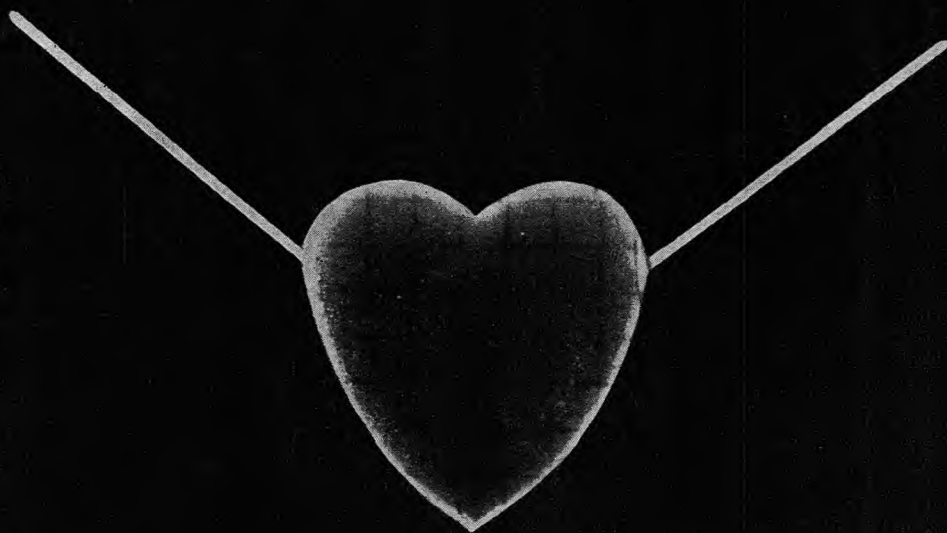


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ELECTRONIC VALENTINE

SEE PAGE 2

The New Du Mont Type 301 - A

A Highly-Portable Cathode-ray Oscilloscope



INTRODUCTION

Allen B. Du Mont Laboratories, Inc. has developed a small, highly portable, uniquely designed instrument for the field technician, the Type 301-A Cathode-ray Oscilloscope. The Type 301-A, despite its size (the front panel is a little smaller than this *Oscilloscope* page), is a rugged, wide-band, quantitative instrument that gives the high-quality performance you would expect from a much larger and heavier laboratory bench instrument.

SMALL, RUGGED AND COMPLETE

The Du Mont Type 301-A Cathode-ray Oscilloscope has many design fea-

tures unique to instruments to date. Its compact design and aluminum construction throughout make it especially useful for applications where portability and high accuracy are prime factors. The complete unit weighs only 20 pounds, and has been compactly engineered for housing in a cabinet $16\frac{5}{8}$ " deep, $9\frac{1}{8}$ " and $6\frac{1}{2}$ " wide. The Type 301-A operates from a 115 volt $\pm 10\%$, 50-1000 cps power source which makes it operative from practically any local a-c power source in the world.

For the first time with a commercial cathode-ray oscilloscope, a complete set of probes is supplied that extends the use of the unit as a portable laboratory,

the probes permitting input signal application over a wide range of impedance requirements. These probes are packed neatly within a front panel protective cover, and are supplied at no extra cost.

The Type 301-A has been engineered for continuous use under adverse conditions. Wherever feasible the standard miniature components utilized in this instrument were chosen for their reliability and wide-range temperature rating. As a result it has been possible to specify an ambient temperature range of -54°C to $+65^{\circ}\text{C}$, and a maximum altitude of 10,000 feet for the unit. A standby heater is incorporated to prevent moisture condensation and fungus growth under adverse climatic conditions. The Type 301-A can be purchased with ruggedized tubes to lengthen service life and increase reliability even with the roughest handling.

Even though the unit was intentionally designed small for portability purposes, no normal functions of a cathode-ray oscillograph were eliminated because of space limitations. To make this possible, miniature components in the unit have been installed very compactly; however, all circuits are accessible for servicing as a result of a hinged-door chassis construction. In some instances, components were designed specially to permit a saving of space without losing the accuracy expected of the instrument.

Compactness and low power consumption in the Type 301-A have been greatly facilitated by circuits engineered for power economy. The one (310V) low-voltage power supply is used for the vertical deflection amplifier circuit, the same current then energizes a 110 volt regulator, the output of which is again used for operating a calibrator and other circuits. Filament voltage for all tubes, other than for the cathode-ray tube and a high voltage rectifier, is taken from only one secondary winding of the miniature power transformer. Bleeder current from the high-voltage supply circuit is used in a brightening gate circuit and is then returned to and used in the operation of a negative voltage

supply circuit. By utilizing the power in this manner it has been possible to keep the power transformer size, number of required tubes, components, and thus the weight, to a minimum.

ACCURATE MEASUREMENT FEATURES OF THE TYPE 301-A

The Type 301-A features a vertical amplifier with a bandwidth that extends from 10 cps to 4 mcps—down not more than 20% at either end (refer to Figure 2). The unit offers a rise time of 0.08 usec (with less than 3% overshoot), and a broad range of sweeps variable in duration from 10 usec to 0.2 second. The linear sweeps are generated by a very linear vacuum-tube time-base generator which enables the operator to obtain reliable measurements over the entire sweep range.

Intensity timing markers are available, compatible with the sweep speeds, that permit time measurements accurate to within 5%. Even for the fastest sweep of 10 usec duration, with the trace expanded to its maximum of twice the tube diameter, four 1 usec intervals of time could be depicted on the screen which can be subdivided even further by the calibrated lines of the engraved scale. These markers assure very accurate time measurements over small increments of sweep, of practically any phenomena normally encountered.

For amplitude measurements the Type 301-A incorporates an accurate voltage standard. The voltage standard is a precise square wave at power-line frequency which is introduced behind an accurately calibrated attenuator, affording

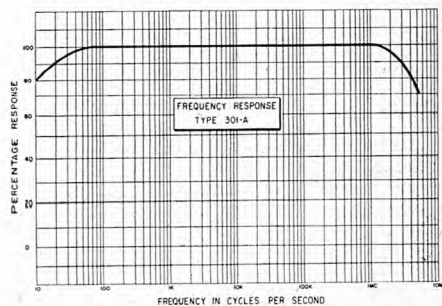


Figure 2. Frequency response characteristic of Type 301-A

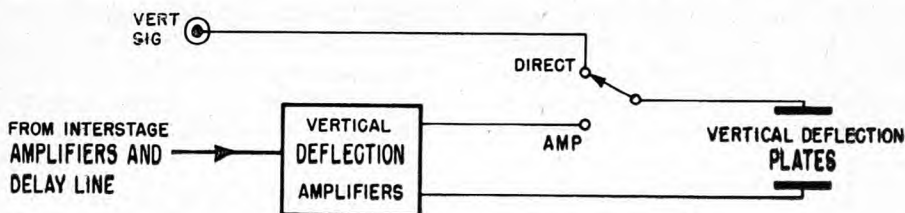


Fig. 3 Vertical deflection output circuit, block diagram

a means of calibrating the screen in volts-per-inch with a precision of 5%.

UNIQUE OPERATING FEATURES

All operating controls and connection jacks are available on the front panel. This has been made possible by a tight mechanical layout and the use of concentric controls. A few operational features of the Type 301-A, utilizing the front-panel setup, are unique.

Circuitry includes the provision for connection of the selected signal source to the vertical deflection plates of the cathode-ray tube directly at the front panel. As can be seen in Figure 3, the signal on the vertical deflection plates can come from either the vertical deflection amplifier, or one deflection plate can be fed directly from a signal coupled to the VERTICAL DIRECT jack on the front panel. The signals on the CRT deflection plates, coming from the vertical deflection amplifier, are opposite in polarity but equal in amplitude as a result of the signal-balancing amplifier circuitry. By setting a front-panel switch and feeding an input signal to the VERTICAL DIRECT jack on the front panel, the incoming signal is connected directly to a CRT vertical deflection plate without making the usual laborious back-of-panel connections.

A dual SWEEP TIME control enables the operator to select a 10, 20, 200, 2K, 20K or 200K microsecond sweep (outer knob), or have continuous control of any sweep duration in between those coarse stages (inner knob).

Timing markers, in the form of blanking markers on the trace, are available at intervals of 1, 10, 100, 1K, or 10K microseconds. These markers are also available as output signals, as selected by the setting of a front panel selector switch (MARKER INTERVAL). This switch determines the time interval between the successive timing markers supplied by a built-in, stable, time-marker generator.

The operator has a choice of three methods for sweep initiation. It is only necessary to set one switch (SYNCHRONIZATION), and connect the input to the appropriate front-panel jack to complete a choice. The sweep can be triggered from a power line frequency source by setting the SYNCHRONIZATION switch to Line (either polarity). By setting the switch to EX and connecting the input signal to the SYNC IN jack, the sweep will be triggered from an external source. The $\pm V$ position couples a portion of the undelayed signal from the vertical amplifier to the

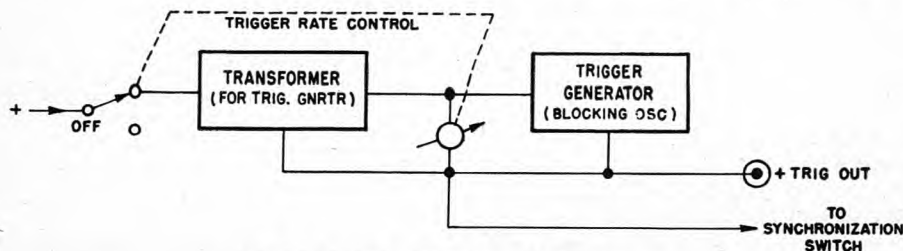


Fig. 4 Trigger generator, block diagram

sync amplifier, thus allowing the sweep to be initiated by either the positive or negative edges of the signal under study 0.3 microsecond before the signal itself reaches the vertical deflection plates.

There is a TRIG position on the SYNCHRONIZATION switch which allows the internal trigger generator to be applied to the sync circuit for sweep initiation (refer to figure 4). The trigger generator consists of a blocking oscillator stage and associated circuitry which comprise a source of positive trigger pulses at variable repetition rates. The rate of the trigger generator is continuously variable between 45 and 5500 pulses per second, and is controlled by the setting of the front-panel TRIGGER RATE control. The output of the trigger generator is fed to a +TRIG OUT jack and to the SYNCHRONIZATION switch on the front panel. This signal from the +TRIG OUT jack is 100 volts $\pm 30\%$ in amplitude. It can be coupled to another unit to initiate action while triggering its own sweep generator, thus making the Type 301-A a virtual synchroscope.

STANDARD OPERATING FEATURES

Other front-panel controls enable the operator to perform such normal oscillographic operations as calibrating the amplitude of an input signal connected to the VERTICAL SIGNAL jack. Several cycles of internally generated square-waves are easily obtained for calibration purposes. These square-waves are formed by a built-in voltage calibrator (see figure 5). A 0.6 volts p-to-p square wave, at power-line frequency, is available at the "CALi-

brator OUT .6V p-p" jack on the front panel for external calibration use, or for internal use by depressing the PRESS TO CALibrate push button. Adjusting the instrument sensitivity (VERTICAL GAIN control) for a given deflection, amplitude of signals connected to the VERT SIG jack can be read directly from the calibrated scale over the CRT screen. The sensitivity of the vertical amplifier is determined by the VOLTS PER INCH switch; a choice of 0.3, 1, 3, 10, 30 or 100 volts per inch deflection factor is available at near maximum sensitivity, and these factors may be doubled by adjustment of the VERTICAL GAIN control.

Traces on the screen can be positioned approximately $2\frac{1}{2}$ inches vertically by a VERTICAL POSITION control. By using a dual HORIZONTAL GAIN and HORIZONTAL POSITION control, the trace can be expanded horizontally to twice the screen diameter without any appreciable distortion, and can be positioned horizontally so that any portion of the sweep can be seen.

ADDED OPERATING FEATURES UTILIZING SUPPLIED PROBES

Three probes — a Cathode Follower Probe, an Attenuator Probe, and a Detector Probe, two accessory cables, a 75-ohm Termination, two BNC-to-binding post adapters, spare fuses and indicator lamps, and an Allen wrench for knobs are stored within a front-panel protective cover of the Type 301-A. Operating instructions, plastic protected, are also contained in the front cover.

The Cathode-Follower Probe is em-

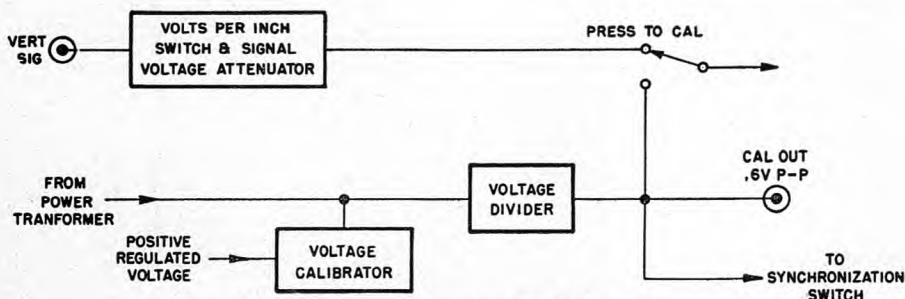


Fig. 5 Voltage calibrator, block diagram

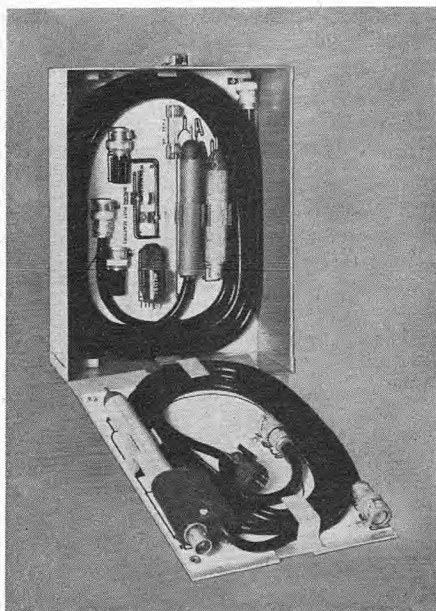


Figure 6. Front panel cover contains complete set of test probes, cables and operating instructions.

ployed where a very high impedance (6 megohms, 10 μmf) must be presented to the circuit under test to avoid loading. It attenuates the signal to 70% of input value.

The Attenuator Probe has a fixed attenuating ratio of 20:1. It offers a very

high input resistance (8 megohms) with low input shunting capacity (8 μmf) to the circuit under test. With the same impedance requirements, the Attenuator Probe would be employed in those applications where the Cathode-Follower Probe would be unsuitable because of high signal voltage. The maximum permissible a-c signal input for the Attenuator Probe is 600 volts peak, as compared to two volts rms maximum for the Cathode-Follower Probe. The signal cable for the Attenuator Probe is permanently attached, since the cable capacity forms part of the circuit for frequency compensation of the probe.

The Detector Probe will demodulate signals in the 10 cps - 15K cps range over a carrier-frequency range of 0.5 to 400 mcps. The audio frequency response is within 6 db at any carrier frequency in the operating range.

The 75-ohm Termination is a plug-in adapter and connects to the front-panel C. F. PROBE socket. When connected, it provides a 75-ohm matching impedance for the VERTICAL SIGNAL at all positions of the VOLTS PER INCH switch.

The binding-post adapters supplied enable the operator to connect wire-type

Figure 7. The highly-portable Type 301-A is invaluable in locations where equipment is not readily accessible



test leads to the coaxial jacks on the front panel.

MANY USES FOR THE TYPE 301-A

Even Du Mont can't foretell the number and variety of uses to which the Type 301-A may be put, but it was designed with some specific applications in mind. Of these applications, because of its small size, wide power-frequency range, extensive ambient temperature range, and high maximum operational altitude, the unit is paramount for maintaining airborne equipment. It is invaluable in any localities where portable generating equipment with unstable frequency outputs may be used.

In addition, the Du Mont Type 301-A

is rugged, is moisture proof, and has a built-in space heater to prevent the internal formation of moisture or fungus growth. These assets make it ideal for maintenance work on mobile units on land or sea. Remote areas, such as microwave relay line localities, become more readily accessible with this unit.

With the Type 301-A Oscilloscope, the traveling technician is virtually able to carry all basic test equipment with him in one instrument.

Additional information on the Du Mont Type 301-A Cathode-ray Oscilloscope may be obtained by writing the Instrument Division, Technical Sales Dept., 760 Bloomfield Avenue, Clifton, New Jersey.

SPECIFICATIONS

CATHODE-RAY TUBE—Tight-tolerance Type 3 WP-1 cathode-ray tube operated at overall acceleration of 1400 volts.

VERTICAL DEFLECTION—Deflection Factor: through amplifier, 0.28 p-p (0.1 rms) volts/inch; direct, 47 p-p (17 rms) volts/inch.

Sinusoidal Frequency Response (any setting of gain or attenuator controls): down not more than 20% at 10 cps and 4 mc. **Rise Time**: 0.08 usec max.

Undistorted Deflection: 2 inches minimum

Signal Delay: built-in delay of 0.35 usec allows time for sweep initiation before signal is applied to vertical deflection plates.

Input Impedance: through amplifier, 1 megohm, 28 uuf ± 2 uuf for all positions of "Volts per Inch" switch; direct 4.7 megohms, 30 uuf.

Maximum Allowable Input Potential: 600 volts d.c. plus peak a.c.

LINEAR TIME BASE—Sweep Range: driven sweep only, continuously variable in duration from 200,000 usec to 10 usec.

Maximum Sweep Speed: 0.55 inches/usec

Sweep Gating: brightening gate turns beam on for sweep duration

Synchronization: Internal sync, $\frac{1}{2}$ " pattern produces adequate sync. External sync, 0.2 volts p-p for repetition rates between 50 cps and 200 kc, 0.8 p-p v for repetition rates below 50 cps, provided that rise time of trigger is equal to, or less than, that of a 5 cps sine wave; 0.8 p-p v for repetition rates between 200 kc and 2 mc.

TRIGGER GENERATOR—(Trigger available at front panel) range: 45-5500 cps; amplitude: 100 peak volts $\pm 30\%$ with load in range from infinity to 5000 ohms paralleled by 1500 uuf; 25 peak volts (approx.) with 75 ohm load; rise time; less than 0.5 usec; duration: 1-2 usec approx.

VOLTAGE CALIBRATION—Source: square-wave 0.6 p-p volts in amplitude introduced behind attenuator (imposed by a momentary push-button switch); attenuator is calibrated to 0.3, 1, 3, 10, 30, and 100 volts/inch; precision $\pm 2\%$, calibration waveform available at front panel.

TIME CALIBRATION—Source: blanking markers at 10,000 usec, 1000 usec, 100 usec, 10 usec, 1 usec intervals; accuracy $\pm 5\%$; available at front panel with an internal impedance of 120,000 ohms.

INTENSITY MODULATION—Front panel connection, positive 10 volts peak signal provides adequate blanking at normal intensity settings; input impedance, 1.2 megohms, 30 uuf.

TUBE COMPLIMENT—6-12AT7, 3-6AN5, 3-6AK5, 3-12AU7, 3-6AU6, 2-6X4, 1-5651, 1-5702, 1-1Z2.

PRIMARY POWER—115 volts, 50-1000 cps, 110 watts. Standby heater consumes 15 watts.

PHYSICAL CHARACTERISTICS—Housed in small, well-ventilated, light-gray, combination metal cabinet with light gray, smooth panel; direct-etched, white filled numerals; two protective handles on front panel, carrying handle on top of cabinet; supporting foot for instrument folds under cabinet.

Size: Height, 9-1/8"; width, 6-1/2"; depth, 16-5/8"; weight, 20 lbs. complete, 17-1/2 lbs. without cover and accessories.

Accessories Supplied: Calibrated scale, filter; **Cables**, 4' and 6', RG-62/U terminated in BNC connectors; input termination, 75 ohm, 2 watt $\pm 10\%$ plug-in adapter; **Probes**, Cathode Follower, input impedance 6 megohms, 10 uuf, gain 0.70 approx., bandwidth 10 cps-7 mc, power cable (power supplied by instrument); passive, attenuation 20:1 $\pm 3\%$ (on vertical input terminal), input impedance 8 megohms, 8 uuf, overall length 72"; Detector, carrier frequency range 0.5-400 mc, demodulation frequency range 10 cps to 15,000 cps ± 6 db, input impedance 20,000 ohms, 7 uuf, input voltage less than 125 volts inverse peak on detector, for use with separate coaxial cable; adapters (2), BNC to binding post; spare fuses and indicator lamps; Allen wrench for knobs.

(Probes, cables and termination, spare fuses, bulbs, etc. fit in protective cover.)

CAT. NO.	TYPE NO.	DESCRIPTION
1640-E	301-A	Cathode-ray oscillograph for 115 volts 50-1000 cps, with Type 3WP-1 Cathode-ray Tube.
1641-E	301-A	Same as above, with ruggedized Tubes.

"Who and Why"

(Continued from Page 17)

on cathode-ray tubes and oscillographs. He then became manager of the Contract Division, which was responsible for all liaison, technical and administrative work with the government procurement agencies and laboratories, and World War II prime contractors. He was appointed Technical Sales Manager at Du Mont in 1945, and he was responsible for the sale of the company's industrial products.

Along with H. C. Gawler and C. L. Gawler, Walter Knoop founded the present Gawler-Knoop Company. The Gawler-Knoop Company is the Du Mont representative in District 14; this includes parts of New Jersey and Pennsylvania,

and all of Maryland, Delaware and Virginia, as well as the metropolitan area of New York.

Mr. Knoop is a member of Sigma Xi and Tau Beta Pi honorary societies, Theta Chi social fraternity, and is an active member of the I.R.E. and A.I.E.E. societies. He is also a member of the Instrument Society of America, Radio Club of America, Montclair Society of Engineers, Essex County Engineering Society, and Society of American Military Engineers.

He is a registered Professional Engineer in New York, New Jersey and North Carolina.