G. LEDGER

Du Mont

Cathode-ray Oscillograph

TYPE 274-A

OPERATING AND MAINTENANCE MANUAL

Allen B. Du Mont Laboratories, Inc.
CLIFTON, NEW JERSEY

Obviously, the design of any piece of electrical indicating equipment results from a series of compromises which represent the designer's opinion of an ideal instrument consistent with contemporary engineering techniques and present-day production possibilities.

In developing this instrument, an attempt has been made to incorporate circuits the characteristics of which, we believe, will satisfy the greatest number of applications, and to this end many circuit combinations have been included to extend its flexibility and versatility.

We feel, however, that the real test of any instrument is the opinion of the man who uses it. This day-to-day test of the instrument's advantages and limitations will prove, more than any other method, just what characteristics are desirable, why the range of any given component or function of the equipment should be extended, and how important such modification is.

Because of the nature of the equipment manufactured by Allen B. Du Mont Laboratories, Inc., it is only by complete cooperation between the customer and our Engineering Department that satisfactory designs can be achieved. In an attempt to continually extend the applicability of our equipment to the problems of the engineer, we sincerely request suggestions advising in what manner the design of this equipment may be further extended to include these problems.

TYPE 274-A

REVISION SHEET

TO

OPERATING AND MAINTENANCE MANUAL

NO. 67002893

To bring the Type 274-A Operating and Maintenance Manual up-to-date with the latest engineering changes, the following modifications should be made:

COMPONENT PARTS LIST

1. I1 changed from 0.25 Amp to 0.15 Amp. Part No. becomes 12001310.
2. R12 value changed from 1300 ±5% to 820 ±10% 1/2W. Part No. remains the same.
3. R17 changed from 100,000 ohms to 220,000 ±10% 2W. Part No. becomes 02038050.
4. R24 changed from 180,000 ohms to 390,000 ±10% 1W. Part No. becomes 02035080.
5. R25 changed from 180,000 ohms to 220,000 ±10% 2W. Part No. becomes 02038050.

SCHEMATIC DIAGRAM

1. Delete R25, 180K 1W ±10%, and change value of R24 to 390K.
2. Add R25, 220K 2W ±10%, in parallel with R17.
3. Change R17 from 100K 3W to 220K 2W ±10%.
4. Change R12 from 1300 ohms ±5% to 820 ohms 1/2W ±10%.
5. Delete the ground symbol at the end of R12 and add potentiometer R34 (BIAS ADJUST) in series with R12 to ground. R34 is 1200 ohms, 1.5W, variable with arm connected to ground.

SERVICE INFORMATION

Adjust R34 (BIAS ADJUST) for a minimum sweep frequency of 8 cycles or less, checking to make sure that sweep then operates properly at the highest frequency setting of controls.

ALLEN B. DU MONT LABORATORIES, INC.
INSTRUMENT DIVISION
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NOTICE

Although this Manual is written for the Type 274-A Cathode-ray Oscillograph, it also applies in general to the Type 274. Circuit schematics for both Types are included inside the back cover.

Part No. 67002891
Issue 2

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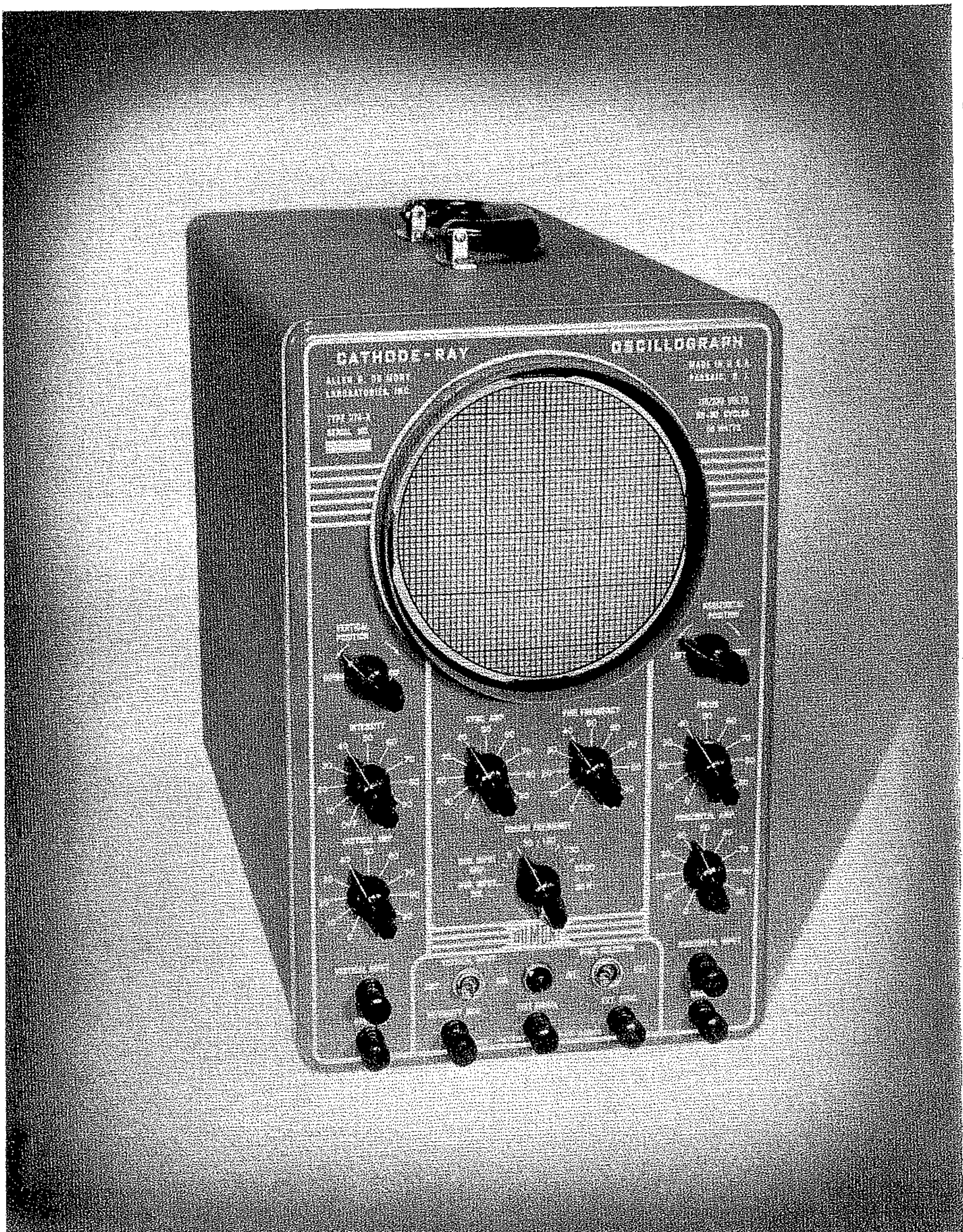

FIGURE 1-1
DU MONT TYPE 274-A CATHODE-RAY OSCILLOGRAPH

SECTION I

GENERAL DESCRIPTION

1. PURPOSE

The Type 274-A Cathode-ray Oscillograph is designed primarily for analysis of electrical circuits by a study of the wave forms of voltage and current at various points. As a general purpose instrument, however, it may be employed to study any variable, within the limits of its frequency response characteristics, which can be converted into electrical potentials. This conversion is made possible by the use of some type of transducer, such as a vibration pickup unit, pressure pickup unit, photo cell, microphone, or a variable impedance, which may be a carbon pile, variable inductance or variable capacitor.

2. CIRCUITS

a. In a specific problem the unknown quantity (which is usually plotted along the vertical or Y-Axis) is a function of some known quantity, such as time, measured along the horizontal or X-Axis. Circuits are incorporated in this insrument which generate a sawtooth-shaped voltage wave to be used as a time-base. This time-base is applied to the horizontal or X-Axis, so that the unknown quantity may be plotted as a linear function of time.

b. Provision is made so the intensity of the trace may be modulated. A terminal is provided on the front panel which is capacitively coupled to the control grid of the cathode-ray tube for the introduction of an external signal. Positive pulses applied to this terminal will intensify the trace at time intervals corresponding with the intervals between pulses. Negative pulses of approximately 15 peak volts will blank the beam.

c. A self-contained power supply furnishes the various voltages and currents for complete operation of the instrument.

3. PHYSICAL DESCRIPTION

Type 274-A Cathode-ray Oscillograph is shown in Figure 1-1. It is enclosed in a gray metal cabinet provided with a plastic carrying handle attached to the top. All controls necessary for the operation of the instrument are located on the front panel. A removable calibrated scale, Type 216-C, for making relative and quantitative measurements is mounted on the face of the cathode-ray tube.

4. FREQUENCY RANGE

a. TRANSIT TIME.—The cathode-ray tube is essentially an indicating device with a pointer of negligible inertia. For this reason its only frequency limitation occurs at deflection frequencies where the transit time of the electron beam across the face of the deflection plates must be considered. Since the electron velocity through the deflection plate space has a finite value, it is possible to apply a deflecting potential which reverses in polarity during the transit time of the electrons.

For example: assume that a 1,000 mc sine wave is applied to the vertical deflection plates. The period of one cycle will be .001 μs. Assume further that the transit time of the electron beam across the face of the deflection plates is .001 μs. The beam will then react to equal positive and negative deflection forces as it travels across the face of the plates, with a resulting deflection of zero. In the modern cathode-ray tube, this effect is not apparent at frequencies below 100 megacycles per second and may normally be disregarded at the lower frequencies.

b. AMPLIFIERS.—The above frequency limitations apply when the cathode-ray tube beam is deflected directly from the signal source without employing any type of vacuum tube amplifier. Since potentials ranging from one hundred to one thousand volts may often be required for full scale deflection of a cathode-ray tube, amplifiers have been incorporated in this instrument to increase the sensitivity of the device so that it may give usable indications from relatively low potential sources. The frequency response of the amplifiers must be considered in the application of this instrument to any problem.

The amplifiers incorporated in the Type 274-A have been designed to give uniform response within 40% over a frequency range from 20 to 200,000 sinusoidal cycles per second. The complete characteristics of the amplifiers are summarized in the quick reference table, Table 1-1.

5. TYPE OF INDICATION

a. LIMITATIONS.—It should be emphasized that the cathode-ray oscillograph does not offer the solution to a problem but that it merely supplies information and data regarding the characteristics of the problem. This information is meant to serve as a guide in analyzing the

TABLE I-I

QUICK REFERENCE DATA

CATHODE-RAY TUBE

- Type 5BP-A
- Accelerating Potential .... 1200 volts

VERTICAL AXIS

- Deflection Factor
  - Direct .... 16 rms volts/inch ±17%
  - Full Gain .... 0.20 rms volts/inch (max.)
- Sinusoidal Frequency Response (full gain)—Uniform within 40% from 20 cps to 200 kc.
- Maximum Input Potential .... 400 rms volts or 600 d-c volts or 600 volts peak
- Input Impedance
  - Direct .... 4.7 meg; 50 μμf
  - Amplifier .... 1 meg; 40 μμf

HORIZONTAL AXIS

- Deflection Factor
  - Direct .... 18 rms volts/inch ±17%
- Full Gain .... 0.25 rms volts/inch (max.)
- Sinusoidal Frequency Response (full gain)—Uniform within 40% from 20 cps to 200 kc.
- Maximum Input Potential .... 400 rms volts or 600 d-c volts or 600 volts peak
- Input Impedance
  - Direct .... 4.7 meg; 60 μμf
  - Amplifier .... 1 meg; 40 μμf

LINEAR TIME BASE

- Gas Triode .... Type 884
- Sweep Frequency Range .... 8 cps to 30 kc.

INTENSITY-MODULATION CIRCUIT

- Input Impedance .... 0.47 megohm, 45 μμf
- Sensitivity .... 10 rms volts to blank
- Test Signal—A test-signal terminal is provided to furnish a test signal of 6.3 volts at the power-line frequency.
- Positioning .... more than 5 inches

POWER SUPPLY

- Primary-Power Potential .... 115 or 230 rms volts ±10%
- Frequency .... 50-60 cycles
- Power Consumption .... 50 watts approx.
- Fuse Protection .... One ampere

TUBE COMPLEMENT

- 2—6AC7 Amplifiers
- 1—884 Sweep Generator
- 2—80 Rectifiers
- 1—5BP-A Cathode-ray Tube

PHYSICAL SPECIFICATIONS

- Height .... 14″
- Width .... 8⅝″
- Depth .... 19⅜″
- Weight .... 35 lbs.

phenomenon which is being studied. The cathode-ray oscillograph is not designed for use as a corrective instrument, which, in itself, performs a specific operation on an electrical signal or on its source. It should rather be considered as an auxiliary instrument which indicates visually the essential characteristics of a signal, thus enabling the operator to quickly make a check on correct functioning or to isolate the causes of any malfunctioning of equipment.

b. INTERPRETATION.—One of the most important procedures used by the oscillograph operator, and the one which probably gives the most trouble to personnel inexperienced in oscillograph work, is the proper interpretation of the patterns traced on the screen of the cathode-ray tube. When interpreting the pattern obtained on the screen of the cathode-ray tube, it should be borne in mind that the unknown signal is always plotted as a function of some signal whose characteristics are known. If the characteristics of the signal on one axis are not known, it will be almost impossible to identify the characteristics of the signal under investigation on the other axis. For this reason it is generally common practice to use for the horizontal variable a sinusoidal signal of known frequency, or a sawtooth signal which has been synchronized to the same or some integral sub-multiple of the frequency of the unknown signal. The sinusoidal signal is often used in applications such as phase, frequency and rate determination. The sawtooth signal gives horizontal deflection which is linearly proportional to time, and it therefore gives a plot of the waveshape of the unknown signal versus time.

c. APPLICATIONS.—The information which may be gained from analyzing screen patterns in the above manner is of great value in determining the characteristics of a device which is under study. The path of a known signal through an amplifier may be followed, and the gain and distortion characteristics of the amplifier may be quickly and easily determined, as well as the point at which the circuit may be faulty. By use of the linear time base as the known function, an unknown waveform may be plotted and analyzed, or the dynamic characteristics of an unknown circuit may be studied. The waveform of a signal shown plotted as a function of the linear sawtooth sweep, will give indications showing the presence of undesirable harmonics, parasitic oscillations, or indication of the degree of faithfulness with which a device is following a desired cycle of operation.

A familiar case of operation where a sinusoidal standard signal is employed for horizontal deflection is found in the application of the cathode-ray tube for frequency comparison of two signals. The unknown signal is fed into the vertical input and the known signal standard frequency is fed into the horizontal input. In this way, the frequency of the unknown signal may be measured by the correct interpretation of the resulting Lissajous pattern.

Another common practice is to impress a modulated carrier upon the vertical input, and the modulation voltage on the horizontal. This results in the pattern known as the modulation trapezoid pattern for the purpose of studying percentage modulation.