

# INSTRUCTION MANUAL

## P6038 Signal Chopper

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All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

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# P6038 SIGNAL CHOPPER

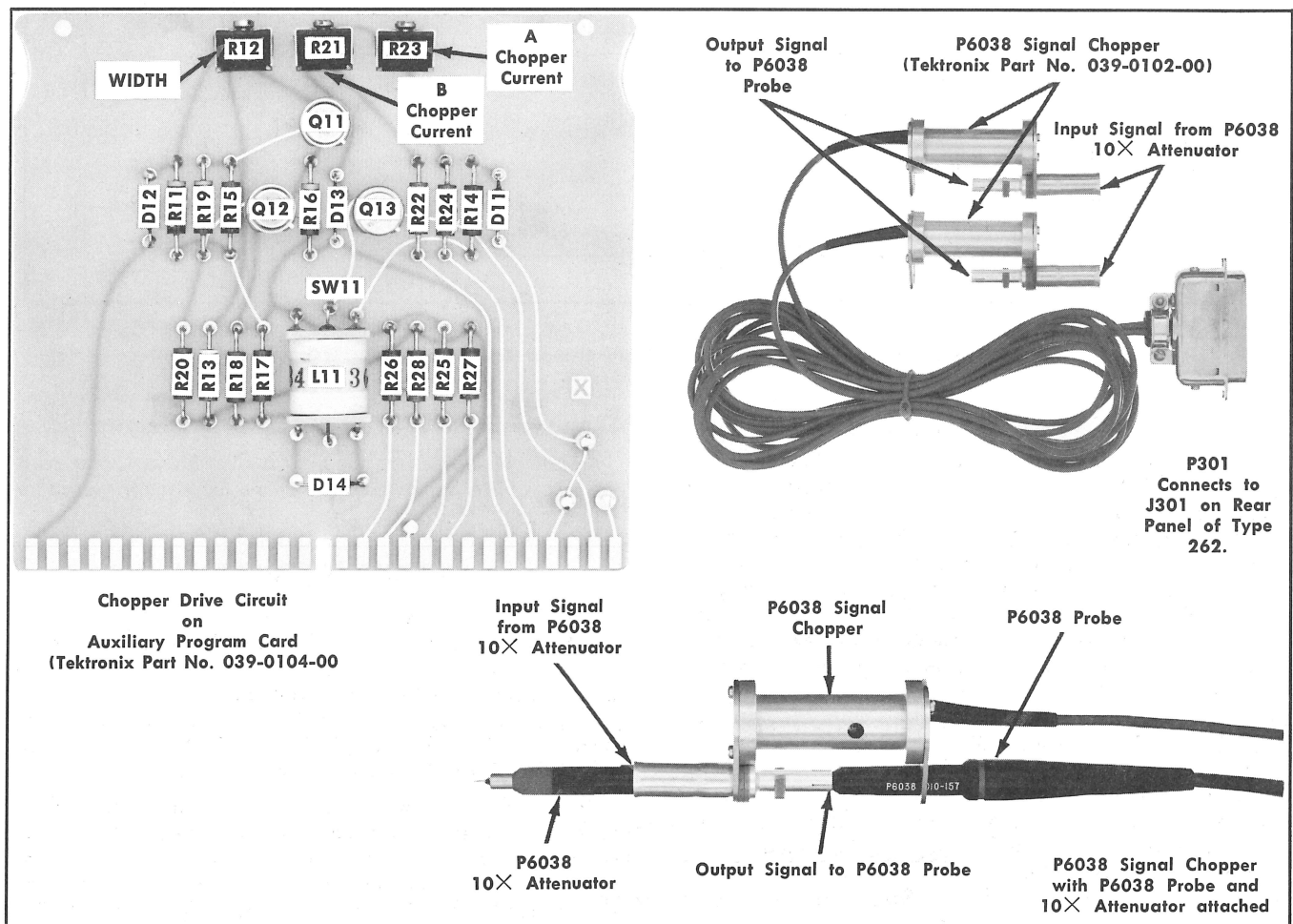


Fig. 1. Chopper Drive Circuit Card and nose Signal Choppers.

## CHARACTERISTICS

### General

The P6038 Signal Chopper with the P6038/3S3 combination provides an accurate on-screen dc reference point. The characteristics are the same as those outlined in the P6038 and Type 3S3 instruction manuals except for those that follow.

### CHANGED ELECTRICAL CHARACTERISTICS

#### Risetime

Typically 0.6 nsec total when driven from a 50-ohm source.

#### Attenuation Ratio

Attenuator head and P6038 Signal Chopper combined;  $10 \times \pm 1\%$ .

### Input Impedance

Input impedance of the attenuator head is 1 megohm paralleled by 2 pf during the time the P6038 Signal Chopper is not looking at ground, and 900 kilohms paralleled by 2.05 pf during the time the P6038 Signal Chopper is looking at ground.

### Maximum Signal Input

Not to exceed  $\pm 30$  volts. Momentary dc or ac peak overload,  $\pm 100$  volts (input signal measured at the tip of the attenuator head).

### Dc Reference Stability

Within 20 mvolts referred to the tip of the attenuator head with maximum temperature variation of  $\pm 5^\circ \text{F}$  and an overall sensitivity of 300 mvolts/cm over a period of 4 hours.

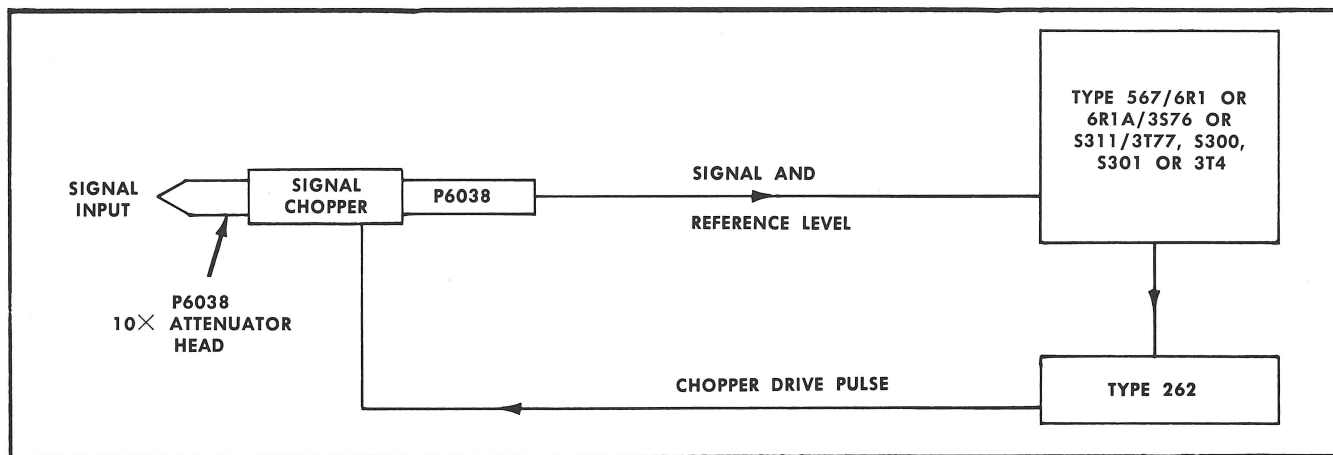


Fig. 2. Block diagram showing how the Signal Chopper fits into the basic system.

### OPERATING INSTRUCTIONS

For many time and voltage measurements using the 567/6R1A/3S3/3T77/262 basic system, a stable ground reference level must be established for the 0% memory. This reference must be established each time the measurement is made in order to assure an accurate instantaneous measurement.

This is accomplished by using the Signal Chopper in conjunction with the P6038 Probe. The Signal Chopper establishes the ground reference during the 0% zone time.

The Signal Chopper is a single-pole single-throw dry-reed switch with associated ground reference circuitry. During the 0% zone time, the coil L2 is energized from the Chopper Drive Circuit Card (039-0104-00). This closes the normally open contacts of SW1 establishing the required ground reference at the P6038 Probe.

To place the Signal Chopper with its associated drive circuit in an operational condition, follow the wiring instructions described and illustrated in Fig. 3. The illustration also points out the signal path of the sweep voltage from the Type 567 to the Chopper Drive Circuit Card.

#### NOTE

If the Chopper Drive Circuit Card is to be operated in a standard Type 262, wire the cathode of D11 to terminal 28 of the card.

If the Chopper Drive Circuit Card is to be operated as part of a special Tektronix system or if it is desired to externally program the Chopper Drive Circuit Card, then wire the cathode of D11 to terminal 25 of the card.

In addition to the wiring instructions in Fig. 3, the Type 3T77, S300, S301 or 3T4 must also be modified. The modification to the Type 3T77, S300, S301 or 3T4 consists of changing the holdoff capacitor in the Miller circuit to a 0.2  $\mu$ f capacitor.

### Additional Signal Choppers

The Chopper Drive Circuit Card as shown will operate two Signal Choppers. The number of additional Signal Choppers that can be added is limited only by the capabilities of the J3138 output stage ( $\approx$  40 ma) and the current requirements of the additional Signal Choppers. Each additional Signal Chopper requires one 5000-ohm potentiometer (311-0359-00) and one 1200-ohm resistor (301-0122-00).

### Chopper Drive Circuit Card Adjustments

Adjustment instructions for the Chopper Drive Circuit card controls will be found in step 4 of the calibration procedure in this manual.

### CIRCUIT DESCRIPTION

The Chopper Drive Circuit consists of a bistable Schmitt circuit and a driver stage. The bistable circuit, consisting of Q11 and Q12 with associated circuitry, is triggered into its stable states by the sweep voltage available at J34/P34 (pin B) of the Type 6R1 or 6R1A. The sweep voltage is applied from pin B through pin 35 of J101/P101 of the Type 262 to pin A on the Auxiliary Program Card.

Triggering of the circuit into one of its stable states occurs during the sweep retrace time. When triggered at this time, the bistable circuit initiates the pulse which is applied to the driver stage consisting of Q13 and associated circuitry. The pulse duration, determined by adjustment of R12 (WIDTH control), lasts through the sweep holdoff time and a portion of the sweep sawtooth rise. The rising sweep voltage is used to force the circuit into its other stable state at which time the pulse terminates.

Assume the sweep has reached its most positive level and is now in the retrace portion of the cycle. During retrace the sweep drops through a voltage level that causes D12 to conduct. The level at which D12 conducts is determined by the setting of R12 (WIDTH control). Conduction of D12 causes Q11 to turn off and Q12 turns on. Through regeneration the fall at the collector of Q12 is very fast. The falling voltage produces a fast negative-going pulse which is applied through SW11 to the driver stage.

Assume that the Auxiliary Program Card is being programmed from a standard Type 262 at this time. Then, pin 28 will be connected essentially ( $\approx$  1 volt) to ground, L11 will be energized and the contacts of SW11 will be closed. The closed contacts apply the negative-going pulse to the base of Q13. Transistor Q13 turns on and a positive-going pulse occurs at the collector of Q13.

The positive-going pulse at the collector of Q13 is applied to L2 in the Signal Chopper. Coil L2 energizes and the reed of SW1 moves over to close the normally-open contacts in

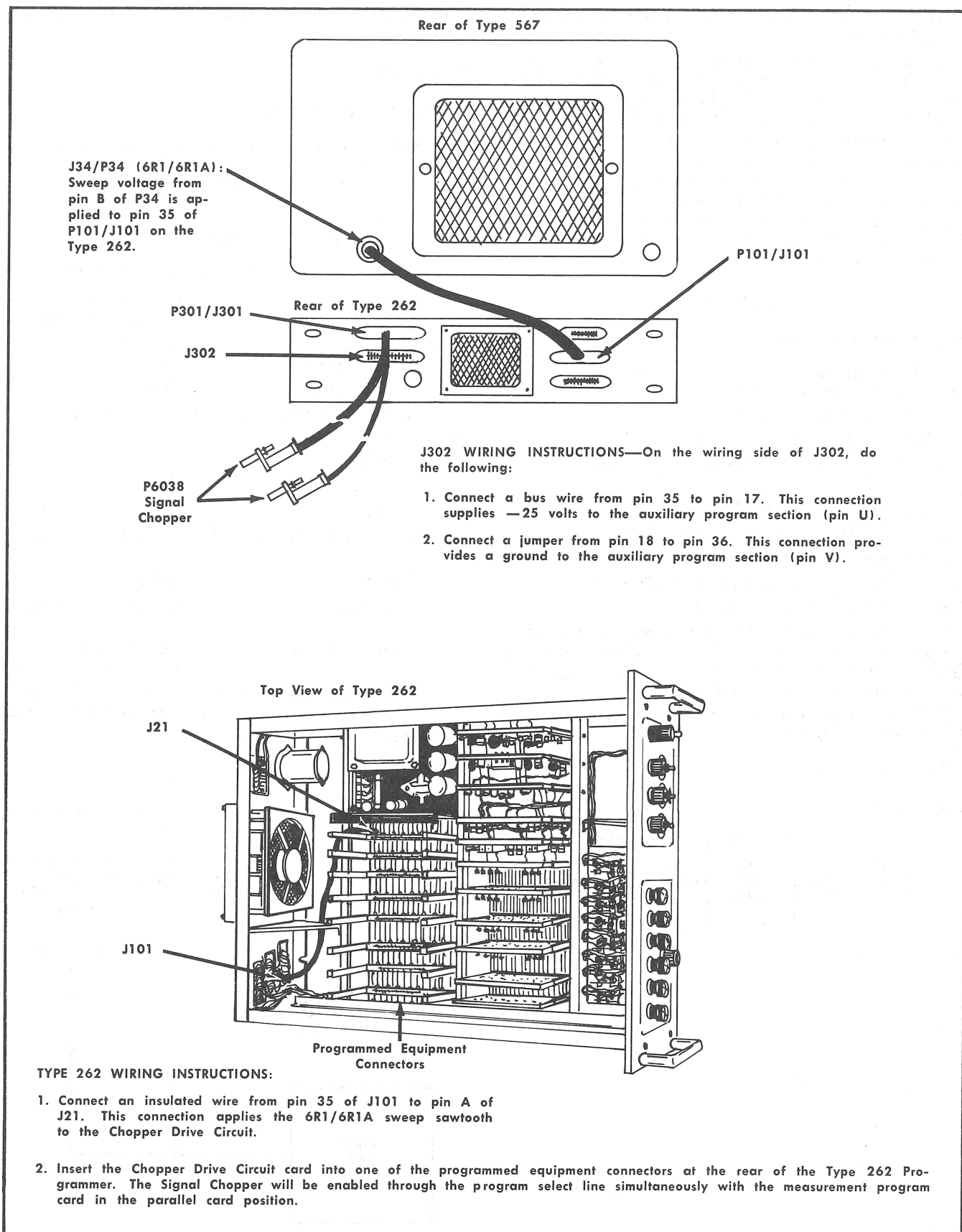


Fig. 3. Illustrations showing where the sweep voltage originates (J34/P34, pin B) and where to add wiring to make the chopper operate properly.

## P6038 Signal Chopper

the circuit to ground. Thus, ground reference is established during 0% zone time.

During the sawtooth-rise portion of the sweep voltage, the rising voltage back biases D12. Simultaneously, Q11 turns on, Q12 turns off and Q13 turns off. Coil L2 de-energizes and opens the contacts of SW1, removing the ground reference from the input to the P6038 Probe.

R12 (WIDTH control) is adjusted so the normally-open contact of the Signal Chopper is closed for a time longer than the 0% zone time. R21 (B Chopper Current control) and R23 (A Chopper Current control) adjust the current to each chopper coil. Each control is adjusted for a stable ground reference during the 0% zone time.

### CALIBRATION

#### Equipment Required

The following equipment, or its equivalent, is needed to perform a complete calibration of the P6038 Signal Chopper.

1. Tektronix Type 567 Oscilloscope.
2. Tektronix Type 3S3 or S310 plug-in unit.
3. Tektronix Type 3T77, S300, S301 or 3T4 plug-in timing unit.
4. Tektronix Type 6R1 or 6R1A Digital Unit.
5. 2—P6038 Probes with 10× attenuators.
6. Tektronix Type 262 Programmer.
7. Chopper Drive Circuit Card for P6038 Signal Chopper, Tektronix Part Number 039-0104-00.
8. A 25-kc square-wave generator capable of delivering about 8 or 10 volts peak-to-peak into 50 ohms, risetime no greater than 13-nsec, 10% to 90%. Tektronix Type 105 Square-Wave Generator recommended.
9. 50-ohm termination with BNC connectors, Tektronix Part Number 011-0049-00.

10. BNC to P6038 adapter, Tektronix Part Number 103-0038-00.

### Procedure

#### 1. Equipment Connections

Connect the equipment as shown in Fig. 4. The Type 262 used must have the necessary wiring changes to allow the P6038 Signal Chopper to operate (see Fig. 3).

#### 2. 10× Attenuator Adjustment

- a. Set the Type 3S3 or S310 controls as follows:

Display Switch	To display the channel for the probe being adjusted.
Mv/Div Switch	100
Variable Control	Calib

- b. Set the Type 3T77, S300, S301 or 3T4 timing controls as follows:

Time/Div Switch	5 $\mu$ sec/div
Variable Control	Calib
Dots/Div	100

- c. Set the Type 105 Square-Wave Generator controls as follows:

Range	25 kc
Frequency	For a meter reading of 25 kc.
Output Amplitude	For a display amplitude of 5 cm.

- d. Connect an external triggering signal to the timing unit. Adjust the controls of the timing unit for external triggering.

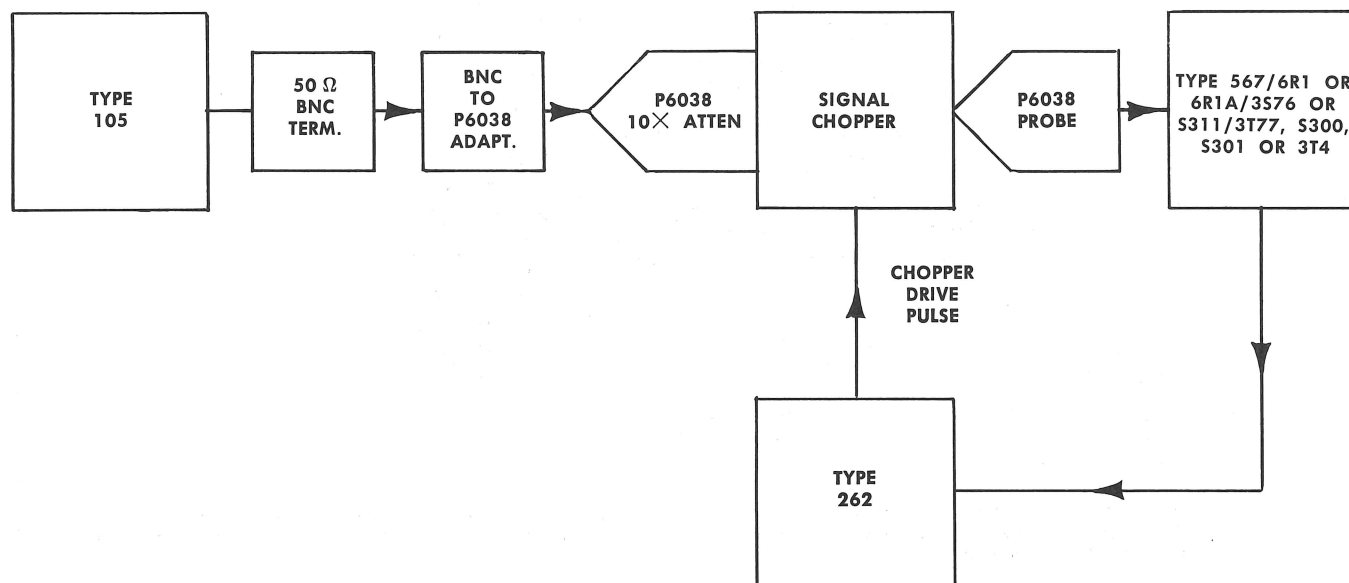


Fig. 4. Block diagram showing equipment connections for Signal Chopper calibration.

e. Using the setup described in this manual, adjust the  $10\times$  attenuator as described in the Calibration section of the P6038 Probe manual. Refer to the figure in the P6038 Probe manual to determine the correct compensation.

### 3. Setting Ground Reference of the Signal Chopper

- a. Ground the input of the  $10\times$  attenuator.
- b. Set the Mv/Div Switch on the Type 3S3 or S310 to 5.
- c. Adjust the controls of the Type 3T77, S300, S301 or 3T4 timing unit for a free running sweep with a rate of  $5\ \mu\text{sec}/\text{div}$ .
- d. Adjust R91 (located in Chopper body) to obtain a straight horizontal line (see Fig. 5). NOTE: The ground reference established in part (a) of this step is approximately the first centimeter portion of the displayed trace.

### 4. Adjusting Chopper Drive Circuit Card Controls

#### a. WIDTH Control

The WIDTH control R12, located on the Chopper Drive Circuit Card, see Fig. 1, is adjusted during operation of the system as follows:

1. Display a signal waveform on the crt of the oscilloscope.
2. Adjust the WIDTH control R12 so the chopped reference level remains at ground reference through the 0% zone time.

#### b. A and B CHOPPER CURRENT Controls

The CHOPPER CURRENT controls, located on the Chopper Drive Circuit Card, see Fig. 1, are adjusted during operation of the system as follows:

1. Display a signal waveform on the crt of the oscilloscope through the Signal Chopper which is to be adjusted.
2. Adjust the proper CHOPPER CURRENT control, R21 or R23, for a stable ground reference during 0% zone time.

P6038 Signal Chopper

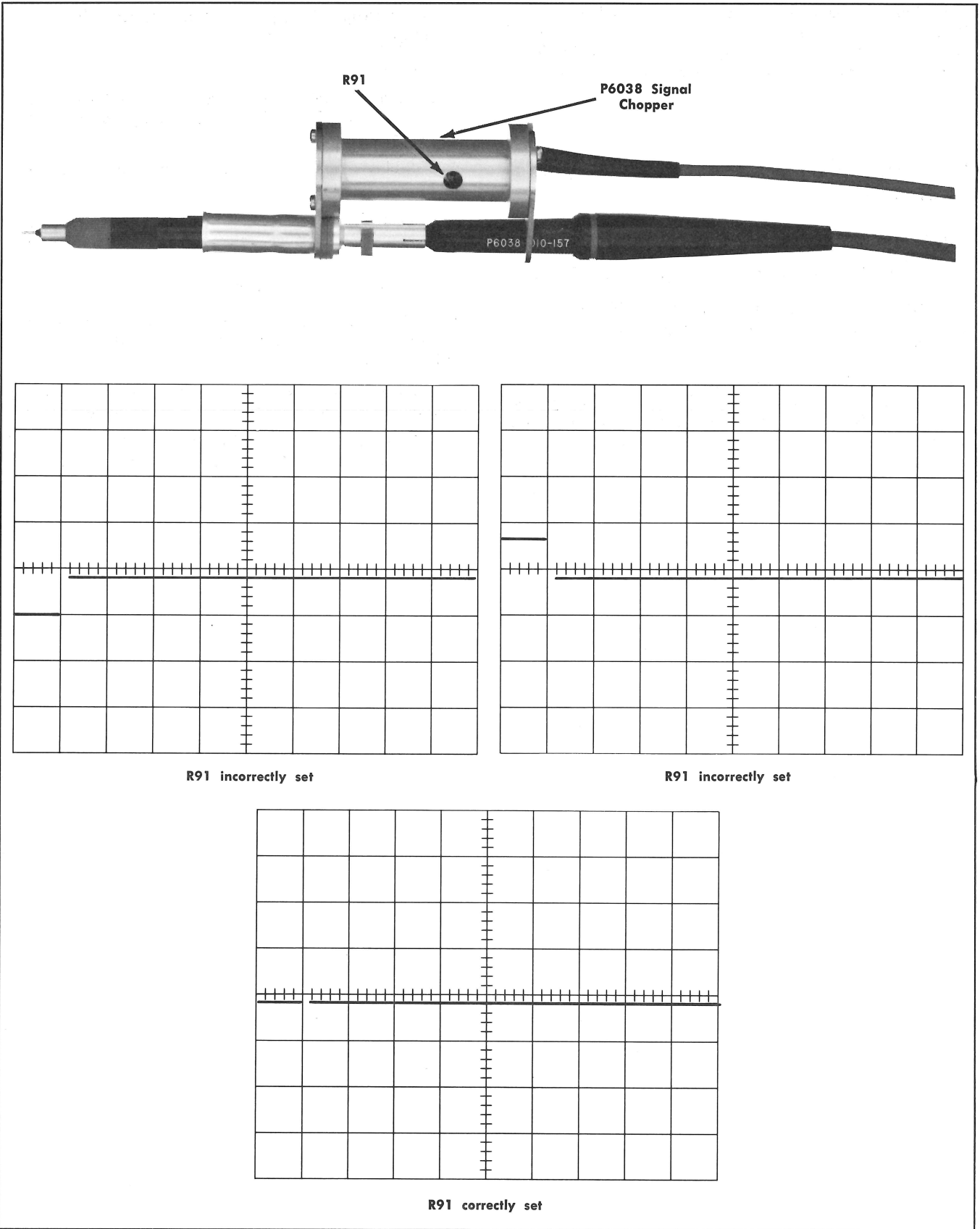


Fig. 5. Location of R91 along with correct and incorrect displays obtained when adjusting R91.



# PARTS LIST

## SIGNAL CHOPPER

NOTE: For those parts which have no part number, order by instrument type and complete description of part.

### Electrical Components

Ckt. No.	Tektronix Part No.	Description	S/N Range
<b>Capacitor</b>			
C90	281-0591-00	5600 pf Cer 200 v	20%
<b>Inductor</b>			
L2	- - - - -	Reed Switch Drive	
<b>Resistors</b>			
R90	315-0106-00	10 meg 1/4 w	5%
R91	311-0245-00	10 k Var	
R92	315-0512-00	5.1 k 1/4 w	5%
R93	315-0512-00	5.1 k 1/4 w	5%
R94	315-0510-00	51 $\Omega$ 1/4 w	5%
<b>Switch</b>			
SW1	- - - - -	Reed	

### Mechanical Components

131-0291-00	CONNECTOR, center assembly
131-0293-00	CONNECTOR, 36-pin, male
200-0488-00	COVER, cable relief, molded, .270 $\times$ 1.5 inches
210-0405-00	NUT, hex., brass, 2-56 $\times$ 3/16 inch
211-0079-00	SCREW, 2-56 $\times$ 3/16 inch, PHS phillips
348-0004-00	GROMMET, rubber, 3/8 inch
354-0225-00	RING, retaining
377-0095-00	INSERT
- - - - -	BODY, chopper
- - - - -	BODY, probe receiving
- - - - -	BODY, tip
- - - - -	BUSHING, insulating
- - - - -	CABLE, coax, 10 ft. long
- - - - -	CHASSIS
- - - - -	CLIP, channel index (1 blue, 1 red)

Mechanical Components (Cont'd)

Ckt. No.	Tektronix Part No.	Description	S/N Range
- - - - -	- - - - -	CLIP, grounding contact	
- - - - -	- - - - -	GUIDE, tubular	
- - - - -	- - - - -	PIN, amphenol	
- - - - -	- - - - -	PLATE, front	
- - - - -	- - - - -	PLATE, rear	
- - - - -	- - - - -	RETAINER, center conductor	
- - - - -	- - - - -	SHIELD, reed switch	
- - - - -	- - - - -	TIP, assembly	

# PARTS LIST

## CHOPPER DRIVE CIRCUIT

\* Indicates component manufactured by or for Tektronix, reworked and/or checked.

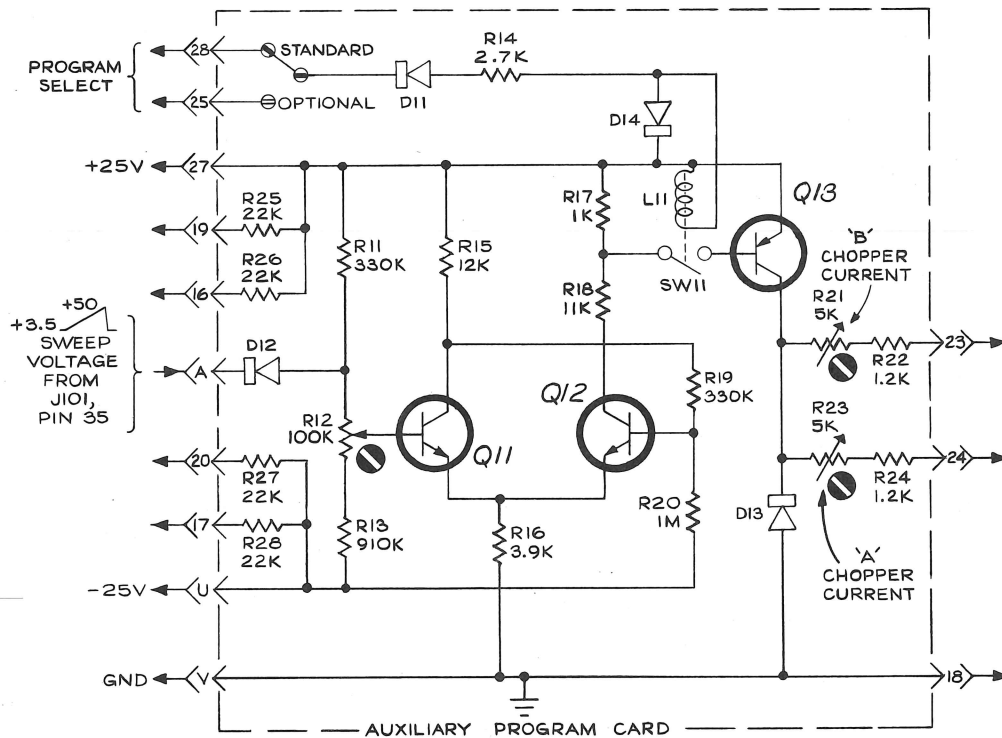
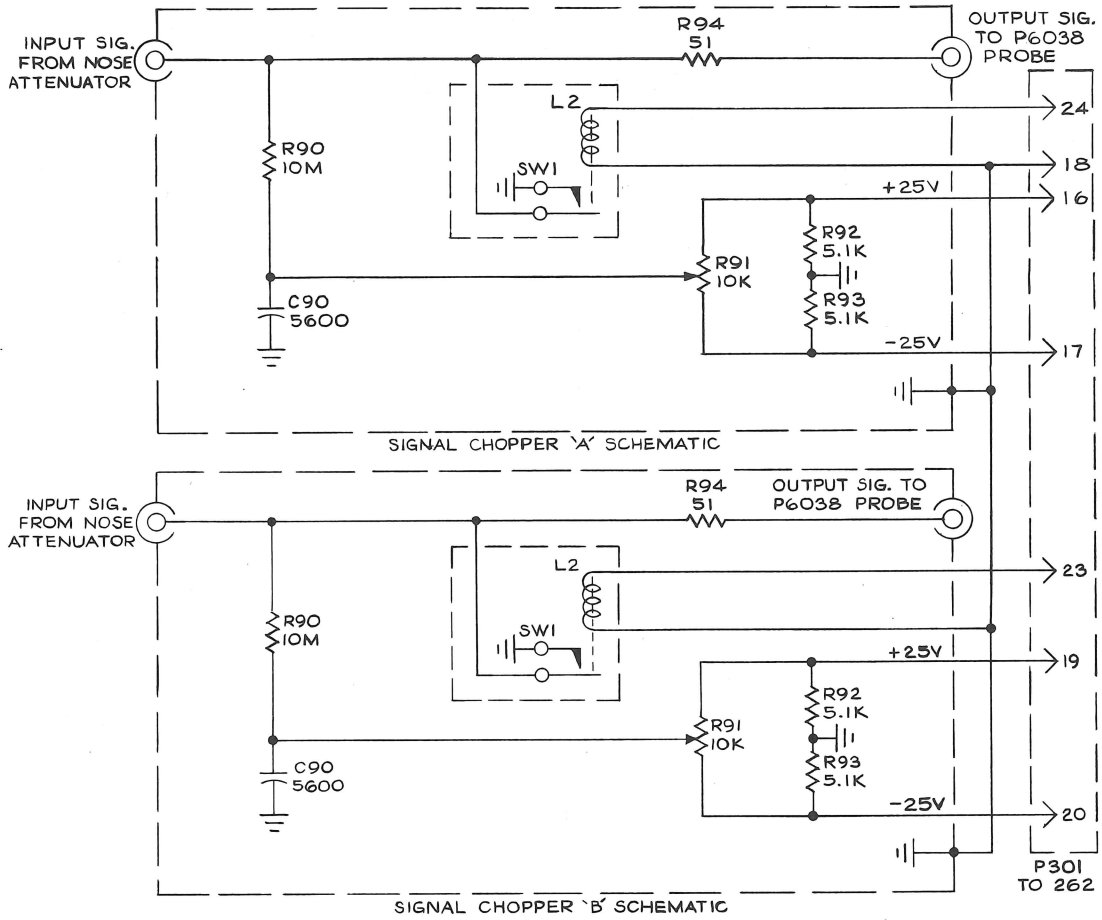
NOTE: For those parts which have no part number, order by instrument type and complete description of part.

### Electrical Components

Ckt. No.	Tektronix Part No.	Description	S/N Range
<b>Diodes</b>			
D11	*152-0107-00	Silicon Replaceable by 1N647	
D12	*152-0107-00	Silicon Replaceable by 1N647	
D13	*152-0107-00	Silicon Replaceable by 1N647	
D14	*152-0107-00	Silicon Replaceable by 1N647	
<b>Inductor</b>			
L11	- - - - -	Reed Switch Drive	
<b>Transistors</b>			
Q11	*151-0103-00	Silicon Replaceable by 2N2219	
Q12	*151-0103-00	Silicon Replaceable by 2N2219	
Q13	*151-0087-00	Silicon Selected from 2N1131	
<b>Resistors</b>			
R11	301-0334-00	330 k	5%
R12	311-0454-00	100 k	5%
R13	301-0914-00	910 k	5%
R14	301-0272-00	2.7 k	5%
R15	301-0123-00	12 k	5%
R16	301-0392-00	3.9 k	5%
R17	301-0102-00	1 k	5%
R18	301-0113-00	11 k	5%
R19	301-0334-00	330 k	5%
R20	301-0105-00	1 meg	5%
R21	311-0359-00	5 k	5% B CHOPPER CURRENT
R22	301-0122-00	1.2 k	5%
R23	311-0359-00	5 k	5% A CHOPPER CURRENT
R24	301-0122-00	1.2 k	5%
R25	301-0223-00	22 k	5%
R26	301-0223-00	22 k	5%
R27	301-0223-00	22 k	5%
R28	301-0223-00	22 k	5%
<b>Switch</b>			
SW11	260-0552-00	Reed	

### Mechanical Components

388-0599-00	CARD, etched circuit
136-0183-00	SOCKET, transistor, 3-pin



SEE PARTS LIST FOR SEMICONDUCTOR TYPES

CHOPPER DRIVE CIRCUIT