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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

067-0938-00 CALIBRATION FIXTURE

SERVICE

INSTRUCTION MANUAL

Tektronix, Inc.
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Serial Number ____________________

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WARRANTY

Tektronix warrants to the original purchaser that this product is free from defects in materials and workmanship, under normal use, for a period of one (1) year from the date of shipment. Tektronix will, at its option, repair or replace the product if Tektronix determines it is defective within the warranty period, and it is returned, freight prepaid, to a Tektronix Service Center.

There is no implied warranty of fitness for a particular purpose. Tektronix is not liable for consequential damages.

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SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

In This Manual

This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment

DANGER — High voltage.

Protective ground (earth) terminal.

ATTENTION — refer to manual.

Grounding the Product

This product is grounded through the grounding conductor of the power module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the power module grounding conductor in the power cord is essential for safe operation.

Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Operate Plug-In Unit Without Covers

To avoid personal injury, do not operate this product without covers or panels installed.

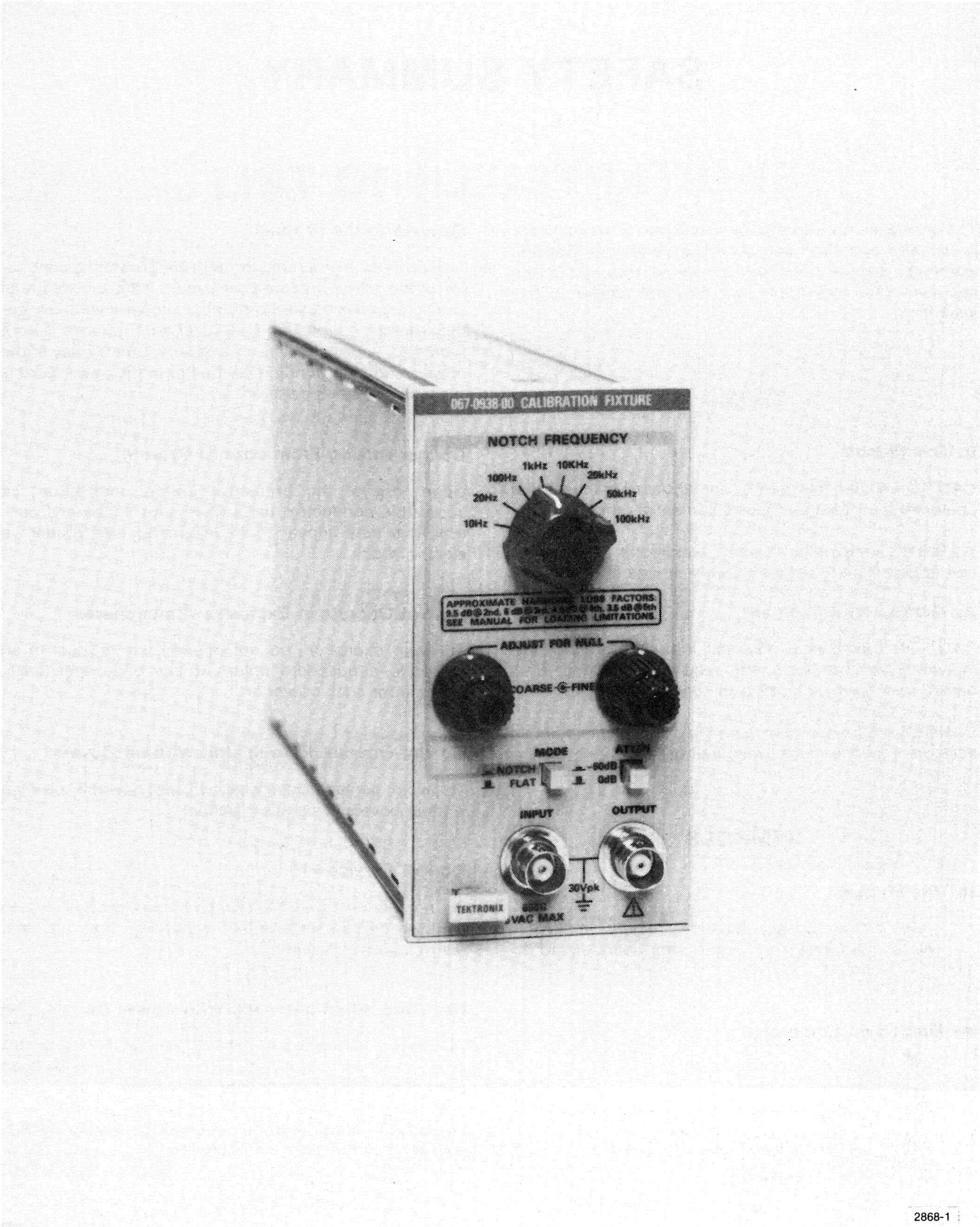
Do Not Service Alone

Do not perform internal service to this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltages can exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.



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067-0938-00 Calibration Fixture.

SPECIFICATION

Introduction

The 067-0938-00 Calibration Fixture is a passive notch filter designed for use in calibration of sinewave oscillators. The instrument's primary function is to reduce the amplitude of the fundamental frequency in the oscillator's output sufficiently to allow viewing of the harmonic content on a spectrum analyzer. The calibration fixture may also be used with a suitable ac voltmeter for checking output level or attenuation accuracy.

Although this calibration fixture requires no power from the power module, it is designed for operation in any compartment of any TM 500 series power module.

Performance Conditions

The electrical characteristics are valid only if the Calibration Fixture has been calibrated at an ambient temperature of +20° C to +30° C and is operating at an ambient temperature of 0° C to +50° C, unless otherwise noted. Load impedance must be ⩾1 MΩ shunted by ⩽75 pF.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in the Calibration Section of this manual. Items listed in the Supplemental Information column are not verified in this manual. They are either explanatory notes or performance characteristics for which no limits are specified.

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Input Impedance		
Flat Mode	600 Ω ±0.5%	
Notch Mode		600 Ω ±5% at notch frequency.
Maximum Input Voltage		5 V rms
Maximum Floating Voltage		30 V pk
Attenuator Accuracy	60 dB ±0.25 dB	
Notch Frequency Accuracy	±2% of indicated frequency with nulling adjustment controls centered, +20° C to +30° C	Tune oscillator for best initial null with adjustment controls centered before final nulling.
Minimum Notch Depth (after nulling)	100 dB at 10 Hz, and 20 Hz. 60 dB at 100 Hz, 1 kHz, 10 kHz, 20 kHz, 50 kHz, and 100 kHz.	
Harmonic Correction Factors (Notch Shape)		Load impedance must be ⩾1 MΩ ±5%, shunted by ⩽75 pF including cabling and spectrum analyzer input capacitance. The oscillator source impedance must be 600 Ω ±5%.
10 Hz to 20 kHz Notch Frequency		
At 2X Center Frequency	9.5 dB ±0.5 dB	
At 3X Center Frequency	6.0 dB ±0.5 dB	
At 4X Center Frequency	4.5 dB ±0.5 dB	
At 5X Center Frequency	3.5 dB ±0.5 dB	
50 kHz Notch Frequency	Add 0.5 dB to above values.	
100 kHz Notch Frequency	Add 1.0 dB to above values.	

Table 1-2

MISCELLANEOUS

Characteristics	Performance Requirements	Supplemental Information
Power Consumption		0 VA

Table 1-3

ENVIRONMENTAL CHARACTERISTICS[a]

Characteristics	Description	
Temperature		Meets MIL-T-28800B, class 5.
Operating	0° C to +50° C	
Non-operating	−55° C to +75° C	
Humidity	90-95% RH for 5 days cycled to 50° C.	Exceeds MIL-T-28800B, class 5.
Altitude		Exceeds MIL-T-28800B, class 3.
Operating	4.6 Km (15,000 ft).	
Non-operating	15 Km (50,000 ft).	
Vibration	0.38 mm (0.015") 10 Hz to 55 Hz, 75 minutes.[b]	Meets or exceeds MIL-T-2880B, class 5, with exception in certain power modules.[b]
Shock	30 g's (1/2 sine), 11 ms, 18 shocks.[c]	Meets or exceeds MIL-T-28800B, class 5 with exception in certain power modules.[c]
Bench Handling	45° or 4" or equilibrium, whichever occurs first.	Meets MIL-T-28800B, class 3.
E.M.C.	MIL-STD 461A/462	Meets MIL-T-28800B, class 3.
Electrical Discharge	20 kV maximum.	Charge applied to each protruding area of the product under test except the output terminals.
Transportation[d]		Qualified under National Safe Transit Association Preshipment Test Procedures 1A-B-1 and 1A-B-2.
Vibration	25 mm (1") at 270 rpm for 1 hour.	
Package Drop	10 drops from 91 cm (3 ft).	

[a] With power module except where noted.

[b] 0.26 mm (0.010") 10 Hz to 55 Hz in TM 501, TM 503, TM 504, TM 506.

[c] 20 g's (1/2 sine), 11 ms, 18 shocks in TM 501, TM 503, TM 504, TM 506.

[d] Without power module.

Table 1-4

PHYSICAL CHARACTERISTICS

Characteristics	Description
Finish	Plastic-aluminum laminate front panel.
Net Weight	0.68 kg (1.15 lbs.)
Overall Dimensions	67.06 mm (2.640") W X 305.82 mm (12.040") D X 126.24 mm (4.970") H.

OPERATING INSTRUCTIONS

Installation Instructions

The 067-0938-00 Calibration Fixture is ready for use when received. Although this Calibration Fixture requires no power from the power module, for convenience it is designed to be used in any compartment of any TM 500 series power module. The circuit board edge connector on the Calibration Fixture is notched to clear any plastic barrier strips installed in the power module interconnecting jack. Align the Calibration Fixture chassis with the upper and lower guides (see Fig. 2-1) of the selected compartment. Push the unit in and press firmly to seat the circuit board edge connector in the inter-connecting jack.

To remove the Calibration Fixture, pull on the release latch (located in the lower left corner) until the inter-connecting jack disengages and the Calibration Fixture slides out.

Repackaging Information

If the Tektronix instrument is shipped to a Tektronix Service Center for service or repair, attach a tag showing customer's name, address, and the name of an individual at your firm to contact. Include the complete instrument serial number and a description of the service required.

Save and reuse the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the instrument finish. Obtain a carton of corrugated cardboard of the correct carton strength having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument on all sides. Seal the carton with shipping tape or an industrial stapler.

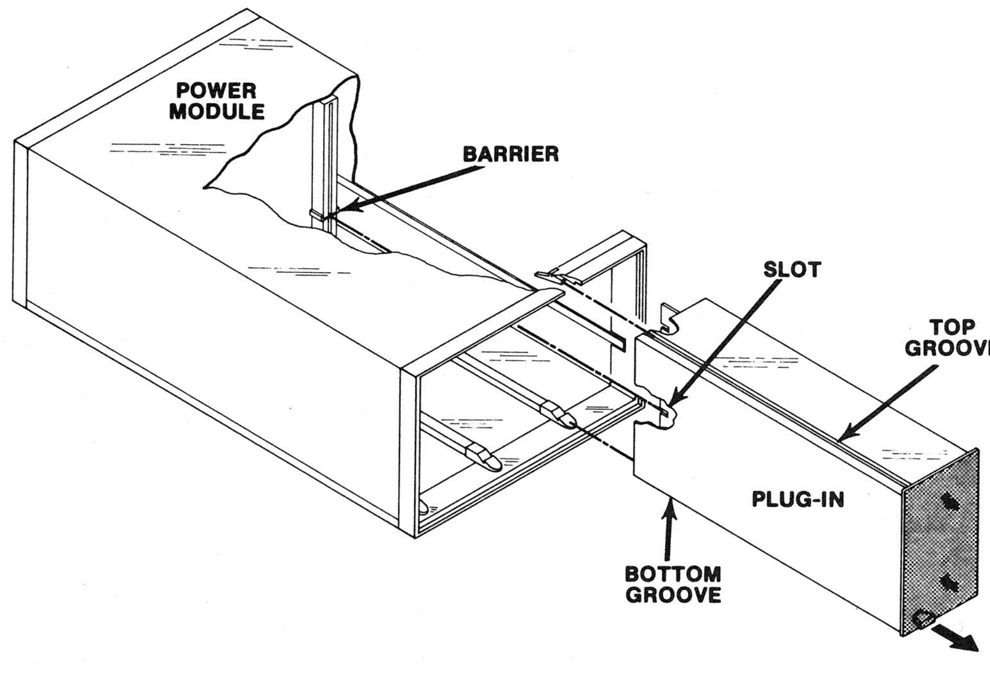


Fig. 2-1. 067-0938-00 Calibration Fixture installation and removal.

The carton test strength for this instrument is 200 pounds per square inch.

CONTROLS AND CONNECTORS

(1) NOTCH FREQUENCY Dial

Selects the nominal center frequency of the Calibration Fixture.

(2) ADJUST FOR NULL Dials

(3) Fine-tune the notch filter for maximum fundamental rejection.

(4) MODE Pushbutton

With pushbutton pressed, the signal from the INPUT connector is routed through the notch filter circuitry to the OUTPUT connector. With pushbutton released, the input signal by-passes the notch filter circuitry to the OUTPUT connector.

(5) ATTEN Pushbutton

With pushbutton pressed, the signal from the OUTPUT connector is attenuated by 60 dB. With the pushbutton released, the OUTPUT signal is unattenuated.

(6) INPUT Connector

Connection for signal from an oscillator.

(7) OUTPUT Connector

Refer to Input-Output Considerations in the Operating Instructions. Output signal from Calibration Fixture.

(8) Release Latch

Pull to remove plug-in from power module.

OPERATORS FAMILIARIZATION

Input-Output Considerations

This Calibration Fixture is designed for use in calibrating sinewave oscillators having a source impedance of 600 Ω. Source impedance other than 600 Ω will cause errors in the correction factors.

To ensure accurate notch depth and shape when checking total harmonic distortion, the load impedance connected to the Calibration Fixture OUTPUT connector must be at least 1 MΩ. In addition, the load capacitance (the spectrum analyzer input capacitance and coaxial cable capacitance) must be $\leqslant$75 pF. An 18 inch, 50 Ω coaxial cable has a capacitance of 45 pF.

CAUTION

To avoid damage to the calibration fixture circuitry, do not apply a voltage exceeding 30 V peak with respect to chassis ground to any front panel connector.

Harmonic Loss (Correction) Factors

When the Calibration Fixture is used with a spectrum analyzer to measure total harmonic distortion, losses occur at the various harmonics due to the purely passive nature of the Calibration Fixture. These losses must be taken into account to correct the harmonic values shown on the spectrum analyzer display. Therefore correction factors must be added to the displayed values to obtain the true values. Approximate correction factors are shown on the Calibration Fixture front panel. These numbers should be increased by 0.5 dB for the 50 kHz notch frequency and 1 dB for the 100 kHz notch frequency. See the Specification section of this manual or Table 2-1.

Table 2-1

HARMONIC CORRECTION FACTORS

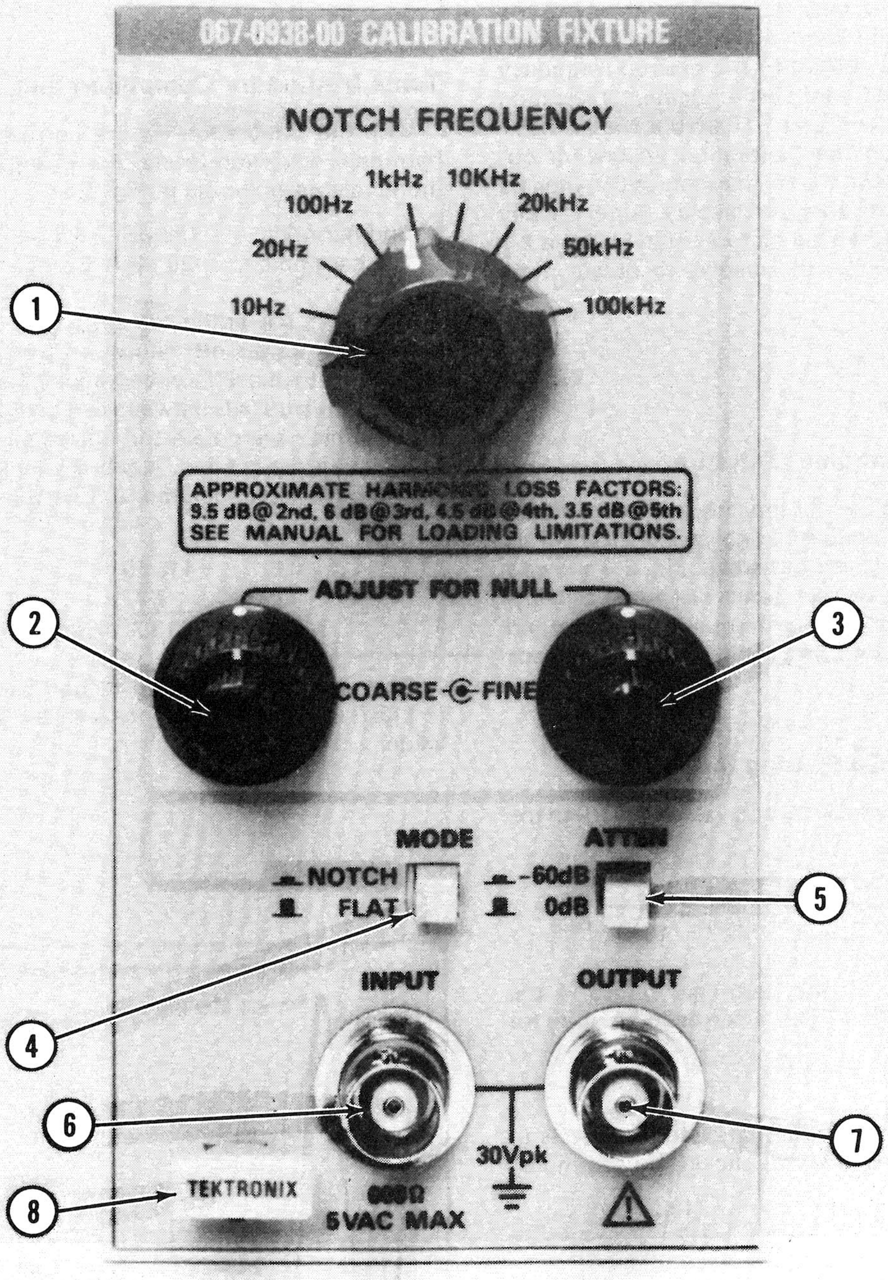
Harmonic	Notch Frequency Setting: 10 Hz to 50 kHz	50 kHz	100 kHz
2nd	9.5 dB	10 dB	10.5 dB
3rd	6.0 dB	6.5 dB	7 dB
4th	4.5 dB	5 dB	5.5 dB
5th	3.5 dB	4 dB	4.5 dB

In addition, exact correction factors for a particular calibration fixture may be determined by performing step 4, Check Harmonic Correction Factors, of the Performance Check procedure.

Examples of Use

This Calibration Fixture can be used to check a sinewave oscillator output level and attenuator accuracy using a suitable ac voltmeter. It can also be used to measure oscillator output distortion with a spectrum analyzer. (Detailed procedures for these measurements may be provided in the oscillator manual; for example the SG 505 Oscillator instruction manual.) In addition, the Calibration Fixture can be used as a precision 600 Ω load.

CONTROLS AND CONNECTORS



2868-3

Fig. 2-2. Front Panel Controls and Connectors.

Measuring Total Harmonic Distortion (THD)

To measure total harmonic distortion, connect the sinewave oscillator signal to the calibration fixture INPUT connector and connect the OUTPUT connector through a coaxial cable (18 inch or less, 50 Ω) to the spectrum analyzer input connector. The function of the Calibration Fixture, in the NOTCH mode, is to reduce the waveform fundamental level to a level that will not overload the spectrum analyzer. This may be checked at any of the Calibration Fixture notch frequencies. Set the Calibration Fixture NOTCH FREQUENCY to the desired frequency and fine-tune the oscillator for best fundamental rejection on the spectrum analyzer display. Then tune the ADJUST FOR NULL controls on the Calibration Fixture for optimum fundamental rejection. The harmonics can then be read from the spectrum analyzer display. Algebraically add the appropriate correction factors listed in Table 2-1 to the harmonic levels on the display to obtain more accurate values.

Computing Total Harmonic Distortion

Determine the dB values for the 2nd, 3rd, 4th, and 5th harmonic levels on the spectrum analyzer display (or as many of these harmonics as are visible). Fig. 2-3 shows a 20 kHz spectrum analyzer harmonic distortion display. Two methods for computing total harmonic distortion and examples for each method using the harmonic distortions levels of Fig. 2-3 follow:

Formula Method for Computing thd:

Substitute the harmonic distortion values (in dB) in the following formula:

$$\text{thd} = 20 \times \log_{10} \text{ times } \sqrt{10^{(2nd + 9.5)/10} + 10^{(3rd + 6)/10} + 10^{(4th + 4.5)/10} + 10^{(5th + 3.5)/10}}$$

The numbers added to the harmonic values in the formula are the Calibration Fixture correction factors for each harmonic.

For example, using the harmonic distortion levels in Fig. 2-3 and the correction factors in the previous formula:

2nd harmonic = −126 dB + 9.5 = −116.5
3rd harmonic = −123 dB + 6 = −117

dividing by 10 and raising 10 to this power gives:

$-116.5 \div 10 = -11.65 \qquad 10^{-11.65} = 2.24 \times 10^{-12}$

$-117 \div 10 = -11.7 \qquad 10^{-11.7} = \underline{2.00 \times 10^{-12}}$

$\qquad\qquad\qquad\qquad 4.24 \times 10^{-12}$

taking the square root results in:

$$\sqrt{4.24 \times 10^{-12}} = 2.06 \times 10^{-6}$$

taking the log:

$$\log_{10} 2.06 \times 10^{-6} = -5.69$$

multiplying by 20:

$$-5.69 \times 20 = -113.7 \text{ dB thd}$$

Table Method for Computing thd:

Add the Calibration Fixture correction factors to the harmonic distortion levels. For example, using the harmonic distortion levels in Fig. 2-3:

2nd harmonic = −126 dB + 9.5 = −116.5
3rd harmonic = −123 dB + 6 = −117

Compute the arithmatic difference between the two numerically lower dB values—in this case, −116.5 and −117. Locate this difference value (0.5) in Table 2-2. If the difference value falls between two of the difference values in the table, interpolate the corresponding value in the Additive Factor column. Algebraically add the number in the Additive Factor column (2.77) to the numerically lower dB value:

$$\begin{array}{r} -116.50 \\ \underline{2.77} \\ -113.7 \text{ dB thd} \end{array}$$

The process is repeated using the resulting number (−113.7) and the next successively smaller harmonic value.

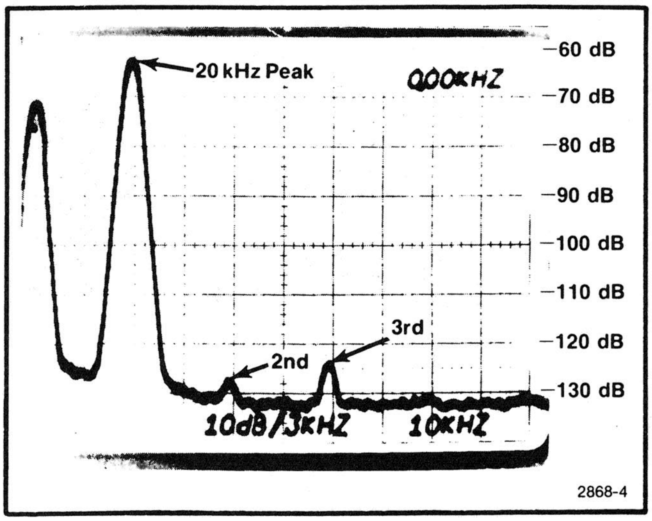


Fig. 2-3. 20 kHz harmonic distortion display.

Table 2-2

FACTORS FOR THD COMPUTATION

DIFFERENCE VALUE	ADDITIVE FACTOR
0.0	3.01
0.5	2.77
1.0	2.54
2.0	2.12
3.0	1.76
4.0	1.46
5.0	1.19
6.0	0.97
7.0	0.79
8.0	0.64
9.0	0.51
10.0	0.41
11.0	0.33
12.0	0.27
13.0	0.21
14.0	0.17
15.0	0.14
16.0	0.11
17.0	0.09
18.0	0.07
19.0	0.05
20.0	0.04

THEORY OF OPERATION

The 067-0938-00 Calibration Fixture consists of a passive notch filter, a precision 600 Ω load, an accurate −60 dB attenuator and the necessary switching. The floating ground is connected to chassis ground through C1431.

Notch Filter

A simplified diagram of the notch filter is shown in Fig. 3-1. This filter is a Twin-T design, using low pass and high pass filters in parallel. In Fig. 3-1, R550, R1424, and C1131 comprise a low-pass filter and C1231, C1112, and R560 comprise a high-pass filter. At the center frequency of the circuit, the two filters pass signals that are of equal magnitude and opposite phase. This provides a null at the notch frequency, with decreasing attenuation above and below the notch frequency.

The ratio of capacitance to resistance in the filter determines the frequency at which the null occurs. To ensure a complete null R550 and R560 are adjustable from the front panel. Each of these potentiometers is in a series parallel network of fixed resistors to reduce the adjustment range.

Switch S1311 changes the notch frequency by allowing selection of different capacitance values. At notch frequencies of 50 kHz and 100 kHz, S1311 disconnects the unused capacitors to reduce stray capacitance effects. Switch S1431 connects the notch filter in or out of the calibration fixture circuit.

Precision 600 Ω Load

The 600 Ω load in the calibration fixture consists of the parallel combination of R1434, R1435 and R1432. These are low tolerance resistors to assure a precise 600 Ω load.

When the notch filter is switched in the calibration fixture circuitry, S1431 removes R1434 from the circuit to compensate for the loading effects of the notch filter. This compensation is accurate only at the notch frequency, since the notch filter's input impedance varies above and below this frequency.

The 60 dB Attenuator

The 60 dB attenuator consists of R1432, R1331, and R1434. Resistor R1432 is in series with the input signal and R1434 and R1331 are in shunt. Switch S1432 places the attenuator in or out of the calibration fixture input circuitry.

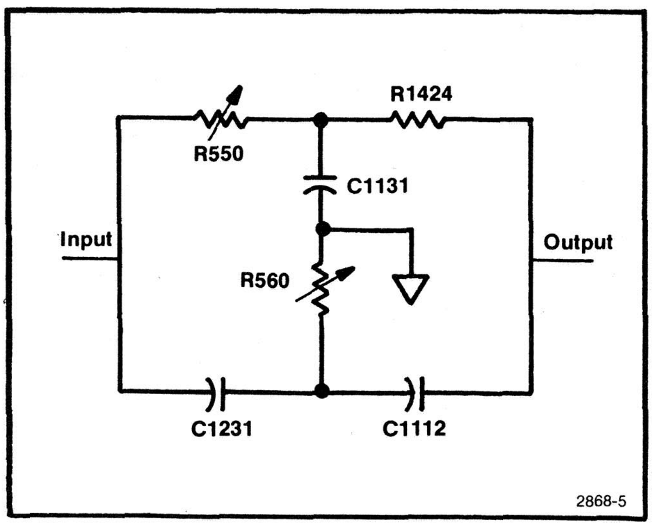


Fig. 3-1. Simplified diagram of the notch filter. See schematic diagram.

CALIBRATION PROCEDURE

Introduction

This section consists of a Performance Check procedure. The Performance Check verifies the electrical specifications listed under Performance Requirements in the Specifications section of this manual.

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

Test Equipment Requirements

Below is a list of equipment required to perform the Performance Check procedure. Other equipment may be substituted when suitable. Tolerances that are specified in the Performance Check procedure apply to the instrument under test and do not include test equipment error.

Table 4-1
LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
TM 500 Series Power Module		All steps.	TEKTRONIX TM 501, TM 503, TM 504 or TM 506.
Low Distortion Oscillator	≤ −100 dB distortion, 4 V output.	Check input impedance. Check attenuator accuracy. Check notch depth.	TEKTRONIX SG 505 Oscillator.[a]
Wideband Oscillator	10 Hz to 500 kHz range.	Check harmonic loss factors.	TEKTRONIX SG 502 Oscillator.[a]
Digital Voltmeter	4 digit readout. 1% accuracy.	Check input impedance.	TEKTRONIX DM 501A Digital Multimeter.[a]
Oscilloscope		Check attenuator accuracy. Check harmonic loss factors.	TEKTRONIX 7704A or 7603 Oscilloscope.
Differential Comparator	1.5% gain accuracy, 1 mV/div sensitivity, 4 V differential comparison range with 1 mV resolution.	Check attenuator accuracy. Check harmonic loss factors.	TEKTRONIX 7A13 Differential Comparator.
Timebase Plug-in		Check attenuator accuracy. Check harmonic loss factors.	TEKTRONIX 7B50A Time Base.
Differential Amplifier Plug-in	0.1 mV/div sensitivity.	Check notch depth.	TEKTRONIX 7A22 Differential Amplifier.
Differential Amplifier		Check notch depth.	TEKTRONIX AM 502 Differential Amplifier.[a]
Counter	10 Hz to 500 kHz range.	Check harmonic loss factors.	TEKTRONIX DC 504 Digital Counters.[a]

Table 4-1 (cont)

Description	Performance Requirements	Application	Example
2 ea bnc female to clip lead adapters		Check input impedance.	Tektronix Part No. 013-0076-00.
2 ea bnc male to bnc male adapters		Check input impedance.	Tektronix Part No. 103-0029-00.
1 ea resistor	400 Ω, 0.1%, 1/8 W.	Check input impedance.	Tektronix Part No. 321-0773-07.
1 ea 8 inch coaxial cable with bnc connectors	8 inch, 50 Ω	Check attenuator accuracy. Check harmonic loss factors.	Tektronix Part No. 012-0208-00.
3 ea coaxial cable with bnc connectors	18 inch, 50 Ω	Check attenuator accuracy. Check notch depth. Check harmonic loss factors.	Tektronix Part No. 012-0076-00.

[a] Requires TM 500 Series Power Module.

PERFORMANCE CHECK

Introduction

This procedure checks the electrical characteristics of the 067-0938-00 Calibration Fixture listed under Performance Requirements in the Specifications section of this manual. Because the CALIBRATION FIXTURE does not contain any internal adjustments, periodic performance verification is not normally required. If a performance check is desired, it should be performed with the instrument operating at an ambient temperature of 20°C to 30°C. For convenience, some steps in this procedure check the performance of this instrument at only one value in the specified performance range. Any value, with appropriate limits, within the specified range may be substituted. If the instrument fails to meet the requirements given in this Performance Check, troubleshooting is indicated.

Test Equipment Required

Test equipment used in the Performance Check is listed in Table 4-1.

Preparation

1. Install the Calibration Fixture in the power module and connect the power module and test equipment to the line voltage source.

2. Turn on the power module and test equipment.

PROCEDURE

1. Check Input Impedance

a. Set the CALIBRATION FIXTURE controls as follows:

NOTCH FREQUENCY	1 kHz
MODE	FLAT (out)
ATTEN	0 dB (out)

b. Connect a bnc male to bnc male adapter and a bnc female to clip lead adapter to the low distortion oscillator output connector. Connect the red clip lead to a 400 Ω, 0.1%, 1/8 W resistor.

c. Connect a bnc male to bnc male adapter and a bnc female to clip lead adapter to the CALIBRATION FIXTURE INPUT connector. Connect the red clip lead to the resistors open end. Connect the two black clip leads together.

d. Set the low distortion oscillator frequency to 1 kHz.

@

e. Connect the negative voltmeter lead to the black clip lead. Connect the positive voltmeter lead to the red clip lead connected to the low distortion oscillator.

f. Adjust the low distortion oscillator output level for a voltmeter reading of 1.000 V rms.

g. Move the positive voltmeter lead to the red clip lead connected to the CALIBRATION FIXTURE.

h. CHECK—that the voltmeter reads between 0.5985 and 0.6015 V rms.

i. Set the CALIBRATION FIXTURE ATTEN switch to −60 dB (in) position.

j. CHECK—that the voltmeter reading is between 0.5985 and 0.6015 V rms.

k. Remove all connection to the CALIBRATION FIXTURE.

2. Check Attenuator Accuracy

a. Connect the low distortion oscillator output through a coaxial cable to the CALIBRATION FIXTURE INPUT connector.

b. Connect the CALIBRATION FIXTURE OUTPUT through an 18 inch coaxial cable to the differential comparator + input.

c. Set the low distortion oscillator frequency to 1 kHz.

d. Set the CALIBRATION FIXTURE MODE to FLAT (out) and ATTEN to 0 dB (out). Center the ADJUST FOR NULL controls.

e. Set the differential comparator deflection factor to 1 V/div.

f. Set the + and − input GND switches to GND. Center the trace on the center horizontal graticule line. Set the + input AC switch to AC.

g. Adjust the low distortion oscillator output level to produce a 6 V p-p waveform on the display.

h. Set the CALIBRATION FIXTURE ATTEN switch to −60 dB (in).

i. Change the differential comparator deflection factor to 1 mV/div.

j. CHECK—that the display waveform amplitude is between 4.5 and 7.5 mV p-p.

k. Repeat step 2 parts d through j with the low distortion oscillator frequency set for 100 kHz.

3. Check Notch Depth

a. Connect the low distortion oscillator output through a coaxial cable to the CALIBRATION FIXTURE INPUT.

b. Connect the CALIBRATION FIXTURE OUTPUT through a coaxial cable to the AM 502 differential amplifier + input.

c. Connect the AM 502 output through a coaxial cable to the 7A22 differential amplifier + input.

d. Set the low distortion oscillator frequency and CALIBRATION FIXTURE NOTCH FREQUENCY to 10 Hz.

e. Set the AM 502 − input to ground, + input to DC coupling, gain to 100, ÷ 100 switch in, HF −3 dB to .1 kHz and LF −3 dB to DC.

f. Set the CALIBRATION FIXTURE MODE to FLAT (out) and ATTEN to 0 dB (out). Center the ADJUST FOR NULL controls.

g. Set the differential amplifier deflection to 1 V/div, input coupling to ac.

h. Adjust the low distortion oscillator output level for a 4 V p-p display.

i. Set the CALIBRATION FIXTURE MODE to NOTCH (in).

j. Adjust the low distortion oscillator variable frequency for minimum display amplitude.

k. Adjust the CALIBRATION FIXTURE ADJUST FOR NULL controls for minimum display amplitude.

l. Increase the AM 502 gain by releasing the ÷ 100 button. Decrease the differential amplifier deflection factor one range at a time to 1 mV/div. At each range change, repeat step 3 parts j and k.

m. Note the p-p amplitude of the display waveform in mV. Divide this value by 100 to obtain V residual in millivolts.

n. Calculate the dB level relative to 1 V using the following formula:

$$\text{dB level} = 20 \log_{10} \frac{4}{\text{V residual}}$$

o. CHECK—that the calculated dB level is ≥100 dB.

p. Set the low distortion oscillator frequency, and the CALIBRATION FIXTURE NOTCH FREQUENCY to 20 Hz and repeat step 3 parts e through o.

q. Remove the AM 502 connections and connect the CALIBRATION FIXTURE OUTPUT through an 18 inch coaxial cable to the differential amplifier + input.

r. Set the low distortion oscillator frequency and the CALIBRATION FIXTURE NOTCH FREQUENCY to 1 kHz., and repeat step 3 parts f through n. (Omit references in these parts to the AM 502 differential amplifier).

s. CHECK—that the calculated dB level is ≥60 dB.

t. Set the low distortion oscillator frequency and the CALIBRATION FIXTURE NOTCH FREQUENCY to 100 kHz and repeat step 3 parts l through n.

u. CHECK—that the calculated dB level is ≥60 dB.

v. Remove all connections to the CALIBRATION FIXTURE.

4. Check Harmonic Loss (Correction) Factors

a. Connect the wide band oscillator output through an 8 inch coaxial cable to the CALIBRATION FIXTURE INPUT.

b. Connect the CALIBRATION FIXTURE OUTPUT through an 18 inch coaxial cable to the differential comparator + input.

c. Connect the wide band oscillator trigger output through a coaxial cable to the counter input.

d. Set the wide band oscillator frequency and the CALIBRATION FIXTURE NOTCH FREQUENCY to 1 kHz.

e. Set the CALIBRATION FIXTURE MODE to FLAT (out) and ATTEN to 0 dB (out). Center the ADJUST FOR NULL controls.

f. Set the differential comparator + and − input coupling to GND. Position the trace on the center horizontal graticule line. Set the + input coupling to ac and the deflection factor to 1 V/div.

g. Adjust the wide band oscillator output level for a 6 V p-p display amplitude. Set the differential comparator − input to V_c. Set the deflection factor to 50 mV/div.

h. Adjust the comparator voltage to position the waveform peaks on the center horizontal graticule line (≈+3 V).

i. Note the comparator voltage reading.

j. Set the CALIBRATION FIXTURE MODE to NOTCH (in). Set the differential comparator − input coupling to GND.

k. Adjust the wide band oscillator variable frequency control for minimum display amplitude. Position the CALIBRATION FIXTURE ADJUST FOR NULL controls for minimum display amplitude.

l. Note the counter frequency reading. This frequency is the center frequency in Table 4-2. Change the wide band oscillator frequency to a value that is twice the frequency just noted, as read on the counter.

m. Set the differential comparator deflection factor to 1 V/div. Divide the peak-to-peak amplitude by two. This is the approximate comparator voltage required to position the waveform peaks in the next step. Set the differential comparator deflection factor to 50 mV/div.

n. Set the differential comparator − input to V_c. Adjust the comparator voltage to position the waveform peaks on the center horizontal graticule line.

o. Note the comparator voltage reading.

p. Calculate the correction factor using the following formula:

$$\text{dB correction} = 20 \log_{10} \frac{V_c \text{ original}}{V_c \text{ new}}$$

Use the comparator voltage reading noted in step 4 part i for V_c original. Use the comparator voltage reading noted in step 4 part o for V_c new.

q. CHECK—that the calculated correction factor is within the limits listed in Table 4-2.

Table 4-2

HARMONIC LOSS (CORRECTION) FACTOR CHECK

1 kHz Notch Frequency	Correction Factor Limits
At 2X Center Frequency	9 to 10 dB
At 3X Center Frequency	5.5 to 6.5 dB
At 4X Center Frequency	4 to 5 dB
At 5X Center Frequency	3 to 4 dB
50 kHz Notch Frequency	Add 0.5 dB to above values
100 kHz Notch Frequency	Add 1.0 dB to above values

r. Repeat step 4 parts e through q for each multiple of the center frequency listed in Table 4-2. In Step 4 part l, set the wide band oscillator frequency to a value that is 3, 4, and 5 times the original frequency measured on the counter.

s. Repeat step 4 parts e through r with the wide band oscillator and CALIBRATION FIXTURE set initially at 50 kHz. Repeat again with the oscillator and CALIBRATION FIXTURE set at 100 kHz.

t. Remove all connections to the CALIBRATION FIXTURE.

MAINTENANCE

Recalibration

Recalibration of this instrument is not required since it contains no internal adjustments.

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

Obtaining Replacement Parts

Most electrical and mechanical parts can be ordered through your local Tektronix Field Office or representative. However, you should be able to obtain many of the standard electronic components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix, Inc., please check the electrical parts list for the proper value, rating, tolerance, and description.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., it is important that all of the following information be included to ensure receiving the proper parts.

1. Instrument type (include modification or option numbers).
2. Instrument serial number.
3. A description of the part (if electrical, include component number).
4. Tektronix part number.

Cleaning Instructions

This instrument should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient heat dissipation that can cause overheating and component breakdown.

Exterior

Loose dust accumulated on the front panel can be removed with a soft cloth or a small brush. Dirt that remains can be removed with a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

CAUTION

To prevent getting water inside the instrument during external cleaning, use only enough water to dampen the cloth or swab.

DO NOT use chemical cleaning agents as they may damage the plastics used in the instrument. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone or similar solvents.

Interior

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low pressure air, then use a soft brush.

Isopropyl alcohol can be used to clean major repairs to the circuit board; however, flush the board well with clean, isopropyl alcohol. Make certain that resin or dirt is carefully removed from board areas of high impedance circuitry.

Troubleshooting Aids

Diagrams. Complete circuit diagrams are located in the foldout pages in the Diagrams and Illustrations section. The portions of the circuit mounted on circuit boards are enclosed by a solid line. The circuit number of each component in this instrument is shown on a diagram. See the first page of the Diagrams and Illustrations section for definitions of the symbols and reference designators used on the diagrams.

Circuit Board Illustrations. In conjunction with each circuit diagram is a circuit board illustration. Each component shown on a diagram is also identified on the circuit board illustration by its circuit number. A table is provided with each diagram listing components by board assembly and circuit number. The table also lists the component grid locations on both the diagram and circuit board illustrations.

OPTIONS

None available at this time.

REPLACEABLE ELECTRICAL PARTS

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

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
19396	ILLINOIS TOOL WORKS, INC. PAKTRON DIV.	900 FOLLIN LANE, SE	VIENNA, VA 22180
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
34263	CTS OF BROWNSVILLE, INC.	1100 ROOSEVELT ST.	BROWNSVILLE, TX 78520
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
91836	KINGS ELECTRONICS CO., INC.	40 MARBLEDALE ROAD	TUCKAHOE, NY 10707

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
	----- -----			CKT BOARD ASSY:NOTCHED FILTER		
	----- -----			(REPLACEABLE AS A UNIT WITH 672-0855-00)		
C1111	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1112	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1131	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1132	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1211	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1212	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1213	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1231	285-1068-00			CAP.,FXD,PLSTC:5UF,1%,200V	14752	230B1C505F
C1311	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1312	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1320	283-0640-00			CAP.,FXD,MICA D:160PF,1%,100V	00853	D151E161F0
C1321	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1322	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C1323	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1324	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1325	285-1066-00			CAP.,FXD,PLSTC:0.05UF,1%,200V	14752	230B1C503F
C1326	285-1051-00			CAP.,FXD,PLSTC:1UF,1%,200V	14752	230B1C105F
C1331	285-1050-00			CAP.,FXD,PLSTC:0.1UF,1%,200V	14752	230B1C104F
C1332	285-1067-00			CAP.,FXD,PLSTC:0.5UF,1%,200V	14752	230B1C504F
C1333	285-1067-00			CAP.,FXD,PLSTC:0.5UF,1%,200V	14752	230B1C504F
C1411	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C1412	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1413	283-0640-00			CAP.,FXD,MICA D:160PF,1%,100V	00853	D151E161F0
C1421	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1422	285-1062-00			CAP.,FXD,PLSTC:0.005UF,0.1%,200V	19396	502F02PP460
C1423	285-1066-00			CAP.,FXD,PLSTC:0.05UF,1%,200V	14752	230B1C503F
C1431	283-0169-00			CAP.,FXD,CER D1:0.022UF,10%,200V	72982	8131N225X5R0223K
J1331	131-1425-00			CONTACT SET,ELE:R ANGLE,0.150" L,STR OF 36	22526	65521-136
J1421	131-1857-00			TERM. SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	22526	65500136
R1331	321-0030-04			RES.,FXD,FILM:20 OHM,0.1%,0.125W	91637	LFF18D20R00B
R1332	321-0222-07			RES.,FXD,FILM:2K OHM,0.1%,0.125W	91637	MFF1816C20000B
R1333	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R1421	321-0816-03			RES.,FXD,FILM:5K OHM,0.25%,0.125W	91637	MFF1816D50000C
R1422	321-0278-00			RES.,FXD,FILM:7.68K OHM,1%,0.125W	91637	MFF1816G76800F
R1423	321-0120-00			RES.,FXD,FILM:174 OHM,1%,0.125W	91637	MFF1816G174R0F
R1424	321-0239-07			RES.,FXD,FILM:3.01K OHM,0.1%,0.125W	91637	MFF1816C30100B
R1425	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R1431	315-0360-00			RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
R1432	321-0318-07			RES.,FXD,FILM:20K OHM,0.1%,0.125W	24546	NE55E2002B
R1434	321-0932-03			RES.,FXD,FILM:2.5K OHM,0.25%,0.125W	91637	MFF1816D25000C
R1435	321-0955-03			RES.,FXD,FILM:823 OHM,0.25%,0.125W	24546	NC55C8230C
S1431	260-1209-00			SWITCH,PUSH:4PDT	80009	260-1209-00
S1432	260-1208-00			SWITCH,PUSH:DPDT	80009	260-1208-00
				CHASSIS PARTS		
J570	131-0274-00			CONNECTOR,RCPT,:BNC	91836	KC79-67
J580	131-0274-00			CONNECTOR,RCPT,:BNC	91836	KC79-67
P1331	198-3097-00			WIRE SET,ELEC:	80009	198-3097-00
	----- -----			(FROM J1331 TO R560)		
P1421	175-5104-00			CA ASSY,SP,ELEC:2,22 AWG,3.0 L	80009	175-5104-00
	----- -----			(FROM J1421 TO R550)		
R550	311-0955-00			RES.,VAR,NONWIR:2K OHM,10%	34263	A45-CTS
R560	311-0955-00			RES.,VAR,NONWIR:2K OHM,10%	34263	A45-CTS
S1311	263-1183-00			SW CAM ACTR AS:CENTER FREQUENCY	80009	263-1183-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1-1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standard Institute
1430 Broadway
New York, New York 10018

Component Values

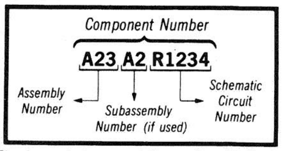
Electrical components shown on the diagrams are in the following units unless noted otherwise:

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

Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number (see following illustration for constructing a component number).

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.

The following special symbols may appear on the diagrams:

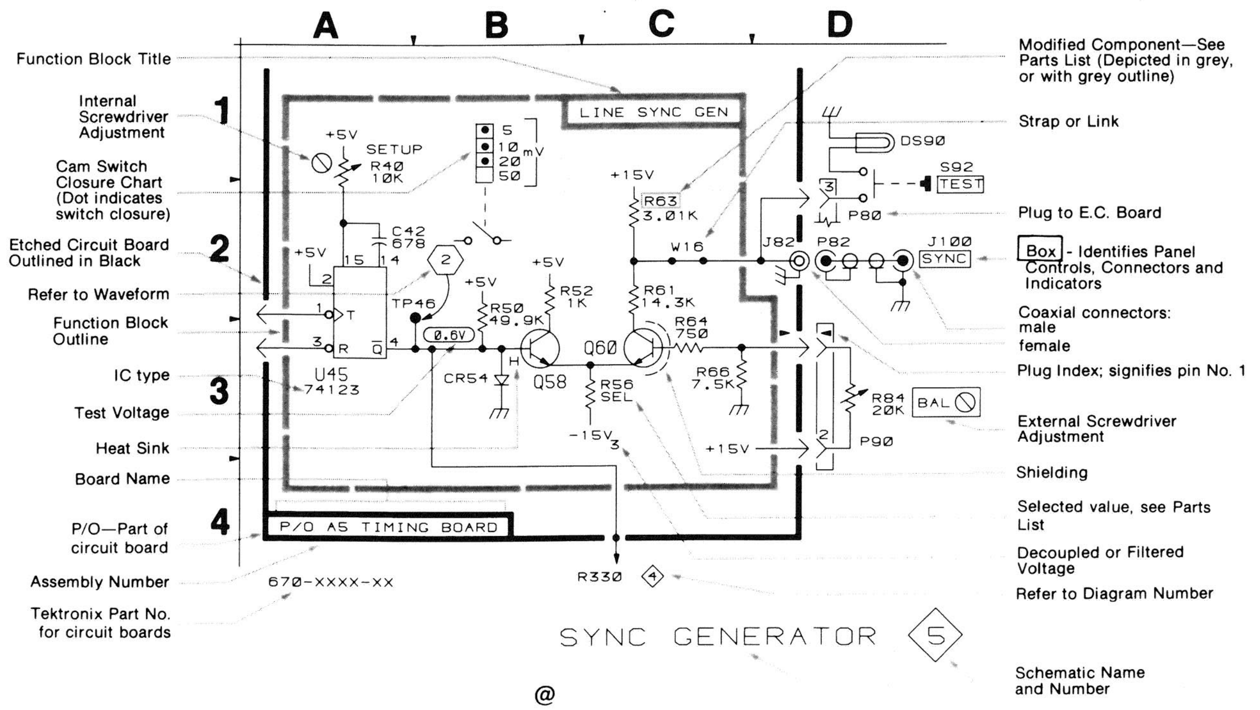
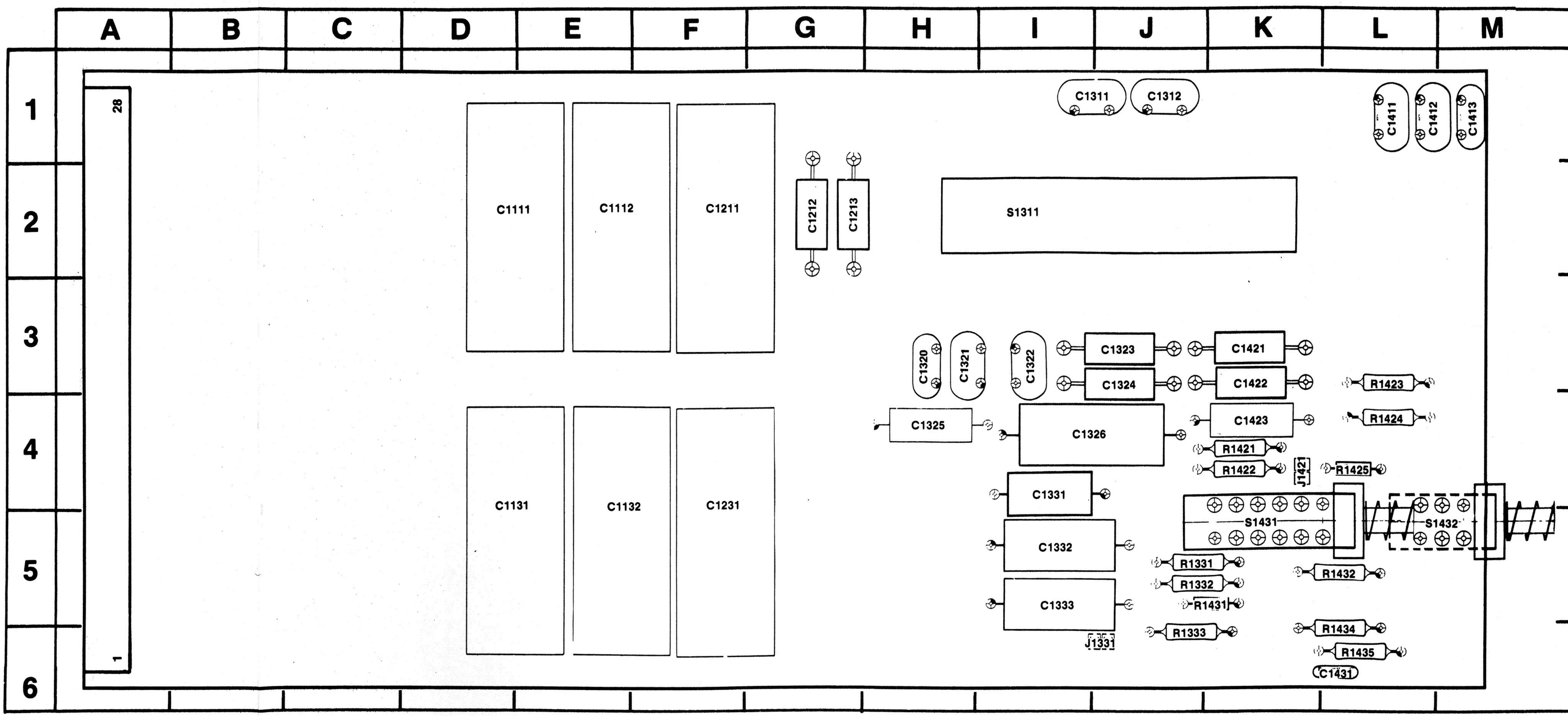


Table 8-1
COMPONENT REFERENCE CHART

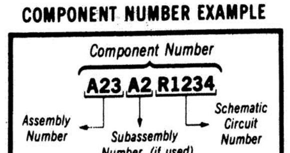
A10 ASSY — **Notch Filter**

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C1111	F3	D2	J570	A2	CHASSIS
C1112	K4	E2	J580	M2	CHASSIS
C1131	E3	D4	J1331	F6	J6
C1132	E4	E4	J1421	D3	K4
C1211	K4	F2			
C1212	E5	G2	P1331	F6	CHASSIS
C1213	E5	G2	P1421	D3	CHASSIS
C1231	E4	F4			
C1311	K3	I1	R550	D3	CHASSIS
C1312	K3	J1	R560	F6	CHASSIS
C1320	E5	H3	R1331	B3	J5
C1322	E6	I3	R1332	J6	J5
C1323	H3	J3	R1333	F6	J6
C1324	J3	J3	R1421	D2	K4
C1325	E4	H4	R1422	E2	K4
C1326	F3	I4	R1423	L2	L3
C1331	H3	I4	R1424	L2	L4
C1332	K4	I5	R1425	C2	L4
C1333	E4	I5	R1431	J6	K5
C1411	K6	L1	R1432	B2	L5
C1412	K6	L1	R1434	A2	L6
C1413	K5	M1	R1435	A2	L6
C1421	K5	K3			
C1422	K5	K3	S1311	C7	I2
C1423	K4	K4	S1431	C2	K5
C1431	A4	L6	S1431	M2	K5
			S1431	C1	K5
			S1432	B2	M5

PARTS LOCATION GRID



COMPONENT NUMBER EXAMPLE

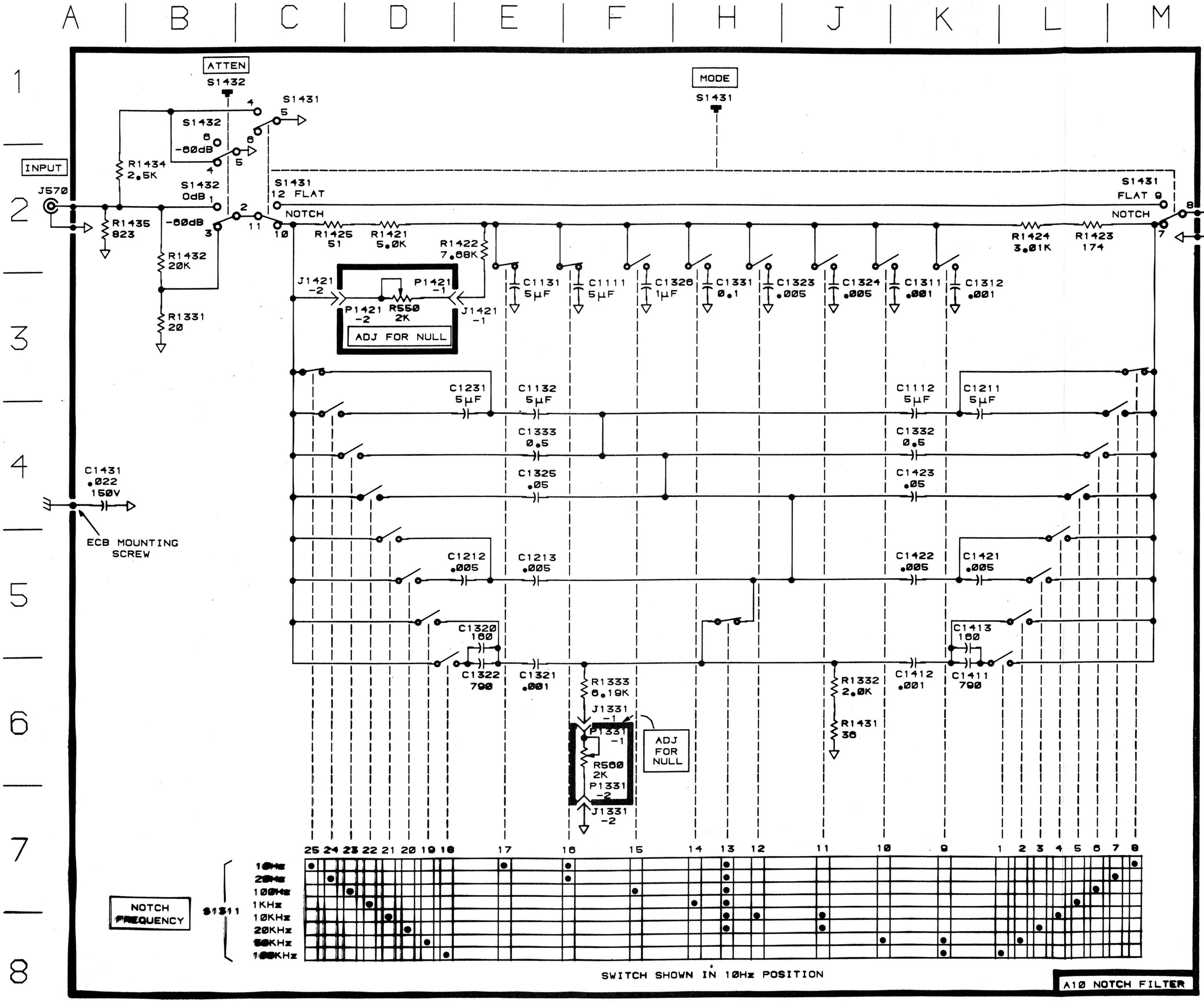


Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Static Sensitive Devices
See Maintenance Section

Fig. 8-1. Notch filter board (A10)

@



Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number
Subassembly Number (if used)
Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

067-0938-00 2868-10 CALIBRATION FIXTURE JP

REPLACEABLE MECHANICAL PARTS

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

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

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.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
--- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
--- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
--- * ---

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.

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

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000EX	O'HARA METAL PRODUCT COMPANY	542 BRANNAN STREET	SAN FRANCISCO, CA 94107
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01536	CAMCAR DIV OF TEXTRON INC. SEMS PRODUCTS UNIT	1818 CHRISTINA ST.	ROCKFORD, IL 61108
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
93907	CAMCAR SCREW AND MFG. CO.	600 18TH AVE.	ROCKFORD, IL 61101

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-00			2	SHIELD,ELEC:SIDE LF-1 PLUG-INS	80009	337-1399-00
-2	366-0500-00			1	KNOB:GRAY,4 SIDED	80009	366-0500-00
-3	358-0029-00			1	BSHG,MACH.THD:HEX,0.375-32 X 0.438"LONG	80009	358-0029-00
					(ATTACHING PARTS)		
-4	210-0590-00			1	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-5	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
					- - - * - - -		
-6	366-1023-00			2	KNOB:GRAY	80009	366-1023-00
-7	366-1120-00			2	KNOB:GRAY,0.600 INCH HIGH	80009	366-1120-00
-8	----- -----			2	RES.,VAR,WW:(SEE R550,R560 EPL)		
					(ATTACHING PARTS)		
-9	210-0590-00			2	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-10	210-0978-00			2	WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
					- - - * - - -		
-11	----- -----			2	CONN,RCPT,ELEC:(SEE J570,J580 EPL)		
-12	366-1690-00			1	KNOB,LATCH:	80009	366-1690-00
-13	366-1512-00			1	PUSH BUTTON:GRAY,0.18 SQ X 0.83 INCH LG	80009	366-1512-00
-14	366-1559-00			1	PUSH BUTTON:GRAY	80009	366-1559-00
-15	333-2609-00			1	PANEL,FRONT:	80009	333-2609-00
-16	105-0719-00			1	LATCH,RETAINING:PLUG-IN	80009	105-0719-00
					(ATTACHING PARTS)		
-17	213-0113-00			1	SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	93907	OBD
					- - - * - - -		
-18	105-0718-01			1	BAR,LATCH RLSE:	80009	105-0718-01
-19	386-4303-00			1	SUBPANEL,FRONT:	80009	386-4303-00
					(ATTACHING PARTS)		
-20	213-0123-00			4	SCREW,TPG,TF:6-32 X 0.375,SPCL TYPE,FLH	80009	213-0123-00
					- - - * - - -		
-21	337-2716-00			1	SHIELD,ELEC:REAR SUBPANEL,AL	80009	337-2716-00
-22	384-1136-00			1	EXTENSION SHAFT:0.95 INCH LONG	80009	384-1136-00
	672-0855-00			1	CKT BOARD ASSY:NOTCHED FILTER W/SWITCH	80009	672-0855-00
					(ATTACHING PARTS)		
-23	213-0146-00			4	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			1	. SW CAM ACTR AS:(SEE S1311 EPL)		
					(ATTACHING PARTS)		
-24	211-0678-00			6	. SCR,ASSEM WSHR:4-40 X 0.281 L,PNH	01536	OBD
	131-0963-00			1	. CONTACT,ELEC:GROUNDING	000EX	OBD
					- - - * - - -		
	----- -----			-	. . ACTR ASSY INCLUDES:		
-25	200-2428-00			1	. . COVER,CAM SW:3.45 L X 0.876 H,AL	80009	200-2428-00
					(ATTACHING PARTS)		
-26	211-0678-00			6	. . SCR,ASSEM WSHR:4-40 X 0.281 L,PNH	01536	OBD
					- - - * - - -		
-27	407-1199-00			1	. . BRACKET,COVER:ABS	80009	407-1199-00
-28	401-0180-00			1	. . BEARING,CAM SW:FRONT	80009	401-0180-00
-29	401-0178-01			1	. . BEARING,CAM SW:CENTER/REAR	80009	401-0178-01
-30	210-0406-00			10	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-31	131-0963-00			1	. . CONTACT,ELEC:GROUNDING	000EX	OBD
-32	214-1139-02			1	. . SPRING,FLAT:GREEN COLORED	80009	214-1139-02
	214-1139-03			1	. . SPRING,FLAT:RED COLORED	80009	214-1139-03
-33	214-1752-00			2	. . ROLLER,DETENT:	80009	214-1752-00
-34	354-0390-00			1	. . RING,RETAINING:0.338 ID X 0.025" THK,STL	79136	5100-37MD
-35	384-0878-17			1	. . SHAFT,CAM SW:OUTER CNCTR,W/DRVR	80009	384-0878-17
-36	105-0837-00			1	. . ACTUATOR,CAM SW:CENTER FREQUENCY	80009	105-0837-00
-37	----- -----			1	. CKT BOARD ASSY:NOTCHED FILTER		
	----- -----			1	. (REPLACEABLE AS A UNIT WITH 672-0855-00)		
-38	131-0604-00			25	. . CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-39	131-0993-00			1	. . BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-40	----- -----			1	. . TERM SET,PIN:(SEE J1421 EPL)		
-41	----- -----			1	. . SWITCH,PUSH:(SEE S1431 EPL)		
-42	361-0685-00			2	. . SPACER,SWITCH:0.365 INCH LONG	80009	361-0685-00
-43	----- -----			1	. . SWITCH,PUSH:(SEE S1432 EPL)		
-44	361-0383-00			2	. . SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
-45	----- -----			-	. . CONTACT SET,ELEC:(SEE J1331 EPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-46	386-4278-00			1	SUPPORT,FRAME:REAR,AL	80009	386-4278-00
					(ATTACHING PARTS)		
-47	213-0146-00			2	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
-48	386-3657-01			2	SUPPORT,PLUG IN:	93907	OBD
					- - - * - - -		
-49	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
-50	426-0725-00			1	FR SECT,PLUG-IN:TOP	80009	426-0725-00
-51	426-0724-00			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0724-00
-52	----- -----			1	CA ASSY,SP,ELEC:(SEE P1421 EPL)		
	352-0169-01			1	. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01
-53	----- -----			1	WIRE SET,ELEC:(SEE P1331 EPL)		
	352-0169-01			1	. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01

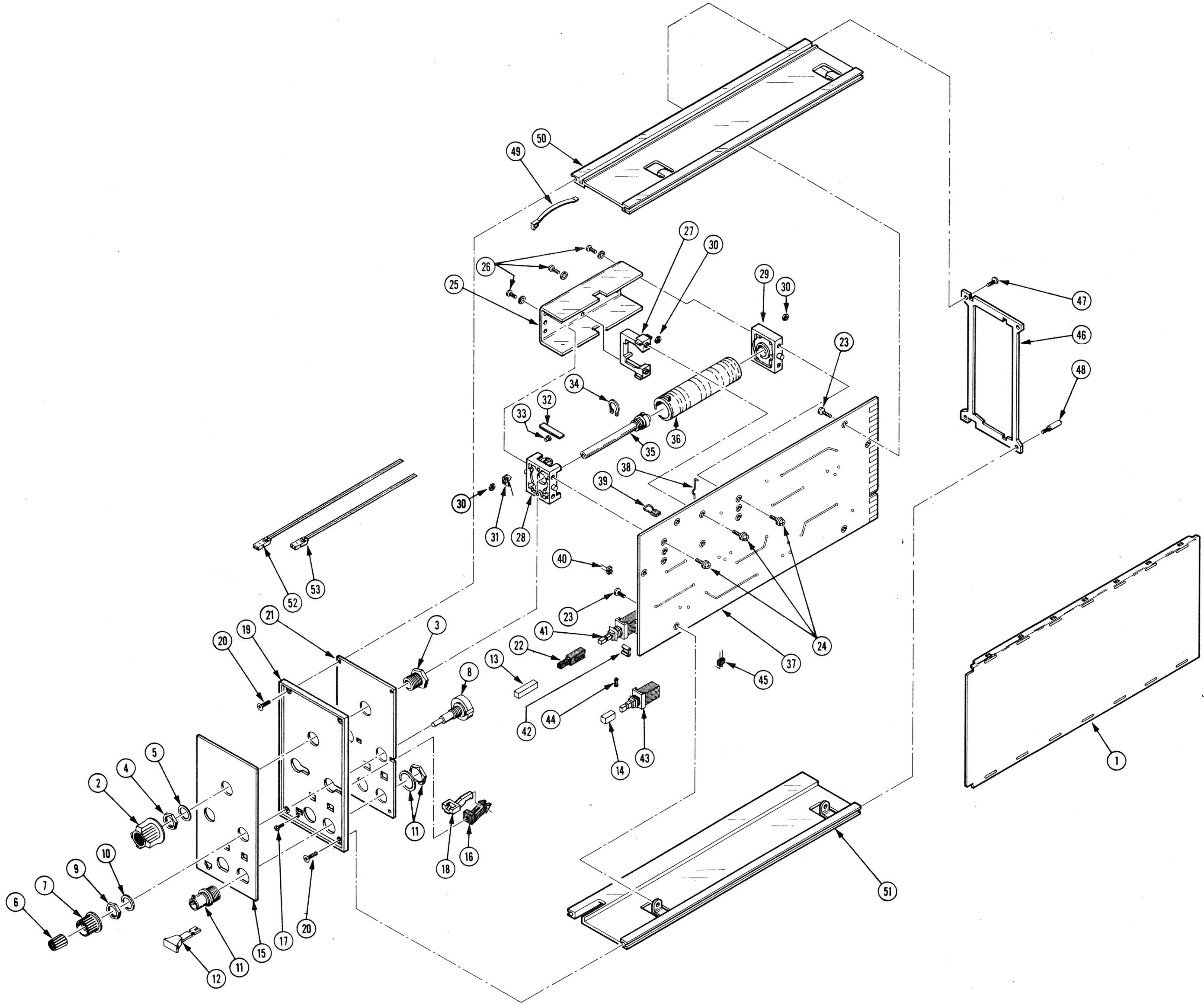


FIG. 1 EXPLODED VIEW

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
	070-2868-00			1	MANUAL,TECH:SERVICE,067-0938-00	80009	070-2868-00

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.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime	108 - 10 V output pulse 1 ns Risetime
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay
PG 508 replaces 114, 115, 2101	Performance of replacement equipment is the same or better than equipment being replaced.	
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191		
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
SG 504 replaces 067-0532-01	SG 504 - Frequency range 245 MHz to 1050 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
067-0650-00		
TG 501 replaces 180, 180A	TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181		181 - Multiple time-marks
184	TG 501 - Trigger output-slaved to market output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Separate trigger pulses of 1 and 0.1 sec; 10, 1, and 0.1 ms; 10 and 1 µs.
2901	TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Separate trigger pulses, from 5 sec to 0.1 µs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

MANUAL CHANGE INFORMATION

Tektronix®
COMMITTED TO EXCELLENCE

Date: 11-19-79 Change Reference: C1/1179

Product: 067-0938-00 Service Manual Part No.: 070-2868-00

DESCRIPTION

TEXT CORRECTION

SECTION 2 OPERATING INSTRUCTIONS

Page 2-4 Formula Method for Computing thd:

CHANGE TO:

$$\text{thd} = 20 \log_{10} A$$

WHERE A =

$$\sqrt{10^{(2nd + 9.5)/10} + 10^{(3rd + 6)/10} + 10^{(4th + 4.5)/10} + 10^{(5th + 3.5)/10}}$$

Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 1-24-86

Change Reference: C2/0186 REV JUN 1986

Product: 067-0938-00 SERVICE

Manual Part No.: 070-2868-00

DESCRIPTION PG 75

Effective Serial Numbers: ALL INSTRUMENTS

TEXT CHANGES FOR THE CALIBRATION PROCEDURE

Remove Pages 4-1, 4-2, 4-3 & 4-4 in Secton 4 and replace with the following attached pages.

NOTE

Change the DIFFERENTIAL COMPARATOR test equipment example from TEKTRONIX 7A12 DIFFERENTIAL COMPARATOR to TEKTRONIX 7A13 DIFFERENTIAL COMPARATOR on PAGE 4-1.