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INSTRUCTION MANUAL
AMENDMENT

AN/PRC-40
Repair, Modification and Redesign
Contract No. N600(11)59324

by

Dixon Industries, Inc.
Gaithersburg, Maryland.

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INTRODUCTION:

The AN/PRC-40, as modified, is a one watt, narrow band, single channel F.M. portable transceiver, complete with self contained battery power supply and canvas carrying case.

This equipment is entirely transistorized and is designed to operate from 132-152 megacycles per second.

The equipment mode of operation is that of a "fixed tuned", crystal controlled, equipment.

The modulation technique is phase shift modulation, using a delay line modulator. The modulator is an encapsulated component, so arranged, in the circuitry as to provide a phase shift of the fundamental oscillator frequency, proportional to audio or voice input. This phase shifted component is then applied to a multiplier chain, the resultant output is F.M. at the output of the multiplier chain and at the frequency of the final amplifier, i.e. the final frequency is twelve (12) times the oscillator frequency.

The AN/PRC-40 operates on +15 volts D.C. from a self contained battery pack. Total power consumption of the equipment is 4.5 watts.

General Description of Modification:

The modification of this equipment is divided into two distinct sections, "mechanical" and "electrical". The "mechanical" modification essentially involves a change in packaging and shielding arrangement and a change in the battery power supply.

The "electrical" or circuit modification involves changes in the output or "final" amplifier circuitry, the last "driver doubler" and certain circuit and operational changes in the multiplier chain.

Adequate description of these changes and the resultant operational and alignment effects are somewhat complex. Therefore, in the interest of simplicity, we shall endeavor to describe the modification separately, i.e. "mechanical" and "electrical".

2.1 Mechanical Modification:

The Engineering evaluation period of this program revealed that the original packaging of this equipment was froth with reactive ground paths and completely without adequate R.F. shielding. Further, the plug in feature of individual modules was so mechanically inadequate as to deteriorate completely, truly reliable R.F. Operation.

Therefore, a wrap-around steel frame with appropriate partitioning was designed and installed. The use of this shielding enabled more "passive" coupling from stage to stage in the multiplier chain resulting in greatly improved reliability of performance.

The module sections of the multiplier chain were permanently affixed to the printed circuit board, by means of soldering the connector pins. This modification assures fixed coupling that is not adversely affected by mal-treatment.

A pre-formed brass shield was added to the unit on the underside of the transmitter printed circuit board, thus providing a closed R.F. shield completely enveloping the transmitter circuitry.

2.2 Electrical Modification:

The electrical modification of this equipment involved the complete redesign of the final power amplifier, the last driver doubler

the driver amplifier Z106, and the tripler. Certain circuit adjustments were also necessary to convert the oscillator amplifier Z104 to a "doubler" and it is, henceforth, the "first doubler" Z104.

The final amplifier Z108 has been converted from a vacuum tube circuitry to a transistorized unit. The output circuitry of the redesigned final stage, employs a "pi" type coupling circuit and filter. The new circuitry incorporates two (2 ea.) 2N1692 type transistors, wired in cascade fashion. "Pi" tank coupling is also used between stages.

Nominal R.F. output is 2 watts with a VSWR of 1.5:1. The final amplifier is designed to drive a whip type antenna, cut to the appropriate wave length. However, other antenna configurations have been successfully used through the expedience of returning and realigning the output, "Pi Tank".

The last "Driver Doubler" Z107 has been completely redesigned to utilize transistor circuitry as opposed to the vacuum tube circuitry originally employed in this stage. The transistor utilized in this stage is a 2N1143. The circuitry is so designed as to accept f_1 as an input frequency at levels up to 25 mw. and provide $2 \times f_1$ at the collector output at a level of at least 150 mw.

Stability of this and other circuitries, employed in the equipment, is accomplished by deliberate mis-match of the input/output circuitries of each stage.

The driver amplifier Z106 is designed to tune to the same frequency as the tripler Z105 and provide power gain at that frequency as well as a degree of isolation for the tripler output. The driver amplifier stage employs a 2N1744 which is capable of a nutralized power gain of 16 db and power output of 50 mw. at these frequencies. The circuit configuration is of grounded emitter variety and stability is accomplished again, by deliberate mis-match.

The tripler stage Z105 incorporates a 2N1744 arranged in grounded emitter configuration. The collector of this circuit is tuned to three times the input frequency at the base. Approximately an 8 db loss is experienced in the tripler stage.

The first "Doubler" Z104 was originally the oscillator amplifier stage. This unit was modified by changing the values of the output "C" to enable the collector to be resonated at twice oscillator frequency.

No modification was necessary in the case of the oscillator Z101 or the deviation control module Z102. These circuitries are as they originally were in the equipment. Slight wiring re-arrangement was necessary in the case of the relay module Z109. This will be obvious if one compares the new schematic Drawing #R10012 with the old one.

3.0 Operation and Alignment Procedures

Remove AN/PRC-40 from shipping container. Check to be assured that each model PRC-40 is equipped with (a) a whip type antenna, (b) a hand held push-to-talk microphone, (c) 2 battery cables as shown in Figure 1, (d) a canvass carrying bag.

Remove the unit from its case by relieving "hold down" screws located at the bottom of the unit, and by means of handle on the front. Slowly extract the equipment from its outer case.

After alignment of the unit has been completed, install six (6 ea.) batteries, type Burgess D-5 or Eveready 707, in the base of the case as shown in figure #1.

The wiring of these batteries is a series - parallel configuration, producing 15 volts with an operating current capability of 50 hours computed on a 4 hours per day discharge curve.

Note: The operating current of the transmitter should be monitored by a milliampmeter with a capacity reading of 500 ma. minimum.

Install cable CBL-1 and CBL-2 as shown in the diagram in Figure #1. Plug in the battery cable plug, P-301, to the mating plug at the rear of the transceiver chassis.

Install the hand held microphone by connecting the plug at the end of the mike cable to mating plug on the transceiver front panel.

Install the antenna assembly by affixing to the mating UHF connector on the front of the transceiver. Be very sure the locking ring at the base of the antenna assembly is securely fastened to the threads provided on the mating connector.

Install appropriate crystal in crystal socket, Y101, adjacent to the oscillator module.

The appropriate crystal frequency is equal to 1/12 of the final frequency at which the transmitter is intended to operate. As an example:

Final frequency = 132 mcs.: Crystal frequency = 132/12
= 11 mcs.

Turn the transceiver "on" by means of rotating the volume control clockwise until a "click" is "heard".

Using a vacuum tube voltmeter, Hewlett-Packard 410-B, on the DC scale, affix the ground clip lead to the chassis of the transceivers and attach the positive lead to TP-1 shown in Figure #2. Adjust oscillator control L1 unit until a maximum DC voltage is indicated on the meter.

Move the positive lead of the voltmeter to (TP-2) and adjust (L3) of the first doubler for a "peak" reading, with positive lead still affixed to (TP-2), adjust (L4) to increase the level of peak. Readjust (L3) to be sure both (L3) and (L4) are peaked. Return positive test probe of voltmeter to (TP-1) and check adjustment of (L1).

Move positive test probe of voltmeter to (TP-3) as shown in Figure #2 and adjust (L5) for a peak reading on voltmeter.

NOTE: The magnitude of reading at (TP-3) will be nominally 0.5 volt. 5V

Remove D.C. ground lead of voltmeter from ground, and with the voltmeter switched to the "A.C." mode clip, the "A.C." ground lead to the chassis, and affix the "hot" A.C. or diode probe to (TP-4)

Adjust (C-23) as shown in Figure #2 for a peak reading at (TP-4). Adjust (C-26) to establish "real peak", and check the adjustment of (C-23). Remove voltmeter leads from the unit.

Detach antenna assembly from mating UHF connector and, by means of very short adaptor, attach a "Byrd" thru line type watt meter to the antenna output connector. Affix the antenna assembly to the output side of the wattmeter.

Depress the push-to-talk button, and note the reading on the wattmeter. Adjust C-28 and C-29 for peak indication on wattmeter.

Adjust C-32, C-33, C-37 and C-38 for peak and maximum power output.

Readjustment of C-28, C-29, C-32, C-33, C-37 and C-38 may be necessary to peak up the output.

At the completion of this procedure, remove wattmeter from the output of the transceiver and replace the antenna assembly on the mating connector on the transceiver. Readjust C-28, C-29, C-32, C-33, C-37 and C-38 for peak current reading on milliameter. Restore transceiver to cover case. Tighten hold down screws at rear of case.

Unit should now be ready for operation.

PARTS LIST

1st Doubler

R4	2700 ohm ½W 10%
R4	10,000 ohm ½W 10%
R5	750 ohm ½W 10%
R6	15,000 ohm ½W 10%
C8	68 uuF Ceramic
C9	680 uuF Ceramic
C10	.001 uF Ceramic Disc
C11	100 uuF 20% Ceramic Disc
C12	100 uuF Silver Mica
C13	10 uuF Silver Mica
Q2	Texas Instrument R366
CR2	1N198
L3	20 Turns - single spaced - #22 wire
L4	20 Turns - single spaced - #22 wire

Tripler

C14	.05 uuF 20% Ceramic Disc
C15	12 uuF Silver Mical 5%
C16	12 uuF Silver Mica 5%
C17	100 uuF 20% N.P.O. Disc
C18	15 uuF Silver Mica
CR3	1n198
L5	5 Turns - single spaced - #18 wire
Q3	2N1744
R7	100K ohm ½W 10%
R8	750 ohm ½W 5%
R9	750 ohm ½W 5%

Tripler - Amplifier

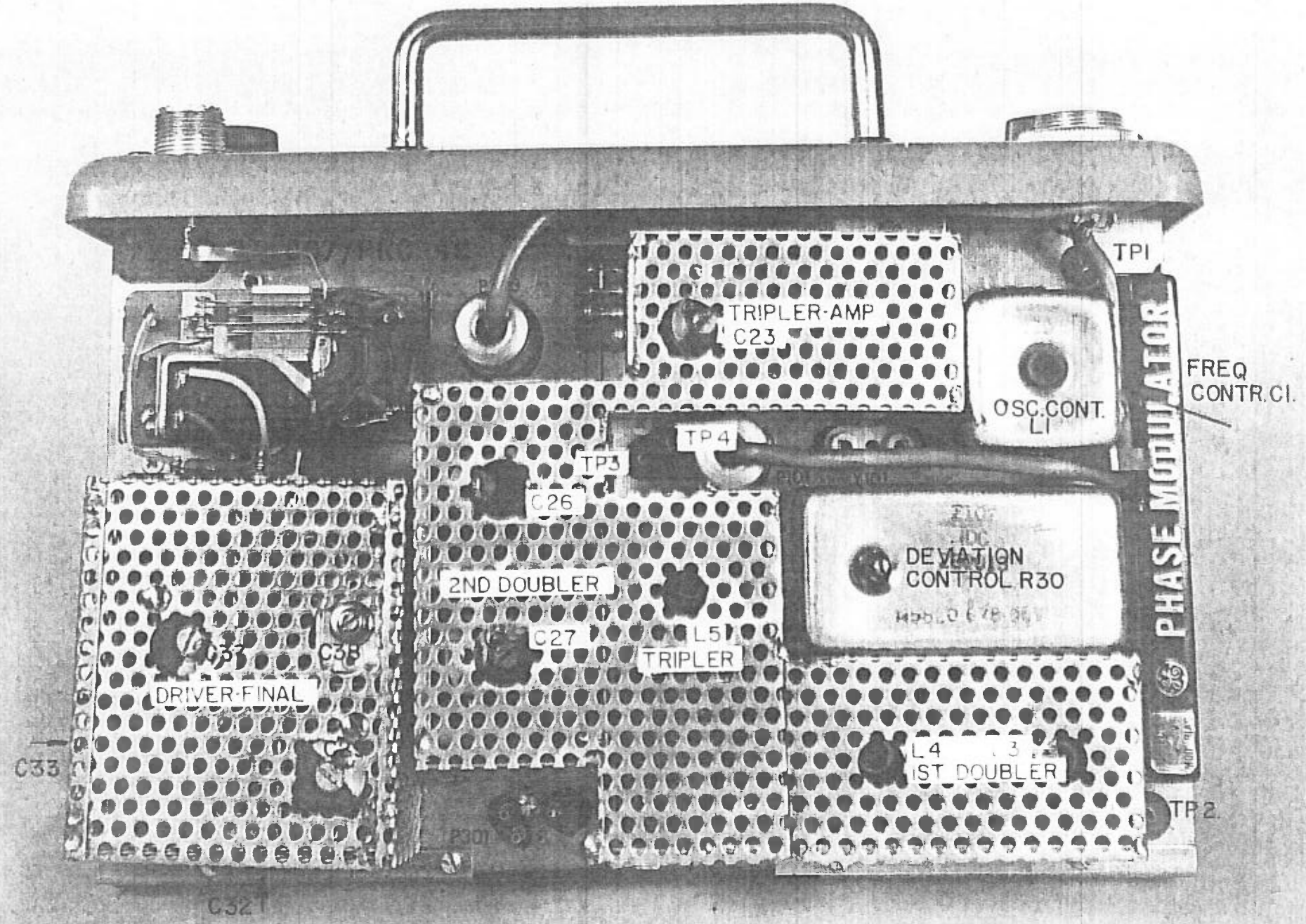
C19	12 uuF Silver Mica
C20	.05 uF 50V Ceramic Disc
C21	.001 uF Ceramic Disc
C22	12 uuF Silver Mica
C23	3.12 uuF Variable
C24	12 uuF Silver Mica
L6	4½ Turns - single spaced - #18 wire
Q4	2N1744
R10	68,000 ohm ½W 5%
R11	10,000 ohm ½W 10%
R12	2700 ohm ½W 5%

2nd Doubler

C25	.05 uF Ceramic Disc
C26	3-12 uuF Variable
C27	.05 uF 50V Ceramic Disc
C28	3-12 uuF Variable
L7	4 Turns - single spaced - #18 wire
Q5	2N1744
R13	27,000 ohm ½W 10%
R14	6,800 ohm ½W 5%
R15	270 ohm ½W 10%

Driver Final

C29	3-12 uuF Variable
C30	.05 uF 50V Ceramic Disc
C31	.05 uF 50V Ceramic Disc
C32	3-12 uuF Variable
C33	5-80 uuF Variable
C34	100 uuF Silver Mica
C35	Eliminated
C36	.05 uF 50V Ceramic Disc
C37	3-12 uuF Variable
C38	5-80 uuF Variable
C39	15 uuF Silver Mica
L8	2 Turns - triple spaced - #14 silver plated wire
L9	20 Turns - close wound - #22 wire
L10	2 Turns - triple spaced - #14 silver plated wire
L11	20 Turns - close wound - #22 wire
Q6	2N1692
Q7	2N1692
R16	4700 ohm ½W 10%
R17	750 ohm ½W 5%
R18	62 ohm ½W 5%
R19	56 ohm ½W 10%
R20	4700 ohm ½W 10%
R21	820 ohm ½W 5%
R22	15 ohm ½W 5%



PRC-40 TRANSMITTER ALIGNMENT LOCATION.

OSCILLATOR 2163

MAT AT TP1

PULSE MODULATOR

12.245

XR1

Q1

C3

L1

CR1

L2

C7

C5

R1

R2

R3

C1

C2

C4

TP1

1ST DOUBLER 2164

PEAK AT TP2

24.49

PEAK TP-2

L3

C8

C9

Q2

CR2

L4

C12

C15

R4

R5

R6

C10

C11

TP2

TRIPLER 2165

73.47

PEAK TP-3

"DRIVER AMPLIFIER"

Q3

CR3

L5

C18

R7

R8

C14

R9

C15

C16

C17

2N 1744

TP3

TRIPLER-AMPLIFIER 2166

"Doubler-2N1

Q4

C19

C24

R10

R11

R12

C20

C21

C22

C23

L6

2N 1744

TP4

Q5

R13

C25

TP4

73.47

VTVM

B3

B1

B2

Q5 B

C40

Q8

R23

R24

R25

R26

R28

C41

R29

L12

R27

C42

C43

R30

C44

C45

R31

Q9

R32

R34

R35

R36

C46

Q10

R33

R37

R38

C47

T1

C48

R39

C49

J101

P101

J102

P102

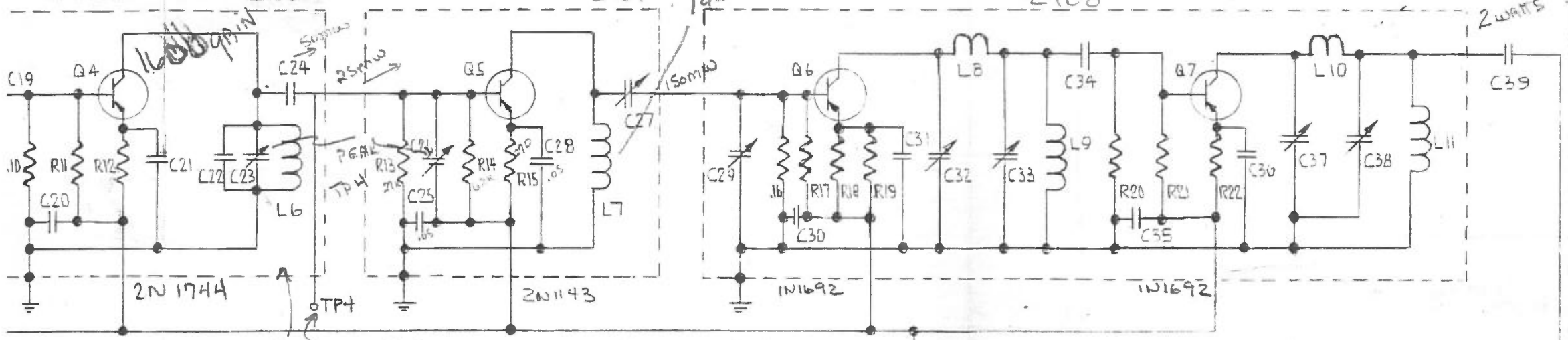
1 2 3 4

HIGHEST R = R39
C = C50
L = L12
CR = CR3
Q = Q10

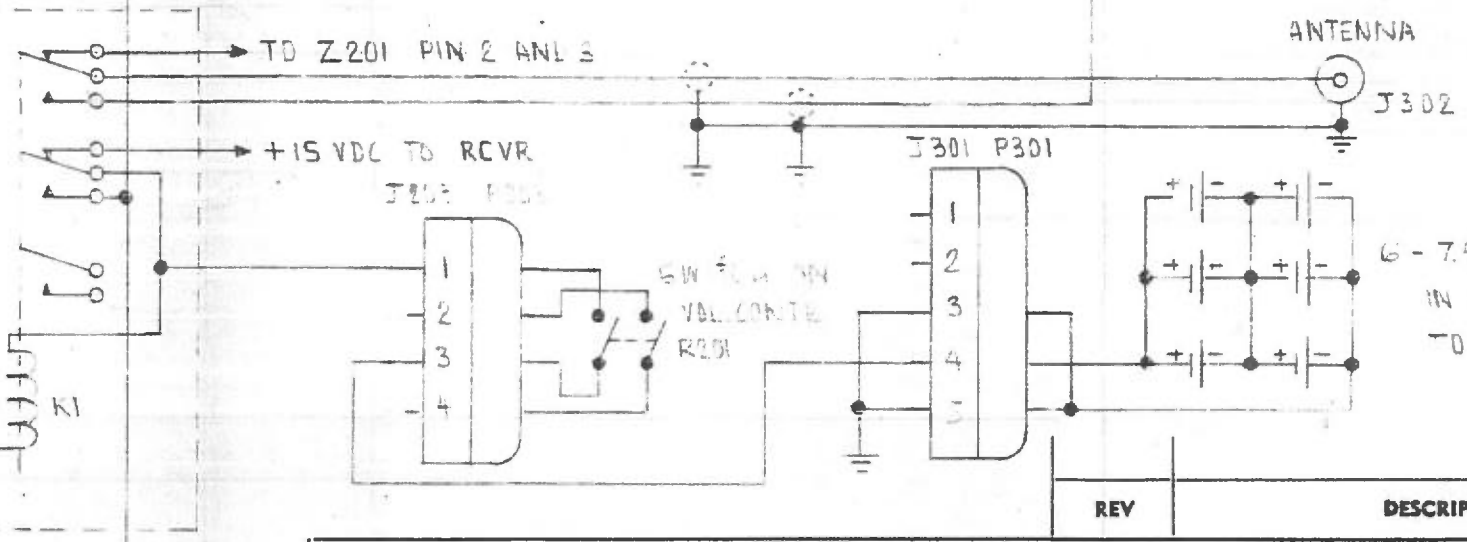
"DRIVER Amplifier"

"Doubler-Driver"

TRIPLER-AMPLIFIER Z106 | 2ND DOUBLER Z107 | DRIVER Z108 | FINAL



TX-RX RELAY



REV	DESCRIPTION	DATE	AUTH

STANDARD TOLERANCES		BY	DATE
FRACTIONS ± 1/64 ANGLES ± ½°	DWN	G.H.S	4-8-63
2 PLACE DECIMALS ± .01	CK	GME	4-8-63
3 PLACE DECIMALS ± .003	AUTH		
4 PLACE DECIMALS ± .0010	PROD		
BREAK ALL EDGES .005 TO .010	SCALE:	:	
MATERIAL:			
FINISH:			
NEXT DWG:			

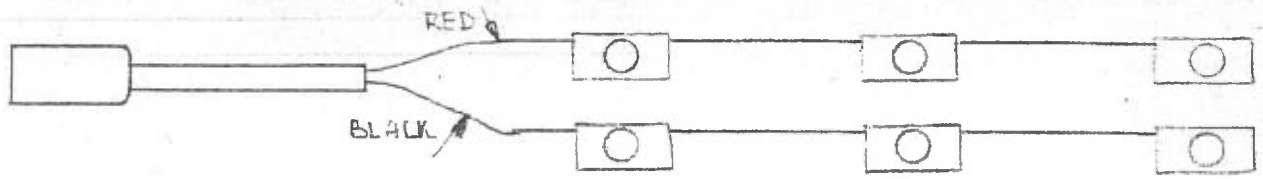
DIXON INDUSTRIES, INC.

GAITHERSBURG — MARYLAND

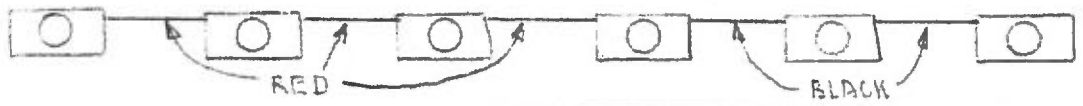
PRC-43 MODIFICATION

TRANSMITTER SCHEMATIC

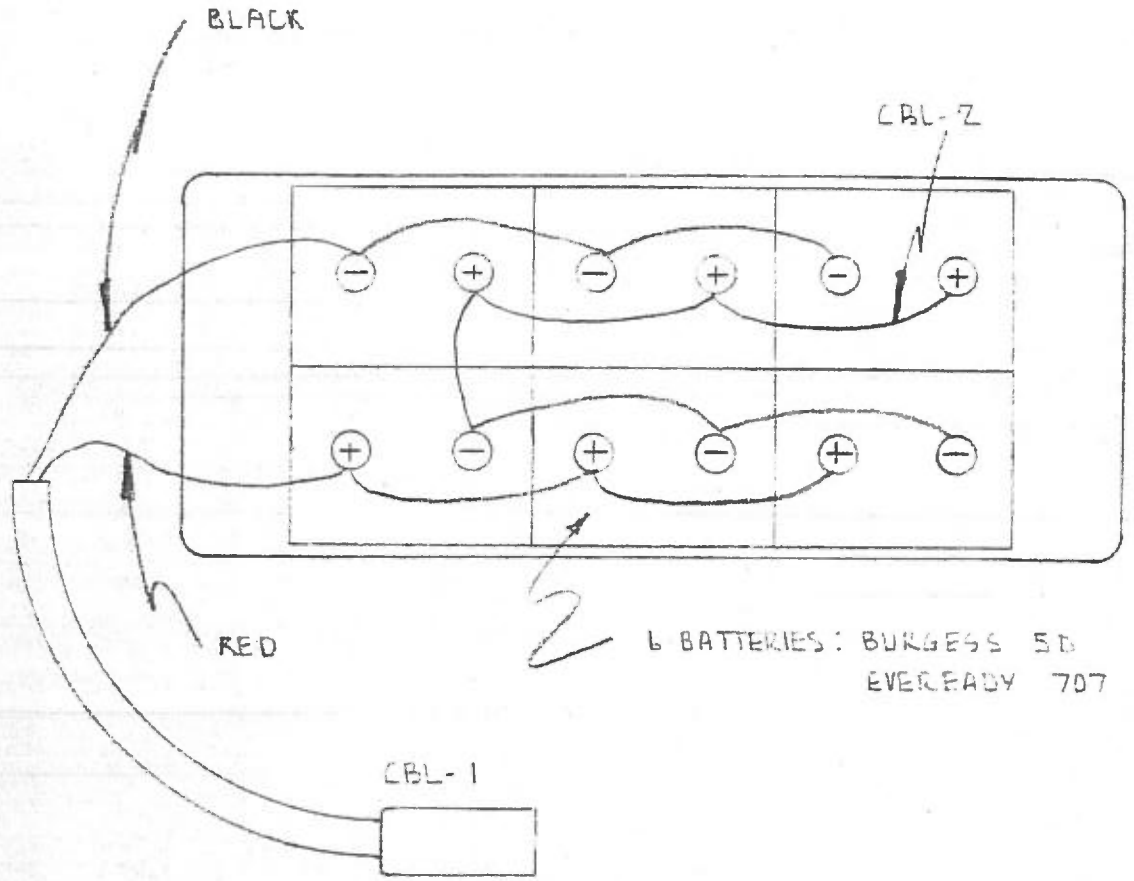
R-10012-



CABLE NO 1 (CBL-1)



CABLE NO 2 (CBL-2)



6 BATTERIES: BURGESS 5D
EVEREADY 707

REV	DESCRIPTION	DATE	AUTH

STANDARD TOLERANCES		BY	DATE
FRACTIONS ± 1/64 ANGLES ± ½° 2 PLACE DECIMALS ± .01 3 PLACE DECIMALS ± .003 4 PLACE DECIMALS ± .0010 BREAK ALL EDGES .005 TO .010	DWN	GHS	4-16-65
	CK	GME	4-16-65
MATERIAL:	AUTH		
FINISH:	PROD		
NEXT DWG:	SCALE: 1 : 2		

DIXON INDUSTRIES, INC.
GAITHERSBURG — MARYLAND

PRC-40 MODIFICATION
BATTERY PLACEMENT & CHANGE.

LP 9018