INSTRUCTION MANUAL

Serial Number 2123

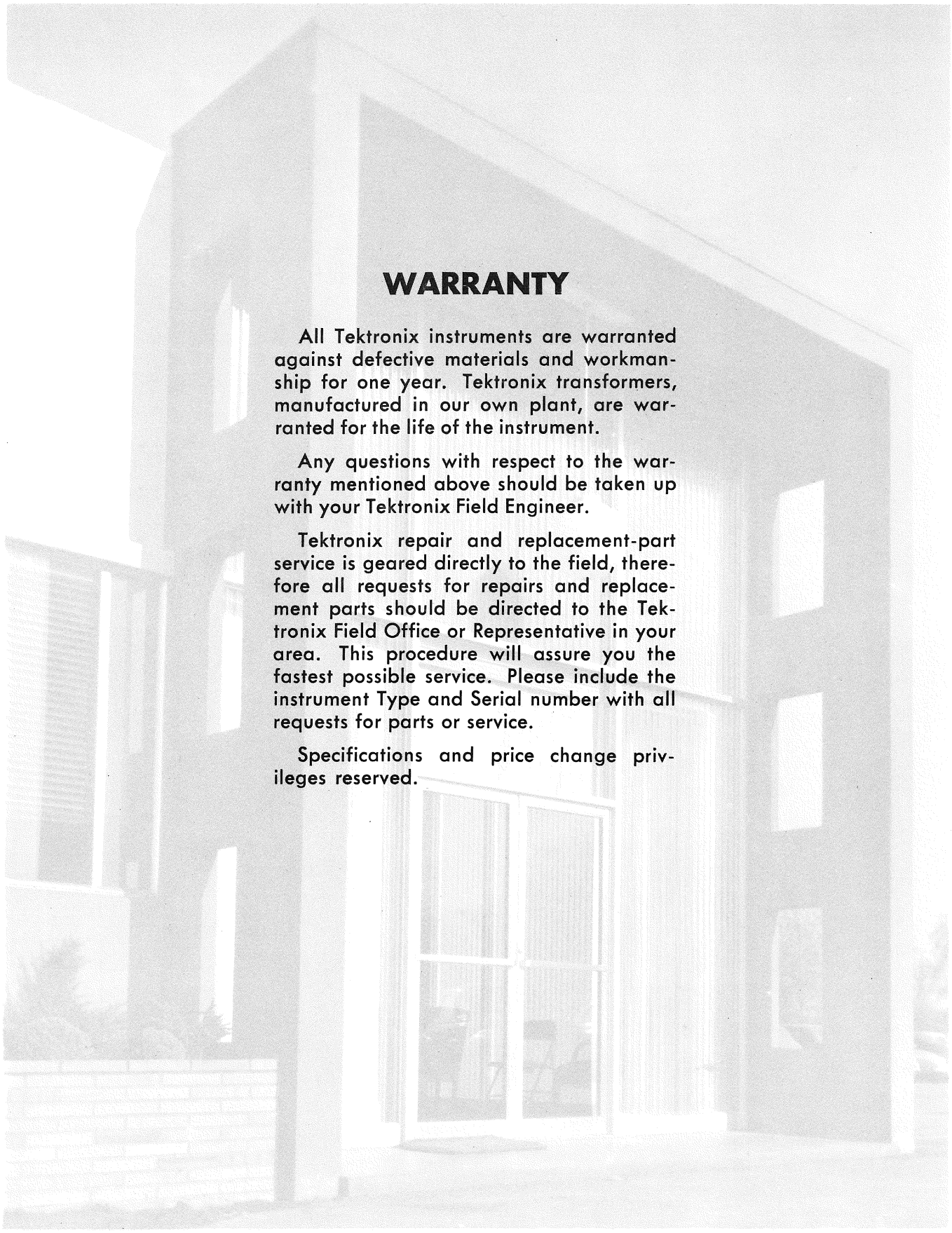
PRIOR TO SERIAL NUMBER 820, THE TYPE 2A60 WAS REFERRED TO AS TYPE 60. The 2A60 Plug-in is interchangeable with the 60 and this manual also applies to the type 60 as far as operation and calibration are concerned.

TYPE 2A60 PLUG-IN

Tektronix, Inc.
S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon ● Phone MI 4-0161 ● Cables: Tektronix

Tektronix International A.G.
Terrassenweg 1A ● Zug, Switzerland ● PH. 042-49192 ● Cable: Tekintag, Zug Switzerland ● Telex 53.574

070-263



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 2A60 Amplifier module.

TYPE 2A60 AMPLIFIER

INTRODUCTION

The Type 2A60 Amplifier module, Fig. 1, is designed for use with Tektronix Type 560-Series Oscilloscopes. It has a bandpass of dc to one megacycle. Sensitivity is adjustable in 4 calibrated steps from .05 volt (50 millivolts) to 50 volts per division of deflection and is continuously variable, uncalibrated, between these steps and up to about 500 volts per division. Accuracy is within 3% at each of the calibrated steps. The Type 2A60 module has an input impedance of 1 megohm paralleled by 47 picofarads. Maximum allowable input signal is 600 volts (dc plus peak ac).

This manual includes operating instructions, circuit description, troubleshooting information, and calibration procedures for the Type 2A60 module. For instructions and information regarding the oscilloscope as a whole, refer to the oscilloscope manual.

Operating Instructions

Throughout the instructions that follow, it is assumed, unless otherwise noted, that the Type 2A60 module is inserted in the Y-axis opening of a Type 560-Series Oscilloscope, thereby providing vertical deflection of the oscilloscope trace. If the module is inserted in the X-axis opening, it will provide horizontal deflection of the trace and the instructions must be interpreted accordingly. It is further assumed 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 cable 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 use with the Type 2A60 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 2A60 module, proceed as follows:

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

2. Establish a common ground between the oscilloscope and the signal source. This can be done by connecting the ground clip on a Tektronix attenuator probe to signal ground.

3. Adjust the time-base controls to obtain a stable display of the signal.

4. Set the VOLTS/DIV. switch and the POSITION control so that the signal is placed as desired on the graticule. In general, if you are interested only in the ac component of the signal, you should set the AC-DC-GND. switch to AC; if you are interested in the dc level of the signal, you should set the AC-DC-GND. switch to DC. An exception to this is in observing low-frequency ac signals. When the AC-DC-GND. switch is in the AC position, the lower bandpass limit (3-db point) of the module is about 1.6 cps; therefore, the best response to signals containing components of less than about 2 cps (0.2 cps with a 10X attenuator probe) will be obtained with the AC-DC-GND. switch in the DC position.

Probe Compensation

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

1. Display several cycles of the calibrator waveform on the crt, using the attenuator probe.

2. Adjust the variable capacitor in the body of the probe to obtain a square leading corner on the positive half cycles (see Fig. 2).

Gain and DC Balance Adjustments

Any time you move the Type 2A60 module from one oscilloscope opening to another you must adjust the gain to compensate for differences in crt deflection sensitivities. This should also be done from time to time even if the module has not been moved. In addition, the dc balance of the module should be checked and adjusted, as necessary, from time to time.

To properly set the gain of the Type 2A60 module, proceed as follows:

1. Set the AC-DC-GND. switch to DC, the VOLTS/DIV. switch to .05, and the VARIABLE control fully clockwise (to the CALIBRATED position).

2. Display a 0.2-volt Calibrator signal on the crt and adjust the front-panel GAIN ADJ. control for a deflection of exactly 4 divisions; or, display a 100-millivolt Calibrator signal and adjust the GAIN ADJ. control for a deflection of exactly 2 divisions (the first method is preferred).

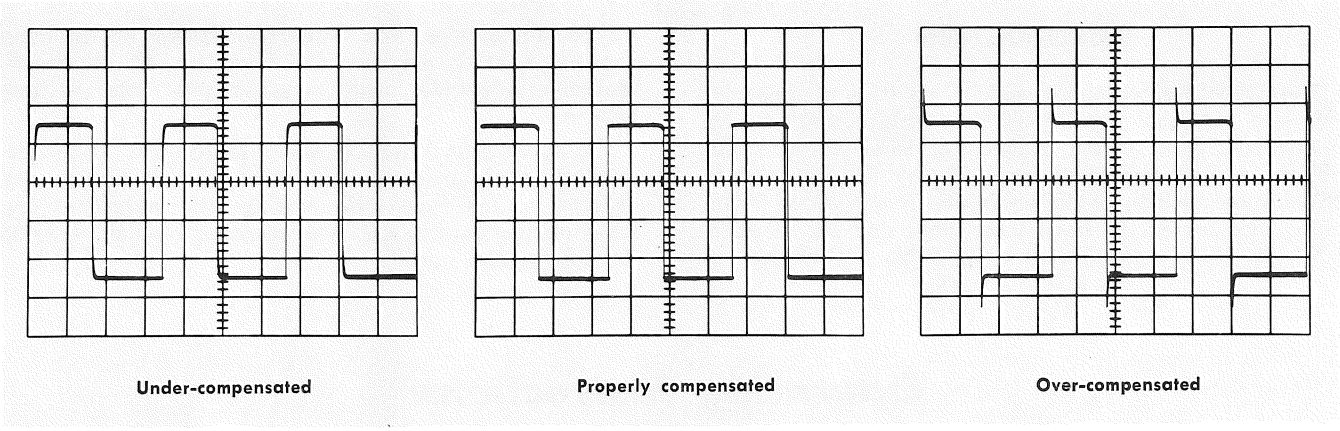


Fig. 2. Probe compensation. When the probe is properly compensated, the displayed calibrator waveform will have square leading corners, as shown in center photograph.

To properly adjust the dc balance of the Type 2A60 module, proceed as follows:

1. Set the AC-DC-GND. switch to GND.

2. Display a free-running trace (or spot, if you are not using a time-base module).

3. Adjust the front-panel DC BAL. adjustment until the trace does not move as you rotate the VARIABLE control back and forth throughout its range.

Voltage Measurements

NOTE

When making measurements, make sure there is a common ground between the oscilloscope and the signal source.

To measure the potential difference between two points on a signal (such as peak-to-peak ac volts), measure the vertical distance, in graticule divisions, between the two points whose potential difference is desired, and multiply by the setting of the VOLTS/DIV. switch and the attenuation factor, if any, of the signal probe. Be sure the VARIABLE VOLTS/DIV. control is set fully clockwise (to the CALIBRATED position).

When the VARIABLE VOLTS/DIV. control is not in the CALIBRATED position, the amplitude of a signal can be determined by comparing its displayed amplitude with the displayed amplitude of a known signal, such as the Calibrator waveform.

To measure the dc level at a given point on a waveform, proceed as follows:

1. Set the AC-DC-GND. switch to GND. Make sure the VARIABLE control is set fully clockwise (to the CALIBRATED position).

2. Position a free-running trace (or the spot, if you are not using a time-base module) so that it lies along one of the horizontal graticule lines. This line will be used as a zero reference line; its position in any given case will depend upon the polarity and amplitude of the voltage to be measured. Do not adjust the POSITION control on the Type 2A60 module after the reference line has been established.

3. Set the AC-DC-GND. switch to DC. (If the position of the trace shifts by more than 1 minor graticule division, see Troubleshooting, "Dc Reference-Level Shift.")

4. Touch the probe tip to the signal source and adjust the time-base controls to obtain a stable display.

5. Measure the distance, in graticule divisions, from the zero reference line established in step 2 to the point on the waveform at which the dc level is desired.

6. Multiply this distance by the setting of the VOLTS/DIV. switch and the attenuation factor, if any, of the probe. This is the dc level of the point measured.

You can reestablish your zero reference line at any time merely by placing the AC-DC-GND. switch to GND.; you do not need to disconnect the probe from the signal source. If desired, you can establish a reference other than zero by placing the AC-DC-GND. switch to DC, connecting the signal probe to the desired reference voltage, and positioning the trace as described in step 2 of the procedure.

Circuit Description

The Type 2A60 Amplifier consists basically of an Input Amplifier, a Driver-Cathode Follower Stage, and an Output Amplifier. The Input Amplifier, V434 and V444, is a cathode-coupled paraphase amplifier which converts the single-ended input to a push-pull output. The Driver Cathode Follower stage, V463, provides isolation between the Input Amplifier and the Output Amplifier. The Output Amplifier, V474, drives the crt deflection plates and the trigger pickoff circuit. Step changes in amplifier sensitivity are accomplished by changes in input attenuation. Vernier sensitivity control is accomplished by degeneration in the cathode circuit of the Input Amplifier.

Input Circuit

The AC-DC-GND. switch, SW400, permits the applied signal to be either ac or dc coupled to the grid of the Input Amplifier. Placing the switch in the AC position places C400 between the INPUT connector and the Input Amplifier, thereby blocking the dc component of the signal. Placing the switch in the GND. position grounds the grid circuit of the Input Amplifier (it does not ground the applied signal.)

The signal at the INPUT connector is applied either "straight through" or through one of three attenuators . . . 10X, 100X, or 1000X . . . to the grid of V434. This provides overall amplifier sensitivities of 0.05, 0.5, 5, and 50 volts per graticule division of deflection at the crt.

The attenuators are both resistance and capacitance dividers which provide constant attenuation of the signal throughout the frequency range of the amplifier. In addition to providing the proper degree of attenuation, the resistance and capacitance values of the attenuators are chosen or adjusted to provide a constant input impedance of 1 megohm paralleled by 47 picofarads, regardless of the setting of the VOLTS/DIV. switch.

Input Amplifier

The gain of the Input Amplifier is controlled by the setting of the GAIN ADJ. adjustment and the VARIABLE control. The GAIN ADJ. adjustment sets the gain of the stage to correspond to the proper value when the VARIABLE control is set fully clockwise (to the CALIBRATED position).

The DC BAL. adjustment provides the means of setting the quiescent cathode potential of V444 equal to that of V434 so that there is no current through R436 and R446 when no signal is applied. When the DC BAL. adjustment is so set, the dc zero reference level on the crt is the same throughout the range of the VARIABLE control.

The POSITION control changes the quiescent plate voltages of V434 and V444, inversely to one another, between about +37 and +46 volts. This change provides a dc shift in the level of the signal at the output of the Output Amplifier, thereby changing the position of the trace on the screen.

C465 and C466 compensate for changes in the input capacitance of V434 and V444 as the setting of the VARIABLE control is changed.

Output Amplifier

The Output Amplifier has a gain of about 20. D474 and D476 improve the linearity near the ends of its range by effectively reducing the cathode-coupling resistance whenever the potential difference between the cathodes exceeds about 0.2 volt.

Trigger Pickoff Circuit

The Trigger Pickoff circuit samples the signal at the plate of V474A and applies the sample through V483 to the trigger input circuit of the time-base module, if one is used. The output of the Trigger Pickoff circuit has a peak-to-peak amplitude of about 5 volts for each division of deflection on the screen.

Hum Balance

The HUM BAL. adjustment provides a means of minimizing any line-frequency hum capacitively or inductively coupled into signal leads from the 6.3-volt ac heater leads.

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 2A60 module by the procedures described there.

No Spot or Trace

If there is no spot or trace on the crt screen, connect a shorting strap between each pair of points shown in Fig 3, starting at the right and working toward the left. As you short between each pair of points, the spot or trace should appear on the screen. When you reach the point where the spot or trace no longer appears when the connections are made, the stage immediately following this point is at fault.

Insufficient Deflection

If the proper deflection cannot be obtained through adjustment of the GAIN ADJ. adjustment (see Operating

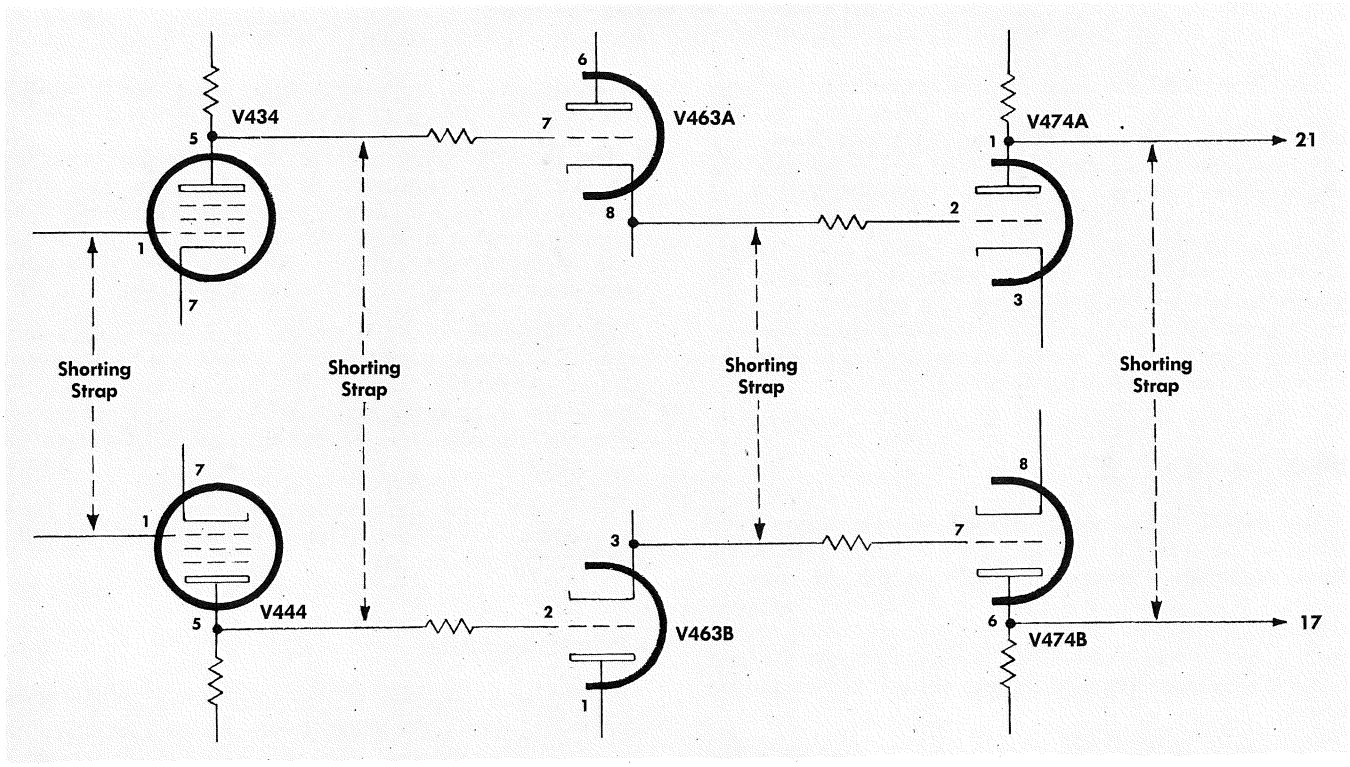


Fig. 3. Checkpoints for isolating dc imbalance in the Type 2A60 module.

Instructions), rotate the POSITION control and see if it has normal range. It should move a no-signal trace or spot off the screen in both directions. If it does not, the trouble is probably in the Driver Cathode Follower or the Output Amplifier. If the POSITION control does have normal range, leave it at mid-range and check the deflection at all positions of the VOLTS/DIV. switch. If the trouble is present at only one position of the switch, the trouble is probably in the associated attenuator. If the trouble is present at all positions of the VOLTS/DIV. switch, the trouble is probably in the Input Amplifier. Check especially the common cathode and plate load resistors.

Dc Reference-Level Shift

If, when there is no signal applied to the INPUT connector, the position of a free-running trace (or spot) changes more than 1 minor graticule division as the AC-DC-GND. switch is moved from GND. to DC or as the VOLTS/DIV. switch is moved between positions, V434 is probably gassy. Before replacing it, try swapping it with V444; the tube may work satisfactorily in that position.

If this condition occurs and cannot be immediately corrected, satisfactory measurement of dc levels can be accomplished by establishing the zero reference line with the AC-DC-GND. switch in the DC position and the signal probe touched to signal ground. (See Operating Instructions, "Voltage Measurements.") In this case, you should reestablish the zero reference line each time you move the VOLTS/DIV. switch.

Calibration

Calibration of the Type 2A60 module is performed with the module inserted in the Y-axis opening of a Type 560-Series Oscilloscope and a time-base module inserted in the X-axis opening. Calibration consists of internal trigger dc level adjustment, hum balance adjustment, and attenuator frequency compensation. If you are performing a complete calibration of the module, you should perform them in the order presented. However, any one of the adjustments may be performed independently of the others as long as you perform all of the steps in the procedure.

Shield the instrument as much as possible during the hum balance adjustment and attenuator frequency compensation. Holding the oscilloscope side panels as nearly in place as possible while still permitting access to the adjustments will probably be sufficient. No shielding is necessary during adjustment of the internal trigger dc level.

The locations of the internal adjustments referred to in the calibration procedures are shown in Fig. 4.

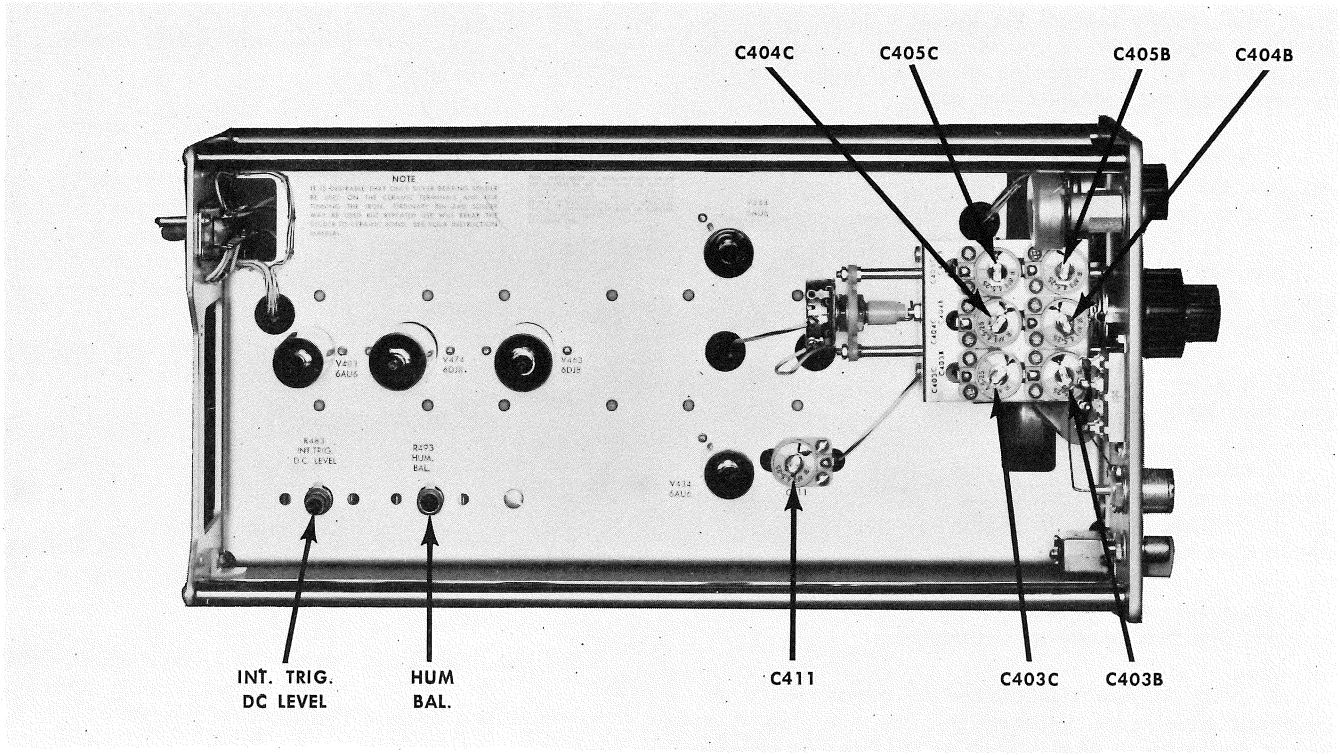


Fig. 4. Type 2A60 module calibration adjustments.

Equipment Required

The following equipment is required to calibrate the Type 2A60 Amplifier module:

1. Square-wave generator with a risetime of 0.35 microsecond or less and a frequency of 1 kc or less. (You may use the Calibrator output if a square-wave generator is not available. See "Attenuator Frequency Compensation", step 2.)

2. 47-pf capacitance standardizer (Tektronix Type CS 47 recommended), or a capacitance meter and an attenuator probe.

3. Dc Voltmeter.

Internal Trigger Dc Level Adjustment

The need for adjustment of the internal trigger dc level is generally indicated by triggering difficulties with a time-base module set for internal dc triggering of the sweep. To properly adjust the internal trigger dc level, proceed as follows:

1. Set the AC-DC-GND. switch to GND. and the VARIABLE control fully clockwise (to the CALIBRATED position).

2. Center the spot or trace on the screen.

3. Set the INT. TRIG. DC LEVEL adjustment so that the potential at pin 11 of the plug-in connector is exactly zero with respect to ground.

Hum Balance Adjustment

The need for hum balance adjustment is indicated by the presence of excessive 60-cps ripple on the trace. To properly adjust for hum balance in the Type 2A60 module, proceed as follows:

1. Set the AC-DC-GND. switch to AC, the VOLTS/DIV. switch to .05, and the VARIABLE control fully clockwise (to the CALIBRATED position).

2. Display a no-signal trace on the screen (preferably triggered at line frequency).

3. Shield the INPUT connector (this can be done by placing a small flat piece of metal, such as a coin, over the face of the connector), and set the FOCUS and INTENSITY controls for the sharpest trace possible.

4. Adjust the HUM BAL. adjustment to minimize any line-frequency ripple on the trace.

Input Capacitance Standardization and Attenuator Frequency Compensation

The input capacitance standardization and attenuator frequency compensation interact, so both are performed in the same procedure. The need for either or both of these calibrations is normally indicated by distortion of fast-rising waveforms on one or more sensitivity ranges of the module. Standardization of the input capacitance of the

Type 2A60 Amplifier

Type 2A60 module requires the use of a 47-picofarad capacitance standardizer. If you do not have a 47-picofarad standardizer, you can make an attenuator probe into one by performing the following five steps:

1. With the Type 2A60 module inserted in left-hand opening, turn the oscilloscope on. Set the VOLTS/DIV. switch to .05 and the AC-DC-GND. switch to DC.

2. Measure the input capacitance at the INPUT connector. With a low-capacitance screwdriver, adjust C411 for a reading of 47 picofarads on the capacitance meter.

3. Disconnect the capacitance meter and connect the attenuator probe to the INPUT connector.

4. Connect the probe tip to the output of the square-wave generator or the oscilloscope Calibrator, and adjust the oscilloscope controls to display several cycles of the square-wave signal.

5. Adjust the variable capacitor in the body of the probe to obtain the best square-wave response.

Your probe is now standardized to perform as a 47-picofarad capacitance standardizer. You may use it as such in the following procedure to set the input capacitance of any module to 47 picofarads. (Do not adjust the probe further during the procedure.)

To set the input capacitance of the module to 47 picofarads and properly compensate the attenuators of the Type 2A60 module, proceed as follows:

1. Set the AC-DC-GND. switch to DC, the VOLTS/DIV. switch to .05, and the VARIABLE control fully clockwise (to the CALIBRATED position).

2. Apply the output of the square-wave generator or the oscilloscope Calibrator through the 47-pf capacitance standardizer or the standardizer probe to the INPUT connector. Throughout this procedure the amplitude of the square wave should be adjusted to produce between 5 and 8 divisions on the crt, if possible. You may use the VARIABLE control on the Type 2A60 module, if necessary.

3. Set the time base controls so that at least one complete cycle of the square wave can be seen on the screen.

4. With a low-capacitance tuning tool, adjust C411 for the most nearly square leading corner on the positive half cycle of the displayed waveform.

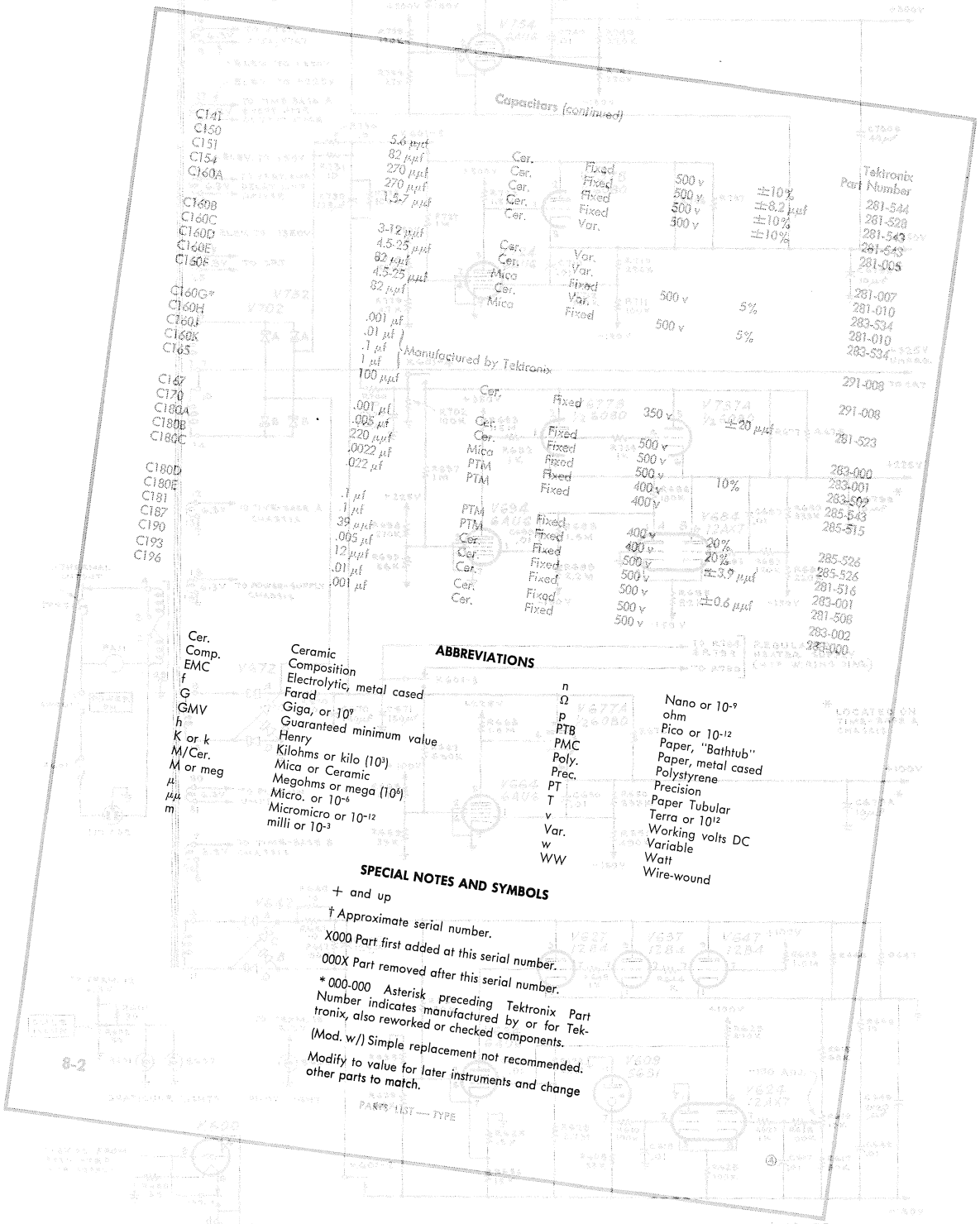
5. Set the VOLTS/DIV. switch to .5 and adjust C405B and C405C for the most nearly square leading corner on the positive half cycle of the displayed waveform.

6. Set the VOLTS/DIV. switch to 5, and adjust C404B and C404C for the most nearly square leading corner on the positive half cycle of the displayed waveform.

7. Set the VOLTS/DIV. switch to 50, and adjust C403B and C403C for the most nearly square leading corner on the positive half cycle of the displayed waveform.

8. Disconnect the square-wave generator and the capacitance standardizer.

PARTS LIST *and* DIAGRAMS



Capacitors (continued)

						Tektronix Part Number
C141	5.6 μμf	Cer.	Fixed	500 v	±10%	281-544
C150	82 μμf	Cer.	Fixed	500 v	±8.2 μμf	281-528
C151	270 μμf	Cer.	Fixed	500 v	±10%	281-543
C154	270 μμf	Cer.	Fixed	500 v	±10%	281-543
C160A	1.5-7 μμf	Cer.	Var.			281-005
C160B	3-12 μμf	Cer.	Var.			281-007
C160C	4.5-25 μμf	Cer.	Var.			281-010
C160D	82 μμf	Mica	Fixed	500 v	5%	283-534
C160E	4.5-25 μμf	Cer.	Var.			281-010
C160F	82 μμf	Mica	Fixed	500 v	5%	283-534
C160G*	.001 μf	Manufactured by Tektronix				
C160H	.01 μf					
C160J	.1 μf					
C160K	1 μf					
C165	100 μμf					
C167	.001 μf	Cer.	Fixed	350 v		291-008
C170	.005 μf	Cer.	Fixed	500 v	±20 μμf	291-008
C180A	220 μμf	Cer.	Fixed	500 v		281-523
C180B	.0022 μf	Mica	Fixed	500 v		
C180C	.022 μf	PTM	Fixed	500 v		283-000
C180D	.1 μf	PTM	Fixed	400 v	10%	283-001
C180E	1 μf	PTM	Fixed	400 v		283-502
C181	39 μμf	Cer.	Fixed	400 v		285-543
C187	.005 μf	Cer.	Fixed	400 v	20%	285-515
C190	12 μμf	Cer.	Fixed	500 v	20%	
C193	.01 μf	Cer.	Fixed	500 v	±3.9 μμf	285-526
C196	.001 μf	Cer.	Fixed	500 v		285-526
		Cer.	Fixed	500 v	±0.6 μμf	281-516
		Cer.	Fixed	500 v		283-001
						281-506
						283-002
						283-000

ABBREVIATIONS

Cer.	Ceramic	n	Nano or 10^{-9}
Comp.	Composition	Ω	ohm
EMC	Electrolytic, metal cased	p	Pico or 10^{-12}
f	Farad	PTB	Paper, "Bathtub"
G	Giga, or 10^{9}	PMC	Paper, metal cased
GMV	Guaranteed minimum value	Poly.	Polystyrene
h	Henry	Prec.	Precision
K or k	Kilohms or kilo (10^{3})	PT	Paper Tubular
M/Cer.	Mica or Ceramic	T	Terra or 10^{12}
M or meg	Megohms or mega (10^{6})	v	Working volts DC
μ	Micro. or 10^{-6}	Var.	Variable
μμ	Micromicro or 10^{-12}	w	Watt
m	milli or 10^{-3}	WW	Wire-wound

SPECIAL NOTES AND SYMBOLS

\+ and up

† Approximate serial number.

X000 Part first added at this serial number.

000X Part removed after this serial number.

* 000-000 Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.

(Mod. w/) Simple replacement not recommended. Modify to value for later instruments and change other parts to match.

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PARTS LIST — TYPE

POWER SUPPLY

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 2A60

Values are fixed unless marked Variable.

Capacitors

Tolerance ±20% unless otherwise indicated.

						Tektronix Part Number
C400	.1 μf	PTM		600 v		285-587
C403B	4.5-25 μμf	Cer.	Var.			281-010
C403C	4.5-25 μμf	Cer.	Var.			281-010
C403E	.01 μf	Mica		300 v	10%	283-564
C404B	4.5-25 μμf	Cer.	Var.			281-010
C404C	4.5-25 μμf	Cer.	Var.			281-010
C404E	1000 μμf	Mica		500 v	5%	283-527
C405B	4.5-25 μμf	Cer.	Var.			281-010
C405C	4.5-25 μμf	Cer.	Var.			281-010
C405E	100 μμf	Cer.		500 v	10%	281-530
C411	4.5-25 μμf	Cer.	Var.			281-010
C425	.01 μf	Discap		500 v		283-002
C430	.01 μf	Discap		500 v		283-002
C432	.01 μf	Discap		150 v		283-003
C465	3.3 μμf	Cer.			±0.25 μμf	281-534
C466	3.3 μμf	Cer.			±0.25 μμf	281-534
C475	.0033 μf	Discap		500 v	5%	283-041
C481	1.8 μμf	Cer.		500 v		281-557
C484	.01 μf	Discap		500 v		283-002
C495	.1 μf	Discap		500 v		283-008
C497	.1 μf	Discap		500 v		283-008

Diodes

D474	T12G, Germanium	152-008
D476	T12G, Germanium	152-008

Inductors

LR433	180 μh	*108-028
L443	400 μh	*108-214

Resistors

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

R400	X301-up	47 Ω	½ w			10%	302-470
R403C		1 meg	½ w		Prec.	1%	309-148
R403E		1 k	½ w		Prec.	1%	309-115
R404C		990 k	½ w		Prec.	1%	309-145
R404E		10.1 k	½ w		Prec.	1%	309-135
R405C		900 k	½ w		Prec.	1%	309-142
R405E		111 k	½ w		Prec.	1%	309-138
R411		1 meg	½ w		Prec.	1%	309-148
R421		1 meg		Var.		DC BAL.	311-184
R423		2.2 meg	½ w				302-225
R425		10 k	½ w				302-103

Resistors *(continued)*

							Tektronix Part Number
R430		100 k	½ w				302-104
R431		100 Ω	½ w				302-101
R432		5.25 k	½ w		Prec.	1%	309-032
R434		11.48 k	½ w		Prec.	1%	309-192
R436		10 k	2 w	Var.		VARIABLE	Use 311-076
R437		18 k	1 w		Prec.	1%	310-066
R441		100 Ω	½ w				302-101
R444		11.48 k	½ w		Prec.	1%	309-192
R446		1 k		Var.		GAIN ADJUST	311-220
R447		18 k	1 w		Prec.	1%	310-066
R451		430 k	½ w			5%	301-434
R453		2 x 500 k		Var.		POSITION	311-226
R455		430 k	½ w			5%	301-434
R460		100 Ω	½ w				302-101
R461		100 Ω	½ w				302-101
R465		22 k	½ w			5%	301-223
R466		1.5 k	½ w			5%	301-152
R467		22 k	½ w			5%	301-223
R470		100 Ω	½ w				302-101
R471		100 Ω	½ w				302-101
R473		10 k	5 w		WW	5%	308-054
R474		4.7 k	1 w			5%	303-472
R475	101-300	82 Ω	½ w			5%	301-820
R475	301-up	39 Ω	½ w			5%	Use 301-390
R476		4.7 k	1 w			5%	303-472
R477		10 k	5 w		WW	5%	308-054
R480	X740-up	4.7 meg	½ w			5%	301-475
R481	101-739	470 k	½ w			5%	301-474
R481	740-up	1 meg	½ w		Prec.	1%	309-014
R482	101-739	100 k	½ w			5%	301-104
R482	740-up	500 k	½ w		Prec.	1%	309-003
R483	101-739	100 k		Var.		Int. Trig. DC Level	311-207
R483	740-up	250 k		Var.			Use 311-373
R484		2.2 k	½ w				302-222
R485		100 Ω	½ w				302-101
R486		33 k	½ w				302-333
R493	101-431X	250 Ω		Var.		Hum Bal.	311-194
R495		27 Ω	½ w				302-270
R497		27 Ω	½ w				302-270

Switches

			Wired	Unwired
SW400	101-819	Slide AC-DC		260-251
SW400	820-up	Slide AC-DC		260-450
SW406		Rotary VOLTS/Div.	*262-373	260-347

Electron Tubes

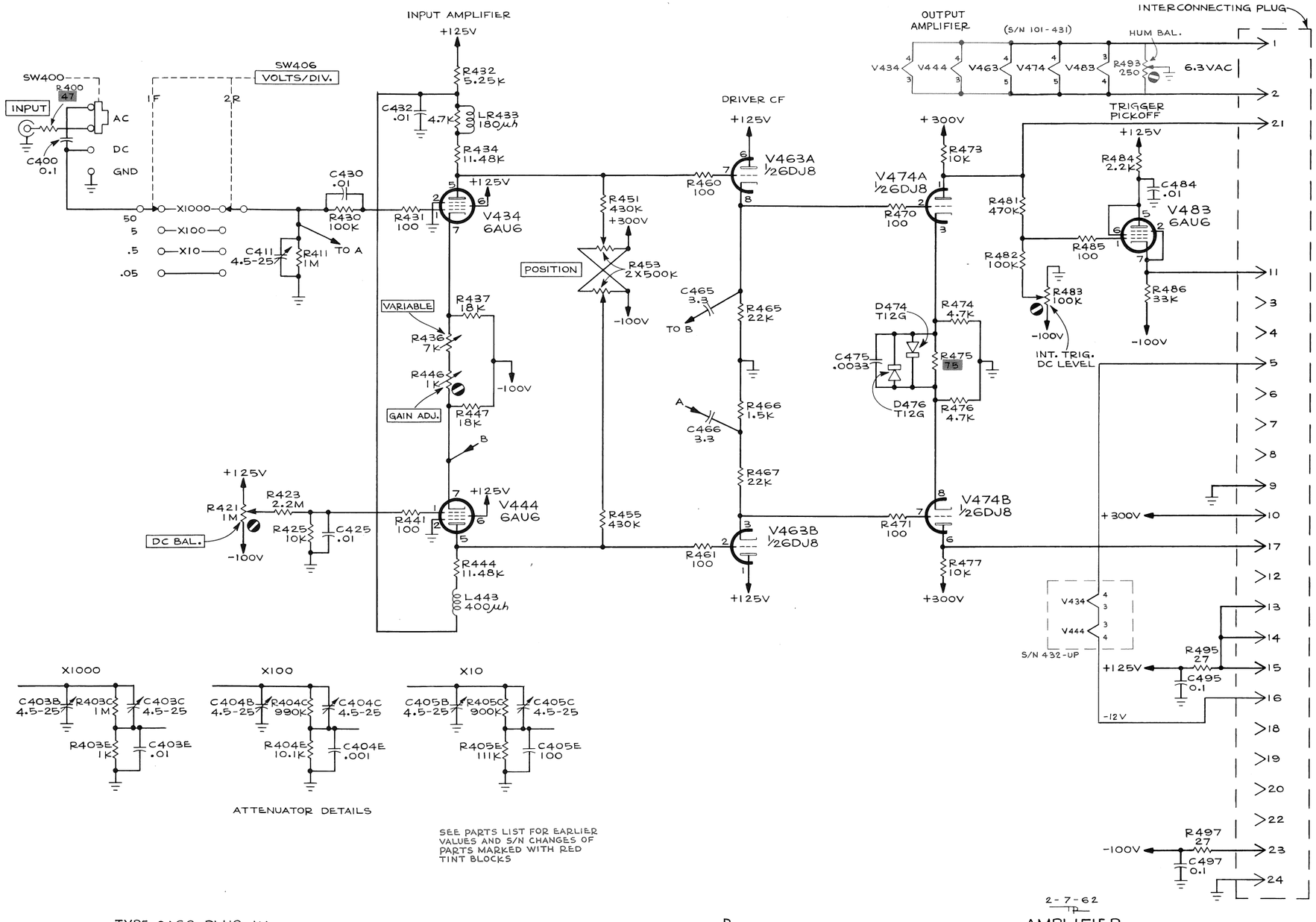
V434	6AU6	154-022
V444	6AU6	154-022
V463	6DJ8	154-187
V474	6DJ8	154-187
V483	6AU6	154-022

Type 2A60
Mechanical Parts List

	Tektronix Part Number
BRACKET, NYLON MLD. .600 WIDE x 1.313 LG. (POT)	406-101
BRACKET, INPUT. ATTEN.	406-615
BUSHING, 3/8-32 x 9/16 x .412	358-010
CABLE HARNESS SN 101-431	179-458
CABLE HARNESS SN 432-up	179-547
CAP, POT 1" DIA. x .390 HI	200-247
CHASSIS SN 101-431	441-333
CHASSIS SN 432-up	441-391
CONNECTOR, CHAS. MT. 1 CONT. FEMALE (101-1149)	131-081
CONNECTOR, CHAS. MT. BNC (1150-up)	131-126
CONNECTOR, CHAS. MT. 24 CONT. MALE	131-149
COUPLING, CAP NYLON MLD. 17/32 LG	376-010
COUPLING, POT WIRE STEEL	376-014
FASTENER, PAWL RIGHT W/STOP	214-052
FASTENER, SNAP DOUBLE-PRONGED	214-153
GROMMET, RUBBER 3/8	348-004
GUIDE, DELRIN 5/8 x 13/16 W/3/16 TRACK	351-037
LOCKWASHER, INT. #4	210-004
LOCKWASHER, INT. 1/4	210-011
LOCKWASHER POT INT. 3/8 x 1/2	210-012
LOCKWASHER POT INT. 3/8 x 11/16	210-013
LOCKWASHER, INT. 1/4	210-046
LUG, SOLDER SE4	210-201
LUG, GROUND .025 THICK MILD STEEL 15/16 LG.	210-241
KNOB, SMALL RED 1/8 HOLE PART WAY	366-038
KNOB, SMALL BLACK 1/4 HOLE PART WAY (101-819)	366-044
KNOB, SMALL CHARCOAL 1/4 HOLE PART WAY (820-up)	366-113
KNOB, LARGE BLACK 17/64 HOLE THRU (101-819)	366-058
KNOB, LARGE CHARCOAL 17/64 HOLE THRU (820-up)	366-144
KNOB, PLUG-IN SECURING 9/16 x 5/8	366-109
NUT, HEX 5-40 x 3/16	210-406
NUT, HEX 3/8-32 x 1/2	210-413
NUT, HEX 1/4-28 x 3/8 x 3/32	210-455
NUT, 3/8-32 x 1/2 x 11/16	210-494
PANEL, FRONT	Use 333-725
PLATE, FRONT	387-577

Mechanical Parts List *(continued)*

	Tektronix Part Number
PLATE, REAR	387-581
POST, BINDING ASS'Y 355-507 & 200-103	129-053
ROD, EXT. $1/8 \times 3\,31/32$	384-231
ROD, FRAME $3/8 \times 12\,1/4$ TAPPED 8-32 BOTH ENDS	Use 384-615
SCREW, 4-40 x $3/16$ BHS	211-007
SCREW, 4-40 x $1/4$ BHS	211-008
SCREW, 4-40 x $3/8$ RHS	211-013
SCREW, 6-32 x $1/4$ BHS	211-504
SCREW, 6-32 x $5/16$ FHS, 100°, CSK, PHILLIPS	211-538
SCREW, 8-32 x $1/2$ FHS, 100°	212-043
SCREW, 8-32 x $1/2$ RHS, PHILLIPS	212-044
SCREW, THREAD CUTTING 5-32 x $3/16$ PAN HS, PHILLIPS	213-044
SPACER, NYLON MLD. $3/8$ FOR CERAMIC STRIP	361-009
SOCKET, STM7G	136-008
SOCKET, STM9G	136-015
STRIP, CERAMIC $7/16 \times 9$ NOTCHES, CLIP MTD.	124-095
WASHER, STEEL .390 x $9/16$	210-840



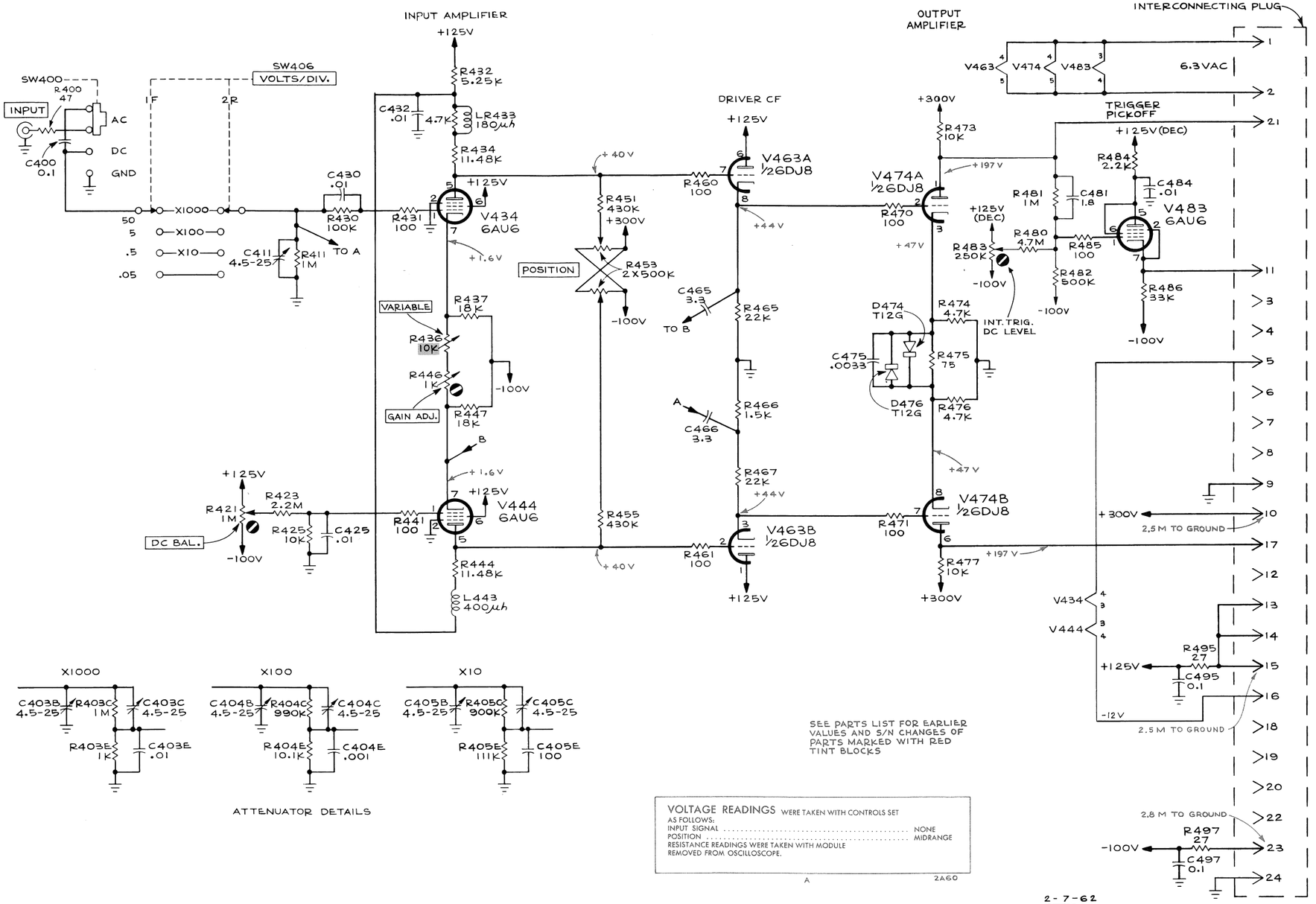
TYPE 2AG0 PLUG-IN

D

2-7-62

AMPLIFIER

S/N 101 THRU 739



X1000

X100

X10

ATTENUATOR DETAILS

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

VOLTAGE READINGS WERE TAKEN WITH CONTROLS SET AS FOLLOWS:

INPUT SIGNAL	NONE
POSITION	MIDRANGE

RESISTANCE READINGS WERE TAKEN WITH MODULE REMOVED FROM OSCILLOSCOPE.

A 2A60

TYPE 2A60 PLUG-IN

B

2-7-62 TP

AMPLIFIER

S/N 740 & UP

AMPLIFIER

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages. If it does not, your manual is correct as printed.