

DU MONT

TYPE 4203 DELAYING SWEEP

INSTRUCTION MANUAL



Serial No. _____

DU MONT

ALLEN B. DU MONT LABORATORIES, Clifton, N. J.

DIVISIONS OF

FAIRCHILD
CAMERA AND INSTRUMENT
CORPORATION

Manual No. 6703 8603

I

TYPE 4203
DELAYING SWEEP
INSTRUCTION MANUAL

ALLEN B. DU MONT LABORATORIES
DIVISIONS OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
INDUSTRIAL ELECTRONICS DIVISION
750 BLOOMFIELD AVENUE, CLIFTON, NEW JERSEY

Manual #6703 8603

II

CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.	TECHNICAL SUMMARY	
1-1	Introduction	1-1
1-2	Technical Summary	1-2
2.	OPERATION	
2-1	First-Time Operation	2-1
2-2	Delaying Sweep Operation	2-1
2-3	Delayed Main Sweep Operation	2-4
2-4	Delayed-Triggered and Delayed- Armed Modes of Main Sweep Operation	2-8
2-5	Simultaneous Display of the Delaying Sweep and the Magnified Delayed Main Sweep	2-10
2-6	Summary of Front-Panel Facilities	2-14
3.	MAINTENANCE AND RECALIBRATION	
3-1	Visual Inspection	3-1
3-2	Gaining Access to Chassis	3-2
3-3	Servicing Hints	3-2
3-4	Replacement Parts	3-3
3-5	Location of Tubes, Service Adjust- ments, and Test Points	3-5
3-6	Service Adjustments	3-5
3-7	Sweep Mode Preset Adjustment (R8124R)	3-8
3-8	Adjusting Trig Level Cent (R8124F)	3-8
3-9	Setting the Trig Adj (R8356)	3-9
3-10	Delay Bal Adjustment (R8273)	3-9
3-11	1 μ sec Trimmer Adjustment (C8215)	3-11
3-12	Adjusting Trig Sens (R8136)	3-12
3-13	Adjusting Main Saw Pick-Off Cal (R8303)	3-12
3-14	Waveform Data	3-15
4.	ELECTRICAL PARTS LIST AND SCHEMATICS	4-1

III

CONTENTS (Continued)

TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1-1	Technical Summary	1-1
2-1	Delaying Sweep Setup	2-2
2-2	Function of Controls and Connectors	2-14
3-1	Preliminary Control Setting	3-7
3-2	Adjustments to be Made when Replacing Tubes	3-15

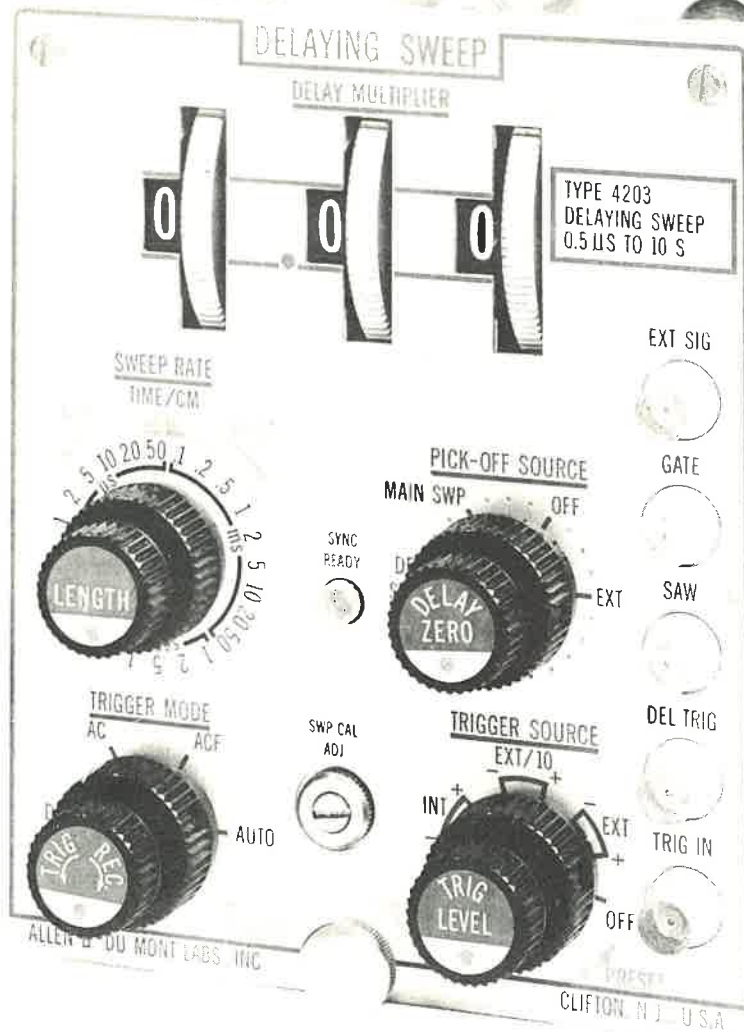


FIGURE 1-1. DU MONT TYPE 4203 DELAYING SWEEP UNIT

SECTION 1

TECHNICAL SUMMARY

1-1. INTRODUCTION

This Instruction Manual includes information on Operating Instructions, Servicing Hints, Procedures for Internal Adjustments, Schematics, and Parts List for the Du Mont Type 4203 Delaying Sweep Plug-in Unit.

1-2. TECHNICAL SUMMARY

The Du Mont Type 4203 Delaying Sweep Plug-in may be used with the Du Mont Type 420 Series Oscilloscopes and all instructions governing cooling, time-delay relay, and general operation may be found in the Operator's Manual of the basic oscilloscope. A functional block diagram of this unit is shown in Figure 1-2. Table 1-1 lists the electrical and physical characteristics of this instrument.

TABLE 1-1

TECHNICAL SUMMARY

DU MONT TYPE 4203 DELAYING SWEEP
(Response with Type 425 Oscilloscope)

CALIBRATED DELAYING SWEEP

Delaying Sweep Rates	19 calibrated sweep rates from 1 microsecond/cm to 1 second/cm
Accuracy	Adjustable to better than 1/2% on the 1 microsecond/cm range and on one other selected range; all other ranges within 2%
Delaying Sweep Length	Continuously variable from less than 4 centimeters to more than 10 centimeters

TABLE 1-1. TECHNICAL SUMMARY (Continued)

CALIBRATED DELAYING SWEEP (continued)

Unblanking	DC coupled. Delaying Sweep intensity variable with respect to the Main Sweep intensity. Main Sweep time appears as intensified strobe on the Delaying Sweep
Trigger Rate Source	Continuously variable from 5 cycles to over 60 Kc using the Delaying Sweep as the free-running generator

OUTPUT WAVEFORMS

Gate	Positive gate of same duration as the Delaying Sweep; 15 volts minimum into an impedance of 10,000 ohms and 10 pf
Saw	Delaying Sweep sawtooth waveform; 40 volts minimum into an impedance of 10,000 ohms and 10 pf
Del Trig	Delayed Trigger pulse from the Main or Delaying Sweep circuit; 3 volts minimum into a 93-ohm load; shunted by less than 20 pf

TRIGGER SHAPER

Ext Sig	2 volts peak-to-peak input; trigger shaper; 30 cycles to 1 megacycle. Shaped output from Del Trig front-panel connector
---------	---

DELAY TIME DATA

Delay Time	Continuously variable from 0.5 microsecond to 10 seconds
------------	--

TABLE 1-1. TECHNICAL SUMMARY (Concluded)

DELAY TIME DATA (continued)

Time Jitter	Untriggered: Less than 1 part in 30,000 with voltage stabilized power line; less than 1 part in 22,000 with normal power line
	Triggered: Jitter free
Range Accuracy	Normally within 2%; always within 3%
Reset Accuracy	Better than 1 part in 750 (0.13%)

PHYSICAL CHARACTERISTICS

Width	5-3/8 inches	(13.65 cm)
Height	6-5/8 inches	(16.83 cm)
Depth	9-5/16 inches	(23.65 cm)
Weight	5 pounds 10 ounces	(2.55 kg)

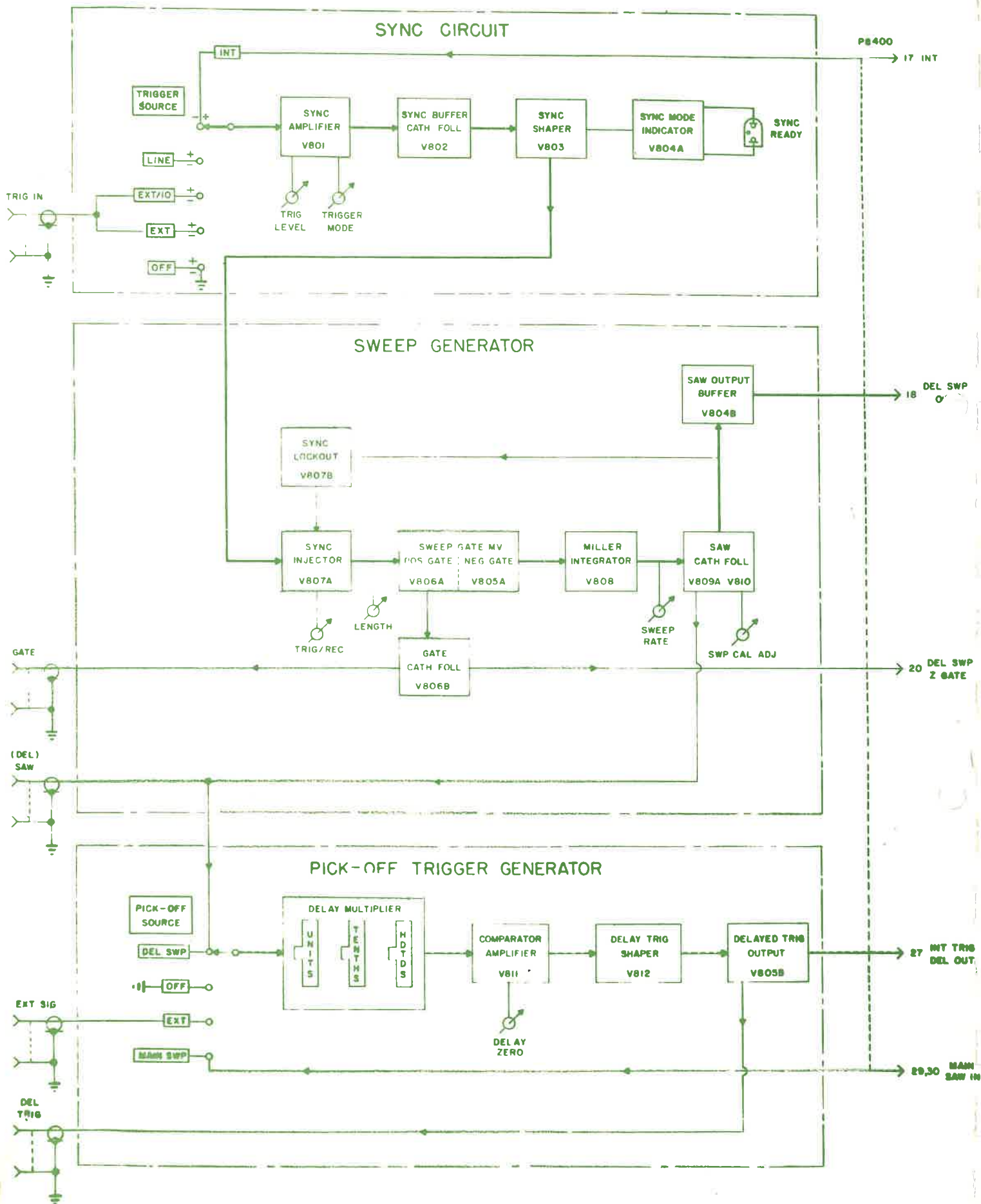


FIGURE 1-2. TYPE 4203 DELAYING SWEEP, FUNCTIONAL BLOCK DIAGRAM

SECTION 2
OPERATION

2-1. FIRST-TIME OPERATION

a. INSTRUCTIONS

We know that you are anxious to get acquainted with your new instrument. To aid you in this endeavor, you may set up the instrument using the built-in calibrator signal to demonstrate the effects of the various controls on the display. In the instructions which follow, bold type printing within the text indicates front-panel controls, connectors, or settings. A brief description of the front-panel controls and connectors is given in a Table at the end of this section.

b. INITIAL CONTROL SETTING

Assuming the Du Mont Type 4202 Y Dual Trace Amplifier as the Y Plug-in, if a Du Mont Type 4202 is not available, any other Y Plug-in Unit may be substituted.

With the Du Mont Type 4202 Y Dual Trace Amplifier and the Type 4203 Delaying Sweep Plug-in Units securely in place, plug the power cord into the proper power source. Set the controls as indicated in Table 2-1.

The operator is advised to follow the specific instructions and sequence of operation as outlined in this section.

2-2. DELAYING SWEEP OPERATION

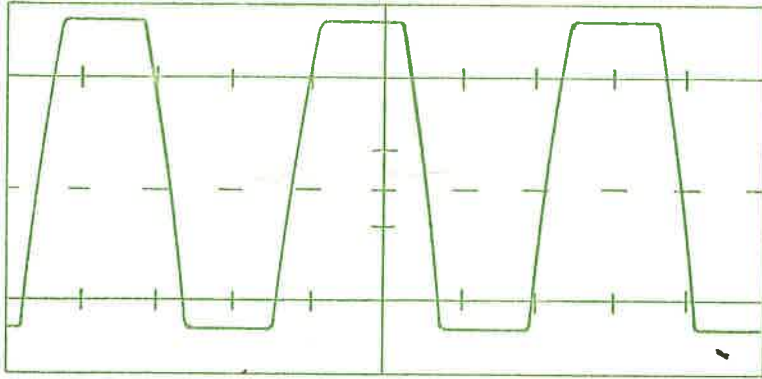
Refer to the Type 425 Operator's Manual for background information and Main Sweep operating procedures.

In this mode of operation, the Delaying Sweep, rather than the Main Sweep is used for horizontal deflection. The Delaying Sweep is applied instead of the Main Sweep when the DISPLAY LOGIC switch is set to DELAYING SWP. Set the controls as indicated in Table 2-1.

TABLE 2-1
 DELAYING SWEEP SETUP

CONTROL	SETTING
MAIN FRAME	
DISPLAY LOGIC SWEEP RATE STABILITY (TRIG/REC) TRIGGER MODE EXPAND	DELAYING SWEEP 1 MS/CM RECurrent ARMED AC X1
DELAYING SWEEP PLUG-IN	
PICK-OFF SOURCE LENGTH SWEEP RATE TRIGGER SOURCE TRIGGER MODE TRIG LEVEL * STABILITY (TRIG/REC) DELAY MULTIPLIER	OFF Fully cw 5 MS/CM +LINE AC PRESET PRESET 3.00
Y DUAL TRACE PLUG-IN	
VOLTS/CM INPUT SELECTOR	CAL A
* The STABILITY (TRIG/REC) control will subsequently be referred to as STABILITY.	

2-2. DELAYING SWEEP OPERATION (Concluded)



Now adjust the INTENSITY and PATTERN POSITIONING controls until the pattern of Figure 2-1 is displayed.

FIGURE 2-1.

CALIBRATOR WAVEFORM DISPLAY
WITH THE DISPLAY LOGIC SWITCH
SET TO DELAYING SWP

Operate the following controls, and note that they function in the same way as they did when the Main Sweep was used: POSITION, PATTERN POSITIONING, AC/DC switch (or AC and DC positions of the INPUT SELECTOR switch), VOLTS/CM and the EXPAND switch.

Turn the Delaying SWEEP RATE knob successively to positions both to the right and left of the 5 milliseconds position. Notice that the Delaying SWEEP RATE switch provides control of the number of cycles of the display that appear on the screen when a waveform having a fixed repetition rate is presented by means of the Delaying Sweep.

Reset the Delaying SWEEP RATE knob to 5 milliseconds per centimeter. Set the Delaying TRIGGER SOURCE switch from +LINE to -LINE and observe that this switch provides control over the beginning rise or fall of the calibrator waveform..

2-3. DELAYED MAIN SWEEP OPERATION

After completing the Delaying Sweep Operation as indicated in the preceding paragraph, turn the PICK-OFF SOURCE switch to DEL SWP and adjust the INTENSITY control until the Figure of 2-2a appears on the screen.

Set the DELAY MULTIPLIER control to 000 and adjust the 10-turn DELAY ZERO control until the strobe just disappears on the left hand side of the trace. This operation calibrates the DELAY MULTIPLIER control. Reset the DELAY MULTIPLIER to 3.00.

The portion of the display between 3 and 5 centimeters of the start of the Delaying Sweep should be brighter than the rest of the display. Notice that the INTENSITY control has a built-in backlash feature permitting individual control of the levels of intensity in the brightened and normal patterns of the display. Again, readjust the INTENSITY control so that the strobe is readily visible on the Delaying Sweep with a minimum of defocusing.

Now turn the DISPLAY LOGIC switch to MAIN SWP. The portion of the original display that was brightened will now be expanded to fill the entire scale as indicated in Figure 2-2b. Thus, it is seen that when the Main Sweep TRIGGER MODE is in the ARMED position, the DISPLAY LOGIC switch is set to MAIN SWP, the PICK-OFF SOURCE switch is set to DEL SWP, the display on the screen will be a Delayed Main Sweep. Move the middle thumb wheel of the DELAY MULTIPLIER through one revolution and observe that the display is truly delayed (phased) by the Delaying Sweep. Reset the DELAY MULTIPLIER to 3.00, and the DISPLAY LOGIC switch to DELAYING SWP. Figure 2-1 should reappear.

2-3. DELAYED MAIN SWEEP OPERATION (Continued)

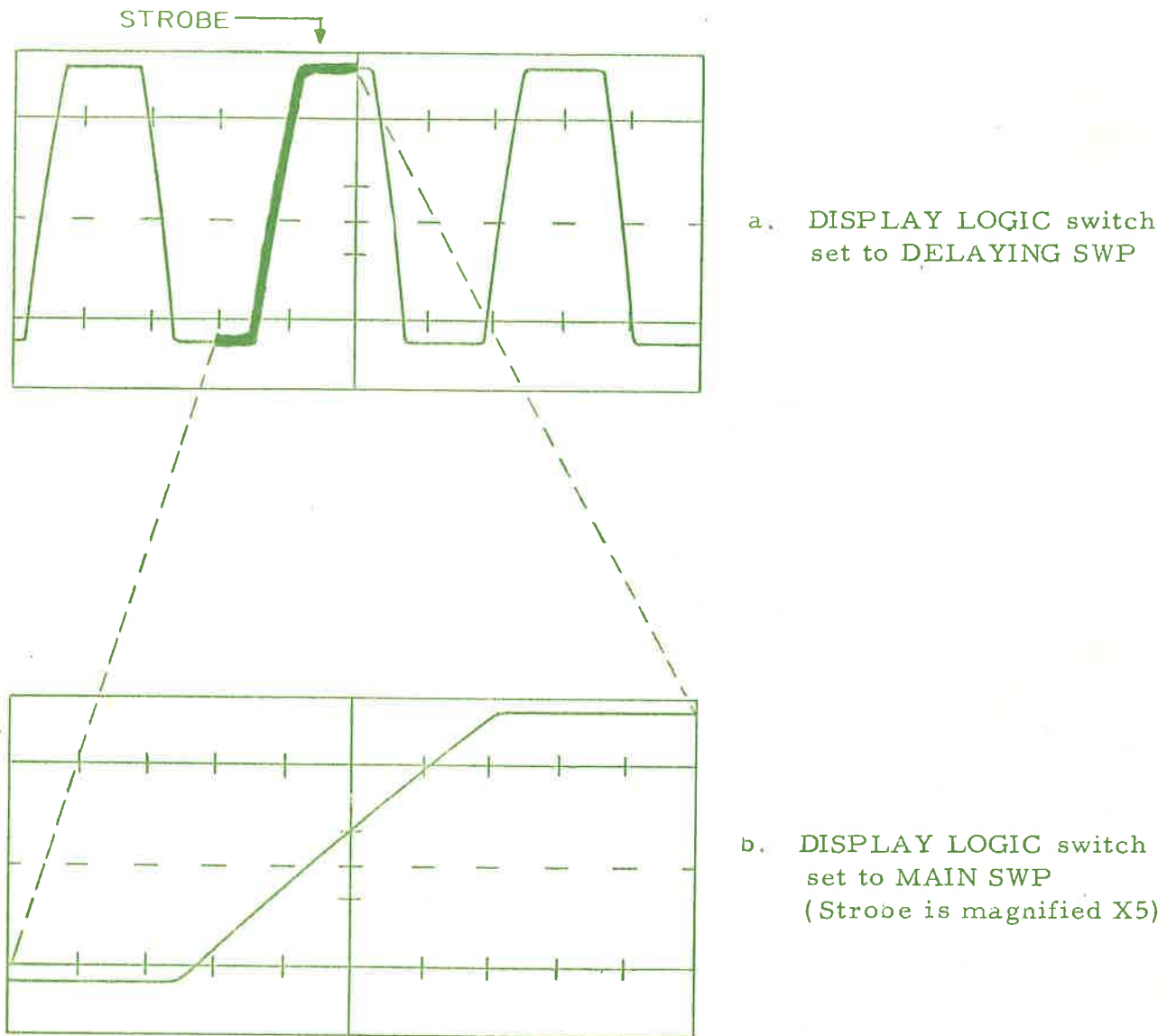


FIGURE 2-2. CALIBRATOR WAVEFORM DISPLAY WITH THE PICK-OFF SOURCE SWITCH SET TO DEL SWP AND ILLUSTRATING MAGNIFICATION OF THE STROBE

2-3. DELAYED MAIN SWEEP OPERATION (Continued)

The amount of the delay occurring from the application of the triggering signal until the sweep starts, is indicated directly by the setting of the Delaying SWEEP RATE and DELAY MULTIPLIER controls. The setting of these two controls are multiplied together to obtain the actual delay time. For example, if the Delaying SWEEP RATE control is set to 5 MS and the DELAY MULTIPLIER is set to 3.00, the delay time is 15 milliseconds. Note that the above applies only when delayed triggered operation is used and the Main Sweep STABILITY control is set to RECurrent.

Turn the Main SWEEP RATE control one position in each direction. Notice that the starting point of the brightened portion of the trace (strobe) is not affected but that the greater the sweep rate, the shorter the brightened section becomes; see Figure 2-3a. The slower the sweep rate, the longer the brightened section becomes; see Figure 2-3c.

Reset the Main SWEEP RATE to 1 millisecond. Now reduce the length of the Delaying Sweep with the LENGTH control until the Delaying Sweep is foreshortened into the strobe region. Decreasing the Delaying Sweep length further will cause the strobe to intensify the retrace of the Delaying Sweep. This condition is abnormal.

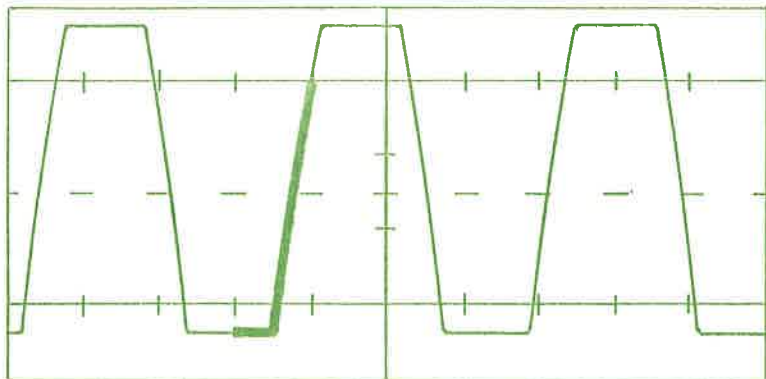
The LENGTH control must always be adjusted so that the Delaying Sweep extends slightly to the right of the intensified strobe.

The above instructions have made it clear that the strobe is equal to the sweep time of the Main Sweep and that the left-hand side indexes the time delay of the Main Sweep from the start of the Delaying Sweep. Since the Main Sweep represents a section in time within the Delaying Sweep display, and since this section may be expanded to full scale, we may now consider the Main Sweep as a calibrated, magnified section of the Delaying Sweep. The magnification ratio may be expressed as follows:

$$\text{Magnification Ratio} = \frac{(\text{Delaying Sweep Rate})(\text{Delay Multiplier})}{\text{Main Sweep Rate}}$$

The previous example, Figure 2-2b shows a magnification of 5 to 1.

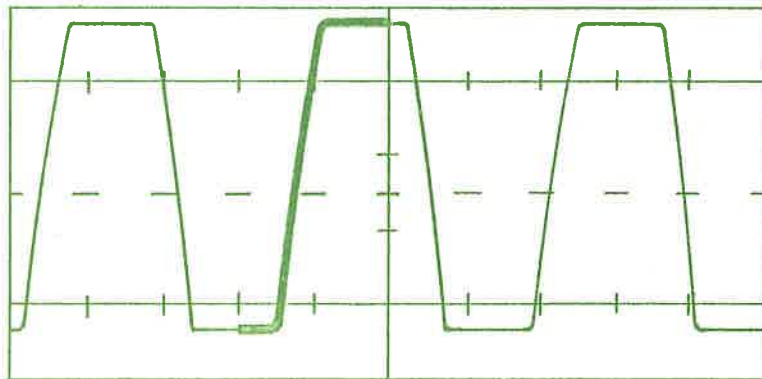
2-3. DELAYED MAIN SWEEP OPERATION (Concluded)



Main SWEEP RATE control
set to 500 us.

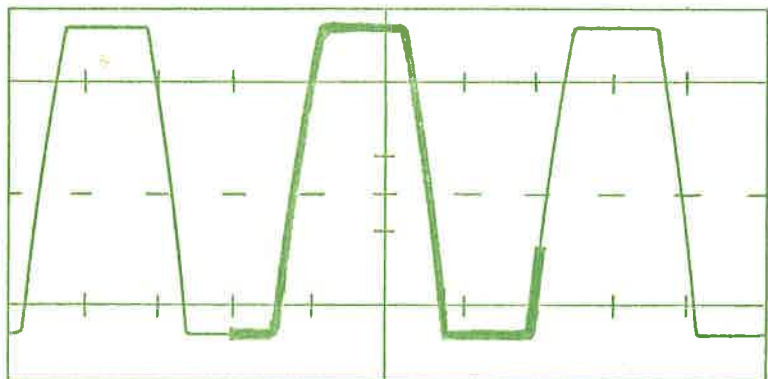
Note: Strobe is shorter than
Figure 2-3b.

Fig. 2-3a.. EFFECT OF MAIN SWEEP RATE
CONTROL ON STROBE LENGTH



Reference Display
Main SWEEP RATE
control set to 1 ms.

Fig. 2-3b.. EFFECT OF MAIN SWEEP RATE
CONTROL ON STROBE LENGTH



Main SWEEP RATE control
set to 2 ms.

Note: Strobe is longer than
Figure 2-3b.

Fig. 2-3c. EFFECT OF MAIN SWEEP RATE
CONTROL ON STROBE LENGTH

2-4. DELAYED-TRIGGERED AND DELAYED-ARMED MODES OF MAIN SWEEP OPERATION

Following the instructions of the previous paragraph, the display illustrated in Figure 2-2a should now appear on the screen. Again, set the DISPLAY LOGIC switch to MAIN SWP and note that the section indicated as a strobe is magnified to fill the entire screen, as shown in Figure 2-2b. Reset the DISPLAY LOGIC switch to DELAYING SWP.

Now turn the Main Sweep TRIGGER MODE switch to AC NORMAL. No change should appear in the display from that of Figure 2-2a. Now again set the DISPLAY LOGIC switch to MAIN SWP and notice that the strobe section is running free (not synchronized), thus making the display indistinguishable. Therefore, to observe only the Delayed Main Sweep, the DISPLAY LOGIC switch is set to MAIN SWP, and the Main Frame TRIGGER MODE switch is in the ARMED position. These settings permit the Main Sweep to be automatically rearmed by the Delaying Sweep pick-off trigger. Reset the DISPLAY LOGIC switch to DELAYING SWP.

Whenever the Main Sweep is delayed, its trigger mode is armed. The Delayed Main Sweep has two operating modes. One of these modes is available when the Main Sweep STABILITY control is set to RECURRENT. In this mode, the Main Sweep starts directly at the delay time indicated by the DELAY MULTIPLIER and Delaying SWEEP RATE control settings. This mode from now on will be referred to as the delayed-triggered sweep mode of operation.

The delayed-triggered mode permits you to select continuously variable delay times and is the mode of operation used to make accurate time and waveform jitter measurements as well as most other measurements.

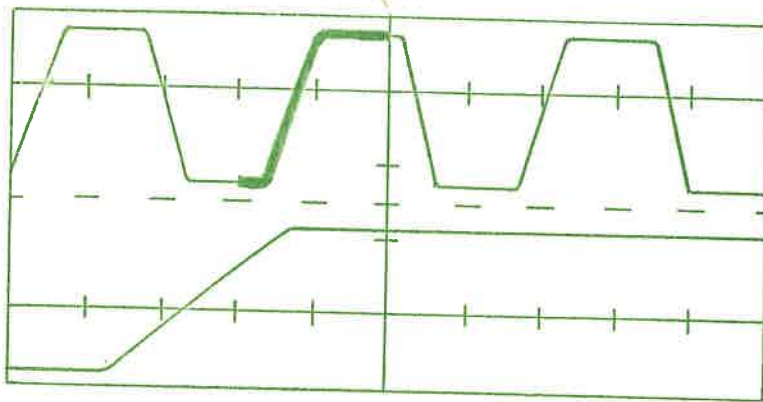
The second mode is available when the Main Sweep STABILITY control is turned to PRESET. In this mode, the Main Sweep does not start precisely at the delay time indicated by the DELAY MULTIPLIER and Delay SWEEP RATE control setting; but instead, is initiated by the next suitable trigger following the indicated delay interval. This mode from now on will be referred to as the delayed-armed mode of sweep operation.

2-4. DELAYED-TRIGGERED AND DELAYED-ARMED MODES
OF MAIN SWEEP OPERATION (Concluded)

The delay time in this mode is not continuously variable and should be used whenever the signal to be displayed has cumulative time jitter between the start of the Delaying Sweep and the delayed magnified section. Since the sweep is triggered by the input signal, jitter is eliminated from the display even though it is inherent in the input waveform.

2-5. SIMULTANEOUS DISPLAY OF THE DELAYING SWEEP AND THE MAGNIFIED DELAYED MAIN SWEEP

The displays of Figure 2-4 indicate the unique feature of the Du Mont Type 425 Oscilloscope. This instrument is capable of displaying a waveform which indicates a section to be magnified and, at the same time, displaying the fully magnified section without the need for manual switching.



Reset the STABILITY control to RECURRENT and leave the other controls as they are. Pull out the Channel A VERNIER control on the Y Plug-in and adjust the amplitude of the display to about two centimeters. Set the DISPLAY LOGIC switch to MAIN SWP AND DELAYING SWP and adjust the SWEEP SEPARATE screwdriver control to simulate Figure 2-4a.

Fig. 2-4a.. DELAYING SWEEP LENGTH IS SET TO 10 CM

Notice that the display flicker rate is low and that two sweeps appear to alternate successively. Flicker may be reduced by shortening the Delaying Sweep duration with the LENGTH control. See Figure 2-4b..

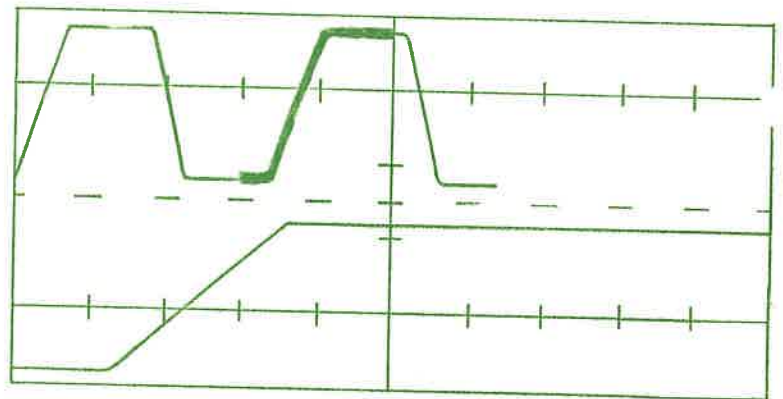
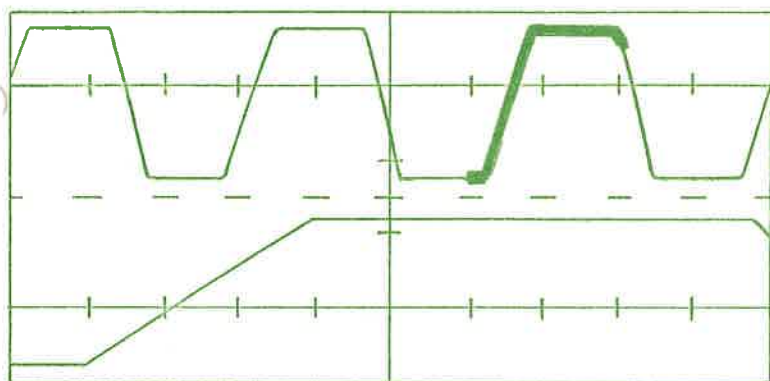


Fig. 2-4b.. DELAYING SWEEP LENGTH IS SET TO LESS THAN 10 CM

2-5. SIMULTANEOUS DISPLAY OF THE DELAYING SWEEP
AND THE MAGNIFIED DELAYED MAIN SWEEP (Continued)

Set the Main Sweep STABILITY control to PRESET and the Delaying Sweep LENGTH to 10 cm.

Now set the Main Sweep TRIGGER SOURCE switch from +LINE to -LINE. Notice in Figure 2-5 that the starting point of the magnified section and its slope have shifted which indicates the delayed-armed mode of sweep operation. Reset TRIGGER SOURCE switch to +LINE.



TRIGGER SOURCE set
to +LINE

Fig. 2-5a.. ILLUSTRATING CHANGE IN
STARTING POINT OF STROBE
WHEN STABILITY CONTROL
IS SET TO PRESET

TRIGGER SOURCE set
to -LINE

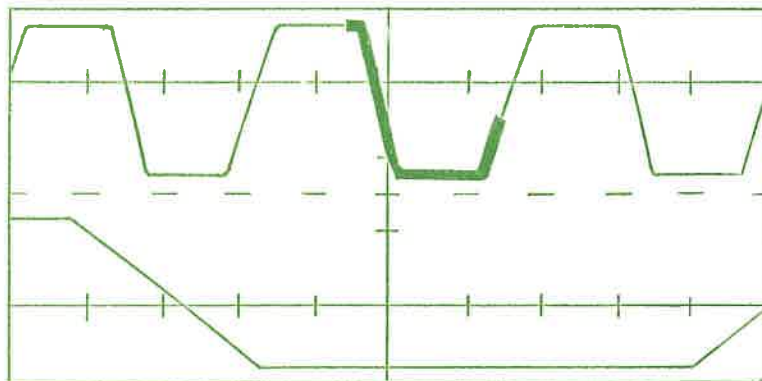
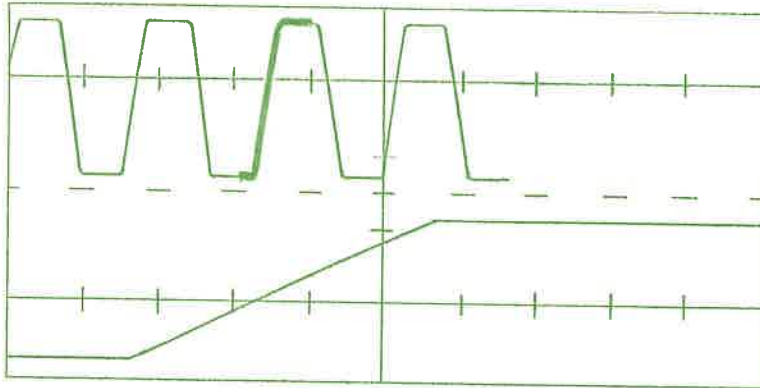


Fig. 2-5b.. ILLUSTRATING CHANGE IN
STARTING POINT OF STROBE
WHEN STABILITY CONTROL
IS SET TO PRESET

2-5. SIMULTANEOUS DISPLAY OF THE DELAYING SWEEP AND
THE MAGNIFIED DELAYED MAIN SWEEP (Continued)

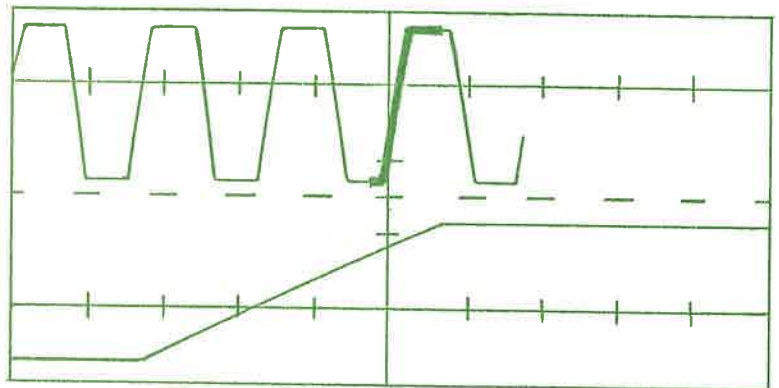
Set the Delaying SWEEP RATE control to 10 MS. Turn the DELAY MULTIPLIER to the settings indicated in Figure 2-6.. Notice that the starting point of the magnified section is the same point on each cycle. This indicates that the signal triggers the Main Sweep after a fixed period of delay and illustrates the delayed-armed mode of sweep operation.



Set DELAY MULTIPLIER to 3 00

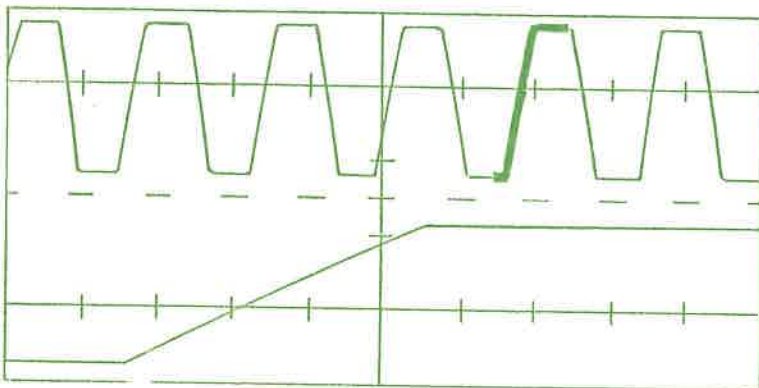
(Note: Main Sweep STABILITY control is set to PRESET)

Fig. 2-6a. ILLUSTRATING THE DELAYED-ARMED MODE OF SWEEP OPERATION



Set DELAY MULTIPLIER to 4.00

Fig. 2-6b. ILLUSTRATING THE DELAYED-ARMED MODE OF SWEEP OPERATION



Set DELAY MULTIPLIER to 5.00

Fig. 2-6c. ILLUSTRATING THE DELAYED-ARMED MODE OF SWEEP OPERATION

2-5. SIMULTANEOUS DISPLAY OF THE DELAYING SWEEP AND
THE MAGNIFIED DELAYED MAIN SWEEP (Concluded)

Set the Main Sweep STABILITY control to RECURRENT and the Delaying SWEEP RATE control to 5 MS. Turn the DELAY MULTIPLIER to the settings indicated in Figure 2-7. Notice that the strobe progresses smoothly and starts directly at the delay time indicated by the DELAY MULTIPLIER and Delaying SWEEP RATE control settings. This indicates the delayed-triggered mode of sweep operation.

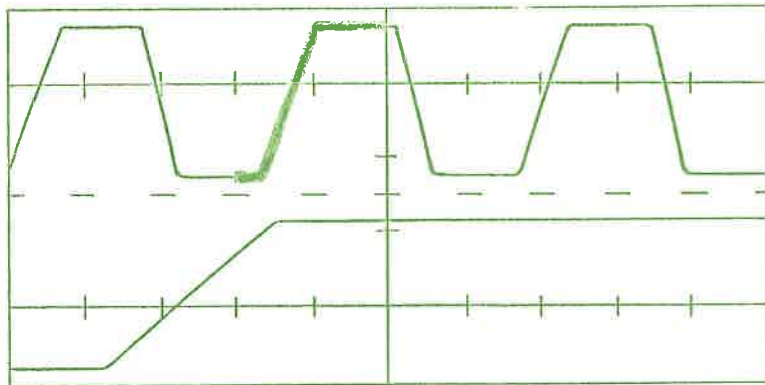


Fig. 2-7a. ILLUSTRATING THE DELAYED-TRIGGERED MODE OF SWEEP OPERATION

Set DELAY MULTIPLIER to 3.00
(Note: Main Sweep STABILITY control is set to RECURRENT)

Set DELAY MULTIPLIER
to 4.00

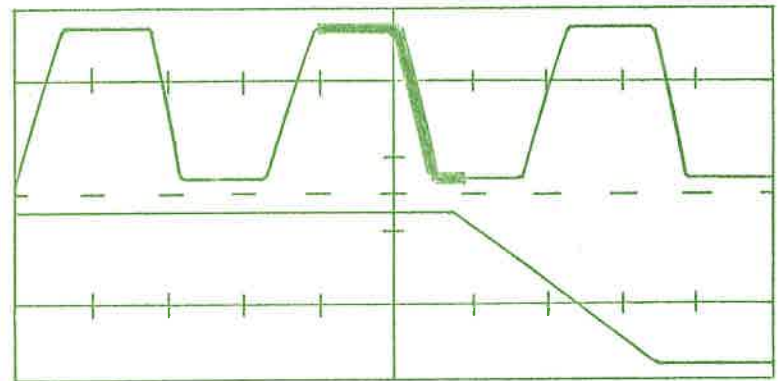


Fig. 2-7b. ILLUSTRATING THE DELAYED-TRIGGERED MODE OF SWEEP OPERATION

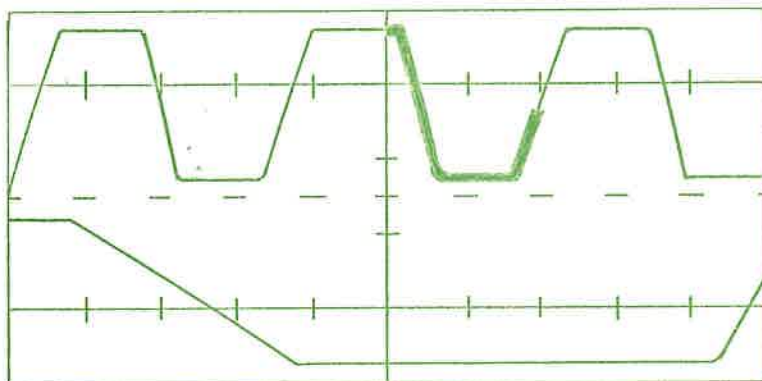


Fig. 2-7c. ILLUSTRATING THE DELAYED-TRIGGERED MODE OF SWEEP OPERATION

Set DELAY MULTIPLIER to 5.00

2-6. SUMMARY OF FRONT-PANEL FACILITIES

Table 2-2 tabulates the function of controls and connectors for the Du Mont Type 4203 Delaying Sweep Plug-in Unit.

TABLE 2-2
FUNCTION OF CONTROLS AND CONNECTORS
TYPE 4203 DELAYING SWEEP UNIT

NAME	FUNCTION
SWEEP RATE	<p><u>Concentric Controls:</u></p> <p>a. Large knob: nineteen-position switch giving the Delaying Sweep rate time from 1 microsecond/centimeter to 1 second/centimeter.</p>
LENGTH	<p>b. Small knob: sweep LENGTH control permits Delaying Sweep to be reverted immediately after delayed Main Sweep is triggered, to optimize the duty cycle. Adjustment from 4 centimeters to the normal setting of 10 centimeters is available.</p>
PICK-OFF SOURCE	<p>a. Large knob: four-position switch which permits selection of the waveform which initiates the delay trigger generator. These positions are DEL SWP, MAIN SWP, (for phase measurements), OFF, and EXT (connection to the TRIG IN BNC connector).</p>
DELAY ZERO	<p>b. Small knob: ten-turn vernier potentiometer to permit precise DELAY MULTIPLIER zero adjustment.</p>

TABLE 2-2. FUNCTION OF CONTROLS AND CONNECTORS (Continued)

NAME	FUNCTION
	<u>Concentric Controls:</u>
TRIGGER SOURCE	<p>a. Large knob: nine-position switch which selects the source and slope for three types of triggering. They are: \pmLINE; \pmINTernal; \pmEXTernal attenuated by a factor of 10; \pmEXTernal direct; and OFF.</p>
TRIG LEVEL	<p>b. Small knob: potentiometer determines at what voltage on the input triggering waveform the horizontal trace will start. A preset position is provided in the counterclockwise direction which provides fixed optimized sensitivity.</p>
TRIGGER MODE	<p>a. Large knob: four-position switch selecting DC coupled triggers, AC coupled triggers, and ACF (ac fast) coupled triggers with a low-frequency cutoff of 5000 cycles. This latter mode is used whenever time-shared phenomenon are presented on internal triggering, and with signals containing undesirable low-frequency amplitude modulating components.</p> <p>The AUTO mode provides a simplified triggering for signals with repetition frequencies above 60 cycles per second.</p>
TRIG/REC	<p>b. Small knob: control for adjusting the Delaying Sweep for TRIGgered or RECURRENT operation and is provided with a PRESET position suitable for most triggering applications. This control</p>

TABLE 2-2. FUNCTION OF CONTROLS AND CONNECTORS (Continued)

NAME	FUNCTION
TRIG/REC (continued)	<p style="text-align: center;"><u>Concentric Controls:</u></p> <p>should only be used for stabilizing high repetition rate and random signals which affect the lock-out of the Delaying Sweep.</p>
DELAY MULTIPLIER	<p>Thumb activated digital decade switches. The measurement is in centimeters of delay and multiplication applies to the SWEEP RATE switch setting.</p>
EXT SIG	<p>BNC coaxial connector to PICK-OFF SOURCE switch. Shaped output from DEL TRIG connector.</p>
GATE	<p>BNC coaxial connector supplying a 15-volt positive pulse through a cathode follower and synchronized with the Delaying Sweep. The pulse duration is the same as the Delaying Sweep. The output may be used to calibrate test probes.</p>
SAW	<p>BNC coaxial connector supplying approximately 40 volts of the positive-going saw waveform synchronized with the Delaying Sweep.</p>
DEL TRIG	<p>BNC coaxial connector from cathode follower supplies delayed trigger from Main Sweep. Delaying Sweep or external signal input, 3 volts.</p>
TRIG IN	<p>BNC coaxial connector to TRIGGER SOURCE switch.</p>
SYNC READY	<p>Indicator Lamp: this lamp is lit whenever the trigger channel is ready to accept signals. This lamp serves as a check on the TRIG LEVEL control setting.</p>

TABLE 2-2. FUNCTION OF CONTROLS AND CONNECTORS (Concluded)

NAME	FUNCTION
SWP CAL ADJ	<p>Screwdriver control used to standardize accurately the steps of the SWEEP RATE switch.</p> <p><u>Note:</u> This adjustment is not normally required and should not be used unless an accurate time standard or power-line frequency is available. When interchanging the Type 4203 Delaying Sweep Plug-in Unit between Main Frames, this control must be reset.</p>
	<p>This adjustment automatically tracks the DELAY MULTIPLIER calibration.</p>

The Operator's Manual for the Type 420 Series Oscilloscopes gives further instructions for use of the Delaying Sweep as follows:

1. Second time base for Independent Displays.
2. Phase measurements using the Trigger Pick-off signal.
3. Using the Type 4203 as a standard time base.
4. Using the Saw Output of the Type 4203 to generate a raster.

SECTION 3

MAINTENANCE AND RECALIBRATION

3-1. VISUAL INSPECTION

WARNING

VOLTAGES SUFFICIENT TO CAUSE INJURY ARE PRESENT WITHIN THIS INSTRUMENT. OBSERVE THE FOLLOWING PRECAUTIONS WHEN NECESSARY TO ENERGIZE THE EQUIPMENT WITH THE PANELS REMOVED.

- 1) Never work alone.
- 2) Make sure the chassis is properly grounded.
- 3) Turn off power before changing tubes.
- 4) Before touching any components, short across the terminals to remove any possible charge that may remain after turning off the power.

The entire Plug-in Unit should be visibly inspected every few months for possible circuit defects, such as damaged connectors, scorched wires or resistors, or broken terminal strips. For most visual troubles the remedy is apparent, however, particular care must be taken when heat-damaged components are detected. Overheating of components is often the consequence of other less obvious defects in the circuit. It is essential that you determine the cause of overheating before replacing heat-damaged components in order to prevent further damage.

The Type 4203 Delaying Sweep Plug-in Unit is a stable instrument that will provide many hours of trouble-free operation. However, to insure the reliability of measurements, it is suggested that the instrument be checked after each 500 hours of operation (or every six months if used intermittently). Complete recalibration procedures are given in this manual.

3-2. GAINING ACCESS TO CHASSIS

Since the Plug-in is not contained in its own dust cover, most of the components are readily accessible when the plug-in is removed from the Main Frame. To gain access to the chassis, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame.

3-3. SERVICING HINTS

In trouble shooting a Plug-in Unit, it becomes necessary to determine if the defect is in the plug-in or in the Main Frame of the oscilloscope. The quickest and easiest way of isolating the trouble is to substitute another plug-in unit and determine if the same trouble persists. If the trouble continues after substitution, it can be safely assumed that the defect is in the Main Frame.

There is no simple way of locating troubles. An understanding of the functions of the circuits is the best help. With an understanding of the circuit operation, it will be possible to make a good guess at the general source of troubles from the symptoms.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. The period between checks will depend on the installation and the conditions of operation. In general, portable units moved about constantly, or units operated in very hot, moist, or dirty areas will require more frequent service.

For these regular checks, clean all dust and dirt from the unit, using a light air blast or soft brush. Be sure that the dust is removed from around the socket contacts and terminal strip connections.

In the event of improper performance of the Plug-in Unit, the following suggestions are recommended:

1. Build up an extension cable of the necessary length so that Plug-in may be operated remotely from the oscilloscope. Connectors used are Amphenol Type 26-159-32 (male) and Type 26-190-32 (female).
Extension Cable Accessory Du Mont Type 4294 is available from Du Mont Laboratories.

2. Localizing the trouble is made easier by using a test oscilloscope. To check waveforms, use a high-impedance probe while trouble shooting. Another Du Mont Type 425 Oscilloscope with a Type 4290 Probe is recommended.
3. Note that all tube heaters are lit, or feel the tubes for warmth.
4. If the trouble persists after tube replacement, replace the original tube in its socket and check for proper voltages. Random tube changing as a means of trouble shooting should be avoided whenever possible. This tends to loosen up the tube pins and could result in unreliable performance.
5. Replacement of tubes may require resetting of one or more service adjustments. Consult Table 3-2. For optimum stability, the new tube should be allowed a warmup time of at least 10 minutes before making any service adjustments. Adjustments may have to be reset after several hours and days of normal operation.

Maintain a high quality of workmanship. Use a clean bench and soldering iron; keep solder joints smooth and bright; do not overheat any component while soldering semiconductors. The use of a 30-watt iron such as a Hexacon Type 26S is recommended.

When using accessory probes or adapters, be sure the trouble is not originating in the accessory, before suspecting the oscilloscope itself.

3-4. REPLACEMENT PARTS

a. STANDARD PARTS

Replacements for all parts used in the Type 4203 Delaying Sweep Plug-in Unit can be purchased directly from Du Mont. However, since most of the components are standard electronic parts, they can generally be obtained locally in less time than is required to obtain them from the factory. If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List

in this manual. The Parts List gives the values, tolerances, ratings, and Du Mont part number for all electrical components used in the instrument. This will help to expedite service.

b. SPECIAL PARTS

In addition to the standard electronic components mentioned in the previous paragraph, some special parts are also used in the assembly of the Type 4203 Delaying Sweep Plug-in Unit. These parts are manufactured specially for Du Mont by other companies in accordance with Du Mont specifications. These parts and most mechanical parts should be ordered directly from Du Mont since they are normally difficult or impossible to obtain from other sources. All parts may be obtained either directly from the factory or through your local Du Mont representative.

Since the production of this instrument, some of the parts may have been superseded by improved components. In such cases, the Part Numbers of these components will not be listed in your Parts List. However, if you order a part from Du Mont, and it has been superseded by an improved component, the new part will be shipped in place of the part ordered. Your local Du Mont representative has knowledge of these changes and may call you if a change in your purchase order is necessary.

It is the aim of the Du Mont organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any Du Mont equipment to its specified performance. Your local Du Mont field representative maintains a limited number of spare parts or the factory may be asked to air ship replacement parts.

3-5. LOCATION OF TUBES, SERVICE ADJUSTMENTS, AND TEST POINTS

The location of tubes and service adjustments are shown on Schematic Drawing 8901 4671-4, Sheet 4 of 4, which will be found in the last section of this manual.

WARNING

When the panels are removed from the instrument for servicing, exercise caution while the power is on. The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead of the power cord whenever the instrument is in use.

3-6. SERVICE ADJUSTMENTS

a. INTRODUCTION

The adjustments outlined in the following paragraphs are based on the test procedure followed at our factory. Normally, it will not be necessary to make all of the adjustments in the paragraphs to follow. However, any adjustment that is made should be accomplished in the indicated sequence. All adjustments should be made at mid-line voltage 115V/230V $\pm 2\%$.

b. EQUIPMENT REQUIRED (Equivalents may be substituted)

<u>DESCRIPTION</u>	<u>CHARACTERISTICS</u>
Oscilloscope	A completely aligned and calibrated Du Mont Type 420-Series Oscilloscope is required as the basic test fixture
Volt-Ohmmeter	Simpson Model 260 or equivalent; 20,000 ohms/volt sensitivity
Time-Mark Generator	Tektronix Type 180A
10:1 Attenuator Probe	Du Mont Type 4290
Sine Wave Oscillator	Hewlett Packard Type 650A
Y Plug-in Unit	Du Mont Types 4201 or 4202
Vacuum Tube Voltmeter	Du Mont Type 405
Recalibration Tool Kit	Du Mont Type 4295; the following items from this kit are required: <ul style="list-style-type: none"> a. Type 4294 Extension Cable b. Type 4295A; Red; (fixed, film, 360K ohms, $\pm 5\%$, 1/2 watt) c. Type 4295B; Black; (fixed, film, 1.95M ohms, $\pm 1\%$, 1/2 watt)

c. INITIAL CONTROL SETTINGS AND TEST SETUP

Set the controls as indicated in Table 3-1.

TABLE 3-1
PRELIMINARY CONTROL SETTING

CONTROL	SETTING
<u>MAIN FRAME</u>	
DISPLAY LOGIC	MAIN SWP
SWEEP RATE	5 MS/CM
TRIGGER SOURCE	OFF
TRIG LEVEL	PRESET
TRIGGER MODE	NORMAL AC
STABILITY (TRIG/REC)	PRESET
<u>DELAYING SWEEP PLUG-IN</u>	
SWEEP RATE	0.5 SEC/CM
LENGTH	Fully cw
TRIGGER MODE	AC
STABILITY (TRIG/REC)	PRESET
PICK-OFF SOURCE	OFF
DELAY ZERO	Centered
TRIGGER SOURCE	OFF
TRIG LEVEL	PRESET
SWP CAL ADJ	Centered
DELAY MULTIPLIER	5.00

The Type 4203 Delaying Sweep Plug-in may be operated remotely from the oscilloscope by means of the Du Mont Type 4294 Extension Cable. Apply power, and after a one minute warmup interval, the B+ voltages will be applied to the unit under test. Observe that the ST140 neon lamp (E8200) located on a terminal board does not go on. If this neon is lit, trouble shoot the Sync Injector/Lockout (V807) and/or the Sweep Gate Multi-vibrator (V805A and V806A) circuits.

3-7. SWEEP MODE PRESET ADJUSTMENT (R8124R)

To adjust R8124R, proceed as follows:

1. Temporarily connect the Du Mont Type 4295B from the arm of R8124R to ground. (The Type 4295B is a 1.95M-ohm, $\pm 1\%$, 1/2-watt resistor.)
2. Connect a VTVM from pin 3 (cathode) of V804 to ground.
3. Set the STABILITY control to PRESET.
4. Adjust R8124R until the threshold of driven sweep is reached. This condition is noted on the voltmeter at that point when the needle just begins to deflect.
5. Remove the Type 4295B Resistor Kit and the Voltmeter when the adjustments are completed.

3-8. ADJUSTING TRIG LEVEL CENT (R8124F)

To make this adjustment, proceed as follows:

1. Set TRIGGER MODE switch to AC, TRIGGER SOURCE switch to OFF, and TRIG LEVEL control to PRESET.
2. Temporarily connect the Du Mont Type 4295A across R8126 located on TB5. (R8126 is a 2-watt, 24K-ohm resistor; the Type 4295A is a 360K-ohm, $\pm 3\%$, 1/2-watt resistor.)
3. Adjust TRIG LEVEL CENT, R8124F, until the SYNC READY Indicator is just on.
4. Remove the Type 4295A resistor when test is completed.

3-9. SETTING THE TRIG ADJ (R8356)

To make this adjustment of the pick-off trigger shaper, proceed as follows:

1. Preset the Delaying Sweep front-panel controls as follows:

<u>Control</u>	<u>Setting</u>
TRIGGER SOURCE	OFF
TRIG LEVEL	PRESET
DELAY MULTIPLIER	9.00

2. Connect a Simpson Meter across R8351 (this resistor is located on TB4).
3. Set the TRIG ADJ control for 3.5 volts.

3-10. DELAY BAL ADJUSTMENT (R8273)

To make this adjustment, proceed as follows:

1. Preset front-panel controls as follows:

CONTROL	SETTING
MAIN FRAME	
DISPLAY LOGIC	MAIN SWP and DELAYING SWP
SWEEP RATE	100 μ SEC/CM
TRIGGER SOURCE	-EXT
STABILITY	REC
TRIGGER MODE	ARMED ACF
DELAYING SWEEP	
DELAY MULTIPLIER	1.00
SWEEP RATE	1.0 MS/CM
PICK-OFF SOURCE	DEL SWP
TRIGGER SOURCE	+EXT
TRIG LEVEL	PRESET
TRIGGER MODE	AC
STABILITY	PRESET
DELAY ZERO	Centered
SWP CAL ADJ	Centered

2. Apply the 10-millisecond TRIGGER OUT pulse from the Tektronix Type 180A Time-Mark Generator to the TRIG IN connector on the Type 4203 Delaying Sweep.
3. Apply the 500 μ sec and 1 millisecond MARKER OUT signal from the Tektronix Type 180A to the Input connector on the Y Plug-in Unit.
4. Connect a short shielded lead from pin 1 (plate) of the Delayed Trigger Output, V805B, to the EXT SYNC connector on the Main Frame. Two pulses should now appear on the screen of the oscilloscope.
5. Adjust the DELAY ZERO control to bring the pulses to a vertical reference line on the CRT scale.
6. Set the DELAY MULTIPLIER control to 2.00. If the pulse has moved from the pre-established reference line, adjust the DELAY BAL control R8273 to restore the pulse to its initial position.
7. Turn the DELAY MULTIPLIER control back to 1.00. If the pulse has moved from the reference line, reposition it by means of the DELAY ZERO control.
8. Repeat the procedure until a balance is achieved. When this is accomplished, check that there is no deposition when the DELAY MULTIPLIER control is set from 1.00 through 9.00. If there is any deposition, retrim the DELAY BAL adjustment for optimum balance.
9. Check that deposition is less than 0.4 centimeter when setting the DELAY MULTIPLIER control from 1.00 through 9.00. This test is made first with SWP CAL ADJ set fully counterclockwise. Then set fully clockwise.
10. When tests are completed, center the SWP CAL ADJ control.

3-11. 1 μ SEC TRIMMER ADJUSTMENT (C8215)

To make this adjustment, proceed as follows:

1. Preset front-panel controls as indicated in Step 1 of paragraph 3-15. except that the Delaying SWEEP RATE switch is set to 1.0 μ SEC/CM and the Main Frame SWEEP RATE switch is set to 0.1 μ SEC/CM.
2. Apply a 1.0 ms TRIGGER OUT pulse from the Tektronix Model 180A Time-Mark Generator to the TRIG IN connector on the Type 4203.
3. Apply a 1.0 μ sec MARKER OUT pulse from the Tektronix Model 180A to input connector on the Y Plug-in Unit. A pulse should now appear on the screen.
4. Connect a short shielded lead from pin 1 (plate) of Delayed Trigger Output V805 to EXT SYNC connector on the Main Frame.
5. Adjust the DELAY ZERO control to bring the pulse to the first convenient vertical line on the CRT scale (the DELAY ZERO control should be approximately in the center of its range). Turn the DELAY MULTIPLIER control to 2.00.
6. Adjust C8215 to bring the pulse back to the same position occupied by the 1.00 setting.
7. Turn the DELAY MULTIPLIER control back to 1.00; if the pulse moves, readjust the DELAY ZERO control.
8. Repeat the procedure until a balance is achieved.
9. When this is accomplished, check that there is less than 1 millimeter of deposition when the DELAY MULTIPLIER is set from 1.00 to 9.00.

3-12. ADJUSTING TRIG SENS (R8136)

The TRIG SENS adjustment, R8136, is provided in the Sync Shaper Trigger circuit to set the current of the normally conducting tubes and the backlash voltage.

To adjust R8136, proceed as follows:

1. On the Delaying Sweep Plug-in set TRIGGER SOURCE switch to OFF, TRIGGER MODE control to AC, STABILITY control to PRESET, and TRIG LEVEL control to fully counterclockwise but not into PRESET.
2. Connect a Simpson Meter across R8152 (220-ohm resistor on TB5 - lower terminal-strip board on right side of the Type 4203 chassis).
3. Adjust TRIG SENS (R8136) for 2.2-volt reading on meter.
4. Rotate the TRIG LEVEL control slowly clockwise. When this control has been advanced near the center of its range, the voltage should drop to about 0.75 volt and the SYNC READY Indicator lamp should go out.

NOTE: It will be necessary to carefully manipulate the backlash action of the TRIG LEVEL control in order to reach the 0.75-volt level.

5. Turn the TRIG LEVEL control fully clockwise; the SYNC READY Indicator lamp should be off.
6. Turn the TRIG LEVEL control fully counterclockwise but not into PRESET; the SYNC READY Indicator lamp should be on.

3-13. ADJUSTING MAIN SAW PICK-OFF CAL (R8303)

When interchanging the Type 4203 Delaying Sweep Plug-in Unit between Main Frames, R8303 should be reset as follows:

1. Make sure the DELAY BAL (R8273) and 1 μ sec Trimmer (C8215) adjustments have been made as outlined in paragraphs 3-10 and 3-11 of this manual.

2. On the Main Frame, set the DISPLAY LOGIC switch to MAIN SWP, TRIGGER SOURCE switch to +EXT, and the SWEEP RATE control to 100 μ S/CM.
3. On the Dual Trace Plug-in, set the INPUT SELECTOR switch to A & B.
4. On the Delaying Sweep Plug-in, set the PICK-OFF SOURCE switch to MAIN SWP and the DELAY MULTIPLIER control to 0.00.
5. Make Test Setup as shown in Figure 3-1.
6. Turn the DELAY MULTIPLIER control to 1.00; the display should appear as shown in Figure A1. If the delayed trigger pulse on Scale B is not aligned under the number one pulse as shown on Scale A, adjust R8303 until this condition is achieved.
7. Turn the DELAY MULTIPLIER control to 9.00; the delayed trigger pulse on Scale B should move directly under the number 9 pulse on Scale A. If it does not, readjust R8303.
8. Repeat step 6; then step 7. Continue to repeat these steps until the delayed trigger pulse on Scale B tracks with the number one and number 9 pulses on Scale A.

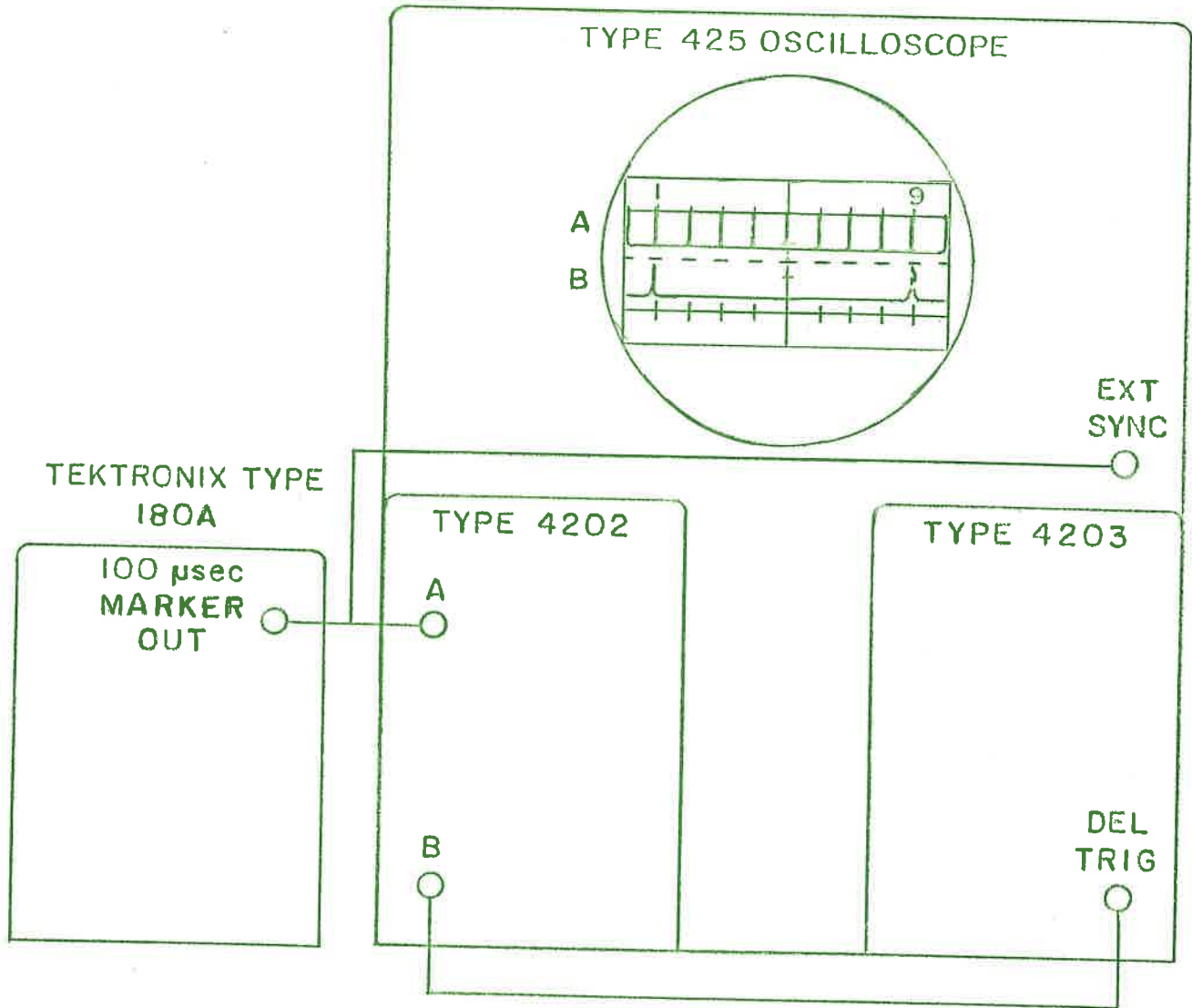


FIGURE 3-1. TEST SETUP FOR MAIN SAW PICK-OFF CAL ADJUSTMENT

TABLE 3-2

ADJUSTMENTS TO BE MADE WHEN REPLACING TUBES

SYMBOL	TYPE	SERVICE ADJUSTMENTS	RESET AFTER 50 HOURS
V801	6922	TRIG LEVEL CENT (R8124F)	Yes
V802	6922	TRIG LEVEL CENT (R8124F) and TRIG SENS (R8136)	Yes
V803	6922	TRIG SENS (R8136)	Yes
V804	6BK7	SWEEP CAL ADJ (R8229)	No
V805	6922	SWEEP MODE PRESET (R8124R)	No
V806	6922	SWEEP MODE PRESET (R8124R)	Yes
V807	6DJ8	SWEEP MODE PRESET (R8124R)	Yes
V808	E80CF	None	
V809	6BR8-A	None	No
V810	OG3/ 85A2	SWEEP MODE PRESET (R8124R) and DEL BAL (R8273)	No
V811	6922	None	No
V812	6922	TRIG ADJ (R8356)	Yes

3-14. WAVEFORM DATA

The chart of waveforms which follow was taken at key points in the circuit and should facilitate trouble shooting; both the time and voltage measurements are given.

WAVEFORMS

(Taken with controls set as follows:)

MAIN FRAME

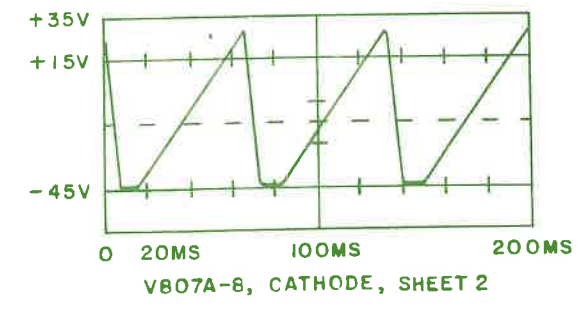
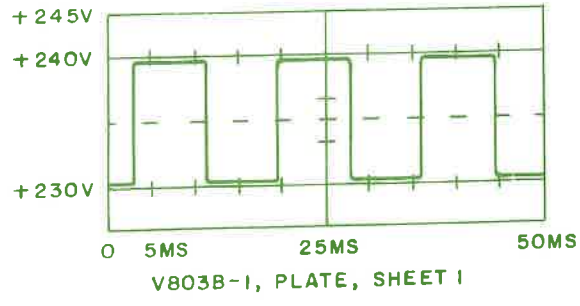
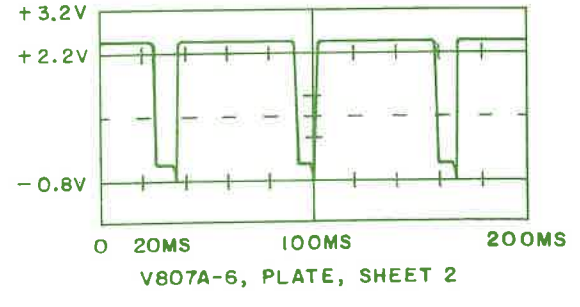
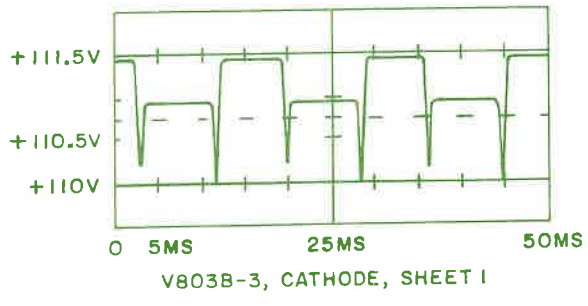
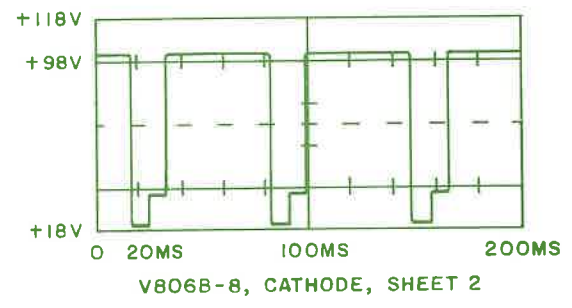
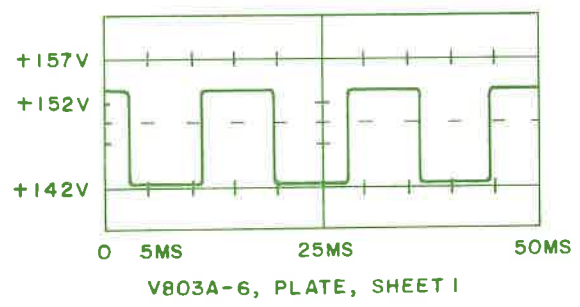
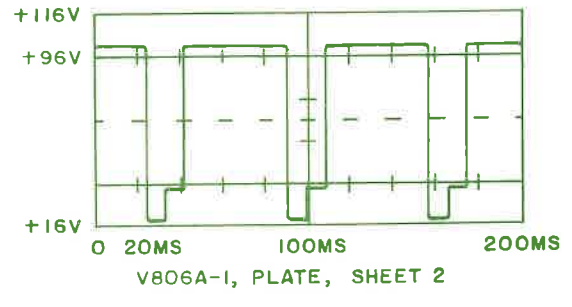
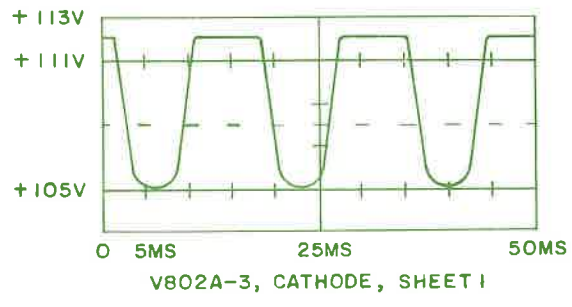
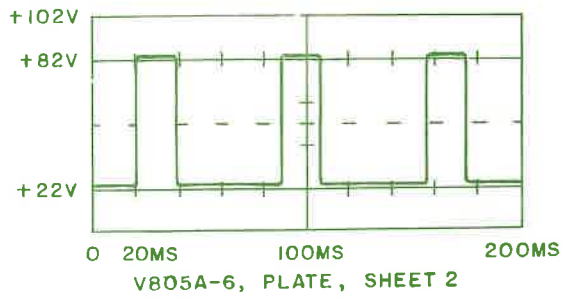
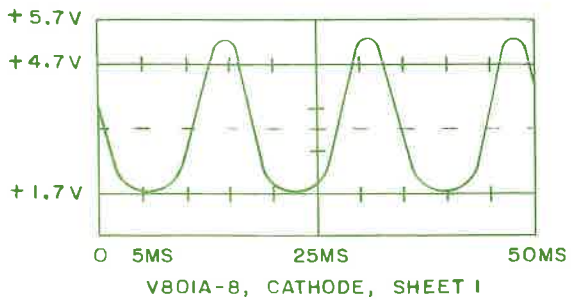
<u>Control</u>	<u>Setting</u>
PATTERN POSITIONING	Centered
POLARITY	+
TRIGGER SOURCE	+INT
TRIG LEVEL	PRESET
TRIG/REC	PRESET
TRIGGER MODE	AC NORMAL
SWEEP RATE	200 μ S/CM
SWITCH MODE	ALTERNATE
DISPLAY LOGIC	DELAYING SWP

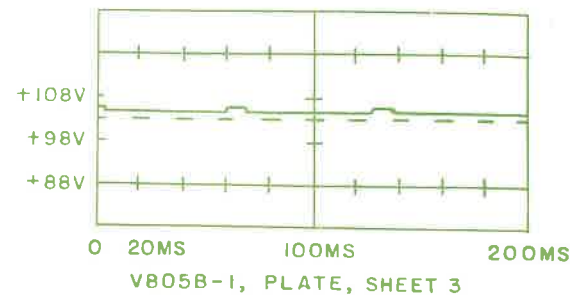
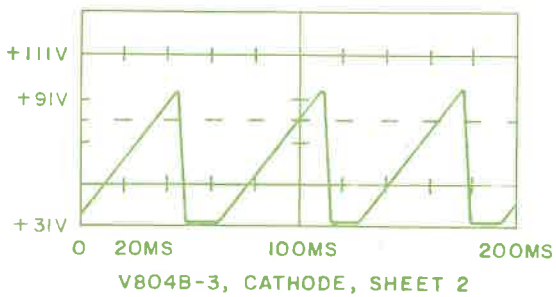
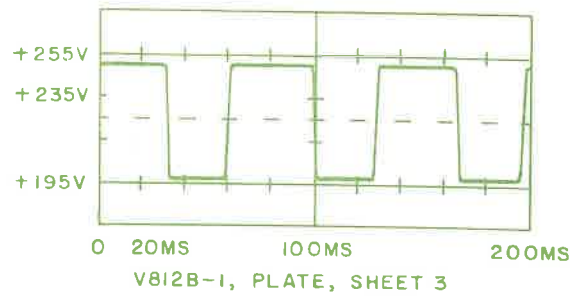
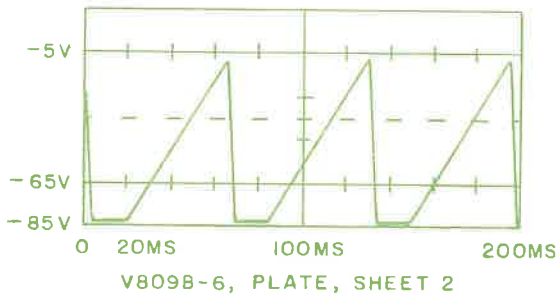
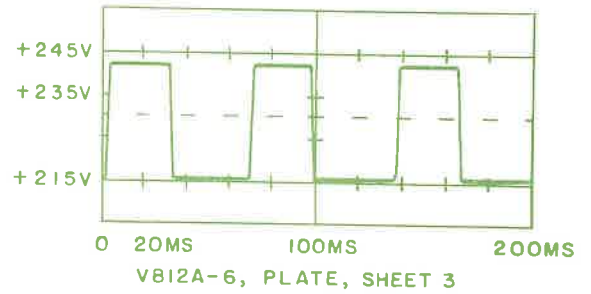
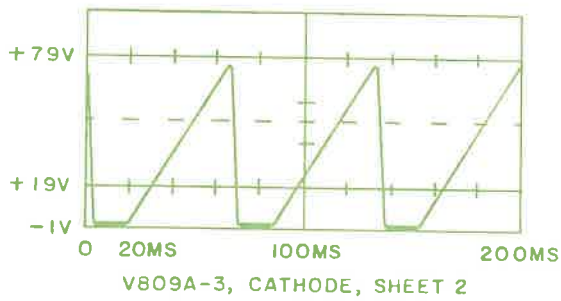
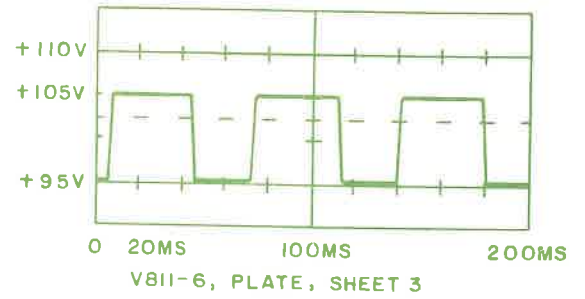
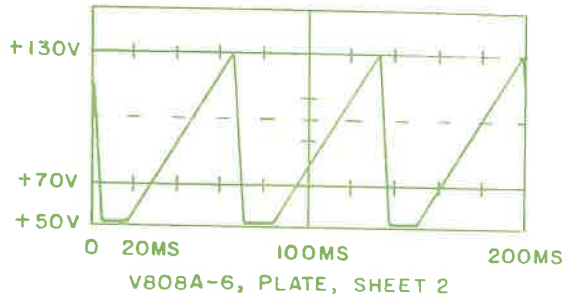
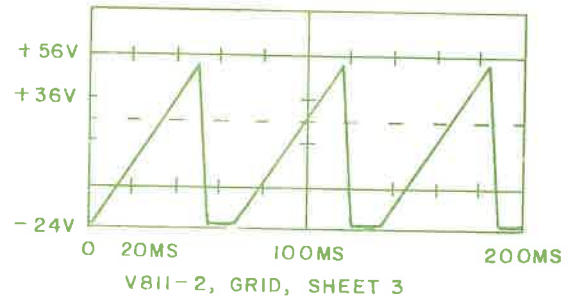
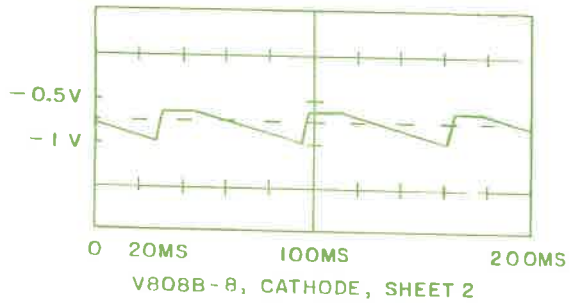
DUAL TRACE

<u>Control</u>	<u>Setting</u>
INPUT SELECTOR	A
VOLTS/CM	CAL
AC/DC	DC
POLARITY	NORMAL
READ OUT	NORMAL

DELAYING SWEEP

<u>Control</u>	<u>Setting</u>
TRIGGER MODE	AC
TRIG/REC	PRESET
TRIG LEVEL	PRESET
TRIGGER SOURCE	+LINE
PICK-OFF SOURCE	DEL SWP
SWEEP RATE	5 MS/CM
LENGTH	10 CM
DELAY MULTIPLIER	3.00





SECTION 4

TYPE 4203 DELAYING SWEEP ELECTRICAL PARTS LIST AND SCHEMATICS

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
CAPACITORS (8100)		
Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified.		
2. GMC denotes Guaranteed Minimum Capacitance.		
3. GMV denotes Guaranteed Minimum Value.		
C8100	0326 4640	0.01 uf, GMV
C8101	0316 7230	6.2 uuf, <u>+0.25</u> uuf
C8103 & C8104	0310 1270	1000 uuf, +100 -0%, 1000V
C8105	0319 0630	plastic, 0.22 uf, <u>+20%</u> , 200V
C8106	0316 7220	5.6 uuf, + 0.25 uuf
C8107	0326 4660	0.02 uf, GMV
C8108	0316 7220	5.6 uuf, + 0.25 uuf
C8109	0318 3730	plastic, 0.022 uf, <u>+20%</u> , 400V
C8111	0326 4660	0.02 uf, GMV
C8112	0315 2000	100 uuf, + 20%
C8113	0311 4930	470 uuf, +100 -0%
C8114	0318 3730	plastic, 0.022 uf, <u>+20%</u> , 400V
C8115	0319 5750	62 uuf, <u>+5%</u>
C8116	0319 0630	plastic, 0.22 uf, + 20%, 200V
C8117	0318 3730	plastic, 0.022 uf, <u>+20%</u> , 400V
C8118	0310 1270	1000 uuf, GMV, 1000V
C8119	0319 1050	0.02 uf, +60 -40%, 150V
C8121	0319 5750	62 uuf, +5%
C8122	0319 0590	plastic, 0.1 uf, <u>+20%</u> , 200V
CAPACITORS (8200)		
C8200	0314 2700	100 uuf, + 5%
C8201 & C8202	0318 3730	plastic, 0.022 uf, <u>+20%</u> , 400V
C8203	0316 7400	20 uuf, <u>+5%</u>

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
CAPACITORS (8200 continued)		
Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified.		
2. GMC denotes Guaranteed Minimum Capacitance.		
3. GMV denotes Guaranteed Minimum Value.		
C8204	0316 7010	39 uuf, +5%
C8205	0318 3730	plastic, 0.022 uf, +20%, 400V
C8206	0316 7330	10 uuf, +5%
C8211	0319 6680	plastic, 0.46 uf, +1%, 100V
C8212	0319 1301	mica, 0.046 uf, +1%, 100V
C8213	0319 1303	mica, 4551 uuf, +1%, 300V
C8214	0319 1302	mica, 411 uuf, +1%, 300V
C8215	0300 3040	variable, 3-12 uuf
C8216	0316 7010	39 uuf, +5%
C8217	0310 1270	1000 uuf, GMV, 1000V
C8218	0318 3730	plastic, 0.022 uf, +20%, 400V
C8221	0318 3730	plastic, 0.022 uf, +20%, 400V
C8222	0316 7010	39 uuf, +5%
C8223	0317 5830	0.04 uf, GMC, 600V
C8224 & C8225	0318 3730	plastic, 0.022 uf, +20%, 400V
C8226	0319 1050	0.02 uf, +60 -40%, 150V
C8227	0318 3730	plastic, 0.022 uf, +20%, 400V
C8228	0310 1270	1000 uuf, GMV, 1000V
C8231	0319 9010	plastic, 0.1 uf, +20%, 150V
C8232	0310 1270	1000 uuf, +100 -20%, 1000V
C8233	0318 3730	plastic, 0.022 uf, +20%, 400V
C8234	0316 7010	39 uuf, +5%
C8235	0326 4640	0.01 uf, GMV
C8236	0319 6270	plastic, 0.068 uf, +10%, 150V
C8237	0319 6330	plastic, 0.68 uf, +10%, 150V
C8238	0318 4660	electrolytic, 8 uf, +250 -10%, 250V

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
CAPACITORS (8300)		
Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified.		
2. GMC denotes Guaranteed Minimum Capacitance.		
3. GMV denotes Guaranteed Minimum Value.		
C8300 to C8302	0326 4660	0.02 uf, GMV
C8303	0326 5190	paper, 0.22 uf, +20%, 200V
C8304	0318 3730	plastic, 0.022 uf, +20%, 400V
C8305	0326 4660	0.02 uf, GMV
C8306	0315 2950	27 uuf, +10%
C8307	0326 5440	paper, 0.22 uf, +20%, 200V
C8308	0315 2980	47 uuf, +10%
C8309	0310 1270	1000 uuf, GMV, 1000V
C8311	0319 0610	plastic, 0.047 uf, +20%, 200V
CAPACITORS (8400)		
C8400 to C8403	0319 0450	1000 uuf, GMV
C8404 to C8407	0310 1270	1000 uuf, +100 -0%, 1000V

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
SEMICONDUCTORS		
CR8100 & CR8101	2600 6820	diode, 75 ma dc, FD281
CR8200 to CR8204	2600 6820	diode, 75 ma dc, FD281
CR8300	2600 6820	diode, 75 ma dc, FD281
NEON LAMPS		
DS8100	1201 1580	NE-2E, ultra-miniature bayonet, white (SYNC READY)
E8200	1200 9161	glow, ST-125-2S
E8201	1200 3960	glow, NE-2
ELECTRICAL CONNECTORS		
J8100	0902 9080	receptacle, female, 1 contact, BNC (TRIG IN)
J8200	0902 9080	receptacle, female, 1 contact, BNC (GATE)
J8201	0902 9080	receptacle, female, 1 contact, BNC (SAW)
J8300	0902 9080	receptacle, female, 1 contact, BNC (EXT SIG)
J8301	0902 9080	receptacle, female, 1 contact, BNC (DEL TRIG)
P8400	0905 7340	plug, male, 32 contacts

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8100)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms:: K = thousand M = million		
R8100 to R8102	0203 0870	43K
R8103	0203 0910	62K
R8104 F,R	0107 1911	variable, 100K/100K, $\pm 20\%$ (TRIG LEVEL)
R8105	0203 1280	2.2M
R8106	0203 1020	180K
R8107	0203 0930	75K
R8109	0229 9120	film, 909K, $\pm 1\%$
R8111	0234 0210	film, 110K, $\pm 1\%$, 1/4W
R8112	0203 1120	470K
R8113 & R8114	0203 1650	100, $\pm 10\%$
R8115 & R8116	0203 0270	130
R8117	0227 8740	wire wound, 15K
R8118	0203 1610	47, $\pm 10\%$
R8119	0203 1580	27, $\pm 10\%$
R8121	0229 7670	film, 4.75K, $\pm 1\%$
R8122	0203 0480	1K
R8123	0203 0870	43K
R8124 F	0108 5100	variable, wire wound, 10K/10K, $\pm 10\%$, 2W (TRIG LEVEL CENT)
R8124 R	0108 5100	variable, wire wound, 10K/10K, $\pm 10\%$, 2W (SWP MODE PRESET)
R8125	0239 1409	film, 33K, 2W
R8126	0239 1406	film, 24K, 2W
R8127 & R8128	0203 0880	47K
R8129	0203 1610	47, $\pm 10\%$

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8100 continued)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms: K = thousand M = million		
R8131	0203 1040	220K
R8132	0229 4700	film, 1M, $\pm 1\%$
R8133	0203 0590	3K
R8134	0239 0346	film, 100K, $\pm 1\%$
R8135	0239 0332	film, 20K, $\pm 1\%$
R8136	0105 5670	variable, 50K, $\pm 10\%$ (TRIG SENS)
R8137	0203 1340	3.9M
R8138	0229 7420	film, 46.4K, $\pm 1\%$
R8139	0203 1610	47, $\pm 10\%$
R8141	0203 1610	47, $\pm 10\%$
R8142	0203 3830	30K, 1W
R8143	0203 0530	1600
R8144	0229 7420	film, 46.4K, $\pm 1\%$
R8145	0203 1610	47, $\pm 10\%$
R8146	0234 3770	film, 237K, $\pm 1\%$
R8147	0203 1000	150K
R8148	0203 0670	6200
R8149	0203 1510	20M
R8151	0203 1320	3.3M
R8152	0203 0320	220
R8153	0203 1650	100, $\pm 10\%$
R8154	0203 3530	1600, 1W
R8155	0203 1460	12M
R8156	0203 1040	220K
R8157	0203 1060	270K
R8158	0203 1770	1K, $\pm 10\%$
R8159	0203 0500	1200

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8100 continued)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms: K = thousand M = million		
R8161	0239 0398	film, 53.6K, $\pm 1\%$
R8162	0203 0960	100K
R8163	0239 0346	film, 100K, $\pm 1\%$
R8164	0107 1901	variable, 10K, $\pm 20\%$ (TRIG/REC)
R8165	0239 0302	film, 3.74K, $\pm 1\%$

RESISTORS (8200)

R8200	0203 0600	3300
R8201	0234 3690	film, 75K, $\pm 1\%$
R8202	0239 1203	film, 30.1K, $\pm 1\%$, 1W
R8203	0239 1391	film, 6200, 2W
R8204	0203 1650	100, $\pm 10\%$
R8205	0234 3730	film, 130K, $\pm 1\%$
R8206	0203 1650	100, $\pm 10\%$
R8207	0239 1198	film, 392K, $\pm 1\%$, 1W
R8208	0203 3760	15K, 1W
R8209	0203 1650	100, $\pm 10\%$
R8211	0203 1000	150K
R8212	0239 1205	film, 51.1K, $\pm 1\%$, 1W
R8213	0203 1650	100, $\pm 10\%$
R8214	0203 1690	220, $\pm 10\%$
R8215	0203 0500	1200
R8216	0239 1407	film, 27K, 2W
R8217	0239 1394	film, 8200, 2W
R8218	0203 1690	220, $\pm 10\%$
R8219	0203 0760	15K
R8221	0229 3200	film, 400K, $\pm 1/2\%$
R8222	0229 3210	film, 1.2M, $\pm 1/2\%$
R8223	0228 6230	film, 2M, $\pm 1\%$
R8224	0234 6500	film, 4M, $\pm 1\%$

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8200 continued)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms: K = thousand M = million		
R8225	0228 8240	film, 12M, $\pm 1\%$
R8226	0228 8270	film, 20M, $\pm 1\%$
R8227	0203 1180	820K
R8228	0233 9690	film, 33K, $\pm 1\%$, 2W
R8229 F,R	0107 2311	variable, 10K/10K, $\pm 20\%$, 2W (SWP CAL ADJ)
R8231	0203 0320	220
R8232	0203 1080	330K
R8233	0203 1130	510K
R8234	0229 3200	film, 400K, $\pm 1/2\%$
R8241	0239 1427	film, 150K, 2W
R8242	0203 1650	100, $\pm 10\%$
R8243	0203 0460	820
R8244	0239 1408	film, 30K, 2W
R8245	0203 0340	270
R8246	0203 0390	430
R8247	0203 0320	220
R8248	0203 0960	100K
R8249	0203 1220	1.2M
R8251	0203 1690	220, $\pm 10\%$
R8252	0203 1650	100, $\pm 10\%$
R8253	0239 0371	film, 182K, $\pm 1\%$
R8254	0234 3730	film, 130K, $\pm 1\%$
R8255	0203 0980	120K
R8256	0203 0320	220
R8257	0203 0600	3300
R8258	0203 1650	100, $\pm 10\%$
R8259	0229 7280	film, 1K, $\pm 1\%$

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8200 continued)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms: K = thousand M = million		
R8261	0234 3740	film, 133K, $\pm 1\%$
R8262	0234 3570	film, 10K, $\pm 1\%$
R8263	0229 5050	film, 2.49M, $\pm 1\%$
R8264	0203 1690	220, $\pm 10\%$
R8265	0239 1206	film, 110K, $\pm 1\%$, 1W
R8266	0234 3610	film, 14.7K, $\pm 1\%$
R8267	0203 0720	10K
R8268	0203 0320	220
R8269	0233 9690	film, 33K, $\pm 1\%$, 2W
R8272	0203 0320	220
R8273	0108 4840	variable, wire wound, 50K, $\pm 10\%$, 2W (DELAY BAL)
R8274	0203 1690	220, $\pm 10\%$
R8275	0203 1690	220, $\pm 10\%$
R8276	0233 5310	wire wound, 16K, $\pm 3\%$, 7W
R8277	0203 1730	470, $\pm 10\%$
R8278	0203 0550	2K
R8279	0203 1650	100, $\pm 10\%$
R8281	0233 5300	wire wound, 22.6K, $\pm 3\%$, 7W
R8282	0203 1690	220, $\pm 10\%$
R8283	0203 0940	82K
R8284	0203 0320	220
R8285	0234 3750	film, 200K, $\pm 1\%$
R8286	0229 7290	film, 43.2K, $\pm 1\%$
R8287	0203 1650	100, $\pm 10\%$
R8288	0107 1931	variable, 50K, $\pm 20\%$ (LENGTH)
R8289	0203 1510	20M
R8291	0234 3700	film, 82.5K, $\pm 1\%$
R8292	0203 1360	4.7M

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
RESISTORS (8300)		
Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.		
2. Resistance values in ohms: K = thousand M = million		
R8300	0203 1390	6.2M
R8301	0203 1300	2.7M
R8302	0239 0371	film, 182K, $\pm 1\%$
R8303	0105 5670	variable, 50K, $\pm 10\%$ (MAIN SWP PICKOFF CAL)
R8304	0239 0375	film, 30.1K, $\pm 1\%$
R8305 & R8306	0239 0201	film, 25K, $\pm 1\%$, 1/8W
R8311 to R8319	0239 0201	film, 25K, $\pm 1\%$, 1/8W
R8321 to R8329	0234 5720	film, 5K, $\pm 1\%$, 1/8W
R8331 & R8332	0234 5720	film, 5K, $\pm 1\%$, 1/8W
R8333	0107 1691	variable, wire wound, 10K, 3W (DELAY MULTIPLIER - 100th)
R8334	0203 1690	220, $\pm 10\%$
R8335	0203 1650	100, $\pm 10\%$
R8336	0239 1202	film, 61.9K, $\pm 1\%$, 1W
R8337	0203 1610	47, $\pm 10\%$
R8338	0239 1409	film, 33K, 2W
R8339	0203 1650	100, $\pm 10\%$
R8341	0239 0346	film, 100K, $\pm 1\%$
R8342	0107 1921	variable, composition, 50K, $\pm 20\%$, 1/4W (DELAY ZERO)
R8343	0239 0393	film, 48.7K, $\pm 1\%$
R8344	0203 0640	4700
R8345	0203 1610	47, $\pm 10\%$
R8346	0239 0404	film, 24.3K, $\pm 1\%$

TYPE 4203 DELAYING SWEEP (Continued)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
---------------	--------------------	--------------------

RESISTORS (8300 continued)

Notes: 1. All resistors are fixed, composition, $\pm 5\%$, 1/2W, unless otherwise specified.

2. Resistance values in ohms: K = thousand
M = million

R8347	0239 0405	film, 6.65K, $\pm 1\%$
R8348	0203 3600	3300, 1W
R8349	0229 7330	film, 150K, $\pm 1\%$
R8351	0203 0360	330
R8352	0203 1580	27, $\pm 10\%$
R8353	0203 3600	3300, 1W
R8354	0203 1610	47, $\pm 10\%$
R8355	0239 0357	film, 274K, $\pm 1\%$
R8356	0108 4800	variable, wire wound, 10K, $\pm 10\%$, 2W (TRIG ADJ)
R8357	0239 1202	film, 61.9K, $\pm 1\%$, 1W
R8358	0203 0720	10K
R8359	0203 1100	390K
R8361	0203 1610	47, $\pm 10\%$
R8362	0203 0560	2200
R8363	0203 0480	1K
R8364	0203 0310	200

RESISTORS (8400)

R8400 to R8403	0210 0810	wire wound, 4.7, $\pm 10\%$
----------------	-----------	-----------------------------

TYPE 4203 DELAYING SWEEP (Concluded)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
SWITCHES		
S810	0501 5921	rotary, 4 sections, 9 positions (TRIGGER SOURCE)
S811	0501 5911	rotary, 2 sections, 4 positions (TRIGGER MODE)
S812 (R8104)	0107 1911	SPST (TRIG LEVEL), part of R8104
S813 (R8164)	0107 1901	SPST (TRIG/REC), part of R8164
S820	0501 6371	rotary, 2 sections, 19 positions (SWP RATE TIME/CM)
S830	0501 5931	rotary, 2 sections, 4 positions (PICKOFF SOURCE)
S831	0501 4971	unit decade, thumb-activated (DELAY MULTIPLIER - units)
S832	0501 4971	unit decade, thumb-activated (DELAY MULTIPLIER - tenths)
ELECTRON TUBES		
V801 to V803	2501 1760	E88CC/6922
V804	2501 1540	6BK7B
V805 & V806	2501 1760	E88CC/6922
V807	2501 2220	6DJ8/ECC88
V808	2501 2500	E80CF
V809	2501 1980	6BR8A
V810	2500 9270	OG3/85A2
V811 & V812	2501 1760	E88CC/6922

DU MONT

INSTRUMENT WARRANTY AND SERVICE NOTICE

WARRANTY

Allen B. Du Mont Laboratories warrants that each new Cathode-ray Oscilloscope, Automotive Test Equipment, and other Electronic or Electrical Test or Measuring Equipment (hereinafter referred to as "Instrument") manufactured or sold by it, is free from defects in material or workmanship under normal use and service for a period of one year from the date of its sale to the first purchaser for use. If, upon examination by Du Mont, the Instrument is determined to be defective in workmanship or material, Du Mont will, subject to the conditions set forth below, either repair the defective part or replace it with a new part. Du Mont shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall Du Mont be liable for damages by reason of the failure of the Instrument to perform properly or for any consequential damages. This warranty does not apply to any Instrument that has been subject to negligence, accident, misuse or improper installation or operation or that in any way has been tampered with, altered or repaired by any person other than an authorized Du Mont service organization or an employee thereof, or to any Instrument whose serial number has been altered, defaced or removed, or to any Instrument purchased within, and thereafter removed beyond, the continental limits of the United States.

This warranty shall, at Du Mont's option, become void unless registration thereof is promptly effected as provided below. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of Du Mont or impose any obligation upon it in connection with the sale of any Instrument, other than as stated above.

REGISTERING THE WARRANTY

To register this warranty, the enclosed warranty registration card must be properly filled out and mailed to the Instrument Service Department immediately upon receipt of the equipment. Complete information is necessary. **BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.** Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure service under our warranty, the enclosed warranty service card must be properly filled out and returned to the factory. In all cases where service or adjustment is requested, please first contact the factory or authorized depot, giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. **THE TYPE NUMBER AND SERIAL NUMBER** of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing to the factory in this respect, address:

ALLEN B. DU MONT LABORATORIES

Divisions of Fairchild Camera and Instrument Corporation
Industrial Electronics Division

750 Bloomfield Avenue, Clifton, New Jersey

The Instrument Service Department will then send to the customer the written procedure for disposition and shipping instructions. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the Instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in the Instruction Manual. The Parts List gives the values, tolerances, ratings, and Du Mont part number for all electrical components used in the Instrument. This will help to expedite service.

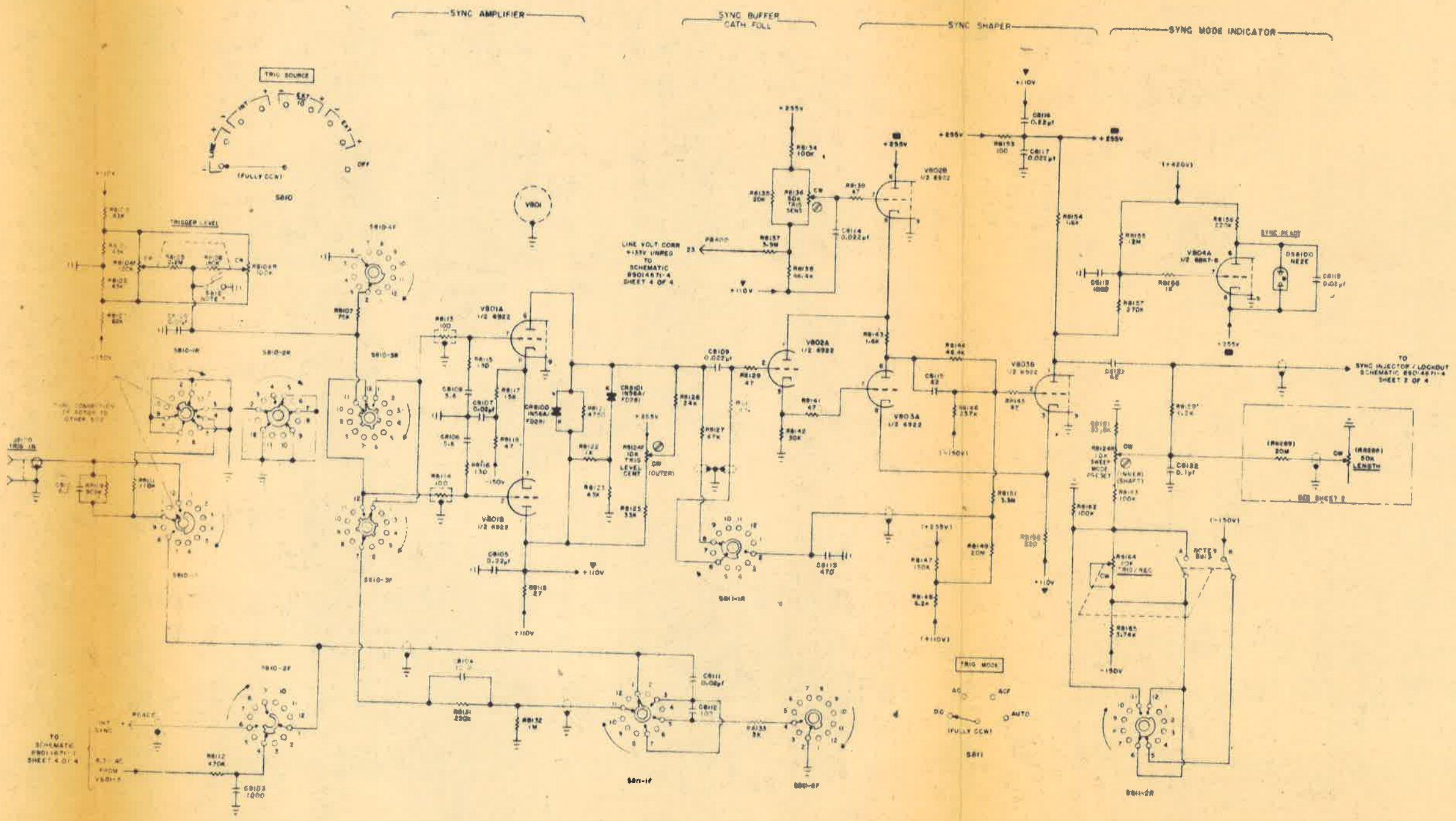
ALLEN B. DU MONT LABORATORIES

Divisions of Fairchild Camera and Instrument Corporation
Industrial Electronics Division

750 Bloomfield Avenue, Clifton, New Jersey

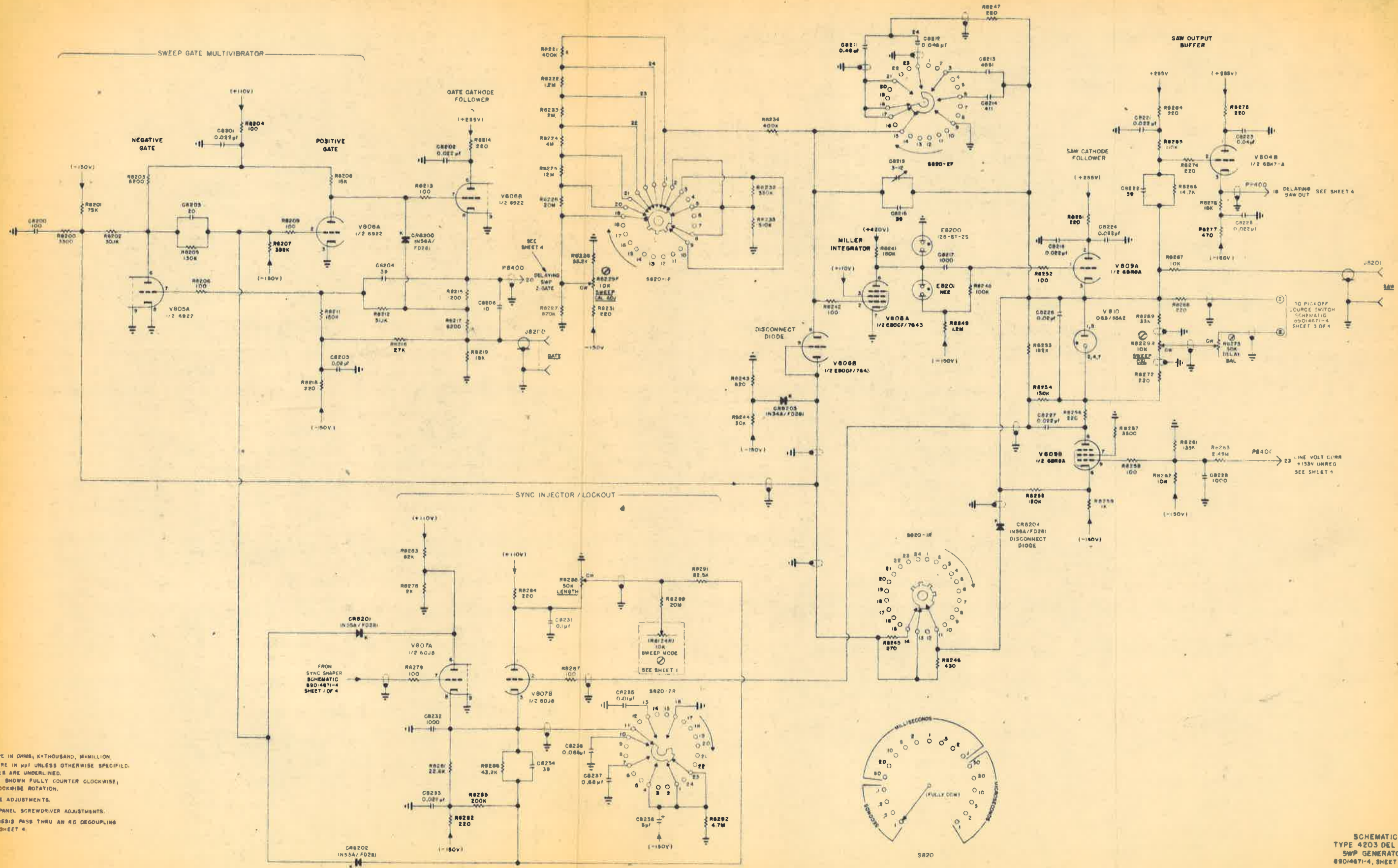
PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Allen B. Du Mont Laboratories, Divisions of Fairchild Camera and Instrument Corporation, 750 Bloomfield Avenue, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.



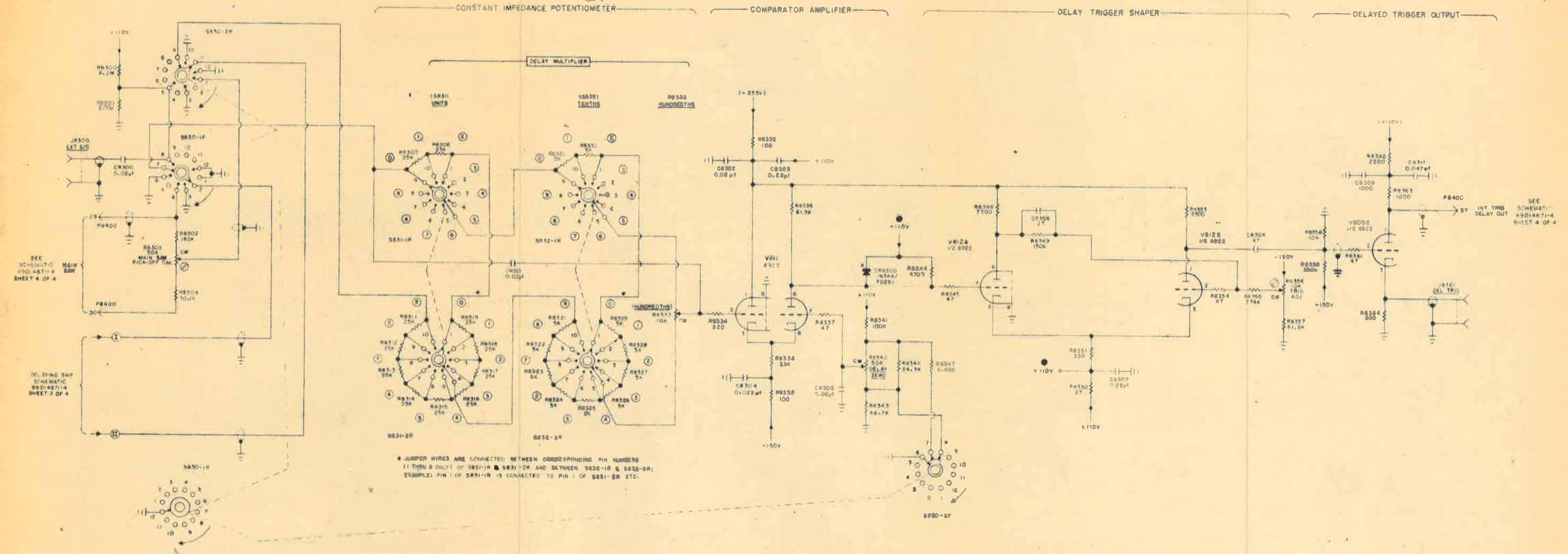
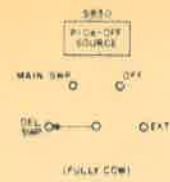
- NOTES
- 1 - RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
 - 2 - CAPACITANCE VALUES ARE IN PPF UNLESS OTHERWISE SPECIFIED.
 - 3 - FRONT PANEL FACILITIES ARE UNDERLINED.
 - 4 - ROTARY SWITCHES ARE SHOWN FULLY COUNTERCLOCKWISE. ARROW INDICATES CLOCKWISE ROTATION.
 - 5 - ○ INDICATES SERVICE ADJUSTMENT.
 - 6 - ○ AND ○ INDICATES COMMON LEVEL CONNECTION.
 - 7 - SW1A CLOSURE WHEN TRIGGER LEVEL IS FULLY COUNTERCLOCKWISE.
 - 8 - SW1A CLOSURE & SW1B OPEN WHEN TRIGGER/RECURRENT IS FULLY COUNTERCLOCKWISE.
 - 9 - VOLTAGES IN PARENTHESIS PASS THRU AN RC DECOUPLING NETWORK SHOWN ON SHEET 4.

SCHEMATIC
TYPE 4203 DEL SWP
SYNC CIRCUIT
89014671-4, SHEET 1 OF 4



- NOTES
1. RESISTANCE VALUES ARE IN OHMS; K=THOUSAND, M=MILLION.
 2. CAPACITANCE VALUES ARE IN μF UNLESS OTHERWISE SPECIFIED.
 3. FRONT PANEL FACILITIES ARE UNDERLINED.
 4. ROTARY SWITCHES ARE SHOWN FULLY COUNTER CLOCKWISE; ARROW INDICATES CLOCKWISE ROTATION.
 5. S INDICATES SERVICE ADJUSTMENTS.
 6. A INDICATES FRONT PANEL SCREWDRIVER ADJUSTMENTS.
 7. VOLTAGES IN PARENTHESES PASS THRU AN RC DECOUPLING NETWORK SHOWN ON SHEET 4.

SCHMATIC
TYPE 4203 DEL SWP
GENERATOR
89014671-4, SHEET 2 OF 4



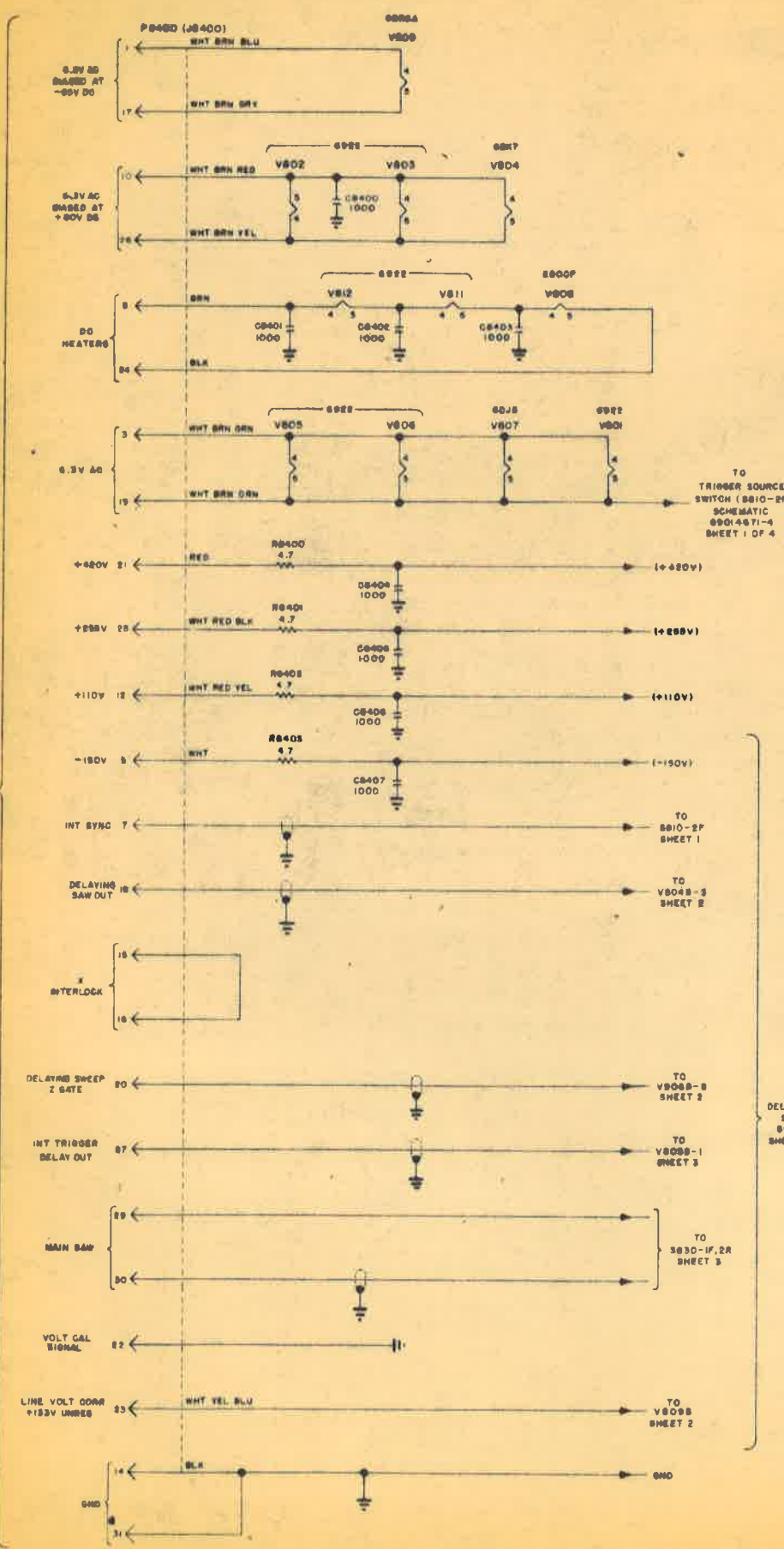
- NOTES:
- 1- RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
 - 2- CAPACITANCE VALUES ARE IN μ F UNLESS OTHERWISE SPECIFIED.
 - 3- FRONT PANEL FACILITIES ARE UNDERLINED.
 - 4- ROTARY SWITCHES ARE SHOWN FULLY COUNTERCLOCKWISE; ARROW INDICATES CLOCKWISE ROTATION.
 - 5- \odot INDICATES SERVICE ADJUSTMENT.
 - 6- \bullet \pm 110V INDICATES COMMON CONNECTION.
 - 7- VOLTAGES IN PARENTHESES PASS THRU AN RC DECOUPLING NETWORK SHOWN ON SHEET 4.

SCHEMATIC
 TYPE 4203 DEL SWP
 PICK-OFF TRIGGER
 42014671-4, SHEET 3 OF 4



100000 0000

TO LV MODULE SCHEMATIC 8901471-4 SHEET 3 OF 4



NOTES
 1-RESISTANCE VALUES ARE IN OHMS.
 2-CAPACITANCE VALUES ARE IN μF.
 3-DECOUPLED VOLTAGES ARE INDICATED BY PARENTHESIS.

SEE DELAYING SWEEP SCHEMATIC 89014671-4 SHEETS 1 THRU 3

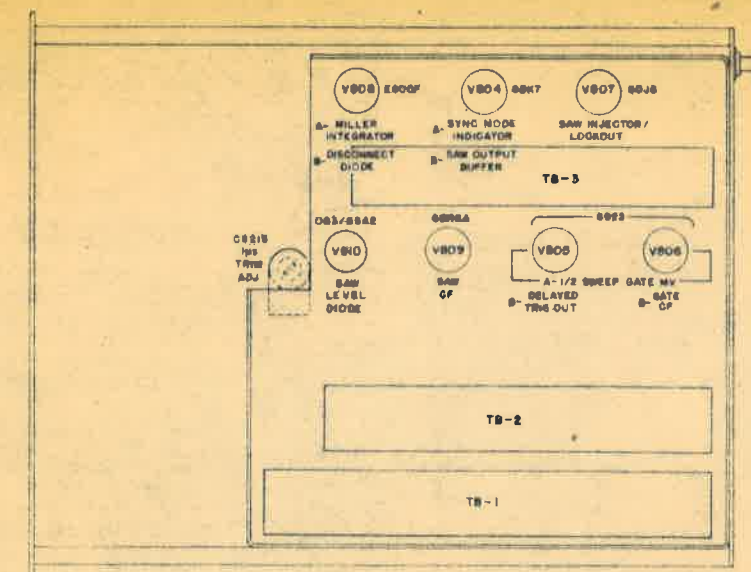
TO 8830-1F, 2R SHEET 3

TO V805B-2 SHEET 2

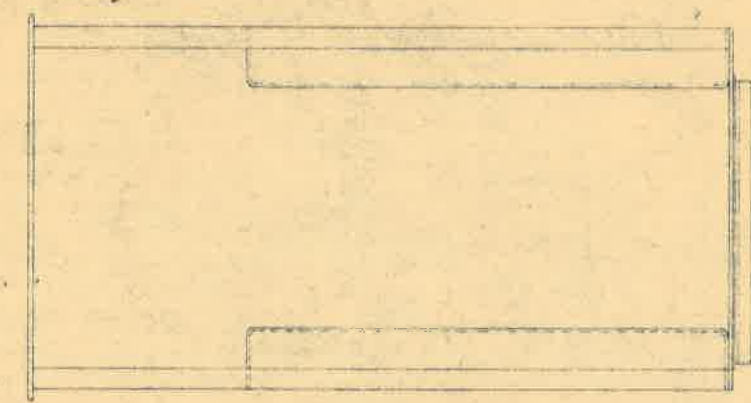
TO V805B-1 SHEET 3

TO 8810-2F SHEET 1

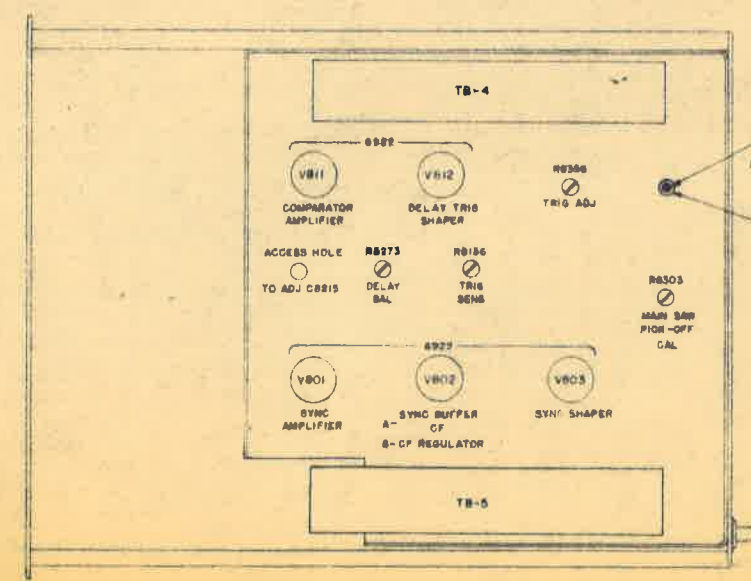
TO V805B-3 SHEET 2



(LEFT SIDE VIEW)



(TOP VIEW)



TUBE LOCATIONS & SERVICE ADJUSTMENTS (RIGHT SIDE VIEW)

X PLUG-IN

SCHEMATIC TYPE 4203 DEL SWP CONN. TUBES & ADJ 89014671-4, SHEET 4 OF 4

