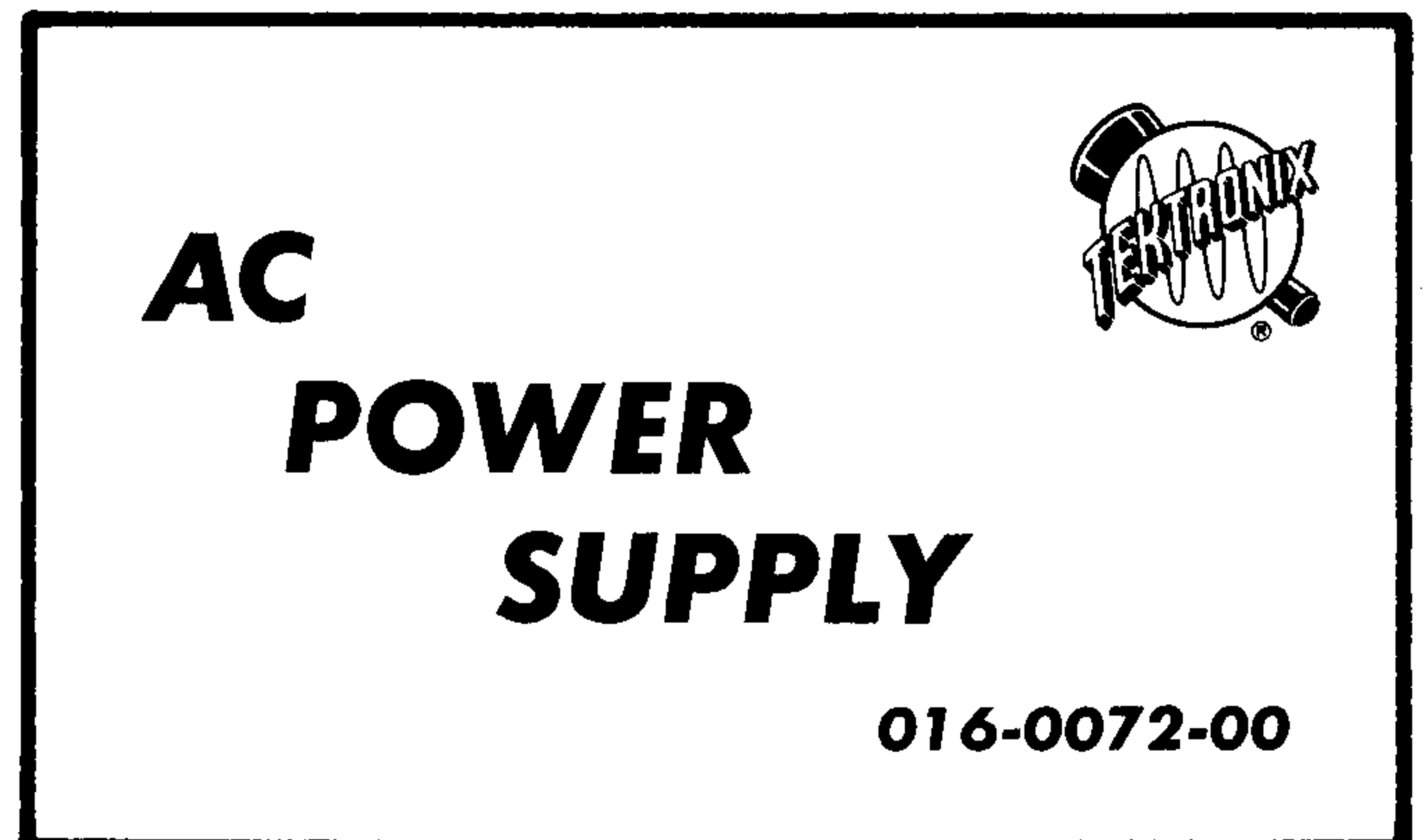


INSTRUCTION MANUAL

Serial Number _____



Tektronix, Inc.

S.W. Millikan Way • P. O. Box 500 • Beaverton, Oregon 97005 • Phone 644-0161 • Cables: Tektronix
070-0528-00

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Kurt's TekWiki

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WARRANTY

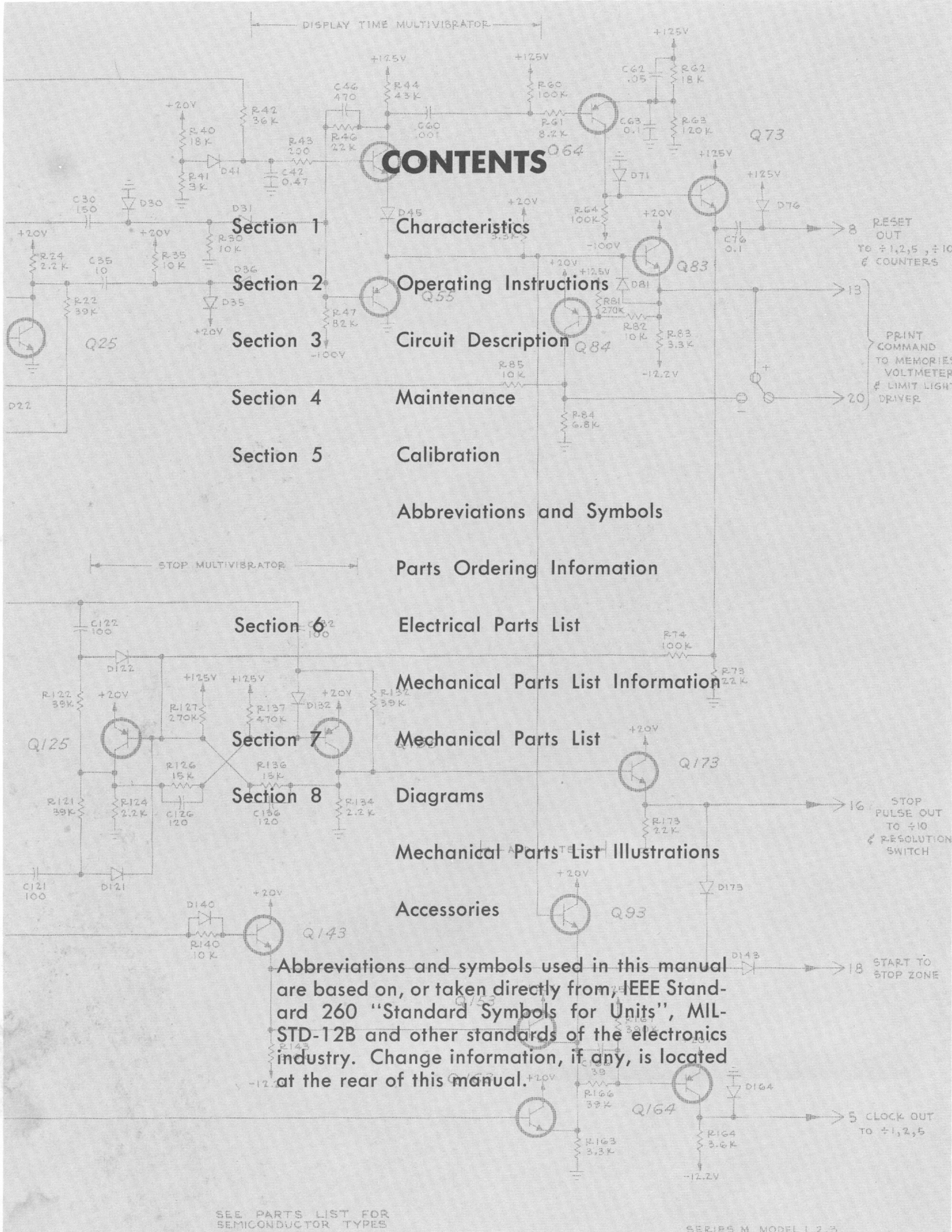
All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

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Abbreviations and symbols used in this manual are based on, or taken directly from, IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

SERIES M MODEL 1, 2, 3

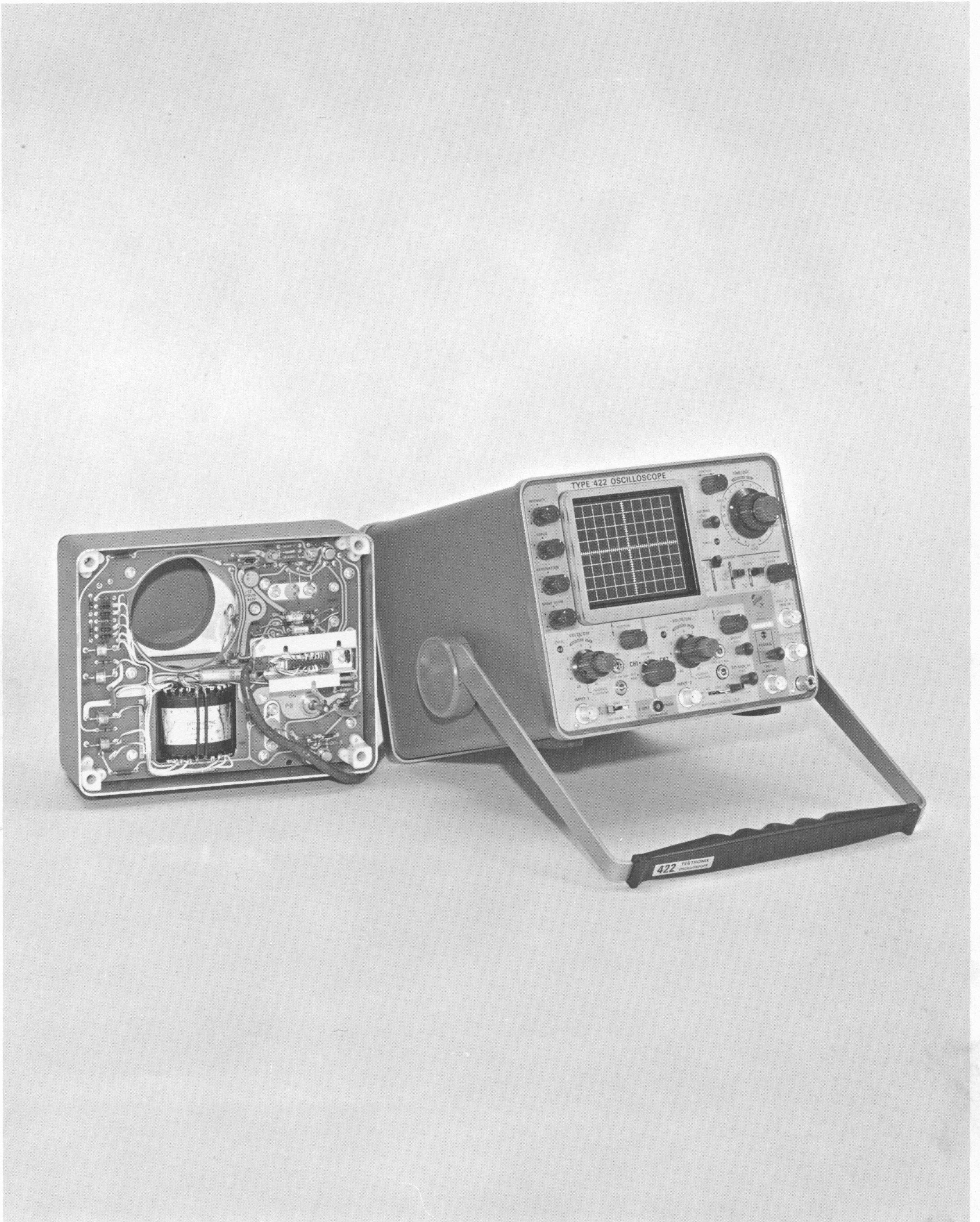


Fig. 1-1. Type 422 AC Power Supply with Type 422 Indicator.

SECTION 1

CHARACTERISTICS

Introduction

The Tektronix 016-0072-00 AC Power Supply provides the necessary operating voltages for the Type 422 Indicator from an AC-line voltage source. The AC Power Supply may be operated from either a 115-volt or 230-volt nominal line.

The following characteristics apply over an ambient temperature range of -15°C to $+55^{\circ}\text{C}$. Warm-up time for given accuracy is 20 minutes.

STANDARD ACCESSORIES

Standard accessories supplied with the 016-0072-00 AC Power Supply are listed on the last pullout page at the rear of this manual. For optional accessories available for use with this instrument, see the current Tektronix, Inc. catalog.

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Voltage Requirements 115-volts nominal	105 volts $\pm 10\%$, 115 volts $\pm 10\%$, or 125 volts $\pm 10\%$, RMS.	Applicable when line contains 1% or less total harmonic distortion. Power transformer must be rewired to convert between nominal voltage ranges or to higher or lower than nominal voltage.
230-volts nominal	210 volts $\pm 10\%$, 230 volts $\pm 10\%$, or 250 volts $\pm 10\%$, RMS.	
Line Frequency	45 to 440 hertz	
Power Consumption		40 watts maximum
Line Fuse 115-volts nominal		0.6 amp, slow-blow
230-volts nominal		0.3 amp, slow-blow

MECHANICAL CHARACTERISTICS

Characteristics	Information
Construction	
Chassis	Aluminum alloy
Cabinet	Aluminum alloy with blue-vinyl finish

Circuit board	Glass-epoxy laminate
Overall Dimensions (measured at maximum points)	
Height	6.75 inches
Width	8.375 inches
Depth	3.875 inches

SECTION 2

OPERATING INSTRUCTIONS

Introduction

The 016-0072-00 AC Power Supply provides the voltages necessary for operation of the Type 422 Oscilloscope. This section gives information for operating the AC Power Supply in conjunction with the Type 422 Oscilloscope.

GENERAL OPERATING INFORMATION

Removing the Power Supply

The AC Power Supply can be removed from the Indicator for maintenance, calibration, remote operation, or to gain access to the interior of the Indicator. Loosen the four securing screws located in the rear feet of the power supply (see Fig. 2-1) and then separate the two units by sliding the power supply to the rear, off the support rods.

To re-attach the AC Power Supply to the Indicator, reverse the above procedure.

Operating the Power Supply Remotely

The Indicator can be operated with the AC Power Supply removed for maintenance, calibration or special applications. The interconnecting plug on the rear of the Indicator can be detached and used as an extension cable. To remove the interconnecting plug, loosen the three screws holding it to the Indicator and slide it up slightly, then move it away from the rear of the unit. Unwrap the power cable from the rear of the Indicator.

The two spring clips on the AC Power Supply (see Fig. 2-2) are provided to lock the power cable to the AC Power Supply for remote operation. To use the clips, hook one



Fig. 2-1. Securing screws on rear of AC Power Supply.

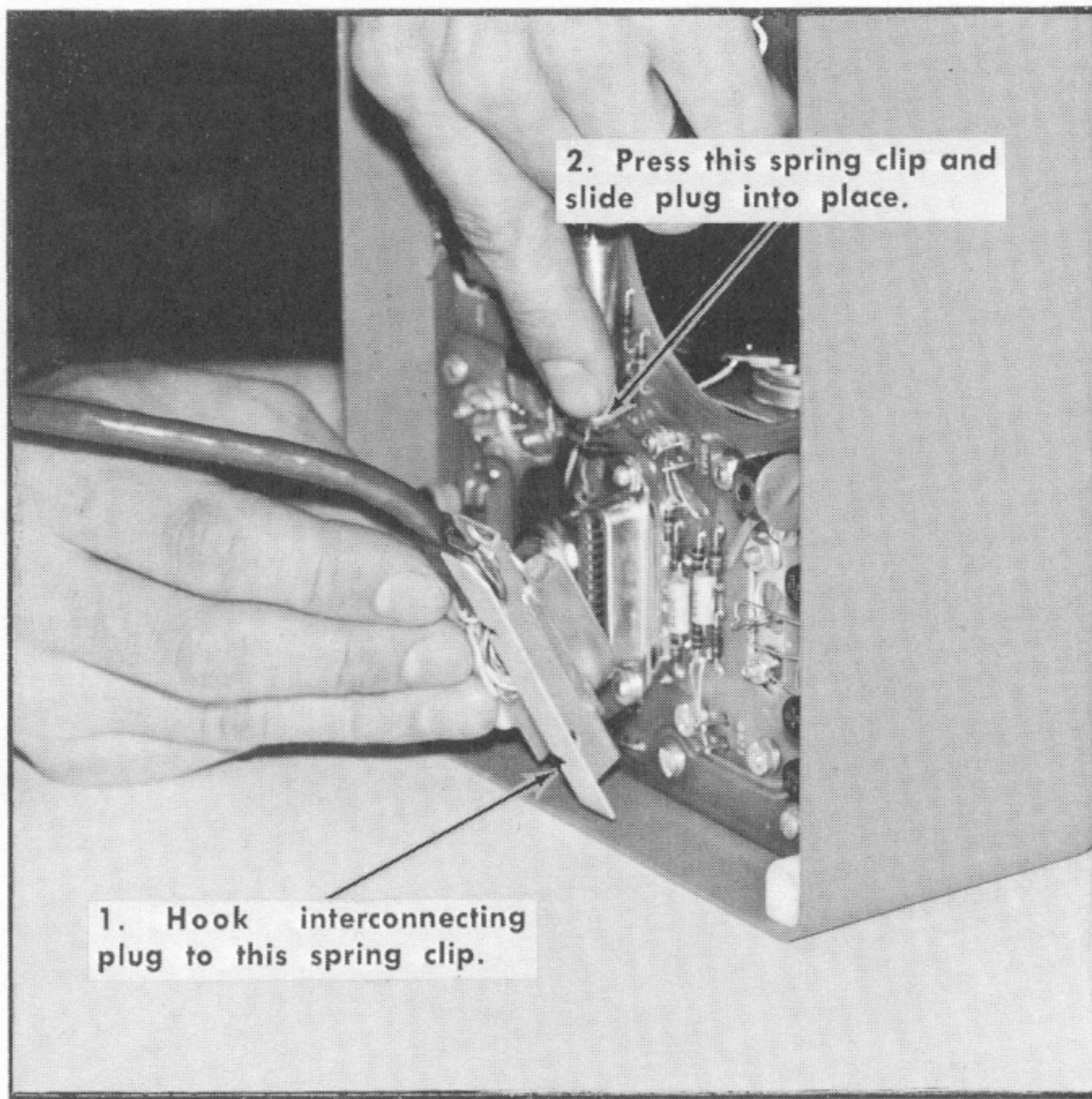


Fig. 2-2. Securing the power cable to the power supply for remote operation.

spring clip into the hole provided in the interconnecting plug (be sure the POWER switch is set to OFF). Slide the plug into place while depressing the other spring clip. To remove the plug, reverse the order in which it was attached.

CAUTION

Do not bend the spring clips so they latch without using the procedure described above. If bent in this manner, they will latch when the AC Power Supply is remounted on the Indicator and will be difficult to remove without damage to the instrument.

When operating the AC Power Supply remotely, the POWER switch on the front panel of the Indicator is inoperative. The POWER switch can be actuated at the AC Power Supply.

Voltage Conversion

The AC Power Supply can be connected to operate from either a 115- or 230-volt nominal line. Two auxiliary windings in addition to the standard windings allow the primary voltage to be increased or decreased 10 volts from 115-volts nominal (providing 105, 115 or 125 volt operation), or 20 volts from 230-volts nominal (to provide 210, 230 or 250 volts).

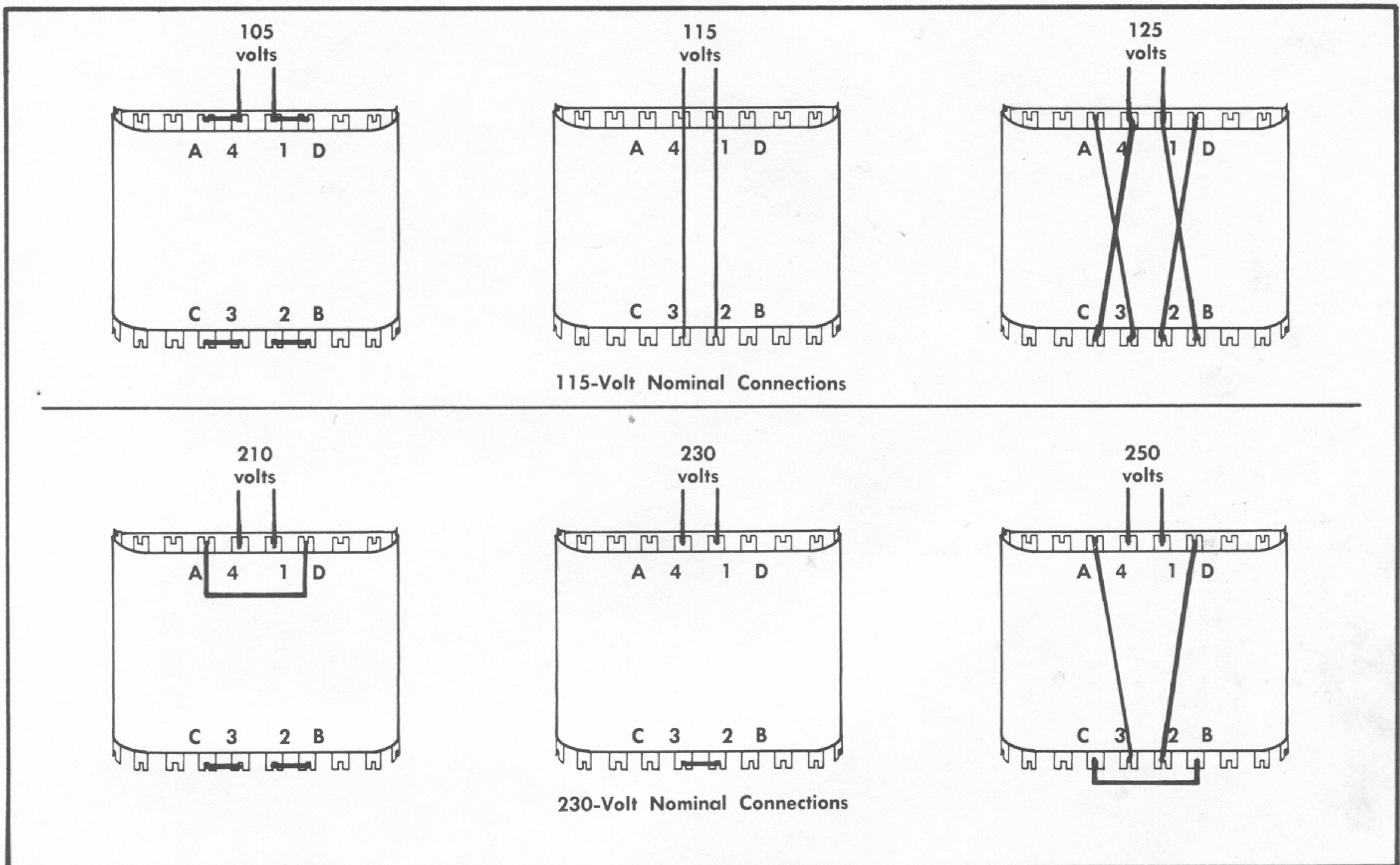


Fig. 2-3. Power transformer primary connections.

250 volt operation). This also changes the regulating range of the power supply to provide regulated output voltages with input line voltages within $\pm 10\%$ of the voltage for which the instrument is wired. The metal tag on the rear of the AC Power Supply indicates the nominal voltage range for which the instrument is wired. To convert the instrument to a different operating voltage, use the following procedure.

1. Connect the transformer for the desired line voltage as shown in Fig. 2-3.

2. If converting from 115-volt to 230-volt nominal line voltage, or vice versa, change the line-cord power plug to match the power-source receptacle.

3. If converting from 115-volt to 230-volt nominal line voltage, or vice versa, change the line fuse as shown in Table 2-1.

4. If converting from 115-volt to 230-volt nominal line voltage, or vice versa, change the voltage tag on the rear of the instrument. Use the tag underneath the existing voltage tag.

TABLE 2-1
Line Fuses

Voltage Range	Fuse Rating
115-volts nominal	0.6 amp, slow-blow
230-volts nominal	0.3 amp, slow-blow

SECTION 3

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains an electrical description of the circuits in the 016-0072-00 AC Power Supply. A complete schematic diagram is shown in the Diagrams section. Refer to these diagrams for electrical values and relationship throughout the following circuit description.

Block Diagram

Fig. 3-1 shows a block diagram of the AC Power Supply. This block diagram shows the relationship between the circuits in the power supply. These circuits will be discussed in detail in the following circuit description.

LOW-VOLTAGE POWER SUPPLY

General

The Low-Voltage Power Supply provides the operating power for the Indicator from two regulated supplies and three unregulated supplies. Electronic regulation is used in the regulated supplies to provide stable output voltages. The power transformer can be wired to operate the instrument from 115-volts or 230-volts nominal line voltage.

Power Input

Power is applied to the instrument through P601. It is applied to the primary of transformer T601 through the line fuse F601, POWER switch SW601, the AC interlock and thermal cutout TK601. The primary of the transformer contains two main windings and two auxiliary windings. The main windings are connected in parallel for 115-volt operation or in series for 230-volt operation. The auxiliary windings may be connected to either aid or oppose the main windings. This provides compensation for line voltages slightly higher or lower than normal.

The AC interlock opens the primary circuit when the AC Power Supply is disconnected from the Indicator. The thermal cutout provides thermal protection by opening to interrupt the power if the instrument overheats. The thermal cutout automatically resets when the temperature drops to a safe operating level.

—12-Volt Supply

Output from the secondary of T601 is rectified by diodes D610-D611. The output of the rectifier is regulated as follows to provide a stable output voltage. Transistors Q624 and Q634 are connected as a difference amplifier. Zener diode D622 is the reference diode for the supply and holds

the base of Q624 at about -6.4 volts. In this configuration, the emitter level of the transistors will be established by D622 with the emitter current through R624 dividing between Q624 and Q634, depending on the setting of R639. Collector current of Q634 controls the conduction of Q633, which in turn controls the conduction of the series regulator Q637 to provide the correct output voltage. The base level of Q634 is set by the -12 Volts adjustment, R639, to provide -12 -volts output from the supply.

Ripple in the output voltage is held to a minimum by feeding a sample of the output back to the regulator transistor Q637. To understand this operation, assume that the ripple is in the negative half of its cycle. This negative voltage change at the output is connected to the base of Q624 through C622 and D622 resulting in reduced current flow through Q624. Reduced current flow through Q624 allows Q634 to conduct more and its collector goes negative. This negative change is connected to the base of Q637 through emitter follower Q633. The result is a reduction in current through Q637 which opposes the original output change due to ripple and provides a stable output voltage. In a similar manner, the regulator circuit compensates for changes in input voltage or changes in load current.

+12-Volt Supply

Rectified voltage for operation of the +12-Volt Supply is provided by D651-D652. Reference voltage for this supply is provided by voltage divider R658-R659 between -12 volts and the output of this supply. The -12 volts is held stable by the -12 -Volts Supply as discussed previously. Therefore, any change at the base of Q654 is from the +12-volt output. If the +12-volt output changes, this change is applied to Q657 as an error signal. Regulation is controlled by the regulator transistor Q657 in the same manner as described for the -12 -Volt Supply.

Unregulated Supplies

Rectifiers D641, D646-D661 and D645-D662 provide the unregulated output for the -110 -volt, +55-volt and +95-volt supplies respectively. The nominal voltage output of these supplies is given at low line voltage. At normal line voltage, the output voltage from these supplies is somewhat higher.

HIGH-VOLTAGE DRIVER

Q675 and Q685 in conjunction with T801 (in the Indicator) form an astable multivibrator which provides power for the high-voltage circuits in the Indicator unit. Oscillation of the multivibrator is sustained by the networks C675-R675-R676 and C685-R685-R686 which couple the transistors together. Repetition rate of the multivibrator is about 20 kilohertz.

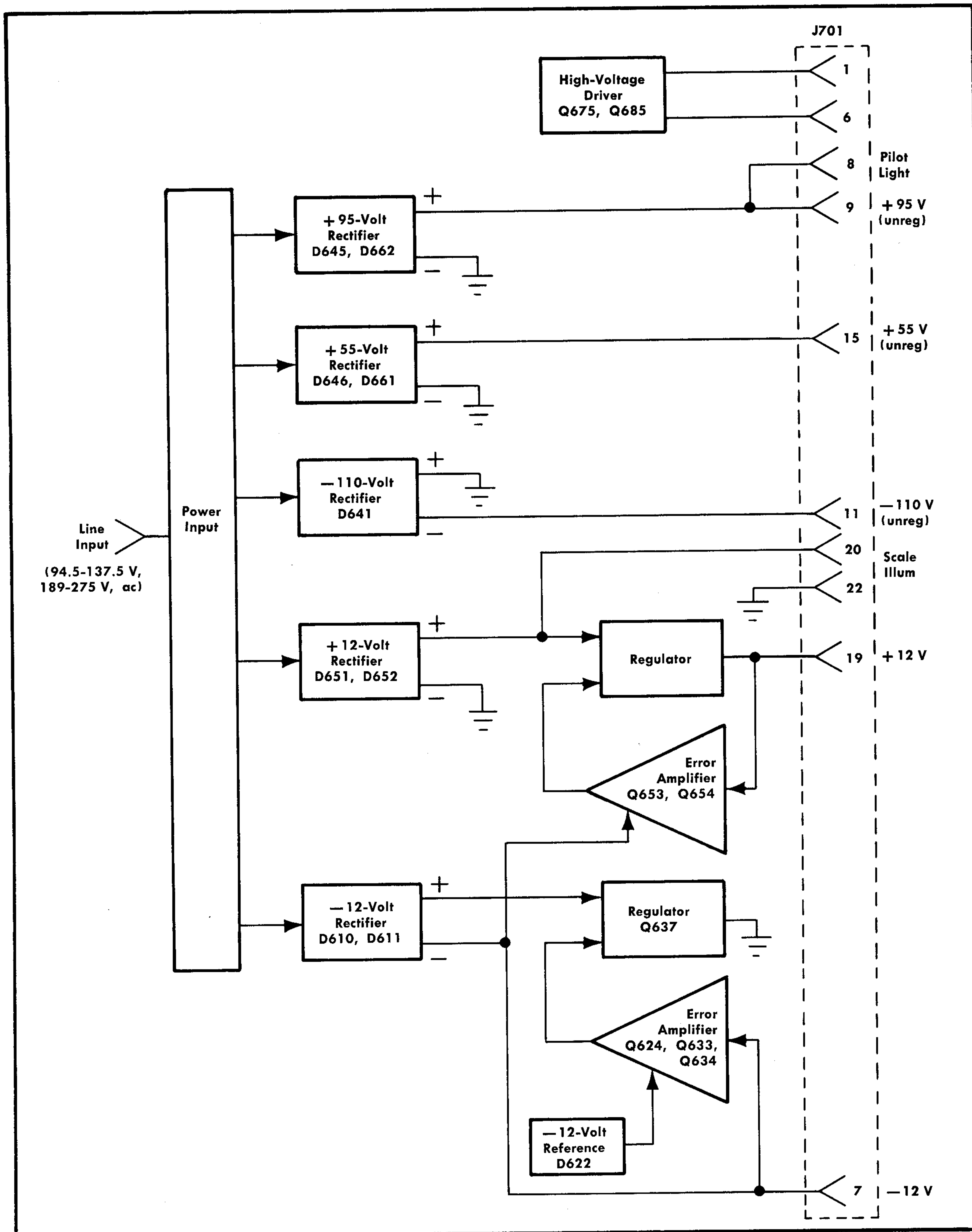


Fig. 3-1. Block diagram of the AC Power Supply.

SECTION 4

MAINTENANCE

Introduction

General maintenance information which applies to the AC Power Supply is given in the Indicator instruction manual. The following information applies specifically to the AC Power Supply.

CORRECTIVE MAINTENANCE

Removing the Power Supply

The AC Power Supply can be removed from the Indicator for maintenance by loosening the four securing screws located in the rear feet of the power supply (see Fig. 4-1). Then, separate the two units by sliding the power supply to the rear, off the support rods.

To re-attach the AC Power Supply to the Indicator, reverse the above procedure.

Removing the Power Supply Cover

The power supply cover is held in place with four screws at the back and two on the bottom (see Fig. 4-1). After these screws have been removed, the cover can be slipped off the power supply chassis.

Component Location on Circuit Board

Fig. 4-2 shows the circuit board used in the AC Power Supply. Each component on the board is identified by its circuit number. In addition, the color of each wire soldered to the board is given.

Power Transformer Replacement

The power transformer in this instrument is warranted for the life of the instrument. If the power transformer

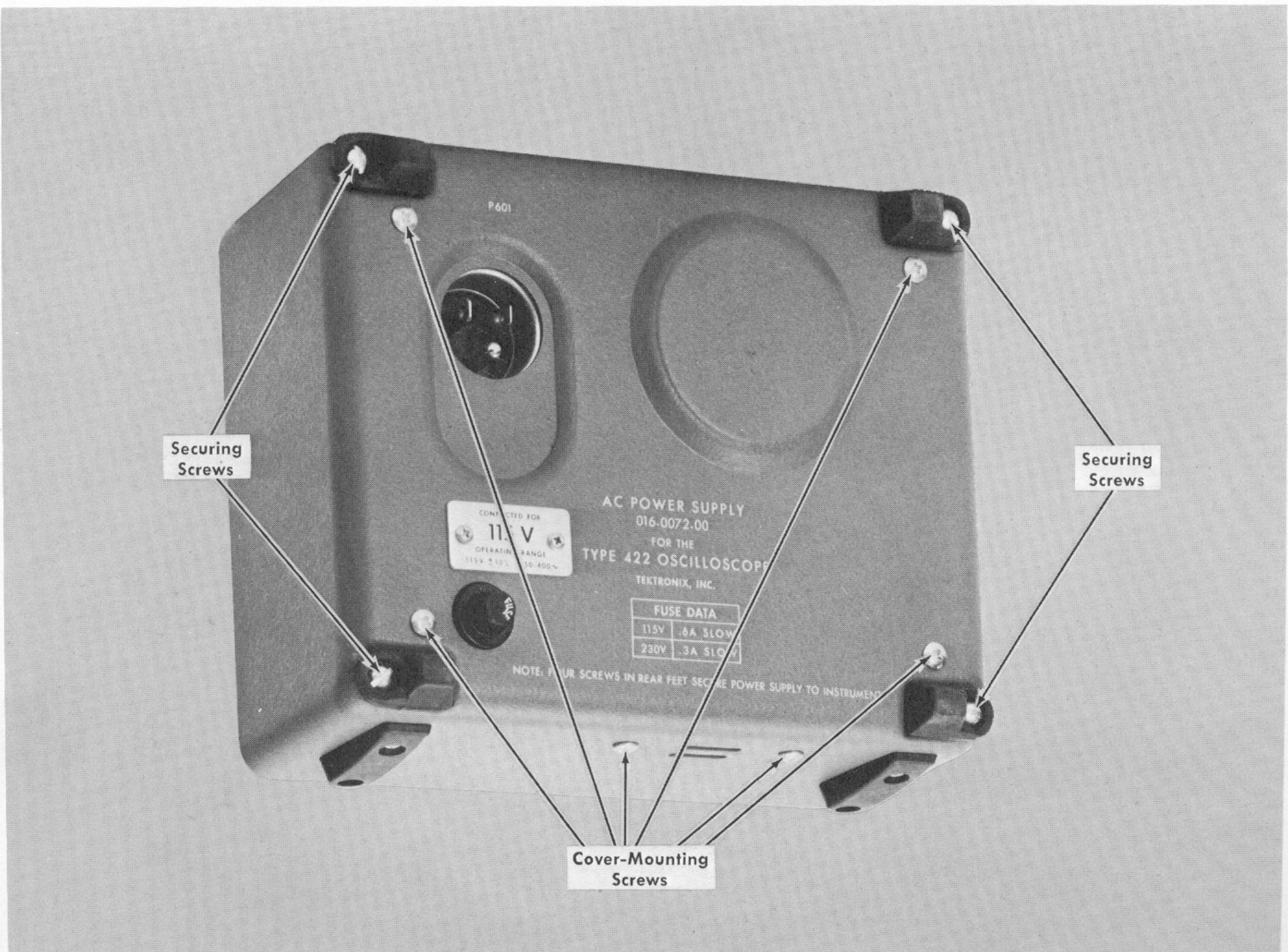


Fig. 4-1. Securing screws and cover-mounting screws on rear of power supply.

Maintenance—016-0072-00 AC Power Supply

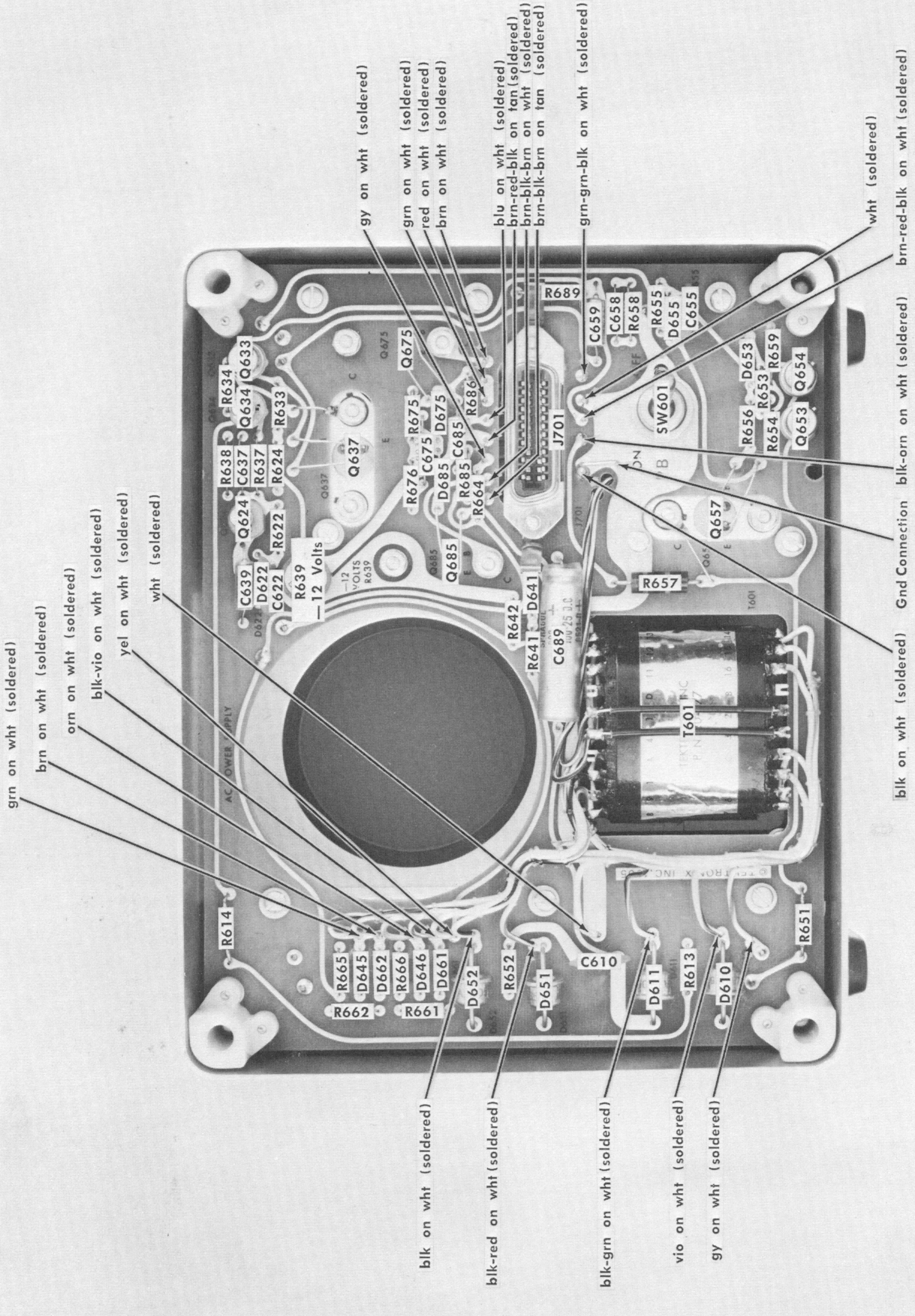
becomes defective, contact your local Tektronix Field Office or representative for a warranty replacement (see the Warranty note in the front of this manual). Be sure to replace only with a direct replacement Tektronix transformer.

When removing the transformer, tag the leads with the corresponding terminal numbers to aid in connecting the new transformer. After the transformer is replaced, check

the performance of the instrument using the Calibration Procedure.

TROUBLESHOOTING

Troubleshooting information for the AC Power Supply is included with the troubleshooting procedure for the Indicator. Refer to the Indicator instruction manual.



NOTE
C611, C642, C652, C665, C666, F601, TK601
mounted behind board.

Fig. 4-2. AC Power Supply circuit board.

SECTION 5

CALIBRATION

Introduction

Complete calibration information for the 016-0072-00 AC Power Supply is given in this section. Performing the complete procedure returns this instrument to original performance standards. Limits, tolerances and waveforms in this procedure are given as calibration guides and are not instrument specifications. If it is desired to only touch up the calibration, perform only those steps entitled "Adjust . . .". A short-form calibration procedure is also provided in this section for the convenience of the experienced calibrator. It may also be used as a calibration record or as an index to the steps in the complete Calibration Procedure.

The AC Power Supply should be checked, and recalibrated if necessary, after each 1000 hours of operation, or every six months if used infrequently, to assure correct operation and accuracy.

EQUIPMENT REQUIRED

General

The following equipment, or its equivalent, is required for complete calibration of the AC Power Supply (see Fig. 5-1).

Specifications given are the minimum necessary for accurate calibration of this instrument. All test equipment is assumed to be correctly calibrated and operating within the given specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

1. Variable autotransformer. Must be capable of supplying at least 75 volt-amperes over a range of 103.5 to 126.5 volts (207 to 253 volts for 230-volts nominal line). (If autotransformer does not have an AC voltmeter to indicate output voltage, monitor output with an AC voltmeter with range of at least 135 or 270 volts, RMS.) For example, General Radio W10MT3W Metered Variac Autotransformer (note that the full current capabilities of this unit are not required).

2. Precision DC voltmeter. Accuracy, within $\pm 0.1\%$; resolution, 50 microvolts; range, 0-125 volts. For Example, Fluke Model 825A.

3. Test oscilloscope. Bandpass, DC to five megahertz; minimum deflection factor, five millivolts/division; accuracy, within $\pm 3\%$. Tektronix Type 422 Oscilloscope recommended (use $\times 10$ Gain feature for five millivolt minimum deflection factor).

4. $1\times$ probe with BNC connector. Tektronix P6028 Probe recommended.

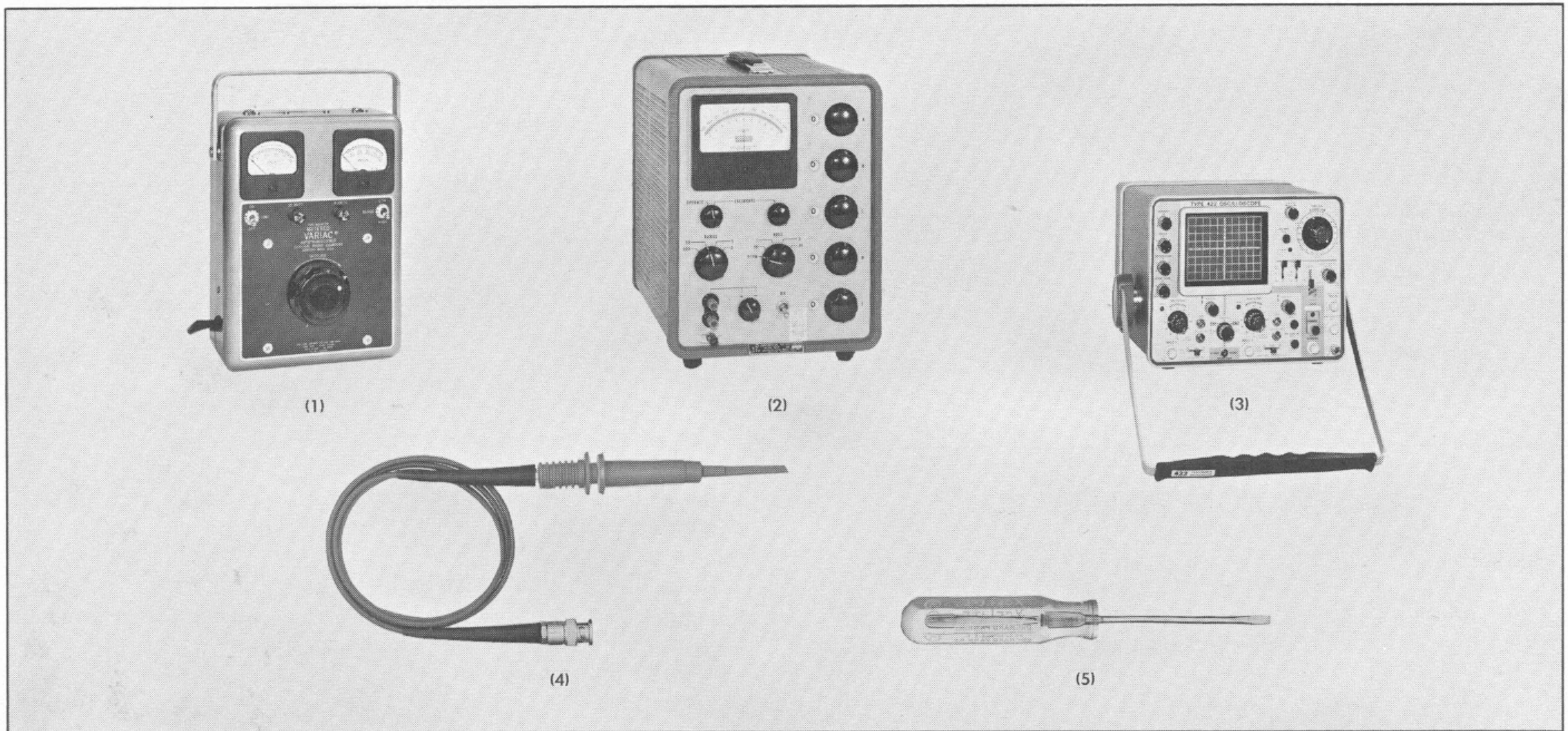


Fig. 5-1. Recommended calibration equipment.

Calibration—016-0072-00 AC Power Supply

5. Screwdriver. 3-inch shaft. Tektronix Part No. 003-0192-00.

CALIBRATION RECORD AND INDEX

This short-form calibration procedure is provided to aid in checking the operation of the AC Power Supply. It may be used as a calibration guide by the experienced calibrator, or it may be used as a record of calibration. Since the step numbers and titles used here correspond to those used in the complete Calibration Procedure, this procedure also serves as an index to locate a step in the complete procedure. Performance requirements given correspond to those given in the Characteristics section.

016-0072-00 AC Power Supply, Serial No. _____

Calibration Date _____

Calibration Technician _____

- 1. Adjust —12-Volt Power Supply (R639).
—12 volts, ± 0.12 volt.
- 2. Check Output of +12-Volt Supply.
+12 volts, ± 0.24 volt.
- 3. Check Output of —110-Volt, +55-Volt and +95-Volt Supplies.
Minimum output voltage of —110 volts, +55 volts and +95 volts respectively at minimum line voltage limit.
- 4. Check Power Supply Regulation.
—12-Volts Within ± 0.12 volt
+12-Volts Within ± 0.24 volt
- 5. Check Power Supply Ripple.

Power Supply	Low Frequency	High Frequency
—12-Volts	1 millivolt	15 millivolts
+12-Volts	1 millivolt	10 millivolts
+55-Volts	1.3 volts	
+95-Volts	2.5 volts	
—110-Volts	2.5 volts	

CALIBRATION PROCEDURE

General

The following procedure is arranged in a sequence which allows the AC Power Supply to be calibrated with the least

interaction of adjustments and reconnection of equipment. However, some adjustments affect the calibration of other circuits within the instrument. In this case it will be necessary to check the operation of other parts of the instrument. When a step interacts with others, the steps which need to be checked are noted in the "INTERACTION- . . ." step.

Any needed maintenance should be performed before proceeding with calibration. Troubles which become apparent during calibration should be corrected using the techniques given in the Maintenance section.

The "Adjust . . . **Ⓐ**" steps in the following procedure provide a check of instrument performance, whenever possible, before the adjustment is made. To prevent recalibration of other circuits when performing a partial calibration, re-adjust only if the listed tolerance is not met. However, when performing a complete recalibration, best overall performance will be provided if each adjustment is made to the exact setting, even if the CHECK is within the allowable tolerance. The symbol **Ⓐ** is used to identify the steps in which an adjustment is made.

In the following calibration procedure, a test equipment setup is shown for each major group of adjustments and checks. Following the first setup picture is a list of front-panel control settings for the Indicator. If only a partial calibration is performed, start with the nearest setup preceding the desired portion.

The following procedure uses the equipment listed under equipment required. If substitute equipment is used, control settings or setup must be altered to meet the requirements of the equipment used.

Preliminary Procedure

1. Remove the power supply from the Indicator.
2. Remove the Indicator cabinet.
3. Connect the interconnecting cable for remote operation.
4. Connect the autotransformer to a suitable power source.
5. Connect the power cord to the autotransformer.
6. Set the autotransformer output voltage for the nominal operating voltage of the AC Power Supply.
7. Set the POWER switch to ON (at power supply). Allow at least 20 minutes warm up at 25° C, $\pm 5^\circ$, for checking the instrument to the given accuracy.

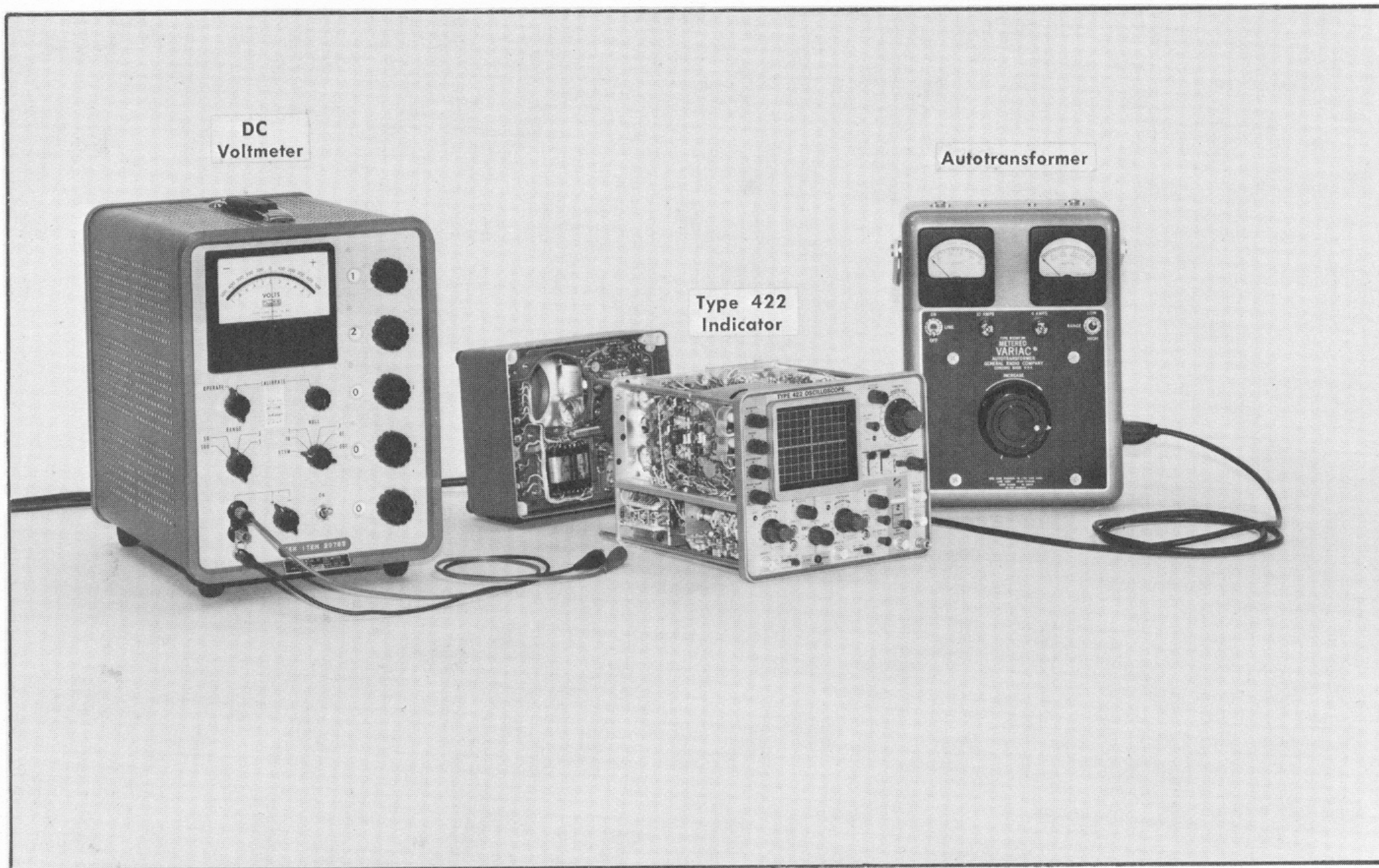


Fig. 5-2. Test equipment setup for steps 1 through 3.

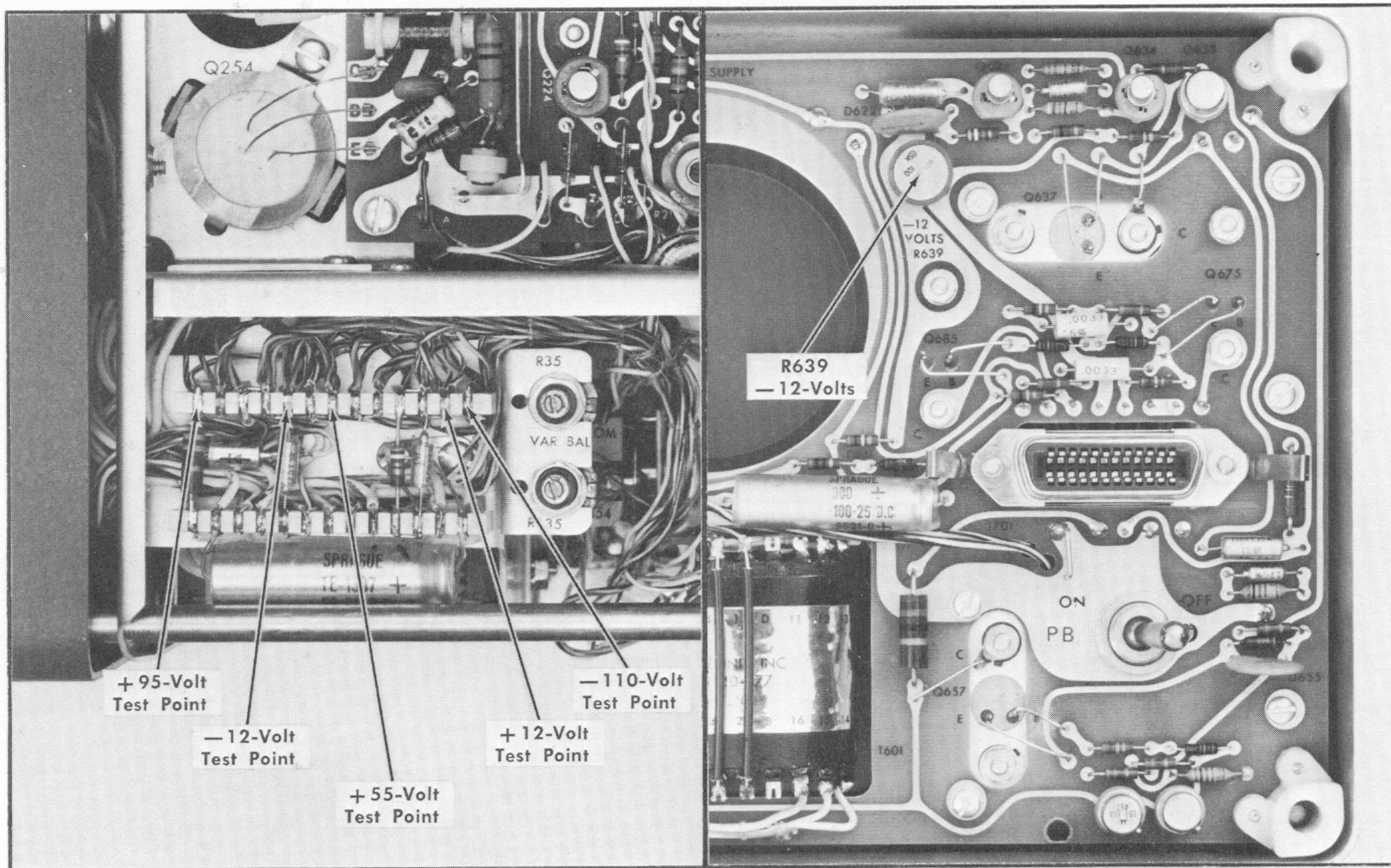


Fig. 5-3. (A) Location of power-supply test points (left side of Indicator), (B) Location of -12-Volts adjustment.

Calibration—016-0072-00 AC Power Supply

Indicator control settings

Triggering LEVEL	Adjust so sweep is not triggered
SCALE ILLUM	Clockwise
Remaining controls	Any Position

1. Adjust —12-Volt Power Supply ①

- a. Test equipment setup is shown in Fig. 5-2.
- b. Connect the DC voltmeter from the —12-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.
- c. CHECK—Meter reading; —12 volts, ± 0.12 volt.
- d. ADJUST— —12 Volts adjustment, R639 (see Fig. 5-3B), for —12 volts.
- e. INTERACTION—May affect operation of all circuits within the instrument.

2. Check Output of +12-Volt Supply

- a. Connect the DC voltmeter from the +12-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.
- b. CHECK—Meter reading; +12 volts, ± 0.24 volt.

3. Check Output of —110-Volt, +55-Volt and +95-Volt Supplies

- a. Set the autotransformer to the low-line limit (103.5 volts for 115-volts nominal).
- b. Connect the DC voltmeter from the —110-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.
- c. CHECK—Meter reading; minimum voltage of —110 volts.
- d. Connect the DC voltmeter from the +55-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.
- e. CHECK—Meter reading; minimum voltage of +55 volts.
- f. Connect the DC voltmeter from the +95-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.
- g. CHECK—Meter reading; minimum voltage of +95 volts.

4. Check Power Supply Regulation

- a. Connect the DC voltmeter from the —12-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.

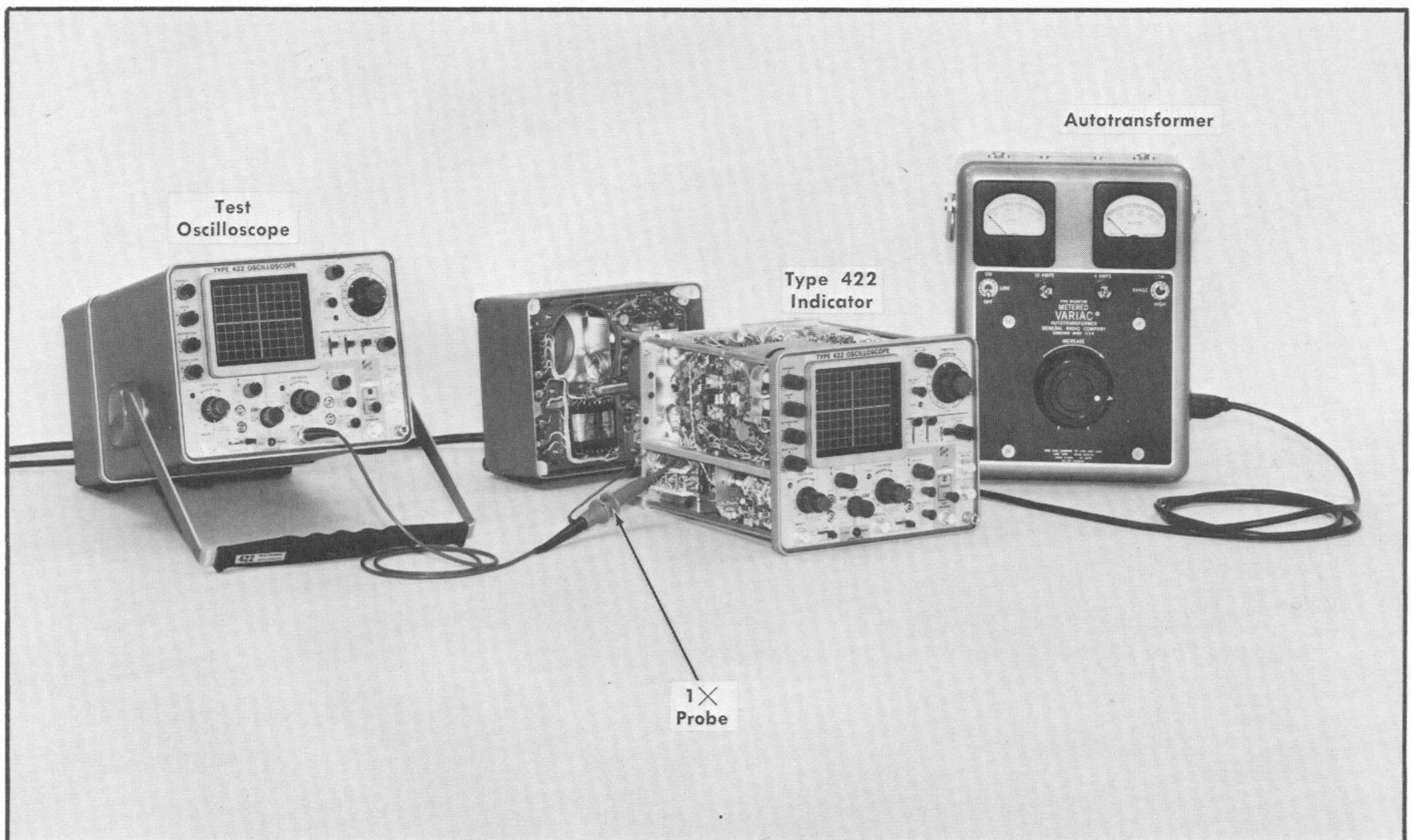


Fig. 5-4. Test equipment setup for step 4.

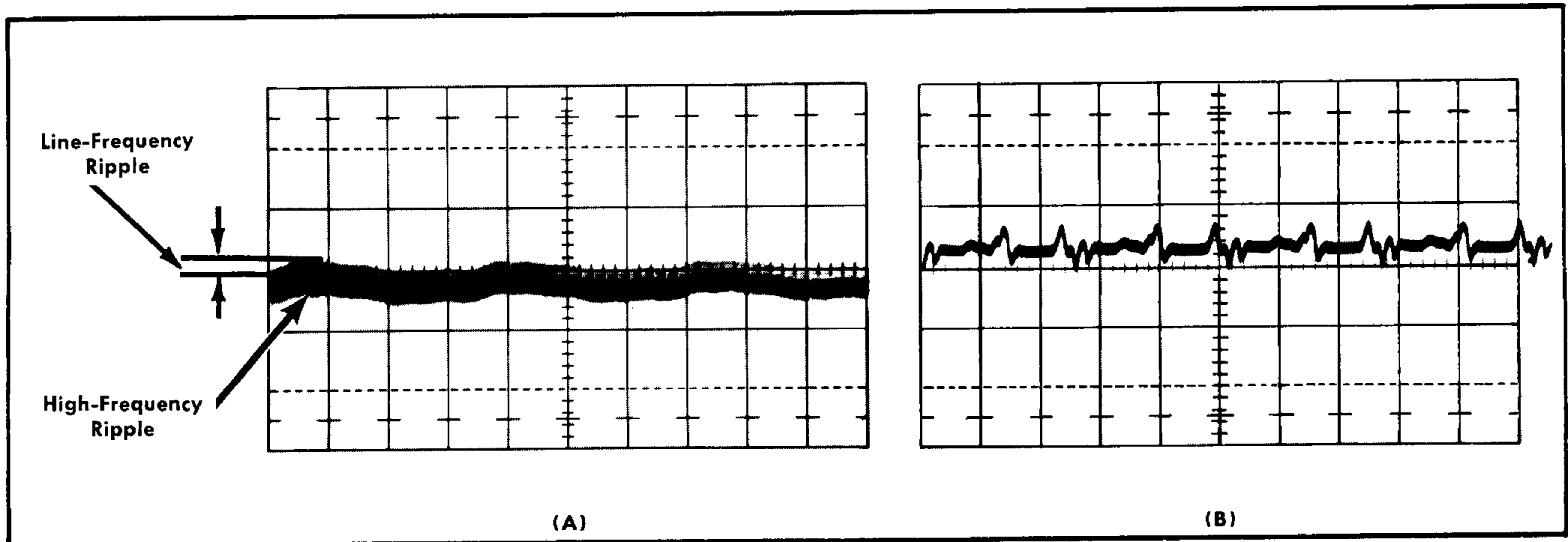


Fig. 5-5. Typical test oscilloscope display of power-supply ripple: (A) Low-frequency (60-cycle line), sweep rate 5 milliseconds/division; (B) High-frequency, sweep rate 20 microseconds/division.

b. CHECK—Meter reading for ± 0.12 volt maximum change while varying the autotransformer output voltage between 103.5 and 125.6 volts (207 and 253 volts for 230-volts nominal).

c. Connect the DC voltmeter from the +12-volt test point (in Indicator, see Fig. 5-3A) to chassis ground.

d. CHECK—Meter reading for ± 0.24 volt maximum change while varying the autotransformer output voltage between 103.5 and 126.5 volts (207 and 253 volts for 230-

e. Disconnect the DC voltmeter.

TABLE 5-1
Power Supply Ripple

Supply	Maximum Ripple	
	Low Frequency (Line Frequency)	High Frequency (15-25 kHz)
-12-Volts	1 millivolt	15 millivolts
+12-Volts	1 millivolt	10 millivolts
+55-Volts	1.3 volts	
+95-Volts	2.5 volts	
-110-Volts	2.5 volts	

5. Check Power Supply Ripple

a. Test equipment setup is shown in Fig. 5-4.

b. Connect the $1\times$ probe to the test oscilloscope input connector.

c. Set the test oscilloscope for 0.005 volt/division, AC coupled.

d. CHECK—Measure the ripple on the -12-volt, +12-volt, +55-volt and +95-volt supplies to the tolerance listed in Table 5-1. Test points are shown in Fig. 5-3A. Check for low-frequency ripple (line frequency, test oscilloscope

sweep rate 5 milliseconds/division) and high-frequency ripple (15-25 kHz, test oscilloscope sweep rate 20 microseconds/division) while varying the autotransformer output voltage between 103.5 and 126.5 volts (207 and 253 volts for 230-volts nominal). Fig. 5-5 shows typical test oscilloscope display of ripple.

This completes the calibration procedure for the AC Power Supply. Disconnect all test equipment. Replace the Indicator cabinet and re-attach the power supply to the Indicator. Before making measurements, the performance of the Indicator should be checked using the performance check procedure given in the Indicator instruction manual.

ABBREVIATIONS AND SYMBOLS

A or amp	amperes	L	inductance
AC or ac	alternating current	λ	lambda—wavelength
AF	audio frequency	\gg	large compared with
α	alpha—common-base current amplification factor	$<$	less than
AM	amplitude modulation	LF	low frequency
\approx	approximately equal to	lg	length or long
β	beta—common-emitter current amplification factor	LV	low voltage
BHB	binding head brass	M	mega or 10^6
BHS	binding head steel	m	milli or 10^{-3}
BNC	baby series "N" connector	M Ω or meg	megohm
\times	by or times	μ	micro or 10^{-6}
C	carbon	mc	megacycle
C	capacitance	met.	metal
cap.	capacitor	MHz	megahertz
cer	ceramic	mm	millimeter
cm	centimeter	ms	millisecond
comp	composition	—	minus
conn	connector	mtg hdw	mounting hardware
\sim	cycle	n	nano or 10^{-9}
c/s or cps	cycles per second	no. or #	number
CRT	cathode-ray tube	ns	nanosecond
csk	countersunk	OD	outside diameter
Δ	increment	OHB	oval head brass
dB	decibel	OHS	oval head steel
dBm	decibel referred to one milliwatt	Ω	omega—ohms
DC or dc	direct current	ω	omega—angular frequency
DE	double end	p	pico or 10^{-12}
$^{\circ}$	degrees	/	per
$^{\circ}$ C	degrees Celsius (degrees centigrade)	%	percent
$^{\circ}$ F	degrees Fahrenheit	PHB	pan head brass
$^{\circ}$ K	degrees Kelvin	ϕ	phi—phase angle
dia	diameter	π	pi—3.1416
\div	divide by	PHS	pan head steel
div	division	\pm	plus
EHF	extremely high frequency	\pm	plus or minus
elect.	electrolytic	PIV	peak inverse voltage
EMC	electrolytic, metal cased	plstc	plastic
EMI	electromagnetic interference (see RFI)	PMC	paper, metal cased
EMT	electrolytic, metal tubular	poly	polystyrene
ϵ	epsilon—2.71828 or % of error	prec	precision
\geq	equal to or greater than	PT	paper, tubular
\leq	equal to or less than	PTM	paper or plastic, tubular, molded
ext	external	pwr	power
F or f	farad	Q	figure of merit
F & I	focus and intensity	RC	resistance capacitance
FHB	flat head brass	RF	radio frequency
FHS	flat head steel	RFI	radio frequency interference (see EMI)
Fil HB	fillister head brass	RHB	round head brass
Fil HS	fillister head steel	ρ	rho—resistivity
FM	frequency modulation	RHS	round head steel
ft	feet or foot	r/min or rpm	revolutions per minute
G	giga or 10^9	RMS	root mean square
g	acceleration due to gravity	s or sec.	second
Ge	germanium	SE	single end
GHz	gigahertz	Si	silicon
GMV	guaranteed minimum value	SN or S/N	serial number
GR	General Radio	\ll	small compared with
$>$	greater than	T	tera or 10^{12}
H or h	henry	TC	temperature compensated
h	height or high	TD	tunnel diode
hex.	hexagonal	THB	truss head brass
HF	high frequency	θ	theta—angular phase displacement
HHB	hex head brass	thk	thick
HHS	hex head steel	THS	truss head steel
HSB	hex socket brass	tub.	tubular
HSS	hex socket steel	UHF	ultra high frequency
HV	high voltage	V	volt
Hz	hertz (cycles per second)	VAC	volts, alternating current
ID	inside diameter	var	variable
IF	intermediate frequency	VDC	volts, direct current
in.	inch or inches	VHF	very high frequency
incd	incandescent	VSWR	voltage standing wave ratio
∞	infinity	W	watt
int	internal	w	wide or width
\int	integral	w/	with
k	kilohms or kilo (10^3)	w/o	without
k Ω	kilohm	WW	wire-wound
kc	kilocycle	xmfr	transformer
kHz	kilohertz		



PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

- | | |
|---|---|
| ×000 | Part first added at this serial number |
| 00× | Part removed after this serial number |
| *000-0000-00 | Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components. |
| Use 000-0000-00 | Part number indicated is direct replacement. |
|  | Screwdriver adjustment. |
|  | Control, adjustment or connector. |

SECTION 6

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description			S/N Range
Capacitors					
Tolerance $\pm 20\%$ unless otherwise indicated.					
C610	283-0081-00	0.1 μF	Cer	25 V	
C611	290-0257-00	2000 μF	EMT	20 V	+75%—10%
C622	283-0081-00	0.1 μF	Cer	25 V	
C637	290-0267-00	1 μF	EMT	35 V	
C639	Use 290-0135-01	15 μF	EMT	20 V	100-6279
C639	*290-0135-02	15 μF	EMT	20 V	6280-up
C642	290-0260-00	50 μF	EMT	200 V	+75%—10%
C652	290-0257-00	2000 μF	EMT	20 V	+75%—10%
C655	283-0081-00	0.1 μF	Cer	25 V	
C658	290-0267-00	1 μF	EMT	35 V	
C659	290-0135-00	15 μF	EMT	20 V	100-6279
C659	*290-0135-02	15 μF	EMT	20 V	6280-up
C665	290-0259-00	100 μF	EMT	50 V	+75%—10%
C666	290-0258-00	350 μF	EMT	100 V	+75%—10%
C675	285-0627-00	0.0033 μF	PTM	100 V	5%
C685	285-0627-00	0.0033 μF	PTM	100 V	5%
C689	290-0215-00	100 μF	EMT	25 V	+75%—10%
Diodes					
D610	152-0198-00	Silicon	MR1032A (Motorola)		
D611	152-0198-00	Silicon	MR1032A (Motorola)		
D622	Use *050-0257-00	Replacement Kit			100-588
D622	152-0212-00	Zener	1N936 9 V, 5%, TC		589-up
D641	*152-0107-00	Silicon	Replaceable by 1N647		
D645	*152-0107-00	Silicon	Replaceable by 1N647		
D646	*152-0107-00	Silicon	Replaceable by 1N647		
D651	152-0198-00	Silicon	MR1032A (Motorola)		
D652	152-0198-00	Silicon	MR1032A (Motorola)		
D653	Use 152-0233-00	Silicon	Selected from 1N3605		
D655	152-0119-00	Zener	1N969A 0.4 W, 22 V, 10%		
D661	*152-0107-00	Silicon	Replaceable by 1N647		
D662	*152-0107-00	Silicon	Replaceable by 1N647		
D675	*152-0185-00	Silicon	Replaceable by 1N3605		
D685	*152-0185-00	Silicon	Replaceable by 1N3605		
Fuses					
F601	159-0043-00	0.6 A 3AG Slo-Blo	115 V operation		
F601	159-0029-00	0.3 A 3AG Slo-Blo	230 V operation		

Electrical Parts List—016-0072-00 AC Power Supply

Transistors

Ckt. No.	Tektronix Part No.	Description	S/N Range
Q624	*151-0103-00	Silicon	Replaceable by 2N2219
Q624	*151-0151-00	Silicon	Replaceable by 2N930
Q633	*151-0103-00	Silicon	Replaceable by 2N2219
Q634	*151-0103-00	Silicon	Replaceable by 2N2219
Q634	*151-0151-00	Silicon	Replaceable by 2N930
Q637	*151-0148-00	Silicon	Selected RCA 40250
Q653	*151-0103-00	Silicon	Replaceable by 2N2219
Q654	*151-0103-00	Silicon	Replaceable by 2N2219
Q657	*151-0148-00	Silicon	Selected RCA 40250
Q675	*151-0148-00	Silicon	Selected RCA 40250
Q685	*151-0148-00	Silicon	Selected RCA 40250

Resistors

Resistors are fixed, composition, $\pm 10\%$ unless otherwise indicated.

R613	315-0103-00	10 k Ω	$\frac{1}{4}$ W		5%	
R614	*308-0141-00	1 Ω	$\frac{1}{2}$ W	WW	5%	101-4639
R614	*308-0415-00	1 Ω	$\frac{1}{4}$ W	WW	5%	4640-5705
R614	*308-0433-00	1 Ω	$\frac{1}{4}$ W	WW		5706-up
R622	315-0102-00	1 k Ω	$\frac{1}{4}$ W		5%	100-588
R622	315-0391-00	390 Ω	$\frac{1}{4}$ W		5%	589-up
R624	315-0621-00	620 Ω	$\frac{1}{4}$ W		5%	100-588
R624	315-0102-00	1 k Ω	$\frac{1}{4}$ W		5%	589-up
R633	315-0123-00	12 k Ω	$\frac{1}{4}$ W		5%	
R634	315-0242-00	2.4 k Ω	$\frac{1}{4}$ W		5%	100-588
R634	315-0272-00	2.7 k Ω	$\frac{1}{4}$ W		5%	589-up
R637	321-0270-00	6.34 k Ω	$\frac{1}{8}$ W	Prec	1%	100-588
R637	321-0191-00	953 Ω	$\frac{1}{8}$ W	Prec	1%	589-up
R638	321-0251-00	4.02 k Ω	$\frac{1}{8}$ W	Prec	1%	100-588
R638	321-0227-00	2.26 k Ω	$\frac{1}{8}$ W	Prec	1%	589-up
R639	311-0496-00	2.5 k Ω		Var		100-588
R639	311-0532-00	1.5 k Ω		Var		589-up
R641	315-0100-00	10 Ω	$\frac{1}{4}$ W		5%	
R642	315-0104-00	100 k Ω	$\frac{1}{4}$ W		5%	
R651	*308-0141-00	1 Ω	$\frac{1}{2}$ W	WW	5%	101-4639
R651	*308-0415-00	1 Ω	$\frac{1}{4}$ W	WW	5%	4640-5705
R651	*308-0433-00	1 Ω	$\frac{1}{4}$ W	WW		5706-up
R652	315-0103-00	10 k Ω	$\frac{1}{4}$ W		5%	
R653	315-0202-00	2 k Ω	$\frac{1}{4}$ W		5%	100-157
R653	315-0182-00	1.8 k Ω	$\frac{1}{4}$ W		5%	158-up
R654	315-0622-00	6.2 k Ω	$\frac{1}{4}$ W		5%	100-157
R654	315-0682-00	6.8 k Ω	$\frac{1}{4}$ W		5%	158-up
R655	315-0562-00	5.6 k Ω	$\frac{1}{4}$ W		5%	
R656	315-0123-00	12 k Ω	$\frac{1}{4}$ W		5%	
R657	303-0270-00	27 Ω	1 W		5%	100-7189
R657	303-0150-00	15 Ω	1 W		5%	7190-up
R658	321-0259-00	4.87 k Ω	$\frac{1}{8}$ W	Prec	1%	100-157
R658	321-0239-00	3.01 k Ω	$\frac{1}{8}$ W	Prec	1%	158-up
R659	321-0260-00	4.99 k Ω	$\frac{1}{8}$ W	Prec	1%	100-157
R659	321-0239-00	3.01 k Ω	$\frac{1}{8}$ W	Prec	1%	158-up

Resistors (Cont)

Ckt. No.	Tektronix Part No.		Description		S/N Range
R661	315-0100-00	10 Ω	1/4 W	5%	
R662	315-0100-00	10 Ω	1/4 W	5%	
R664	315-0104-00	100 kΩ	1/4 W	5%	
R665	315-0753-00	75 kΩ	1/4 W	5%	
R666	315-0333-00	33 kΩ	1/4 W	5%	
R675	315-0152-00	1.5 kΩ	1/4 W	5%	
R676	315-0104-00	100 kΩ	1/4 W	5%	
R685	315-0152-00	1.5 kΩ	1/4 W	5%	
R686	315-0104-00	100 kΩ	1/4 W	5%	
R689	*308-0141-00	1 Ω	1/2 W	5%	100-4639
R689	*308-0415-00	1 Ω	1/4 W	5%	4640-5705
R689	*308-0433-00	1 Ω	1/4 W	5%	5706-up

Switch

	Unwired	Wired		
SW601	260-0014-00		Toggle	POWER

Thermal Cutout

TK601	260-0551-00	187° F
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Transformer

T601	*120-0377-00	Power
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FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear on the pullout pages immediately following the Diagrams section of this instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
Detail Part of Assembly and/or Component
mounting hardware for Detail Part
Parts of Detail Part
mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

INDEX OF MECHANICAL PARTS LIST ILLUSTRATIONS

(Located behind diagrams)

FIG. 1 MECHANICAL PARTS

FIG. 2 ACCESSORIES

SECTION 7

MECHANICAL PARTS LIST

FIG. 1 MECHANICAL PARTS

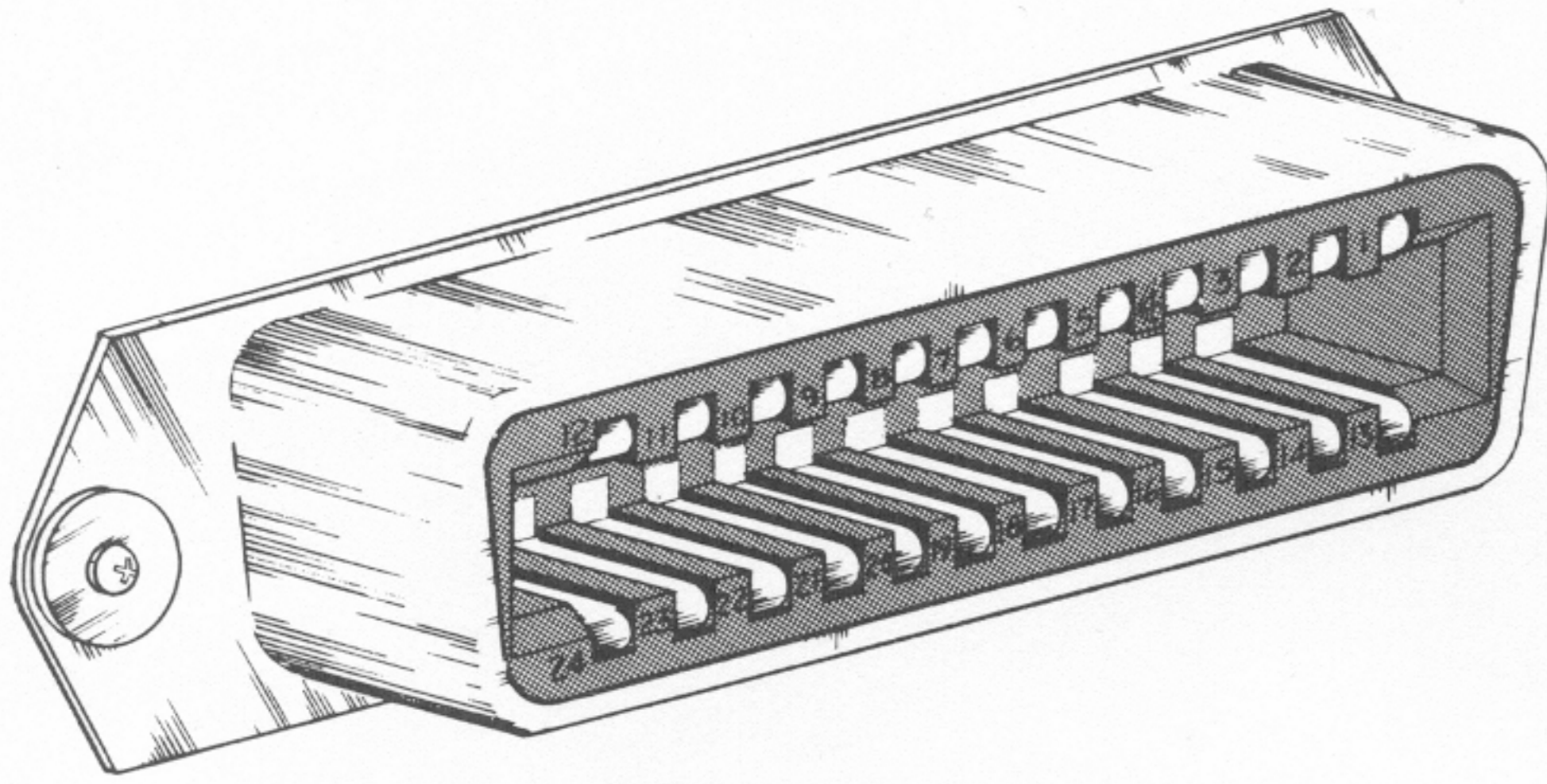
Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description	
				t	y	1	2	3		4
1-	016-0072-00			-						AC POWER SUPPLY
	- - - - -			-						AC power supply includes:
-1	670-0412-00	100	7189	1						ASSEMBLY, AC POWER SUPPLY CIRCUIT BOARD
	670-0412-02	7190		1						ASSEMBLY, AC POWER SUPPLY CIRCUIT BOARD
	- - - - -			-						assembly includes:
-2	388-0612-00			1						BOARD, circuit, AC power
-3	136-0183-00			5						SOCKET, transistor, 3 pin
	- - - - -			-						mounting hardware: (not included w/assembly)
	211-0097-00	100	1929	9						SCREW, 4-40 x 5/16 inch, PHS
	211-0116-00	1930		9						SCREW, sems, 4-40 x 5/16 inch, PHB
	210-0054-00	100	1929X	9						LOCKWASHER, #4, split
	210-0994-00	100	1929X	9						WASHER, flat, 0.125 ID x 0.250 inch OD
-4	351-0090-00			4						GUIDE, corner, power supply
	- - - - -			-						mounting hardware for each: (not included w/guide)
-5	213-0034-00			2						SCREW, thread forming, 4-40 x 5/16 inch, PHS
-6	131-0346-00			1						CONNECTOR, 24 pin, female
	- - - - -			-						mounting hardware: (not included w/connector)
-7	211-0034-00			2						SCREW, 2-56 x 1/2 inch, RHS
-8	210-0850-00			4						WASHER, flat, 0.093 ID x 9/32 inch OD
-9	210-0053-00			2						LOCKWASHER, #2, split
-10	214-0566-00			2						SPRING, clip
-11	210-0405-00			2						NUT, hex., 2-56 x 3/16 inch
-12	- - - - -			2						TRANSISTOR
	- - - - -			-						mounting hardware for each: (not included w/transistor)
	211-0507-00			2						SCREW, 6-32 x 5/16 inch, BHS
	210-0802-00			2						WASHER, flat, 0.150 ID x 5/16 inch OD
	210-0055-00			2						LOCKWASHER, #6, split
	210-0407-00			2						NUT, hex., 6-32 x 1/4 inch
-13	386-0143-00			1						PLATE, mica, insulator
14	260-0014-00			1						SWITCH, toggle—POWER
	- - - - -			-						mounting hardware: (not included w/switch)
-15	354-0055-00			1						RING, locking, switch
	210-0902-00			1						WASHER, flat, 0.470 ID x 21/32 inch OD
-16	210-0473-00			1						NUT, 12 sided, 15/32-32 x 5/64 inch

FIG. 1 MECHANICAL PARTS (cont)

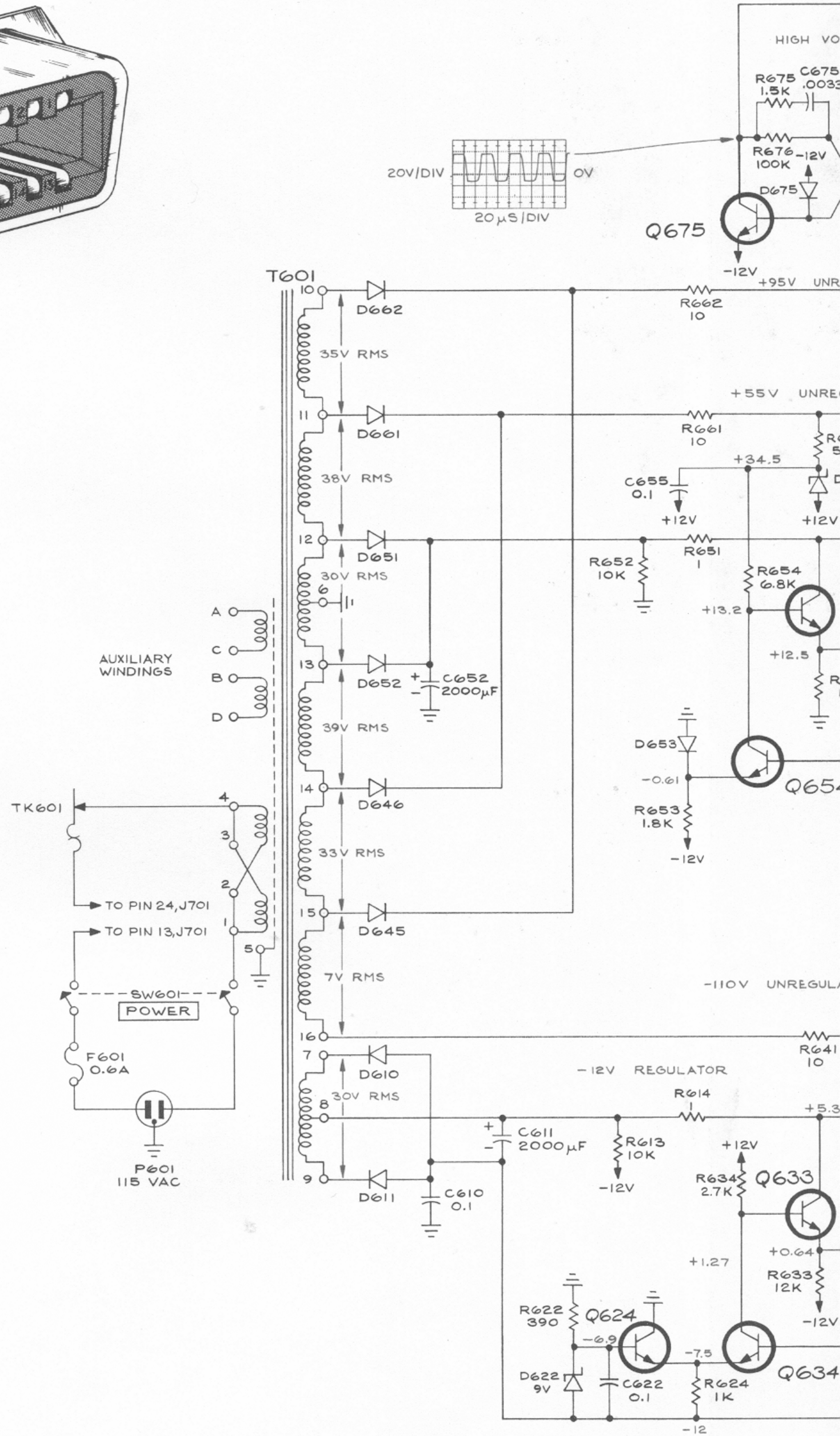
Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	Description
		Eff	Disc		
1-17	- - - - -			2	TRANSISTOR
	- - - - -			-	mounting hardware for each: (not included w/transistor)
-18	211-0507-00			2	SCREW, 6-32 x 5/16 inch, BHS
-19	386-0143-00			1	PLATE, mica, insulator
	210-0983-00	100	7399	2	WASHER, alum., shouldered
	210-0811-00	7400		2	WASHER, fiber, #6
-20	210-0802-00			1	WASHER, flat, 0.150 ID x 5/16 inch OD
-21	210-0261-00			1	LUG, solder
-22	210-0055-00			2	LOCKWASHER, #6, split
-23	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-24	179-0944-00			1	CABLE HARNESS, power
-25	407-0091-00			1	BRACKET, transistor
	- - - - -			-	mounting hardware: (not included w/bracket)
	211-0008-00			5	SCREW, 4-40 x 1/4 inch, BHS
	210-0801-00	X1560		2	WASHER, flat, 0.140 ID x 0.281 inch OD
-26	- - - - -			1	THERMAL CUTOUT
	- - - - -			-	mounting hardware: (not included w/thermal cutout)
-27	210-0054-00			2	LOCKWASHER, #4, split
-28	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
-29	407-0092-00			1	BRACKET, capacitor, left
	- - - - -			-	mounting hardware: (not included w/bracket)
	211-0008-00			3	SCREW, 4-40 x 1/4 inch, BHS
-30	- - - - -			1	TRANSFORMER
	- - - - -			-	mounting hardware: (not included w/transformer)
-31	211-0552-00			4	SCREW, 6-32 x 2 inches, BHS
	210-0802-00	100	2129	8	WASHER, flat, 0.150 ID x 5/16 inch OD
	210-0802-00	2130		4	WASHER, flat, 0.150 ID x 5/16 inch OD
-32	210-0983-00			4	WASHER, alum., shouldered
-33	210-0055-00	100	2129X	4	LOCKWASHER, #6, split
-34	210-0407-00	100	2129	4	NUT, hex., 6-32 x 1/4 inch
	210-0457-00	2130		4	NUT, keps, 6-32 x 5/16 inch
-35	407-0093-00			1	BRACKET, capacitor, right
	- - - - -			-	mounting hardware: (not included w/bracket)
-36	211-0008-00			3	SCREW, 4-40 x 1/4 inch, BHS
-37	386-0189-00			1	PLATE, serial number tag
	- - - - -			-	mounting hardware: (not included w/plate)
-38	211-0105-00			2	SCREW, 4-40 x 3/16 inch, FHS
-39	352-0014-00			1	HOLDER, fuse
	- - - - -			-	holder includes:
-40	- - - - -			1	NUT, hex.
-41	- - - - -			1	CAP, fuse
-42	214-0519-00			1	GASKET, fuse holder

FIG. 1 MECHANICAL PARTS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description	
				f	Y	1	2	3		4
1-43	131-0150-00	100	9529	1						CONNECTOR, motor base, male
	131-0150-01	9530		1						CONNECTOR, motor base, male
	- - - - -			-						connector includes:
	129-0041-00	100	9529	1						POST, ground
	129-0041-01	9530		1						POST, ground
	200-0185-00	100	9529	1						COVER
	200-0185-01	9530		1						COVER
	205-0014-00			1						SHELL
	210-0003-00	100	9529X	2						LOCKWASHER, external, #4
	210-0551-00	100	9529X	2						NUT, hex., 4-40 x 1/4 inch
	211-0132-00	X9530		2						SCREW, sems, 4-40 x 1/2 inch, PHS
	211-0015-00	100	9529	1						SCREW, 4-40 x 1/2 inch, RHS
	213-0088-00	9530		1						SCREW, thread forming, #4 x 1/4 inch
	214-0078-00			2						PIN, connecting
	377-0041-00	100	9529	1						INSERT, plastic
	377-0051-00	9530		1						INSERT, plastic
- - - - -			-							mounting hardware: (not included w/connector)
-44	210-0586-00			2						NUT, keps, 4-40 x 1/4 inch
-45	407-0090-00			1						BRACKET, transformer
-46	387-0999-00			1						PLATE, rear, power supply
-47	354-0255-00			4						RING, retaining
-48	212-0579-00			4						SCREW, 10-32 x 2 1/2 inches, PHS
-49	437-0075-00			1						CABINET, AC power supply
- - - - -				-						cabinet includes:
-50	348-0068-00			4						FOOT, rear
- - - - -				-						mounting hardware for each: (not included w/foot)
-51	213-0034-00	100	299	1						SCREW, thread forming, 4-40 x 5/16 inch, RHS
	213-0045-00	300		4						SCREW, self tapping, 4-40 x 5/16 inch, PHS
-52	348-0069-00			2						FOOT, bottom
- - - - -				-						mounting hardware for each: (not included w/foot)
-53	211-0501-00			2						SCREW, 6-32 x 1/8 inch, BHS
- - - - -				-						mounting hardware: (not included w/cabinet)
-54	211-0565-00			6						SCREW, 6-32 x 1/4 inch, THS
-55	334-0948-00			1						TAG, voltage rating, 115 volt
	334-0949-00			1						TAG, voltage rating, 230 volt
- - - - -				-						mounting hardware: (not included w/tags)
-56	213-0088-00			2						SCREW, thread forming, 4-40 x 1/4 inch, PHS



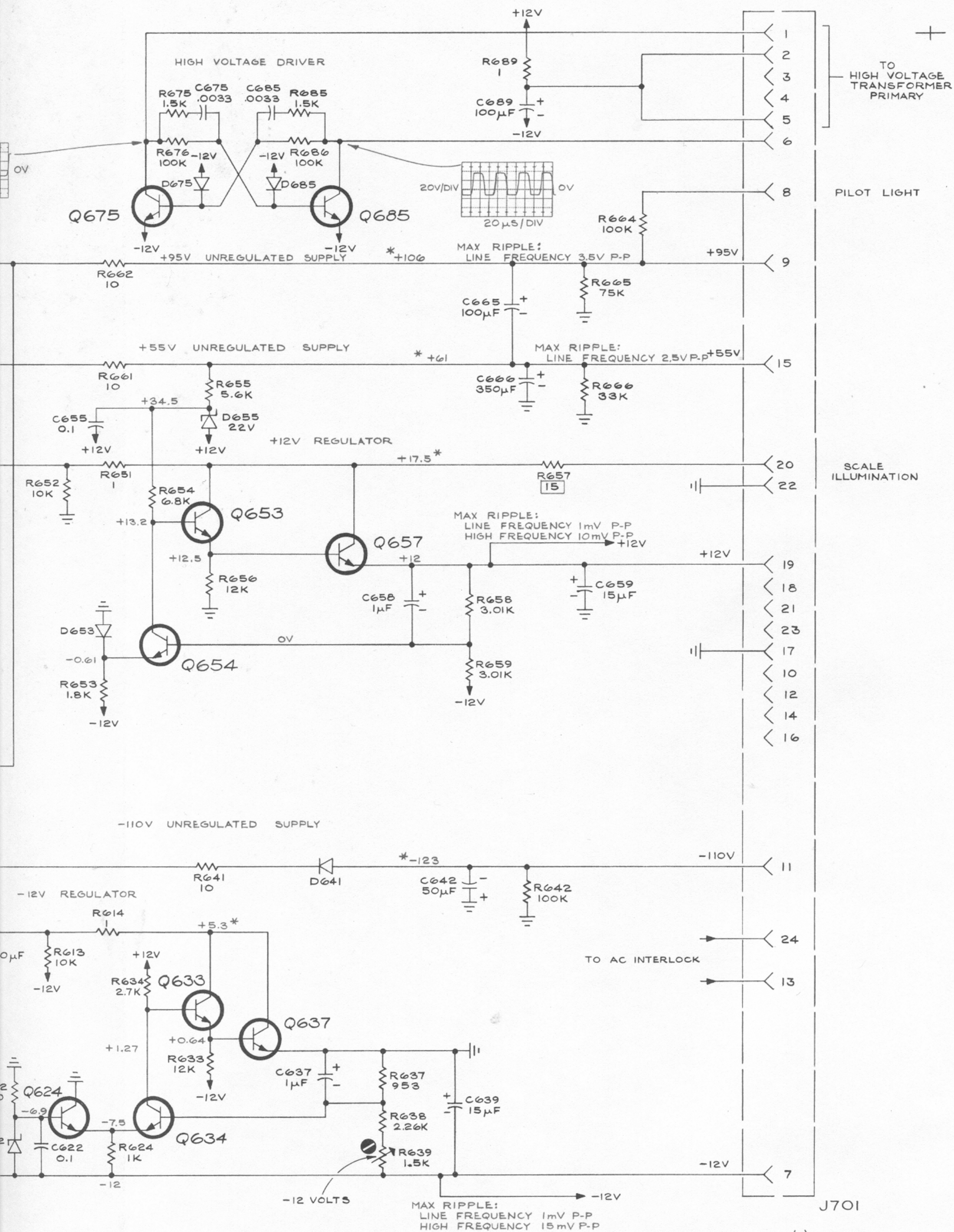
DETAIL OF J701



* MEASURED AT 115V LINE.
NOMINAL OUTPUT (BLACK)
GIVEN FOR MINIMUM AT LOW LINE.

SEE PARTS LIST FOR
SEMICONDUCTOR TYPES

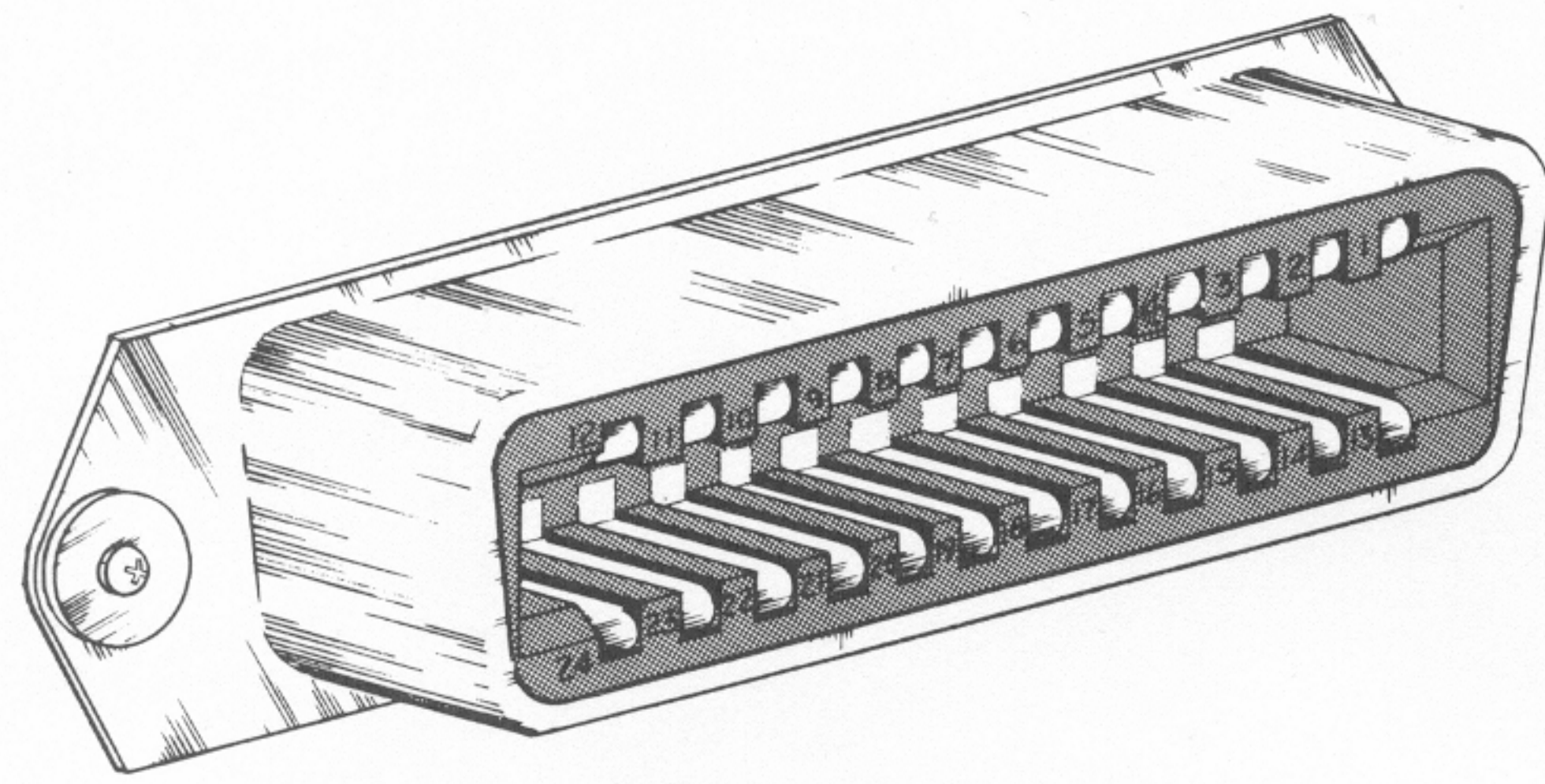
SEE PARTS LIST FOR EARLIER
VALUES AND SERIAL NUMBER
RANGES OF PARTS MARKED
WITH BLUE OUTLINE.



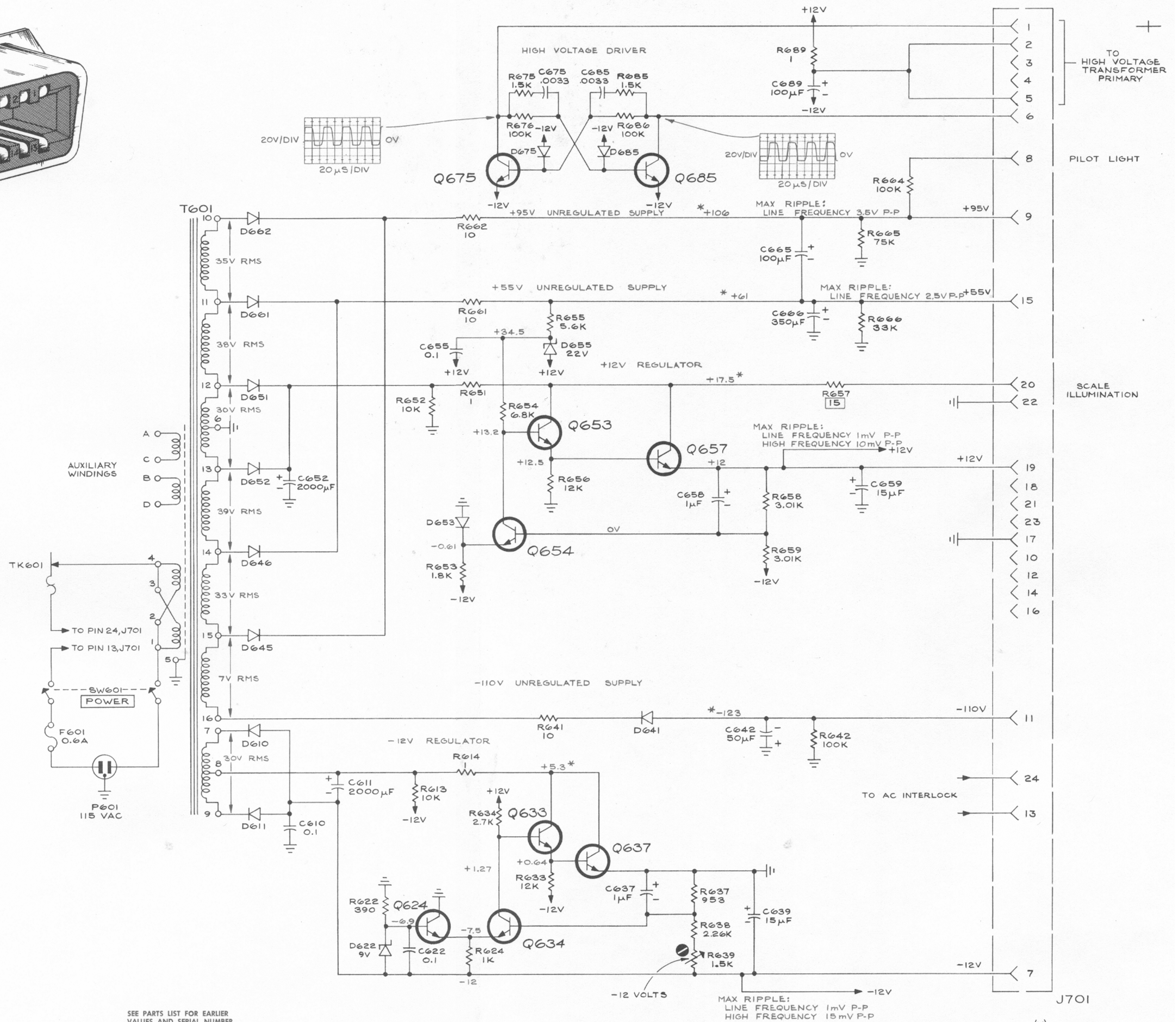
J701

AC POWER SUPPLY

B1



DETAIL OF J701



* MEASURED AT 115V LINE.
NOMINAL OUTPUT (BLACK)
GIVEN FOR MINIMUM AT LOW LINE.

SEE PARTS LIST FOR
SEMICONDUCTOR TYPES

SEE PARTS LIST FOR EARLIER
VALUES AND SERIAL NUMBER
RANGES OF PARTS MARKED
WITH BLUE OUTLINE.

016-0072-00

AC POWER SUPPLY

267

FIG. 1 MECHANICAL PART

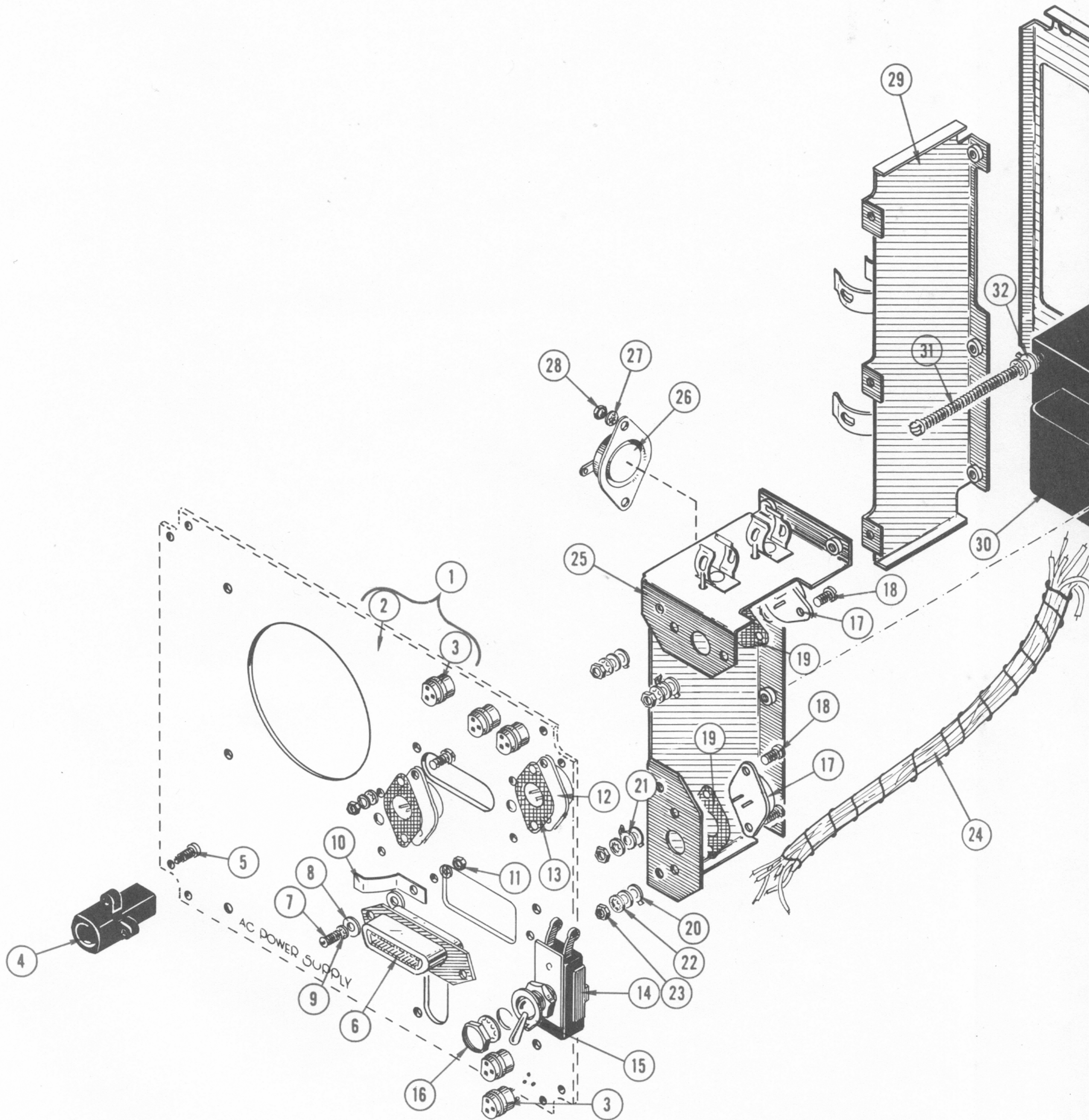


FIG. 1 MECHANICAL PARTS

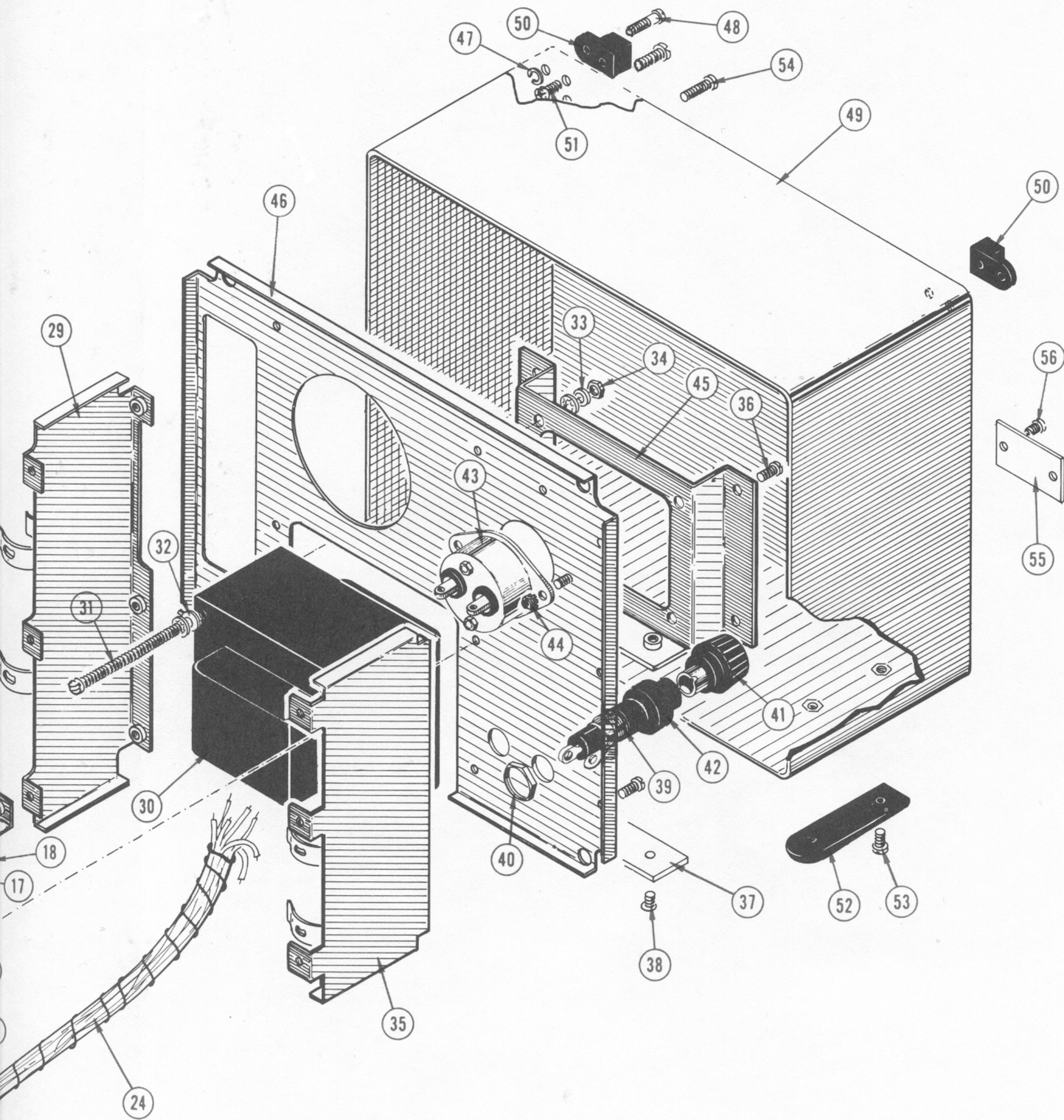


FIG. 1 MECHANICAL PART

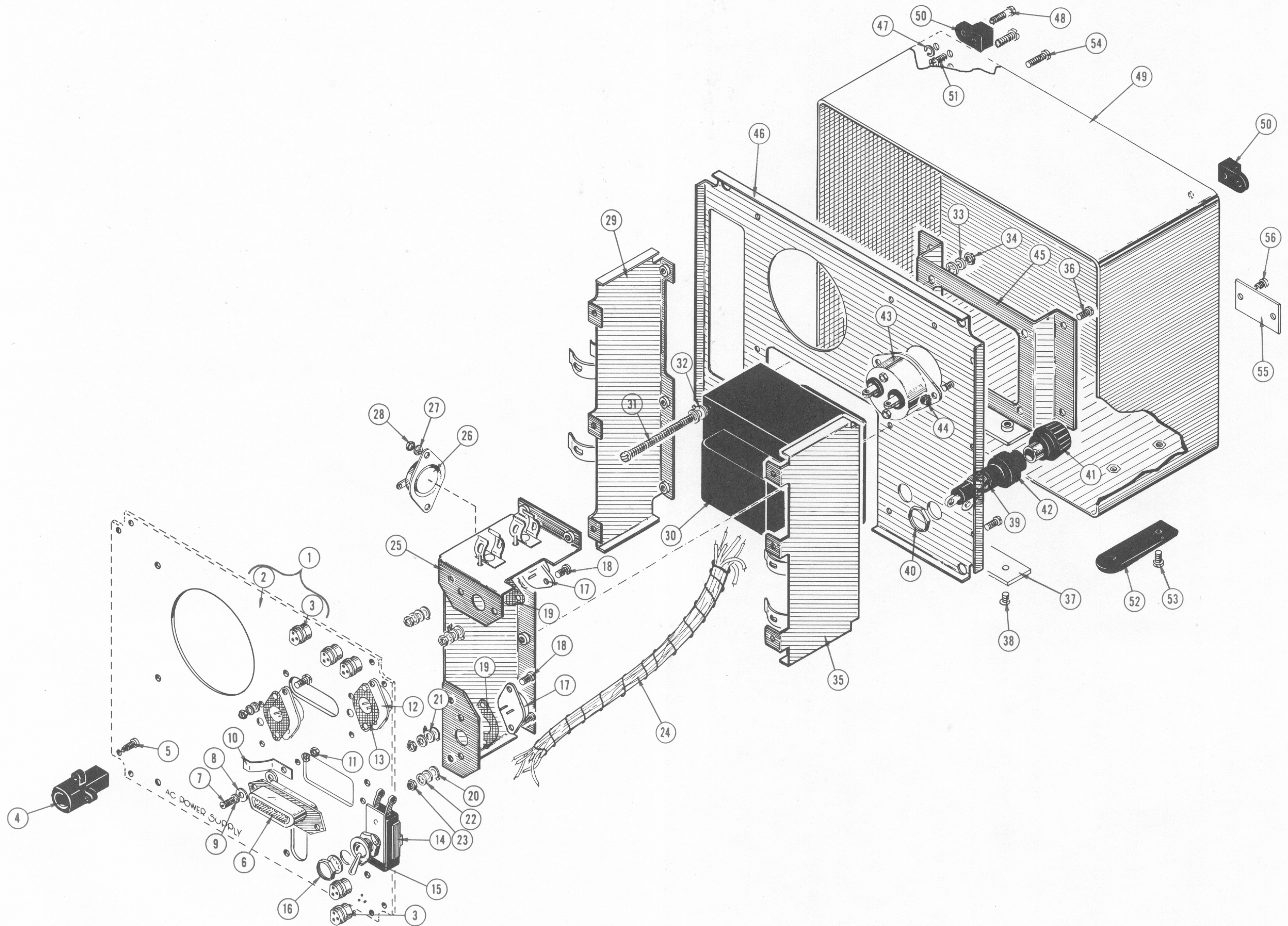
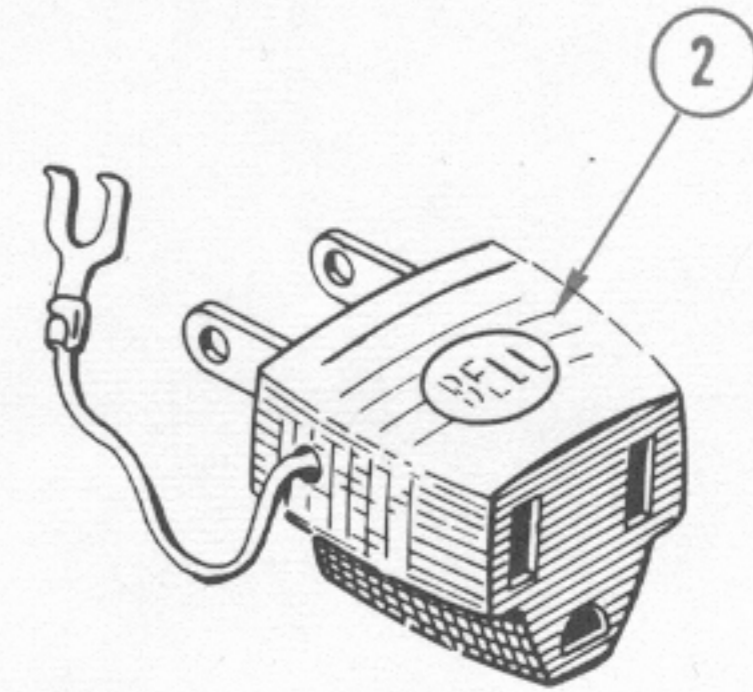
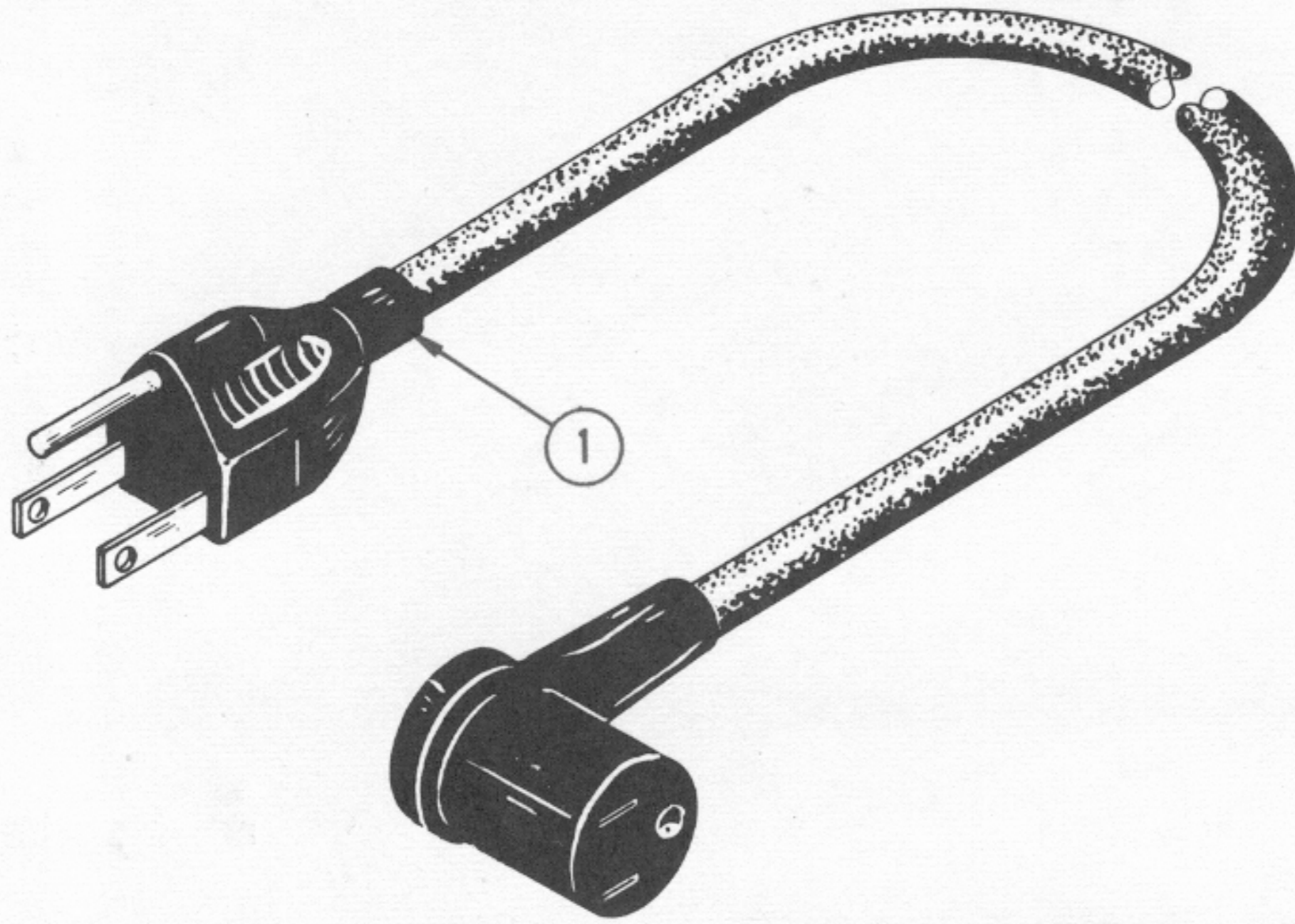


FIG. 2 STANDARD ACCESSORIES



A

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q t Y						Description
					1	2	3	4	5	
2-1	161-0024-00	100	8579	1						CORD, power, 8 ft right angle female end
	161-0024-01	8580		1						CORD, power, 8 ft right angle female end
-2	103-0013-00			1						ADAPTER, power cord 3 to 2 wire
	070-0528-00			1						MANUAL, instruction (not shown)

B

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.