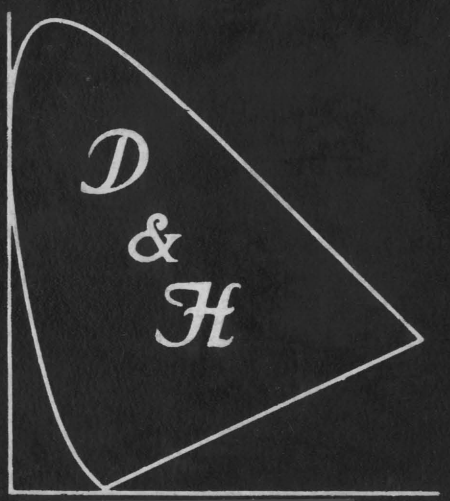
COLORANT MIXTURE COMPUTER

MODEL 10B (COMIC/TDC)

MAINTENANCE MANUAL

APPLICABLE TO COMIC 69 TDC 49 AND UP



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COLOR MEASUREMENT AND CONTROL

COLORANT MIXTURE COMPUTER

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MAINTENANCE MANUAL

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C O N T E N T S

10-10/63-C

COMIC

Maintenance Manual

INTRODUCTION

A good maintenance program on any device, and especially one as intricate as an electronic computer, is essential in order that the device may be used to its maximum capabilities with minimum down-time.

In general, maintenance consists of four sections: first, adequately trained technicians who are familiar with the instrument and trouble-shooting procedures; second, availability of spare parts, tools, and basic instrumentation; third, technical information about the instrument to acquaint the repairman with its operation; and fourth, a complete record including operating times, conditions preceding a malfunction and corrections for given malfunctions.

A program to maximize the usefulness of an instrument is based upon the assignment of one individual to be primarily responsible for the operation of the instrument. The selection of one man to service the instrument means that he will gain in experience both in component location and in how the instrument operates each time that he works on it. This becomes extremely valuable if a failure occurs during an important use period, and also, if remote trouble-shooting via Davidson and Hemmendinger personnel is necessary.

The responsible technician must also have at his disposal good quality instrumentation and tools in order that his skill is not hampered by equipment which affects the circuits that it is being used to test. For this reason, a list has been included giving examples of instrumentation and tools that have been found satisfactory for maintenance. We have selected certain manufacturers and indicated the model numbers of their particular products only as a guide in the purchases of instruments for your own maintenance. Any comparable instrument will do the job with the possible exception of the oscilloscope, the Hewlett-Packard model recommended is the same oscilloscope that is used in COMIC. It has been mechanically modified but left electrically the same. In the event of a failure of the COMIC oscilloscope, the Hewlett-Packard model which has been purchased for instrumentation could be used as the output of the computer and thereby minimize the down-time.

Part of the maintenance program is the keeping of a log book of operating time and failure reports. This type of record, if well kept and consulted, becomes a valuable asset to the repairman. If a failure does occur, he has an idea of what corrected the same or a similar failure and, therefore, makes it possible to anticipate breakdowns and replace suspected parts during periods when work on the computer will not affect production schedules. Intermittent malfunctions can be noted and recorded, and then a technician can look for the cause of these during a shut-down for failure, correction, or overhaul. In this way, a failure that occurs occasionally might be corrected before it causes down-time during a period of intensive use.

This manual supplies technical information about the instrument and will provide ideas for successful trouble-shooting.

THEORY OF OPERATION OF COMIC

Since COMIC is designed to add and subtract curves as explained in the Operation Manual, it is necessary to convert the reflectance (1) vs. wavelength information into a meaningful electrical analog for computation. To do this, the smooth curve is "iterated", in that it is approximated by a curve having sixteen flat-topped steps at regular intervals. This is shown in Fig. 1. The analog of ~~reflectance~~ wavelength - dh becomes time. The conversion of reflectance to voltage is accomplished

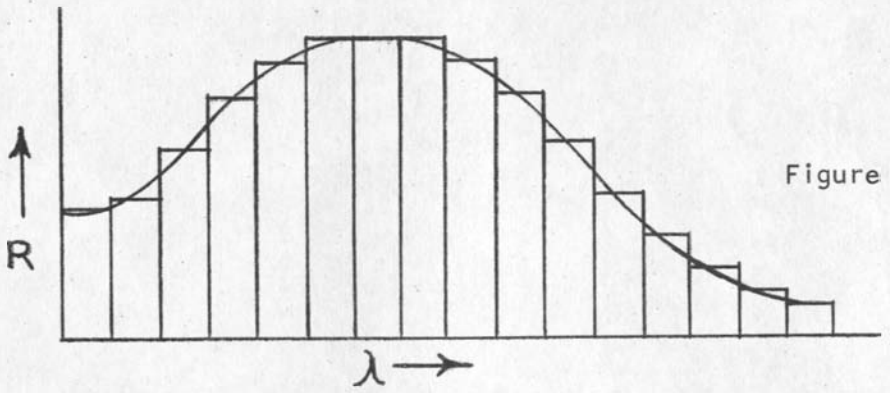
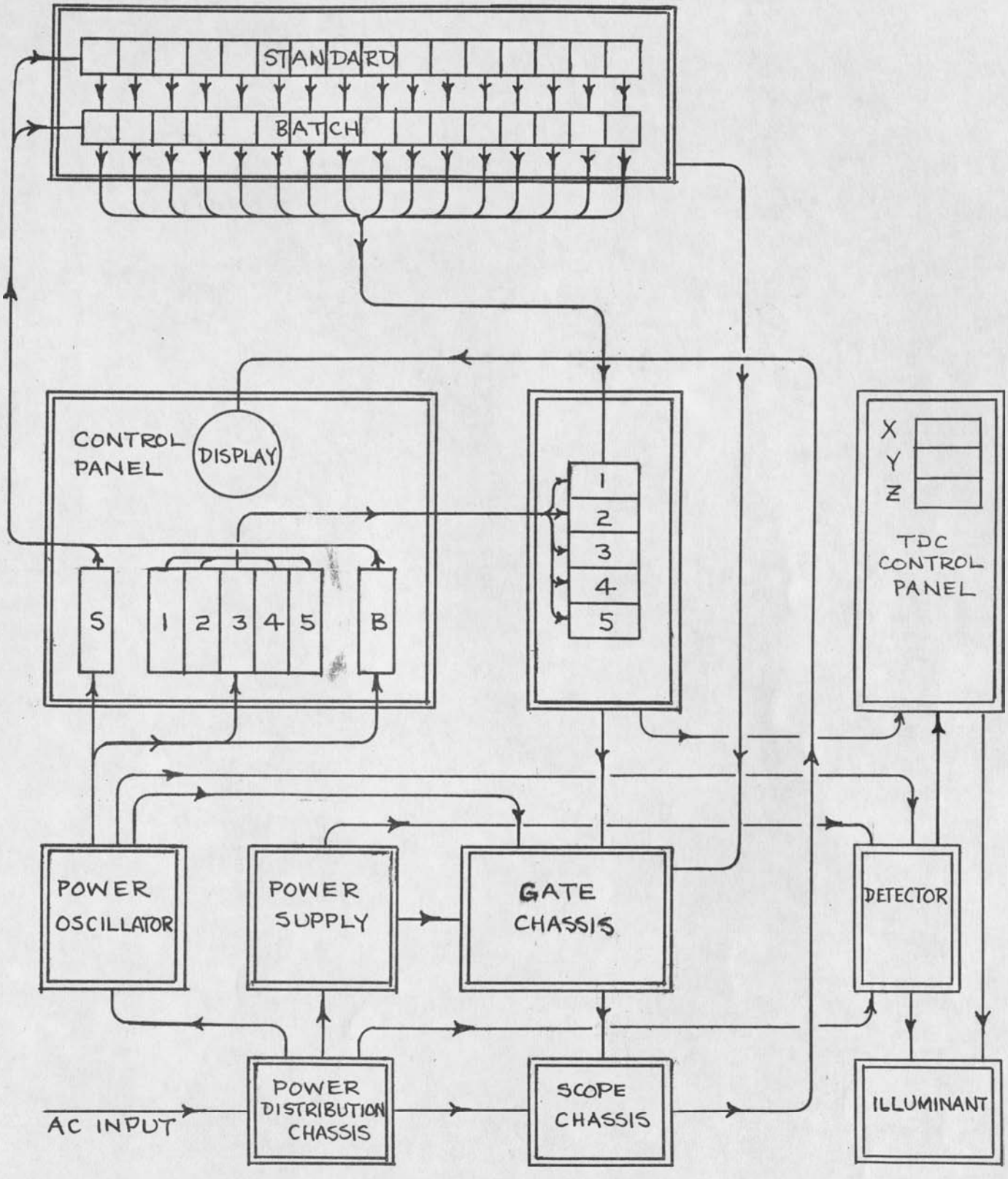


Figure 1

by the individual rows of pots in the Batch and Standard Panel and the pots in the five constituent plug-ins. The conversion of wavelength to time is performed by a parallel-to-serial converter located in the electronic system of COMIC. The amplitude of the reflectance curve is determined by the concentration and correction knobs on the Control panel. Addition of the seven curves involved is achieved through the use of a summation matrix of seven rows and sixteen columns. Each row of sixteen points represents a curve, and each column of seven addends represents the sum of the reflectance value of each of the curves at each selected wavelength point. The sixteen individual sums are displayed on the COMIC scope, and this represents the solution of the problem.



COMIC BLOCK DIAGRAM

THE COLORANT MIXTURE COMPUTER

MAIN PANEL ASSEMBLIES

1. Batch and Standard Panel
2. Oscilloscope Control Panel (behind door)
3. Control Panel
4. Plug-in Panel
5. Tristimulus Difference Control Panel

INDIVIDUAL CONTROLS

A. Standard K/S Dials

B. Batch K/S Dials

C. Point Blanking Switches

D. Colorant Display Switches

E. Concentration Dials

F. 10X Scaling Switches

G. Correction Dials

H. Colorant Add or Subtract Switches

I. Base Line Brightness Control

J. Main Power On/Off Switch

K. Power On Pilot Light

L. Computer Display

M. Zero Display Button

N. Electronic Reset Button

O. Display Zero Line Control

P. Display Sensitivity

Q. Tristimulus Ratio Input Dials

R. Tristimulus Absolute Input Dials

S. Tristimulus Absolute Input Polarity Switches

T. Standard dR/d(K/S) Input Dials

U. Tristimulus Error Display Meters

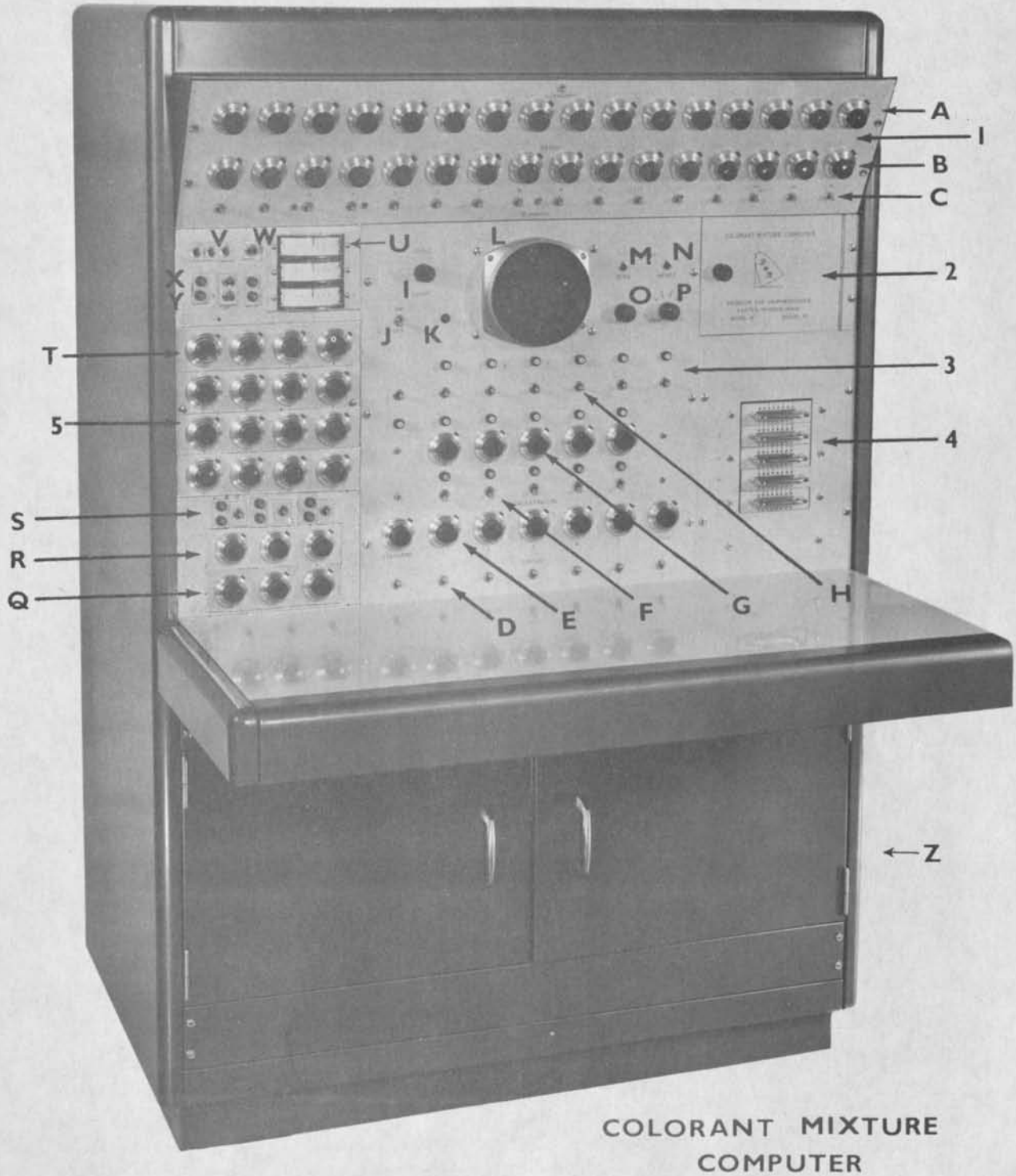
V. Meter Zero Controls

W. Meter Off Switch

X. Illuminant Select Switch

Y. Tristimulus Input Select Switch

Z. Access Doors for Calibration



COLORANT MIXTURE
COMPUTER

CIRCUIT DESCRIPTION

The computer, in a general way, consists of two sections, the electronic and the computing. Failures or malfunctions in the computing section are most easily located by comparing one suspected circuit with another of the same type. Trouble in the electronic portion must be located using standard trouble-shooting techniques. Each section will be discussed with emphasis on the particular trouble-shooting method required.

THE COMPUTING SECTION

Reference to the Comic Block Diagram will indicate the interconnections between the various chassis and panels that make up the computer. Of particular interest in this discussion,will be the four units in the upper half of the diagram, the Batch and Standard Panel, the Control Panel, the Plug-in Panel, and the TDC Panel. The primary computing voltage is generated in the Power Oscillator Chassis and feeds the seven concentration pots on the control panel and also the calibration control on the TDC detector chassis. This voltage is a 1kc square wave with a peak-to-peak amplitude of about 36 volts. This is the AC voltage measured at the Power Oscillator during calibration checks. After the concentration pots on the Control Panel, where the voltage has been split into seven independently variable sources, it passes through the scaling switches, the correction pots, the polarity switches, and into seven isolation transformers. The schematic drawing 010BB003-12 gives the details of this panel. Each of the isolation transformers feeds one of the curve generating sets of pots. There are seven of these 16-pot circuits, and they are all identical in operation, except that the Batch and Standard rows have calibrated dials. The details of these rows are shown in the schematic diagram of the Batch and Standard Panel 010BB004-6. The schematic diagram of the Transformer Chassis will be seen to be identical in function, except that the pots are left out. This circuit is completed when the five colorant plut-ins are inserted. It is an electrical requirement that all five plug-ins are in place during use or when trouble-shooting the instrument. The point-by-point summations for the Comic display are carried out by connecting the secondaries of all seven transformers, corresponding to the first point of each row of pots, in series. These sum lines are most easily seen in Drawing 010BB009-1. The complete sum line for point number one will consist of T1, T17, T33, T49 and T65 on Drawing 010BB009-1 and T1 and T17 on Drawing 010BB004-6. These sum lines go directly to the Gate Chassis where the computing voltages are prepared for display.

Analysis of the computing section then shows that it is a matrix of seven rows and sixteen columns. At each intersection, there is a 50K pot feeding a signal transformer. Therefore, any pot and transformer combination can be checked by comparing its output with another in either the same row or column. It is suggested that five plug-ins set up at 500 be used for this type of point checking test, and that the suspected point be checked against both Batch and Standard independently. It is possible to have a faulty pot in one of the removable plug-ins cause what looks like a failure in, for instance, a Standard pot. This can be checked by removing all five of the plug-ins and inserting a complete new group. If the problem disappears, the removed plug-ins can be reinserted one at a time to determine which one is at fault. If plug-ins operate correctly in one plug-in position and not in another, the malfunction will probably be found in one of the controls on the Control Panel for that position. It is unlikely that a transformer will ever fail in the computer. It is much more likely that either a pot or a switch will fail. The function of each control should be checked as completely as

possible. It will be necessary for the repairman to know something of the operational procedure for the computer in order to utilize the dials on the panel to check the individual functions. The computer operator should be able to answer questions regarding this type of check. For instance, if a colorant box is balanced against Standard and a straight line is indicated by the computer display, the display should not change if the plug-in box concentration dial reading is doubled, and the correction dial reading is halved. This simple test will check the operation of both pots as well as the loading resistor on the concentration pot. The polarity switches can be tested by comparing a plug-in with both the Batch and the Standard dials. The readouts, of course, should agree within the computing accuracy of the instrument.

A simplified representation of the TDC electrical circuit is shown in Figure 2. Complete electrical drawings will be found in the list of Electrical Drawings. The dR/d(K/S) potentiometers R145-R160, are connected across the COMIC sum lines. The outputs of these potentiometers feed individual groups of three potentiometers which are located on the Illuminant Plug-in Unit on the Illuminant Chassis. One plug-in unit will have the groups of three R1-R3, R7-R9, etc., and the other R4-R6, R10-R12. The plug-in unit to be used is selected by a switch on the control panel. The individual summations of the RE $\bar{x}$, RE $\bar{y}$, and RE $\bar{z}$ values and the outputs of the Δ X, Δ Y and Δ Z potentiometers are carried out in the vertical sum lines shown. The summation of the RE $\bar{x}$ values at the 16 points is carried out by connecting the secondaries of the isolation transformers T1, T4, ... T46, and T55 in series and feeding this voltage to the amplifier which consists of V1 and V2. Since this is a nulling circuit, a reversing switch SW1 is provided to allow the Δ X potentiometer output to cancel the existing sum of T1, T4 ... T46. The amplifier output is fed to a phase-sensitive null detector and the output of the detector is used to drive the X meter. Analysis of the Y and Z circuits is similar.

The instrument then, in a general way, consists of 16 identical horizontal circuits and three identical vertical circuits. This will be an aid in trouble-shooting the TDC for malfunctions. For instance, if one of the meters does not respond to a change in the input or the Δ dial, it is a simple matter to exchange the suspected amplifiers with a pair that are operating satisfactorily. If this does not clear up the problem, the repairman could exchange the amplifier input leads, and in this manner, determine in which section of the instrument the malfunction exists.

To isolate the TDC from Comic, disconnect the following cables:

The sum cable on the rear of the plug-in chassis that goes to the TDC control panel, the cable on the front of the power oscillator that goes to the Detector Chassis, the small cable on top or the Power Supply that goes to the Detector Chassis, and the cable on top of the Distribution Chassis that goes to the TDC panel. With these cables disconnected, Comic will function as an independent unit and can be tested without the influence of TDC. If a change is noticed, other than a slight drop in gain of the entire curve when TDC is reconnected, then a malfunction may exist in TDC that is affecting Comic.

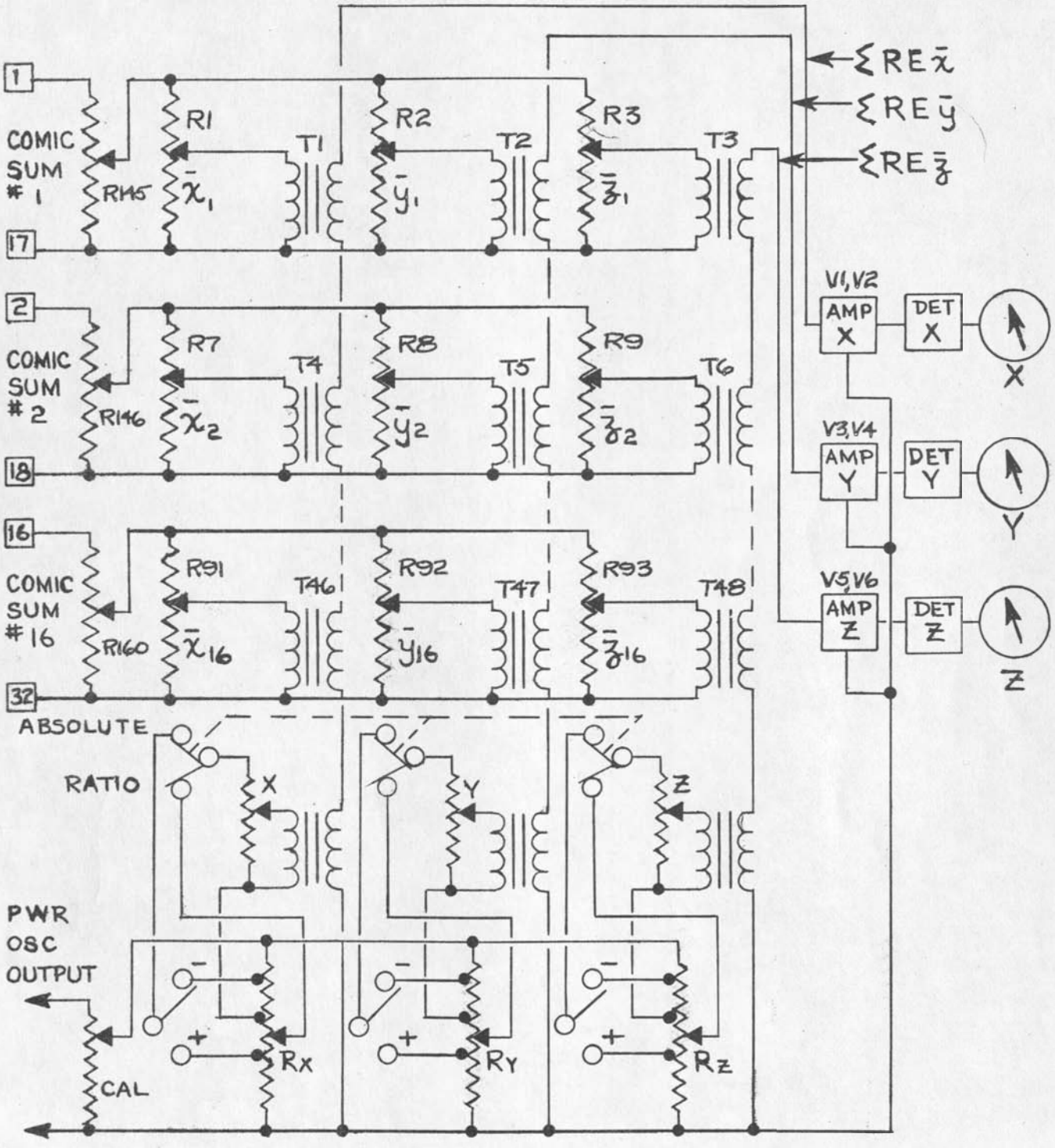

1
COMIC SUM #1
17
R1
R2
R3
T1
T2
T3
RH5
$\bar{x}_1$
$\bar{y}_1$
$\bar{z}_1$
2
COMIC SUM #2
18
R7
R8
R9
T4
T5
T6
R146
$\bar{x}_2$
$\bar{y}_2$
$\bar{z}_2$
16
COMIC SUM #16
32
R91
R92
R93
T46
T47
T48
R160
$\bar{x}_{16}$
$\bar{y}_{16}$
$\bar{z}_{16}$
$\Sigma RE\bar{x}$
$\Sigma RE\bar{y}$
$\Sigma RE\bar{z}$
V1,V2
AMP X
DET X
X
V3,V4
AMP Y
DET Y
Y
V5,V6
AMP Z
DET Z
Z
ABSOLUTE
RATIO
X
Y
Z
PWR OSC OUTPUT
CAL
R_X
R_Y
R_Z

FIG. 2

THE ELECTRONIC SECTION

The function of the electronic portion of the Comic is to change the form of the signal voltages developed in the computing section into a usable display for the computer operator. The output device used is a modified oscilloscope with a remote CRT and vertical controls. The CRT is mounted in the center of the control panel, and the vertical position control, relabelled zero, and the vertical sensitivity, labelled sensitivity, are mounted immediately to the right of it. The scope inputs are derived from the Gate Chassis located below the writing surface on the right side of the computer. The horizontal (X) axis input is a 16-step staircase generated by four Z90059 flip-flops and the horizontal detector can. The vertical (Y) axis input is the sequenced sum line voltages. This parallel to serial conversion is performed by the two rows of eight Z90166 flip-flops and the associated 16 gate cans. Synchronism between the two inputs is provided by a Z8889 one shot multivibrator that generates a pulse when the sixteenth step is reached and is used to reset all flip-flops to an initial condition. The staircase and gate rings are driven by a clock circuit consisting of two Z90166 flip-flops and a Z90001 squaring circuit. This clock output is also used to generate a pulse for the purpose of modulating the intensity of the display. This pulse occurs during each gate "ON" period,and its position in relation to the beginning of the "ON" is adjustable through the use of the line straightness pot. These pulses can be selectively eliminated by the blanking switches on the B & S panel and the Z8327 pulse gate. The effect of the pulse is to cause a brighter display during a portion of each gate "ON" period. This creates the effect of dots on the screen. The output of the gate cans is amplified by the AC coupled Z8762 amplifier and fed to a null detector circuit. There are two balance controls for this circuit, and they are labelled dot size and zero balance. These pots are located beside the line straightness pot on the Gate Chassis, and their settings are explained in the computer calibration section.

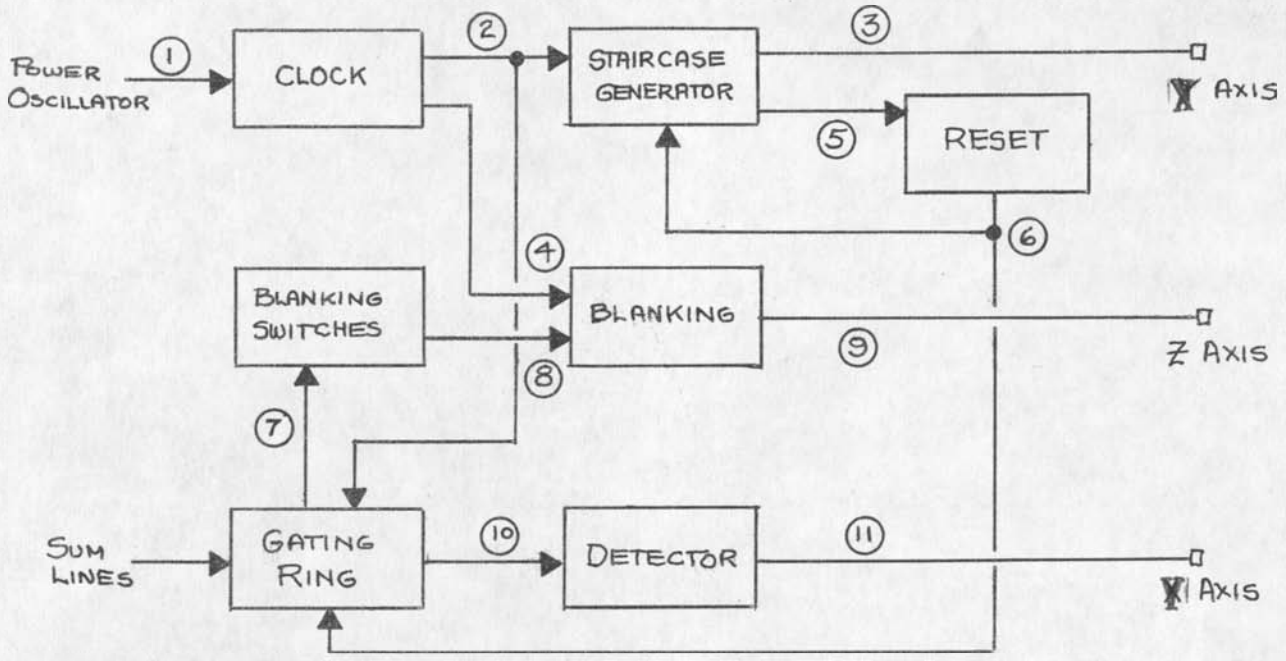
The filament and plate voltages for the tubes on the Gate Chassis are obtained from the two electronically regulated power supplies located on the Power Supply Chassis.

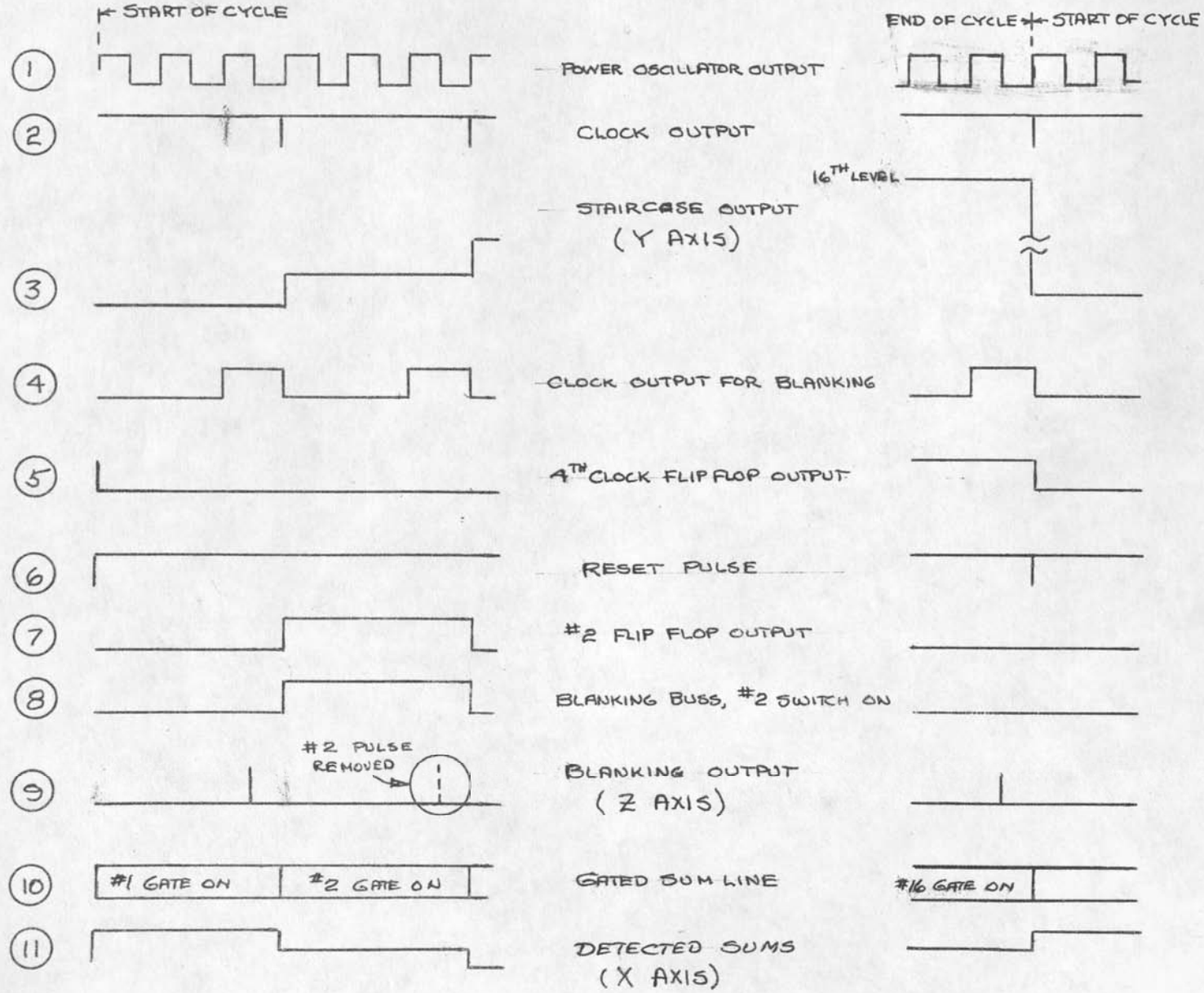
The driving voltage for the clock circuit is obtained from the Z90001 squaring circuit on the Power Oscillator chassis. The 18 VAC output from the oscillator is used to provide the signal voltages on the Comic control panel and also to drive the polarized null detector on the Gate Chassis.

The Power Distribution Chassis is an AC line voltage junction box controlled by the power switch on the Comic control panel. One side of this switch is always "HOT" when the instrument is plugged in, so that caution should be exercised when working near it. Also located in the distribution chassis is a 24 VDC power supply to operate the relays on the illuminant chassis.

The electronic portion of the TDC is located in the detector chassis. The filament and plate voltages are obtained from the front supply on the Power Supply Chassis. Polarizing and driving voltage is obtained from the Power Oscillator.

COMPUTER WAVESHAPES





INITIAL PROCEDURE

In the event of a malfunction that impairs the use of the computer, it is suggested that prior to a request from Davidson and Hemmendinger, the procedure outlined below should be followed.

1. Check all voltages as per the instructions in the calibration provided. Check all fuses. If a major symptom such as a single dot has occurred, do not change the calibration controls on the Gate Chassis until some kind of vertical display has been found. If no display can be found, disconnect the round amphenol plug on the side of the Scope chassis. Turn the intensity control full CW and center the dot with the horizontal control and the panel zero control. If no dot can be found, consult the Hewlett Packard Manual provided.

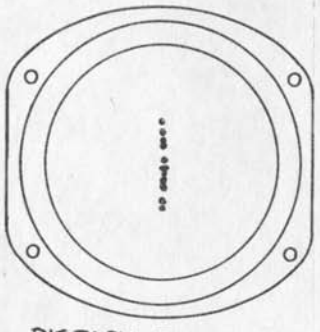
2. Check all applicable tubes with a good mutual conductance tube tester or substitute a good tube for each suspected one in turn. Tube layouts are given showing the sections of each chassis that are associated with each axis.

3. Exchange EECO plug-in units in the suspected portion of the computer with identical units used in other sections.

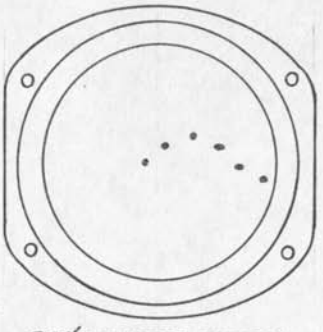
In almost all cases, the above procedure will allow the repairman to locate the problem in the shortest time. The above tests will, of course, not be effective in the location of faulty pots or panel components. Failures of this type will be apparent to the operator while he is using the instrument or show up during periodical calibration checks.

TYPICAL FAILURE PATTERNS

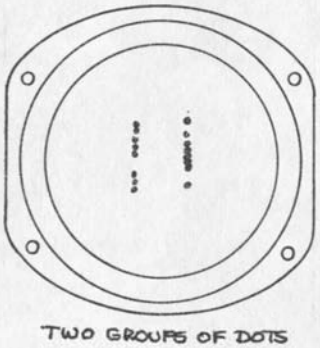
On the following pages, are representations of typical failure patterns and layout charts showing the electronic portions that are most likely to be associated with the failure. The failures have been divided into four categories, single dot, horizontal, vertical and blanking, for ease of lookup and extra blank pages are included, so that the repairman may record new failure patterns as they occur and the measures taken to correct them. The repairman will note that under each pattern is given the chassis name and component that is the most likely to cause the problem. These are, of course, only guides where to begin. The malfunction may be in a component under the socket of the suspected unit or in a circuit before or after it.



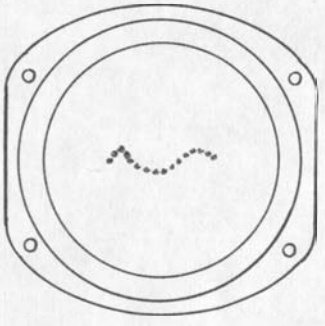
DISPLAY COMPRESSED
SCOPE - ANY
GATE CHASSIS - ANY



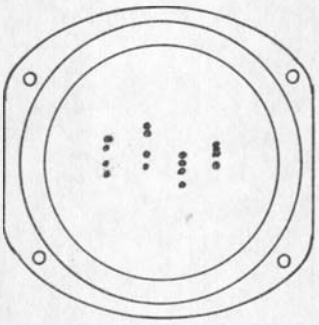
CAN'T CENTER DISPLAY
SCOPE - ECC82



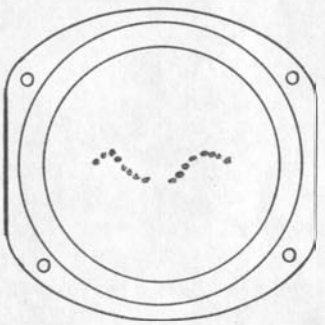
TWO GROUPS OF DOTS
GATE CHASSIS - Z90059



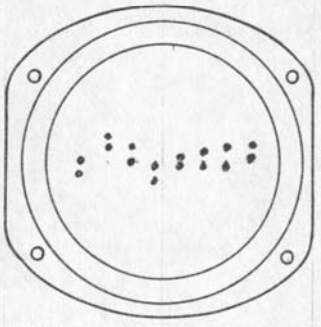
LOW HORIZ. GAIN
SCOPE - 6DJ8



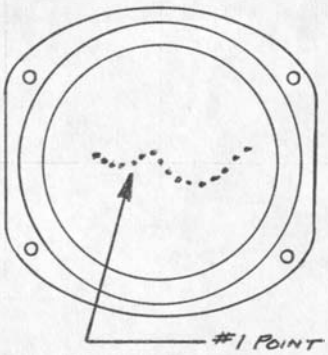
FOUR GROUPS OF DOTS
GATE CHASSIS - Z90059



16 DOTS, BUT NOT EVENLY SPACED
GATE CHASSIS - DET



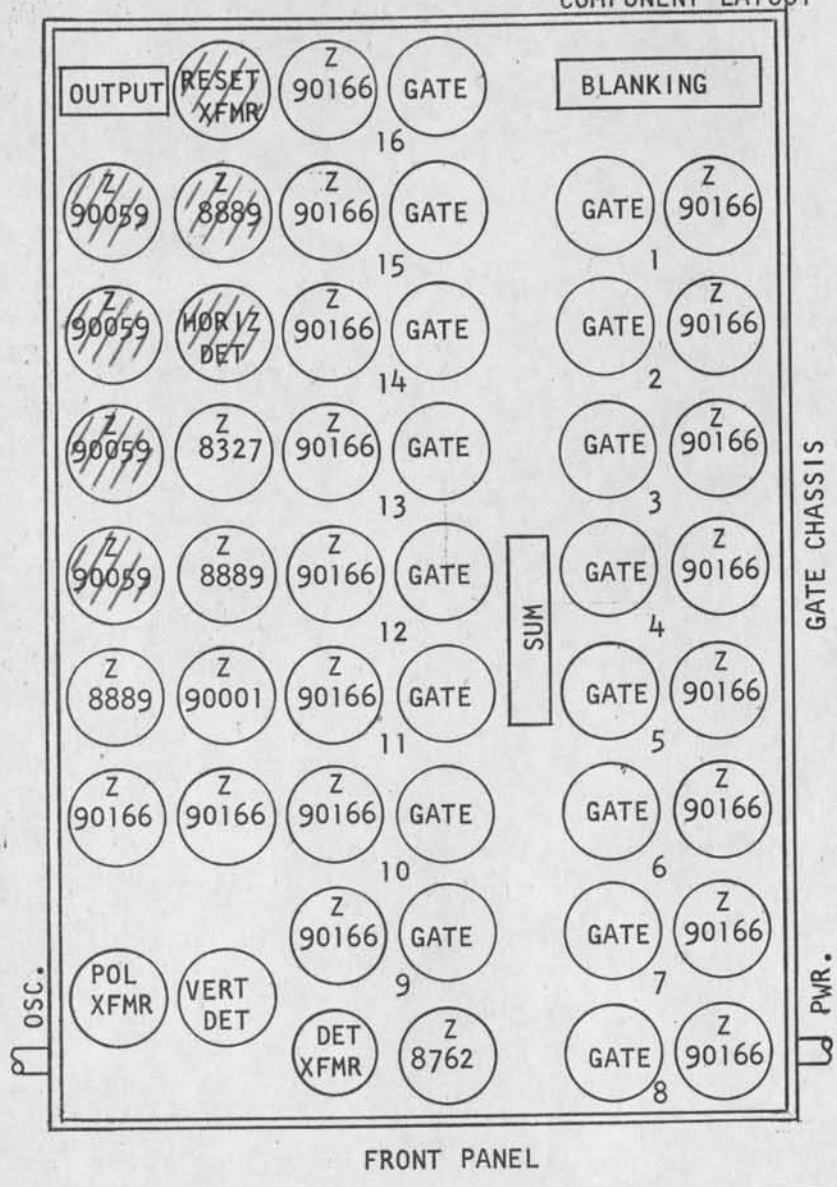
EIGHT GROUPS OF DOTS
GATE CHASSIS - Z90059

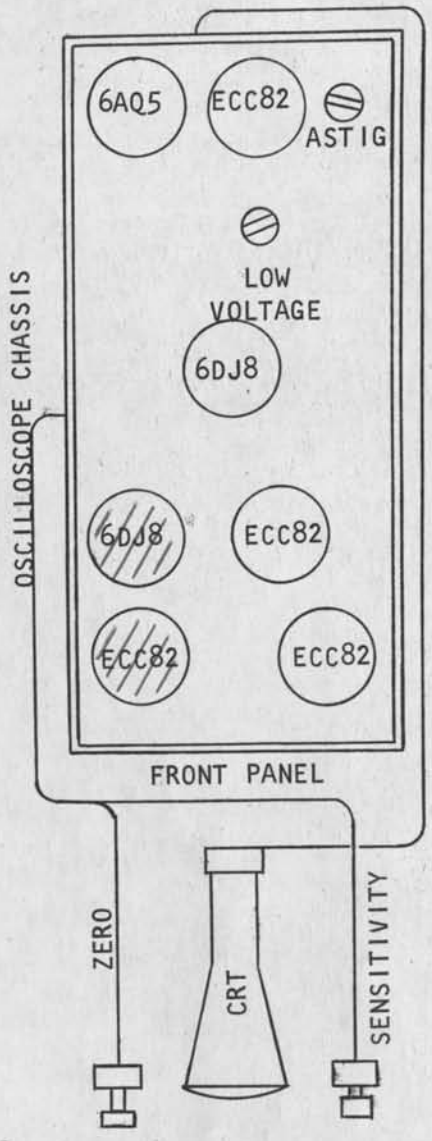


DOTS NOT IN ORDER
GATE CHASSIS - Z8889

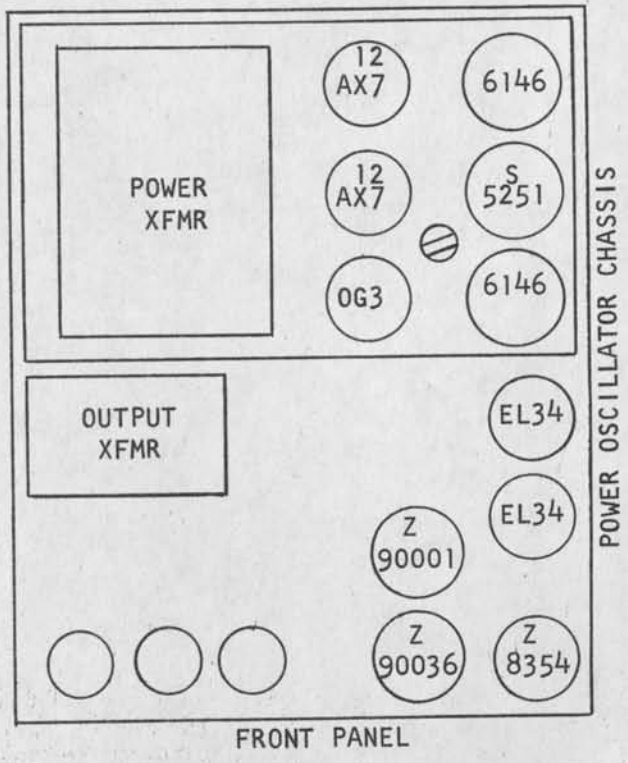
SCOPE PATTERNS INDICATING HORIZONTAL FAILURES

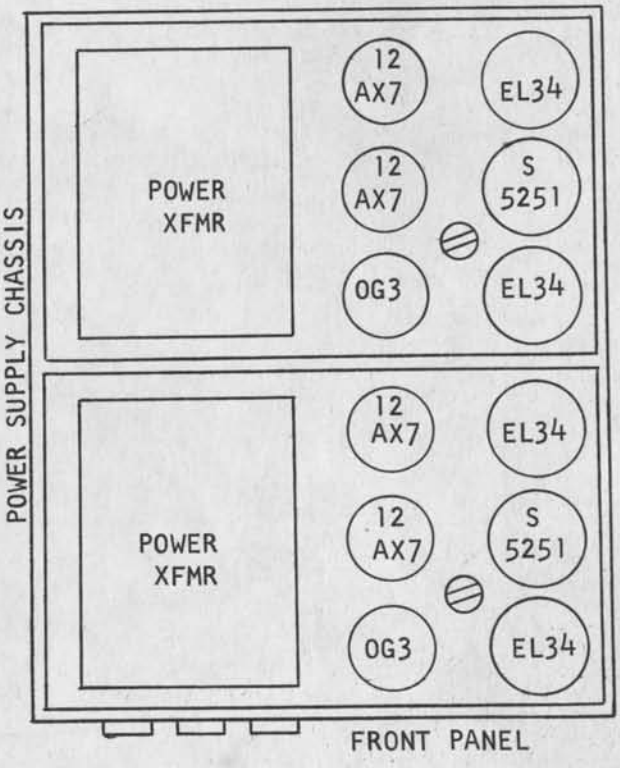
COMPONENT LAYOUT

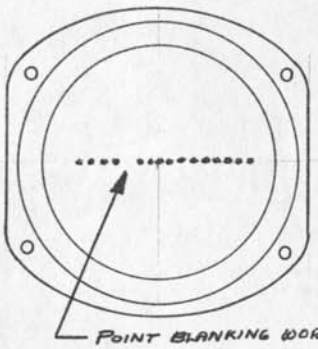




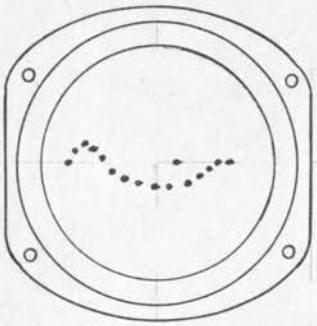
HORIZONTAL (X) AXIS



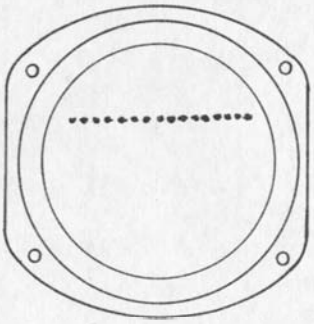




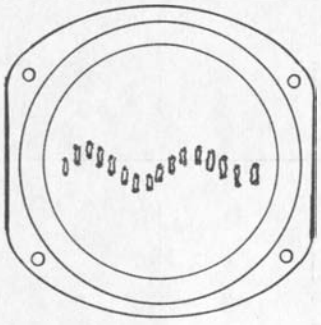
POINT BLANKING WORKS
NO VERTICAL MOTION
ANY EXCEPT Z90166



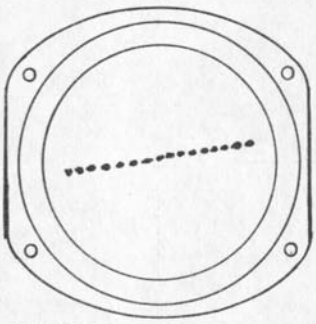
ONE POINT WON'T MOVE
GATE CHASSIS - GATE CAN



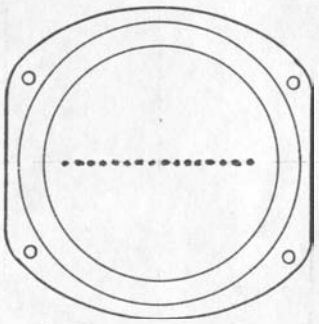
CAN'T ZERO DOTS
SCOPE - ECC82



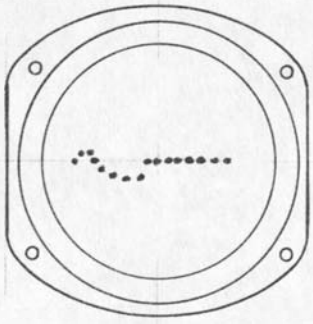
DOTS ARE NOISY
GATE CHASSIS - Z8762
SCOPE - ANY



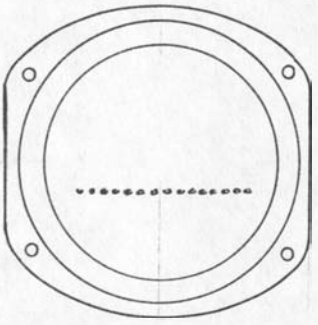
ZERO LINE CROOKED
CRT CROOKED



NO POINT BLANKING
POWER SUPPLY - FUSE

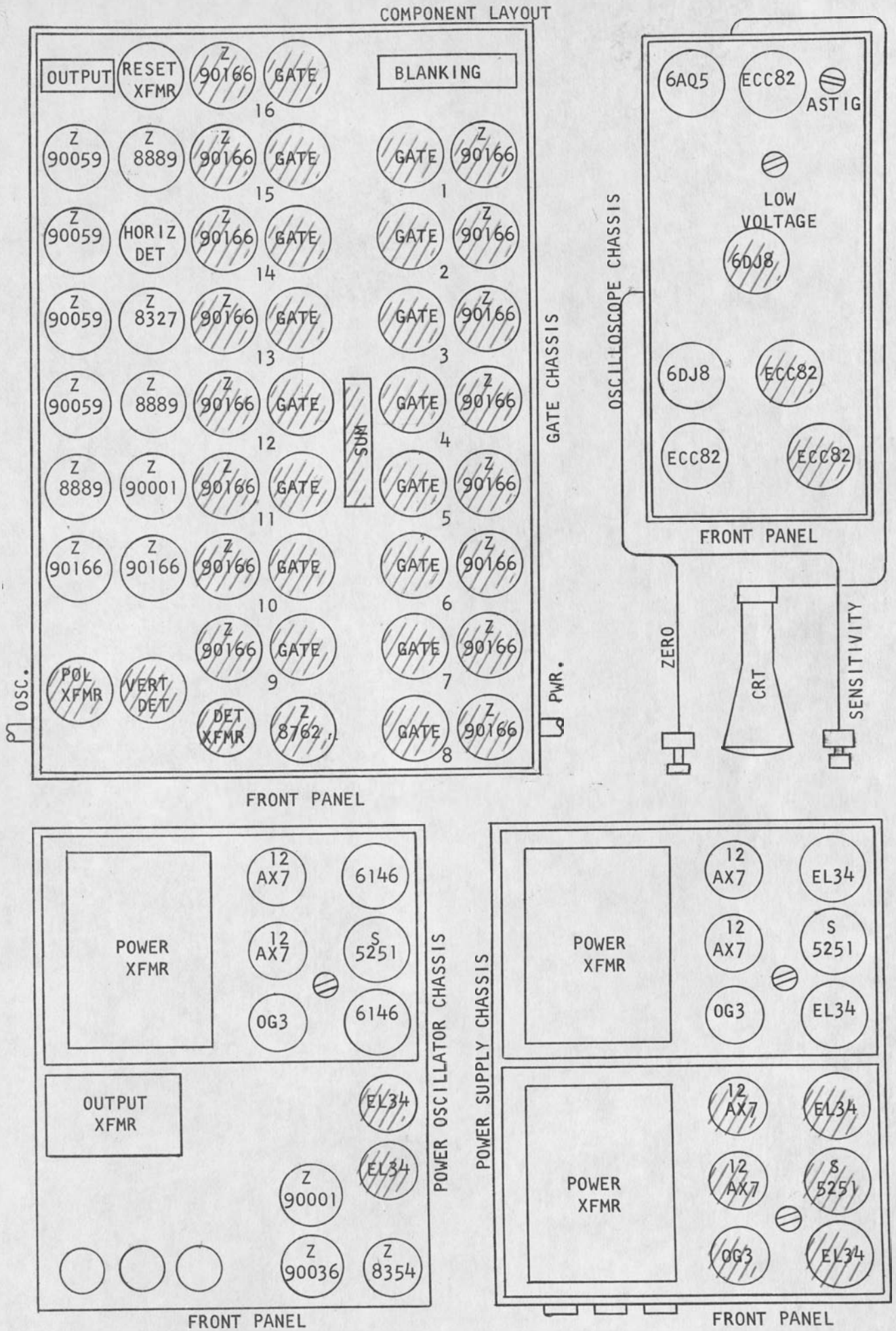


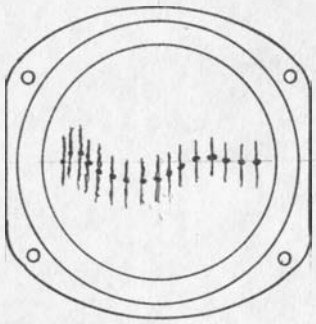
ZERO DISPLAY AFTER POINT
GATE CHASSIS - Z90166



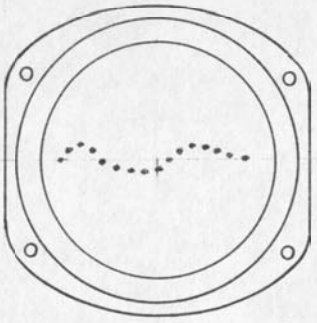
ONE POINT DIAL MOVES ALL DOTS
GATE CHASSIS - Z90166

SCOPE PATTERNS INDICATING VERTICAL FAILURES

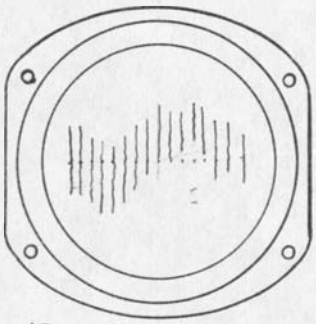

COMPONENT LAYOUT
OUTPUT
RESET XFMR
Z 90166
GATE
16
BLANKING
Z 90059
Z 8889
15
HORIZ DET
14
Z 8327
13
12
SUM
Z 8889
Z 90001
11
10
9
POL XFMR
VERT DET
DET XFMR
Z 8762
OSC.
GATE CHASSIS
PWR.
1
2
3
4
5
6
7
8
FRONT PANEL
OSCILLOSCOPE CHASSIS
6AQ5
ECC82
ASTIG
LOW VOLTAGE
6DJ8
ECC82
ECC82
ECC82
FRONT PANEL
ZERO
CRT
SENSITIVITY
VERTICAL (Y) AXIS
POWER XFMR
12 AX7
6146
S 5251
OG3
POWER OSCILLATOR CHASSIS
OUTPUT XFMR
EL34
Z 90001
Z 90036
Z 8354
FRONT PANEL
POWER SUPPLY CHASSIS
FRONT PANEL



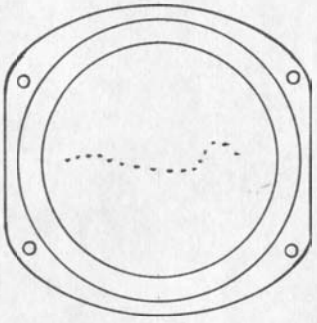
VERTICAL LINES WITH DOTS
GATE CHASSIS-~~Z~~8327
SCOPE - ANY



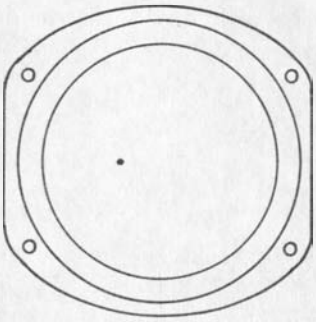
NO SWITCH BLANKS
GATE CHASSIS - Z8327
CABLE TO SWITCHES



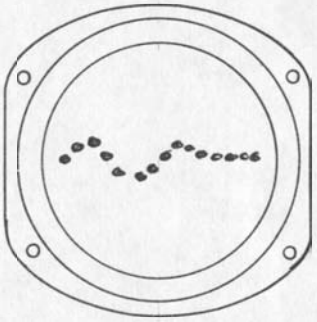
VERTICAL LINES NO DOTS
GATE CHASSIS - ANY



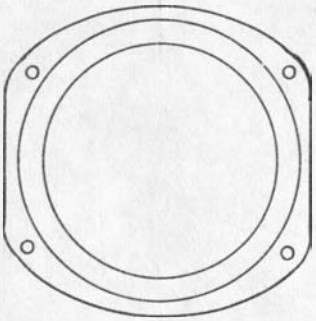
DOTS VERY WEAK
GATE CHASSIS - Z8327, 8889
SCOPE - CRT



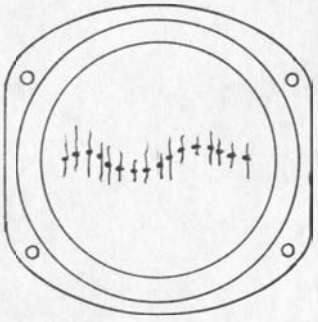
ONE DOT WON'T BLANK
GATE CHASSIS - DIODE OR RES.
PANEL SWITCH OR WIRE



INTENSITY BLOOMS
SCOPE - HV SUPPLY

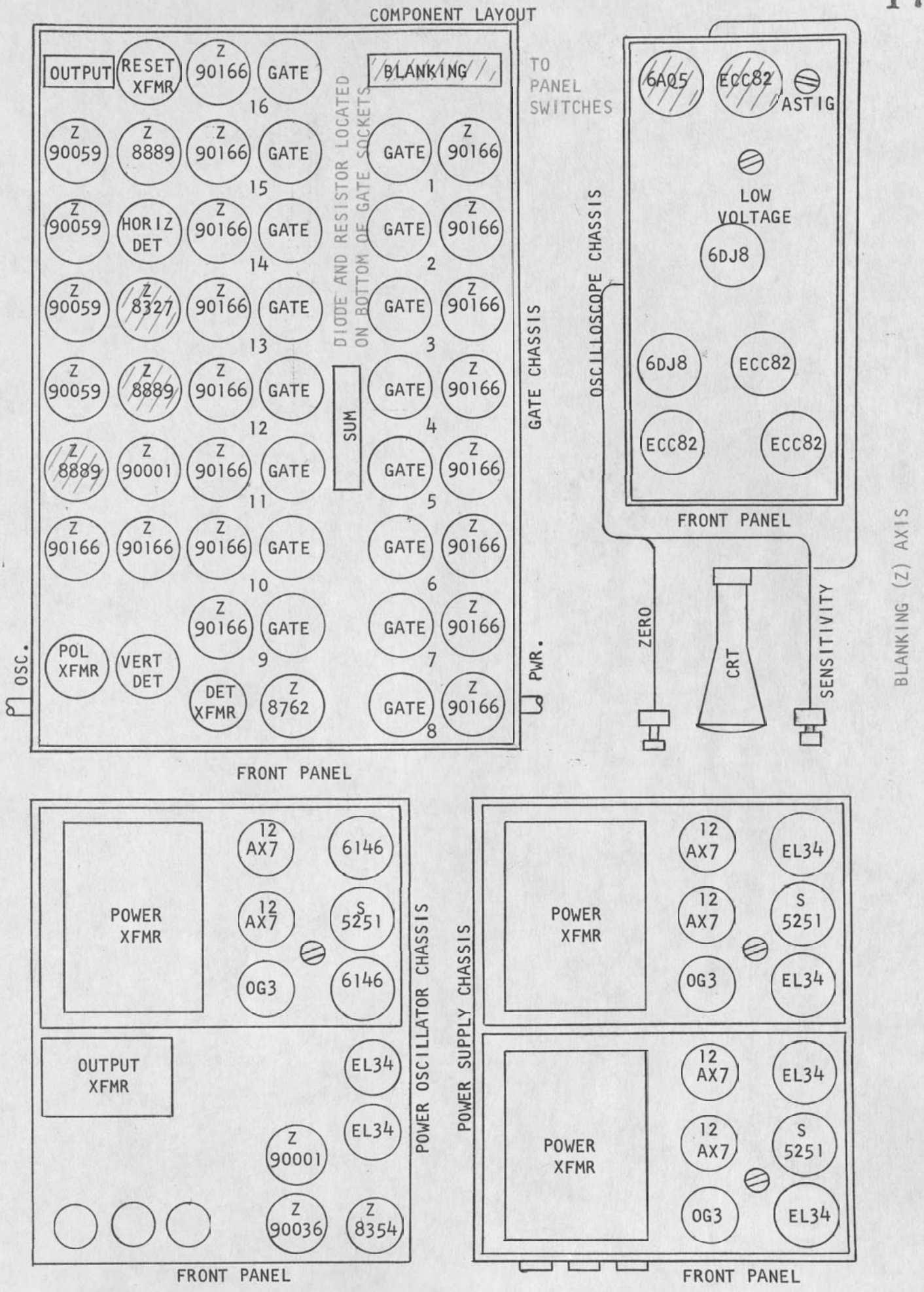


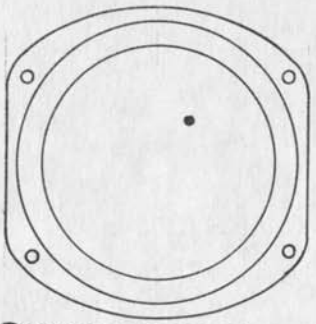
ONE SWITCH BLANKS ALL DOTS
GATE CHASSIS - DIODE



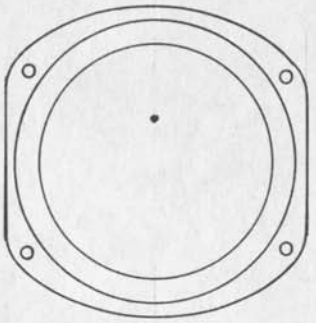
NO INTENSITY CONTROL
SCOPE - ANY

SCOPE PATTERNS INDICATING BLANKING FAILURES

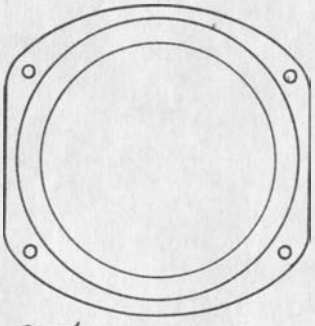

COMPONENT LAYOUT
OUTPUT
RESET XFMR
Z 90166
GATE
16
BLANKING
TO PANEL SWITCHES
DIODE AND RESISTOR LOCATED ON BOTTOM OF GATE SOCKETS
Z 90059
Z 8889
15
HORIZ DET
14
Z 8327
13
12
SUM
Z 90001
11
10
9
POL XFMR
VERT DET
DET XFMR
Z 8762
8
7
6
5
4
3
2
1
GATE CHASSIS
OSC.
PWR.
FRONT PANEL
6AQ5
ECC82
ASTIG
LOW VOLTAGE
6DJ8
OSCILLOSCOPE CHASSIS
ZERO
CRT
SENSITIVITY
BLANKING (Z) AXIS
POWER XFMR
12 AX7
6146
S 5251
OG3
POWER OSCILLATOR CHASSIS
OUTPUT XFMR
EL34
Z 90036
Z 8354
POWER SUPPLY CHASSIS



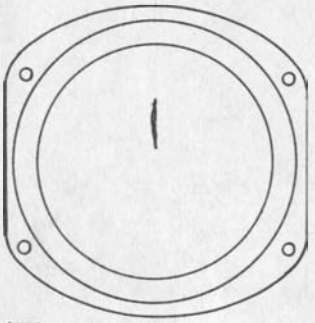
DOT MOVED BY SCOPE CONTROLS
PROBABLY NOT SCOPE



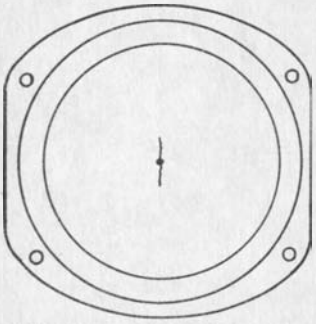
DOT AFFECTED BY POINT DIAL
GATE CHASSIS - Z90001



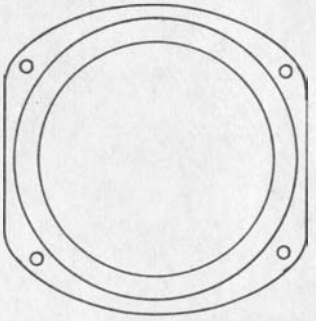
CAN'T FIND DOT
SCOPE - LV SUPPLY

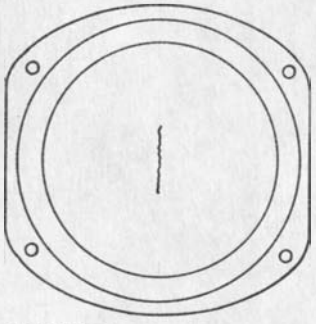


VERTICAL LINE AFFECTED
BY POINT DIAL
GATE CHASSIS - Z90166

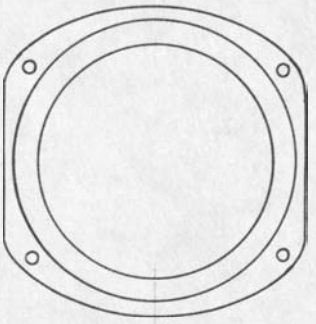


VERTICAL LINE WITH DOT
GATE CHASSIS - Z90001



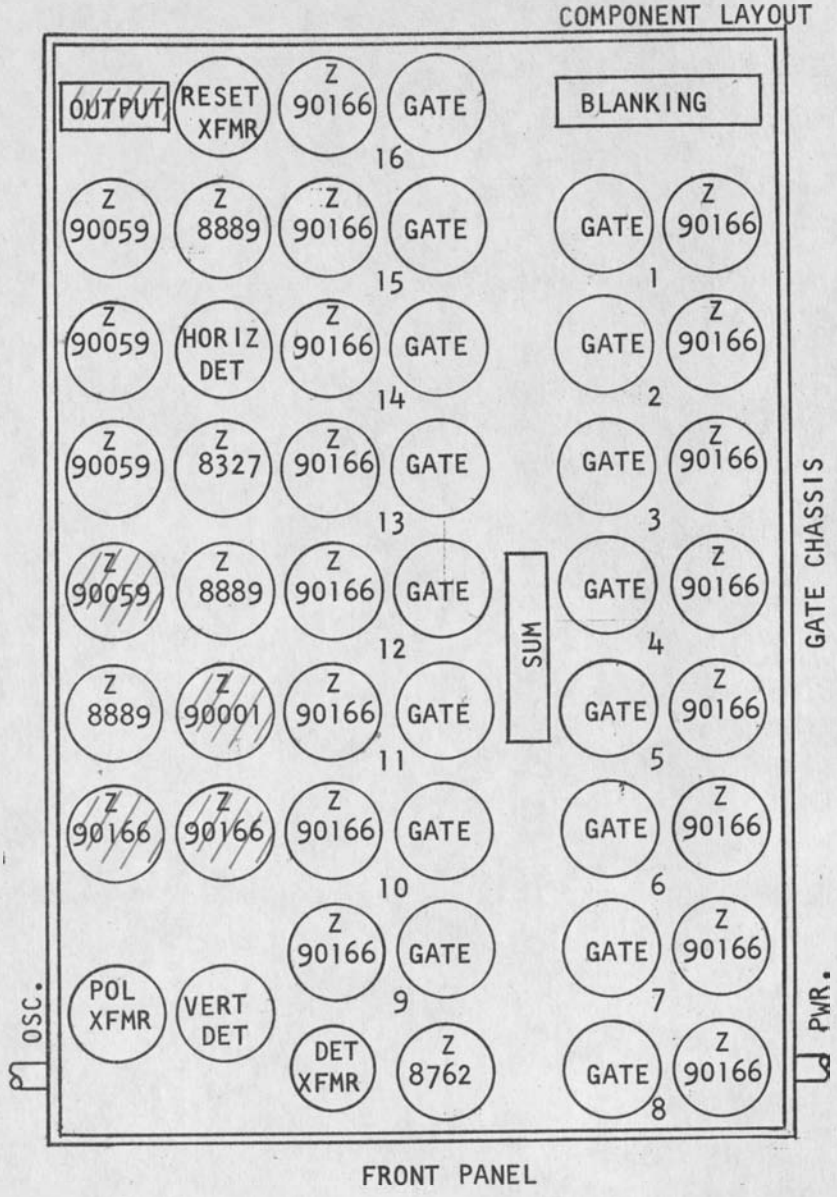


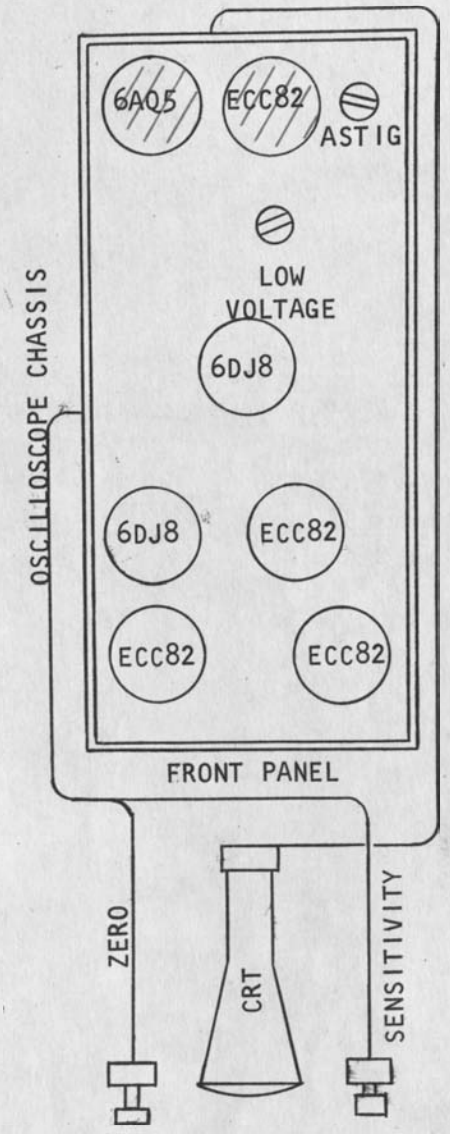
VERTICAL LINE, NO DOT
GATE CHASSIS - Z90166
POWER OSC - Z90001



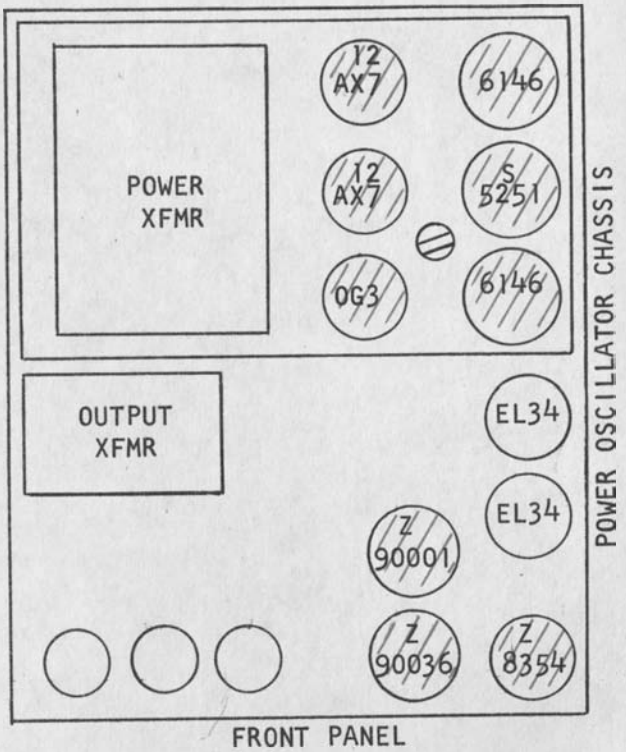
SCOPE PATTERNS INDICATING SINGLE DOT FAILURES

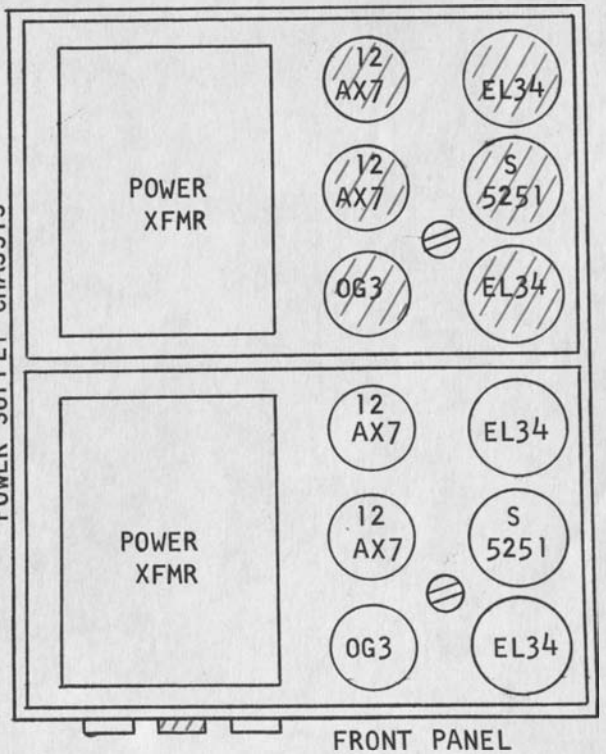
COMPONENT LAYOUT

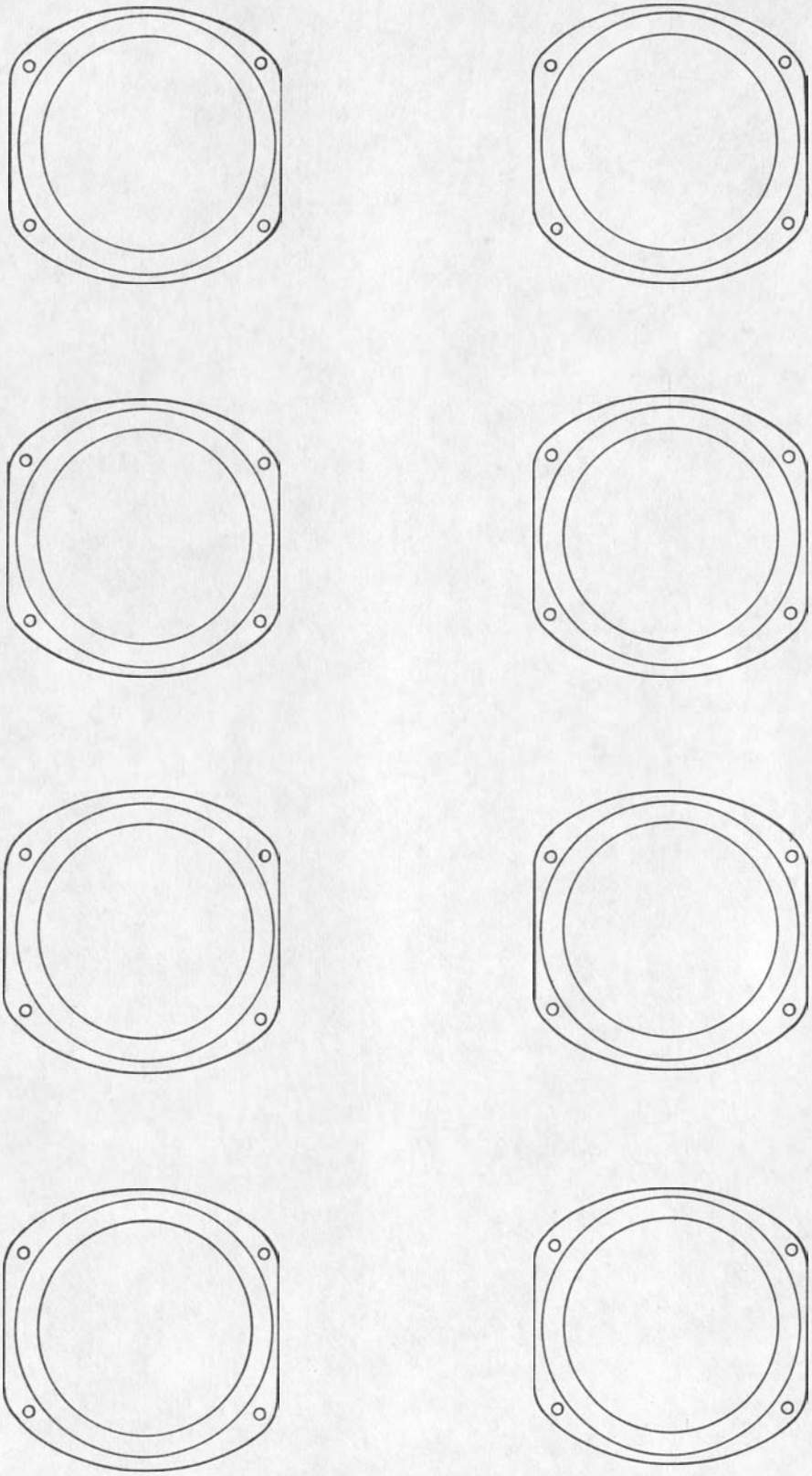


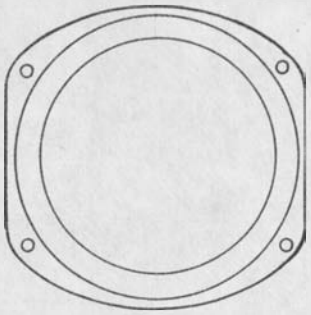
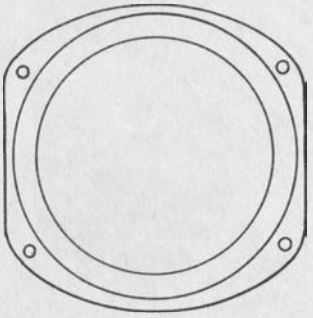
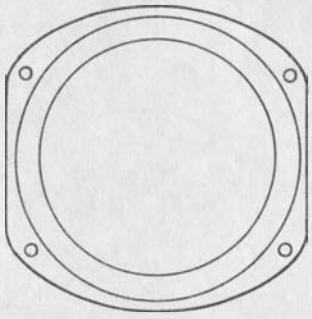
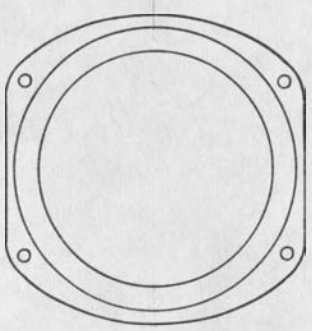
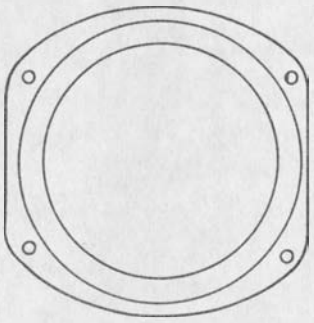
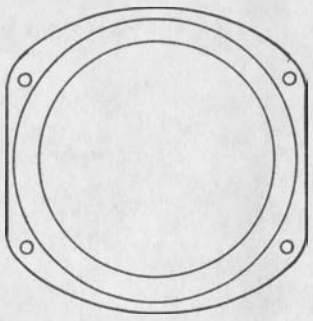
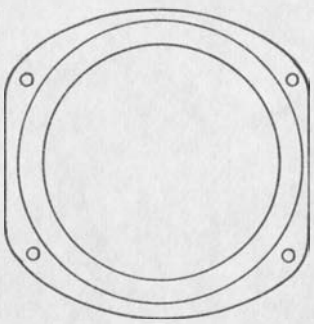
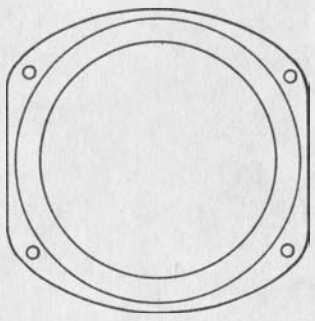


SINGLE DOT







CHASSIS CALIBRATION PROCEDURES

Simple periodic calibration of the individual chassis results in better operation and improved repeatability of COMIC. When calibrating a chassis, care must be taken to read at the same point and with equivalent meters at all times.

Power Supply Chassis

Set the two voltages at +200V, ±5V by rotating the B+ ADJUST potentiometers. The potentiometer on the rear supply varies the voltage at the left B+ fuse, and the potentiometer on the front supply varies the voltage at the right B+ fuse. Read the voltages between the fuse tap and the ground jack.

If the potentiometer does not vary the voltage:

1. Examine the fuse to see if it is open.
2. Determine that the meter is across the proper points for the supply being adjusted.

This procedure should be repeated every month.

Power Oscillator Chassis

Set the voltage at +270V, ±5V by rotating the OUTPUT ADJUST potentiometer. This chassis may have to be removed from COMIC in order to make the necessary adjustments.

DO NOT OPERATE THE POWER OSCILLATOR CHASSIS WITHOUT A LOAD

ACROSS THE OUTPUT TRANSFORMER.

The amplitude of the output is checked with an AC voltmeter between OSC OUT and GND. Normally, the output will be 18V RMS, ± 1V. If bench tests are necessary, use a 25 ohm resistor as a load. After the chassis is replaced in COMIC, RECONNECT ALL CABLES TO THE CHASSIS BEFORE TURNING ON THE POWER.

This output should be checked every month.

Oscilloscope Chassis

This chassis is electronically identical to Hewlett-Packard H08-120B, and the Hewlett-Packard manual is provided. However, one electronic and one mechanical adjustment will be discussed here.

Zero Shift Calibration

After completing the COMIC calibration procedures found on Pages 20 and and 21 of the COMIC Maintenance Manual, press the zero switch. If there is a shift of the dots from the zero line, do the following:

1. Note the direction the dots shift.

2. If the dots move down, adjust the scope vertical balance to move the line of dots up two inches.

3. Return the dots to the zero line with the zero balance located on the gate chassis.

4. Repeat steps 1, 2 and 3 until no motion occurs when depressing the zero switch.

5. If the dots move up, adjust the scope vertical balance to move the line of dots down about two inches. Repeat step 3.

6. Repeat steps 1, 3 and 5 until no motion occurs when depressing the zero switch.

Oscilloscope Chassis Sensitivity Adjustment. Set the control panel switch marked SENSITIVITY to 4 and turn the VERTICAL GAIN full CCW. Now, place the dots on the engraved zero line with ZERO control. Turn the VERTICAL GAIN full CW and return the dots to the zero line with VERTICAL BALANCE. Repeat until there is no apparent zero line shift between low (CCW) gain and high (CW) gain.

In order to calibrate the oscilloscope to the outputs from COMIC, the following sensitivity calibration is suggested:

Set all STANDARD dials of B & S Panel to 500.
Set all BATCH dials of B & S Panel to 500.
Set STANDARD and BATCH CONCENTRATION dials to 100.
Set SENSITIVITY switch to 4.
Turn BATCH and STANDARD switches ON and change any batch dial to 600. The dot associated with that dial should move vertically from the rest of the dots. Adjust the distance to 1 inch by trimming the oscilloscope VERTICAL GAIN.

This procedure should be checked every week.

Display Calibration

Set one or more of the STANDARD K/S dials at 1000.
Set SENSITIVITY at position 1.
Adjust the display calibration pot (located on left rear of the control panel), so that when the STANDARD display switch is depressed, the deflection produced by those K/S points which were set to 1000 is about 1.5 inches or just on screen.

Oscilloscope Presentation Adjustment. The display dots should line up exactly with the zero line engraved on the screen cover. Adjustment is made at the rear of the CRT by loosening the clamp and rotating the tube with the socket handle provided. Re-zero the line as necessary while rotating the tube. Only personnel who are familiar with this type of equipment should attempt this adjustment, because of the high voltage present.

Gate Chassis

All inputs should be off (no lights except pilot and illuminant.) Set SENSITIVITY switch to 4 and zero all dots with the panel ZERO control. Adjust the DOT SIZE potentiometer for the smallest dot. Adjust the ZERO BALANCE until there is no apparent motion of the dots when the SENSITIVITY switch is moved from 1 to 4. Turn the LINE STRAIGHTNESS potentiometer full CW. This adjustment will result in two positions of acceptable line straightness. Turn the potentiometer CCW until the best line is presented.

Repeat the adjustment for DOT SIZE, ZERO BALANCE, and LINE STRAIGHTNESS daily for best operation of COMIC.

Tristimulus Difference Computer Portion

It is important that COMIC be calibrated and functioning properly before repairs or calibration are made to TDC, since the TDC derives its inputs from COMIC. The zero line of COMIC must be straight at maximum gain as described in the previous section, before nulling the TDC meters.

The null positions of the X, Y, and Z meters are sometimes shifted slightly when values are changed on the dR/d(K/S) dials. For this reason, it is necessary to adjust the meter zero after setting in a new problem. The following procedure should be used:

1. Turn meter switch ON (up position.)
2. Set INPUT switch to ZERO (center position.)
3. Turn BATCH, STANDARD, and all colorant switches of COMIC OFF so that dots on the screen are all on the zero line.
4. Adjust the TDC meters to null (pointers at mid-scale) by the small potentiometers X, Y, and Z to the left of the METER switch.

Illuminant Chassis

The Illuminant Chassis is designed to accept two Illuminant Plug-in Units. This permits the operator to attempt metameric matches under different light sources. Plug-in units are available for illuminant A (Tungsten), C (north sky light), CE special design for use with Color Eye and 7500° K.

The adjustable Illuminant Plug-in Unit on the Illuminant Chassis contains 48 potentiometers. These are used to set the appropriate values for the desired illuminant; 16 are used for X, 16 for Y, and 16 for Z on each unit and are located as shown in figure 082BB004. Tables are included in the appendix giving the appropriate values for several illuminants at each of the sixteen wavelengths. In order to set these values into the plug-in units on the Illuminant Chassis, the following procedure should be used.

1. Set the operation switches as follows: Turn meters ON (switch up.) Turn input to ABSOLUTE (right.)
2. Select the Illuminant Plug-in Unit to be calibrated. The location of the Illuminant Plug-in Units on the Illuminant Chassis are given in figure 082BB004. Use upper socket.
3. Set all dR/d(K/S) dials on TDC to ZERO.
4. Set all the BATCH and STANDARD dials on COMIC to 500.
5. Set the X, Y, and Z dials to ZERO. Set the polarity switches over the dials to the + position. Zero the meter.
6. On COMIC, turn the Standard Switch on the ON position and all Colorant Switches and the Batch Switch to the OFF position.
7. Set the Standard Concentration dial on COMIC to 200.
8. Set the #1 dR/d(K/S) dial at 100.

9. Set the X, Y, Z values for point #1 for the desired illuminant on the X, Y, and Z dials. These values are given in Table III for illuminants A, C, CE, and 7500° K.
10. Adjust the X meter to zero with the X potentiometer for point #1 on the Illuminant Plug-in Unit being calibrated. Adjust the Y and Z meters with the appropriate potentiometers.
11. Return the #1 dR/d(K/S) dial on TDC to zero and set the #2 point to 100. Repeat steps 9 and 10 using the illuminant values for #2 point on the Illuminant Plug-in Unit. Continue in this manner until all 16 points have been set. After each fourth point check, and, if necessary, re-adjust the zero. Because of the end resistance of the potentiometers, it will be found that the meters cannot be accurately zeroed for very small settings on the X, Y, and Z dials. When this is the case, set the potentiometer as low as it will go; the residual error will be negligible in the use of the TDC.
12. Set all dR/d(K/S) dials on TDC to 100 and the Standard Concentration dial to 100. Check the zero, then turn the Standard Switch to ON.

Zero the meters with the X, Y, and Z dials. The settings on these dials should then be the "1/2" figures given in the Illuminant Tables. If these dials are within 5% of the correct values, the accuracy will be more than adequate for normal TDC computations. If the errors are larger than 5%, readjust the Illuminant Plug-in Unit as specified in steps 1 through 12. When the illuminants have been properly set, no further adjustment should be required unless a different illuminant is to be used.

Half-Sum Calibration

In the event that all three half sums are in error in the same direction, the following procedure may be used to correct them.

1. Set up TDC and COMIC to read 1/2 sums.
2. Set in the desired sums on the X, Y, and Z dials.
3. Zero the meters.
4. Use the "TDC CAL" pot on the detector chassis to zero the meters.

This adjustment will correct only the illuminant being checked. The other illuminant will have to be reset point by point, if it requires corrections.

ILLUMINANT -A-

Point	Mu	X	Y	Z
1	400	0	0	2
2	420	5	0	25
3	440	19	1	93
4	460	20	4	118
5	480	9	12	73
6	500	1	36	30
7	520	9	95	11
8	540	46	152	3
9	560	110	184	1
10	580	194	186	0
11	600	254	151	0
12	620	227	101	0
13	640	131	51	0
14	660	53	19	0
15	680	16	6	0
16	700	4	2	0
Sum		1098	1000	356
1/2 Sum		549	500	178

ILLUMINANT -C-

X	Y	Z
2	0	8
25	1	120
79	5	397
67	14	388
22	32	190
1	68	58
12	129	14
56	183	4
118	196	1
168	160	0
178	106	0
142	63	0
74	29	0
27	10	0
7	3	0
2	1	0
980	1000	1180
490	500	590

ILLUMINANT 7500° K

Point	Mu	X	Y	Z
1	400	2	0	11
2	420	30	1	145
3	440	84	5	423
4	460	70	14	401
5	480	22	31	183
6	500	1	69	58
7	520	13	140	16
8	540	52	171	4
9	560	122	204	1
10	580	187	177	0
11	600	167	99	0
12	620	128	57	0
13	640	55	21	0
14	660	20	7	0
15	680	7	3	0
16	700	2	1	0
Sum		962	1000	1242
1/2 Sum		481	500	621

COLOR EYE

X	Y	Z
0	2	2
0	4	148
0	8	259
0	23	334
0	50	200
0	90	50
5	146	6
44	188	1
154	188	0
253	158	0
242	89	0
145	34	0
80	12	0
42	5	0
23	2	0
12	1	0
1000	1000	1000
500	500	500

APPENDIX

RECOMMENDED SPARE TUBES
COMIC AND TDC

NO. OF TUBES PER INSTRUMENT	RECOMMENDED SPARE QTY.	UNITED STATES TUBE	FOREIGN TUBE EQUIVALENT
6	2	12AU7/ECC82	ECC82
1	1	12B4A	Unknown
1	1	6U8	ECF82
1	1	5651	5651
1	1	6AU6	EF94
2	1	6DJ8/ECC88	ECC88
1	1	6AQ5	N727
2	1	5881	KT66 or EL 37
3	1	S-5251 IN2389	Unknown
12	2	12AX7/ECC83	ECC83
3	1	0G3	Unknown
2	1	6146	Unknown
29	3	5963	Unknown
4	1	6CA7/EL34	EL34
1	1	6CW5	Unknown

SUGGESTED TOOLS AND INSTRUMENTS

1. Multimeter having the following scales or measuring capabilities.

   a. 0-300 or 500 Volts DC
   b. 0-10 or 15 Volts AC
   c. 0-25 or 30 Volts AC
   d. 0-100 ohms resistance
   e. 0-1meg ohms resistance

   A suitable meter should have at least 20,000 ohms per volt rating on the DC scales.

2. General purpose oscilloscope (desirable)

   The Hewlett Packard 120 B instrument could serve as an auxiliary computer display in the event of failure of the Comic scope. Most other scopes will require a wiring change to be made in the Comic Gate Chassis in order that the blanking can be used effectively.

3. Mutual Conductance Tube Tester (desirable)

   A tube tester that duplicates the actual circuit conditions can save time, since the change in tube characteristics as it ages will be more likely to cause a malfunction than will a simple drop in emission.

   Example: Hickok Model 752

4. Instrument quality soldering iron

   Example: Weller

5. ROSIN Core Solder (this is essential)

   Example: Kester Type 58 60/40

6. Hand tool including the following:

   a. Long-nosed pliers
   b. Diagonal Cutters
   c. Screwdrivers
   d. Phillips screwdrivers
   e. Allen wrench set
   f. Open end wrenches
   g. Insulated probe

10-1263-C

INSTRUCTIONS FOR USING AUXILIARY SCOPE

This cable is made for use with the 120-B Hewlett Packard oscilloscope.

If for any reason the scope in COMIC is inoperative, disconnect the four-pin Amphenol from the side of the scope chassis. Connect it to the four-pin Amphenol at the end of the auxiliary cable. Run it out through the scope door to the auxiliary scope.

Before plugging the scope in, do the following:

(1) Remove the High Voltage guard at the back of the scope.

(2) Remove the shorting buss on Z-axis at rear of scope.

(3) Attach orange and white wire to the top screw on the Z-axis at rear of scope.

(4) Plug red banana jack into horizontal input socket (red).

(5) Plug the double banana jack into the vertical input plugs at the lower left of the scope, insert the plug so that the red dot on the plug is in the red socket.

(6) Set controls the same as they are on the scope in COMIC.

  (a) Vertical sensitivity on 10 millivolts/cm, red vernier knob all the way to the right.

  (b) SYNC ON EXT.

  (c) HOR. SENS. on 1 in the volts/cm block (1:00). Adjust red vernier knob so all 16 dots are centered on the screen.

  (d) Adjust focus and intensity.

(7) COMIC can now be used in the normal fashion, except that <u>zero</u> is vertical position, and <u>sensitivity</u> is vertical gain vernier knob on the auxiliary scope.

10-1263-C

COLORANT MIXTURE COMPUTER WITH TDC

SHIPPING INSTRUCTIONS

1. Where suitable trucking facilities are available, it is recommended that Colorant Mixture Computers (COMIC) be shipped uncrated by a mover accustomed to handling either uncrated industrial electronic equipment, such as IBM machines, or uncrated fine household furniture and pianos. To prepare for such shipment, proceed as follows:

2. Remove both rear panels and unfasten both writing surface arms by removing the four screws holding them to the cabinet. Slide the writing surface and arms out the front of the computer and wrap the entire writing surface assembly separately for shipment.

3. Check to see that all chassis are securely fastened with nuts, lockwashers, and screws to the chassis rails. Check all covers on top of the grey (EECO) plug-ins. Check the illuminant plug-ins on the "Illuminant Select" chassis of TDC, seeing that they are securely tied down with the two posts that are supplied with each illuminant plug-in.

4. Remove the power cord from the power distribution box and tape to convenient rail.

5. Wrap individually and pack all extra plug-ins and manuals in a separate container for shipment.

6. Replace the rear panels.

7. Tape the two front lower doors closed. Secure the plug-ins in the plug-in panel by taping the edges of the plug-ins to the computer panel. Cover the Oscilloscope display tube with cardboard and tape. If possible, cover the front panels with Masonite or plywood for protection.

8. Insert wooden blocks between power oscillator-power supply rails, and cabinet bottom.

9. Ship in an upright position only.

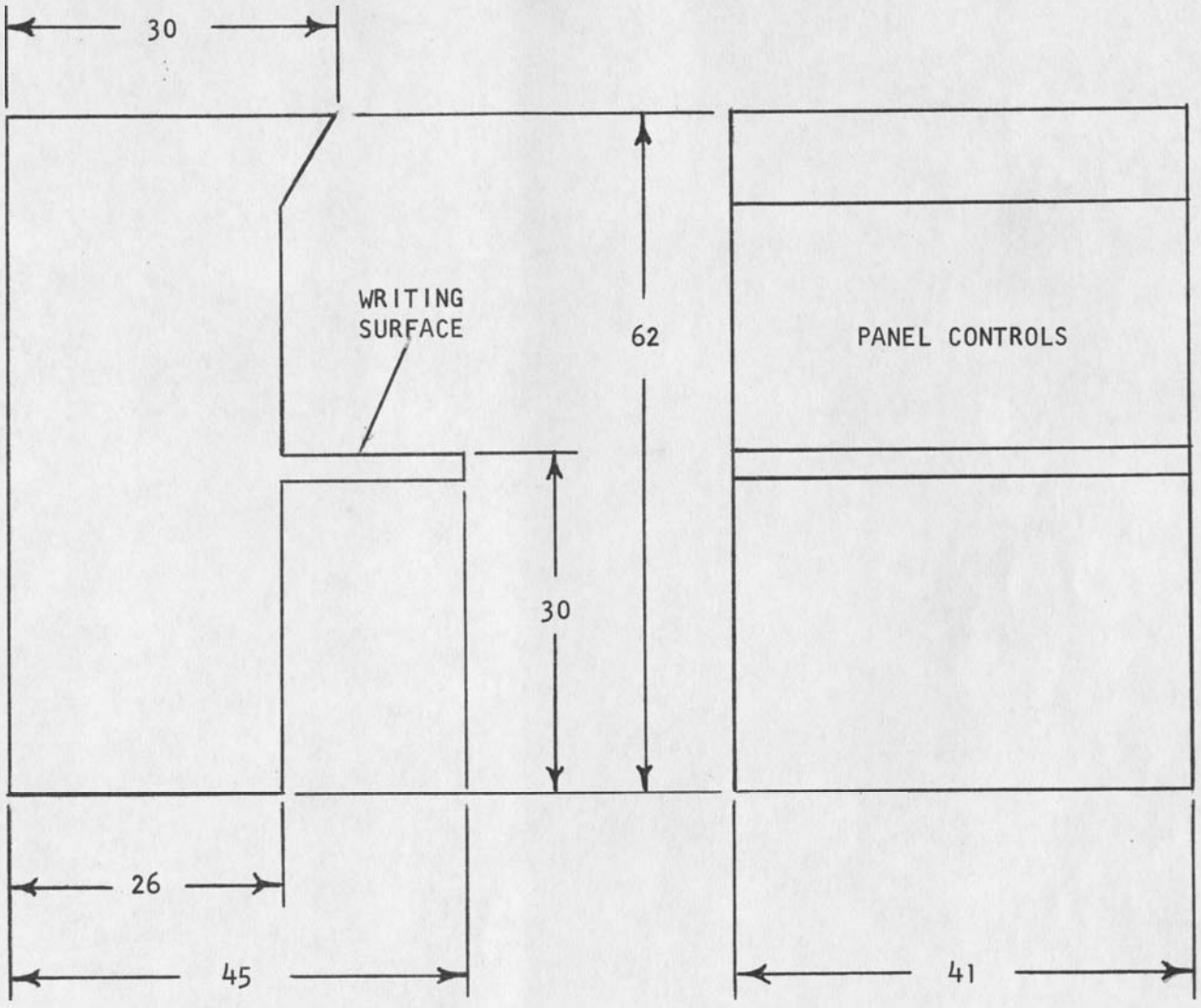
AT NEW LOCATION, BE SURE THAT POWER SUPPLY IS <u>105-125 VOLTS</u>, <u>50/60 CYCLES</u>, BEFORE PLUGGING INSTRUMENT INTO POWER LINE.

DAVIDSON AND HEMMENDINGER, INC.
EASTON, PENNSYLVANIA

COLORANT MIXTURE COMPUTER - PHYSICAL SPECIFICATIONS

INPUT POWER 105-125 VAC 50-60 cps
3-3.5 amps (400W)
WEIGHT Approx. 300 lbs.

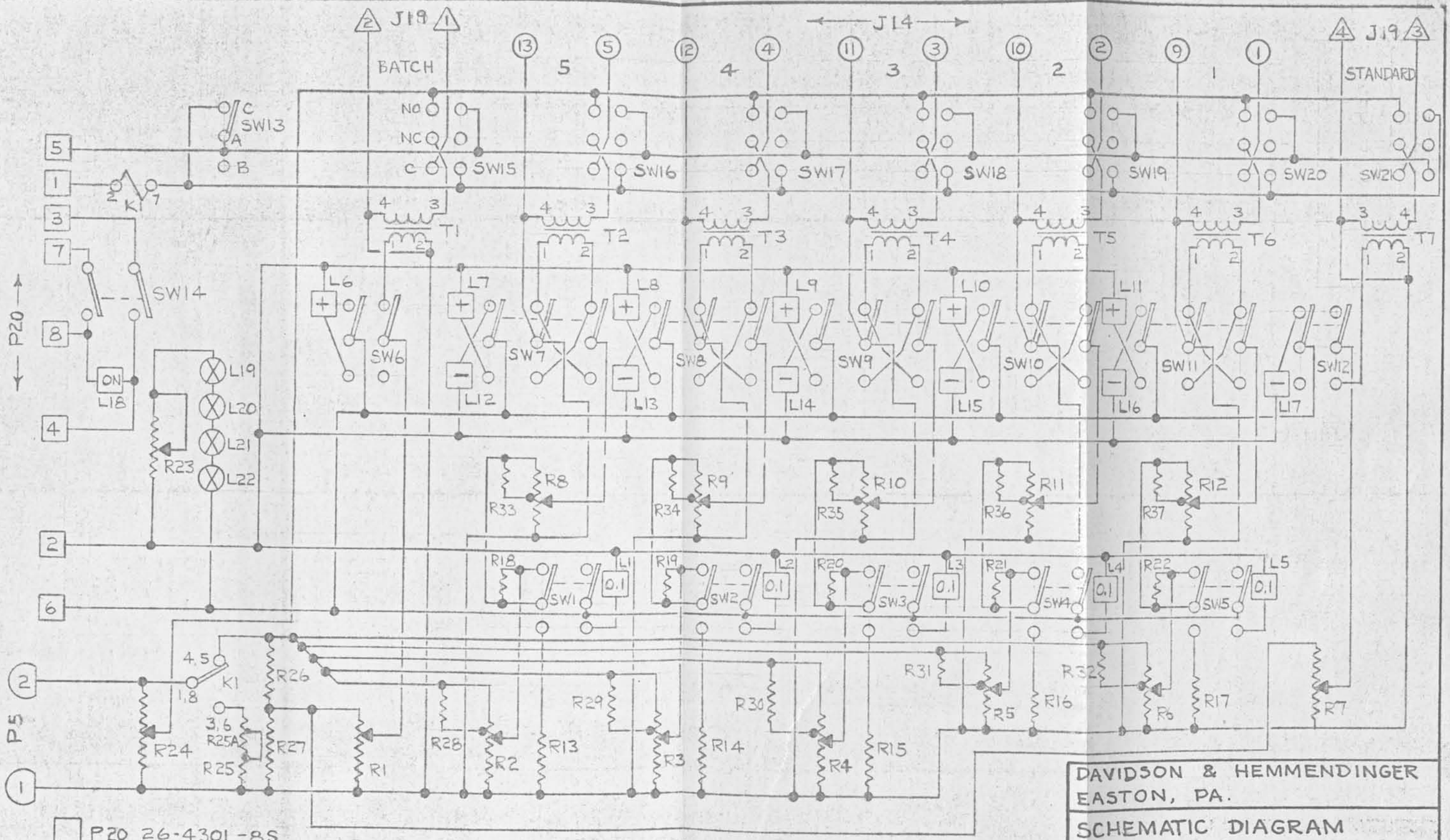
Crated for overseas shipment approximately 650 lbs.



COMIC/TDC

CONTENTS

ELECTRICAL DRAWINGS



13	3-18-64	JCB	CORRECTED PINS (J-14 & P-20)
12	8-28-63	JCB	ADDED R25A P5 WAS P4 - P20 WAS P3 J19 WAS J1 - J14 WAS J2
	7-23-63	JCB	TRACED

REVISIONS

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
CONTROL PANEL

WB	11-21-62
WB	7/15/63

010BB003-13

DAVIDSON & HEMMENDINGER Easton, Penna.	REVISION
Date 7-29-63 By JCB	Part List 010PL003-13

COMIC

Control Panel / 10A & 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Control Panel - Fabrication	A	010CA011-3	1			
K1	Relay KRP11A	Y	25004	1	1	1	
R1 & R7	Pot SA3406A	B	27008	2		1	
R2-R6	Pot SA3350A	B	27007	5	1	1	
R8-R12	Pot SC846A	B	27010	5		1	
R24	Pot 53C2 10K	C	27013	1			
R13-R17	Resistor 100 ohm 1/2W 1%	N	26009	5			
R18-R22	Resistor 782 ohm 1/2W 1%	N	26010	5			
R28-R32	Resistor 309 ohm 1/2W 1%	N	26011	5			
R33-R37	Resistor 3K 1/2W 1%	N	26012	5			
R41,R43	Resistor 220 ohm 1W 5%	N	26014	2			
R38	Resistor 2.2K 1/2W 5%	N	26015	1			
R39	Resistor 6.8K 1/2W 5%	N	26016	1			
R40	Resistor 100K 1/2W 5%	N	26017	1			
R26	Resistor 252.5 ohm 5W 1%	N	26018	1			
R27	Resistor 247.4 ohm 5W 1%	N	26019	1			
R25A	Resistor 15 ohm 10W	BE	26054	1			
R25	Resistor 5 ohm 10W Variable	BE	27029	1			
SW13-SW21	Switch (display) 2PB11	Z	30013	9		1	
SW6-SW12	Switch (polarity) HM250-73	H	30014	7		1	
SW-14	Switch (power) 7561K4	J	30015	1			
SW22	Switch (gain) 1404	AA	30016	1			
T1-T7	Transformer M3443	M	32004	7			
P20	Plug 26-4301-8S	F	38009	2			

* Recommended spares for use in United States
** Recommended spares for use overseas

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 7/29/63 By JCB	Part List 010PL003-13	

COMIC

Control Panel / 10A & 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
J14	Socket 26-4401-16P	F	38014	1			
P5	Plug 91-MC-3M	F	38015	1			
J32	Connector 5501 MP	F	38017	1			
J19	Socket 91 PC4F	F	38018	1			
	Knob C20959-14 (black matte finish)	AB	17003	2			
	Knob C20959-22 w/dot (black matte fin)	AB	17004	1			
	Socket octal 8JM-2	T	20003	1			
	Terminal Strip 866	G	20001	1			
	Terminal Strip 1063	G	20002	1			
C1	Capacitor .0015 uf 5%	AC	12009	1			
	Pilot light (100K) 249-7841-931	K	23008	1			
	Lampholder 7538	K	23002	17			
	Cap 250-1473 Stamp ".1"	K	23009	5			
	Cap 250-1475 Stamp "-"	K	23010	6			
	Cap 250-1475 Stamp "+"	K	23011	6			
	Cartridge 39-604-1437	K	23001	17	6	6	
	Dial RBC	B	17001	12	1	1	
	Bracket Gain Switch	A	010AA053	1			
	Bracket CRT	A	010BA054-3	2			
	Bracket Panel	A	010BA064-2	1			
	Frame Panel	A	010DD052-2	1			
SW1-SW5	Switch (X10) .1 7565K5	H	30019	5			
R44	Pot 100Ω 43C1-100	C	27033	1			
R42	Resistor 7.5K 1W 1%	N	26013	1			
	Resistor 2K 1/2W 1%	N	26078	1			

* Recommended spares for use in United States
** Recommended spares for use overseas

TO PLUG-IN UNIT

P17 26-4301-32S

TO CONROL PANEL

P14

BATCH

STANDARD

R65 R1 R66 R2 R67 R3 R80 R16

R81 R17 R82 R18 R83 R19 R96 R32

50K 10T 0.1L

T1 T2 T3 T16 T17 T18 T19 T32

R33 R34 R35 R48 R49 R50 R51 R64

1 2 3

4 PIN AMPHENOL 91MC4M (MALE)

P7 26-4301-24S

TO GATE CHASSIS

S1 S2 S3 S16

BLANKING SWITCHES

10 OR 16

ST 12A SWITCH

ALL TRANSFORMERS 500K PRI, 10K SEC. SPECIAL MICROTRAN M3444

ALL POTS HELIPOT SA3408A 10 TURN L 0.1

M3444 WAS M3221.
AMPHENOL WAS JONES PLUG
REV. 5 4-30-63 JCB

REV. 2	1-11-63	WB	
REV. 1	8-18-59	WB	

WB	2-4-59	010BB004-6	
WB	5-1-63		

6	8-29-63	JCB	ADDED P & R NO'S.

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
BATCH & STANDARD PANEL

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date By	Part List 010PL004-6	

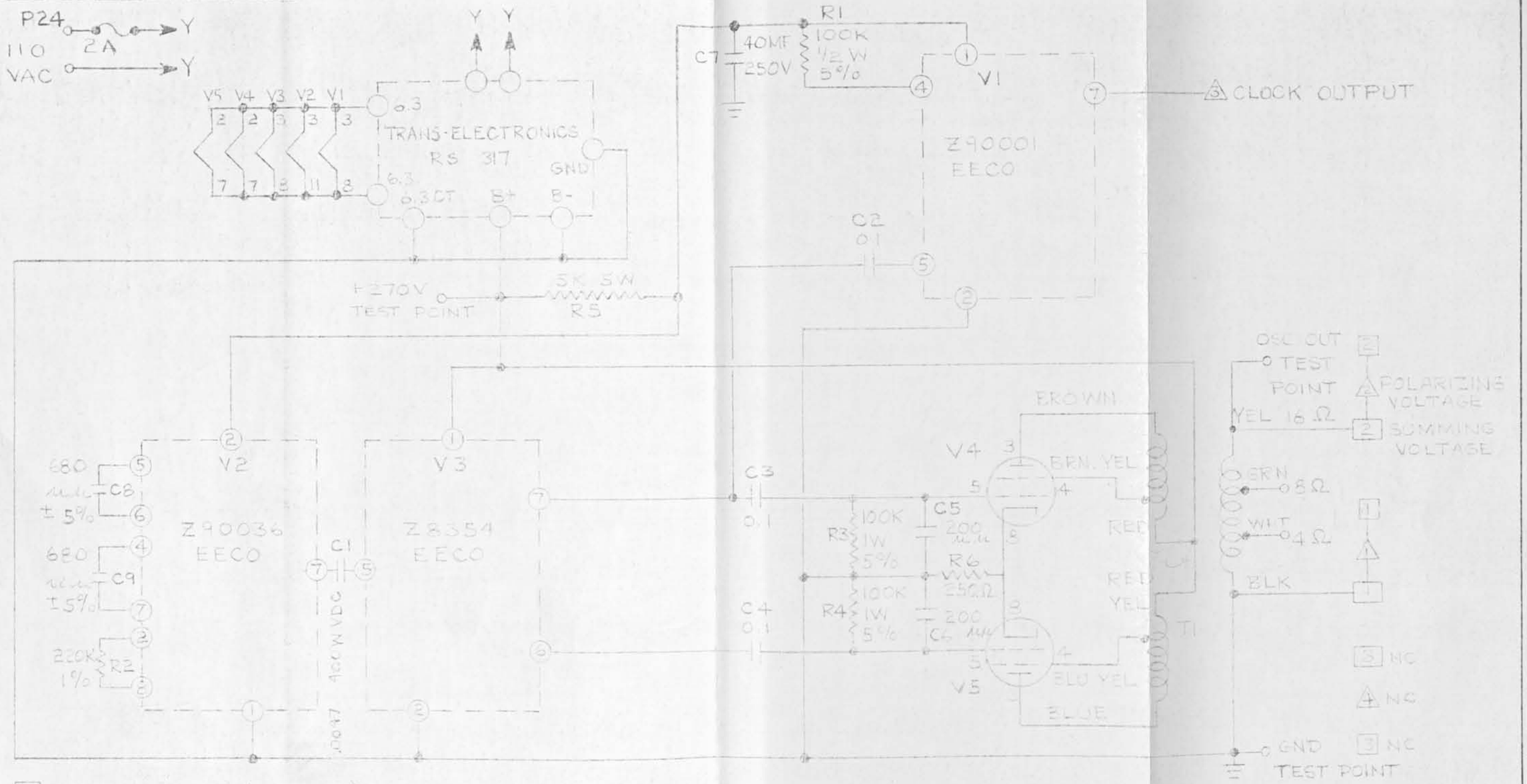
COMIC

Batch & Standard / 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Panel - Fabrication	A	010CA037-5	1			
R1-R32	Pot SA3408A	B	27009	32	1	1	
R33-R64	Resistor 10K 1/8W 1% CML	C	26004	32			
R65-R96	Resistor 150K 1/8W 1% CML	C	26003	32			
T1-T32	Transformer M3444	M	32003	32		1	
S1-S16	Switch 750K13	J	30008	16			
	Dial RBC	B	17001	32			
P17	Plug 26-4301-32S	F	38007	1			
P14	Plug 91-MC-4M	F	38016	1			
P7	Plug 26-4301-24S	F	38005	1			
	Terminal Strip 1066	G	20005	14			
	Terminal Strip 866	G	20001	2			
	Bracket	V	01BD033	16			
	Clamp 5/8" I.D.	G	20008	1			
	Rings, Knurled	X	010AA084	16			

* Recommended spares for use in United States

** Recommended spares for use overseas



□ 3 PIN SOCKET (91PC3F) J5

△ 4 PIN SOCKET (91PC4F) J2

□ 3 PIN SOCKET (91PC3F) J11

V4, V5 - 5881

T1 - STANCOR A8072

6	3-18-64	JCB		V2 FIL. PIN WAS 3 & 8.
5	8-28-63	JCB		DELETED V6 ADDED C-J-P-R NO'S.
	6-21-63	JCB		TRACED
4	4-6-62	RHE		DELETED 28351
3	3-10-62	RHE		DELETED 150 V SUPPLY
2		RHE		ADDED AUX. OUTPUT PLUG
1		RHE		CHGD. OSC. INPUT CIRCUIT
REVISIONS				

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
POWER OSCILLATOR CHASSIS

RHE	6-2-60	010BB005-6

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8/5/63 By JCB	Part List 010PL005-6	

COMIC

POWER OSCILLATOR 10A & 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
V1	Squaring Amplifier Z90001	Q	13023	1			
V2	Multivibrator Z90036	Q	13042	1			
V3	Phase Inverter Z8354	Q	13043	1			
V4-V5	Amplifier Tube EL34 or 5881	AQ	34005	2	1	2	
R1	Resistor 100K 1/2W 5%	N	26017	1			
R2	Resistor 220K 1/2W 1%	N	26026	1			
R3-R4	Resistor 100K 1W 5%	N	26027	2			
R5	Resistor 5K 5W	C	26028	1			
R6	Resistor 250 ohm 10W	AS	26029	1			
C1	Capacitor .0047 uf 200V	S	12006	1			
C2-C4	Capacitor .1 uf 400V	S	12010	3			
C5-C6	Capacitor 200 uuf 500V	S	12017	2			
C7	Capacitor 40 mfd. 250V	S	12021	1			
C8-C9	Capacitor 680 uf 1%	AC	12022	2			
T1	Output Transformer A-8072	AY	33005	1			
	Power Supply RS-317B	AM	24002	1			
J5, J11	Plug 91PC 3F	F	38020	2			
J2	Plug 91PC 4F	F	38018	1			
	Test Jack Black 78-1S	F	20026	1			
	Test Jack Red 78-1S	F	20027	2			
P24	Plug, Arrow Hart Line 5274	AJ	20019	1			
	Cable Clamp 3/4" I. D.	G	20023	1			
	Terminal Strip 866	G	20001	2			
	Standoff 69002-0102	BZ	20040	7			
	Rubber Grommet 7/8" I.D. #2187	AD	20024	2			

* Recommended spares for use in United States
** Recommended spares for use overseas

DAVIDSON & HEMMENDINGER Easton, Penna.	REVISION
Date 8-5-63 By JCB	Part List 010PL005-6

COMIC

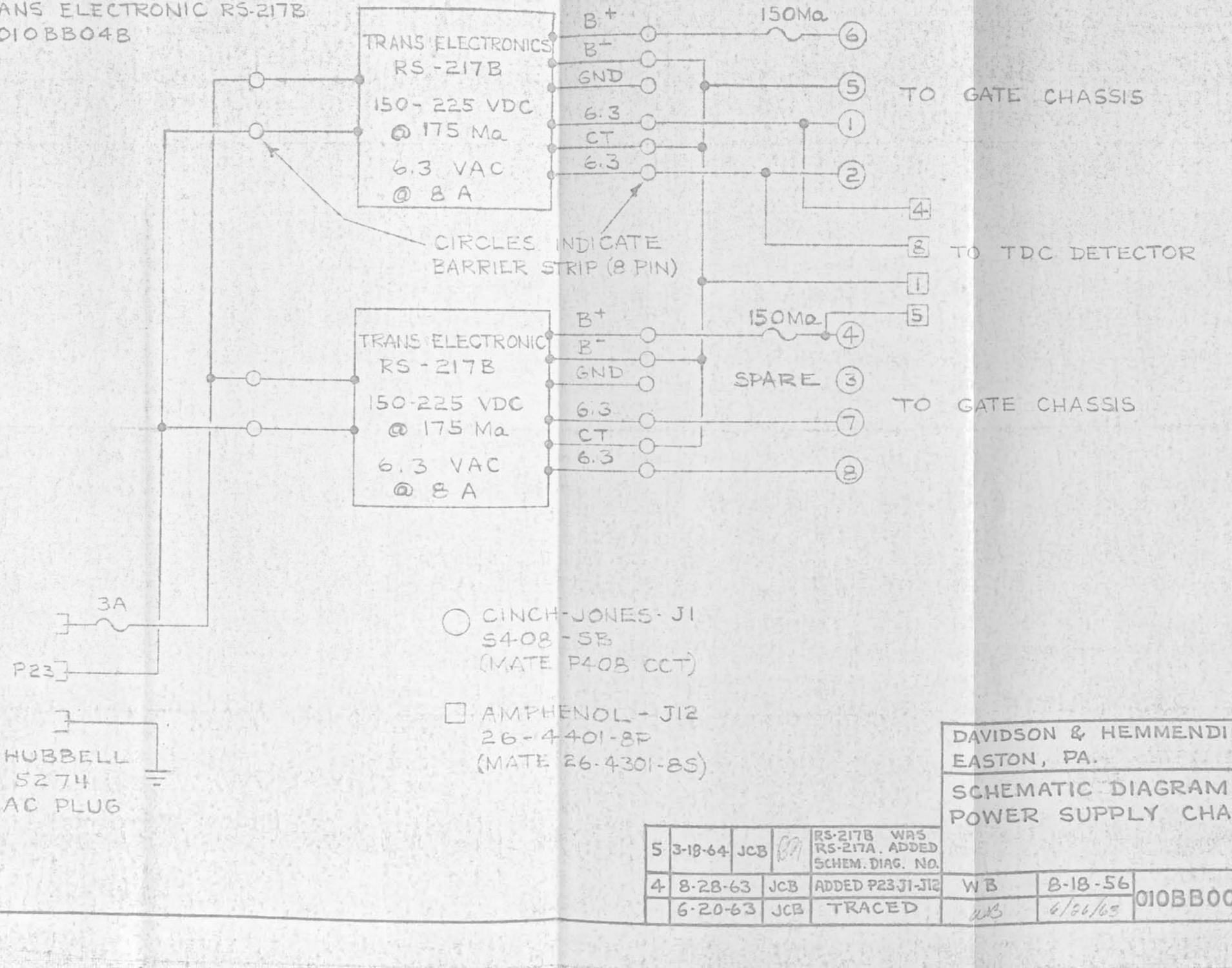
Power Oscillator / 10A & 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Strain Relief Bushing	BF	20020	1			
	Terminal Strip 8 - 14D	T	20017	1			
	Socket 8J M-2	T	20003	4			
	Socket 77M1P11T	T	20009	1			
	Stakons RA18-8	AP	20021	19			
	Fuse 3A MDL3	AH	31006	1	5	5	
	Fuse Holder HKP	AH	31003	1			
	Silicon rectifier S5251	AX	29008	1	1	1	
	Angle Bracket	A	010AA074-1	4			
	Chassis Fabrication	A	010CA020-7	1			

* Recommended spares for use in United States

** Recommended spares for use overseas

FOR INTERNAL SCHEMATIC
OF TRANS ELECTRONIC RS-217B
SEE 010BB04B



○ CINCH-JONES · J1
S4-08-SB
(MATE P408 CCT)

□ AMPHENOL - J12
26-4401-8P
(MATE 26-4301-8S)

5	3-18-64	JCB	[illegible]	RS-217B WAS RS-217A. ADDED SCHEM. DIAG. NO.			
4	8-28-63	JCB		ADDED P23 J1-J12	WB	8-18-56	010BB006-5
	6-20-63	JCB		TRACED	WB	6/26/63	

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
POWER SUPPLY CHASSIS

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8-5-63 By JCB	Part List 010PL006-5	

COMIC

Power Supply / 10A & 10B

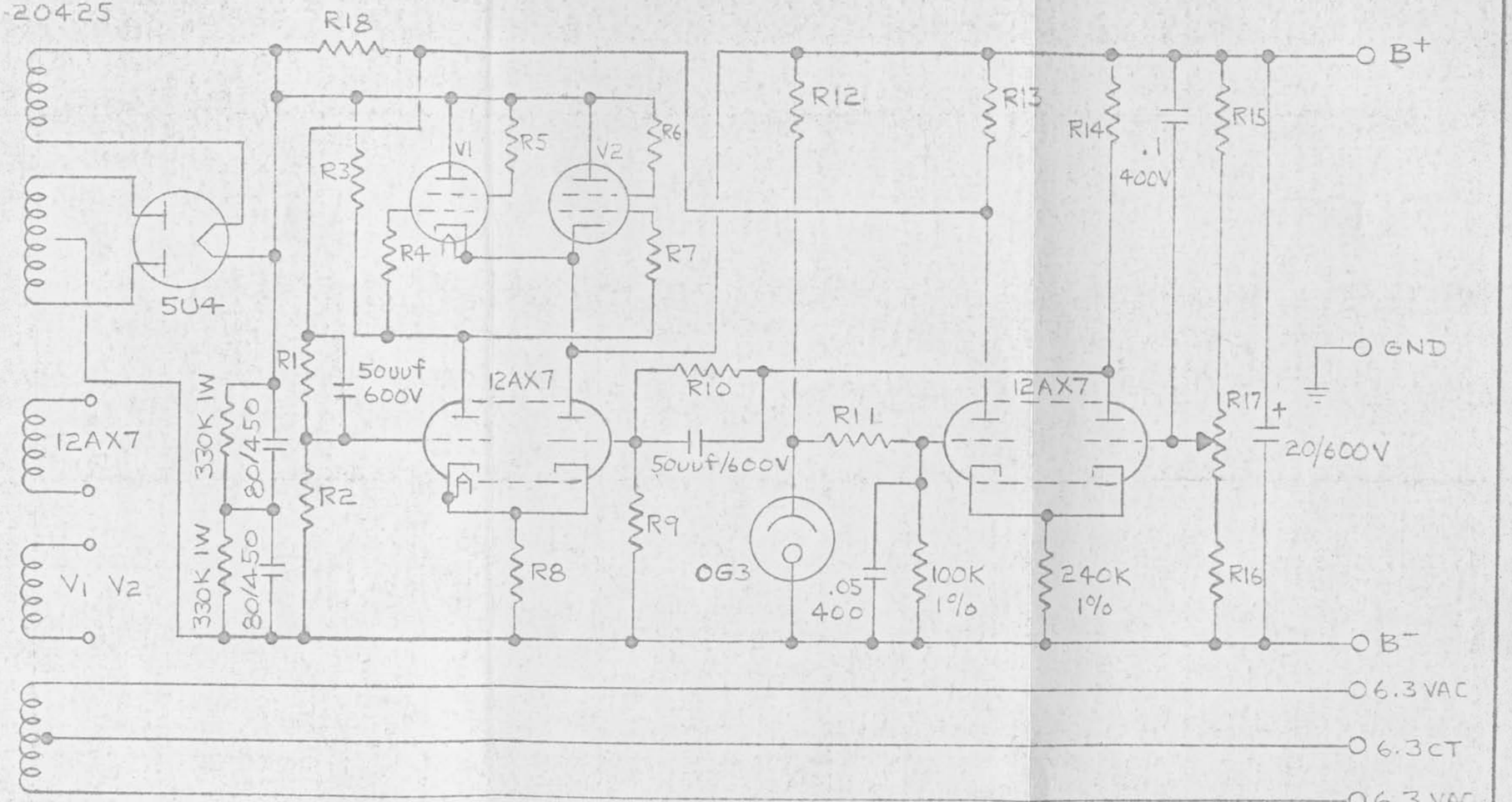
CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Chassis - Fabrication	A	01CD021-3				
	Power Supply RS-217-B	AM	24001	2			
	Terminal Strip 8-14D	T	20017	2			
J12	Socket S-408-SB	T	20018	1			
	Fuse Holder HKP-H	AH	31004	3			
	Fuse 150 ma SB	AN	31005	2	5	5	
	Fuse 3A MDL3	AH	31006	1	5	5	
P23	3 Wire AC Line Plug 5274	AJ	20019	1			
J1	Socket 26-4401-8P	F	38008	1			
	Grommet 1/2" I. D.	AD	20014	1			
	Strain Relief Bushing	BF	20020	1			
	Stakons RA18-8	AP	20021	30			
	Terminal Strip 866	G	20001	1			
	Cable Clamp 3/8 I. D. 835	G	20007	1			
	Angle Brackets	A	010AA074-1	4			
	Silicon Rectifier S-5251	AX	29008	2			

* Recommended spares for use in United States
** Recommended spares for use overseas

TRANS ELECTRONIC T-20425

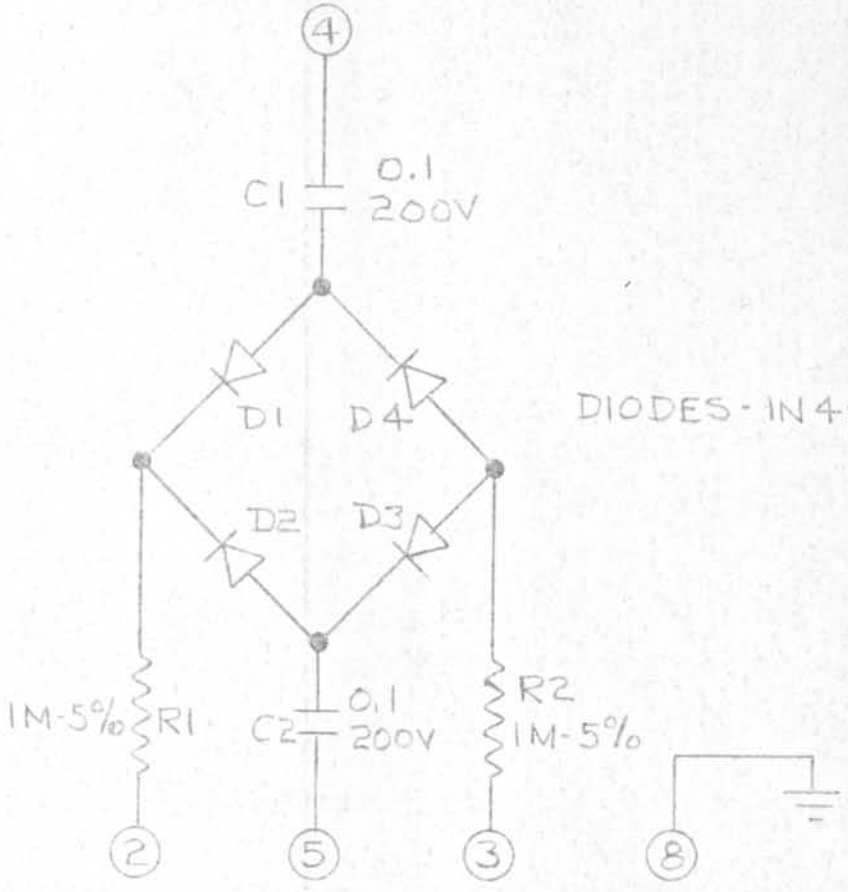
	POWER SUPPLY RS217B	RS317A
V1, V2	5881	6146
R1	3.3M	3M
R2	2.2M	3M
R3	-	8.2M
R4, R7	10K	1K 10%
R5, R6	-	120Ω 10%
R8	200K	240K
R9	2.2M	3M
R10	3.3M	3M
R11	75K-1%	68K-1%
R12	33K 1W-10%	100K 1W-10%
R13, R14	430K-1%	1M-1%
R15	500K-1%	330K-1%
R16	160K-1%	56K-1%
R17	250K-10T	50K-10T
R18	-	(FACTORY SELECTED)

ALL RESISTORS 5% ½W
UNLESS NOTED



CINCH JONES

DAVIDSON & HEMMENDINGER EASTON, PA.	
SCHEMATIC DIAGRAM POWER SUPPLY - COMIC MOD. 010 TRANS ELECTRONIC	
JCB 3-16-64	010BB048
Cam 3-17-64	



DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC PLUG-IN UNIT – GATE		
JCB	12-3-63	010AB008-5
WB	12-3-63	

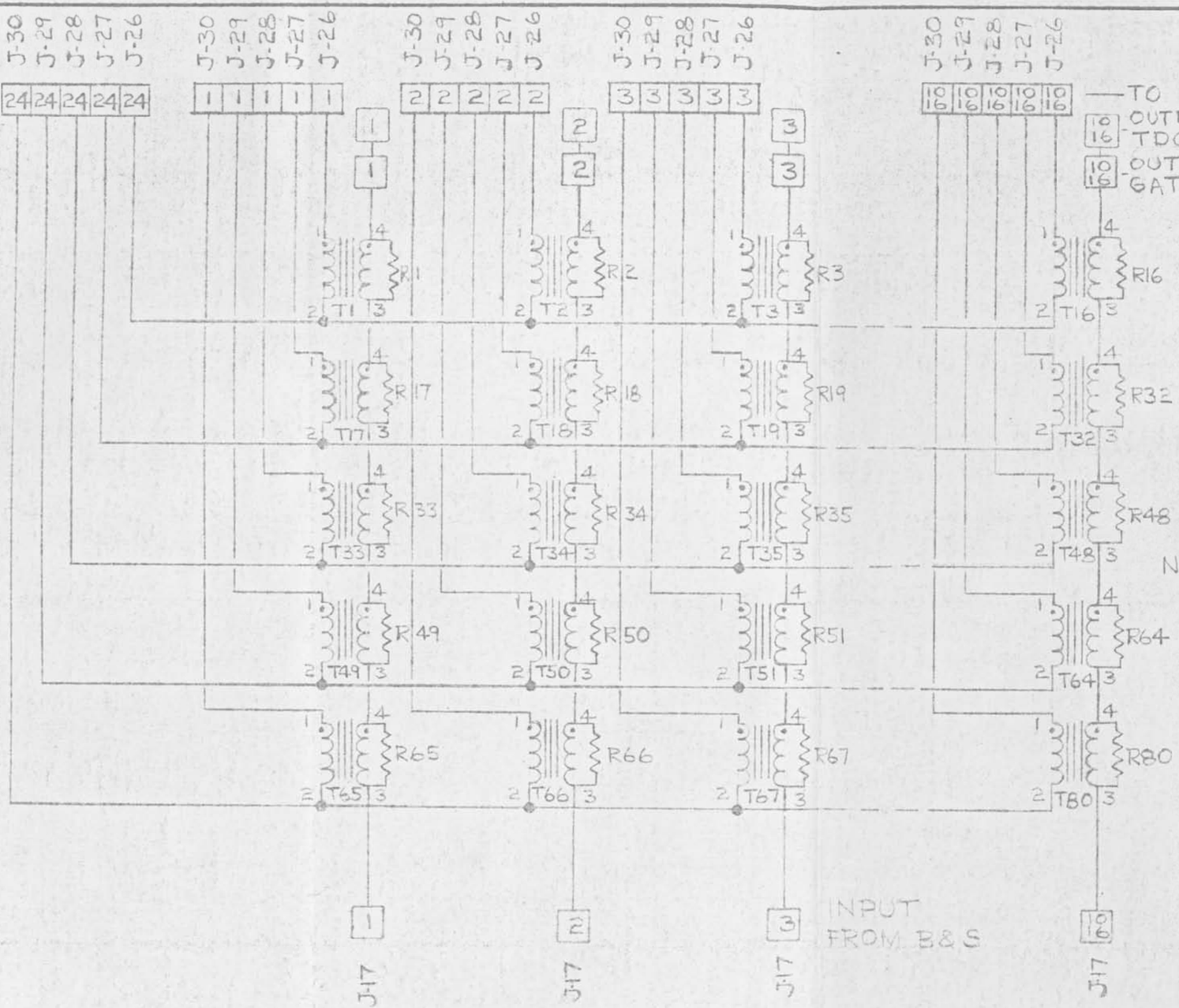
DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8/30/63 By JCB	Part List 010PL008-5	

COMIC

Gate Circuits / 010

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Network Can 95052-1	Q	11002	16			
	Diode IN485A - Matched	BG	29001	64			
	Resistor 1M 1/4W 5%	N	26058	32			
	Capacitor V84C2P1 .1 mfd 200V	S	12025	32			
	PC Board	BM	010PC060	16			

* Recommended spares for use in United States
** Recommended spares for use overseas



J-26 TO J-30
AMPHENOL BLUE RIBBON
26-4200-24S

J15, J16 & J-17
AMPHENOL BLUE RIBBON
26-4401-32P

ALL TRANFORMERS 500K PRI,
10K SEC SPECIAL
MICROTRAN M3444

NOTE-10K ½W 1% RESISTOR ACROSS
PINS 3 & 4 OF ALL TRANSFORMERS
FOR SUM LINE LOADING

AMPH. B.R. 26-4301-16P TO CONTROL PAN. P14

1	9	2	10	3	11	4	12	5	13
17-20	21-24	17-20	21-24	17-20	21-24	17-20	21-24	17-20	21-24
J-26	J-26	J-27	J-27	J-28	J-28	J-29	J-29	J-30	J-30

2	11-29-63	JCB	WB	ADDED J16
1	8-29-63	JCB		CHGD. P-NO'S TO J-NO'S. ADDED R & T NO'S. J1-J5 WAS 26-4201-24S
	6-20-63	JCB		TRACED
REVISIONS				

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
TRANSFORMER CHASSIS

WB	5-15-59	010BB009-2
WB	6/26/63	

DAVIDSON & HEMMENDINGER Easton, Penna.	REVISION
Date 8/5/63	Part List
By JCB	010PL009-2

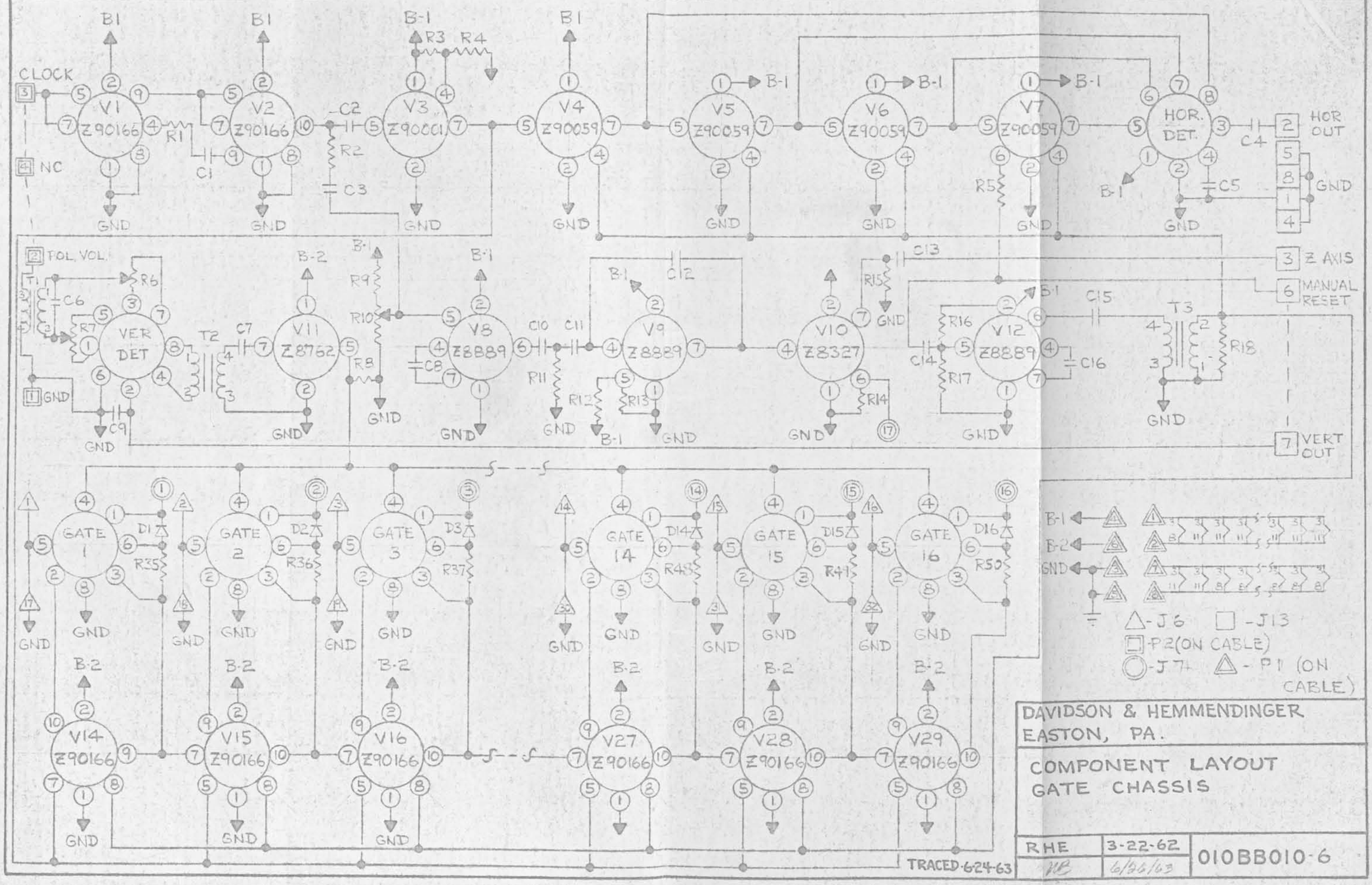
COMIC

Transformer Chassis 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
J15-J17	Socket 26-4401-32P	F	38011	3			
P14	Plug 26-4301-16S	F	38010	1			
J26-J30	Plug 26-4200-24S	F	38021	5			
T1-T80	Transformer M-3444	M	32003	80			
	Clamp 3/8" I.D. 835	G	20007	1			
R1-R80	Resistor 10K 1/8W 1% CML	C	26004	80			
	Front Rail	A	010BA024-1	1			
	Transformer Box Fins	A	010BA049-4	2			
	Plug-in Amphenol Bracket	A	01BD034	1			
	Plug-in Side Bracket	A	01BD023-1	2			
	Angle Bracket	A	010AA074-1	2			
	Plug-in Panel	A	01BD016	1			
	Transformer Plate	A	01BD029	2			
	Chassis Base	A	01CD050-6	1			
	Rear Rail	A	010BA069	1			
	Bottom Rail	A	010BA081	1			
	Top Rail	A	010BA093	1			
	Clamp 1/4" I.D. 833	G	20037	2			
	Clamp 5/16" I.D. 834	G	20038	2			

* Recommended spares for use in United States

** Recommended spares for use overseas



TRACED 6-24-63

DAVIDSON & HEMMENDINGER
EASTON, PA.

COMPONENT LAYOUT
GATE CHASSIS

RHE	3-22-62	010BB010-6
WE	6/26/63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 7-29-63 By JCB	Part List 010PL010-6	

COMIC

Gate Chassis / 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Chassis - Fabrication	A	01DD022-5	1			
V1-V2 V14-V29	Flip Flop Z-90166	Q	13021	18	1	1	
V4-V7	Flip Flop Z-90059	Q	13025	4		1	
V8-V9 V12	One Shot MV Z-8889	Q	13027	3		1	
V11	Amplifier Z-8762	Q	13026	1		1	
V10	Pulse Gate Z-8327	Q	13024	1		1	
V3	Amplifier Z-90001	Q	13023	1		1	
	Socket 8JM-2	T	20003	28			
	Socket 77M1 P11T	T	20009	18			
P1	Plug P-408-CCE	T	20012	1			
	Clamp Cable 1/2" I. D.	G	20011	1			
	Terminal Strip 1063	G	20002	1			
	Terminal Strip 866	G	20001	2			
J13	Socket 26-4401-8P	F	38008	1			
J7	Socket 26-4401-24P	F	38013	1			
J6	Socket 26-4401-32P	F	38011	1			
P2	Plug 91 MC 4M	F	38016	1			
T2-T3	Transformer M7H	M	32002	2		1	
T1	Tranformer M3443	M	32004	1		1	
R10	Pot 53C2 1 meg 2W	C	27014	1			
R6-R7	Pot 53C2 5K 2W	C	27015	2			
R1	Resistor 150K 1/8W 1% CML	C	26003	1			
R8	Resistor 10K 1/2W 5%	N	26020	1			
R2, R4,R13	Resistor 100K 1/2W 5%	N	26017	3			
R5,R35 R50,R11	Resistor 47K 1/2W 5%	N	26021	18			

* Recommended spares for use in United States
** Recommended spares for use overseas

DAVIDSON & HEMMENDINGER Easton, Penna.	REVISION
Date 7-29-63	Part List
By JCB	010PL010-6

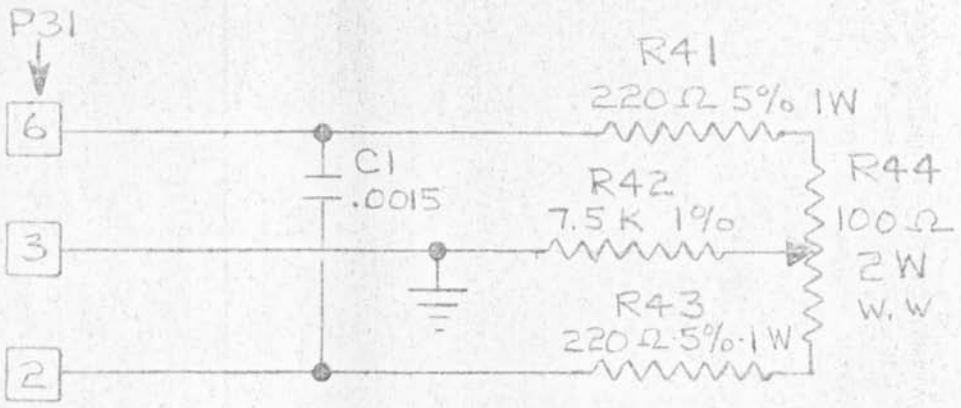
COMIC

Gate Chassis / 10B

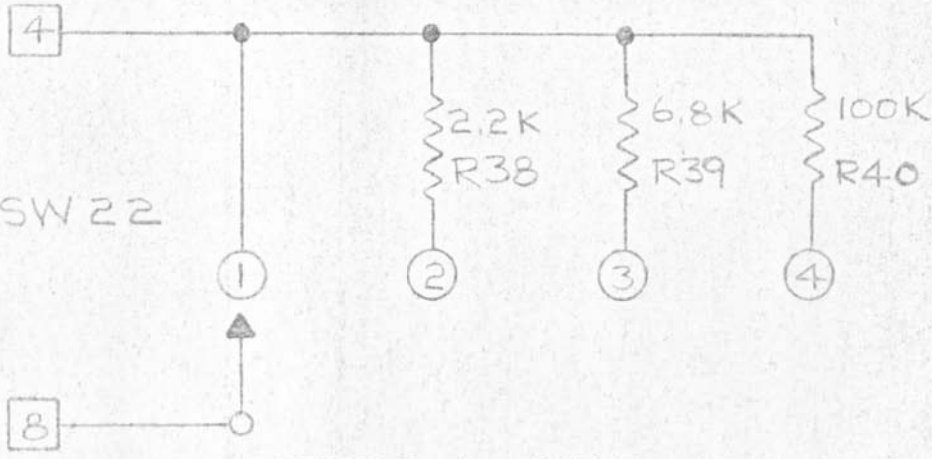
CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
R17,R12	Resistor 470K 1/2W 5%	N	26022	2			
R9-R16	Resistor 3.9M 1/2W 5%	N	26023	2			
R14,R15	Resistor 1M 1/2W 5%	N	26024	2			
R3	Resistor 33K 1/2W 5%	N	26025	1			
R18	Resistor 10K 1/8W 1% CML	C	26004	1			
C15	Capacitor .1 uf 400V	S	12010	1			
C4	Capacitor .47 uf 200V	S	12007	1			
C11,C13	Capacitor .01 uf 400V	S	12011	2			
C9	Capacitor .001 uf 600V	S	12012	1			
C8	Capacitor .068 uf 400V	S	12013	1			
C7	Capacitor .25 uf 400V	S	12014	1			
C1,C12	Capacitor .56 uuf 500V	S	12015	2			
C2,C3,C16	Capacitor 100 uuf 500V	S	12016	3			
C14	Capacitor 200 uuf 500V	S	12017	1			
C6	Capacitor .0047 uf 200V	S	12006	1			
C10	Capacitor 330 uuf 500V	S	12030	1			
	L Angle Bracket	A	010AA074-1	4			
D1-D16	Diodes IN485A	BG	29001	16		4	
C5	Capacitor 10 mfd 150V SRE Type	S	12018	1			
	Strain Relief Bushing SR-6P	BF	20020	1			
	Strain Relief Bushing SR-5P	BF	20030	1			
	Standoff 69002-0102	BZ	20040	11			
	Tube 12AU7/ECC82	R	34008	1			

* Recommended spares for use in United States

** Recommended spares for use overseas



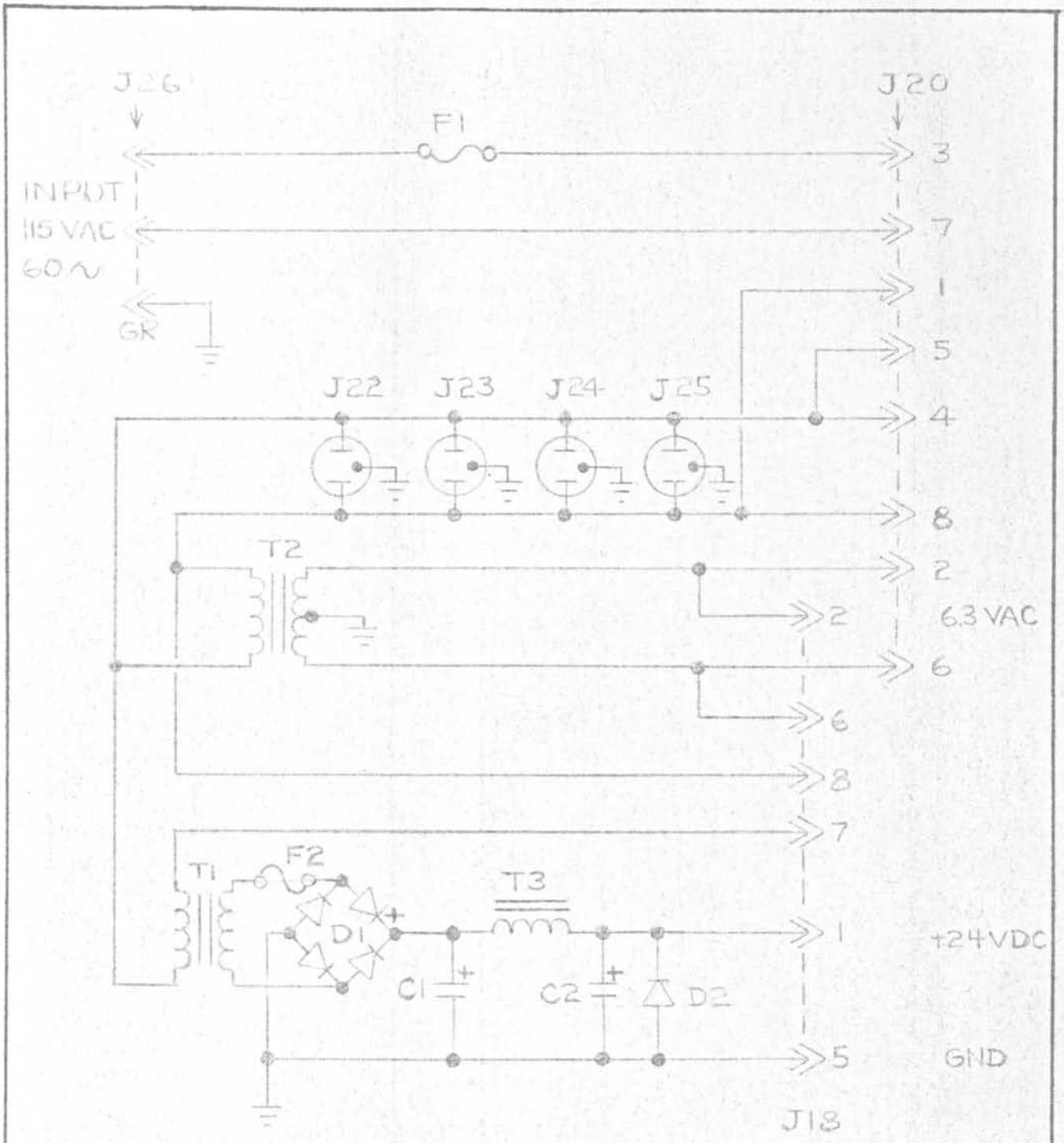
VERTICAL POSITION
(ZERO)



VERTICAL GAIN
(SENSITIVITY)

26-4301-8S
ON CONTROL PANEL
TO SCOPE

DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC HP CONTROL CABLE		
JCB	12-2-63	010AB045-3
WB	12-3-63	



9	8-28-63	JCB	J18 WAS P5 J20 WAS P2 J26 WAS P1 J25 WAS J4 J24 WAS J3 J23 WAS J2 J22 WAS J9 T3 WAS L1 CHGD. LOCATION - F2	DAVIDSON & HEMMENDINGER EASTON, PA.		
				SCHEMATIC DIAGRAM COMIC DISTRIBUTION CHASSIS A C POWER		
	6-20-63	JCB	TRACED	RHE	5-3-63	010AB046-9
8	5-27-63	WB	P2-1, 5 TO 110VAC	WB	7/15/63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 7-29-63 By JCB	Part List 010PL046-9	

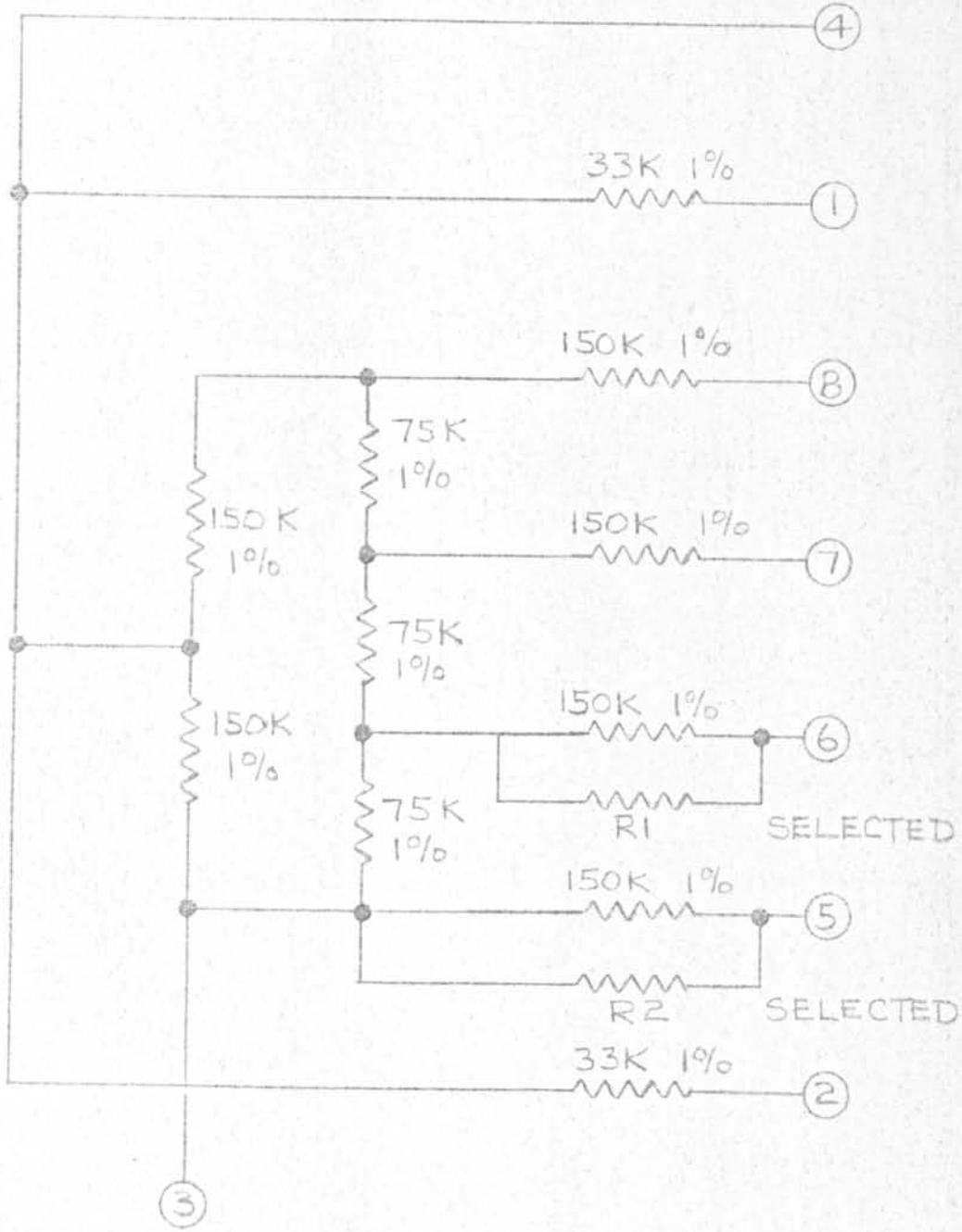
COMIC

Power Distribution Chassis / 10B

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Chassis - Fabrication	A	010DA047-10	1			
C1	Capacitor 2 uf 50V	S	12019	1			
C2	Capacitor 500 uf 50V	AE	12020	1			
D1	Selenium J29 B1	AF	29006	1		1	
D2	Diode SR500	AG	29007	1		1	
F1	Fuse 10 amp	AH	31001	1	5	5	
F2	Fuse 2 amp	AH	31002	1	5	5	
J22-J25	Socket 3 prong S258	AJ	20015	4			
J26	Twist Lock 3 prong 7556	AJ	20016	1			
J18,J20	Socket 26-4401-8P	F	38008	2			
T1	Power Transformer RT-201	AK	33002	1			
T2	6.3 VAC CT 3A21F10	L	33003	1			
T3	Filter Reactor C47U	AL	33004	1			
	Fuse Holder HKP	AH	31003	2			
	Terminal Strip 866	G	20001	2			
	Angle Brackets Feet	A	010AA074-1	4			

* Recommended spares for use in United States

** Recommended spares for use overseas



DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC PLUG-IN UNIT - HORIZONTAL DETECTOR		
JCB	12-3-63	010AB055-1
WB	12-3-63	

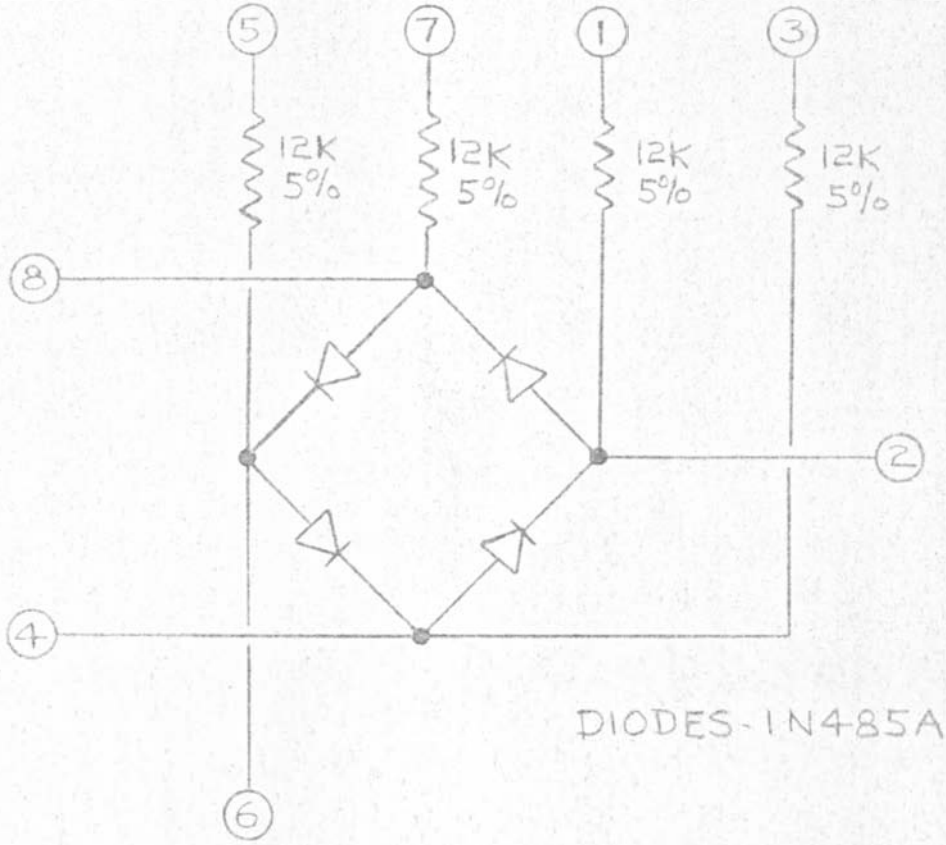
DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8-30-63	Part List	
By JCB	010PL055-1	

Comic

Horizontal Detector 055

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Network Can 95052-1	Q	11002	1			
	Board	X	18001	1			
	Resistor 150K 1/8W 1% CML	C	26003	6			
	Resistor 33K 1/2W 1%	C	26049	2			
	Resistor 75K 1/2W 1%	C	26055	3			
	Resistor 1.5M 1/2W 5%	C	26080	1			
	Resistor 2.2M 1/2W 5%	C	26056	1			

* Recommended spares for use in United States
** Recommended spares for use overseas



DIODES - 1N485A

DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC PLUG-IN UNIT - VERTICAL DETECTOR		
JCB	12-3-63	010AB056
WB	12-3-63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8-30-63	Part List	
By JCB	010PL056	

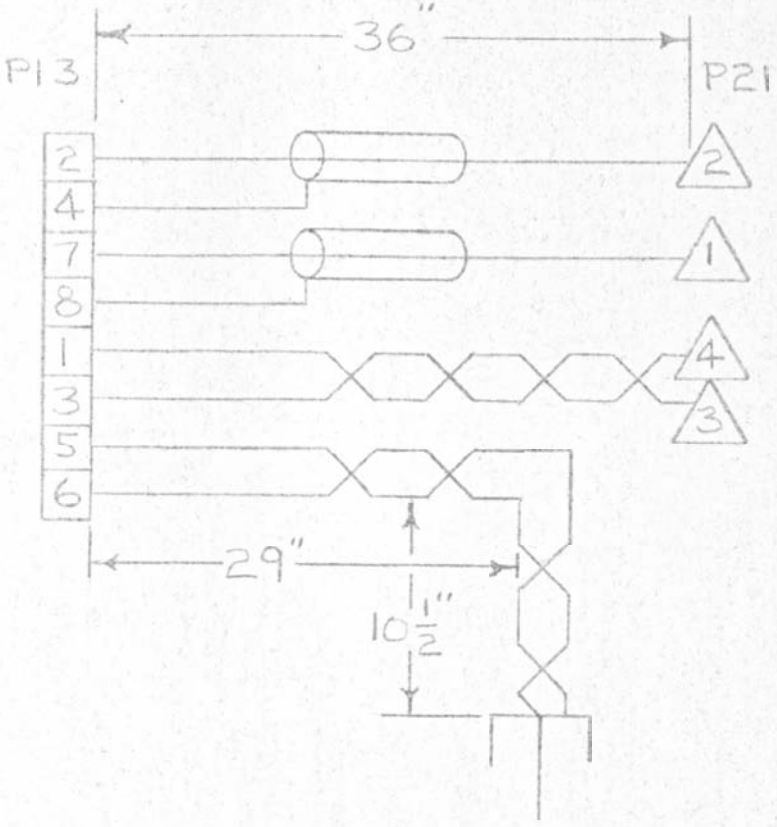
Comic

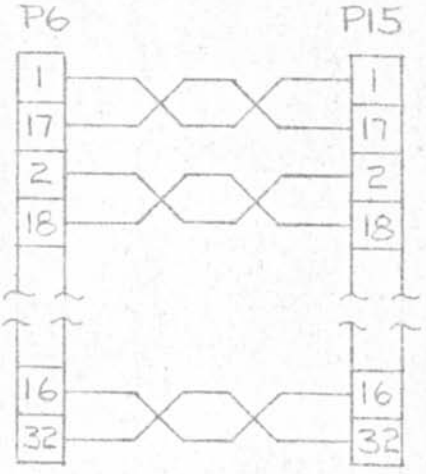
Vertical Detector / 056

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Network Can 95052-1	Q	11002	1			
	Diode 1N485A	BG	29001	4			
	Resistor 12K 1/2W 5%	N	26057	4			

* Recommended spares for use in United States

** Recommended spares for use overseas





DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC SCOPE CABLE		
JCB	12-3-63	010AB092
WB	12-3-63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION Chgd quan. Item 1 Added Item 5 Added 6,7,8
Date 8-3063 By JCB	Part List 010PL092	

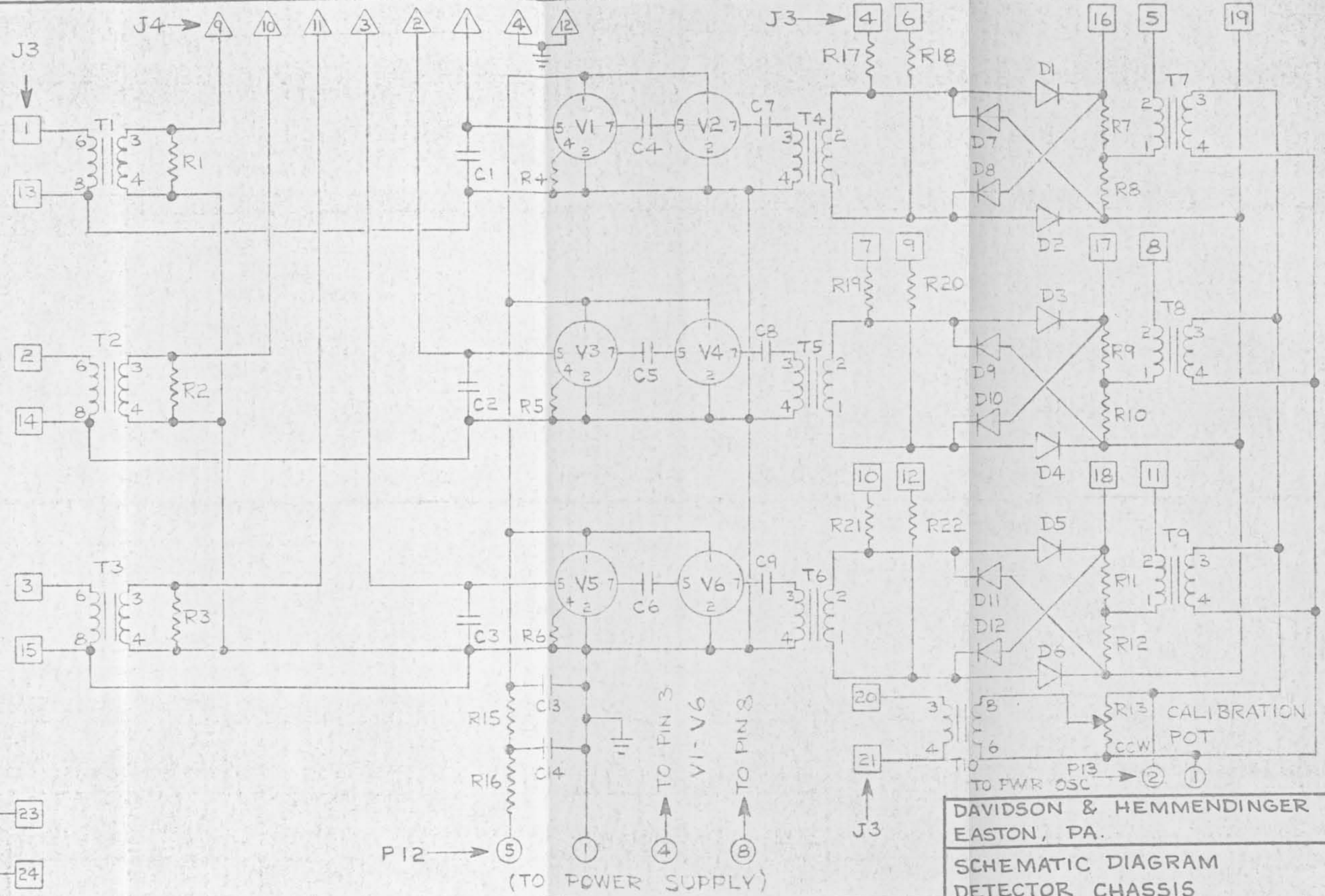
Comic

Cables / 010

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
P6	Plug 26-4301-32S	F	38007	1			
P32	Mic Connector 5501F	F	38029	1			
P21	Plug 91MC 4M	F	38016	1			
P13	Plug 26-4301-8S	F	38009	1			
P15	Plug 26-4501-32S	F	38006	1			
	Plug 7555	AJ	20039	1			
	Plug 5274	AJ	20019	1			
	Cable (18SJ) 10 ft.			1			

* Recommended spares for use in United States

** Recommended spares for use overseas



6	11-29-63	JCB	WB	CHGD. XFMR PINS. ADDED GNDS.
5	9-30-63	JCB	WB	SWITCHED PIN 1&2 (P13)
	7-8-63	JCB		TRACED
4	5-27-63	WB		CALIBRATE CIRCUIT
3	5-14-63	RHE		ADDED R17 - R22
2	5-1-63	RHE		DELETED P5

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
DETECTOR CHASSIS

RHE	1-17-63	081BB007-6
WB	7/15/63	

DAVIDSON & HEMMENDINGER Easton, Penna.	REVISION
Date 7/26/63 By JCB	Part List 081PL007-6

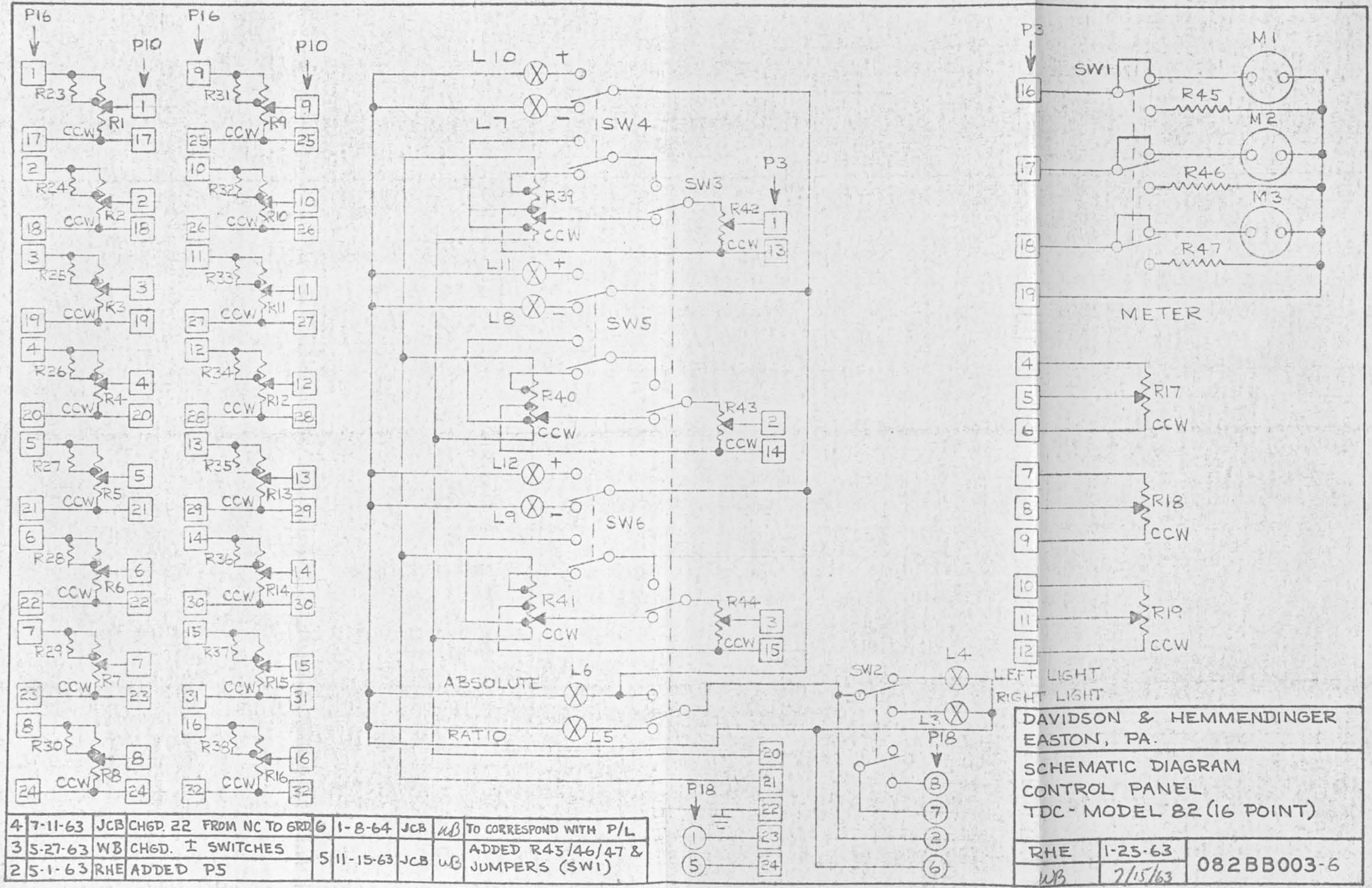
TDC

Detector / 81 & 82

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Chassis Fabrication	A	081CA006-4	1			
V1-V6	Tube 12AX7/ECC83	BY	34001	6	2	2	
J3	Socket 26-4401-24P	F	38013	1			
J4	Socket 26-4401-16P	F	38014	1			
P13	Connector 91MC3M	F	38015	2			
P12	Plug 26-4301-8S	F	38009	1			
T1-T3	Transformer M10H	M	32001	4		1	
T8-T9	Transformer M3443	M	32004	6			
D1-D12	Diode IN485A	BG	29001	12			
R1-R3	Resistor 50 ohm 1/2W 1%	N	26005	3			
R4-R6	Resistor 330 ohm 1/2W 5%	N	26006	3			
R7-R12	Resistor 10K 1/8W 1% CML	C	26004	6			
R13	Pot 10 ohm 10T Model A	B	27012	1			
R15-R16	Resistor 2200 ohm 1W 5%	N	26007	2			
R17-R22	Resistor 10K 1/2W 5% CML	C	26020	6			
C1-C3	Capacitor .0015 mfd 600V	S	12005	3			
C4-C6	Capacitor .0047 uf 200V	S	12006	3			
C7-C9	Capacitor 0.47 mfd 200V	S	12007	3			
C13-C14	Capacitor 50-50 mfd 450V	S	12008	1			
	Socket Octal 8JM-2	T	20003	6			
	Standoff 69002-0102	BZ	20040	7			
	Terminal Strip 1066	G	20005	6			
	Plug-ins Z-8324	Q	13041	6			
	Strain Relief Bushings SR-6P	BF	20020	1			

* Recommended spares for use in United States

** Recommended spares for use overseas



4	7-11-63	JCB	CHGD. 22 FROM NC TO GRD	6	1-8-64	JCB	WB	TO CORRESPOND WITH P/L
3	5-27-63	WB	CHGD. I SWITCHES	5	11-15-63	JCB	WB	ADDED R45/46/47 & JUMPERS (SW1)
2	5-1-63	RHE	ADDED P5					

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
CONTROL PANEL
TDC - MODEL 82 (16 POINT)

RHE	1-25-63	082BB003-6
WB	7/15/63	

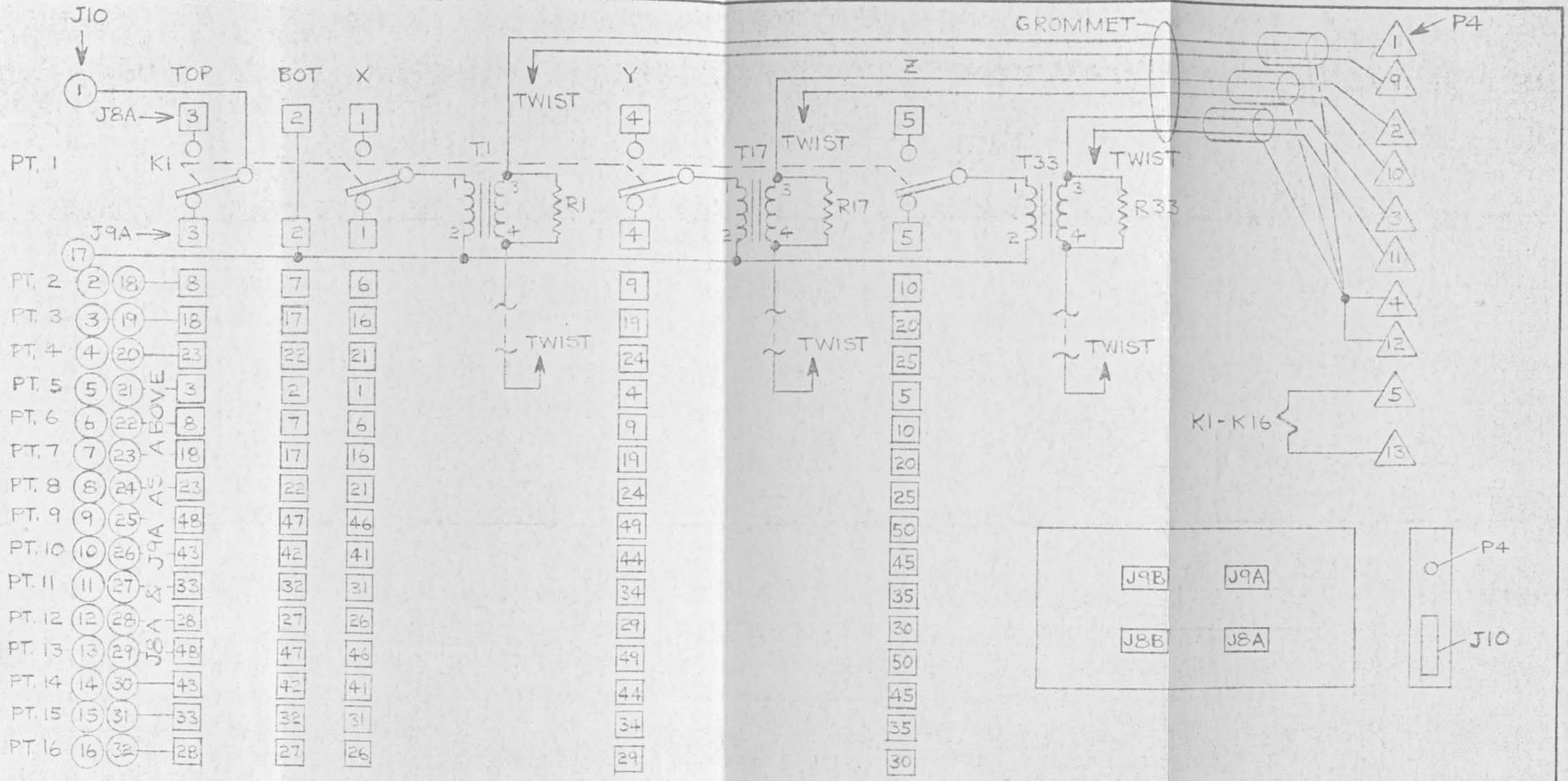
DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION ADD R 330Ω SW1-was HK253 Chg M1-M3
Date 7/26/63 By JCB	Part List -6 082PL003-6	

TDC

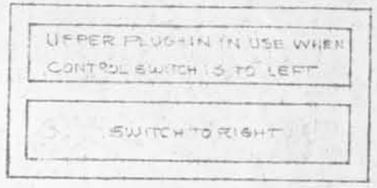
Control Panel / 82

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Panel Fabrication	A	082DA001-5	1			
	Duodial RBC	B	17001	22			
R1-R16	Pot 50K 10T 7216-235-0	B	27003	16	1	1	
R17-R19	Pot 1K 57 M1K	C	27006	3			
R23-R38	Resistor 150K 1/8W 1% CML	C	26003	16			
R39-R41	Pot 50 ohm 10T T1440° 1800° 2160° 7216-237-0	B	27005	3	1	1	
R42-R44	Pot 500 ohm 10T 7216-R500L.25	B	27004	3	1	1	
M1-M3	Meter 3200-922 1145 HBC 050 DCUA	E	36004	3		1	
P16	Plug 26-4501-32S	F	38006	1			
P10	Plug 26-4301-32S	F	38007	1			
P3	Plug 26-4301-24S	F	38005	1			
P18	Plug 26-4301-8S	F	38009	1			
SW1	Switch 1L250-73	H	30020	1			
SW3	Switch 1M253-73	J	30011	1			
SW2, SW4 SW5-SW6	Switch 7565K5	J	30019	4		1	
L1-L12	Lampholder 7538	K	23002	10			
L1-L12	Cartridge 39-604-1437	K	23001	10			
L7-L9	Cap 250-1475 + Stamp	K	23011	3			
L10-L12	Cap 250-1475 - Stamp	K	23010	3			
L5-L6	Cap 250-1475 No Stamp	K	23012	2			
L3-L4	Cap 250-1475 Stamp 1 "C" 1 "CE"	K	23013	1 ea.			
	Knob A019	D	17002	3			
	Clamp, Cable 9/16 I. D. 838	G	20006	3			
	Clamp, Cable 3/8 I. D. 835	G	20007	1			
R45-R47	Resistor 330Ω 1/2W 1%	N	26079	3			

* Recommended spares for use in United States
** Recommended spares for use overseas

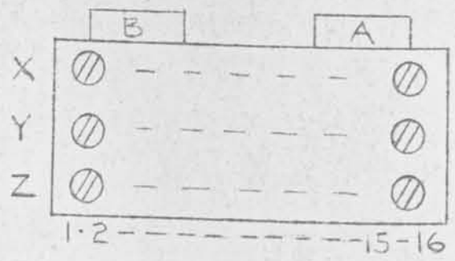


PLUG-IN LOCATION



FRONT OF ILLUMINANT CHASSIS

POTENTIOMETER LOCATION



TRACED 7-9-63-JCB

DAVIDSON & HEMMENDINGER
EASTON, PA.

SCHEMATIC DIAGRAM
ILLUMINANT CHASSIS
MODEL 82 (16 POINT)

1	11-29-63	JCB	WB	ADDED PLUG-IN & POT. LOCATIONS	RHE	1-28-63	082BB004-1
				REVISIONS	WB	7/15/63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 7/26/63 By JCB	Part List 082PL004-1	

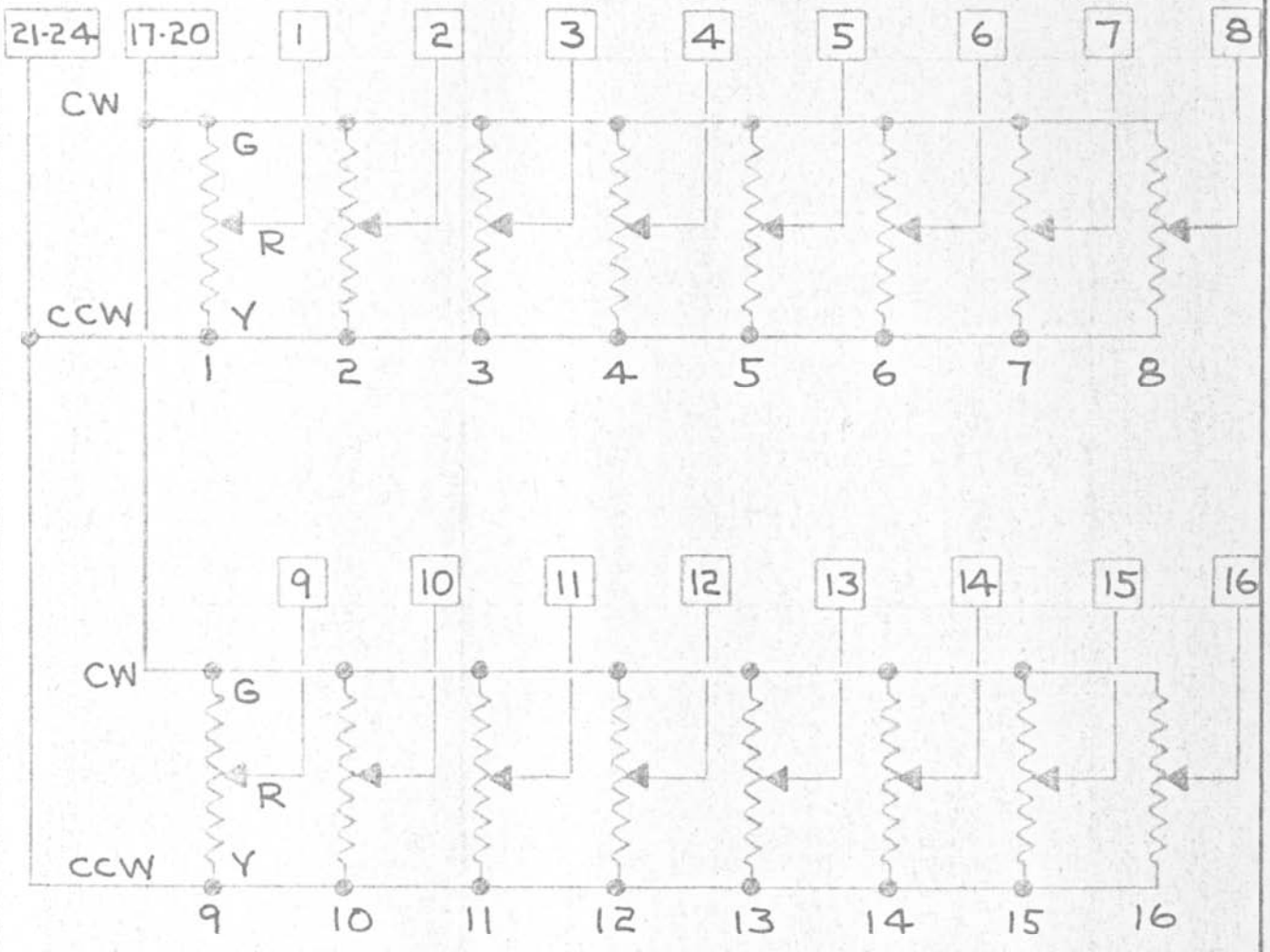
TDC

Illuminant / 82

	CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
		Chassis Fabrication	A	082CA006-3	1			
		Bottom Plate	A	082BA007	1			
	T1-T48	Transformer M3444	M	32003	48			
	R1-R48	Resistor 10K 1/8W 1% CML	C	26004	48			
	P4	Plug 26-4301-16S	F	38010	1			
	J10	Socket 26-4401-32P	F	38011	1			
	J8-J9	Socket 57-20500	F	38012	4			
*	K1-K11	Relay 10057 Mark 11	P	25003	11	1	1	
		Terminal Strip 866	G	20001	1			
		Terminal Strip 1063	G	20002	3			

* Recommended spares for use in United States

** Recommended spares for use overseas



R - 50K

AMPHENOL BLUE RIBBON
26-4101-24P

DAVIDSON & HEMMENDINGER EASTON, PA.		
SCHEMATIC DIAGRAM COMIC PLUG-IN UNIT MODEL 140 COLORANT		
RHE	1-9-62	140AB001-1
	6-26-63	

TRACED JCB 6-26-63

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 8/30/63 By JCB	Part List 140PL001-1	

COMIC

Colorant Plug-ins / 140

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Trimpot 50K 215L-490-503	AR	27002	80			
	Handle	BX	140AA010-1	5			
	Box 3 x 4	BJ	140BA020	5			
	Panel	X	140AA007	5 sets			
	Card Holder	BL	20031	5			
	Socket 26-4101-24P	F	38028	5			

* Recommended spares for use in United States

** Recommended spares for use overseas

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 2/7/64	Part List	
By JCB	140PL001-1	

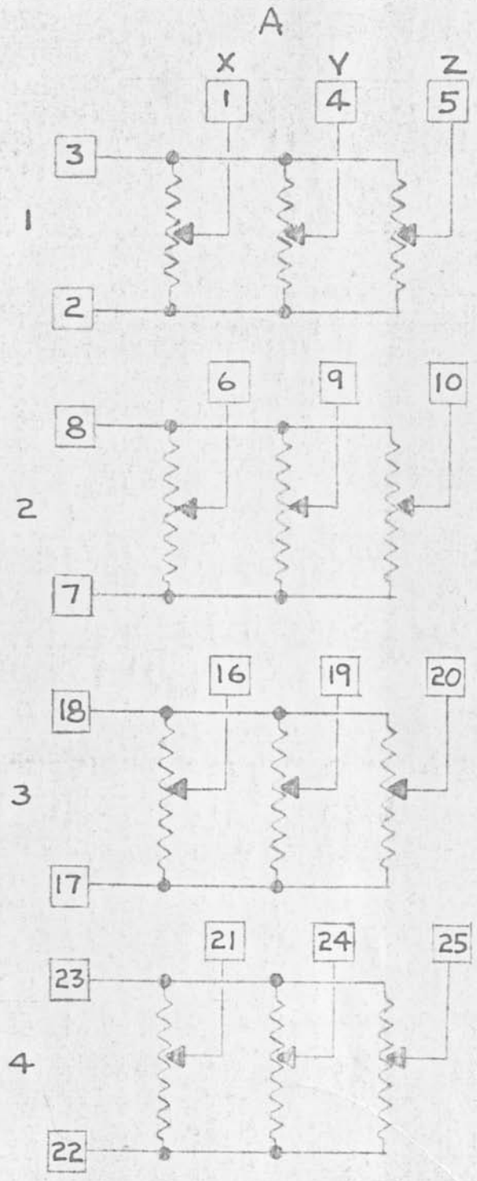
COMIC

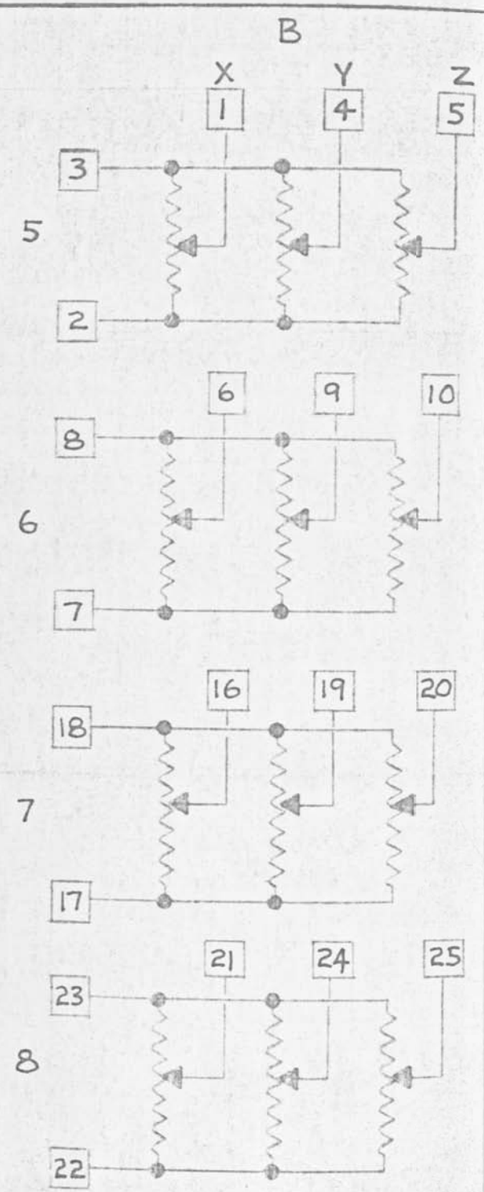
Colorant Plug-ins / 146

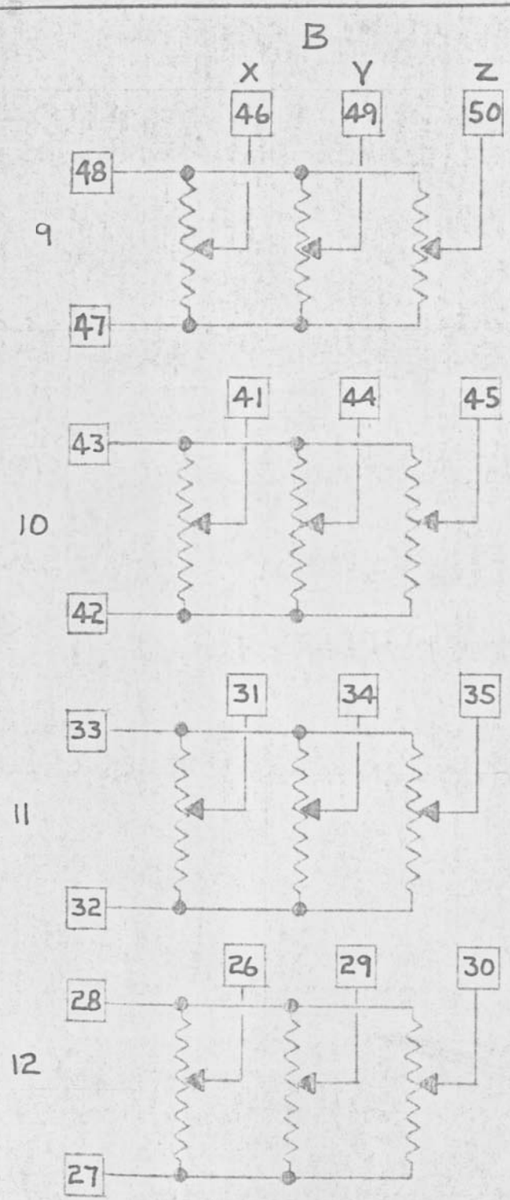
CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
	Pot 1M (12 quad.)	AA	27016				
	Handle	BX	140AA010-1				
	Box 3x4	BJ	140BA019				
	Card Holder	BL	20031				
	Socket 26-4101-24P	F	38028				
	PC Board	AB	200PC001				
	Panel	X	140AA011-1				

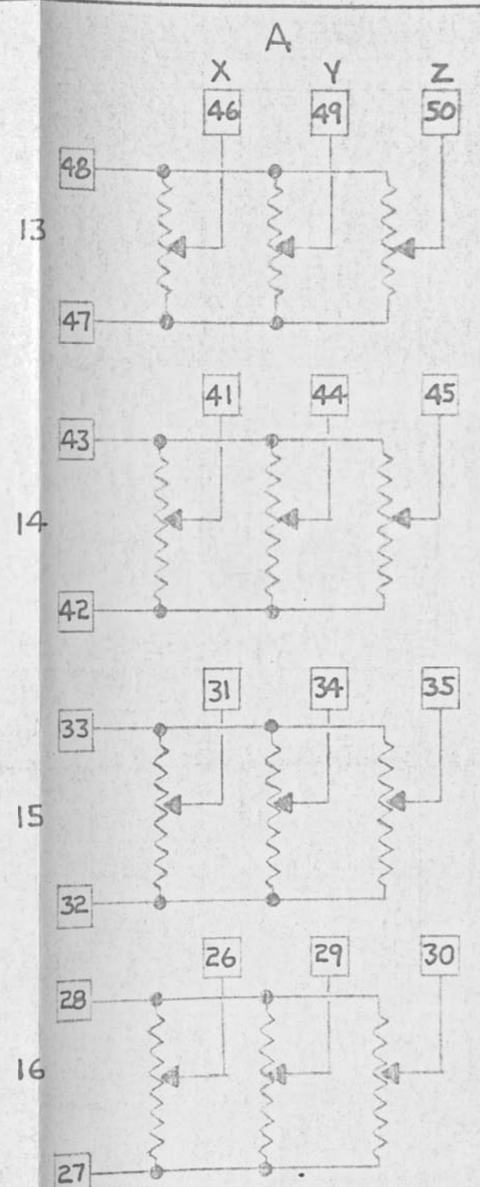
* Recommended spares for use in United States

** Recommended spares for use overseas









P-57-10500
R-1 MEG

DAVIDSON & HEMMENDINGER EASTON, PA.			
SCHEMATIC DIAGRAM PLUG-IN UNIT - ILLUMINANT MODEL 160			
JCB		6-25-63	160BB006
WB		6/26/63	

DAVIDSON & HEMMENDINGER Easton, Penna.		REVISION
Date 10/21 63 By BAN	Part List 160PL006	

TDC

Illuminant
~~Plug-in~~ / 160

CIRCUIT REF	PART DESCRIPTION	VENDOR CODE	D&H NUMBER	NO. REQ'D	*	**	
2	Illuminant Plug-in - var			(2)			
	Trimpots 1M YANN001-25-E6F	AA	27016	24			
	Chassis Plug 50 pin 57-10500	F	38019	4			
	Box and Cover	V	160CA005-2	2			
	Connector Mounting Bracket	V	160BA008	2			
	Board Spacers	BV	160AA010	8			
	Post	A	160AA013-1	2			
	Hold Down Block	V	082AA012	2			
	PC Board	AB	200PC002	2			
	Clamp Plate	V	160BA012-1	1			
	Knob	Salvage		2			

* Recommended spares for use in United States
** Recommended spares for use overseas

A	Stockertown Machine Shop
B	Beckman - Helipot
C	Clarostat
D	Millen
E	International Instrument
F	Amphenol
G	H. H. Smith
H	Carling
J	Cutler - Hammer
K	Dialco
L	Thordarson
M	Microtran
N	Allan-Bradley
P	Electro Tec
Q	Engineered Electronics (EECO)
R	Raytheon
S	Aerovox
T	Cinch Jones
V	Electro Space Fabricators
W	Winchester
X	H. W. Ostrander
Y	Potter-Brumfield
Z	Microswitch
AA	Centralab
AB	National
AC	Elmenco
AD	Walsco
AE	Mallory
AF	International Rectifier
AG	Sylvania
AH	Buss
AJ	Hubbell
AK	Stancor
AL	Triad
AM	Trans-Electronics
AN	Littlefuse
AP	T & B Engineered
AQ	R. C. A.
AR	Bourns
AS	Ward Leonard Axiohm
AT	ELCO Corp.
AV	Chicago Transformer
AW	A. H. & H.
AX	Sarkes-Tarzian
AY	Shallcross
AZ	Selectro
BA	Electronic Research
BB	Merit
BC	Marian
BD	Grayhill
BE	Ohmite
BF	Heyco (Heyman Mfg.)
BG	Computer Diode Corp.
BH	Cambion
BJ	Vector
BK	Lehigh Valley Electronics
BL	Brainerd
BM	Ansley
BN	Trimflex
BP	Davis Cabinet Shop
BQ	Mutual Design
BR	Clare
BS	Southco
BT	Engineering Hardware Supply
BU	General Electric
BV	Angler Industries
BW	International Semiconductor Corp.
BX	Vemaline
BY	Mullard
BZ	Garlock
CA	Texas Instrument
CB	Industrial Electronic Engineering
CC	Auth Electric
CD	Sprague
CE	Circuit Structures Lab
CF	Chassis Trak
CG	A. P. I. (AM PANCOR)
CH	Cannon
CJ	Neshaminy Electronic Corp.
CK	Royal
CL	Titchener
CM	Sangamo
CN	General Instrument
CP	PIC Design Corp.
CQ	MRC (Marlin Rockwell Corp.)
CR	Halogen
CS	Victor (O-Rings)
CT	Albany
CV	Switchcraft