The following pages contain the text, parts list, and schematics for the Type 50 Plug-In Module. This module is designed for use with Tektronix Type 560-Series Oscilloscopes.

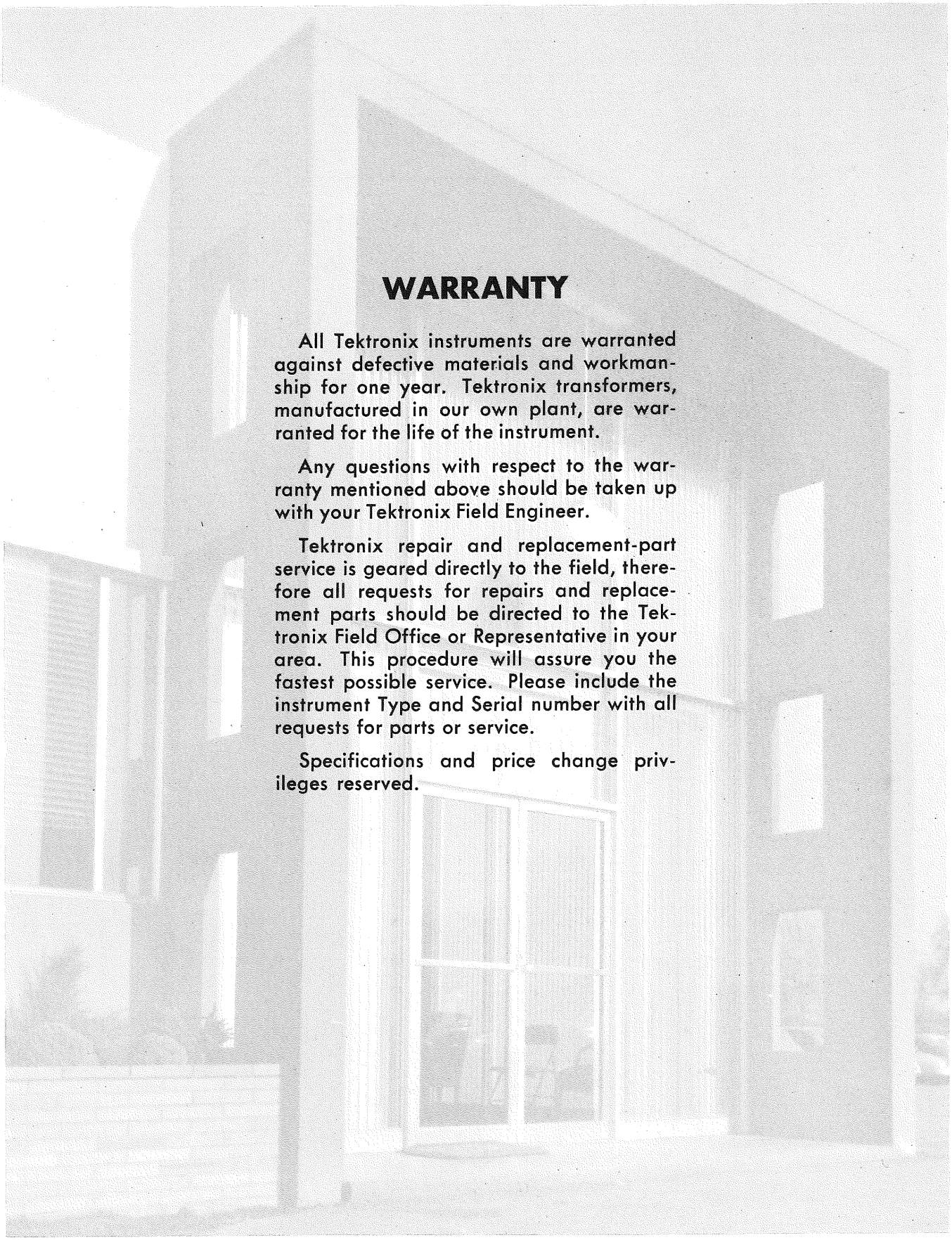
Insert these pages into the binder you received with the Indicator Unit manual so that you will have a complete instruction manual for your oscilloscope.

Instruction Manual

TYPE 50 AMPLIFIER

Tektronix Inc. 070-264

P. O. Box 500 ● Beaverton, Oregon ● Phone: MI 4-0161 ● Cables: Tektronix



WARRANTY

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.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or Representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial number with all requests for parts or service.

Specifications and price change privileges reserved.

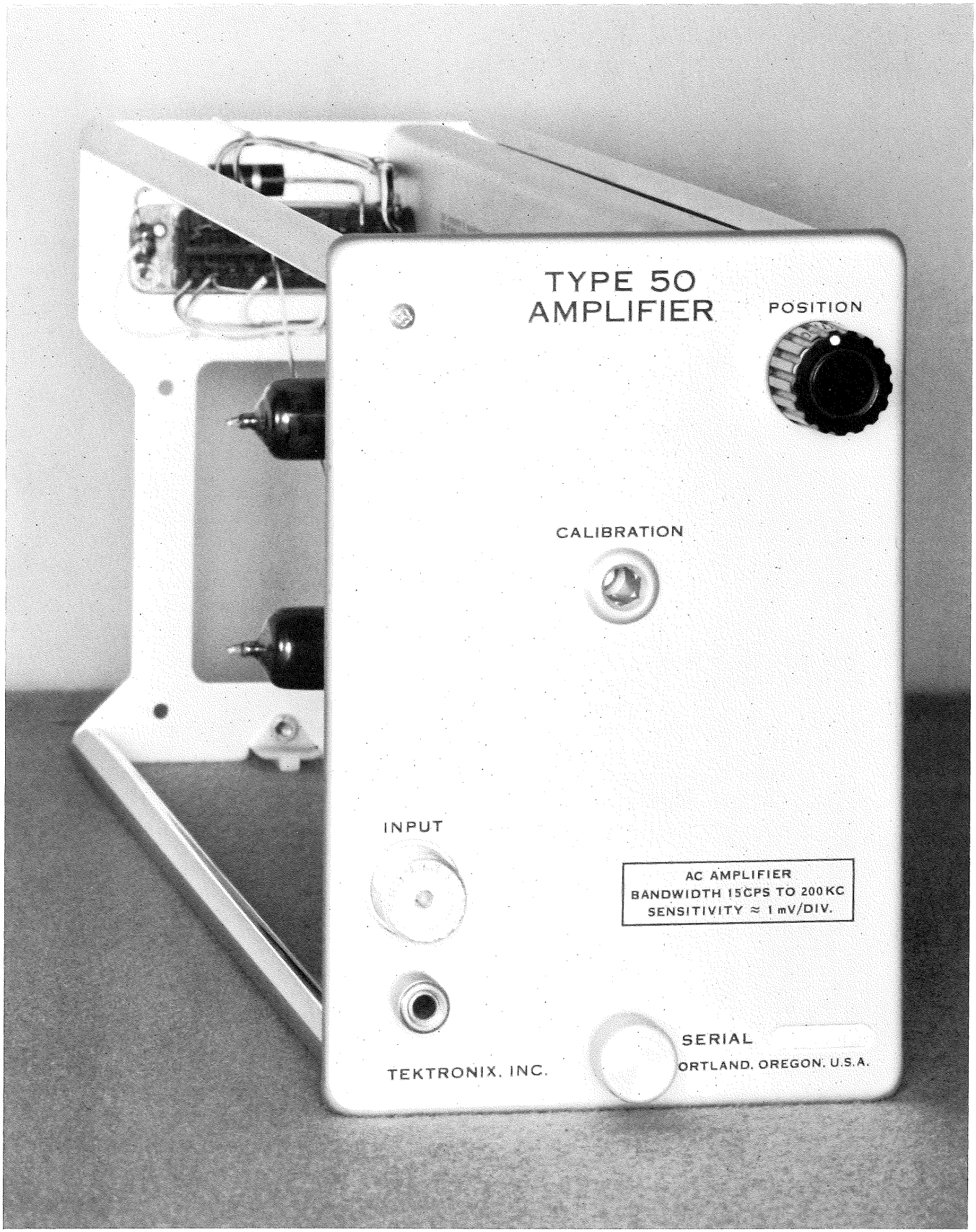


Fig. 1. Type 50 Amplifier module.

TYPE 50 AMPLIFIER

INTRODUCTION

The Tektronix Type 50 Amplifier, Fig. 1, is designed for use with Tektronix Type 560-Series Oscilloscopes. It has a nominal sensitivity of one millivolt per division — that is, one millivolt of signal at the INPUT connector will produce a deflection of one graticule division at the oscilloscope screen. The sensitivity is adjustable, by means of a front-panel screwdriver adjustment, between about 0.5 and 1.5 millivolts per division. The Type 50 has a bandpass of 15 cps to 200 kc and an input resistance of one megohm.

The Type 50 Amplifier is intended primarily to be used with the Type 51 Sweep module in the Type 560 or Type 561 Oscilloscope for displaying signals produced by magnetic-ink characters as they are scanned by a magnetic-ink tester, such as the Kidder Whirly-Sig. A special manual has been prepared containing instructions for the operation of these oscilloscopes (with the Type 50 and Type 51 modules) specifically in this application. If you are using your Type 50 module for this purpose and do not have the special manual, contact your Tektronix Field Engineer.

This manual describes operating instructions for general use of the Type 50 module. It also contains a detailed circuit description of the module, and troubleshooting instructions. A parts list and schematic diagram are contained at the rear.

Operating Instructions

Throughout the instructions that follow, it is assumed, unless otherwise stated, that the Type 50 module is inserted in the Y-axis opening of a Type 560-Series Oscilloscope, thereby providing vertical deflection of the trace. If the module is inserted in the X-axis opening it will provide horizontal deflection, and the instructions must be interpreted accordingly. It is further assumed throughout the discussion that there is a time-base or sweep module in the X-axis opening of the oscilloscope.

Signal Connections

The signal to be displayed is applied to the INPUT connector on the front panel of the module. For best results, the signal should be applied through a shielded cable, with the shield connected to the chassis of both the oscilloscope and the signal source. Leads should be kept as short as possible.

High-impedance attenuator probes are available for applying the signal to the module. These probes reduce the resistive and capacitive loading effect of the module and, at the same time, attenuate the signal to allow display of larger signals than would otherwise be possible. These probes and other accessories are described in the Accessories section of the oscilloscope manual.

Displaying a Signal

To display a signal with the Type 50 module, proceed as follows:

1. Apply the signal (preferably through a shielded cable or an attenuator probe) to the INPUT connector.

2. Adjust the time-base or sweep controls to obtain a stable display of the signal.

3. Set the POSITION control on the Type 50 module so that the waveform is placed as desired on the graticule.

CALIBRATION Adjustment

The sensitivity of the Type 50 module is adjusted by means of the front-panel CALIBRATION adjustment. The setting of this adjustment should be checked and adjusted, as necessary, whenever the module is moved from one oscilloscope opening to the other, due to differences in cathode-ray tube deflection plate sensitivities. It may also need to be adjusted when you change the module in the other channel because differences in average output voltages between modules can affect the sensitivity of the crt.

The nominal sensitivity of the Type 50 module is 1 millivolt per division. To set the CALIBRATION adjustment for this sensitivity, proceed as follows:

1. If you are using a Type 560 or Type 565 Oscilloscope, apply 1 millivolt of Calibrator signal through a shielded cable to the INPUT connector. If you are using a Type 561

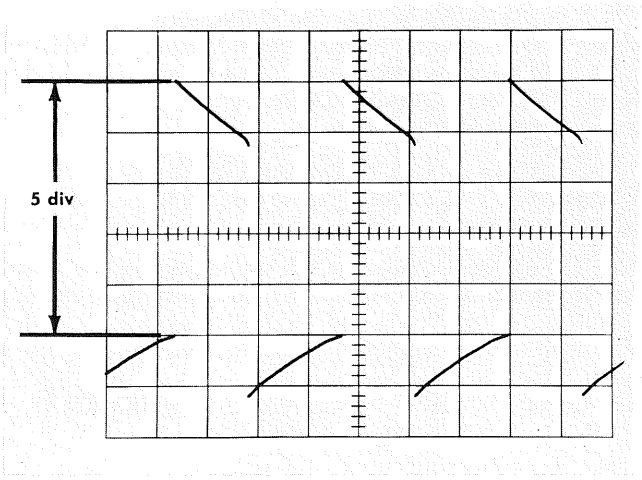


Fig. 2. Five-millivolt Calibrator signal displayed with Type 50 CALIBRATION control set for 1 millivolt per division.

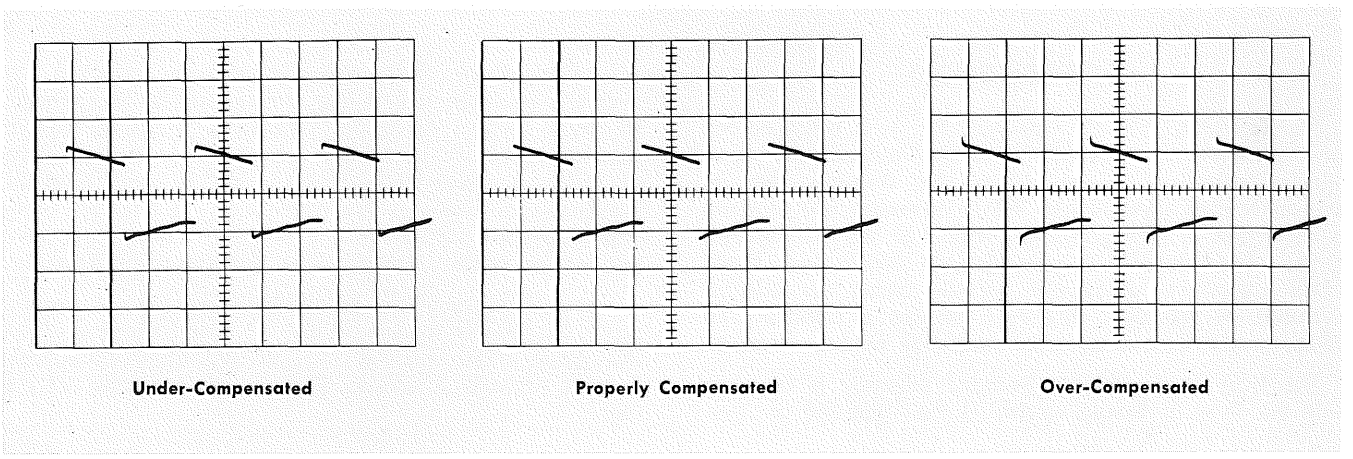


Fig. 3. Probe-compensation waveforms.

Oscilloscope, apply 5 millivolts of Calibrator signal through a shielded cable to the INPUT connector.

2. Adjust the time-base or sweep controls to obtain a stable display of several cycles of the Calibrator waveform.

3. Set the CALIBRATION adjustment so that the vertical portions of the displayed waveform are exactly 1 graticule division high if you are using the Type 560 or Type 565 Oscilloscope, or 5 divisions high if you are using the Type 561 Oscilloscope. See Fig. 2. (The slope in the top and bottom of the waveform is due to ac coupling within the amplifier.)

Probe Compensation

If the attenuator probe is used, its capacitance must be compensated to that of the module to which it is connected for best signal response. To compensate a Tektronix 10X attenuator probe, proceed as follows:

1. Connect the probe to the INPUT connector of the module.

2. If you are using a Type 560 or Type 565 Oscilloscope, apply 10 millivolts of Calibrator signal through the probe to the INPUT connector. If you are using a Type 561 Oscilloscope, apply 20 millivolts of Calibrator signal through the probe to the INPUT connector.

3. Adjust the controls on the time-base or sweep module to produce a stable display of several cycles of the Calibrator waveform.

4. Adjust the variable capacitor in the body of the probe for the correct signal response, as shown in Fig. 3, center.

If desired, you may use a higher-frequency square wave for compensating the probe. In this case, display several cycles on the screen, and adjust the variable capacitor in the body of the probe for the best square-wave response. Above a frequency of approximately 1 kc, the slope of the top and bottom of the waveform is not noticeable.

Voltage Measurement

NOTE

When making voltage measurements with the Type 50 module, make sure there is a common ground between the oscilloscope and the signal source. If you are using a probe, you can establish this common ground by attaching the ground clip of the probe to signal ground.

To measure the potential difference between two points on a signal, such as peak-to-peak ac volts, proceed as follows:

1. Measure the vertical distance, in graticule divisions, between the two points whose potential you wish to measure.

2. Multiply the measurement obtained in step 1 by the sensitivity of the module (nominally 1 millivolt per division if you have set the CALIBRATION adjustment as previously described) and the attenuation factor, if any, of the signal probe. This is the potential difference between the two points measured.

Since the Type 50 is an ac-coupled amplifier, it cannot be used to measure dc voltages.

Circuit Description

The Type 50 Amplifier consists basically of a two-stage Input Amplifier and a one-stage push-pull Output Amplifier. Overall signal gain through the amplifier is about 20,000; 1000 in the Input Amplifier and 20 in the Output Amplifier.

The Input Amplifier consists of a cathode-coupled paraphase amplifier stage, V424, and a push-pull transistorized stage. The signal to be displayed is applied through the INPUT connector to the grid of V424A. V424 converts the

single-ended input to a push-pull output which is then amplified by the second stage. Positive feedback from the collector of each transistor to the base of the other provides very high gain in this stage. Negative feedback from the collector circuit of each transistor to the cathodes of V424 controls the gain and prevents the circuit from oscillating.

The gain of the Output Amplifier is controlled by the CALIBRATION adjustment, R497, which varies the cathode degeneration.

Adjustment of the POSITION control varies the return voltage of each of the cathodes of the Output Amplifier inversely to the other and, at the same time, produces a small dc voltage change of opposite polarity at the corresponding grid. The result is that the cathodes remain essentially constant in voltage while the current through the cathode resistors, and therefore through the tubes, changes. The change in current through each of the Output Amplifier tubes changes the average plate voltage of each tube inversely to the other, and the position of the crt beam is shifted accordingly.

A sample of the signal at the plate of V484 is obtained at the junction of R487 and R488. This sample is applied through C488 and the interconnecting plug to the time-base circuitry as a triggering signal. The signal at the junction of R487 and R488 has a peak-to-peak amplitude of about 3.5 volts for each division of deflection produced on the screen.

Troubleshooting

General maintenance and troubleshooting information is contained in the Type 560-Series Oscilloscope manuals. In the following discussion, it is assumed that you have read that information and have definitely isolated a trouble to the Type 50 module by the procedures described there.

First, remove the left-hand side panel of the oscilloscope and check to see if there is heater glow in all tubes in the module. Replace any in which there is no heater glow. If there is still no heater glow in any tube, trace out its heater circuit to find the trouble.

If there is heater glow in all tubes, remove the module and inspect it closely for damaged or burned components, loose wires, etc., which could cause trouble. If the visual inspection does not reveal the source of the trouble, reinsert the module in the oscilloscope and change all the tubes and transistors. If this does not eliminate the trouble, it will be necessary to isolate it by voltage and resistance checks.

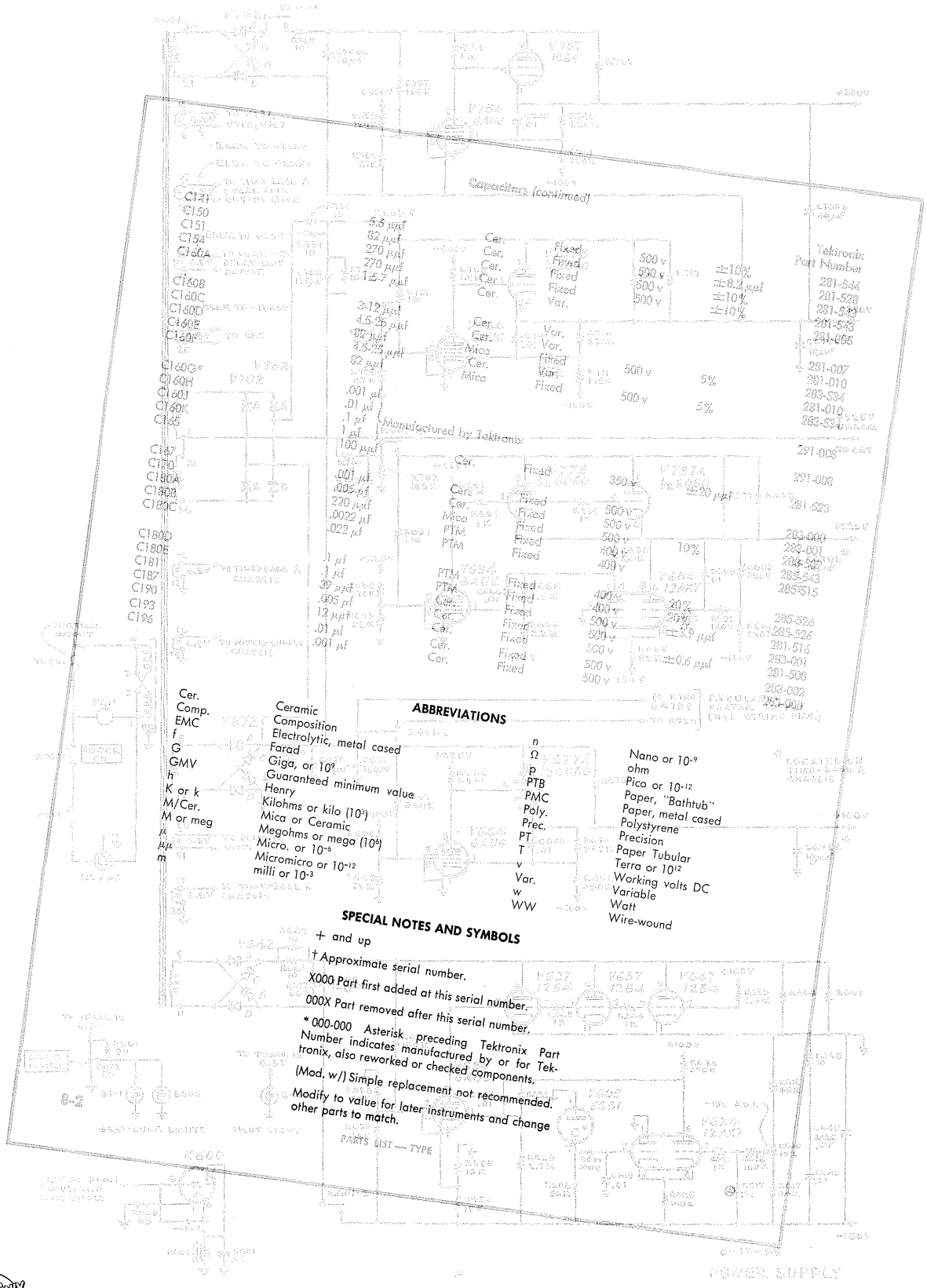
Insert the module in the right-hand opening of the oscilloscope and remove the right-hand side panel to gain access to the wiring and components. You do not need to have a module in the left-hand opening. If, for some reason, you do not wish to exchange positions of modules for troubleshooting work, use a plug-in extension, Tektronix part no. 013-034, which allows the module to be operated while extended partially out of the front of the oscilloscope.

Typical voltages to be encountered throughout the unit are shown on the schematic diagram at the rear of this manual. Resistance measurements in a circuit will usually be point-to-point checks, for which the proper values can be approximated from the schematic diagram. Resistance measurements from the base to the collector or emitter of each of the transistors should be in the vicinity of 500 to 700 ohms when the negative ohmmeter lead is connected to the base, and in the vicinity of 50 k to 80 k when the positive ohmmeter lead is connected to the base. Use the X1000 range of the ohmmeter when checking transistors; otherwise, you might damage them.

When the trouble has been isolated, replace the faulty component.

NOTES

PARTS LIST *and* DIAGRAMS



MANUFACTURERS OF CATHODE-RAY OSCILLOSCOPES

HOW TO ORDER PARTS

Replacement parts are available through your local Tektronix Field Office.

Improvements in Tektronix instruments are incorporated as soon as available. Therefore, when ordering a replacement part it is important to supply the part number including any suffix, instrument type, serial number, plus a modification number where applicable.

If the part you have ordered has been improved or replaced, your local Field Office will contact you if there is a change in part number.

PARTS LIST
Type 50

Values are fixed unless marked Variable.

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	S/N Range		Description			Tektronix Part Number
C402	101-160X	6.25 μf	EMT	300 v		290-025
C408		250 μf	EMT	6 v		290-111
C430		.005 μf	Cer.	500 v		283-001
C450		47 μμf	Cer.	500 v	10%	281-519
C451	X161-up	6.25 μf	EMT	300 v		290-025
C453		.1 μf	Cer.	100 v		283-012
C456		2.2 μμf	Cer.	500 v		281-500
C457	101-219	18 μμf	Cer.	500 v	10%	281-542
C457	220-up	12 μμf	Cer.	500 v	10%	281-505
C460		47 μμf	Cer.	500 v	10%	281-519
C466		2..2 μμf	Cer.	500 v		281-500
C467	101-219	18 μμf	Cer.	500 v	10%	281-542
C467	220-up	12 μμf	Cer.	500 v	10%	281-505
C487		2.7 μμf	Cer.	500 v	10%	281-547
C488		.01 μf	Cer.	500 v		283-002

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R400		16 Ω	5 w	WW	5%	308-166
R402	101-160X	1 k	½ w			302-102
R408		51 Ω	½ w		5%	301-510
R404		1.2 k	2 w			306-122
R416		1 meg	½ w	Prec.	1%	309-148
R421		470 Ω	½ w			302-471
R424		75 k	½ w	Prec.	1%	309-323
R428		38.3 k	1 w	Prec.	1%	310-074
R430		100 k	½ w			302-104
R431		470 Ω	½ w			302-471
R434		75 k	½ w	Prec.	1%	309-323
R438		38.3 k	1 w	Prec.	1%	310-074
R450	X161-up	2.2 k	½ w			302-222
R451	X161-up	15 k	5 w		5%	308-108
R452		10 k	1 w			304-103
R453	101-219	10 k	½ w			302-103
	220-up	6.8 k	½ w		5%	301-682
R454	X220-up	3.3 k	½ w		5%	301-332
R456		390 k	¼ w			316-394
R457		12.5 k	½ w	Prec.	1%	309-228
R458		820 k	½ w			302-824
R466		390 k	¼ w			316-394
R467		12.5 k	½ w	Prec.	1%	309-228
R468		820 k	½ w			302-824
R479		2 x 10 k	Var.		POSITION	311-228
R481		100 Ω	½ w			302-101
R483		40 k	5 w	WW	5%	308-010
R485		18 k	2 w		5%	305-183
R486		12 k	2 w		5%	305-123
R487		470 k	½ w			302-474

Resistors *(continued)*

							Tektronix Part Number
R488		270 k	½ w				302-274
R490	X250-up	240 k	½ w			5%	301-244
R491		100 Ω	½ w				302-101
R493		40 k	5 w		WW	5%	308-010
R495		18 k	2 w			5%	305-183
R496		12 k	2 w			5%	305-123
R497	101-249	2 k		Var.	WW	CALIBRATION	311-141
R497	250-up	2.5 k		Var.			311-222
R498	101-249	390 Ω	½ w				302-391
R498	250-up	220 Ω	½ w				302-221

Transistors

Q454		2N1631	151-047
Q464		2N1631	151-047

Electron Tubes

V424		6DJ8	154-187
V484		6EW6	154-212
V494		6EW6	154-212

Diodes

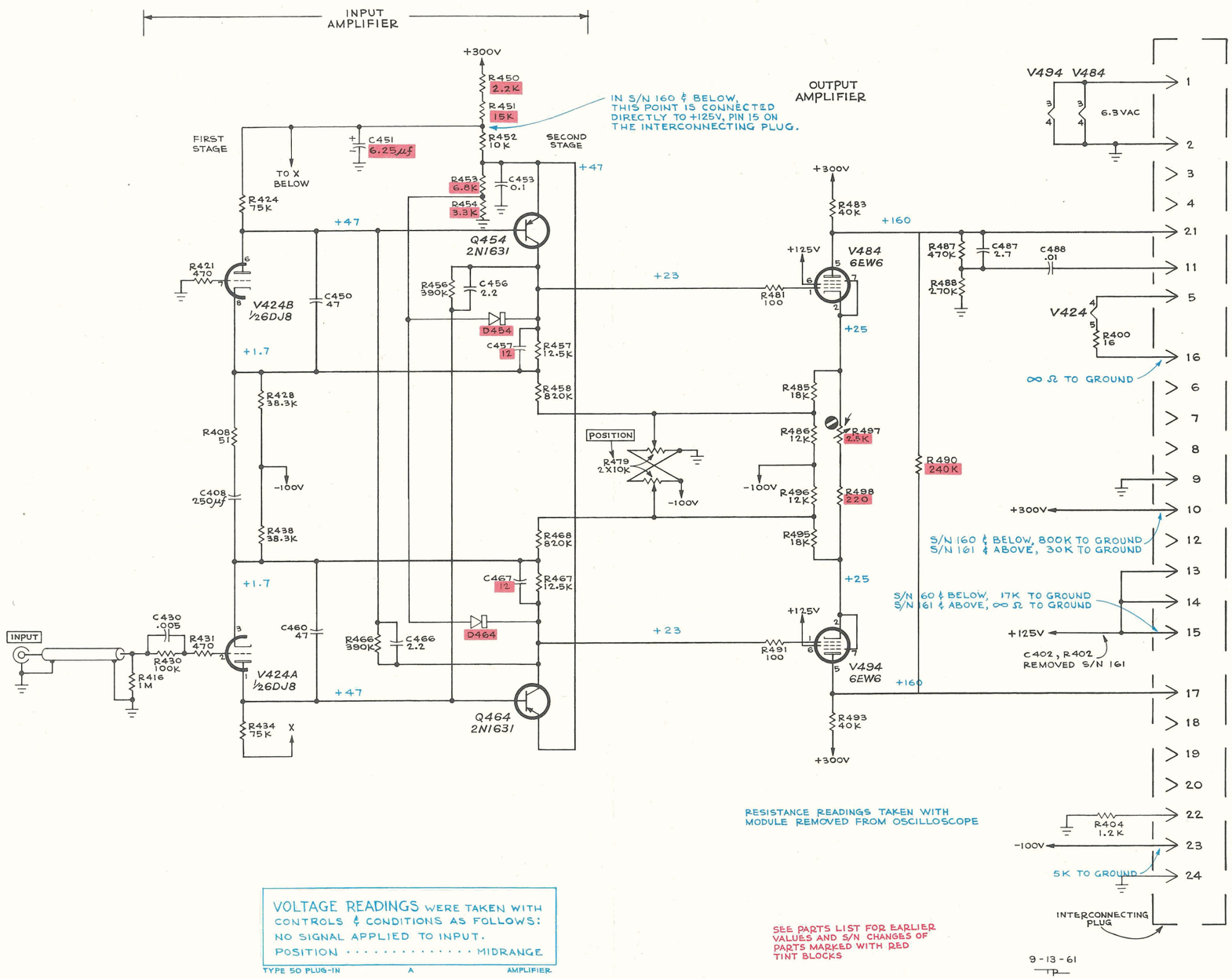
D454	X220-up	T12-G Germanium Diode	152-008
D464	X220-up	T12-G Germanium Diode	152-008

Mechanical Parts List
Type 50

	Tektronix Part Number
BUSHING, ALUM. 3/8-32 x 9/16 x .412	358-010
CABLE, HARNESS	179-490
CHASSIS	441-349
CLAMP, CABLE 3/4" Plastic	343-008
CONNECTOR, CHASSIS MT. 1 contact, female	131-081
CONNECTOR, CHASSIS MT. 24 contact, male	131-149
FASTENER, PAWL, RIGHT w/stop	214-052
GROMMET, RUBBER 3/8	348-004
GROMMET, RUBBER 1/2	348-005
GROMMET, POLYPROPOLENE 1/4 x .202 x 3/32	348-031
GUIDE, PLUG-IN, 5/8 x 13/16 w/3/16 track	351-037
KNOB, SMALL BLACK	366-044
KNOB, ALUM.	366-109
LOCKWASHER, STEEL INT. #4	210-004
LOCKWASHER, STEEL INT. #6	210-006
LOCKWASHER, STEEL INT. 1/4	210-011
LOCKWASHER, STEEL INT. POT, 3/8 x 1/2	210-012
LOCKWASHER, STEEL INT., 3/8 x 11/16	210-013
LOCKWASHER, STEEL, INT. 1/4	210-046
LUG, SOLDER SE4	210-201
LUG, SOLDER SE6 w/2 wire holes	210-202
LUG, SOLDER POT, PLAIN, 3/8	210-207
LUG, GROUND .025 x 15/16	210-241
NUT, HEX 4-40 x 3/16	210-406
NUT, HEX 6-32 x 1/4	210-407
NUT, HEX 3/8-32 x 1/2	210-413
NUT, HEX BUSHING, 3/8-32 x 1/2 x 1 1/16	210-429
NUT, HEX 1/4-28 x 3/8	210-455
PANEL, FRONT	333-634
PLATE, REAR	387-581
PLATE, FRONT	387-583
POST, BINDING	129-053
ROD, FRAME	384-566
SCREW 4-40 x 1/4 BHS	211-008
SCREW 4-40 x 3/8 BHS	211-012
SCREW 4-40 x 3/8 RHS	211-013
SCREW 4-40 x 5/16 PAN HS w/lockwasher	211-033
SCREW 6-32 x 1/4 BHS	211-504

Mechanical Parts List *(continued)*

	Tektronix Part Number
SCREW 6-32 x 3/8 BHS	211-510
SCREW 6-32 x 5/16 FHS 100°, CSK, Phillips	211-538
SCREW 8-32 x 1/2 FHS 100°, Phillips	212-043
SCREW 8-32 x 1/2 RHS Phillips	212-044
SCREW, THREAD CUTTING 4-40 x 1/4 PHS, Phillips	213-035
SCREW, THREAD CUTTING 5-32 x 3/16 PHS, Phillips	213-044
SCREW 2-32 x 5/16 RHS Phillips	213-113
SOCKET STM7	136-007
SOCKET, 9 PIN SHIELDED BASE	136-087
SOCKET, 4 PIN TRANSISTOR	136-095
SPACER, NYLON 3/16 (For Ceramic Strip)	361-008
STRIP, CERAMIC 7/16 x 3 notches, clip mounted	124-092
STRIP, CERAMIC 7/16 x 5 notches, clip mounted	124-093
STRIP, CERAMIC 7/16 x 11 notches, clip mounted	124-106
TAG, SERIAL NO. INSERT	334-679
TUBING, PLASTIC INSUL., #20 BLACK (Skein)	162-504
WASHER, STEEL 6L x 3/8 x .032	210-803
WASHER, STEEL .390 x 9/16 x .020	210-840



VOLTAGE READINGS WERE TAKEN WITH CONTROLS & CONDITIONS AS FOLLOWS:
NO SIGNAL APPLIED TO INPUT.
POSITION . . . . . MIDRANGE

RESISTANCE READINGS TAKEN WITH MODULE REMOVED FROM OSCILLOSCOPE

SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF PARTS MARKED WITH RED TINT BLOCKS

9-13-61
TP

TYPE 50 PLUG-IN A AMPLIFIER