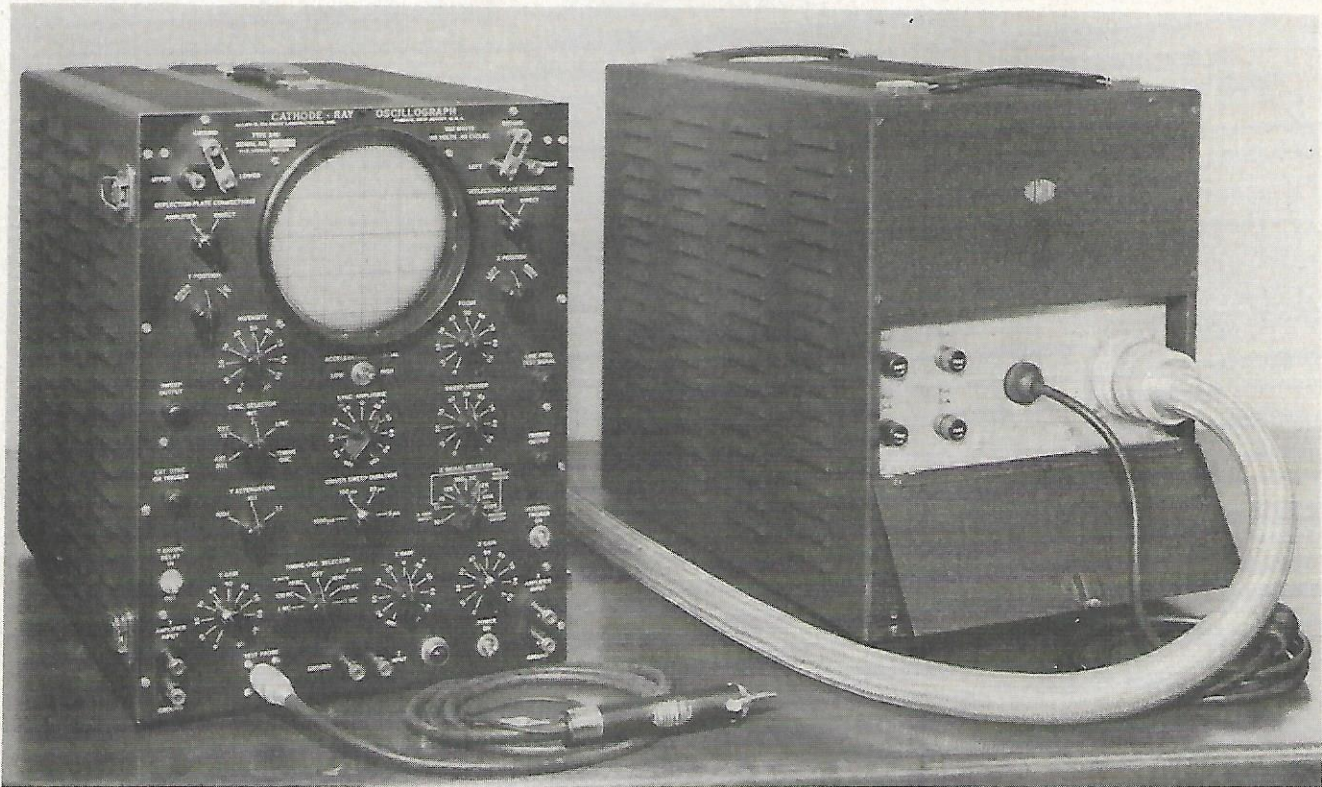


DuMONT

Type 248

CATHODE-RAY OSCILLOGRAPH



FUNCTION

The DuMont type 248 Cathode-ray Oscilloscope has been developed to provide a relatively inexpensive instrument of portable design for the accurate observation and study of micro-second pulses containing frequency components as high as ten megacycles. Either transient or recurrent phenomena can be displayed, and the instrument has been designed to accommodate phenomena of inconstant repetition rate.

The leading edge of short pulses is not obliterated and the accelerating potential applied to the cathode-ray tube is great enough to permit

study of extremely short pulses with low repetition rates. Such phenomena usually can be observed only with specialized and costly oscillographic equipment. Timing markers are available for quantitative or calibration purposes. In short, this instrument removes the very noticeable deficiencies in commercial test equipment performance brought to light by recent advances in the art and technique of electronics.

The special features which have been incorporated in the Type 248 Cathode-ray Oscilloscope do not in any way restrict its usefulness as a general purpose laboratory instrument or as a production test instrument.

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Passaic, N. J., U. S. A.

DESCRIPTION

Cathode-ray Tube

A five-inch diameter Army-Navy preferred type 5JPI cathode-ray tube is used to provide a clear, well-defined image. An accelerating potential of 4,000 volts and a retractable light shield permit observations of phenomena which heretofore could not be readily distinguished because of the relatively small amount of energy imparted to the fluorescent screen. Phenomena of 1 microsecond duration having a repetition rate of 60 cycles per second can be satisfactorily reproduced on the screen. The Type 5JP series of cathode-ray tubes have deflection plate terminals leading through the glass neck of the tube, thereby decreasing the input capacity of the tube and making possible more efficient Y-axis amplification. A lower accelerating potential of approximately 2,000 volts may be selected by a toggle switch on the front panel in case the phenomena do not require high brilliance, and deflection sensitivity is important.

Time - Base :

Continuous Sweep

A high vacuum sweep circuit generates a continuously variable, recurrent sawtooth wave over a frequency range of 15 cycles per second to 150 kilocycles per second. This increased range will be of interest to the investigator concerned with the display of radio frequency phenomena.

The direction of the sweep is from left to right and at least three inches of undistorted deflection is assured at 4,000 volts accelerating potential.

The continuous sweep may be synchronized from an external source, or internally from the Y-axis amplifier, providing the periodic waveform has a frequency between 15 cycles and 5 megacycles per second, a peak amplitude of at least 0.5 volt of either positive or negative polarity, a duration of the synchronizing phase of at least 0.1 microsecond, and a ratio of synchronizing frequency to sweep frequency of not more than 20:1.

A synchronizing signal attenuator is included which permits an external signal input of 200 volts maximum without coupling into the deflection amplifiers.

Driven Sweep

Manipulation of a switch provides for single

or repetitive sweep conditions. This type of operation is also known as "slave sweep," or "start-stop," wherein a sawtooth wave is generated only upon the initiation of an external signal which may or may not be repetitive, and does not necessarily have a constant repetition rate.

There are four switch-selected sweep ranges available: 5, 25, 100 and 1,000 microseconds. Here again the sweep direction is from left to right, and the sweep may be initiated or driven by the signal under observation or by a signal occurring slightly before the observed signal. The driven sweep may be repeated at any periodic rate up to the frequency corresponding to the sweep period. The initiating signal must have a peak amplitude between the limits of 1.0 to 200 volts, of either positive or negative polarity, and a duration on the synchronizing polarity of less than the desired sweep period, but not less than 0.1 microsecond.

Y-Axis Amplifier and Delay Network

The sinusoidal frequency response of the Y-axis, or vertical amplifier, is uniform within 10% of the average value from 40 cycles per second to 4 megacycles and is not down by more than 15% at 5 megacycles and approximately 50% at 7 megacycles.

It is generally recognized that distortionless reproduction of high-frequency pulse waveforms can be attained only with amplifiers having no positive slope at the upper end of their frequency response curves and with a very gradual "fall-off" following the flat portion. The Y-axis amplifier of the Type 248 fulfills these conditions. Great care has been exercised in providing proper gain and phase correction for both high and low frequencies without any of the ill effects of over-compensation.

With the amplifier at full gain and 4,000 volts accelerating potential, the deflection factor is 0.10 r.m.s. volt per inch deflection or better. And, when connecting directly to the deflection plates of the cathode-ray tube through the terminals provided, 120 d.c. volts per inch deflection. These deflection factor figures are halved for 2,000 volts accelerating potential.

At least three inches of undistorted deflection is available on the vertical axis.

The observed signal may be applied to input terminals located on the front panel, in which case the input impedance is 1 megohm resistance and 40 uuf. capacitance in parallel, or to

the special input probe which presents an input impedance of 5 megohms resistance and 10 uuf. capacitance. The probe causes a signal attenuation of 20:1. In addition, a stepped attenuator followed by a continuously variable low impedance gain control provides all attenuation ratios between the limits of 1:1 and 1,000:1. A balanced input signal may also be applied directly to the deflection plates through a capacitive network which presents an input impedance represented by 9.4 megohms with 20 uuf. parallel capacitance, or 4.7 megohms, 25 uuf. for an unbalanced or single ended signal.

Panel markings indicate the actual location (upper, lower, left or right) of the deflection plate connected to each terminal, so that the polarity of a deflecting signal can easily be ascertained.

The test probe is connected to the instrument by five feet of flexible cable. This probe has insulated input clips to allow safe use when connecting to high potentials, and can be used on circuits producing as high as 1,000 d.c. or peak signal volts.

A delay network is provided which may be inserted in the vertical deflection channel by means of a switch on the front panel. The purpose of this network is to delay the observed pulse signal long enough to allow initiation of the single or repetitive sweep before the pulse appears on the screen of the cathode-ray tube. This delay line is characterized by constant attenuation and linear phase shift for frequencies

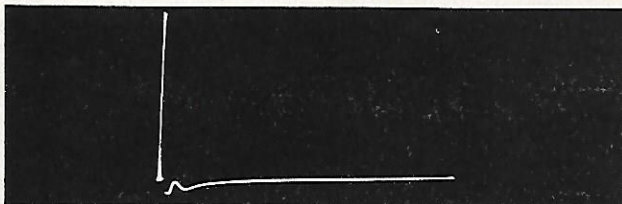


Figure 1

Sharp Pulse on 5 Microsecond Sweep. No Time Delay

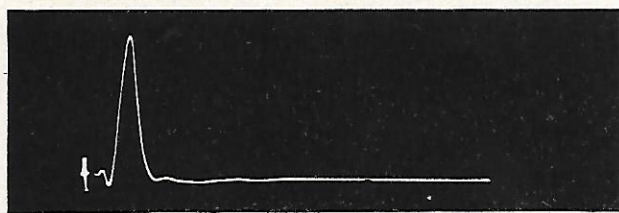


Figure 2

Same Pulse on 5 Microsecond Sweep. Time Delay In Operation of a Driven Sweep for the Observation of Short Pulses.

within the range of the Y-axis amplifier. Figures 1 and 2 show the usefulness of this device in presenting an entire 0.5 microsecond pulse on the cathode-ray tube screen.

X - Axis Amplifier

The X-axis or horizontal amplifier is used to amplify either the output of the time-base generator or an external signal. When performing the latter function its response through input terminals on the front panel is uniform within 25% between 20 cycles per second and 2 megacycles. Its deflection factor is 2.5 r.m.s. volts per inch deflection at 4,000 volts accelerating potential or better.

A stepped attenuator followed by a continuously variable low impedance gain control provides all attenuation ratios between the limits of 1:1 and 100:1. The impedance at the input terminals is 1.0 megohm resistance in parallel with 40 uuf. capacitance. Input characteristics of direct connections to the horizontal deflection plates are similar to those of the vertical axis.

Z - Axis or Beam Modulation Amplifier

Provision for blanking or intensifying the brightness of the fluorescent trace in accordance with some particular wave has been found so useful in cathode-ray oscillograph applications that this feature is included in the Type 248.

The response of the Z-axis amplifier is uniform within 10% of the average value between 40 cycles per second and 4 megacycles. The voltage gain is sufficient to cause a sinusoidal signal of 2.0 r.m.s. volts to blank the beam at normal intensity control settings. Z-axis input impedance is 1 megohm resistance in parallel with 30 uuf. capacitance.

This amplifier may be used in conjunction with an external signal or with an internal timing oscillator described below. Either polarity of the input signal may be used to brighten or darken the beam. A beam control circuit blanks out the return trace of continuous sweeps or the return trace and beam rest position of driven sweeps, without interference to normal use of the Z-axis amplifier.

Timing Oscillator

A timing oscillator and pulse forming circuit accurate within 5%, provides marker signals at intervals of 1, 10, or 100 microseconds. This oscillator is keyed on by the driven sweep cir-

cuit. By a switch on the front panel, it can be made to blank or brighten accurate markers along the observed trace. Figs. 3A and 3B show 10 microsecond intervals modulated on a driven sweep of approximately 100 microsecond duration.

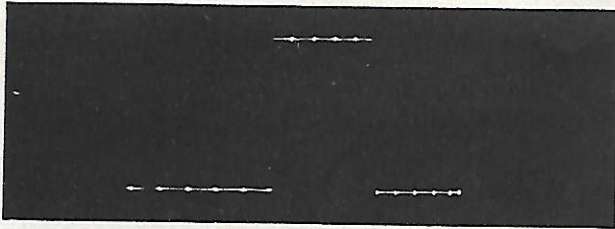


Figure 3A
With Markers Brightening Beam

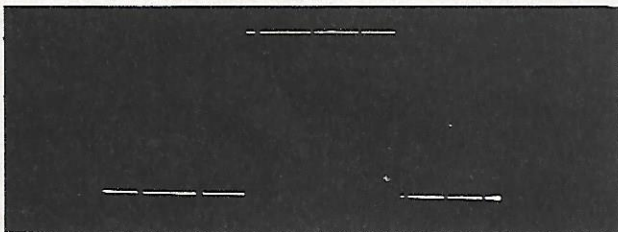


Figure 3B
With Markers Blanking Beam
Operation of Marker Circuit with Square-wave Signal

Trigger Output

The DuMont Type 248 Cathode-ray Oscilloscope may also be used as a synchroscope since a separate trigger pulse generator is included. This furnishes an output signal of either polarity consisting of one-half microsecond pulses of approximately 100 volts peak amplitude, the repetition rate being variable between 200 and 3,000 pulses per second. Thus, an external circuit may be driven by the trigger output signal and a phenomenon produced by that external circuit applied to the oscilloscope and observed, since the oscilloscope sweep may be synchronized with either the trigger output pulse or the phenomenon itself.

Power Supply

The DuMont Type 248 Cathode-ray Oscilloscope operates from a supply of 105/125 volts, 50-400 cycles per second, of sinusoidal waveform. A fifteen-second delay relay controls

the application of high voltages and prevents surges which might be harmful to the circuit components.

Mechanical Characteristics

The instrument has been constructed in two units to facilitate handling and installation. The power supply is housed in a cabinet measuring approximately 14" x 18" x 21" deep, and weighs about 80 pounds. The amplifier-indicator cabinet is the same size and weighs about 30 pounds. It is connected to the power supply by means of a six-foot shielded cable. The cabinets have a black wrinkle finish and the steel chassis are cadmium- or copper-plated to resist corrosion. The front panel is finished in dull black with white lettering and graduations.

FEATURES

For the first time a cathode-ray oscilloscope incorporating the most advanced features is available at moderate cost as a standard commercial instrument. The DuMont Type 248 Oscilloscope will be especially valuable to the present-day investigator who has been restricted in his work by inadequate performance or prohibitive cost of existing equipment.

The salient features of this instrument can be summarized as follows:

1. A wide band vertical axis amplifier is usable to 10 megacycles.
2. 4,000 volts accelerating potential applied to the cathode-ray tube, allowing observation of phenomena characterized by fast writing rates.
3. An extremely flexible time-base generator to display signals which heretofore required special sweep circuits.
4. A delay network in the vertical channel permitting observation of the entire waveshape of short duration phenomena.
5. A timing oscillator for quantitative analysis.
6. A trigger output signal useful for "synchroscope" applications.
7. A convenient mechanical design which permits placing the separate power supply on the floor or a shelf underneath the laboratory bench.

SPECIFICATIONS

Cathode-ray Tube

Type	5JP1
Other fluorescent screens of long or short persistence can be furnished.	
Accelerating Potential (overall)	2,000 or 4,000 volts
Input impedance to either pair of deflection plates from terminals on front panel:	
Balanced	9.4 megohms, 20 uuf.
Single-ended	4.7 megohms, 25 uuf.
Deflection factor (4,000 volts accelerating potential)	120 d.c. volts/inch
Maximum Input Potential	1,000 volts d.c. plus peak a.c.
Image Positioning	Retain at all times

Y-Axis Amplifier

Frequency Response	Uniform within 15% from 40 c.p.s. to 5 mc. No overshoot on square wave having rise time of 0.1 usec.
Input Impedance:	
Through Test Probe	5 megohms, 10 uuf.
To Terminals	1 megohm, 40 uuf.
Deflection Factor:	
Through Probe	2 r.m.s. volt/inch
To Terminals	0.1 r.m.s. volt/inch
Undistorted Deflection	3 inches, from symmetrical signal
Maximum Input Potential	600 volts d.c. plus peak a.c. through terminals 1000 volts d.c. plus peak a.c. through probe.
Delay Network	Constant attenuation and linear phase shift to 6 mc. .5 microsecond delay.

X-Axis Amplifier

Frequency Response	Uniform within 25% from 20 c.p.s. to 2 mc. No positive slope at high frequency end of response curve.
Input Impedance	1 megohm, 40 uuf.
Deflection Factor	2.5 r.m.s. volts/inch
Undistorted Deflection	3 inches
Maximum Input Potential	600 volts d.c. plus peak a.c.

Z-Axis Amplifier

Frequency Response	Uniform within 10% from 40 c.p.s. to 4 mc.
Input Impedance	1 megohm, 30 uuf.
Sensitivity	At normal beam intensity blanks on 2 volts r.m.s.
Return Trace Blanking	Retained at all times. Does not interfere with other uses of Z-axis.
Timing Markers	Timing oscillator furnishes markers at intervals of 1, 10, or 100 microseconds. These can be made to either blank or brighten the beam and are perfectly synchronized with driven sweeps.

Linear Time-Base

Continuous Sweep

Range	15 c.p.s. to 150 kc.
Sweep Direction	Left to right
Synchronizing Conditions: Sweep may be synchronized at a signal to sweep ratio of not more than 20:1 with any periodic wave form having a frequency between 15 c.p.s. and 5 mc., a peak amplitude of 0.5 volts, and a duration on the synchronizing phase of at least 0.1 microseconds.	

Driven Sweep

Durations	5, 25, 100, and 1,000 microseconds.
Sweep Direction	Left to right
Triggering Conditions: Sweeps may be initiated by a pulse of either polarity, a peak amplitude of 1.0 volt, and a duration of not less than 0.1 microsecond and not more than the sweep period.	
Repetition Rate	May be triggered repeatedly at rates up to approaching the frequency corresponding to the sweep period.

Trigger Oscillator

Pulse Rate	200 to 3,000 per second
Amplitude	100 volts fixed, either polarity
Duration	0.5 microsecond
Output Impedance	Less than 500 ohms

Mechanical Construction

Size Two unit construction with interconnecting cable. Storage space for cable, etc., in power supply unit. Both units approximately 14" x 18" x 21".
Weight Power supply 80 lbs.; indicator unit 30 lbs.
Finish Cabinets, black wrinkle; chassis, copper plate; front panel, dull black with white lettering and graduations.
Light Shield Retractable

Catalog No.	Type No.	Description	Code Word
1199	248	115 v. 50-400 cycles, with Type 5JP1 Cathode-ray Tube	YAJZA
1200	248	115 v. 50-400 cycles, with Type 5JP5 Cathode-ray Tube	YAKAB
1201	248	115 v. 50-400 cycles, with Type 5JP7 Cathode-ray Tube	YAKBA

