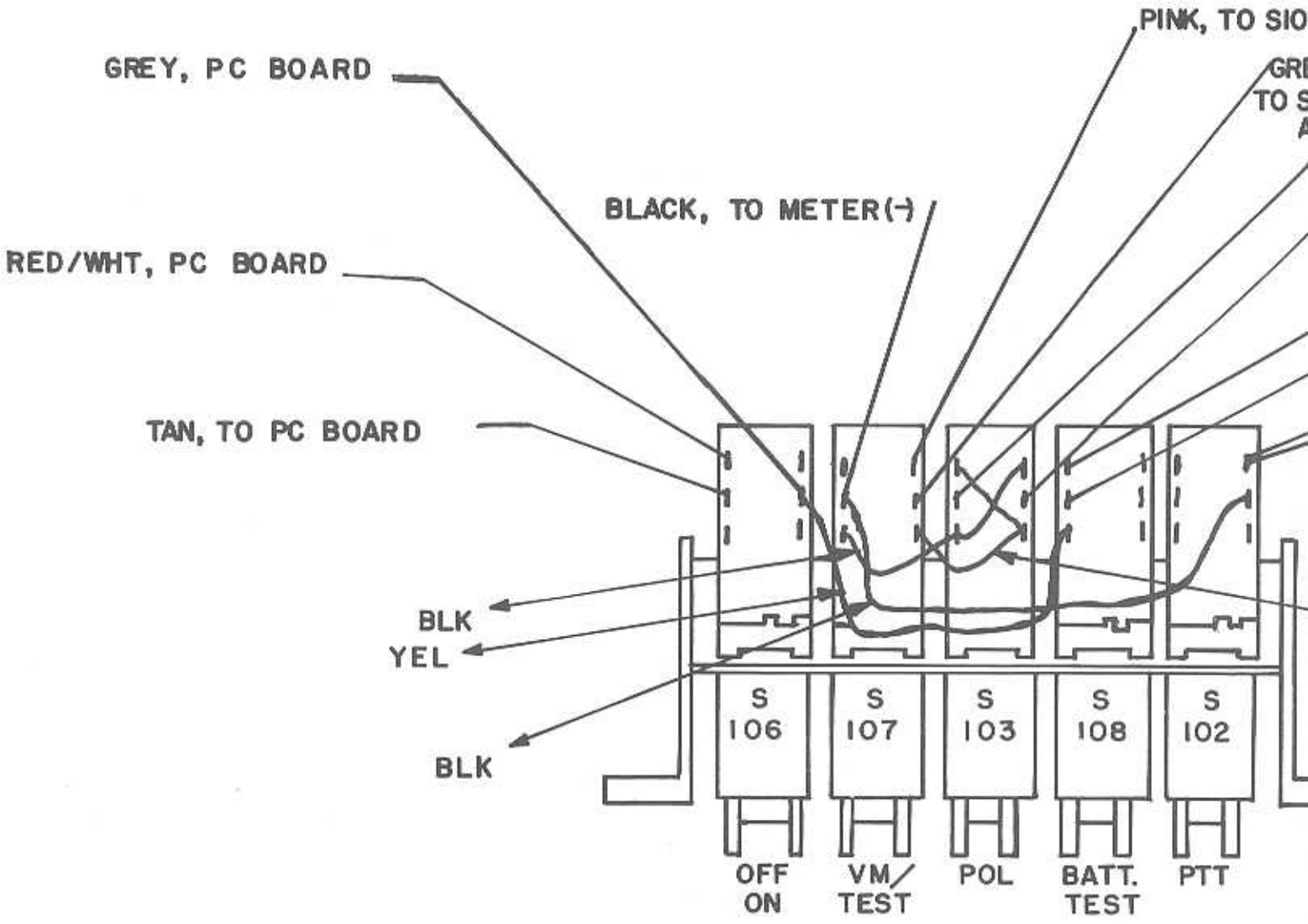
1037 assembly
D1037-024

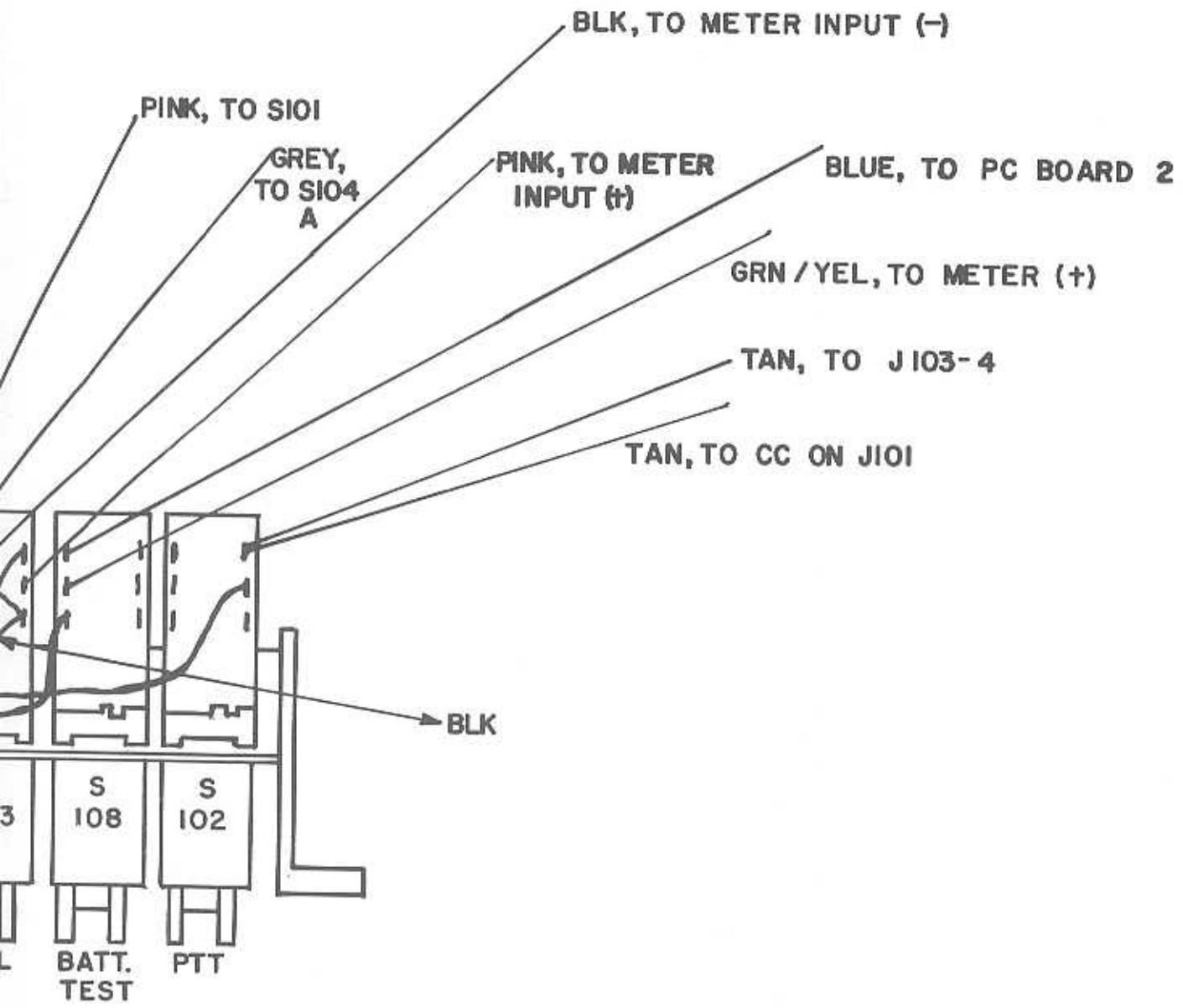
P & B CONNECTOR	WIRE COLOR	ELCO CONNECTOR
1	WHT / YEL	A
2	WHT / GRN	B
3	WHT / BLU	C
4	ORN	D
5	YEL	E
6	GRN	F
7	BLU	H
8	VIO	J
9	GRAY	K
10	WHT	L
11	WHT / BLK	M
12	WHT / BRN	N
13	WHT / RED	P
14	WHT / ORN	R
**	BLACK	BB
* BREAK OUT	BROWN	CC
* BREAK OUT	RED	DD
NOTE 1	COAX	BB





Test cable assembly
C6051-1037-018 (B)
(See parts list 1939-1037-103)


PINK, TO SIO
GREY, PC BOARD
BLACK, TO METER(-)
RED/WHT, PC BOARD
TAN, TO PC BOARD
BLK
YEL
BLK
S 106
S 107
S 103
S 108
S 102
OFF ON
VM/ TEST
POL
BATT. TEST
PTT



Switch wiring
B1037-041