

INSTRUCTION MANUAL

Serial Number _____

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TYPE 285
**POWER
SUPPLY**

Tektronix, Inc.

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070-0903-00

1168

SECTION 1

TYPE 285 SPECIFICATION

General Information

The Type 285 Power Supply for S-50 Series Heads contains the regulated power supplies for operation of either the Type S-50 Pulse Generator Head or the Type S-51 Trigger Countdown Head. It provides a front panel trigger output jack for the internal trigger pulse of any S-50 series head.

Characteristics

The following characteristics apply over an ambient temperature range of 0° C to +50° C and after a five-minute warmup, provided the instrument has been calibrated at a temperature between +20° C and +30° C.

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement
Output Voltage	+15 V within 1% and -12.2 V within 2%
Maximum Output Current	100 mA from each supply
Ripple	1 mV or less
Line Voltage Range	Grounded Neutral Distribution System
115 V	90 VAC to 136 VAC
230 V	180 VAC to 272 VAC
Line Frequency	50 Hz to 400 Hz

Fuse Data

115 V	1/8 A Slo Blow
230 V	1/16 A Slo Blow

ENVIRONMENTAL CHARACTERISTICS

Storage Temperature-- -40° C to +65° C	Operating Temperature-- As stated above in the Electrical Characteristics table.
Altitude-- To 50,000 feet	Altitude-- to 15,000 feet

MECHANICAL CHARACTERISTICS

Dimensions-- Height	3 1/8 inches
Width	5 inches
Length	8 inches

Approximate dimensions include switch and cord holders.

Construction-- Aluminum alloy chassis with epoxy laminated circuit boards. Both circuit boards are removable without using a soldering iron. The front panel is anodized aluminum. The textured aluminum cover has blue vinyl paint.

Accessories--- Standard accessories supplied with the Type 285 are listed in the Mechanical Parts List.

SECTION 2 OPERATING INSTRUCTIONS

General Information

The Type 285 Power Supply for S-50 Series Heads is intended for use with special heads such as the Type S-50 Pulse Generator Head or the Type S-51 Trigger Countdown Head. The Type 285 provides the regulated supply voltage requirements of one Type S-50 series head.

Regulated voltages are delivered to the S-50 series head through connector J40 at the rear of the plug-in compartment. A coaxial connector, J17, is also located at the rear of the plug-in compartment. A coaxial cable within the Type 285 connects J17 to the TRIGGER OUT connector (J45), on the Type 285 front panel. The signal available at the TRIGGER OUT connector depends on the type of S-50 series head plugged into the Type 285. See the instruction manual for your S-50 series head for further information.

Operating Information

A line voltage Selector switch on the Type 285 rear panel permits operation from 115 VAC or 230 VAC. Be sure the switch is set to the position corresponding to the line voltage to be utilized, and connect the Type 285 power cord to the AC line.

The S-50 series head is plugged into the compartment provided in the Type 285 front panel. To insert a S-50 series head, slide the unit completely into the compartment in the Type 285, leaving the latch at the bottom of the unit free to move. Push the latch knob to lock the S-50 series head in place. To remove the head, pull the latch knob away from the panel. See Fig. 2-1.

A toggle switch on the front panel of the Type 285 turns the instrument on or off. A POWER indicator lights when the POWER switch is on and the instrument is connected to the line voltage.

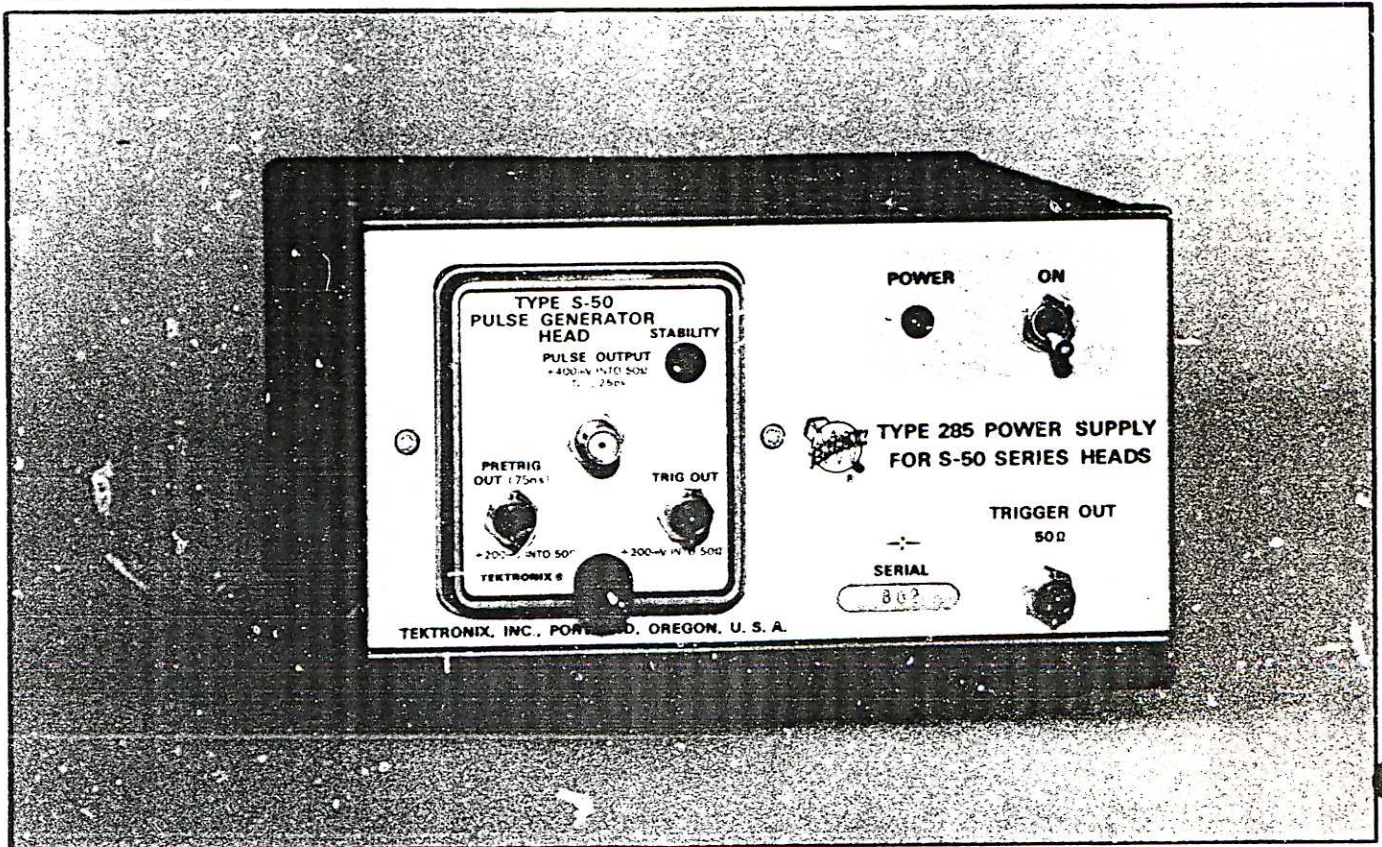


Fig. 2-1. S-50 series head installed in the Type 285.

SECTION 3 CIRCUIT DESCRIPTION

The Type 285 Power Supply develops regulated voltages of -12.2 V and +15 V for the Type S-50 series head. The Type 285 Power Supply operates from a 115 VAC or 230 VAC power source. Switch SW2 must be placed in the 115 V position if the power source is 115 VAC. The primary windings of transformer T2 are connected in parallel and fuse F1 protects the Type 285 Power Supply in case of overload. If the power source is 230 VAC, place switch SW2 in the 230 V position. The primary windings of transformer T2 are connected in series. Fuse F2 is connected in series with F1, and F2 is the controlling fuse. A POWER indicator light is connected across the secondary winding of the -12.2 V Power Supply. POWER switch SW1 connects both sides of the power line to the Type 285 Power Supply.

The +15 V Power Supply is composed of transformer T2 secondary winding (terminals 5 and 6 on the transformer), full wave bridge rectifier D20, filter capacitor C20, error signal amplifier Q24, inverter amplifier Q33 and series regulator Q35.

The regulator action is as follows: (Assuming a positive-going change in output voltage.) Q24A is biased at +9 V by Zener diode D22. Q24B base is biased by the voltage divider network R29, R30 and R31. R30 sets the Power Supply output to +15 V. The error signal is applied to Q24B base through the voltage divider R29, R30, and R31. (C29 couples fast-rise signals to Q24B base for greater output from Q24B.) Emitter follower Q24B drives Q24A emitter. The in-phase error output signal at the junction of R26 and R27 drives Q33 base. Q33 inverts and amplifies the signal to drive Q35, which serves as a variable resistor in series with the load. The signal to Q35 reverse biases the transistor to decrease the current through it and the load. The decreased current through the load lowers the load voltage to the desired value.

Turning on the Type 285 with the load connected, at first most of the supply voltage appears across Q35 which is cut off (it has very high resistance); Therefore, the output voltage is about zero volts. Q16 in the -12.2 V Power Supply is also turned off since that

supply does not have the +15 V necessary for proper operation. Network R36, R37, R38 and D37 applies forward bias and turns on Q35. With about zero volts feeding R37, (instead of the normal operating voltage of -12.2 V), approximately -27 volts at the junction of R37-R38, D37 is biased into conduction. The resulting voltage drop across R36 forward biases Q35 into conduction and the +15 volt Power Supply output rises to +15 V at which time the -12.2 V Power Supply operates properly and D37 is reverse biased (cut off).

Components not described above provide the following functions: C22 helps to stabilize Q24A base voltage for high frequency signals and to reduce the noise generated by D22. R26 is a parasitic suppressor. D33 provides temperature compensation for Q33. C39 reduces the high frequency output impedance of the supply.

The -12.2 V Power Supply is composed of transformer T2 secondary winding (terminals 7 and 8 on the transformer), full wave bridge rectifier D4, filter capacitor C4, error signal amplifier Q6, emitter follower Q12 and series regulator Q16.

The regulator action is as follows: (Assume a negative change in output voltage). Q6B base is biased by the voltage divider R10 and R11. R10 is connected to the +15 V reference voltage. The error signal is applied to Q6B by voltage divider R10 and R11. (C11 couples fast rise signals to Q6B base for greater output from Q6B.) Emitter follower Q6B drives Q6A emitter. The in-phase error output signal at the collector of Q6A drives emitter follower Q12. In-phase output from Q12 emitter drives Q16, which serves as a variable resistor in series with the load. The negative-going signal at Q16 base reverse biases the transistor to decrease the current through it and the load. The decreased current through the load raises the voltage back to -12.2 V.

R12 is transistor Q12's dissipation limiting resistor. C18 reduces the high frequency output impedance of the supply.

SECTION 5 PERFORMANCE CHECK/CALIBRATION

Introduction

This section of the manual contains a procedure for checking and calibrating the power supplies of the Type 285. The instrument will not require frequent calibration, but occasional adjustments will be necessary as components age or are replaced.

Equipment Required

The following equipment or its equivalent is required for calibration of the Type 285.

1. Autotransformer with output voltage variable between 90 and 136 VAC (or 180 to 272 VAC) and a minimum rating of 25 watts. If the autotransformer does not have an AC voltmeter to indicate output voltage, monitor its output with an RMS reading voltmeter with a range of at least 150 (300) volts. For example, General Radio W10MT3W Metered Variac Autotransformer.

2. Oscilloscope, maximum deflection factor of 1 mV/div and comparison voltage for measurement of +15 V and -12.2 V within 0.2%. Tektronix Type W Plug-In Unit with Type 545B Oscilloscope (540 series) or Tektronix Type 3A7 Differential Comparator with Type 3B4 Time Base Unit and Type 561A Oscilloscope (560-Series) meet these requirements.

3. 1X probe, Tektronix P6028. Tektronix Part No. 010-0074-00.

4. If a Type W plug-In Unit is not available, a precision voltmeter is needed that can measure up to +15 or -12.2 V with an accuracy of $\pm 0.2\%$. John Fluke Model 801B meets the requirements.

5. Test loads for power supplies:

+15 V supply; a 150 Ω , 2 watt, composition resistor, 10% tolerance, Tektronix Part No. 306-0151-00.

-12.2 V supply; a 120 Ω , 2 watt, composition resistor, 10% tolerance, Tektronix Part No. 306-0121-00.

6. Four clips, Mueller #30 miniature, to be attached to the test load resistors. Tektronix Part No. 344-0024-00.

PRELIMINARY INSTRUCTIONS

1. Disconnect the power cord. Remove the case of the Type 285 by removing the power cord holder screws and sliding the case off to the rear.

2. Connect the 120 Ω resistor between pin A of J40 and ground. Connect the 150 Ω resistor between pin 1, opposite pin A, and ground.

3. Connect the Type 285 power cord to the output of the variable autotransformer.

4. Turn on the instrument power and adjust the autotransformer for an output of 115 volts as determined by the LINE VOLTAGE SELECTOR, located on the rear panel.

5. Turn on the oscilloscope. Allow 15 minutes for warmup and stabilization.

6. Set the oscilloscope and Type W controls as follows:

Performance Check/Calibration-Type 285

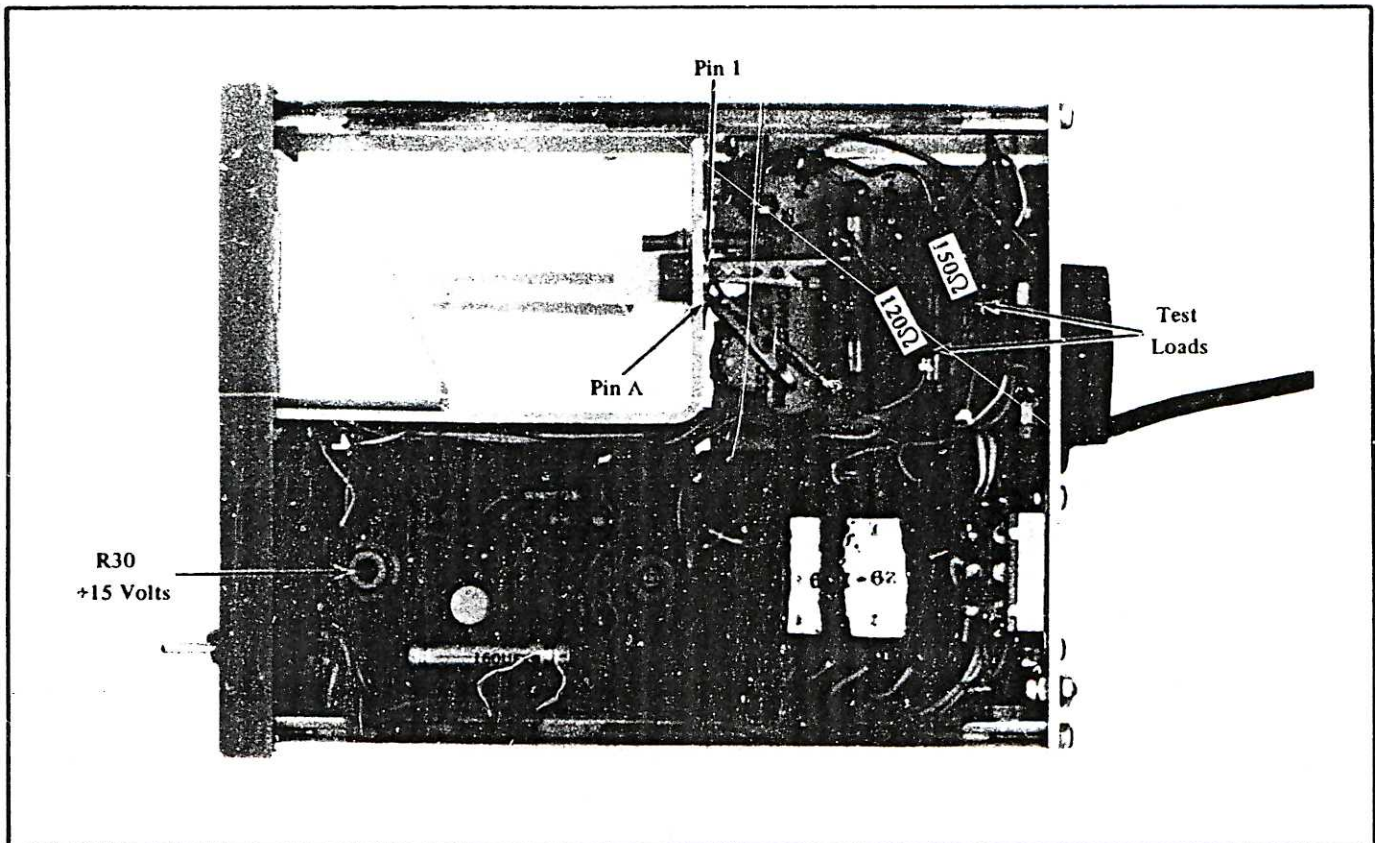


Fig. 5-1. Locations of test points and adjustment.

Oscilloscope

Triggering	Int, +, AC
Stability	Fully clockwise
Time/cm	1 ms

Type W

Vc Range	0
Comparison Voltage	1500
AC DC GND	GND
Input Atten	10
Display	A-Vc
Millivolts/cm	5
Variable	Calib

b. Set the AC DC GND switch to DC and the Vc Range switch to +11.

c. Check that the trace is at the center line with a comparison Voltage setting between 1515 and 1485 (15 volts $\pm 1\%$).

d. If the Comparison Voltage is not between 1515 and 1485, adjust R30, the +15 volts control, until the trace is at the graticule center line with Comparison Voltage set at 1500.

e. Change the autotransformer output voltage from 90 volts to 136 volts and check that the ± 15 V supply remains within the 1% tolerance.

f. Set the autotransformer output voltage to 115 volts. Set the Vc Range switch to 0 and the AC DC GND switch to GND. Connect the 1X probe to pin A at the 120 Ω resistor. Set the trace at the center line.

g. Set the Comparison voltage to 1220. Change the AC DC GND switch to DC and the Vc Range switch to -11.

PROCEDURE

1. Check or Adjust Power Supplies

a. Set the oscilloscope trace at the graticule center line. Connect the 1X probe to pin 1 at the 150 Ω resistor in the Type 285. Fig. 5-1 shows the locations of test points and the adjustment.

Performance Check/Calibration-Type 285

h. Check that the trace is at the center line with a comparison Voltage setting between 124B and 1196 (12.2 volts $\pm 2\%$).

i. Change the autotransformer output voltage from 90 volts to 136 volts and check that the -12.2 volt supply remains within the 2% tolerance.

2. Check Ripple

a. Set the Vc Range switch to 0 and the AC DC GND switch to AC. Set the Input Atten switch to 1 and the Millivolts/cm switch to 1.

b. Set the oscilloscope Time/cm switch to 5, the Triggering switch to Auto and the Trigger Slope switch to + line.

c. Change the autotransformer output voltage from 90 volts to 136 volts and check that the ripple as observed on the oscilloscope does not exceed 1 mV (1 division); see Fig. 5-2. Measure from trace bottom at a low point to trace bottom at a high point.

d. Connect the 1X probe to pin 1 at the 150 Ω resistor.

e. Change the autotransformer output voltage from 90 volts to 136 volts and check that the ripple does not exceed 1 mV (1 division).

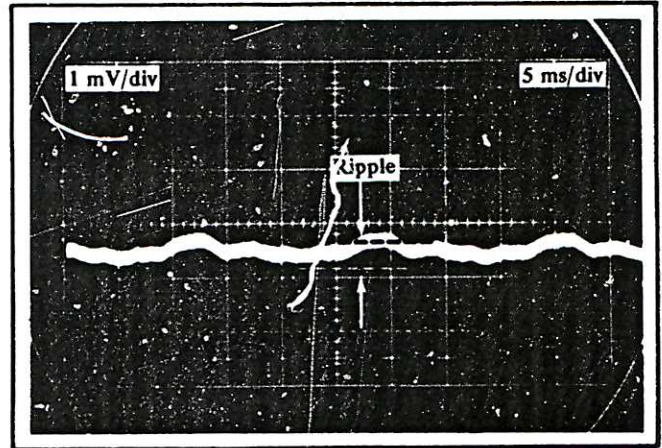


Fig. 5-2. Typical display of ripple.

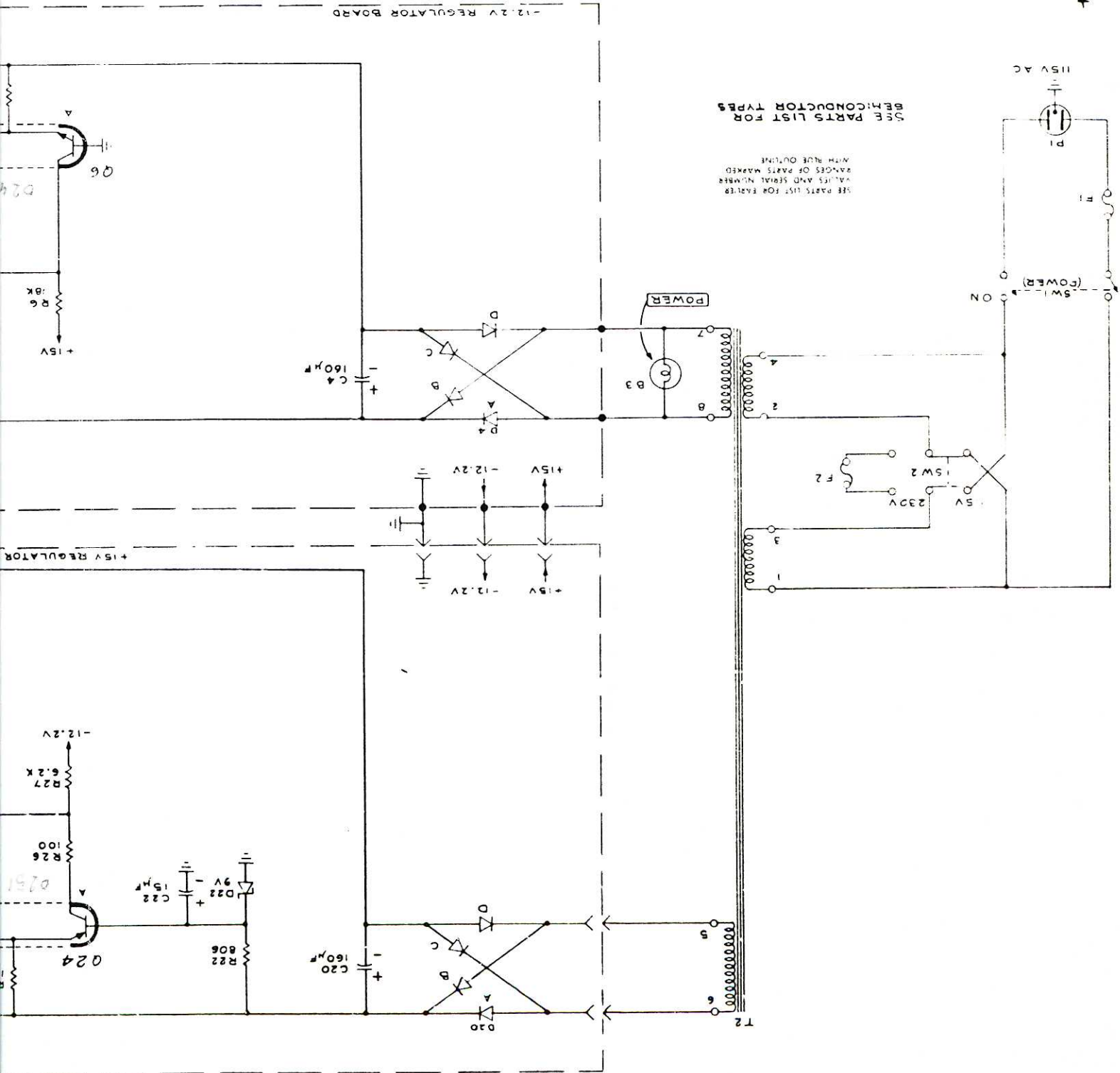
f. Turn the Type 285 Power Off and disconnect the power cord from the autotransformer.

3. Check 230-Volt Operation

a. Set the LINE VOLTAGE SELECTOR switch on the rear panel to 230 V.

b. Connect the Type 285 power cord to a 230 V source and set the Type 285 Power On.

c. Check the +15 volt and -12.2 volt supplies, pin 1, and pin A of J40, as described in step 1. Tolerance on the +15 volt supply is 1% and on the -12.2 volt supply tolerance is 2%. The autotransformer range for checking the regulation is 180 through 272 volts.



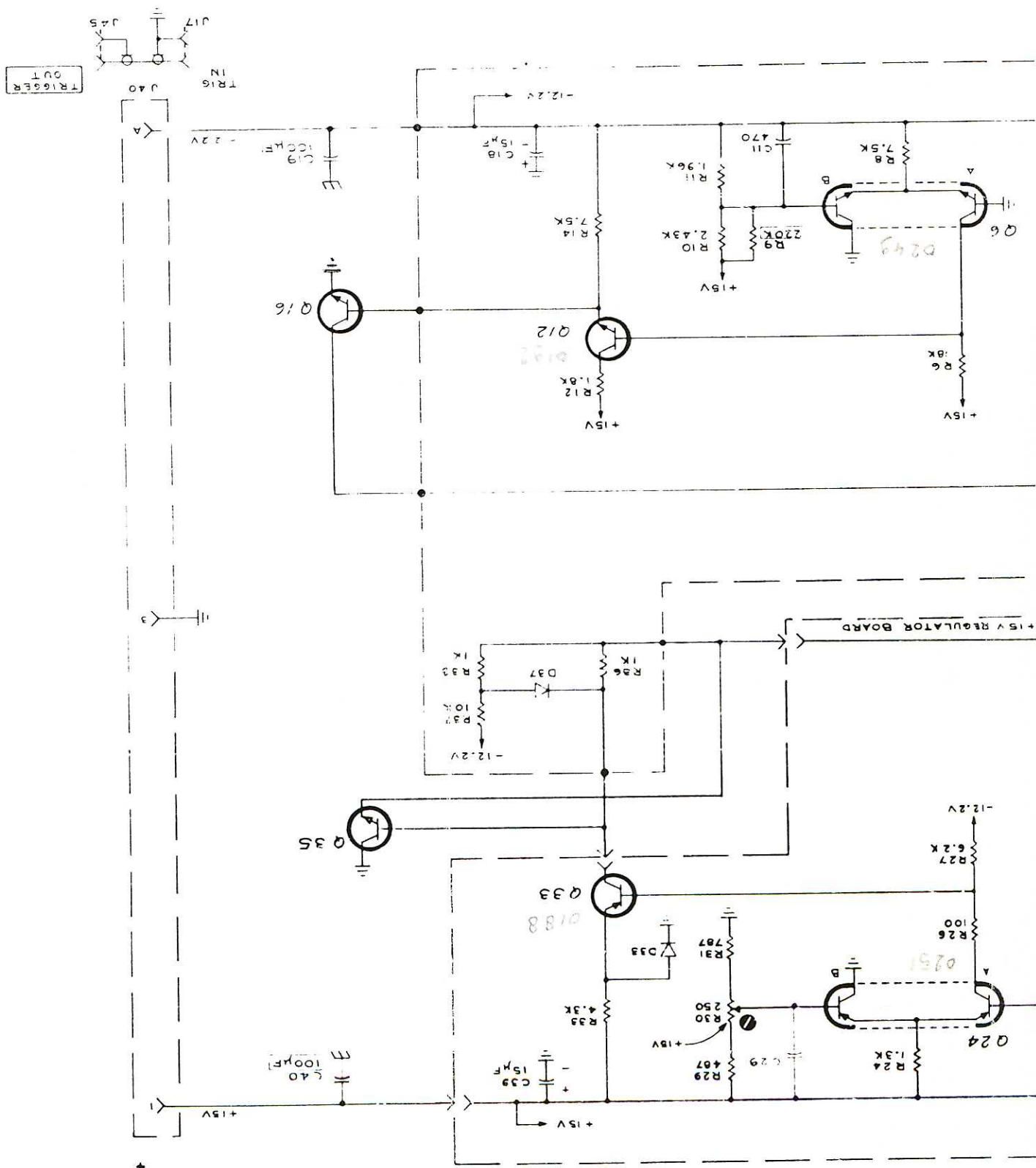
SEE PARTS LIST FOR
SEMICONDUCTOR TYPES
RANGES OF PARTS MARKED
WITH TRUE OUTLINE

-12.2V REGULATOR BOARD

+15V REGULATOR

+15V REGULATOR BOARD

SAMPLING HEAD POWER SUPPLY



0271

TRIGGER OUT

TRIG IN

+15V REGULATOR BOARD

0243

0251

0188

SECTION 6

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
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Bulb

B3	150-0088-00			Incandescent 2187D
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Capacitors

Tolerance $\pm 20\%$ unless otherwise indicated.

C4	290-0394-00			160 μ F	Elect.	50 V	
C11	283-0032-00			470 pF	Cer	500 V	10%
C18	290-0135-00			15 μ F	Elect.	20 V	5%
C19	290-0309-00	XB040000		100 μ F	Elect.	25 V	
C20	290-0394-00			160 μ F	Elect.	50 V	10%
C22	290-0135-00			15 μ F	Elect.	20 V	
C29	283-0065-00	B010100	B039999X	0.001 μ F	Cer	100 V	5%
C39	290-0135-00			15 μ F	Elect.	20 V	
C40	290-0309-00	XB040000		100 μ F	Elect.	25 V	

Semiconductor Device, Diodes

D4 A,B,C,D (4)	*152-0107-00			Silicon	Replaceable by 1N647
D20 A,B,C,D (4)	*152-0107-00			Silicon	Replaceable by 1N647
D22	152-0212-00			Zener	1N936 9 V, 5%, TC
D33	152-0141-02			Silicon	1N4152
D37	152-0141-02			Silicon	1N4152

Fuses

F1	159-0063-00			1/8 A	3AG Slo-Blo
F2	159-0051-00			1/16 A	Slo-Blo

Connectors

J17 ¹					
J40	131-0581-00			12 Pin, Female	
J45 ¹					

Transistors

Q6A,B	151-0249-00	B010100	B039999	Silicon	Dual
Q6A,B	151-0232-00	B040000		Silicon	Dual
Q12	*151-0192-00			Silicon	Replaceable by MPS-6521
Q16	*151-0148-00			Silicon	Selected from 40250 (RCA)
Q24	151-0261-00			Silicon	Dual
Q33	151-0188-00			Silicon	2N3906
Q35	*151-0148-00			Silicon	Selected from 40250 (RCA)

¹See Mechanical Parts List (*175-1012-00)

Electrical Parts List—Type 285

Resistors

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Description		
Resistors are fixed, composition, $\pm 10\%$ unless otherwise indicated.						
R6	315-0183-00			18 k Ω	1/4 W	5%
R8	315-0752-00			7.5 k Ω	1/4 W	5%
R9	315-0224-00			220 k Ω	1/4 W	5%
R10	321-0230-00			2.43 k Ω	1/8 W	Prec 1%
R11	321-0221-00			1.96 k Ω	1/8 W	Prec 1%
R12	315-0182-00			1.8 k Ω	1/4 W	5%
R14	315-0752-00			7.5 k Ω	1/4 W	5%
R22	321-0184-00			806 Ω	1/8 W	Prec 1%
R24	315-0132-00			1.3 k Ω	1/4 W	5%
R26	315-0101-00			100 Ω	1/4 W	5%
R27	315-0622-00			6.2 k Ω	1/4 W	5%
R29	321-3163-00			487 Ω	1/8 W	Prec 1%
R30	311-0442-00	B010100	B035999	250 Ω , Var		
R30	311-1223-00	B040000		250 Ω , Var		
R31	321-0183-00			787 Ω	1/8 W	Prec 1%
R33	315-0432-00			4.3 k Ω	1/4 W	5%
R36	315-0102-00			1 k Ω	1/4 W	5%
R37	315-0103-00			10 k Ω	1/4 W	5%
R38	315-0102-00			1 k Ω	1/4 W	5%

Switches

SW1	Wired or Unwired		Toggle	POWER
SW2	260-0834-00		Slide	115 V/230 V
	260-0675-00			

Transformer

T2	*120-0581-00		Power
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SAMPLING HEAD POWER SUPPLY

