

TEKTRONIX®

**016-1000-00
RSS EXTERNAL
NORMALIZER**

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

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INSTRUCTION MANUAL

Serial Number _____ 070-1743-00

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WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

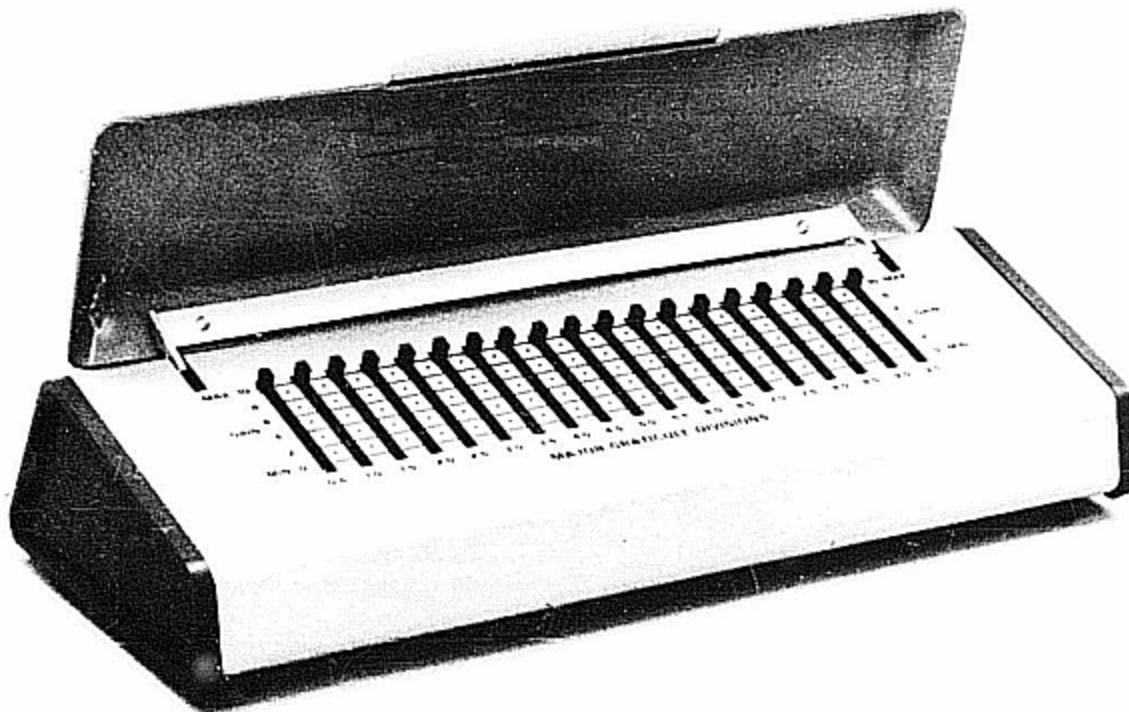
All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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RSS EXTERNAL NORMALIZER

INTRODUCTION

The 016-1000-00 RSS External Normalizer is an optional accessory device intended for use with the J20/7J20 Rapid-Scanning Spectrometer system. The device plugs into the Spectral Normalizer jack on the 7J20 Spectrometer Plug-In and provides the ability to arbitrarily adjust the flatness of a spectrum display. Nineteen slide potentiometers on the External Normalizer adjust the gain of the video amplifier circuitry in the 7J20 Spectrometer Plug-In at 19 discrete points (0.5-division increments over the center nine divisions of an unexpanded display) to achieve display flatness. No offset is introduced into the spectrometer amplifier circuitry. A display that is flat over some arbitrary wavelength range allows each division of vertical deflection in the display to represent a fixed percentage of transmission without having to take the spectral response characteristics of the RSS (or the spectral characteristics of any external optical elements) into consideration.

SPECIFICATIONS

INTRODUCTION

The following is a list of specifications for the RSS External Normalizer. These specifications apply over the ambient temperature range of +15°C to +35°C after a minimum warm-up time of one minute.

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OPERATIONAL SPECIFICATIONS	
Characteristic	Limits
Ramp Input Required (From 7J20)	0 to +8 volts (plus overscan)
Position of First Break Point	0.5 division to the right of the extreme left edge of the crt graticule, $\pm 1\%$ of full screen (± 0.1 div).
Span Between First And Last Break Points	Nine divisions, $\pm 1\%$ of full screen (± 0.1 div).
Span Between Alternate Break Points	One division, ± 0.1 division.
Normalization Range (Output Volts Controlled By GAIN Adjustments)	0 volts, ± 0.05 volt to +5.5 volts, $\pm 3\%$.

OPERATING INSTRUCTIONS

INTRODUCTION

The ability to obtain a flat spectrometer display using the RSS External Normalizer simplifies making transmission or absorption measurements. Having each vertical division of signal amplitude in the spectrometer display represent the same percentage of transmission, regardless of wavelength, allows direct comparison of transmission at two or more wavelengths without having to make any adjustments to the display.

A spectrometer user should be aware, however, that using the RSS External Normalizer results in a reduced dynamic signal range for the spectrometer. Two factors cause the reduced range. First, the RSS External Normalizer increases the absolute value of display baseline noise (which is electronically limited); second, the maximum signal amplitude is attenuated. Since dynamic signal range is defined as the ratio of baseline noise to signal amplitude, the result is a reduced range.

BASIC NORMALIZER OPERATION THEORY

Basically, the RSS External Normalizer generates a variable-voltage signal during vidicon scanning that is applied to the video-amplifier circuit of the 7J20 Spectrometer Plug-In. This variable-voltage signal alters the

gain of the 7J20 video amplifier at nineteen discrete points along the horizontal axis of the display. The amount of gain variation is determined by the settings of the nineteen slide potentiometers on the RSS External Normalizer. The ability to adjust vertical gain every 1/2-division allows the operator to adjust the shape of a spectral curve in the spectrometer display to be, for example, flat instead of curved.

NORMALIZATION

The following procedure provides instructions for externally normalizing a J20/7J20 Rapid-Scanning Spectrometer display. Set the 7J20 TIME/DIV switch to 10 ms to obtain the largest possible dynamic signal range in the spectrometer. To externally normalize a display, proceed as follows:

1. Set the 7J20 VERTICAL GAIN switch to the 1 position.
2. Plug the RSS External Normalizer into the 7J20 SPECTRAL NORMALIZER jack (EXTERNAL NORMALIZER jack on Option 1 7J20's) and set the SPECTRAL NORMALIZER switch to off.
3. Obtain a spectral display containing the wavelength region of interest.

ENVIRONMENTAL SPECIFICATIONS

Characteristic	Limits
Temperature	
Operating	-15°C to -35°C
Non-operating	30°C to -50°C
Altitude	
Operating	To 15,000 feet
Non-operating	To 50,000 feet
Humidity	95% relative humidity, non-condensing from +15°C to -35°C, operating or non-operating for 4 hours.
Vibration	15 minutes along each of the 3 major axes at a total displacement of 0.015", p-p with frequency varied from 10 to 55 to 10 Hz in one-minute cycles. After sweep vibration in each axis, hold frequency steady at

each major resonance for three minutes, or if no such resonances are found, hold at 55 Hz for three minutes.

Shock	30 g's, 1/2-sine, 11 ms duration, 2 guillotine-type shocks per axis each direction, total of 12 shocks.
Transportation	Tested to National Safe Transit Committee procedure 1A with a 36" drop.

PHYSICAL

Characteristic	Limits
Dimensions	
Length	10 inches
Width	4 inches
Height	2-1/2 inches
Weight	1 pound

4. Press the BASELINE RESTORE pushbutton on the 7J20 and hold it. Use the VERT POSITION control to position the display baseline to the bottom crt graticule line. Release the BASELINE RESTORE pushbutton.

5. Determine the vidicon saturation level. Refer to the appropriate section of the J20/7J20 Rapid-Scanning Spectrometer Operators Instruction Manual for instructions on determining vidicon saturation. See Fig. 1.

6. Position the light source in front of the spectrometer entrance slit in a manner that will yield a spectral display whose maximum amplitude is approximately equal to 75% of the vidicon saturation level. See Fig. 2.

7. Set the 7J20 VERTICAL GAIN switch to 5 and the SPECTRAL NORMALIZER switch to EXT.

8. Press the BASELINE RESTORE pushbutton on the 7J20 and check to see that the display baseline is still positioned to the bottom crt graticule line. Release the BASELINE RESTORE pushbutton.

9. Adjust the 19 GAIN slide controls on the RSS External Normalizer to achieve a "flat" spectral response curve in the spectrometer display. Fig. 3 shows a typical externally-normalized display. The normalized spectrum

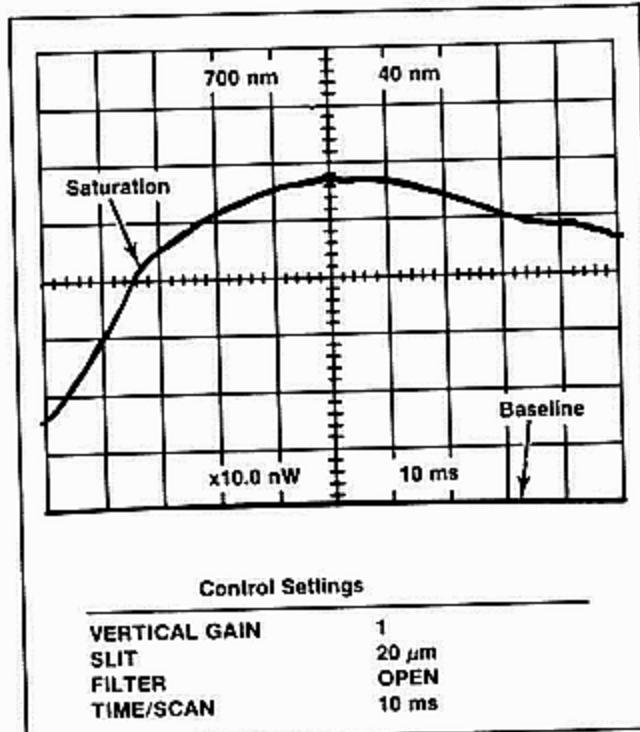


Fig. 1. Spectral display showing vidicon saturation.

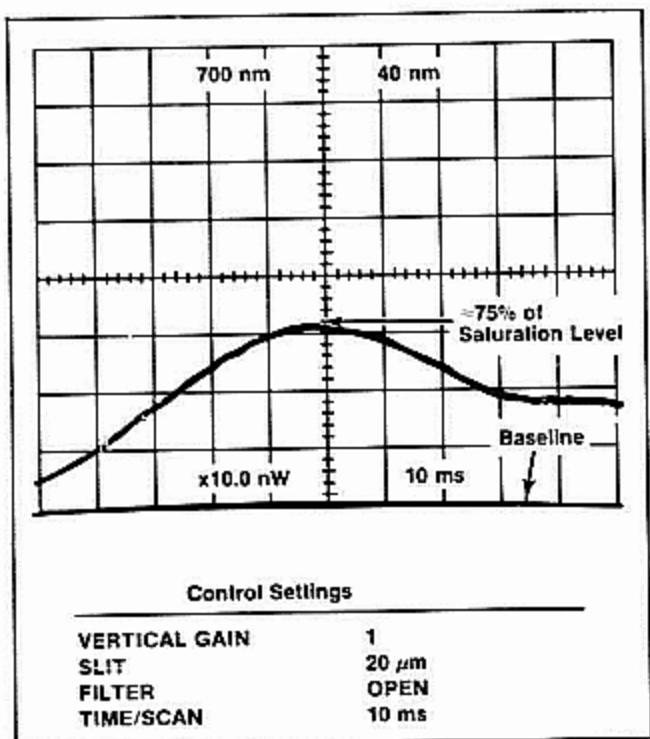


Fig. 2. Spectral display with amplitude reduced to approximately 75% of vidicon saturation level.

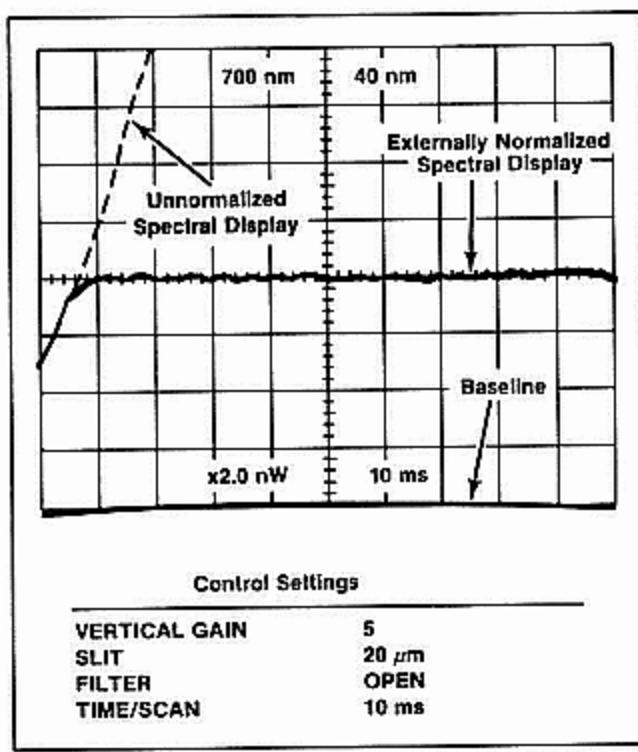


Fig. 3. Spectral display after external normalization.

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The RSS External Normalizer is also useful for external normalization of line spectra sources. If it is desired to know, for example, the transmission characteristics of a filter to the spectral lines of a low-pressure mercury lamp in the 400 nm-800 nm region, these spectral lines can be displayed and normalized to some arbitrary level. Then, when the filter is placed between the light source and the spectrometer entrance slit, transmission at two or more wavelengths can be directly compared on-screen in the spectrometer display.

CIRCUIT DESCRIPTION

INTRODUCTION

The following discussion contains a description of the electrical operation and relationship of the circuitry in the RSS External Normalizer. This circuit analysis is written around the circuit diagram located at the rear of this manual.

REFERENCE CURRENT CIRCUIT

VR8, U2A, and Q1 form the reference current circuit. The function of the circuit is to generate a fixed reference current of approximately 2 milliamperes. U2A and Q1 are configured as a voltage-to-current converter. Span adjustment R10 sets the value of the output current, which is connected to pin 7 of U1.

RAMP AMPLIFIER

U3B, U2B, and Q2 form the Ramp Amplifier circuit. The positive-going, sawtooth-shaped scanning ramp waveform from the spectrometer is applied to pin 5 of U3B. U3B is a non-inverting voltage follower with a gain of one, and provides isolation between the signal source in the spectrometer and the remainder of the Ramp Amplifier circuit. U2B and Q2 are a voltage-to-current converter. The ramp current output from the converter is applied to pin 5 of U1.

PROGRAMMABLE FUNCTION GENERATOR

U1 is a programmable function generator integrated circuit. It has 19 discrete output current nodes, each capable of supplying a current approximately equal to half the value of the reference current connected to pin 7. The amplitude of the current ramp connected to pin 5 determines which output nodes will be conducting. Each node comes into conduction in a gradual linear fashion. Between each of the 19 discrete correction points, the value of output current will be shared between two adjacent output current nodes. Comp adjust R22 provides some compensation for U1 by balancing the ratio of some currents internal to U1.

in Fig. 3 is four major crt graticule divisions in amplitude, resulting in each vertical major division being equal to 25%T.

Other values of %T/division can be obtained by selecting different gain positions of the VERTICAL GAIN switch. For example, switching from the 5 position to the 10 position would reduce the %T/division for the spectrum in Fig. 3 to 12.12%. The vertical VARIABLE control can be used in conjunction with the VERTICAL GAIN switch to obtain other desired signal amplitudes. The OFFSET control provides the ability to offset overscanned displays back to within the limits of the crt viewing area. This is useful, for example, when it is desired to view small variations in transmission that occur at relatively high absolute transmission levels (e.g., 5% variations occurring around an absolute transmission level of 90%).

10 To make absorbance measurements, press the BASELINE RESTORE pushbutton on the 7J20 to ensure the 0%T reference baseline is still positioned to the bottom crt graticule line. Release the button and set the VERTICAL GAIN switch to one of the ABSORBANCE positions (.1A, .2A, or .5A). Using the ABSORBANCE ZERO control on the 7J20, position the normalized 100%T (zero absorbance) line to the bottom crt graticule line. See Fig. 4. Each vertical division of deflection over the wavelength range externally normalized is now equal to

the number of absorbance units selected by the VERTICAL GAIN switch on the 7J20 without regard to wavelength.

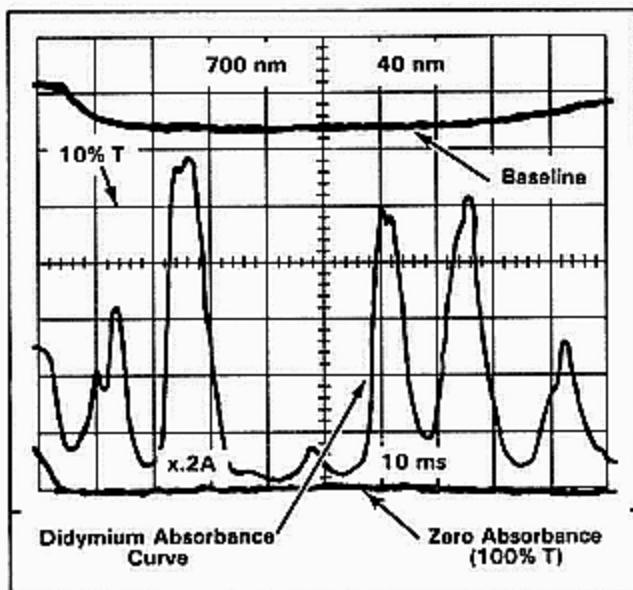


Fig. 4. Spectrum externally normalized for absorbance measurements.

OUTPUT AMPLIFIER

U3A is the output amplifier stage. It is configured as an inverting feedback amplifier. The stage converts the output signal currents from U1 into a voltage signal; the gain of the stage is set by variable resistor R68.

MAINTENANCE

PREVENTIVE MAINTENANCE

There are no preventive maintenance routines recommended for the RSS External Normalizer. If care is taken to keep the control panel cover closed when not actually adjusting the GAIN controls, the device will operate reliably for extended periods of time. Operation of the device without all of its covers in place is not recommended.

CLEANING

Occasionally it may be desired to clean the instrument. Loose dust accumulated in the interior and on the exterior of the instrument can be removed using a small paint brush or a stream of low-pressure air. Dirt that remains on the exterior of the instrument can be removed in most cases with a soft, lint-free cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

PARTS REPLACEMENT

All electrical and mechanical parts replacements for the RSS External Normalizer can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description. When ordering replacement parts from Tektronix, Inc., always include instrument type, instrument serial number, a description of the part (including circuit number of electrical components), and the Tektronix Part Number.

INSTRUMENT REPACKAGING

If the RSS External Normalizer is to be shipped for long distances by commercial means of transportation, it is recommended that the instrument be repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. New shipping cartons can be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representative.

CALIBRATION

INTRODUCTION

The simplicity of the circuitry in the RSS External Normalizer in conjunction with solid-state components result in a reliable design requiring only periodic adjustment. Tektronix, Inc. recommends recalibration of the RSS External Normalizer every 1000 hours of operation, or every six months if used infrequently.

Tektronix, Inc. provides complete instrument repair and recalibration services at local Field Service Centers and the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

TEST EQUIPMENT REQUIRED

The following test equipment, or its equivalent, is required for complete calibration of the RSS External Normalizer. Specifications given for test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications. All test equipment is assumed to be correctly calibrated and operating within the listed specifications.

In addition to the following list of test equipment, calibration of the RSS External Normalizer requires a fully-calibrated, properly-operating J20/7J20 Rapid-Scanning Spectrometer system.

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PRELIMINARY PROCEDURE FOR CALIBRATION

NOTE

For best overall instrument accuracy, the instrument should be calibrated at an ambient temperature of -25°C. +5°C.

1 Connect the J20 Spectrometer and the 7J20 Spectrometer Plug-In together as a system.

2 Install the 7J20 Spectrometer Plug-In and the 7A15A Amplifier Plug-In in the 7000-series oscilloscope. The 7J20 should occupy one vertical and one horizontal plug-in compartment.

3 Remove the end castings and the bottom plate from the RSS External Normalizer.

4 Connect the RSS External Normalizer to the Spectral Normalizer jack on the 7J20 and set the Spectral Normalizer switch to Ext.

5 Set the oscilloscope controls to display the spectrometer output. Set the spectrometer and external normalizer controls as follows:

J20

Wavelength Span	A400 nm
Slit Width	100 μm
Filter	Open
Grating A Wavelength Interval	500-900 nm

7J20

Vertical Gain	5
Offset	Locked at 0.00
Time Scan	20 ms
Display Dispersion	40 nm/div
Display Trigger Mode	Free Run
Spectral Normalizer	Ext

RSS External Normalizer

GAIN Controls	Odd-numbered controls to MAX.
	Even-numbered controls to MIN.

6. Connect the oscilloscope to a suitable power source and turn instrument power on. Allow twenty minutes of instrument warm-up before proceeding.

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TEST EQUIPMENT REQUIRED

Description	Minimum Specifications	Usage	Example
1 Oscilloscope	Has at least three plug-in compartments; compatible with J20/7J20 RSS system.	Used throughout entire procedure.	Tektronix 7603 Oscilloscope.
2 Amplifier Plug-In	Bandwidth of at least 10 mHz; deflection factor of 50 mV/div to 1 V/div; accuracy, $\pm 3\%$.	Used to check signals and dc levels in normalizer.	Tektronix 7A15A Amplifier Plug-in.
3 Passive Voltage Probe	Attenuation, X10; accuracy (w/amplifier), $\pm 3\%$; compatible with amplifier plug-in used.	Used to check signals and dc levels in normalizer.	Tektronix P6053A 3.5-Ft. Probe.
4 Light Source	Must exhibit smooth continuous spectrum with emission in 500 nm to 900 nm range.	Used throughout procedure.	60-watt incandescent lamp.
5 Screwdriver	Three-inch shaft; 3/32-inch bit.	Used to adjust variable resistors.	Xcelite R-3323.

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CALIBRATION PROCEDURE

1. ADJUST COMPENSATION

a. Place the tungsten incandescent lamp in front of the Spectrometer entrance slit. Position the lamp to obtain a spectrometer display approximately 4 divisions in amplitude. See Fig. 5.

b. Press the Baseline Restore pushbutton on the 7J20 briefly, then release.

c. CHECK—Spectrometer display to see that the sawtooth waveform peaks are just starting to broaden.

d. ADJUST—Comp R22 (see Fig. 6) so the waveform peaks just start to broaden.

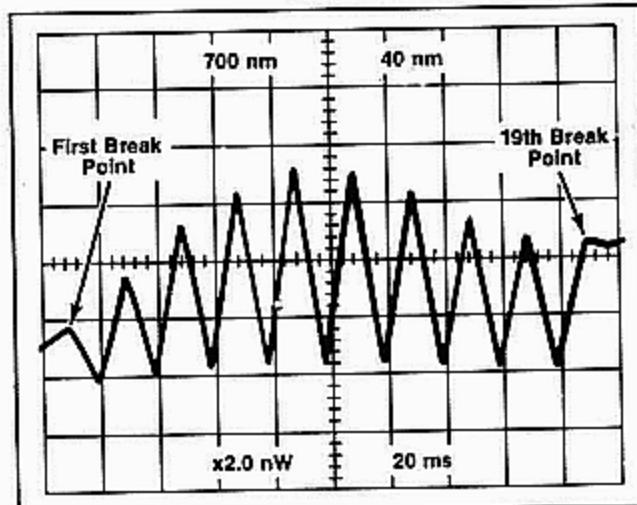


Fig. 5. Spectrometer display with RSS External Normalizer operating.

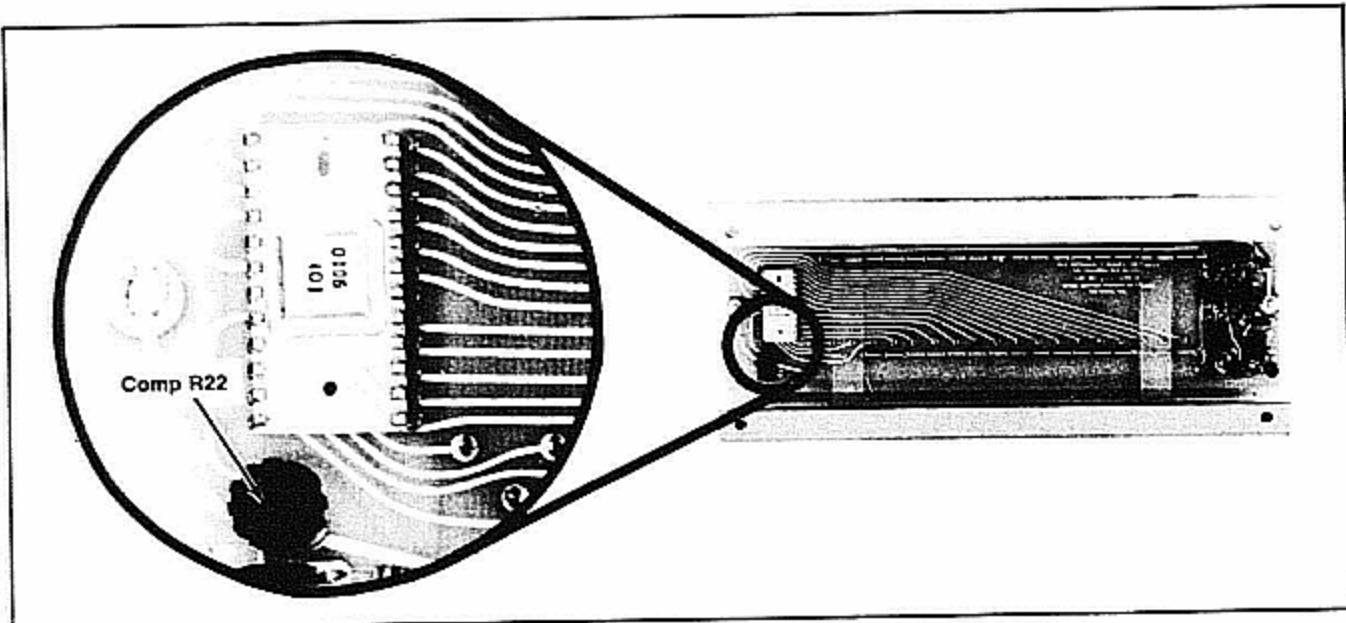


Fig. 6. Location of Comp R22.

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c. CHECK - Spectrometer display to see that the first break point is 0.5 division, -0.1 division to the right of the left edge of the crt graticule. See Fig. 5

3. ADJUST GAIN

a. Set the oscilloscope to display the 7A15A Amplifier Plug-In output

b. Install the P6053A X10 probe onto the 7A15A Input connector and set the 7A15A Volts/Div switch for 1 volt div vertical deflection sensitivity.

c. Connect the probe tip to pin 1 of plug P1 (see Fig. 8) in the RSS External Normalizer.

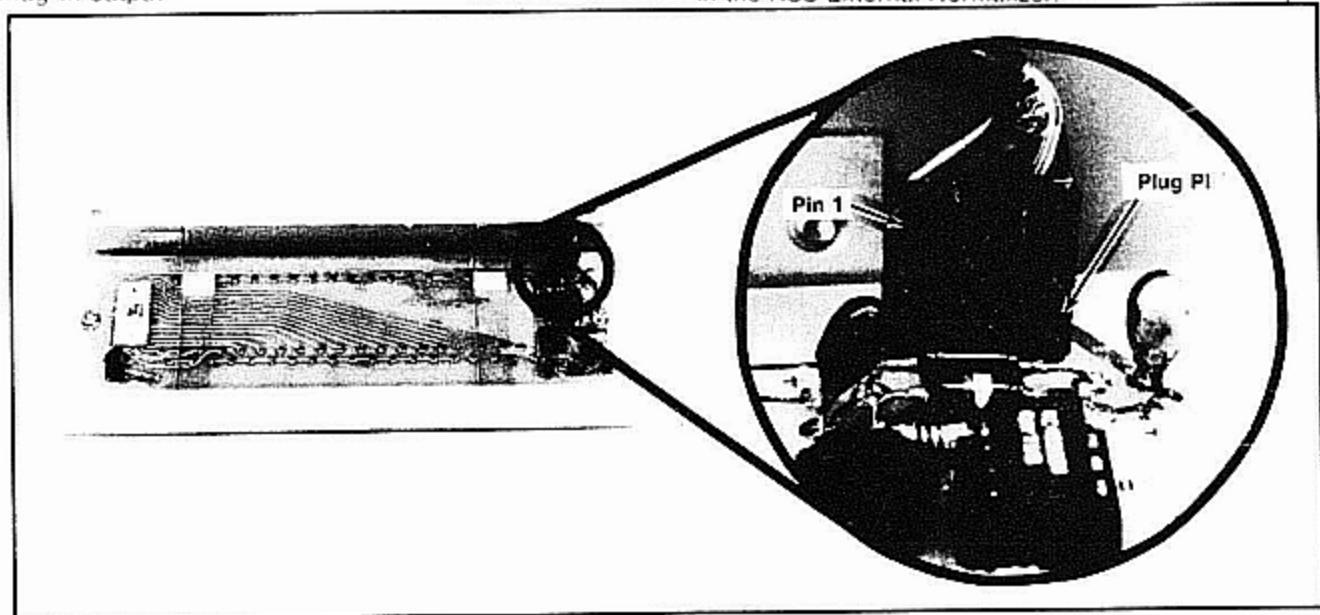


Fig. 8. Location of Plug P1.

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2. ADJUST SPAN

NOTE

This step requires that the Horiz Cal and Horiz Pos adjustments on the 7J20 Spectrometer Plug-In be accurately adjusted.

a. CHECK—Spectrometer display for 9 divisions.
0.1 division of horizontal deflection between the first break point and the nineteenth break point. See Fig. 5.

b. ADJUST—Span R10 (see Fig. 7) for exactly 9 divisions of horizontal deflection between the first break point and the nineteenth break point.

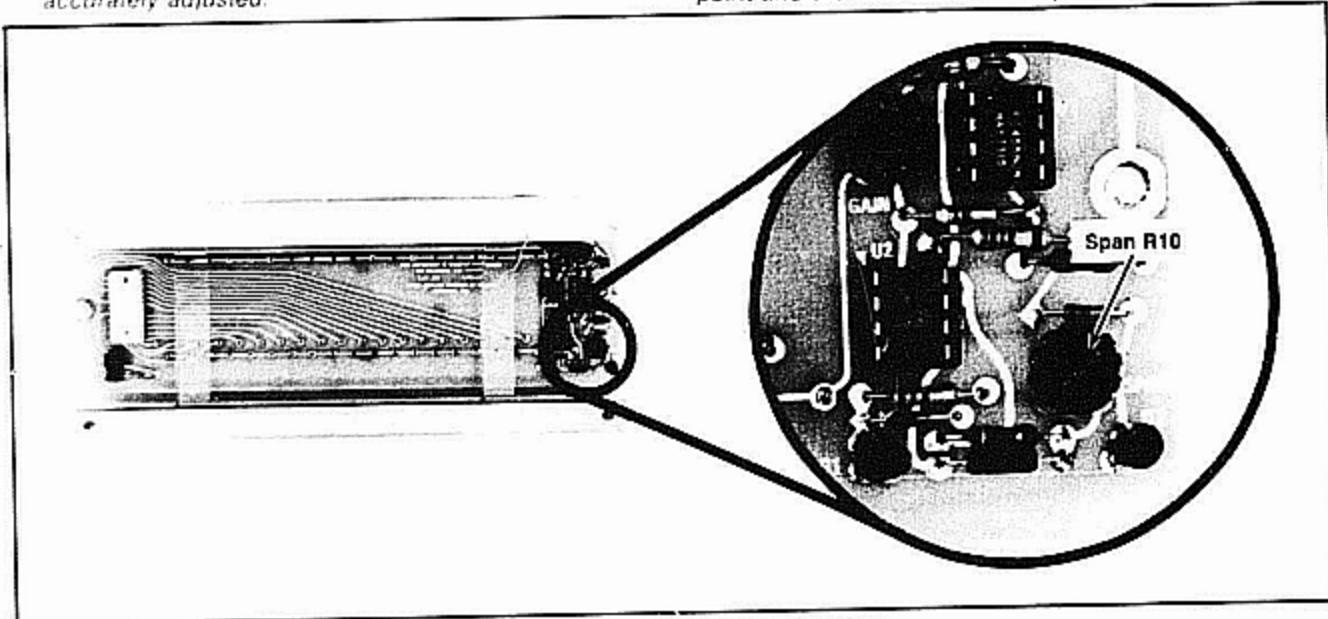


Fig. 7. Location of Span R10.

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d. CHECK—Oscilloscope display for sawtooth waveform 5.5 volts, +3% in amplitude. See Fig. 9.

e. ADJUST—Gain R68 (see Fig. 10) for sawtooth waveform amplitude of exactly 5.5 volts.

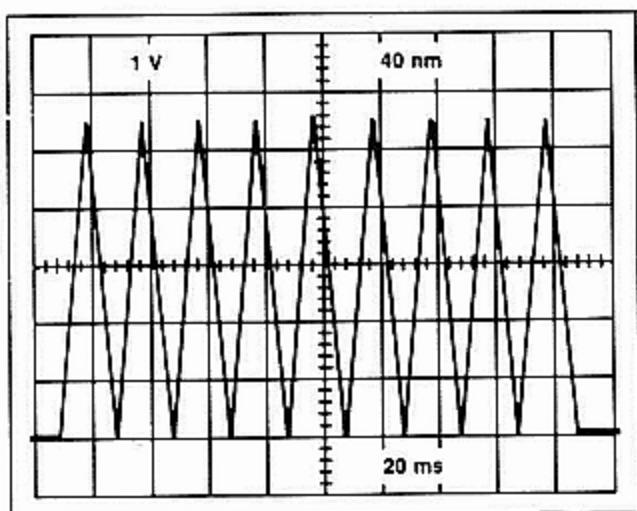


Fig. 9. Test oscilloscope display showing waveform at pin 1 of Plug P1 in RSS External Normalizer.

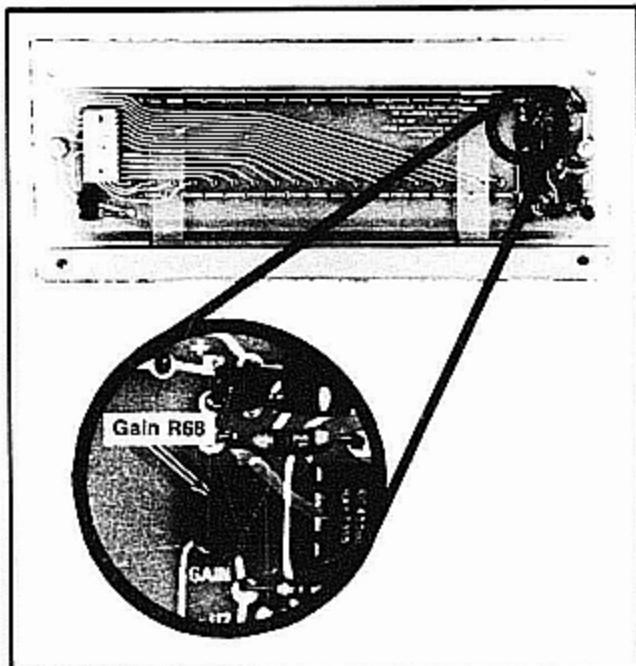


Fig. 10. Location of Gain R68.

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f Set all the GAIN controls on the RSS External Normalizer to MAX

g Set the 7A15A Volts/Div switch for 50 mV/div vertical deflection sensitivity.

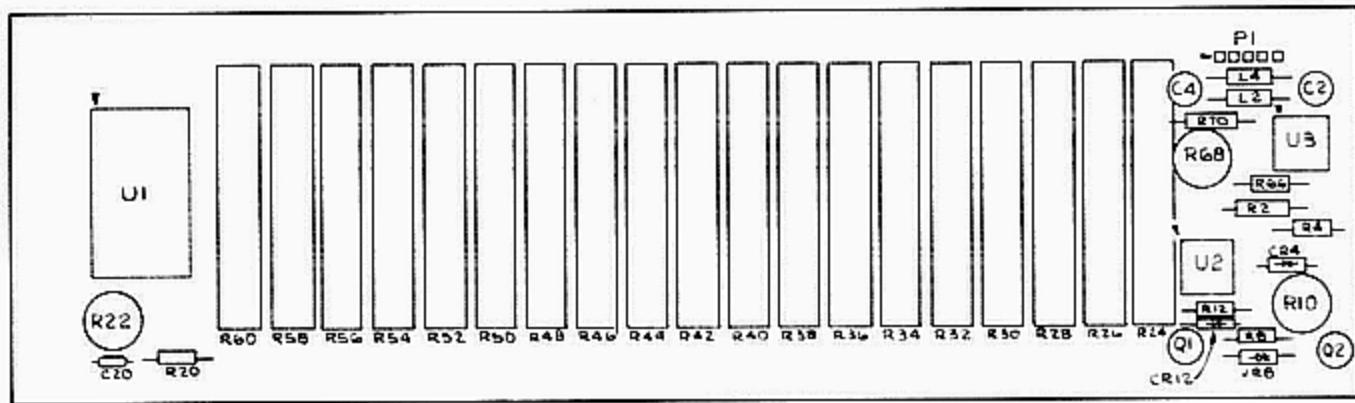
h CHECK—Oscilloscope display to see that the voltage level at pin 1 of plug P1 is 0 V. +0.5 V.

This completes calibration of the RSS External Normalizer. Disconnect it from the 7J20 Spectrometer Plug-In and replace the bottom plate and end castings.

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R24 THRU R60 ON BACK OF BOARD

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CIRCUIT BOARD ILLUSTRATION, DIAGRAM, AND PARTS LISTS

Symbols and Reference Designators

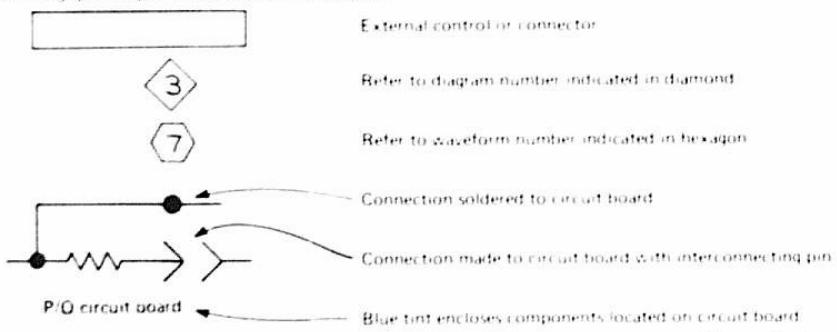
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors	Values one or greater are in picofarads (μF)
	Values less than one are in microfarads (μF)
Resistors	Ohms (Ω)

Symbols used on the diagrams are based on ANSI Y32.2 1970 and IEEE No. 315 March 1971.

Logic symbology is based on MIL-STD 806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



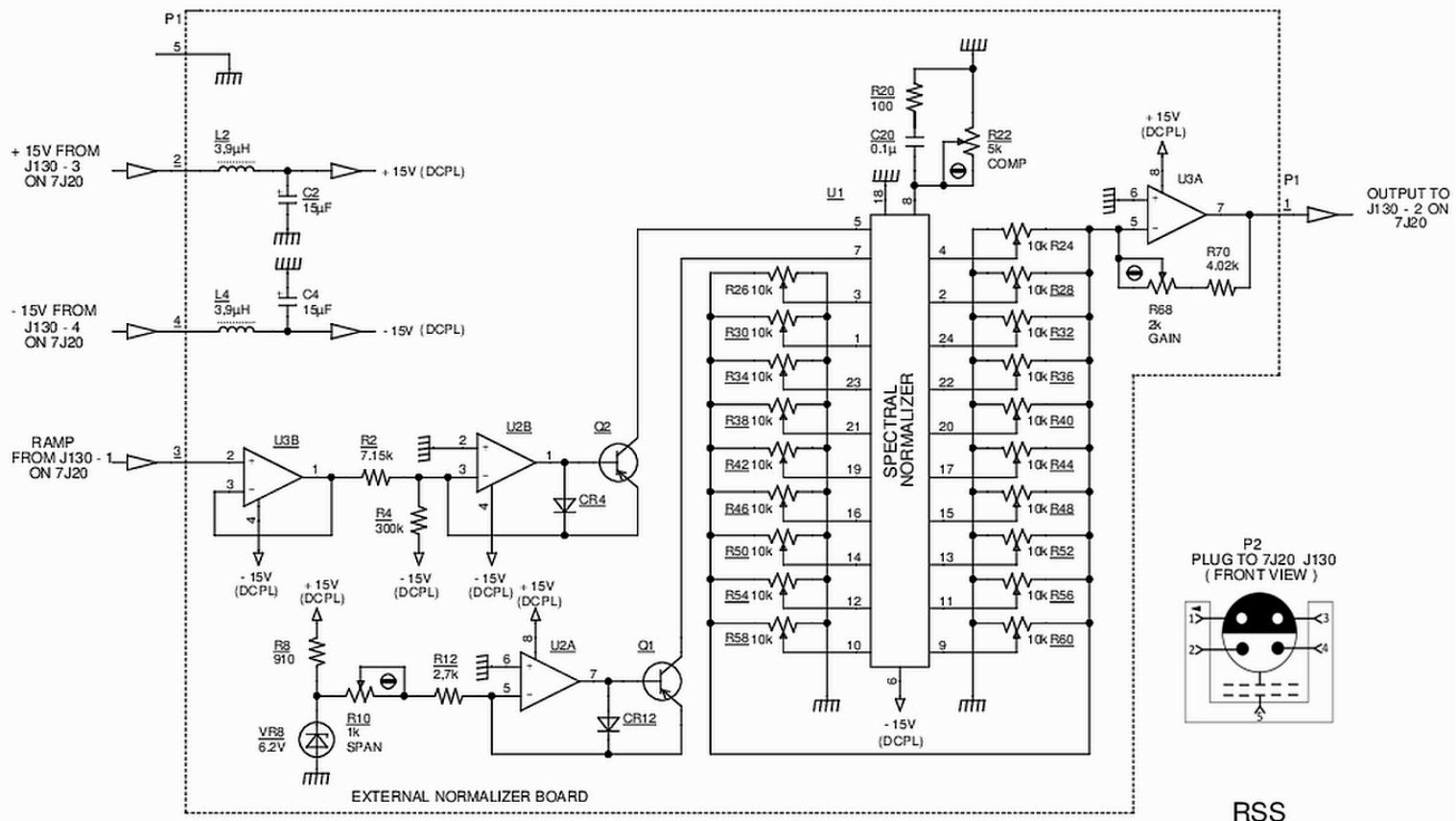
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams:

A	Assembly, separable or repairable (circuit board, etc.)	P	Connector, movable portion
BT	Battery	R	Resistor, fixed or variable
C	Capacitor, fixed or variable	S	Switch
CR	Diode, signal or rectifier	T	Transformer
F	Fuse	TP	Test point
J	Connector, stationary portion	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
L	Inductor, fixed or variable	VR	Voltage regulator (Zener diode, etc.)
Q	Transistor or silicon controlled rectifier		

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ELECTRICAL REPLACEABLE PARTS LIST

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 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.

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

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CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
01111	Allen-Bradley Co.	1201 2nd St., South	Milwaukee, WI 53204
04713	Motorola, Inc., Semiconductor Products Div.	5005 E. McDowell Road	Phoenix, AZ 85008
07910	Teledyne Semiconductor	12515 Chadron Avenue	Hawthorne, CA 90250
18324	Signetics Corporation	811 E. Arques	Sunnyvale, CA 94086
71450	CIS Corporation	1142 W. Beardsley Avenue	Elkhart, IN 46514
72982	Frie Technological Products, Inc.	644 W. 12th St.	Frie, PA 16512
73138	Beckman Instruments, Inc., Helipot Div.	2500 Harbor Blvd.	Fairlawn, CA 92634

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Electrical Parts List—016-1000-00

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ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCLLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	SEP	SEPARATELY
FXD	FIXED	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL



Ckt No.	Tektronix Part No.	Serial/Model No.	Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
	670-2280-00				CKT BOARD ASSY:EXTERNAL NORMALIZER	80009	670-2280-00
C2	290-0527-00				CAP., FXD, ELCLLT:15UF, 20%, 20V	90201	TDC156M020FL
C4	290-0527-00				CAP., FXD, ELCLLT:15UF, 20%, 20V	90201	TDC156M020FL
C20	283-0111-00				CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8131N075651104M
CR4	152-0141-02				SEMICOND DEVICE:SILICON, 30V, 150mA	07910	CD8220
CR12	152-0141-02				SEMICOND DEVICE:SILICON, 30V, 150mA	07910	CD8220
L2	108-0245-00				COIL, RF:3.9UH	80009	108-0245-00
L4	108-0245-00				COIL, RF:3.9UH	80009	108-0245-00
Q1	151-0410-00				TRANSISTOR:SILICON, PNP	04713	SPS6765
Q2	151-0410-00				TRANSISTOR:SILICON, PNP	04713	SPS6765
R2	311-0275-00				RES., FXD, FILM:7.15K OHM, 1%, 0.125W	75042	CEATO-7151F
R4	315-0304-00				RES., FXD, COMP:300K OHM, 5%, 0.25W	01121	CB3045
R8	315-0911-00				RES., FXD, COMP:910 OHM, 5%, 0.25W	01121	CB9115
R10	311-1563-00				RES., VAR, NONWIR:1K OHM, 20%, 0.50W	73138	91A-1000M
R12	315-0272-00				RES., FXD, COMP:2.7K OHM, 5%, 0.25W	01121	CB2725
R20	315-0101-00				RES., FXD, COMP:100 OHM, 5%, 0.25W	01121	CB1015
R22	311-1560-00				RES., VAR, NONWIR:5K OHM, 5%, 0.50W	73138	91A-5000M
R24	311-1600-00				RES., VAR, COMP:10K OHM, 30%, 0.25W	71450	440-YA2335
R26	311-1600-00				RES., VAR, COMP:10K OHM, 30%, 0.25W	71450	440-YA2335
R28	311-1600-00				RES., VAR, COMP:10K OHM, 30%, 0.25W	71450	440-YA2335
R30	311-1600-00				RES., VAR, COMP:10K OHM, 30%, 0.25W	71450	440-YA2335
R32	311-1600-00				RES., VAR, COMP:10K OHM, 30%, 0.25W	71450	440-YA2335



Ckt No.	Tektronix Part No.	Serial/Model No.	Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R34	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R36	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R38	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R40	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R42	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R44	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R46	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R48	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R50	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R52	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R54	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R56	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R58	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R60	311-1600-00				RES., VAR, COMP: 10K OHM, 30%, 0.25W	71450	440-YA2335
R66	315-0471-00				RES., FWD, COMP: 470 OHM, 5%, 0.25W	01121	CB4715
R68	311-1562-00				RES., VAR, NONWIR: 2K OHM, 20%, 0.50W	73138	91A-20000M
R70	321-0251-00				RES., FWD, FILM: 4.02K OHM, 1%, 0.125W	75042	CEATD-4021F
U1	155-0106-00				MICROCIRCUIT, LI: MONOLITHIC SI, NORM CKT	80009	155-0106-00
U2	156-0158-00				MICROCIRCUIT, LI: DUAL OPERATIONAL AMPLIFIER	18324	S5558V
U3	156-0158-00				MICROCIRCUIT, LI: DUAL OPERATIONAL AMPLIFIER	18324	S5558V
VRS	152-0317-00				SEMICOND DEVICE: ZENER, 0.25W, 6.2V, 5%	81483	IN3497

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ABBREVIATIONS

"	INCH	FLH	FLAT HEAD	PWR	POWER
*	NUMBER SIZE	FILT	FILTER	RECPT	RECEPTACLE
ACTR	ACTUATOR	FR	FRONT	RES	RESISTOR
ADPTR	ADAPTER	FASTN	FASTENER	RIGD	RIGID
ALIGN	ALIGNMENT	FT	FOOT	REL	RELIEF
AL	ALUMINUM	FIX	FIXED	PTNR	RETAINER
ASSEM	ASSEMBLED	GSFT	GRAFIT	SCH	SOCKET HEAD
ASSTY	ASSEMBLY	HDL	HANDLE	SCOPE	OSCILLOSCOPE
ATTEN	ATTENUATOR	HEX	HEXAGON	SCH	SCRIN
AWG	AMERICAN WIRE GAGE	HEX RD	HEXAGONAL HEAD	SE	SINGLE END
BD	BOARD	HEX SOC	HEXAGONAL SOCKET	SECT	SECTION
BRKT	BRACKET	HLCPS	HELICAL COMPRESSION	SEMICOND	SEMICONDUCTOR
BRS	BRASS	HLEXT	HELICAL EXTENSION	SHLD	SHIELD
BRZ	BRONZE	HV	HIGH VOLTAGE	SHLDR	SHOULDERED
BUSH	BUSHING	IC	INTEGRATED CIRCUIT	SFT	SOCKET
CAB	CABINET	ID	INSIDE DIAMETER	SL	SLIDE
CAT	CAPACITOR	IDENT	IDENTIFICATION	SLFLNG	SELF-LOCKING
CER	CERAMIC	IMPLS	IMPELLER	SLVG	SLEAVING
CHAS	CHASSIS	IN	INCH	SPR	SPRING
CFT	CIRCUIT	INCAND	INCANDESCENT	SQ	SQUARE
COMP	COMPOSITION	INSUL	INSULATOR	SST	STAINLESS STEEL
CONN	CONNECTOR	INTL	INTERNAL	STL	STEEL
COV	COVER	LPHLDR	LAMPHOLDER	SW	SWITCH
CPLG	COUPLING	MACH	MACHINE	T	TUBE
CRT	CATHODE RAY TUBE	MECH	MECHANICAL	TERM	TERMINAL
DEG	DEGREE	MTG	MOUNTING	THD	THREAD
DWR	DRAWER	NIP	NIPPLE	THR	THICK
ELECTRN	ELECTRON	NON WIRE	NON WIRE WOUND	TNSN	TENSION
ELEC	ELECTRICAL	OD	ORDER BY DESCRIPTION	TPG	TAPPING
ELECTLT	ELECTROLYTIC	OD	OUTSIDE DIAMETER	TRH	TRUSS HEAD
ELEM	ELEMENT	OVM	OVAL HEAD	V	VOLTAGE
EPL	ELECTRICAL PARTS LIST	PH BRZ	PHOSPHOR BRONZE	VAR	VARIABLE
EQPT	EQUIPMENT	PL	PLAIN OR PLATE	W/	WITH
EXT	EXTERNAL	PLSTC	PLASTIC	WSHR	WASHER
FIL	FILLISTER HEAD	PN	PART NUMBER	XFMR	TRANSFORMER
FLEX	FLEXIBLE	PNH	PAN HEAD	XSTR	TRANSISTOR

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MECHANICAL REPLACEABLE PARTS LIST

PARTS ORDERING INFORMATION

INDENTATION SYSTEM

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 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.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook HG-1 can be utilized where possible.

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

1 2 3 4 5	Name & Description
	<i>Assembly and/or Component</i>
	<i>Attaching parts for Assembly and/or Component</i>

	<i>Detail Part of Assembly and/or Component</i>
	<i>Attaching parts for Detail Part</i>

	<i>Parts of Detail Part</i>
	<i>Attaching parts for Parts of Detail Part</i>

Attaching Parts always appear 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. The separation symbol indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.



CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
12327	Freeway Washer And Stamping Co.	P.O. Box 05206	Cleveland, OH 44105
12526	Berg Electronics, Inc.	Teek Expressway	New Cumberland, PA 17070
16520	Heyman Mfg. Co.	147 N. Michigan Ave.	Renfrew, NJ 07033
80009	Tektronix, Inc.	P.O. Box 500	Beaverton, Oregon 97005
82647	Texas Instruments, Inc., Control Products Div.	34 Forest St.	Attleboro, MA 02703
83385	Central Screw Co.	2530 Crescent Drive	Broadview, IL 60153



Fig. &

Index	Tektronix Serial/Model No.	Part No.	Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
-1	200-1680-01				1	Cover,Normalizer:With Trim (Attaching Parts)					80009	200-1680-01	
-2	211-0503-00				2	Screw,Machine:6-32 X .188 LG PNH STL -----*					83385	OBD	
-3	348-0345-00				4	Foot,Cab:0.375 OD X 0.25 LONG (Attaching Parts)					80009	348-0345-00	
-4	211-0012-00				1	Screw,Machine:4-40 X 0.375 INCH,PNH STL					83385	OBD	
-5	210-0994-00				1	Washer,Flat:0.125 ID X 0.25" OD,STL -----*					83385	OBD	
-6	386-3017-00				1	Side Panel:Housing,Left					80009	386-3017-00	
-7	386-3018-00				1	Side Panel:Housing,Right					80009	386-3018-00	
-8	386-2357-00				1	Plate					80009	386-2357-00	
-9	386-3148-00				2	Support,Ckt Board:					80009	386-3148-00	
-10	175-1552-00				1	Cable Assy,Elec:42 INCH LONG,W/CONNECTOR					80009	175-1552-00	
-11	352-0163-00				1	Holder,Term.Con:5 Wire Black					80009	352-0163-00	
-12	358-0091-00				1	BShg,Strain,,RLF:					28520	SA2MI	
-13	----- -----				1	Ckt Board Assy:External Normalizer (Attaching Parts)							
-14	210-0457-00				2	Nut,Plain,Ext W:6-32 X 0.312 INCH,STL					83385	OBD	
-15	210-0802-00				2	Washer,Flat:0.15 ID X 0.312 INCH OD					12327	OBD	
-16	361-0656-00				2	Spacer,Sleeve:0.18ID X 0.25OD X 0.599" L -----*					80009	361-0656-00	
-17	136-0514-00				2	. Ckt Board Assy Includes:					82647	C9030802	
-18	131-0608-00				2	. Socket,Plug-In:MICROCIRCUIT,8 Contact					22526	47357	
-19	136-0252-04				5	. Contact,Elec:0.365 INCH LONG					22526	75060	
-20	----- -----				30	. Contact,Elec:0.188 INCH LONG							
-21	380-0300-01				19	. Res.,Var: (SEE EPL)							
					1	Housing,Wraparound:Normalizer W/Hinge					80009	380-0300-01	

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Fig. &

Index	Tektronix Serial/Model No.	Part No.	Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
REPACKAGING													
	065-0218-00				1	Carton Assy:(Not Shown)					80009	065-0218-00	
	----- -----				-	. Carton Assembly Includes:							
	004-0651-00				1	. Carton:20 X 10.1 X 12.15 INCHES					80009	004-0651-00	
	006-1525-00				1	. Air Cap:24 W X 48 INCH LONG					80009	006-1525-00	

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EXPLODED

