

# Instructions for 90902 Cathode Ray Oscilloscope

## 1. DESCRIPTION

The 90902 is a general purpose basic Cathode Ray Oscilloscope comprised of a 2BP1 two-inch cathode ray tube, its associated circuit and power supply. All controls are on the front panel. These are: Intensity Control, Focus Control, Horizontal Centering, Vertical Centering, Power Switch and a switch for selecting the Horizontal Input.

The Horizontal Input Switch has three positions which connect the Horizontal Deflection plates to the External Horizontal Input jacks, an internal 60 cycle sweep voltage, or to ground to eliminate pickup.

The 90902, in contrast to other inexpensive oscilloscopes, has a high voltage power supply, which allows much improved definition and intensity of trace.

The green light filter supplied with the oscilloscope passes the color of the trace and rejects other colors thus affording greater contrast. This allows the oscilloscope to be used in fairly bright light without excessive intensity.

The design of the voltage divider eliminates interaction between centering controls and intensity control.

## 2. APPLICATION

The 90902 is entirely adequate for many laboratory, as well as industrial and communication uses. As a transmitter modulation monitor, no additional equipment or accessories are required. The well known trapezoidal monitoring patterns are secured by feeding some modulated carrier voltage from a pickup loop and link-coupled tuned circuit to the vertical plates of the cathode ray tube and some audio modulating voltage to the horizontal plates.

By the addition of such units as a sawtooth sweep generator, amplifiers, a servo-sweep, etc., all of which can be conveniently and neatly constructed on companion rack panels, the original basic oscilloscope unit can be expanded to serve any conceivable oscilloscope application.

The Millen 90921 Amplifier-Sweep available as an auxiliary unit consists of a 6SJ7 Vertical Amplifier, a 6SJ7 Horizontal Amplifier, and a 6SN7-GT Sweep Oscillator. The 90921 is built on a 19 inch rack panel.

## 3. 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 through a 0.5 mfd. condenser and connect the horizontal input terminal to the vertical input terminal through approximately 50,000 ohms. Ground the oscilloscope chassis 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.

Then percentage of modulation equals  $[(A-B)/(A+B)] \times 100$ .

The signal must be in the clear for this measurement to be accurate.

## 4. INSTALLATION

**Caution:** Be certain that the power cord is removed from the wall socket before inserting tubes.

The type 2BP1 two-inch cathode ray tube is inserted from the front of the panel. In order to insert the cathode ray tube, it is necessary to remove the panel bezel, which can be done by the removal of the two screws on the corners of this bezel. Loosen the tube clamp and insert the 2BP1. Rotate the tube so that the key way is up. Plug the tube socket into the tube base and tighten clamp. It might be desirable, after check, to loosen the clamp in order to orient slightly the figure on the screen.

Insert a Type 2X2-A rectifier tube into the rectifier socket and attach plate cap.

Plug the power cord into a source of 117 volt 60 cycle power and turn the oscilloscope on. Set the Horizontal Input Switch to 60 C.P.S., adjust Centering, Intensity and Focus for a sharp line. **BEING VERY CAREFUL NOT TO TOUCH THE TUBE SOCKET WHICH CARRIES VOLTAGE AS HIGH AS 1000 VOLTS,** rotate the tube so that the trace is horizontal. Remove voltage, tighten tube clamp, install socket shield and bezel. The oscilloscope is now ready for operation.

## 5. OPERATING PRECAUTIONS

1. Never operate the oscilloscope with the socket shield or the top plate removed.
2. Never leave a small stationary bright spot on the face of the tube. This will burn the fluorescent material on the inside of the tube

face.

3. Reduce the intensity by turning the Intensity Control counter-clockwise before removing power from the oscilloscope. This will prolong the life of the cathode ray tube.

## 6. TECHNICAL SUMMARY

### Power Supply

105-125 volts—60 cycles  
Power consumption—19 watts  
Fuse size—1½ amperes  
DC supply voltage—800 volts  
Plate voltage—705 volts

### Physical Dimensions

Height—3½ inches  
Width—19 inches  
Depth 9¼ inches  
Weight—12 pounds

The oscilloscope is designed to mount in a standard rack.

### Tube Complement

Cathode Ray Tube—2BP1  
Rectifier Tube—2X2-A

### Deflection Sensitivity

#### Vertical

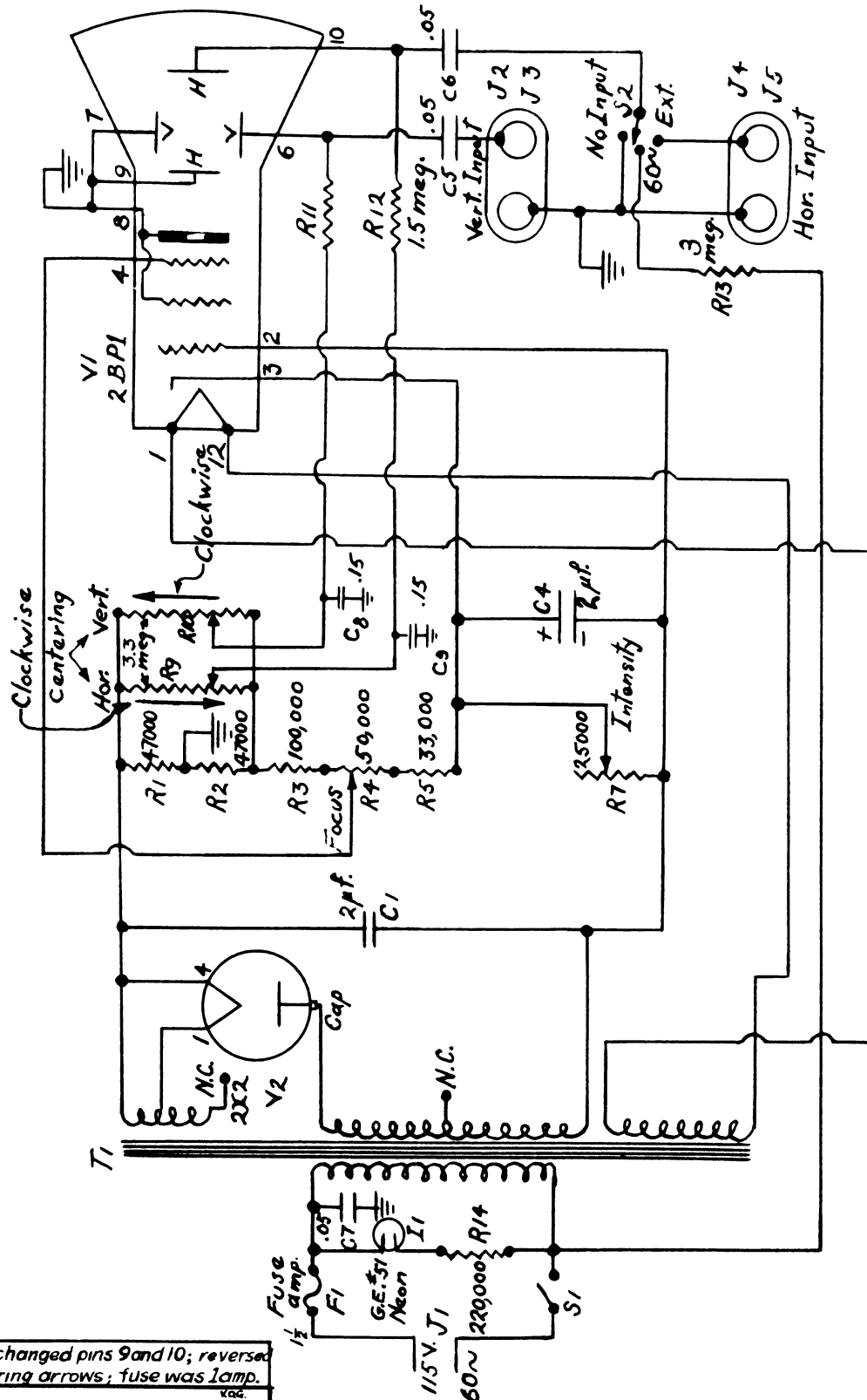
36 volts r.m.s. per inch deflection.  
100 volts peak to peak per inch deflection.

#### Horizontal

43 volts r.m.s. per inch deflection.  
120 volts peak to peak per inch deflection.

Horizontal and vertical deflection sensitivity vary somewhat with line voltage changes, intensity control setting, and position of the trace, as well as with different 2BP1 cathode ray tubes. The above values are representative.

THIRD ANGLE PROJECTION



9-13-54	⑦	Interchanged pins 9 and 10; reversed centering arrows; fuse was 1 amp.
8-20-54	⑥	Pin 2 was pin 5 in C.R.T. V.D.G.
6-11-54	⑤	R <sub>9</sub> and R <sub>10</sub> were 2 megs V.D.G.
7/14/53	④	ADDED C <sub>8</sub> AND C <sub>9</sub> A.W.C.
9/24/46	③	C <sub>4</sub> was 10 mfd. - R <sub>13</sub> was 2.2 meg. R.W.C.
8/1/46	②	R <sub>8</sub> was 62,000 ohms. V1 was 9C2. - R <sub>6</sub> was 2200
7/24/46	①	Inverted arrows on R <sub>9</sub> & R <sub>10</sub> A.D.M.

ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF .005" R<sub>14</sub>

**2" C.R. Oscilloscope**

FIRST MADE FOR

DESIGNED BY <u>H.K.M.</u>	CHECKED BY <u>R.W.C.</u>
DRAWN BY <u>A.D.M.</u>	APPROVED _____

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

K 90902

DATE 8/7/46