INSTRUCTIONS

for

CATHODE RAY OSCILLOSCOPE

Cat. No. 90911 - Serial No.....

JAMES MILLEN MFG. CO., INC.
MALDEN, MASS., U. S. A.

Instructions for 90911 Cathode Ray Oscilloscope

1. DESCRIPTION

The 90911 is a miniature panel mounting instrumentation basic cathode ray oscilloscope, complete with bezel and panel control of intensity, focus, vertical centering and horizontal centering. The 90911 uses the RCA 1EP1 or 1EP11 flat faced 1¼ inch diameter cathode-ray tube. This oscilloscope produces unusually sharp traces with moderate acceleration voltage.

Panel space required is the same as a "two inch" conventional indicating instrument. The panel bezel is 2¼ inches square. The miniature design of the oscilloscope is made possible by the use of the MILLEN series of sub-miniature knobs and the new miniature dual potentiometer.

A sharp trace is made possible by use of a very efficient mu-metal magnetic shield, the MILLEN No. 80801-C.

Ten turret lug terminals are available on the rear of the unit, connecting the signal source to the vertical deflection plates, the sweep source to the horizontal plates, acceleration voltage, and heater voltage.

The 90911 is a basic oscilloscope with intensity, focus and centering controls, but with no amplifiers, sweep or power supply. Both horizontal and vertical deflection sources, as well as heater and acceleration voltages are to be taken from the equipment on which the oscilloscope is mounted. Since no amplifiers are normally supplied with the oscilloscope, the frequency response is good through the VHF band. The Millen No. 90202 plug-in high voltage power supply is a miniature power supply available for use with the 90911 in applications where heater and accelerating voltages are not already available. The 90911 has balanced deflection and blanking input terminals. The oscilloscope complete with tube weighs only 12 ounces.

2. APPLICATION

The 90911 oscilloscope is intended for a wide variety of monitoring applications. Since an oscilloscope shows wave shape as well as magnitude it may be used in many applications where voltmeters and milliameters have had to suffice in the past due to the size and cost limitations of oscilloscopes. Such applications include:

Lissajous frequency comparator
Null indicator
Klystron mode indicator
Pulse jitter indicator
Neutralization indicator
Tuning indicator
Voltage output indicator
Power output indicator
Per cent modulation indicator
Phase shift indicator
Frequency drift indicator
and many, many others.

One of the chief advantages of an oscilloscope over a moving coil meter is that the oscilloscope may be used for many indications whereas the meter is usually used for only one indication. The oscilloscope responds immediately, does not require damping and does not load the circuit to which it is connected. Because the 90911 is a "basic", but complete, oscilloscope with balanced deflection and blanking output, its cost is kept to a minimum. The user can readily add any auxiliary circuits that may be required for his particular application without having to carry the cost burden of unneccessary circuit refinements.

3. INSTALLATION

A mounting template, drawing No. K90911-2, is included with this instruction book. The nine holes which must be drilled in the panel are:

1—1⅜ inch diameter hole for the tube.
4—⅜ inch diameter holes for the controls.
4—No. 28 drill holes for mounting the oscilloscope and bezel to the panel.

After the panel holes are drilled remove the two Phillips head screws which hold the bezel to the oscilloscope. Do not lose the two spacer washers provided behind the bezel on these two screws. These spacer washers are provided so that the oscilloscope may be mounted on panels thinner than $\frac{1}{16}$ inch thick. If the panel is over $\frac{1}{16}$ inch thick the two spacer washers can be discarded. Insert the oscilloscope controls

through the panel from the rear. Mount the oscilloscope to the panel by means of two studs, one at the top and one at the bottom. Screws and lock washers for this purpose are provided in the studs. Plug the 1EP1 cathode-ray tube into the socket from the front, using extreme care in orienting the tube with the socket so that the tube terminal pins will not be bent nor the seal on the tube broken in inserting the tube in the socket.

Mount the bezel on the front of the panel by means of the two Phillips head screws through the two remaining studs, one at the left and one at the right.

Solder a pair of leads from the 6.3 volts a.c. source to the terminals marked "6.3" on the right panel. Solder a pair of leads from the horizontal deflection signal source to the terminals marked "HOR." on the right panel. Neither of the deflection plates is grounded so that balanced deflection may be used or either plate may be grounded. Solder a pair of leads from the vertical deflection signal source to the terminals marked "VERT." on the left panel. Neither of these deflection plates is grounded so that a balanced signal may be used or either plate may be grounded. Solder a pair of leads from the blanking signal source to the terminals marked "BLANK" on the left panel. The coupling condenser to the cathode-ray tube is rated for 1600 volts d.c. so that a blanking signal may be removed from the rest of the oscilloscope by a d.c. potential up to 1600 volts. The front "BLANK" terminal is marked "G" and is grounded to the ground point on the oscilloscope voltage divider. Solder a lead from the positive terminal of the acceleration voltage source (often ground or near ground) to the terminal marked "H.V." "+" on the left panel. This point is separated from the ground "BLANK" terminal by the centering voltage therefore "G" and "+" should not be connected to the same point in the supply circuit. Solder a lead from the negative terminal of the accelerating voltage sources to the terminal marked "H.V." "—". The total supply voltage may be any value between 400 and 1600 volts d.c. The maximum current drawn at 1600 volts is 0.9 milliamperes. The higher acceleration voltages result in sharper traces and greater range of horizontal and vertical positioning but lower deflection sensitivity as indicated in the technical summary.

Since the 90911 is a miniature oscilloscope, the terminal lugs are placed fairly close together, therefore care must be used in soldering to avoid any possible short circuit or leakage path between terminals.

If the trace is not exactly horizontal the two hex-nuts which mount the tube socket mounting plate to the magnetic shield may be loosened so that the tube may be rotated for proper orientation of trace. After this is done the socket should be held while the hex-nut is clamped down tight to prevent rotation of the tube.

4. OPERATING PRECAUTIONS

As with any cathode ray oscilloscope, the phosphor coating on the inside face of the tube can be burned by excessive intensity of trace, therefore always use the minimum intensity which yields a satisfactory trace, and always turn the intensity control full counter-clockwise when the trace is not viewed. In some monitoring applications it may be advisable to install a spring return push switch which will automatically blank out the trace when it is not being viewed. Only a small limiting resistor is included in the design so that it will be possible to obtain adequate illumination for fast writing rates. At normal writing rates it is possible to advance the intensity control to a point where a fixed trace would burn the phosphor.

5. MEASUREMENT OF PERCENTAGE OF MODULATION OF RECEIVED SIGNALS

Couple the plate of the last I.F. amplifier in the receiver to the vertical input on the oscilloscope and to the horizontal input terminal through approximately 50,000 ohms. Ground the low input terminals to the receiver chassis. Retune the last I.F. transformer.

An unmodulated carrier will appear as an ellipse. Modulation will cause the line to widen to a ribbon leaving a dark oval in the center. At exactly 100% modulation the dark oval in the center decreases to zero. With overmodulation a bright spot appears at the center.

Let A equal the overall outside length of the ellipse.
Let B equal the length of the dark oval.
The per cent modulation equals $(A-B)/(A+B) \times 100$.
The signal must be relatively free from interference for this measurement to be accurate.

6. TECHNICAL SUMMARY

Power Supply—

400 to 1600 volts d.c. at 0.9 milliampere.
6.3 volts a.c. at 0.6 ampere
Millen No. 90202 Plug-In High Voltage Power Supply is available for this application.

Physical Dimensions—

Height—2⅝ inches overall.
Width—3⅛ inches overall.
Depth—4⅜ inches behind panel.

Tube Complement—

1—RCA 1EP1—1¼ Flat Face Cathode-Ray Tube.

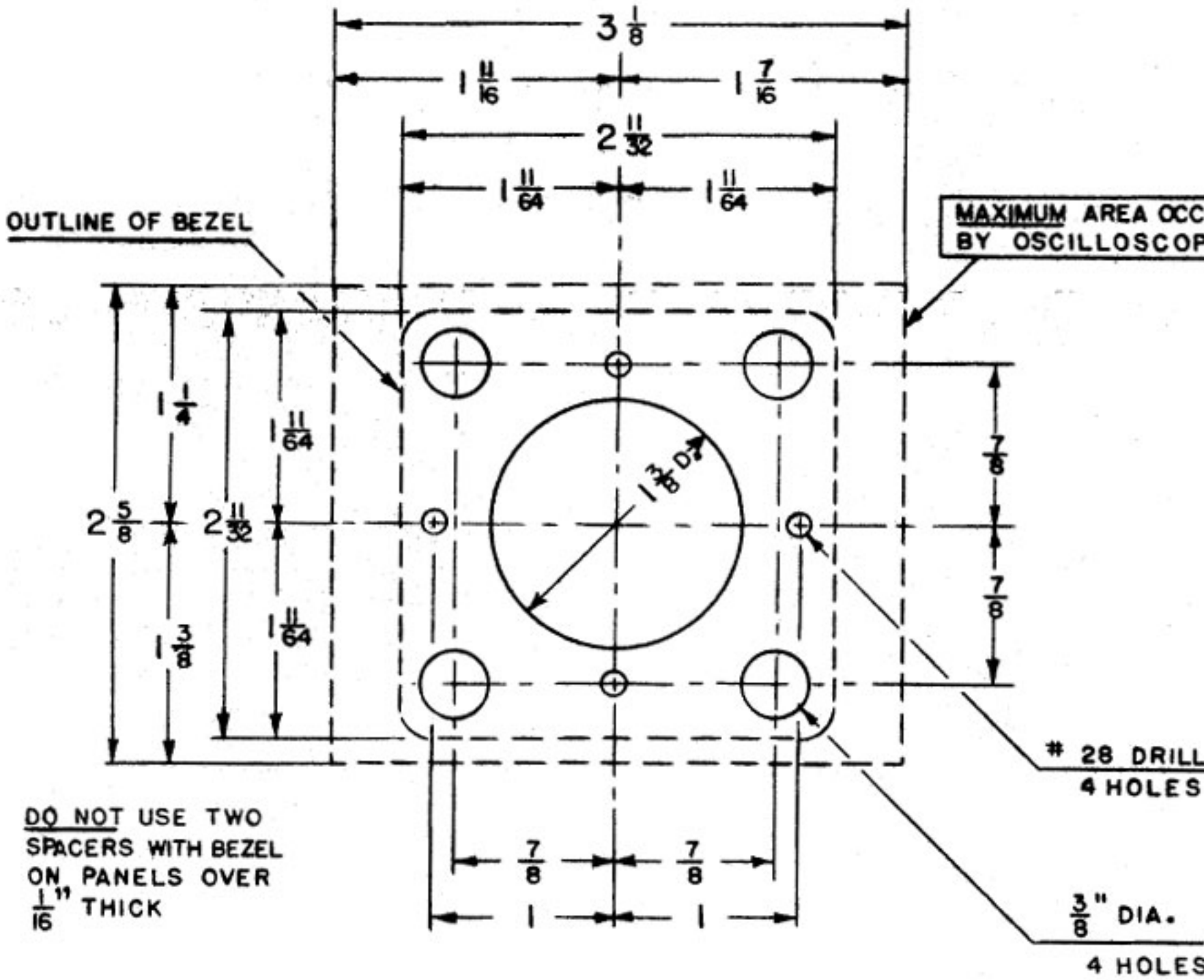
Deflection Sensitivity—

Sensitivity—(Using Millen No. 90202 Power Supply).
Vertical—113 to 138 volts peak to peak per inch.
40 to 49 volts r.m.s. per inch.
Horizontal—118 to 144 volts peak to peak per inch.
42 to 51 volts r.m.s. per inch.

Sensitivity—(Using 500 volts accelerating voltage).
Vertical—105 to 155 volts peak to peak per inch.
37 to 55 volts r.m.s. per inch.
Horizontal—120 to 175 volts peak to peak per inch.
42 to 62 volts r.m.s. per inch.
Sensitivity—(Using 1000 volts accelerating voltage).
Vertical—210 to 310 volts peak to peak per inch.
74 to 110 volts r.m.s. per inch.
Horizontal—240 to 350 volts peak to peak per inch.
85 to 124 volts r.m.s. per inch.
Blanking Sensitivity—(Using 500 volts accelerating voltage).
-7 to -21 volts d.c. or peak to peak.
Blanking Sensitivity—(Using 1000 volts accelerating voltage).
-14 to -42 volts d.c. or peak to peak.
Panel Controls—
Intensity.
Focus.
Vertical Centering.
Horizontal Centering.
Weight—
12 ounces.

R.W.C.—6/21/57

THIRD ANGLE PROJECTION



MOUNTING TEMPLATE
FOR
MILLEN NO. 90911 1 1/4" OSCILLOSCOPE

SCALE – 1 : 1

ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

TEMPLATE FIRST MADE FOR 90911			
DESIGNED BY R.W.C. DRAWN BY R.K.		CHECKED BY R.W.C. APPROVED	
JAMES MILLEN MFG. CO., INC. MALDEN, MASS., U.S.A.	K-90911-2		DATE 6-21-57

C4
0.01

R8
510K

R9
5.1 MEG

BLANK

G

HEATER
INPUT

6.3V
0.6A

V1
1EP1

C3
0.05

R17
1.5 MEG

C5
0.05

RIGHT
HOR.

C6
0.05

C7
0.05

UP
VERT.

C8
0.05

1.5
MEG
R16

1.5
MEG
R14

VERTICAL
CENTERING

1.5
MEG
R15

0.05
C2

R7
100K
INTENSITY

R6
51K

R5
250K
FOCUS

R4
300K

R3
300K

R2
510K

R1
510K

R10 1 MEG
CW

R11 1 MEG

R12 1 MEG
CW

R13 1 MEG

HORIZONTAL
CENTERING

H.V.
− +
300 TO 1700 V.D.C.
0.9 MA.
ACCELERATION
INPUT

OSCILLOSCOPE CIRCUIT DIAGRAM
FIRST MADE FOR - STOCK

DESIGNED R.W.C.	CHECKED R.W.C.
DRAWN BY R. Baker	APPROVED

JAMES MILLEN MFG. CO.
MALDEN MASS, U.S.A.

K-90911-1

DATE 5 JULY 1957

6-61	1	CHANGED R14, R15, R16, R17

90911