# 4202 Y DUAL TRACE Instruction Manual

DU MONT

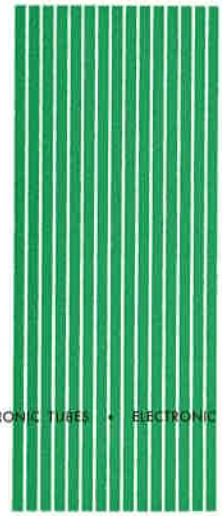
ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, NEW JERSEY, U. S. A.

TYPE

# 4202 Y DUAL TRACE Instruction Manual

DUMONT

Serial No. _____



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ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, NEW JERSEY, U. S. A.

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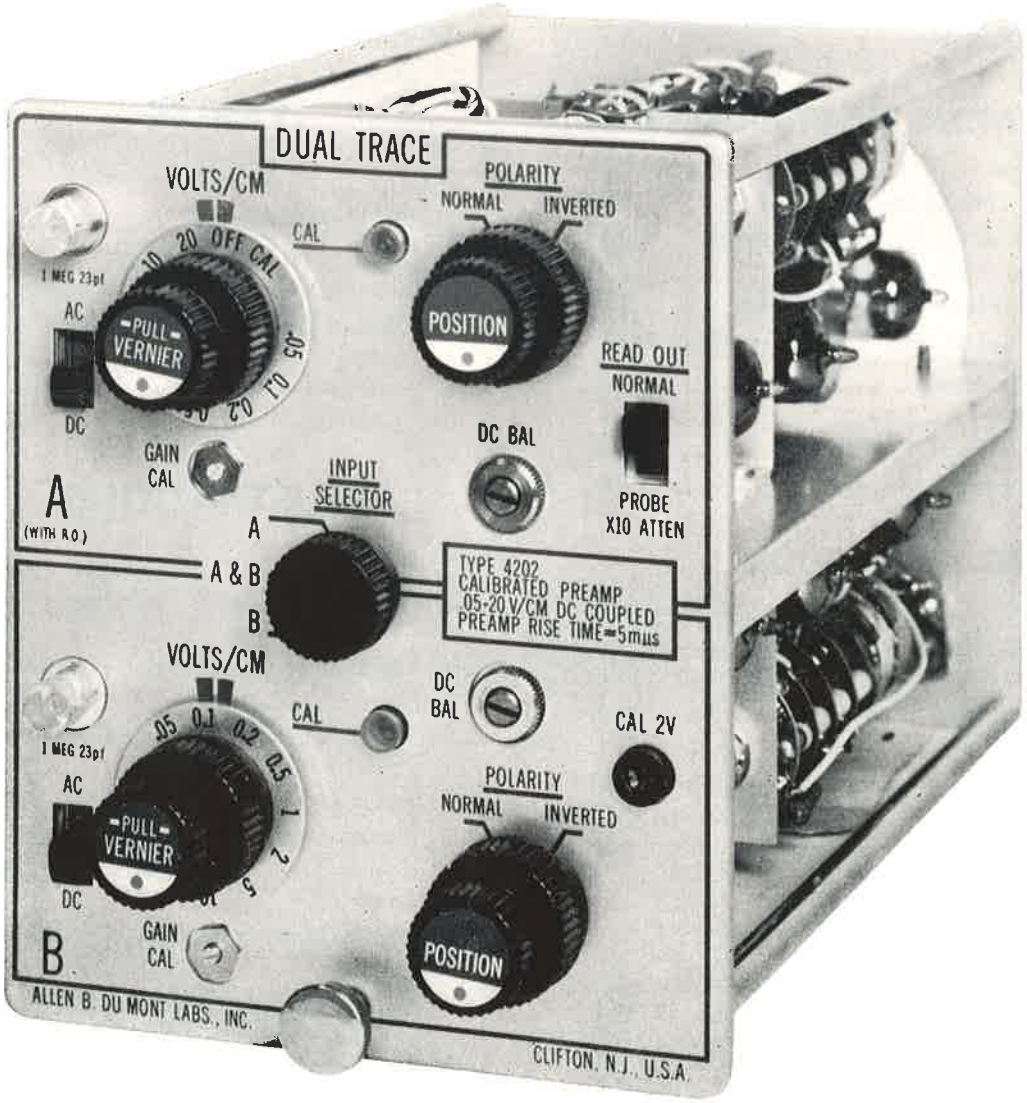



***Figure 1-1. Du Mont Type 4202 Y Dual Trace Plug-In***

# SECTION I
# TECHNICAL SUMMARY

## 1-1. INTRODUCTION

The Du Mont Type 4202 Y Dual Trace Plug-in has a bandwidth of 33 megacycles and sensitivity of 50 millivolts/cm. It enables the user to obtain two vertical signals on the screen simultaneously, or to display either channel individually. It is designed to operate with the Du Mont Type 420 Series Oscilloscopes, and consists of two independent amplifiers, each operating into its respective channel of the Main Frame Vertical Amplifier. An INPUT SELECTOR switch is provided which enables the selection of either Channel A or B for separate display or the combination of both for dual display.

The attenuator of Channel A includes Read-Out facility. When a 10:1 passive attenuator probe is used the decimal point is moved one place to the right by the READ OUT switch so that Read Out remains accurately calibrated. GAIN CALibration and DC BALance are front-panel screwdriver adjustments. Each amplifier has an Inverter Balance and Gas Compensation potentiometer available when the left side of the Main Frame dust cover is removed.

Instructions for operating this Plug-in Unit with the Du Mont Type 425 Oscilloscope are given in Section 2 of this manual.

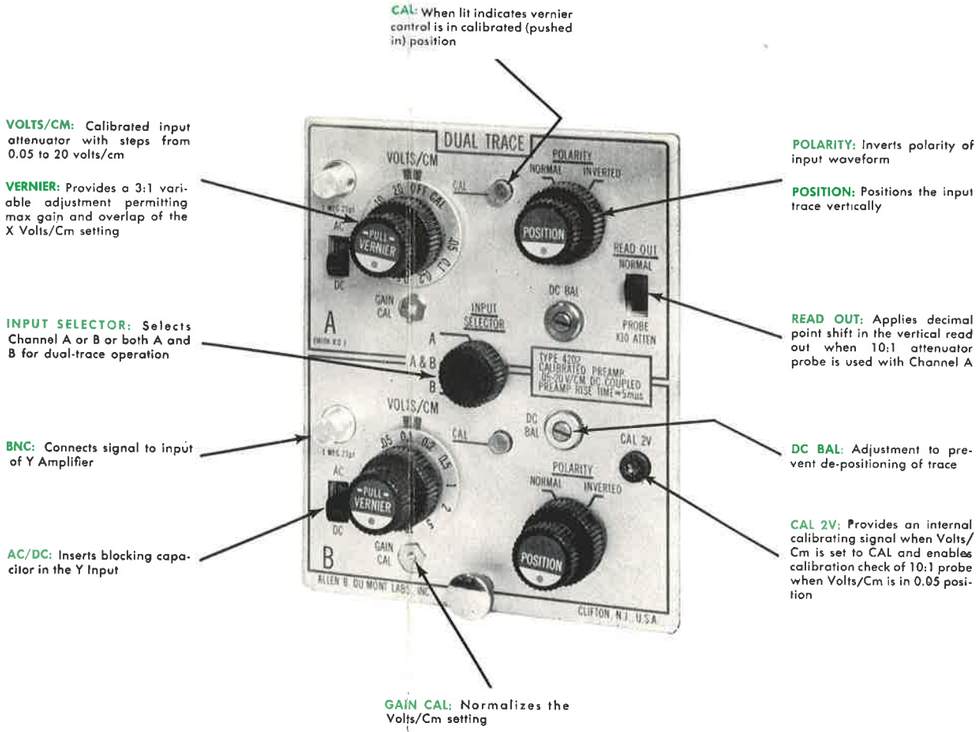



***Figure 2-0. Function of Controls and Connectors***

# section 1
# technical summary

## TABLE 1-1
## TECHNICAL SUMMARY
## DU MONT TYPE 4202 Y DUAL TRACE
## (With Type 425 Oscilloscope)

| | |
|---|---|
| Deflection Factor | 50 millivolts/centimeter |
| Rise Time | 11 nsec (11 millimicroseconds) |
| Frequency Response | |
| Direct Coupled | DC to 33 megacycles, down 3 db ± 1 db |
| Capacitively Coupled | From 2 cycles to 33 megacycles, down 3 db ± 1 db at 33 megacycles; 6 db. at approximately 45 megacycles |
| Input Attenuation | Provided by a frequency compensated attenuator with steps from 0.05 volt/cm to 20 volts/cm, accurate to within 2% when set on any one step; OFF and CAL positions are provided. |
| Maximum Allowable Combined DC and AC Peak Voltage Input | 600 volts |
| Input Impedance | 1 megohm, 23 pf (μμf) |
| Input Impedance Using 10 to 1 Attenuator Probe (Du Mont Type 4290) | 10 megohms, 10 pf (μμf) |
| Y Read Out | Available with Channel A Input |

**PHYSICAL CHARACTERISTICS**

| | | |
|---|---|---|
| Width | 5⅜ inches | (13.65 cm) |
| Height | 6⅝ inches | (16.83 cm) |
| Depth | 9 5/16 inches | (23.65 cm) |
| Weight | 5 pounds | (2.268 kg) |

# SECTION II
# OPERATING INSTRUCTIONS

## 2-1. GENERAL

The Type 4202 Y Dual Trace 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.

## 2-2. 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 cailbrator signal to demonstrate the effects of the various controls on the display. In the instructions which follow, capital letters within the text indicate 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 Settings

(Assuming the Type 4203 Delaying Sweep as X Plug-in)

If a Du Mont Type 4203 is not available, any other X Plug-in Unit may be substituted and disregard the instructions for INDEPendent DISPLAY.

With the Du Mont Type 4202 Y Dual Trace Amplifier and the Type 4203 Delaying Sweep 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 as outlined in this Section.

## 2-3. EFFECT OF THE POSITIONING CONTROLS

Pull out the Channel A VERNIER control and adjust pattern for two centimeters of vertical deflection. Using Channel A POSITION control, set dis-

play as shown in Figure 2-1a. Adjust the INDEX POSITIONING control until the Read-Out dots are superimposed on the waveform as shown in Figure 2-1a. When this instrument is used on a 60-cycle line, the horizontal Read-Out controls should read between 16.2 and 17.2 milliseconds (1/60 cycle = 16.7 ms). The SWITCH MODE control may be pushed into the CHOPped position to eliminate flicker.

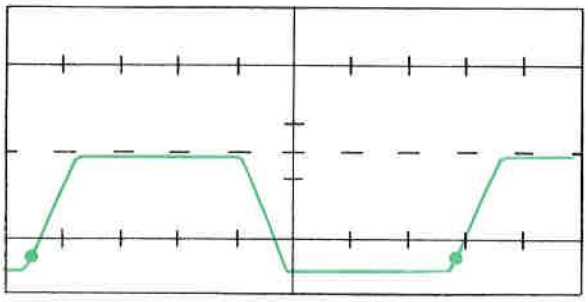


***Figure 2-1a. Reference Display***

Turn the POSITION control of Channel A back and forth and notice that it lowers and raises the display on screen. Notice especially that as you position the display far off screen in either direction, one of the Beam Position Indicator Lamps located above the screen will light to indicate the direction in which the display is being positioned. This will indicate the direction in which to turn the POSITION control in order to return the trace to the screen. Reset the POSITION control to return the display to the center of the screen.

*Note:* Notice that the Read-Out dots are not affected by Channel A POSITION control; see Figure 2-1b.

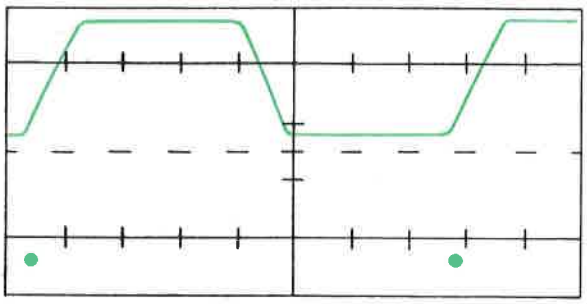


***Figure 2-1b. Waveform Positioned Vertically by Position Control***

## TABLE 2-1

## PRELIMINARY CONTROL SETTING

| CONTROL | SETTING |
|---|---|
| **MAIN FRAME** | |
| EXPAND | X1 |
| DISPLAY LOGIC | R.O. |
| SWEEP RATE | 2 MS/CM |
| VERNIER (Sweep) | Pushed in |
| TRIGGER SOURCE | + LINE |
| TRIG LEVEL | PRESET |
| TRIGGER MODE | AC NORMAL |
| STABILITY (TRIG/REC) | PRESET |
| SWITCH MODE | ALTERNATE (out) |
| POLARITY | + |
| Y Read Out (Voltage) | 000 |
| X Read Out (Time) | 16.7 (20.0) for 50 cps |
| INTENSITY, FOCUS, ASTIG, INDEX & PATTERN POSITIONING | Centered |
| **DELAYING SWEEP PLUG-IN (Type 4203)** | |
| DELAY MULTIPLIER | 3.00 |
| PICK-OFF SOURCE | DEL SWP |
| SWEEP RATE | 5 MS/CM |
| TRIGGER SOURCE | + LINE |
| TRIG LEVEL | PRESET |
| TRIGGER MODE | AC |
| TRIG/REC | PRESET |
| LENGTH | Fully cw |
| **Note:** If this unit is not available, any other X Plug-in may be substituted and disregard instructions for INDEPendent DISPLAY. | |
| **Y DUAL TRACE PLUG-IN (Channel A)** | |
| VERNIER | Pushed in |
| VOLTS/CM | CAL |
| POLARITY | NORMAL |
| READ OUT | NORMAL |
| INPUT SELECTOR | A |
| AC/DC | AC |
| POSITION | Centered |

### 2-4. EFFECT OF THE AC/DC SWITCH

The AC/DC switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input.

1. Set the DISPLAY LOGIC switch to MAIN SWP, SWEEP RATE to 1 MS, and push in Channel A VERNIER control.

2. Set the VOLTS/CM switch to 0.5. Connect a lead from the CAL 2V jack to the Y Input BNC connector of Channel A and observe pattern displayed on screen. The trapezoidal line-frequency calibrator pattern should appear as shown in Figure 2-2. The Type 4290 Attenuator Probe may be used as the connecting lead.

The VOLTS/CM switch should then be set to 0.05.

3. Set the AC/DC switch of Channel A to DC. Notice that the trace shifts vertically since the calibrator waveform is referenced to ground.
4. Position the display on the CRT so that it is centered in the vertical direction. When the AC/DC switch is moved to the AC position, the effect of the dc component is excluded from the display. When the AC/DC switch is set to DC, the ac signal and the dc level of the calibrator waveform will be noted. The dc component of the waveform causes the entire display to rise or fall on the screen. Now reset the AC/DC switch to AC.
5. Keep the input to calibrator jumper lead or probe connected until further notice.

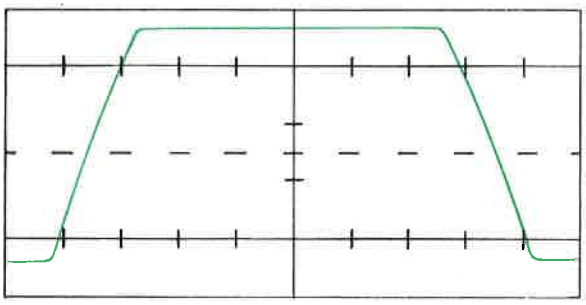


***Figure 2-2. Calibrator Waveform Display***

## 2-5. EFFECT OF THE VOLTS/CM SWITCH

1. Turn the VOLTS/CM knob successively to positions both to the right and to the left of the 0.5 position. Notice that when you set this control to the higher numbered positions, the amplitude of the calibrator waveform is reduced and vice versa.
2. Reset the VOLTS/CM knob to the 0.5 position. Pull the VERNIER control out and turn it counterclockwise. Notice that the CALibrator lamp is extinguished and that the amplitude of the calibrator waveform is reduced. Push in the VERNIER control and notice that the calibrator waveform is restored to the original display. Thus, it is seen that when a given voltage is applied to Y Input, the VOLTS/CM and VERNIER controls are used for adjusting the amplitude of the resulting vertical deflection.

## 2-6. EFFECT OF THE DC BAL SCREWDRIVER CONTROL

Set the VOLTS/CM control of Channel A to OFF. Pull out the Channel A VERNIER knob and rotate it in either direction throughout its range. The reference trace on the screen should not move up or down for any setting of the VERNIER control. If the trace shifts vertically, turn the VERNIER control counterclockwise. Next, while pulling the VERNIER control in and out, carefully adjust the Channel A DC BAL screwdriver control until no movement of the trace is noted. Reset the Channel A VOLTS/CM control to CAL and push in the VERNIER knob. Disconnect the lead between the CAL 2V jack and the Y Input BNC connector of Channel A.

## 2-7. USE OF PROBES

An attenuator probe reduces both the capacitive and resistive loading caused by the oscilloscope to a minimum value. Simultaneously, while isolating the oscilloscope from the signal source, it reduces the effective sensitivity of the instrument. In other words, the displayed waveform will be reduced in amplitude by the attenuation factor of the probe. The attenuation introduced by the probe permits measurement of signal voltages in excess of those which may be accommodated by the Y Plug-in Unit. When using a probe to sample signals from a tuned, matched, or otherwise critical circuit, capacitive loading may cause erroneous readings. In these cases it may be necessary to add capacity and resistance to the circuit under observation after the probe is removed from the circuit. This substitution will equalize loading and restore the measured characteristics of the circuit under observation. The value of resistance and capacitance should equal the input impedance of the probe.

When using the attenuator probe to make amplitude measurements, multiply the observed amplitude of the display by the attenuation factor marked on the probe. The Du Mont 4200 Series of Y Plug-ins are provided with a slide switch which may be set to permit direct and accurate use of the Read-Out feature when using a 10 to 1 attenuator probe.

The Type 4290 probe accessory for the Y Plug-in Units has an attenuation factor of 10 to 1. The maximum voltage that may be applied to the probe is 600 volts. When both ac and dc components are present, the dc plus peak ac must not exceed 600 volts. Voltages in excess of this value (either dc volts or peak ac volts) may cause damage to components inside of the probe housing.

*IMPORTANT:* Before using the probe, always check its adjustment.

# section 2
# operating instructions

An adjustable capacitor in the probe body compensates for variations in input capacitances from one Plug-in unit to another. To insure accuracy in pulse and transient measurements, check the probe adjustment frequently.

To check the probe adjustment, set the Main Frame STABILITY control to RECurrent. Set the Main Frame SWEEP RATE control to 500 μs/cm. Apply the probe tip to the Main Frame GATE OUT connector. Adjust the probe capacitor for a flat horizontal trace on the screen.

To prevent distortion in the waveform of the signal being displayed, clip the probe ground lead to the chassis of the equipment being tested. Select a short clean ground point near the probe input connection. In some cases, only one ground point should be used for the entire oscilloscope so that ground current loops, along with their inherent signal distortions may be avoided.

### 2-8. CALIBRATOR

An internal precision line-frequency calibrator signal is available for normalizing the sensitivity of the Y Amplifier system and for checking the sweep rate accuracy where a stable and known line-frequency exists. The calibrator trapezoidal waveform is applied to the Y Amplifier when the VOLTS/CM switch is set to CAL. A pin jack is provided on all Y Plug-in units for checking out the 10 to 1 attenuator probe.

To check the 10 to 1 attenuator probe calibration, proceed as follows:

Set the VOLTS/CM switch to 0.05 and apply the probe tip to the CAL 2V pin jack. The amplitude of the calibrator signal should be 4 centimeters; if not, adjust the GAIN CAL screwdriver control for 4 centimeters of vertical deflection.

### 2-9. DUAL-TRACE OPERATION

Using the Type 4202 Dual Trace Plug-in Unit in conjunction with the main oscilloscope, makes it possible to view two different time-shared vertical input signals displayed against one time base.

The electronic switch located in the Y Amplifier of the Main Frame will alternately accept either the Channel A or Channel B signal from the Type 4202 Plug-in. Each channel retains individual control of sensitivity, position, polarity, etc.

To obtain dual-trace operation, set the INPUT SELECTOR switch on the Type 4202 to position A & B. The DISPLAY LOGIC switch on the Main Frame must be set to MAIN SWP or DELAYING SWP for dual-trace presentation against either of the respective time bases. The Y electronic switch will normally flip from Channel A to B at the end of each sweep. Should the sweep rate be so low that the display has excessive flicker, the SWITCH MODE pushbutton control may be pushed in to the CHOP position. The electronic switch will now chop the signals at approximately 100 Kc rate. Switching transients will automatically be blanked for a clean, undistorted display.

The dual-trace display applications include comparisons of the input and output of the amplifiers, multivibrators, shaping circuits, comparative phase and time delay measurements, etc. The bandwidth capability is from dc to 33 Mc. Triggering the time base for dual-trace operation is best done through the EXTernal input of the TRIGGER SOURCE switch. The two AUTO positions of the TRIGGER MODE switch will provide continuous operation of the dual-trace display even though the triggering signal is temporarily lost.

Internal triggering is also possible yet several precautions are necessary. The TRIGGER MODE switch should be set to ACF to avoid faulty triggering on the different positioning levels found in each channel. ACF will differentiate the triggering signal so that the dc levels of each channel cannot effect triggering. External or auto triggering should be used when slow waveforms (below 10 Kc) are displayed.

Do not use INTernal triggering when in the CHOPped switch mode since the random switching transients will cause poor synchronization of the sweep.

Further triggering hints may be found in the Operator's Manual for the Du Mont Type 425 Oscilloscope.

### 2-10. INDEPENDENT DISPLAYS (Time-Shared, Dual-Beam Operation)

When a Type 4202 Y Dual Trace and a Type 4203 Delaying Sweep Plug-in Units are used within the Main Frame of the oscilloscope, it becomes possible to view two unrelated input signals against two unrelated time bases. This is accomplished by use of the electronic switches which are available in each axis within the Main Frame of the oscilloscope. The Delaying Sweep is used with the Channel B input and the Main Sweep is used with the Channel A input of the Dual Trace Plug-in Unit. The Type 425 now performs as an effective two-beam oscilloscope with a vertical bandwidth of 33 Mc.

Since time-sharing is synchronized with the Delaying Sweep, it becomes necessary for this sweep to be always longer in time (having slower sweep rate at 10 cm display) than the Main Sweep. Time-

sharing the display may cause aberrations in the Channel A vertical display. To simplify triggering, it is recommended that the Main Sweep be set up as a Delayed Main Sweep, armed at a point soon after the start of the Delaying Sweep. External triggering of both circuits is always preferred.

To set up instrument for Independent Display, proceed as follows:

### a. Display Logic Switch Set to Main SWP

1. Reset front-panel controls as follows:

| CONTROL | SETTING |
|---|---|
| DISPLAY LOGIC | MAIN SWP |
| SWEEP RATE (Main Frame) | 1 MS |
| INPUT SELECTOR | Channel A |
| VOLTS/CM (Channel A) | CAL |

2. Pull out and adjust Channel A VERNIER control to obtain a 2-centimeter pattern.
3. Adjust Channel A POSITION control to place a pattern as shown in Figure 2-3a.

Note that with the DISPLAY LOGIC switch set in the MAIN SWP position, the INPUT SELECTOR switch, on the Dual Trace Plug-in, is in the circuit displaying the Main Sweep on Channel A as shown in Figure 2-3a.

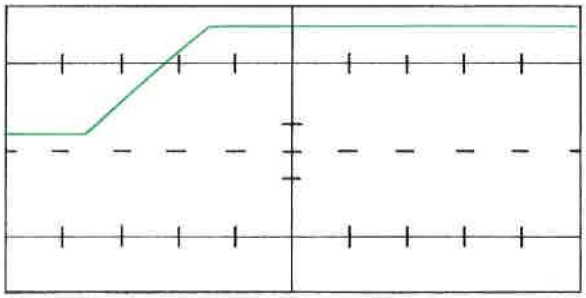


***Figure 2-3a. Display Logic Switch Set to Main SWP***

### b. Display Logic Switch Set to Delaying SWP

1. Reset front-panel controls as follows:

| CONTROL | SETTING |
|---|---|
| DISPLAY LOGIC | DELAYING SWP |
| SWEEP RATE (Main Frame) | 1 MS |
| INPUT SELECTOR | Channel B |
| VOLTS/CM | CAL |
| DELAY MULTIPLIER | 3.00 |
| PICK-OFF SOURCE | DEL SWP |
| SWEEP RATE (Delaying Sweep) | 5 MS |

2. Pull out and adjust Channel B VERNIER control to obtain a 2-centimeter pattern.
3. Adjust Channel B POSITION control to place pattern as shown in Figure 2-3b.

Note that with the DISPLAY LOGIC switch set in the DELAYING SWP position, the INPUT SELECTOR switch, on the Dual Trace Plug-in, is in the circuit displaying the Delaying Sweep with STROBE on Channel B as shown in Figure 2-3b.

The strobed section on the Delaying Sweep indicates the start and duration of the Main Sweep being delayed.

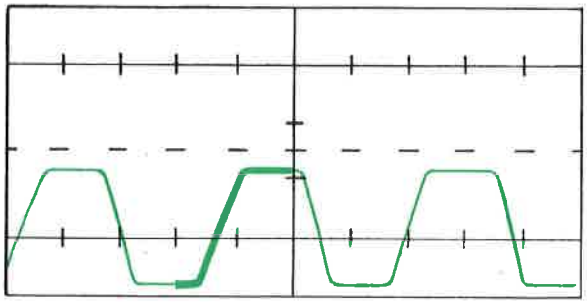


***Figure 2-3b. Display Logic Switch Set to Delaying SWP***

### c. Display Logic Switch Set to Indep Display

1. Reset front-panel controls as follows:

| CONTROL | SETTING |
|---|---|
| DISPLAY LOGIC | INDEP DISPLAY |
| TRIGGER MODE | ARMED AC OR ACF (Depending on signal) |

2. With the SWEEP RATE switch, on the DELAYING SWEEP Plug-in, set for a slower rate than the Main Frame SWEEP RATE switch, a pattern as shown in Figure 2-3c should appear on the screen.

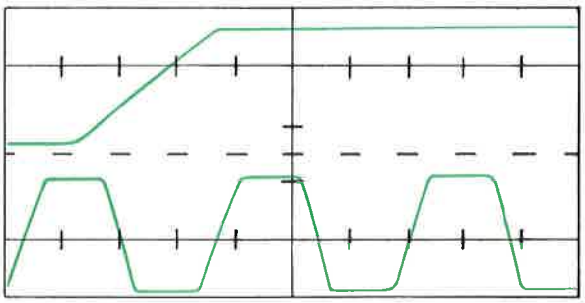


***Figure 2-3c. Display Logic Switch Set to Indep Display***

Note that with the DISPLAY LOGIC switch set in the INDEP DISPLAY position, the INPUT SELECTOR switch, on the Dual Trace Plug-in, is automatically disconnected. Figure 2-3c shows Channel A signal being displayed on the Main Sweep and Channel B signal on the Delaying Sweep.

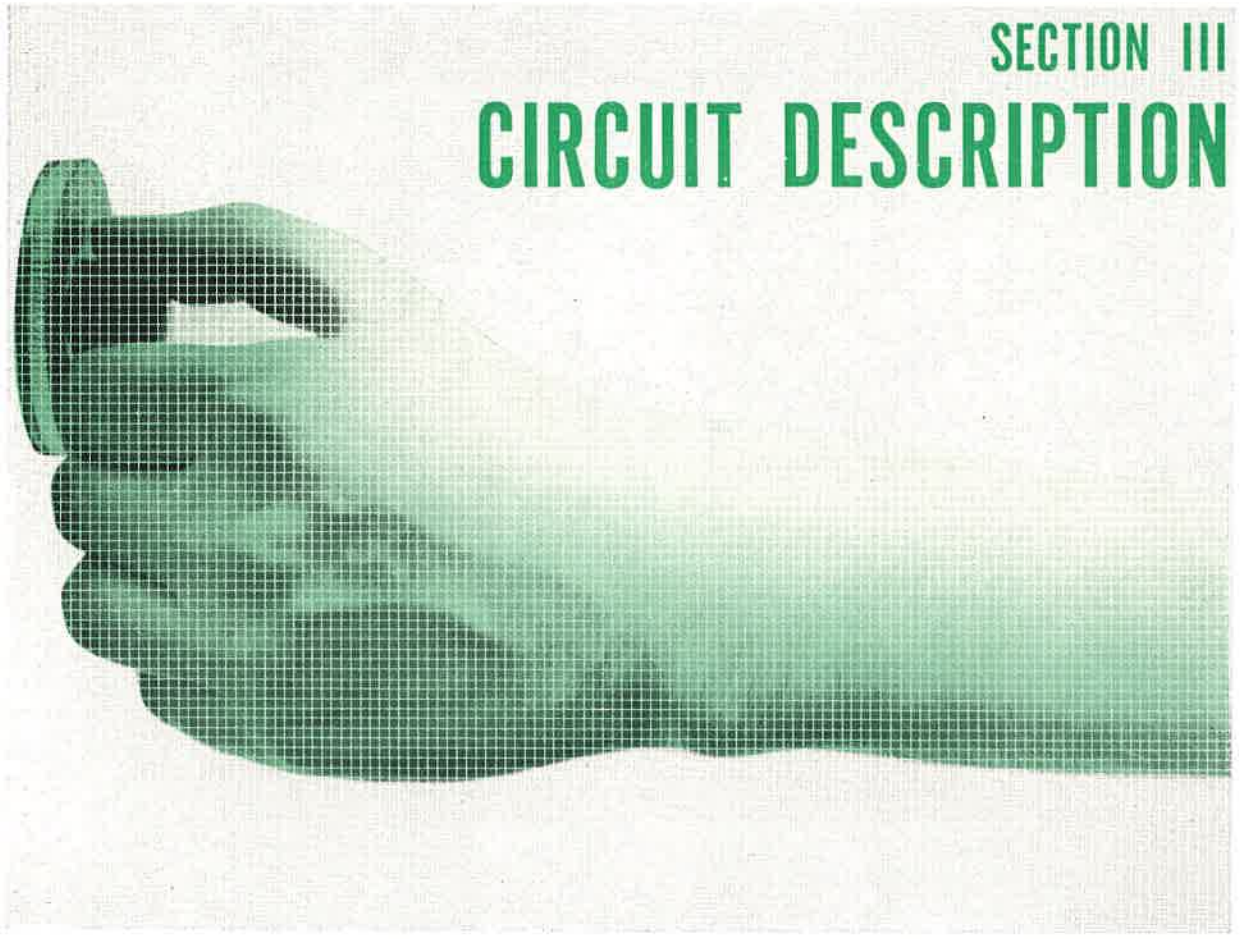
For ease of illustration, the calibrator signal is being used in Figure 2-3c, showing the same input signal being displayed agains two unrelated time bases. Normally two unrelated input signals would be used and observed against two unrelated time bases.

Instabilities may exist when the TRIGGER SOURCE switch is set to INT and AC or DC TRIGGER MODE settings are used, or when the SWITCH MODE push button is set to CHOP. Triggering will be greatly simplified if external triggering signals are used for synchronizing the respective time bases.

Delaying the Main Sweep (Armed Mode) for Independent Display presentation, only helps to avoid difficulty on internal triggering. The DELAY MULTIPLIER thumbswitches must be adjusted for minimum signal delay giving a stable display. It is not necessary to use the delay feature for jitter reduction on external or line triggering of the Main Sweep time base when using the Independent Display feature.

## TABLE 2-2
## FUNCTION OF CONTROLS AND CONNECTORS
## TYPE 4202 Y DUAL TRACE AMPLIFIER

| NAME | FUNCTION |
|---|---|
| VOLTS/CM | **Concentric Controls:**<br>a. **Large knob:** calibrated input attenuator switch with eleven positions. Sensitivity adjustable from 0.05-volt to 20 volts per centimeter; an OFF position and a line-frequency precision calibrator waveform are provided. The Amplifier may be normalized to the calibrator waveform by means of the GAIN CAL screwdriver control. The calibrating waveform is set to deflect 4 centimeters. |
| PULL VERNIER | b. **Small knob:** push-pull switch: the VERNIER is activated by pulling out the switch. This control provides a 3:1 continuously variable (uncalibrated) adjustment permitting both maximum gain and overlap of attenuator VOLTS/CM setting. An indicator CAL lamp is lit while the VERNIER is in the calibrated gain position. |
| POLARITY | **Concentric Controls:**<br>a. **Large knob:** two-position switch to invert the polarity of the input waveform. |
| POSITION | b. **Small knob:** potentiometer used to position the input signal vertically. |
| (Y INPUT) | BNC coaxial connector to the input of the Y Amplifier. Input impedance is 1 megohm and 23 picofarads (μμf). |
| DC BAL | Ten-turn screwdriver control adjusted to prevent depositioning of the trace while using the VERNIER control. |
| AC/DC | Slide switch to insert dc blocking capacitor in the (Y INPUT). |
| GAIN CAL | Screwdriver control to normalize the VOLTS/CM setting. |
| READ OUT | Two-position slide switch which applies a decimal point shift in the vertical Read Out when 10:1 passive attenuator probe is used with Channel A. |
| CAL 2V | Jack tip used to calibrate 10:1 attenuator probes in the 0.05 position of the VOLTS/CM switch for 4 centimeters of vertical signal. |
| INPUT SELECTOR | Three-position switch selecting Channel A, Channel B or dual-trace operation of Channel A with B.<br>The INPUT SELECTOR switch functions only when the DISPLAY LOGIC switch is set to MAIN SWP or to DELAYING SWP. The DISPLAY LOGIC switch codes the Y Channel electronic switch so that only Channel A is available in the X AMP, R.O., and MAIN SWP AND DELAYING SWP positions. Both A and B Channels are automatically available in the INDEPendent DISPLAY position. Channel A is displayed with the Main Sweep and Channel B is displayed with the Delaying Sweep. |



# SECTION III
# CIRCUIT DESCRIPTION

## 3-1. GENERAL

The Du Mont Type 4202 Y Dual Trace Plug-in Unit consists of two independent amplifiers, each with input and output cathode followers operating respectively into one of the two input channels of the Main Frame vertical amplifier. A cathode follower regulator (V907) supplies the necessary plate voltage to the amplifiers and output cathode followers. In the discussion which follows, refer to the schematics and simplified block diagrams.

## 3-2. SIGNAL INPUT CIRCUIT

Either of two BNC inputs connects the signal to the respective grid of the input cathode followers (V901, V902) through the AC/DC and attenuator switches. Each Y input presents an impedance of 1 megohm and 23 picofarads (μμf) to the signal source. When the AC/DC switch is set to AC, a capacitor is inserted in series with the input, thereby blocking the dc component of the waveform and allowing only the ac component to be displayed.

## 3-3. INPUT ATTENUATORS

The VOLTS/CM switches (S911, S921) consist of eight compensated RC attenuators permitting the selection of the desired attenuation of the input signal in steps from 0.05 to 20 volts per centimeter. Compensating capacitors, C9111 through C9118, and C9211 through C9218, are adjusted for optimum square-wave response. Input capacity trimmers, C9101 through C9108, and C9201 through C9208, are set to give equal input capacity in all positions of the attenuator. The input capacity variation from range to range is accurately set to within 2 picofarads (μμf) at the factory to a nominal 23 pf ± 3 pf. Input resistance variation will not exceed 3% for any attenuator setting.

In the OFF position of the attenuator, the input of the amplifier is grounded and the input jack is disconnected. In the CAL position, the calibrator signal is applied to the input stage and may be used to facilitate calibration check. When gains are normalized, the peak-to-peak value of the calibrated

# section 3
# circuit description

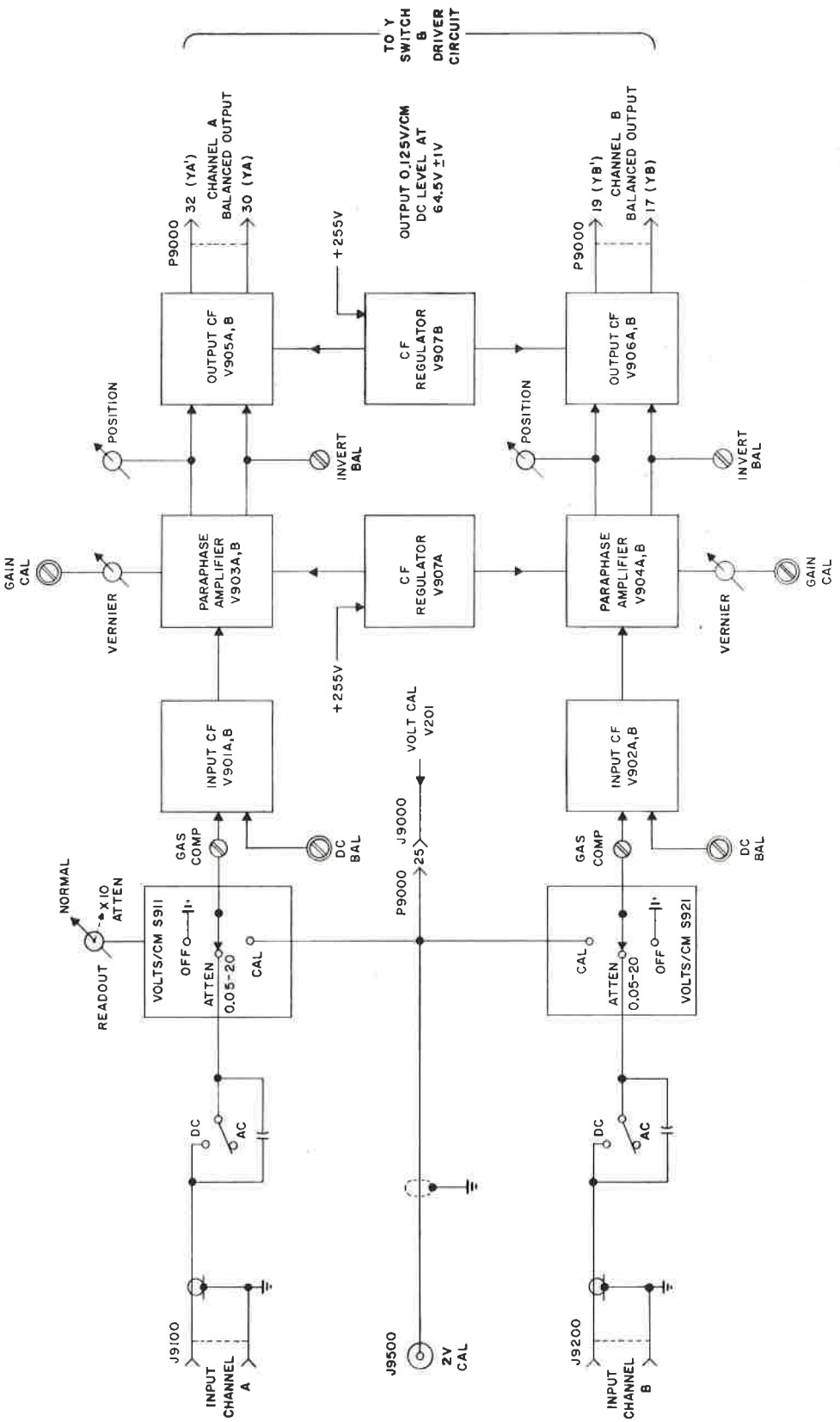



*Figure 3-1. Du Mont Type 4202 Dual Trace Simplified Block Diagram*

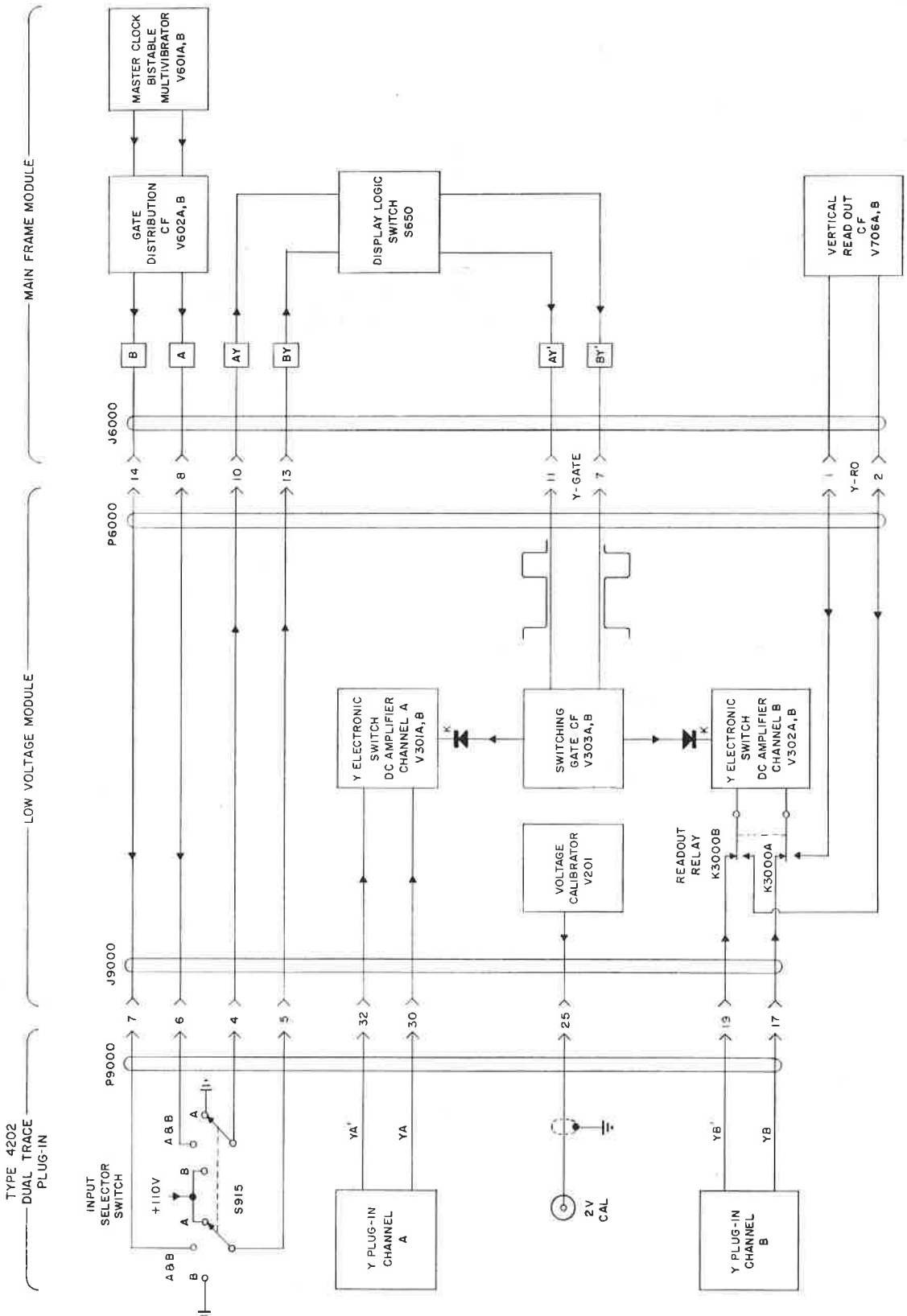



*Figure 3-2. Simplified Diagram of Signal and Gate Distribution System for Y Plug-In Unit*

waveform will indicate 4 centimeters of vertical deflection on the screen.

### 3-4. INPUT CATHODE FOLLOWERS

Input cathode followers V901 and V902 serve as buffers between the attenuators and the input amplifiers. The input cathode followers are dc coupled to the amplifiers. Resistors R9307, R9308, R9407, R9408, and R9409, in series with the grids of V901 and V902 are incorporated to suppress any parasitic high-frequency oscillations. Resistors R9191 and R9291 are inserted to limit grid current in the event that any excess voltage is applied to the input. A DC BALance control nulls the dc voltage across the VERNIER control, so that in the absence of an input signal, there will be no depositioning of the trace when the VERNIER control is rotated throughout its range.

### 3-5. AMPLIFIERS

V903 and V904 are conventional paraphase amplifiers. The amplified signal is coupled to the respective grid of the output cathode followers through POLARITY switches S931 and S941. The Gain controls in the cathode circuits of each amplifier vary sensitivity by means of negative feedback. VERNIER controls R9331 and R9431, when in the calibrated position (pushed in) set the deflection factor equal to that indicated by the VOLTS/CM switch. In the uncalibrated (out) position, the Vernier provides maximum amplifier gain and sufficient range to assure overlap for all settings of the VOLTS/CM attenuator switch.

### 3-6. OUTPUT CATHODE FOLLOWERS

Output cathode followers V905 and V906, are dc coupled through interconnecting connector P9000/

## TABLE 3-1
## EFFECT OF DISPLAY LOGIC AND INPUT SELECTOR SWITCH SETTINGS

| DISPLAY LOGIC SET TO | INPUT SELECTOR ON PLUG-IN | DISPLAY ON THE CRT |
|---|---|---|
| X AMP | Automatically disconnected by Display Logic Switch | Channel A signals displayed against external X signals |
| R.O. (MAIN SWP) | Automatically disconnected | Channel A signal and Read-Out dots, time-shared, and displayed with the Main Sweep |
| MAIN SWP | Channel A<br>Channels A & B<br>Channel B | Channel A<br>Channels A & B (Time-shared)<br>Channel B |
| MAIN SWP AND DELAYING SWP | Automatically disconnected | Channel A only. Top trace shows Delaying Sweep with strobe (Main Sweep delayed) superimposed on it.<br>Bottom trace shows the strobed portion of top trace magnified |
| DELAYING SWP | Channel A<br>Channels A & B<br>Channel B | Channel A<br>Channels A & B<br>Channel B<br>In all positions, display shows the Delaying Sweep with strobe.<br>The strobed section on the Delaying Sweep indicates the delayed start and duration of the Main Sweep being delayed. |
| INDEP DISPLAY | Automatically disconnected | Channel A displayed on Main Sweep.<br>Channel B displayed on Delaying Sweep.<br>Used in conjunction with a Dual-Trace Type 4202 Plug-in and a Delaying Sweep Type 4203 Plug-in to observe two unrelated input signals against two unrelated time bases.<br>**Note:** External triggering preferred. Delaying Sweep must be longer in time than Main Sweep. |

J9000 to the respective DC Amplifiers in the Y Switch and Driver Circuit.

### 3-7. INPUT SELECTOR SWITCH

The INPUT SELECTOR switch (S915) permits the selection of either Channel A or B for separate display or the combination of both channels for time-shared dual trace displays. The INPUT SELECTOR switch codes the Y Channel electronic switch located in the Main Frame with specific dc gating levels, or with the Master Clock gates. A choice of Chopped or Alternate sweep switching mode is accomplished by the SWITCH MODE push-button control on the Main Frame.

Refer to Table 3-1 which indicates the vertical signal channels in operation with different settings of the INPUT SELECTOR and DISPLAY LOGIC switches.

### 3-8. READ OUT

Channel A attenuator incorporates switching to assure that the decimal points, multipliers, and vertical Read-Out calibration tracks with the VOLTS/CM switch setting. A slide switch on the front panel permits correlation of A Channel read out accuracy when a 10:1 attenuator probe is used.

# NOTES

# SECTION IV
# MAINTENANCE

## 4-1. INTRODUCTION

This Maintenance Section contains Service Information, Procedures for Internal Adjustments, Schematics, and Parts List for the Du Mont Type 4202 Y Dual Trace Plug-in Unit.

**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.

## 4-2. VISUAL INSPECTION

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 4202 Y Dual Trace 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.

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## 4-3. 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 tube 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 after tube replacement the trouble persists, replace the original tube in its socket and check for proper voltages.
5. Replacement of tubes may require resetting of one or more service adjustments. Repeat Balance and Gain adjustments if necessary. 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. Use heat sinks when 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.

## 4-4. 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. Removal of the front panel will be necessary if any attenuator adjustments are to be made. This procedure is explained in a subsequent paragraph entitled Attenuator Adjustments.

## 4-5. REPLACEMENT PARTS

### a. Standard Parts

Replacements for all parts used in the Type 4202 Y Dual Trace 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 4202 Y Plug-in. 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 new 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.

## 4-6. LOCATION OF TUBES, SERVICE ADJUSTMENTS, AND TEST POINTS

The location of tubes, service adjustments, and test points are shown on the appropriate schematic drawings 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.

## 4-7. SERVICE ADJUSTMENTS

### a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at our factory.

Normally, only periodic adjustment of the Gain and Balance controls will be necessary. The procedure outlined in this manual should be followed. The attenuators are factory aligned and should not be touched unless there is a positive indication that they require adjustment.

All adjustments should be made at mid-line voltage 115V/230V ±2%.

### b. Equipment Required

(Equivalents may be substituted)

| | |
|---|---|
| Volt-ohmmeter | Simpson Model 260 |
| Square Wave Generator | Tektronix Model 105 |
| Cable Termination, 93 ohm | Tektronix Type B93R |
| Pulse Generator | Du Mont Plug-in Type 4209 |
| Capacitance Checker | Kay Lab Model 407B Micro-Miker |
| Termination, 50 ohm | Du Mont Type 4285 |
| Standard Signal Generator | Measurements Model 82 |

## 4-8. BALANCE ADJUSTMENTS

Preset front-panel controls as follows:

| CONTROL | SETTING |
|---|---|
| DISPLAY LOGIC | MAIN SWP |
| SWEEP RATE | 1 MS |
| TRIGGER MODE | RECurrent Sweep |
| INPUT SELECTOR | Channel A |
| VOLTS/CM | OFF |
| INVERTER BALANCE | Centered |
| POSITION | Centered |

### a. DC Bal Adj

Adjust DC BAL (R9303) to bring trace on screen. When trace appears on screen, pull out VERNIER knob and rotate it in either direction throughout its range. The reference trace on the screen should not move up or down with any setting of the VERNIER control. If the trace shifts vertically, turn the VERNIER control counterclockwise. Next, while pulling the VERNIER control (R9331) in and out, carefully adjust DC BAL potentiometer (R9303) until no movement of the trace is noted.

Turn INPUT SELECTOR switch to Channel B and repeat the above procedure using DC BAL potentiometer (R9403) and VERNIER control (R9431).

If the dc balance is out of adjustment, operation of the POLARITY switch will cause the trace to shift. Obtain dc balance before assuming that the INVERTER BALance is out of adjustment.

### b. Inverter Bal

While operating POLARITY switch (S931) from Normal to Inverted position, adjust INV BAL potentiometer (R9339) for minimum deposition of trace. Alternately adjust the DC BAL and INV BAL controls until trace is stable.

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# maintenance

### 4-9. GAS COMPENSATION ADJUSTMENT

This adjustment provides compensation for the effects of minute grid currents which develop voltages from grid to ground and vary with the attenuator setting. These voltages, if not bucked out, may cause trace depositioning with changes of the attenuator setting.

1. Preset front-panel controls as follows:

| CONTROL | SETTING |
|---|---|
| TRIGGER MODE | RECurrent Sweep |
| VOLTS/CM | 0.05 |
| INPUT SELECTOR | Channel A |

2. Short Channel A input jack and adjust gas compensation potentiometer (R9193) until there is no change of trace position when the AC/DC switch (S910) is operated. To gain access to R9193, remove side of Main Frame dust cover.
3. Turn INPUT SELECTOR switch to Channel B. Short input jack and adjust gas compensation potentiometer (R9293) until there is no change of trace position when the AC/DC switch (S920) is operated.

### 4-10. GAIN ADJUSTMENTS OF CHANNELS A & B

Aging of tubes will affect the gain of the Plug-in Unit. After the unit has been in operation for a sufficient warm-up period, the gain adjustments should be checked as follows:

1. Insert Plug-in into a Main Frame which is known to be calibrated. Allow 15 minutes for Plug-in to warm up.
2. Preset front-panel controls as follows:

| CONTROL | SETTING | |
|---|---|---|
| VOLTS/CM | CAL | Same for both channels |
| POLARITY | NORMAL | |
| VERNIER | Push (In) | |
| READ OUT | NORMAL | |
| INPUT SELECTOR | Channel A | |

*Note:* CAL lamp is lit.

3. The trapezoidal calibrator waveform should now appear on screen.
4. Adjust Channel A GAIN CAL potentiometer on front panel for 4 cm of vertical deflection.
5. Turn INPUT SELECTOR switch to Channel B. Check that CAL indicator light is lit, and adjust Channel B GAIN CAL potentiometer on front panel for 4 cm of vertical deflection.

### 4-11. ATTENUATOR ADJUSTMENT

The attenuators are factory aligned and should not be touched unless there is a positive indication that they require adjustment. If adjustment is necessary, follow the steps as outlined making reference to Table 4-1 and Figure 4-1.

1. Remove the Plug-in front panel. This is accomplished by removing all the front panel knobs and only the mounting nuts on VOLTS/CM and POLARITY switches for both channels. The panel will fall free revealing the back-up plate.
2. Reset front-panel controls as follows:

| CONTROL | | SETTING |
|---|---|---|
| POLARITY | | NORMAL |
| VERNIER | | Push (In) |
| INPUT SELECTOR | | Channel A |
| AC/DC | | DC |
| TRIGGER SOURCE | Main Frame | + INT |
| TRIGGER MODE | Main Frame | NORMAL AC |
| STABILITY | Main Frame | PRESET |
| SWEEP RATE | Main Frame | 10 μs/cm |

3. Set VOLTS/CM switch to 0.05 position and adjust the fully clockwise trimmer C9192 on the outside ring (see Figure 4-1) for 23 picofarads (μμf) at the A input BNC connector using the Micro-Miker. If difficulty is encountered obtaining the 23 picofarads, set the input capacity as close as possible to 23 picofarads. Any setting within ±3 picofarads is within specifications.
4. Connect a Tektronix Type 105 Pulse Generator with 93-ohm Cable Termination, Model B93R, or equivalent, to Channel A input jack.
5. Set the generator to 10 kc and adjust its symmetry and output amplitude controls to obtain an approximately symmetrical 4 cm square wave on the cathode-ray tube screen.
   Observe any excess peaking on the square wave. This peaking is in the generator (Tektronix 105) and all succeeding adjustments must give the same waveform distortion as seen on the 0.05 Volts/cm range.
6. Turn the VOLTS/CM switch to 0.1 position and adjust the output of the Pulse Generator for no more than 4 cm of vertical deflection.
   Adjust the trimmer (C9111) marked J in Figure 4-1 for a flat top on the square wave.
   Advance in the counterclockwise direction one trimmer at a time with each setting of the VOLTS/CM switch, adjusting each trimmer, K through Q, for a flat pulse response.
7. When all the other outside trimmers (C9112 through C9118) have been set, disconnect the pulse generator.
8. Turn the VOLTS/CM switch to 0.1 position

and adjust the fully clockwise input capacity trimmer (C9101) on the inside ring for the same input capacity as set on the 0.05 Volt/cm range in Step 3.

9. Repeat for each attenuator setting of the VOLTS/CM switch, advancing one trimmer at a time (C9102 through C9108). The input capacity should be adjusted so that it does not vary by more than ±2 picofarads for all settings of the attenuator except OFF and CAL.
10. Reconnect the pulse generator and check square wave for flat pulse response. If realign-

## TABLE 4-1

## ATTENUATOR COMPENSATION AND INPUT CAPACITY TRIMMERS

| VOLTS/CM SETTING | CHANNEL A, CAPACITOR ADJUST | | CHANNEL B, CAPACITOR ADJUST | |
|---|---|---|---|---|
| | INSIDE RING | OUTSIDE RING | INSIDE RING | OUTSIDE RING |
| 0.05 | NONE | C9192 (I) | NONE | C9292 |
| 0.1 | C9101 (A) | C9111 (J) | C9201 | C9211 |
| 0.2 | C9102 (B) | C9112 (K) | C9202 | C9212 |
| 0.5 | C9103 (C) | C9113 (L) | C9203 | C9213 |
| 1.0 | C9104 (D) | C9114 (M) | C9204 | C9214 |
| 2.0 | C9105 (E) | C9115 (N) | C9205 | C9215 |
| 5.0 | C9106 (F) | C9116 (O) | C9206 | C9216 |
| 10.0 | C9107 (G | C9117 (P) | C9207 | C9217 |
| 20.0 | C9108 (H) | C9118 (Q) | C9208 | C9218 |

**NOTE:** Letters A through Q reference capacitor location shown in Figure 4-1.

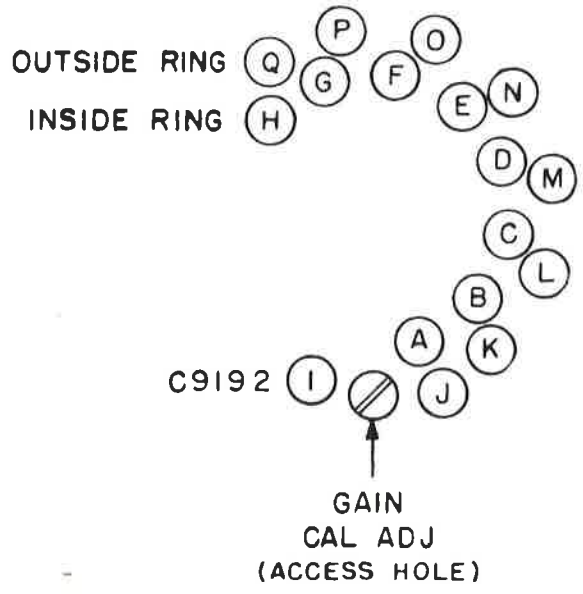



*Figure 4-1*
*Trimmer Locations*

ment of compensation is necessary, be sure to repeat input capacity adjustment in Step 9 above.

11. Repeat attenuator adjustments for Channel B. Pulse compensating capacitors are C9211 through C9218. Input capacity trimmers are C9201 through C9208.

### 4-12. BANDWIDTH CHECKS

The Main Frame system should be checked with a Type 4202 Plug-in before this measurement is attempted. No adjustments are available in the Type 4202 and all components and lead dress must be carefully checked, should the unit not meet specifications.

1. Connect a fast-rise Pulse Generator to A Input using Du Mont Type 4285 50-ohm Termination and five feet of RG8A/U 50-ohm cable with Type C or other appropriate connectors and adapters.
2. Set the SWEEP RATE switch to 0.01 microsecond/cm. Measure the rise time pre-swing and overshoot. Rise time should not be more than 12 nanoseconds. The pre-swing should be less than 5%, the overshoot should be less than or equal to the pre-swing.
3. To check frequency response, connect a Standard Signal Generator to the input jack using the Du Mont Type 4285 50-ohm termination and RG8A/U 50-ohm cable.
4. Set the Main Frame STABILITY control to give RECurrent sweep. Set the signal generator to 100 kc and adjust its output to give four centimeters of vertical deflection when the VOLTS/CM switch on the Plug-in is set to 0.05 position.
5. Change frequency to 33 megacycles and carefully determine that the output of the signal generator remains constant. The vertical pattern should now show between 2.4 and 3.3 centimeters of deflection.

### 4-13. VOLTAGE MEASUREMENTS

As an aid in trouble-shooting, check the following voltages:

| TUBE | PIN NO. | VOLTAGE (DC) |
|---|---|---|
| V901 | 3 & 8 | 2 |
| V902 | 3 & 8 | 2 |
| V905 | 3 & 8 | 64.5 |
| V906 | 3 & 8 | 64.5 |
| V907 | 3 | 65 |
| V907 | 8 | 145 |

# SECTION 5

# ELECTRICAL PARTS LIST AND SCHEMATICS

## PARTS LIST FOR TYPE 4202 Y DUAL TRACE

| Symbol | Part Number | Description |
|---|---|---|
| **CAPACITORS (9100)** | | |
| Notes: 1. All capacitors are fixed, ceramic, and 500 V unless otherwise specified. 2. GMC denotes Guaranteed Minimum Capacitance. | | |
| C9100 | 0319 6050 | paper, 0.1 μf, ±20%, 600V |
| C9101 to C9108 | 0319 1102 | variable, plastic, 0.65-3.2 μμf |
| C9109 | 0319 5030 | 2.2 μμf, ±0.25 μμf |
| C9111 to C9118 | 0319 1256 | variable, plastic, 0.65-3.2 μμf |
| C9121 & C9122 | 0319 4150 | 5.6 μμf ±.5 μμf |
| C9123 | 0313 9790 | mica, 22 μμf, ±10% |
| C9124 | 0313 9760 | mica, 47 μμf, ±10% |
| C9125 | 0313 9730 | mica, 100 μμf, ±10% |
| C9126 | 0313 9750 | mica, 250 μμf, ±10% |
| C9127 | 0313 9740 | mica, 500 μμf, ±10% |
| C9128 | 0326 3040 | mica, 750 μμf, ±10% |
| C9131 | 0319 5050 | 15 μμf, ±0.25 μμf |
| C9132 | 0319 5040 | 3.6 μμf, ±0.25 μμf |
| C9133 | 0319 5030 | 2.2 μμf, ±0.25 μμf |
| C9191 | 0319 1060 | 0.01 μf, +60 −40%, 250V |
| C9192 | 0319 1261 | variable, plastic, 0.4-2.5 μμf |
| **CAPACITORS (9200)** | | |
| C9200 | 0319 6050 | paper, 0.1 μf, ±20%, 600V |
| C9201 to C9208 | 0319 1102 | variable, plastic, 0.65-3.2 μμf |
| C9209 | 0319 5030 | 2.2 μμf, ±0.25 μμf |
| C9211 to C9218 | 0319 1256 | variable, plastic, 0.65-3.2 μμf |
| C9221 & C9222 | 0319 4150 | 5.6 μμf, ±.5 μμf |
| C9223 | 0313 9790 | mica, 22 μμf, ±10% |
| C9224 | 0313 9760 | mica, 47 μμf, ±10% |
| C9225 | 0313 9730 | mica, 100 μμf, ±10% |
| C9226 | 0313 9750 | mica, 250 μμf, ±10% |
| C9227 | 0313 9740 | mica, 500 μμf, ±10% |
| C9228 | 0326 3040 | mica, 750 μμf, ±10% |
| C9231 | 0319 5050 | 15 μμf, ±0.25 μμf |
| C9232 | 0319 5040 | 3.6 μμf, ±0.25 μμf |
| C9233 | 0319 5030 | 2.2 μμf, ±0.25 μμf |
| C9291 | 0319 1060 | 0.01 μf, +60 −40%, 250V |
| C9292 | 0319 1261 | variable, plastic, 0.4-2.5 μμf |
| **CAPACITORS (9300)** | | |
| C9301 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| C9302 | 0319 1050 | 0.02 μf, +60 −40%, 250V |
| C9303 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| C9304 & C9305 | 0319 0450 | 1000 μμf, GMC |
| C9306 | 0318 7040 | 1.8 μμf, ±0.25 μμf |
| C9307 & C9308 | 0319 0450 | 1000 μμf, GMC |
| **CAPACITORS (9400)** | | |
| C9401 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| C9402 | 0319 1050 | 0.02 μf, +60 −40%, 250V |
| C9403 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| C9405 | 0319 0450 | 1000 μμf, GMC |
| C9406 | 0318 7040 | 1.8 μμf, ±0.25 μμf |
| C9407 | 0319 0450 | 1000 μμf, GMC |
| **CAPACITORS (9500)** | | |
| C9500 & C9501 | 0310 1270 | 1000 μμf, GMC, 1000V |
| C9502 & C9503 | 0310 1270 | 1000 μμf, GMC, 1000V |
| C9504 to C9515 | 0319 0450 | 1000 μμf, GMC |
| C9516 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| C9517 | 0319 4680 | 0.01 μf |
| C9518 | 0319 0450 | 1000 μμf, GMC |
| C9519 | 0310 1270 | 1000 μμf, +100 −0%, 1000V |
| **NEON LAMPS** | | |
| DS9300 | 1201 1580 | NE-2E, ultra-miniature bayonet, white (CAL, Channel A) |
| DS9400 | 1201 1530 | NE-2E, ultra-miniature bayonet, white (CAL, Channel B) |
| **ELECTRICAL CONNECTORS** | | |
| J9100 | 0902 9080 | BNC, female, 1 contact (Y INPUT, Channel A) |
| J9200 | 0902 9080 | BNC, female, 1 contact (Y INPUT, Channel B) |
| J9500 | 0904 0600 | jack, tip, black (2V CAL) |
| **COILS** (fixed, unless otherwise specified) | | |
| L9100 | 2101 8271 | inductor, 4 turns |
| L9200 | 2101 8271 | inductor, 4 turns |
| L9301 | 2101 8272 | inductor, 0.075 μh |
| L9302 & L9303 | 2100 6220 | rf, 0.68 μh, ±10% |
| L9304 & L9305 | 2100 6350 | rf, 0.3 μh, ±5% |
| L9306 & L9307 | 2101 8273 | inductor, 0.1 μh |
| L9308 & L9309 | 8800 2352 | inductor, 8 turns |
| L9401 | 2101 8272 | inductor, 0.075 μh |
| L9402 & L9403 | 2100 6220 | rf, 0.68 μh, ±10% |
| L9404 & L9405 | 2100 6350 | rf, 0.3 μh, ±5% |
| L9406 & L9407 | 2101 8273 | inductor, 0.1 μh |
| L9408 & L9409 | 8800 2352 | inductor, 8 turns |
| **ELECTRICAL CONNECTOR** | | |
| P9000 | 0905 7340 | plug, male, 32 contacts Amphenol Type 26-159-32 |
| | 0905 7360 | mate to P9000 is Amphenol Type 26-190-32 |
| **RESISTORS (9100)** | | |
| Notes: 1. All resistors are fixed, film, ±1%, and ½ watt unless otherwise specified. 2. Resistance values in ohms: K = thousand, M = million | | |
| R9100 to R9102 | 0203 1530 | composition, 10, ±10% |
| R9111 | 0229 4890 | 500K |
| R9112 | 0229 4900 | 750K |
| R9113 | 0229 4910 | 900K |
| R9114 | 0229 4920 | 950K |
| R9115 | 0229 9000 | 975K |
| R9116 | 0229 9010 | 990K |
| R9117 | 0229 9020 | 995K |
| R9118 | 0229 9160 | 997.5K |
| R9121 | 0229 4700 | 1M |
| R9122 | 0229 9040 | 333K |
| R9123 | 0229 9050 | 111K |
| R9124 | 0229 9060 | 52.6K |
| R9125 | 0229 9070 | 25.6K |
| R9126 | 0229 9080 | 10.1K |
| R9127 | 0229 4870 | 5030 |
| R9128 | 0229 4880 | 2510 |
| R9131 & R9132 | 0228 7300 | 130, ±5%, ¼W |
| R9190 | 0229 4860 | 1.012M |
| R9191 | 0203 1040 | composition, 220K, ±5% |

# section 5
# parts list and schematics

| Symbol | Part Number | Description |
|---|---|---|
| R9192 | 0204 2300 | composition, 91M, ±20% |
| R9193 | 0106 7600 | variable, composition, 500, ±20%, 0.1W (GAS COMP, Channel A) |

## RESISTORS (9200)

| | | |
|---|---|---|
| R9200 to R9202 | 0203 1530 | composition, 10, ±10% |
| R9211 | 0229 4890 | 500K |
| R9212 | 0229 4900 | 750K |
| R9213 | 0229 4910 | 900K |
| R9214 | 0229 4920 | 950K |
| R9215 | 0229 9000 | 975K |
| R9216 | 0229 9010 | 990K |
| R9217 | 0229 9020 | 995K |
| R9218 | 0229 9160 | 997.5K |
| R9221 | 0229 4700 | 1M |
| R9222 | 0229 9040 | 333K |
| R9223 | 0229 9050 | 111K |
| R9224 | 0229 9060 | 52.6K |
| R9225 | 0229 9070 | 25.6K |
| R9226 | 0229 9080 | 10.1K |
| R9227 | 0229 4870 | 5030 |
| R9228 | 0229 4880 | 2510 |
| R9231 & R9232 | 0228 7300 | composition, 130, ±5%, ¼W |
| R9290 | 0229 4860 | 1.012M |
| R9291 | 0203 1040 | composition, 220K, ±5% |
| R9292 | 0204 2300 | composition, 91M, ±10% |
| R9293 | 0106 7600 | variable, composition, 500, ±20%, 0.1W (GAS COMP, Channel B) |

## RESISTORS (9300)

| | | |
|---|---|---|
| R9301 | 0203 1000 | composition, 150K, ±5% |
| R9302 | 0234 3690 | 75K |
| R9303 | 0107 2031 | variable, wire wound, 50K, ±20%, ¼W (DC BAL, Channel A) |
| R9304 | 0229 7310 | 100K |
| R9305 | 0203 0720 | composition, 10K, ±5% |
| R9306 | 0203 1580 | composition, 27, ±10% |
| R9307 & R9308 | 0203 1550 | composition, 15, ±10% |
| R9311 & R9312 | 0233 9520 | 18K, ±2%, 1W |
| R9313 | 0203 0800 | composition, 22K, ±5% |
| R9314 & R9315 | 0203 1580 | composition, 27, ±10% |
| R9317 | 0239 0393 | 48.7K |
| R9318 | 0239 0342 | 61.9K |
| R9319 | 0203 1610 | composition, 47, ±10% |
| R9321 | 0229 8450 | wire wound, 1740, ±2%, 3W |
| R9322 | 0203 1530 | composition, 10, ±10% |
| R9323 & R9324 | 0229 4500 | 1K, ⅛W |
| R9325 | 0229 7620 | 357 |
| R9326 & R9327 | 0233 9530 | 18.7K, ±2%, 1W |
| R9328 | 0229 7620 | 357 |
| R9330 | 0203 2010 | composition, 100K, ±10% |
| R9331 | 0107 2001 | variable, composition, 500, ±10%, 1W (VERNIER, Channel A) |
| R9332 | 0107 0700 | variable, composition, 100, ±10% (GAIN CAL, Channel A) |
| R9333 | 0203 0520 | composition, 1 5K, ±5% |
| R9334 & R9335 | 0203 1110 | composition, 430K, +5% |
| R9336 | 0203 0520 | composition, 1.5K, ±5% |
| R9337 & R9338 | 0239 0371 | 182K |
| R9339 F, R | 0107 2301 | variable, wire wound. 50K/50K, ±10%, 2W (INV BAL, Channel A) |
| R9341 & R9342 | 0239 0337 | 43.2K |
| R9343 F, R | 0107 2301 | variable, wire wound, 50K/50K, ±10%, 2W (POSITION, Channel A) |
| R9349 | 0203 1530 | composition, 10, ±10% |
| R9351 & R9352 | 0203 1610 | composition, 47, ±10% |
| R9353 & R9354 | 0203 3680 | composition, 6.8K, ±5%, 1W |

| Symbol | Part Number | Description |
|---|---|---|
| R9361 & R9362 | 0239 1393 | 7500, ±5%, 2W |
| R9363 | 0203 1020 | composition, 180K, ±5% |
| R9364 | 0203 0160 | composition, 47, ±5% |
| R9365 | 0203 0900 | composition, 56K, ±5% |

## RESISTORS (9400)

| | | |
|---|---|---|
| R9401 | 0203 1010 | composition, 150K, ±5% |
| R9402 | 0234 3690 | 75K |
| R9403 | 0107 2031 | variable, composition, 50K, ±20%, ¼W (DC BAL, Channel B) |
| R9404 | 0229 7310 | 100K |
| R9405 | 0203 0720 | composition, 10K, ±5% |
| R9406 | 0203 1580 | composition, 27, ±10% |
| R9407 to R9409 | 0203 1530 | composition, 10, ±10% |
| R9411 & R9412 | 0233 9520 | 18K, ±2%, 1W |
| R9413 | 0203 0800 | composition, 22K, ±5% |
| R9414 & R9415 | 0203 1580 | composition, 27, ±10% |
| R9422 | 0203 1530 | composition, 10, ±10% |
| R9423 & R9424 | 0229 4500 | 1K, ⅛W |
| R9425 | 0229 7620 | 357 |
| R9426 & R9427 | 0233 9530 | 18.7K, ±2%, 1W |
| R9428 | 0229 7620 | 357 |
| R9431 | 0107 2001 | variable, composition, 500, ±10%, 1W (VERNIER, Channel B) |
| R9432 | 0107 0700 | variable, composition, 100, ±10% (GAIN CAL, Channel B) |
| R9434 & R9435 | 0203 1110 | composition, 430K, ±5% |
| R9437 & R9438 | 0239 0371 | 182K |
| R9439 F, R | 0107 2301 | variable, wire wound, 50K/50K, ±10%, 2W (INV BAL, Channel B) |
| R9441 & R9442 | 0239 0337 | 43.2K |
| R9443 F, R | 0107 2301 | variable, wire wound, 50K/50K, ±10%, 2W (POSITION, Channel B) |
| R9449 | 0203 1530 | composition, 10, ±10% |
| R9451 & R9452 | 0203 1610 | composition, 47, ±10% |
| R9453 & R9454 | 0203 3680 | composition, 6800, ±5%, 1W |

## RESISTORS (9500)

| | | |
|---|---|---|
| R9500 & R9501 | 0210 0810 | wire wound, 4.7, ±10% |
| R9503 to R9506 | 0203 1530 | composition, 10, ±10% |
| R9507 | 0203 0820 | composition, 27K, ±5% |
| R9508 | 0239 0392 | composition, 27.4K, ±5% |
| R9509 | 0203 0320 | composition, 220, ±5% |
| R9511 | 0234 3560 | 8037 |
| R9512 | 0229 7650 | 894 |

## SWITCHES

| | | |
|---|---|---|
| S910 | 0503 1330 | slide, DPDT (AC/DC, Channel A) |
| S911 | 0501 5971 | rotary, 5 sections, 11 positions (VOLTS/CM, Channel A) |
| S912 | 0500 0420 | slide, DPDT (READ OUT) |
| S915 | 0501 5991 | rotary, 1 section, 3 positions (INPUT SELECTOR) |
| S920 | 0503 1330 | slide, DPDT (AC/DC, Channel B) |
| S921 | 0501 5981 | rotary, 2 sections, 11 positions, (VOLTS/CM, Channel B) |
| S930 | 0503 1330 | slide, DPDT (VERNIER, Channel A) |
| S931 | 0501 5951 | rotary, 3 sections, 2 positions (POLARITY, Channel A) |
| S940 | 0503 1330 | slide, DPDT (VERNIER, Channel B) |
| S941 | 0501 5951 | rotary, 3 sections, 2 positions (POLARITY, Channel B) |

## ELECTRON TUBES

| | | |
|---|---|---|
| V901 to V906 | 2501 1760 | E88CC/6922 |
| V907 | 2501 2220 | 6DJ8/ECC88 |

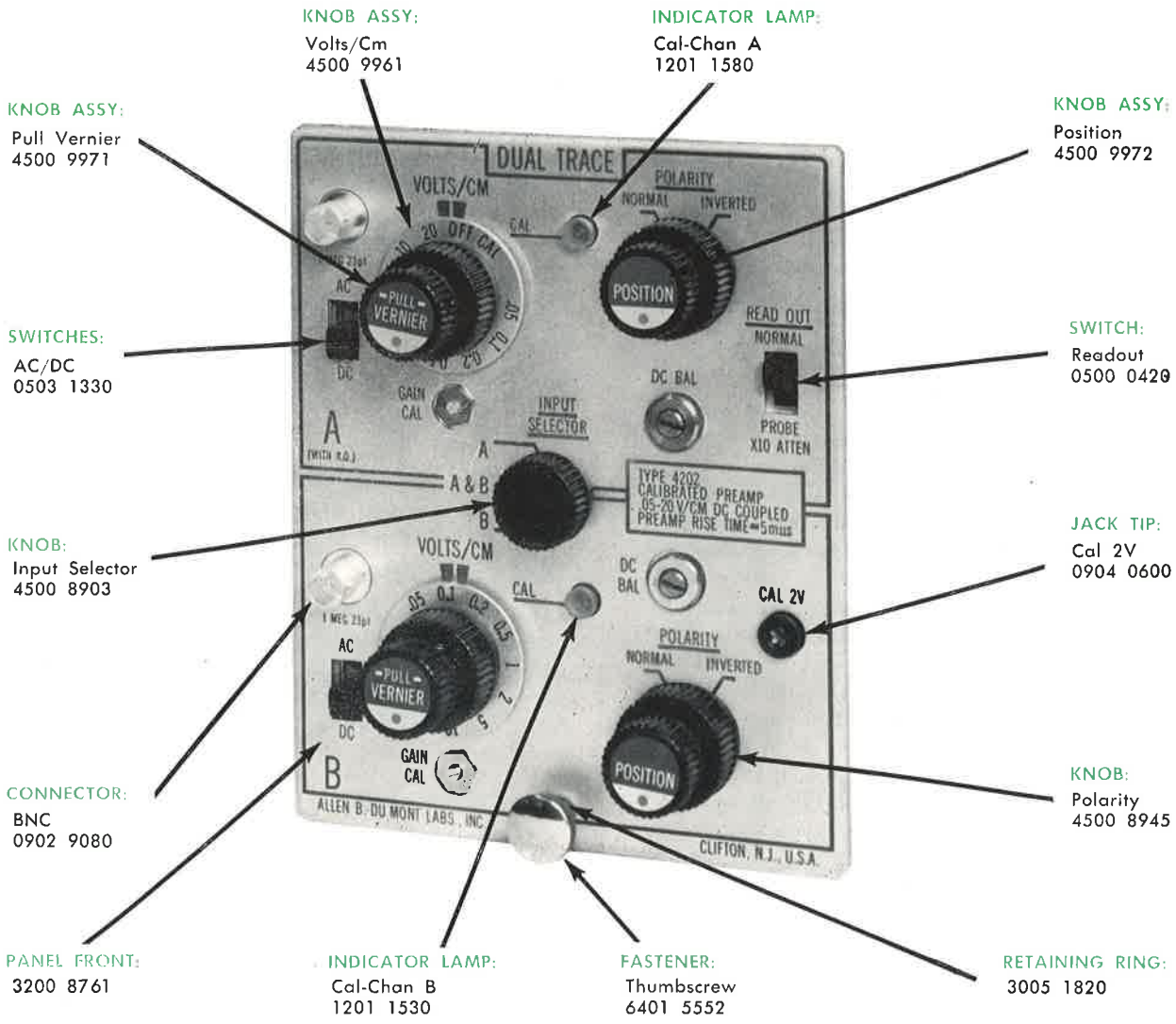



***Figure 5-1. Identification of Replaceable Parts***

# DU MONT

# INSTRUMENT WARRANTY AND SERVICE NOTICE

## WARRANTY

Allen B. Du Mont Laboratories, Inc. 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, INC.**
**Instrument Service Department**
**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.

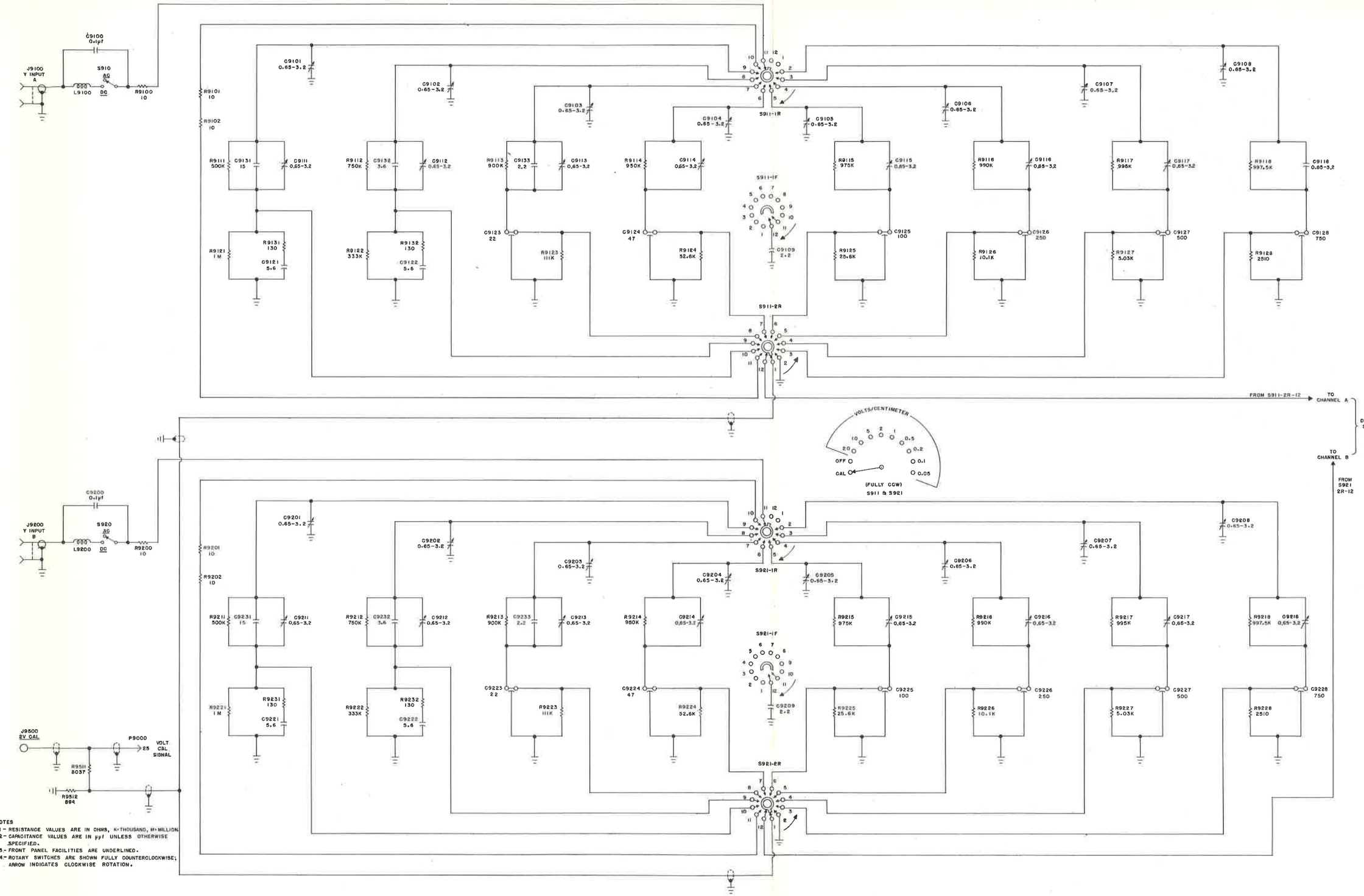
## REPLACEMENT PARTS

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 electircal components used in the Instrument. This will help to expedite service.

**ALLEN B. DU MONT LABORATORIES, INC.**
**Industrial Electronics Division**
**750 Bloomfield Avenue, Clifton, New Jersey**

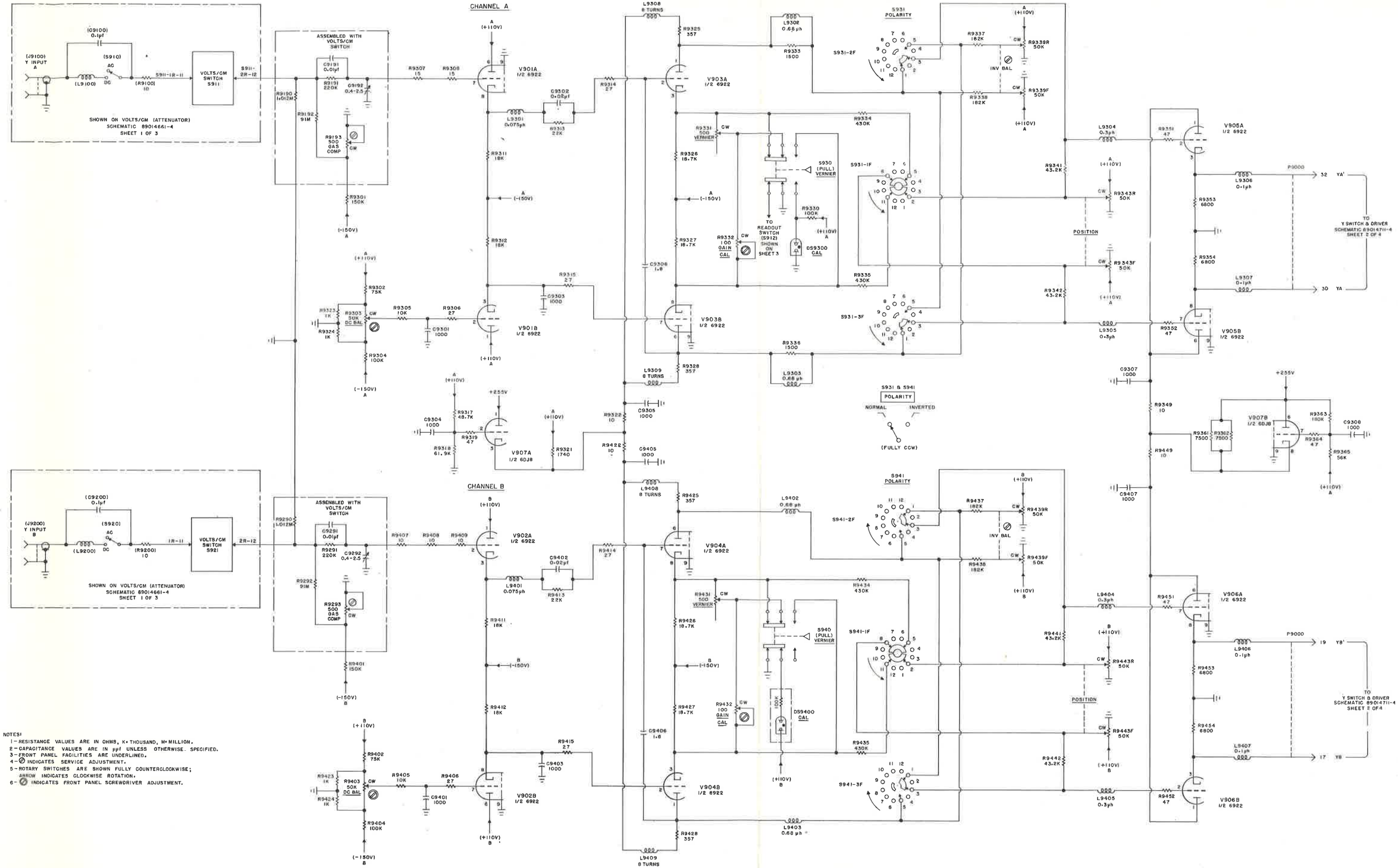
## PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Avenue, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.



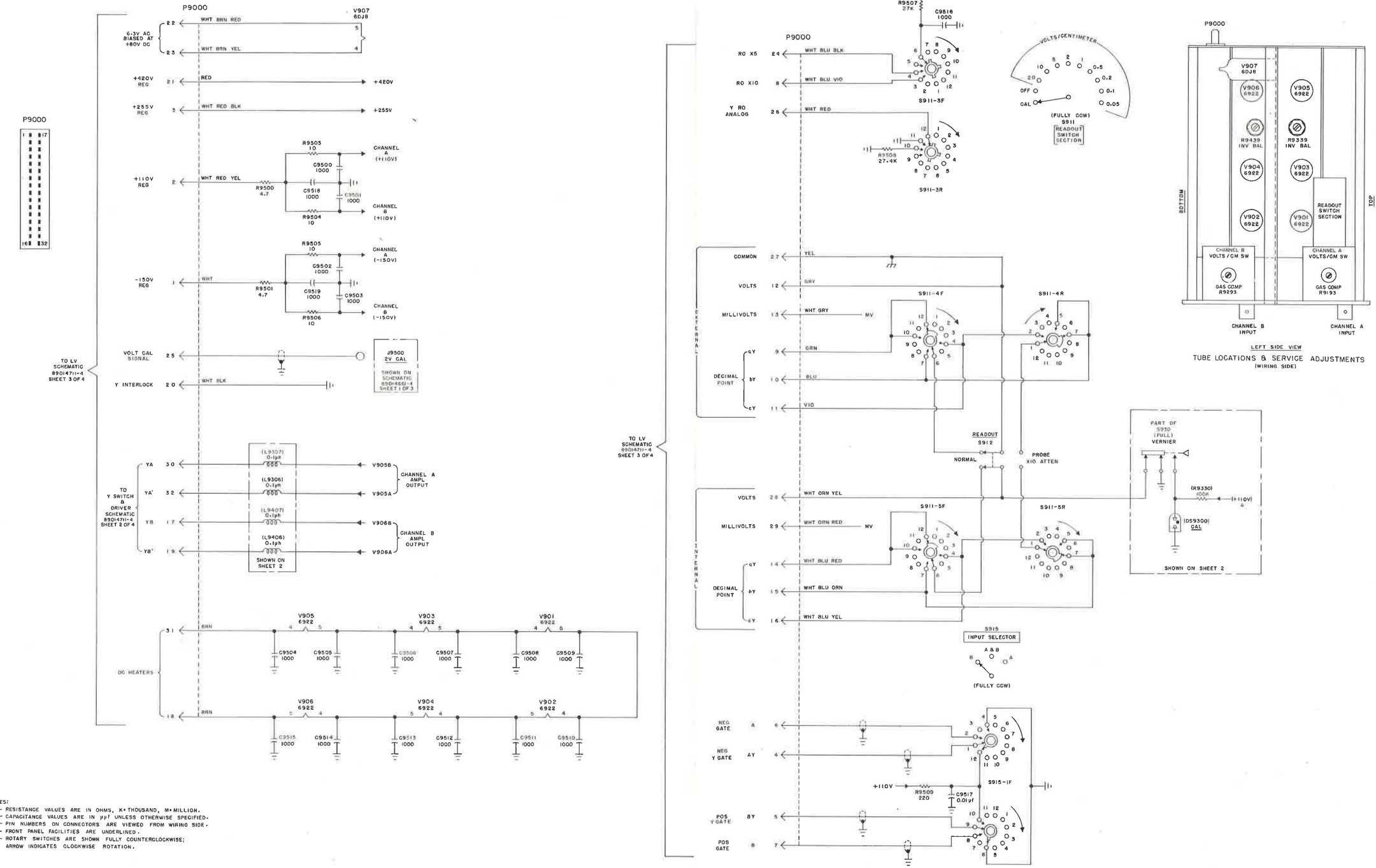

NOTES
1 – RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2 – CAPACITANCE VALUES ARE IN μμf UNLESS OTHERWISE SPECIFIED.
3 – FRONT PANEL FACILITIES ARE UNDERLINED.
4 – ROTARY SWITCHES ARE SHOWN FULLY COUNTERCLOCKWISE; ARROW INDICATES CLOCKWISE ROTATION.

**FIGURE 5-2. SCHEMATIC, DU MONT TYPE 4202 Y DUAL TRACE (DUAL CHANNEL) VOLTS/CM (ATTENUATOR)**
**(Reference Drawing 8901 4661-4, Sheet 1 of 3)**




NOTES:
1 - RESISTANCE VALUES ARE IN OHMS, K= THOUSAND, M= MILLION.
2 - CAPACITANCE VALUES ARE IN μμf UNLESS OTHERWISE SPECIFIED.
3 - FRONT PANEL FACILITIES ARE UNDERLINED.
4 - ⊘ INDICATES SERVICE ADJUSTMENT.
5 - ROTARY SWITCHES ARE SHOWN FULLY COUNTERCLOCKWISE; ARROW INDICATES CLOCKWISE ROTATION.
6 - ⊘ INDICATES FRONT PANEL SCREWDRIVER ADJUSTMENT.

**FIGURE 5-3. SCHEMATIC, DU MONT TYPE 4202 Y DUAL TRACE (DUAL CHANNEL) Y AMPLIFIER**
**(Reference Drawing 8901 4661-4, Sheet 2 of 3)**




NOTES:
1 - RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2 - CAPACITANCE VALUES ARE IN μμf UNLESS OTHERWISE SPECIFIED.
3 - PIN NUMBERS ON CONNECTORS ARE VIEWED FROM WIRING SIDE.
4 - FRONT PANEL FACILITIES ARE UNDERLINED.
5 - ROTARY SWITCHES ARE SHOWN FULLY COUNTERCLOCKWISE; ARROW INDICATES CLOCKWISE ROTATION.

**FIGURE 5-4. SCHEMATIC, DU MONT TYPE 4202 Y DUAL TRACE (DUAL CHANNEL) CONNECTORS, RO, TUBE LOCATIONS AND ADJUSTMENTS**
**(Reference Drawing 8901 4661-4, Sheet 3 of 3)**