Tektronix®

015-0408-00
PEAK-TO-PEAK DETECTOR AMPLIFIER

INSTRUCTION MANUAL

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015-0408-00
PEAK-TO-PEAK DETECTOR AMPLIFIER

INSTRUCTION MANUAL

Tektronix, Inc.
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015-0408-00 P-P Detector Amplifier

TABLE OF CONTENTS

TABLE OF CONTENTS (cont)

TABLE OF CONTENTS (cont)

OPERATORS 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.

Terms 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.

Symbols As Marked on Equipment

DANGER — High voltage.

Protective ground (earth) terminal.

ATTENTION — refer to manual.

Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the 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 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.

Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse of correct type, voltage rating and current rating as specified in the parts list for your product.

Refer fuse replacement to qualified service personnel.

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 Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

Use Care When Servicing With Power On

Dangerous voltages 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.

Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

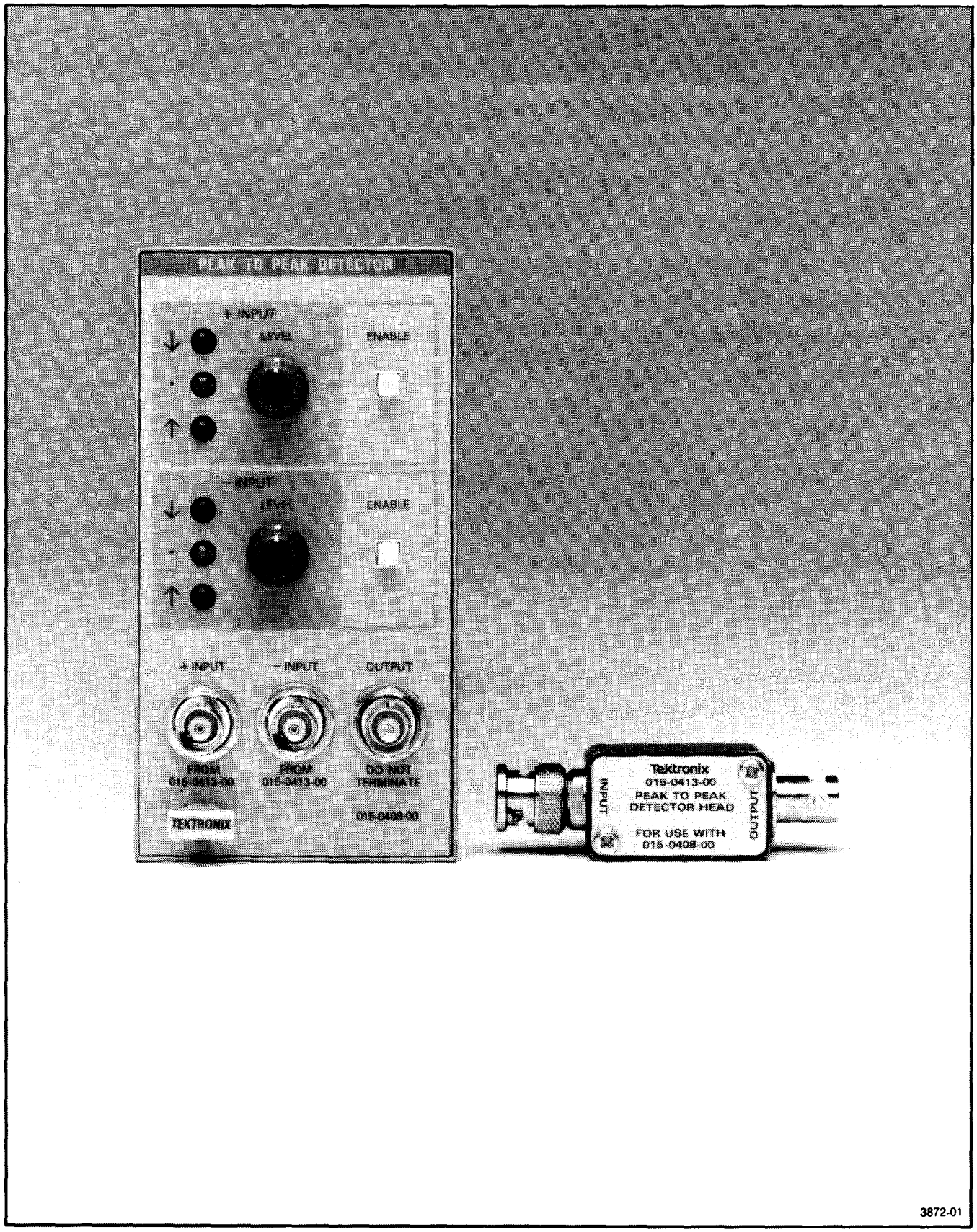

Fig. 1-1. Peak-to-Peak Detector System.

015-0408-00 P-P Detector Amplifier

SECTION I

INTRODUCTION and SPECIFICATION

Product Description

The Tektronix 015-0408-00 Peak-To-Peak Detector Amplifier and an 015-0413-00 Detector Head comprise an NBS-traceable Peak-To-Peak Detector System (Fig. 1-1) intended primarily for baseband video frequency response testing.

The small Detector Head contains the detecting diodes and provides a 75-ohm termination. It is designed to be used directly at the signal source, and is connected to the Detector Amplifier using a 012-0159-00 low-loss coaxial cable. The Detector Amplifier provides a high impedance load and bias for the Detector Head and corrects offset and dynamic gain errors of the head. (Other commonly available detectors do not correct for errors introduced by offset and dynamic impedance of the detector diodes.) Envelope flatness is viewed on an oscilloscope using the unterminated OUTPUT on the front panel of the Amplifier. The Amplifier also has both inverting and non-inverting inputs for differential frequency response measurements. The Amplifier is a single-wide plug-in and requires a TM500 or TM5000 Series Power Module as a host.

Product Purpose

The Peak-To-Peak Detector System allows precise comparison of sinewave amplitudes at frequencies throughout the video spectrum. The frequency response of an analog generator, such as the combination of the Tektronix 067-1011-00 Digital Sweep Generator and the Tektronix 1900 Test Signal Generator (used as a DAC), may be calibrated using the Peak-To-Peak Detector System as a transfer standard. The 1900 Generator may then be used as a frequency response transfer standard to calibrate frequency response and chrominance-luminance gain of test equipment such as waveform monitors and vectorscopes.

The Detector Amplifier's inverting and non-inverting inputs facilitate differential frequency response measurements from the input to the output of a system, thereby cancelling the frequency response errors of the test generator.

Performance Conditions

The following electrical characteristics are valid only if the 015-0413-00 Peak-To-Peak Detector Head has been tested and verified by a Tektronix standards laboratory. Additionally, the 015-0408-00 Peak-To-Peak Detector Amplifier must be adjusted and tested at an ambient temperature of 25 degrees C, plus or minus 5 degrees, and operated at a normal ambient temperature between 0 and 15 degrees C. Allow a 20-minute warm-up period before performing verification tests.

Table 1-1

SYSTEM ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
+ INPUT		Non-inverting.
- INPUT		Inverting.
Level Control Range	0.25 to 1.0V, within 10%	P-P ac input.
Envelope Gain	Unity, within 0.1%	For 1.0% signal change
Envelope Offset	0V, within 0.1V	Envelope Peak
Amplifier Output Impedance		Nominal 75 ohms, source-terminated. Do not terminate receiver.
Detector Input Impedance	75 ohms	
Return Loss	At least 46 dB	To 5 MHz
Maximum Input Voltage	1.0V peak-peak ac.	

Table 1-1 (Cont.)

SYSTEM ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information		
		Typical Response	Transfer Uncertainties	
			TEK	NBS
Frequency Response				
25 kHz	+0.1, -0.7%	+0, -0.25%	+/-0.05%	+/-0.01%
50 kHz	+0.1, -0.3%	+0, -0.1%	+/-0.05%	+/-0.02%
100 kHz	+/-0.1%	+/-0.05%	+/-0.05%	+/-0.02%
200 kHz	+/-0.1%	+/-0.02%	+/-0.05%	+/-0.05%
500 kHz	+/-0.1%	+/-0.02%	+/-0.05%	+/-0.05%
1 MHz	0.0% (Reference)	+/-0.02%	+/-0.05%	+/-0.05%
2 MHz	+/-0.1%	+/-0.02%	+/-0.05%	+/-0.1%
5 MHz	+/-0.1%	+/-0.02%	+/-0.05%	+/-0.1%
10 MHz	+/-0.15%	+/-0.05%	+/-0.05%	+/-0.1%
20 MHz	+/-0.2%	+/-0.1%	+/-0.05%	+/-0.2%
30 MHz	+/-0.5%	+/-0.2%	+/-0.1%	+/-0.2%
50 MHz	+/-2.0%	+/-1.0%	+/-0.2%	+/-0.5%
Mainframe Interface		TM500. Uses any single-wide location. Keyed at 6-7 and 23-24 as Signal Source family.		

Table 1-2

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Supplemental Information
Temperature	
Operating	0 to +50 degrees C.
Storage	-40 to +65 degrees C.
Altitude	
Operating	To 4,572 m (15,000 feet).
Storage	To 15,240 m (50,000 feet).

Table 1-3

PHYSICAL CHARACTERISTICS

Characteristics	Information
Finish	Anodized aluminum side-panel and chassis.
Length	29.2 cm (11.5 in.).
Width	6.6 cm (2.6 in.).
Height	12.7 cm (5.0 in.).
Net Weight	0.59 kg (1.3 lbs.).
Net Shipping Weight	1.3 kg (2.8 lbs.).

SECTION 2

OPERATING INSTRUCTIONS

This section describes installation, operating controls, connectors and indicators. Following these discussions are example applications.

Installation and Removal Instructions

The Peak-To-Peak Detector Amplifier is calibrated with NBS traceability and ready to use when received. It operates in any of the Tektronix TM500 or TM5000 Series Power Modules, referred to hereafter as "TM500". Refer to the power module instruction manual for line-voltage requirements and power module operation.

CAUTION

Turn the power module off before inserting or removing the Detector Amplifier, otherwise arcing may occur at the rear interface connectors. Arcing reduces the useful life of the connectors and damage may be done to the plug-in circuitry.

Check for plastic barriers on the interconnecting jacks of the power module in the selected compartments. If the barriers do not match the cutouts in the Detector Amplifier circuit board edge connector, they may indicate special rear interface connections for another type of instrument. Do not insert the plug-in until this has been verified by qualified service personnel. The TM500 power module MUST have a barrier installed between pins 6 and 7 at the standard barrier location to ensure proper connector alignment. The TM500 Power Module may also have an optional barrier between pins 23 and 24. A barrier in any other location will preclude insertion of the Detector Amplifier because that barrier would indicate that the compartment has been reserved for other plug-ins.

When the connectors are properly matched, align the Detector Amplifier with the upper and lower guides of the selected compartments. Insert the Detector Amplifier into the compartment and press firmly to seat the circuit board in the interconnecting jack.

To remove the Detector Amplifier, turn off the TM500 Power Module and pull the release latch, located on the lower left corner of the Detector Amplifier until the connector disconnects from the power module. The Detector Amplifier will now slide out of the power module.

Functions of Controls, Connectors, and Indicators

+ INPUT	signal fed to this input channel produces a non-inverted envelope at the OUTPUT connector.
- INPUT	A signal fed to this input channel produces an inverted envelope at the OUTPUT connect. Differential measurements are possible using both inputs.
+ INPUT LEVEL - INPUT LEVEL	These variable controls set dynamic gain offset correction in the Detector Amplifier as a function of signal level. Three LED indicators for each INPUT show high, low, and correct settings of the LEVEL controls.
+ INPUT ENABLE - INPUT ENABLE	These button switches turn on or off the corresponding INPUT channel.
OUTPUT	This BNC connector provides the detected envelope output after gain and offset corrections through the INPUT channels. DO NOT TERMINATE THIS OUTPUT.

OPERATING CONSIDERATIONS

Terminating

The 015-0413-00 Detector Head has a built-in 75-ohm termination resistor in its input circuit. Connect the head directly to the output of the generator or device-under-test (D.U.T.). Connect the high impedance output of the Detector Head directly to the 015-0408-00 Detector Amplifier via a 012-0159-01 low-loss 75-ohm coaxial cable. The OUTPUT of the Detector Amplifier is source-terminated in 75 ohms and to avoid reflections should not be terminated at the receiving end.

Low-Loss Coaxial Cables

Use the 72" 75-ohm, low-loss coaxial cable (012-0159-01) supplied as a standard accessory to connect the Detector Head to the Detector Amplifier. For differential measurement applications, a second cable should be ordered along with a second Detector Head. Test cables of this length and type were used to generate the frequency response curve accompanying each Detector Head.

Using 75-ohm coaxial cable longer than 72", or using cable other than 75-ohm coaxial, will degrade the envelope rise and fall times and affect the high frequency response slight =

APPLICATIONS

1900 Frequency Response

The hook-up illustration in Fig. 2-2 shows how the 015-0413-00 Detector Head and the 015-0408-00 Peak-To-Peak Detector Amplifier are used, along with the 067-1011-00 Digital Sweep Generator as a signal source, to calibrate the digital-to-analog converter frequency response in the Tektronix 1900 Digital Test Signal Generator. The Detector Head should be directly attached to the Full Field Out connector on the 1900. The standard accessory 72" coaxial cable should be used between the Head and the Detector

015-0408-00 P-P Detector Amplifier

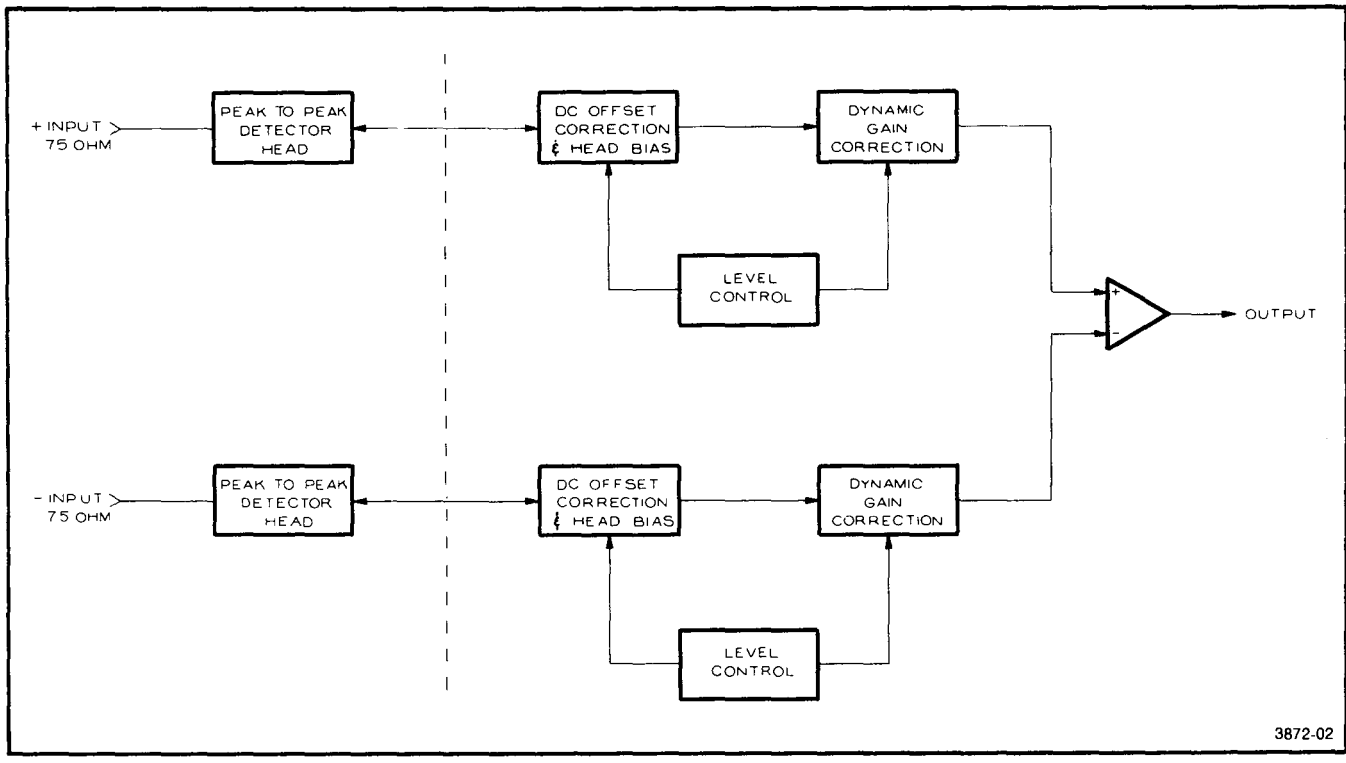

Fig.2-1. Peak-to-Peak Detector System Block Diagram.

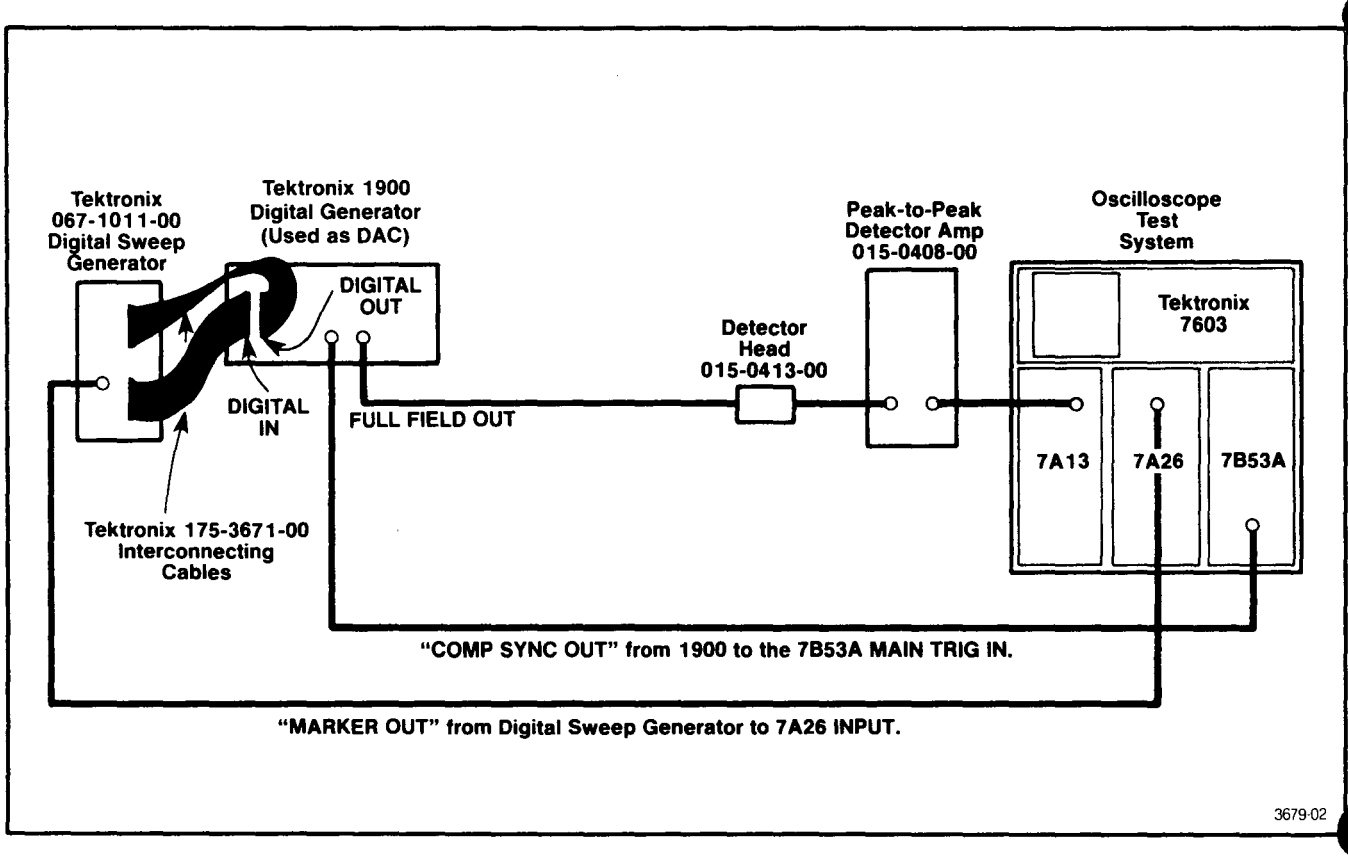

Fig. 2-2. Calibrating the 1900 Frequency Response.

Amplifier. View the unterminated output of the Detector Amplifier using the offset function of a differential comparator vertical amplifier (Tektronix 7A13 or equivalent) in a dual-channel oscilloscope. Adjust the LEVEL control of the INPUT channel being used on the Detector Amplifier until the green LED lights and the two red LED's extinguish.

Establish a reference amplitude level at a low frequency (left side of the display). Compare amplitude deviations throughout the frequency sweep relative to this reference point. Evaluate the amplitudes as percent deviations of the peak-to-peak input signal. Fig. 2-3 shows a typical resultant detector envelope output display, with frequency markers from the 067-1011-00 Digital Sweep Generator displayed through the other vertical channel of the oscilloscope. The frequency response shown is +/- 2 mV for a 714 mV signal, that is, +/- 0.3%.

NOTE

It is very important to understand that, in either the single-ended or differential detection mode, the absolute amplitude of the detected envelope is not displayed on the oscilloscope. The display is the detected change in the peak-to-peak amplitude of the envelope as the input signal sweeps through a frequency range. Once an amplitude is established at a chosen frequency for a reference point, other frequency amplitudes in the sweep may be accurately measured relative to that point.

Waveform Monitor Calibration

Calibration of the frequency response of a waveform monitor or other display device requires having a test signal generator with well-characterized frequency response. If the waveform monitor has a loop-through input, the test signal generator may be fed to one side of the loop-through and its output continuously monitored by terminating the other side of the loop-through with a detector head. (This application is illustrated in Fig. 2-8c under the discussion "Zero Impedance Response vs 75-ohm Response.")

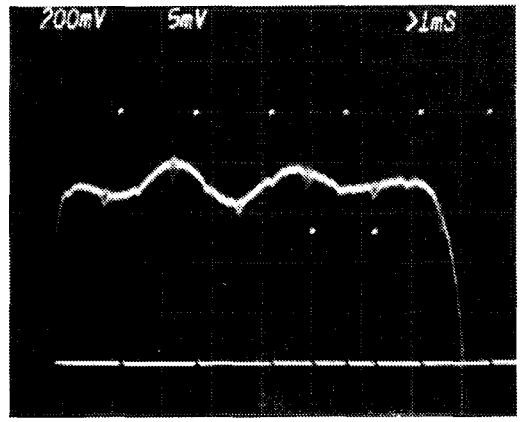

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Fig. 2-3. Typical Detector Output when set up as in Fig. 2-2. Note that glitches and markers are from the signal source, not the Detector.

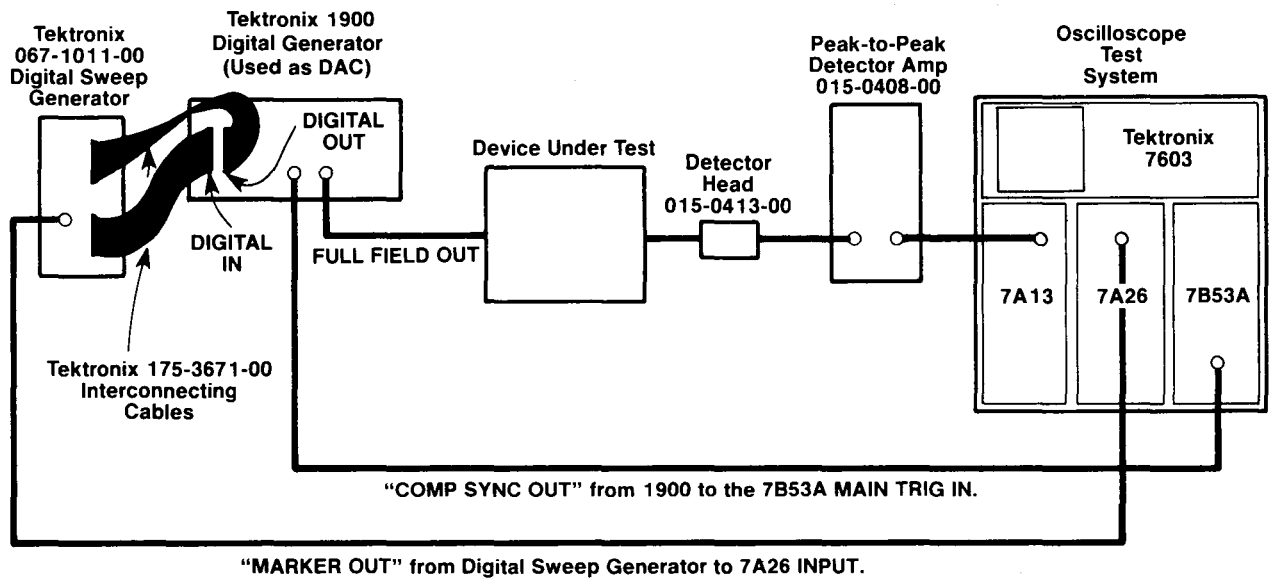

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Fig.2-4. Checking Frequency Response of Device Under Test.

If a CW generator such as a Tektronix SG 503 is being used, the Detector Amplifier output may be fed to a DVM. With this test setup, the test generator output level may be set to exactly the same amplitude by checking for the same DVM reading each time the frequency is changed.

Device-Under-Test (D.U.T.) Frequency Response

The hook-up illustration in Fig. 2-4 shows how the calibrated DAC function of a 1900 can be used with the Digital Sweep Generator and the Peak-To-Peak Detector System to evaluate the video spectrum frequency response of a device-under-test (D.U.T.). The resultant detector envelope represents the frequency response errors of the 1900 DAC and the device-under-test.

Differential Mode

When the frequency response errors of the test signal source are significant compared to the expected errors of the D.U.T., use the differential mode (See Fig. 2-5). Referring to Fig. 2-6, when the gain of the D.U.T. is exactly one, the errors in the frequency response of the test signal generator get cancelled by the common-mode rejection of the differential detector. Since the frequency response, and therefore the gain (Av), of the D.U.T. is going to vary with frequency, the equation describing the configuration in Fig. 2-6 at any one frequency is :

(Vsource) X (Av of D.U.T.) - Vsource = V out.

The "X" (times) symbol is because cascaded voltage gains multiply, and the "-" (minus) symbol is because of the function of the differential amplifier.

So, if the Vsource has a 0.5% frequency response error and the D.U.T. has a 2.0% error, the detected difference (ideally 2.0%) will actually be:

(0.995) X (0.98) - (0.995) = -0.0199 = -1.99%.

In this example, the 0.5% test signal generator error resulted in a measurement error of 2.0% - 1.99%, or only 0.01%.

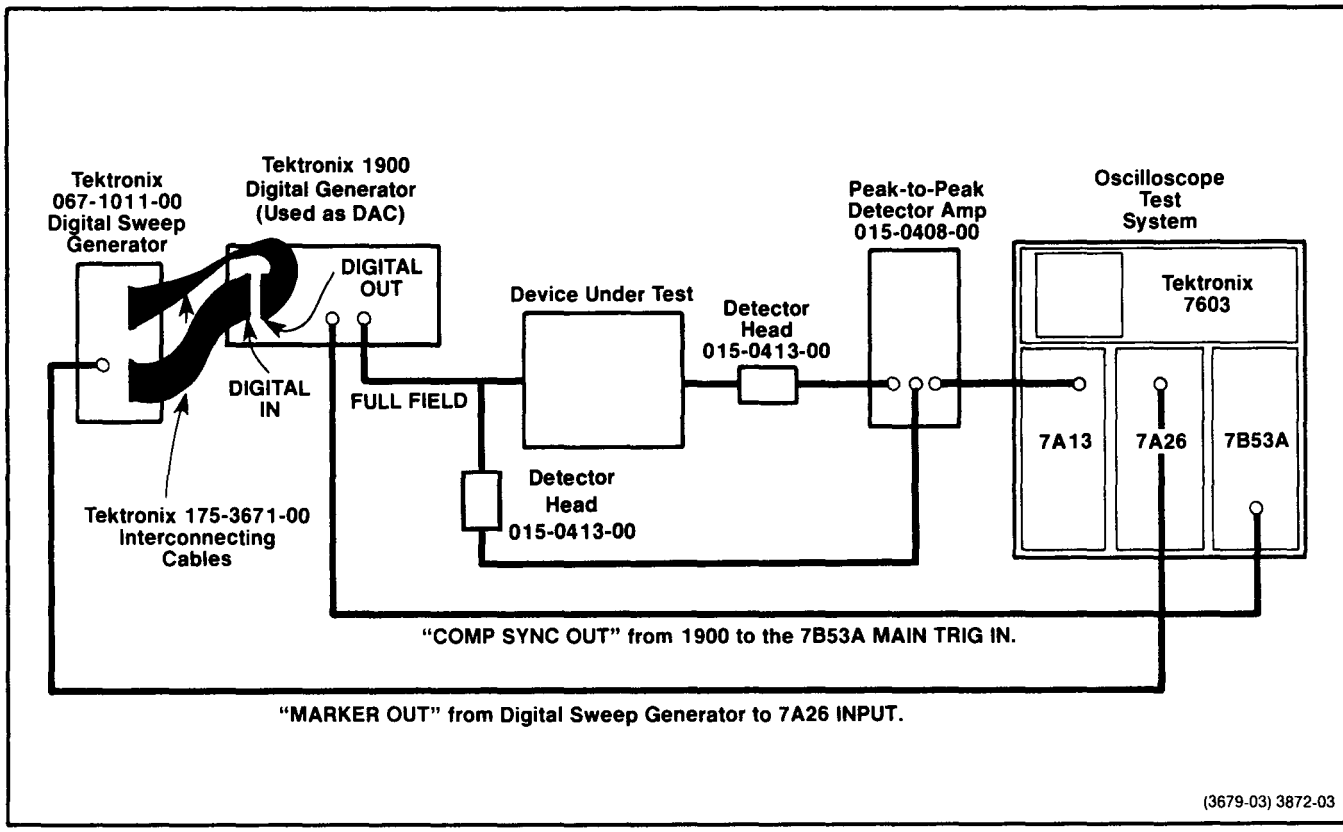


Fig.2-5. Checking Frequency Response of Device Under Test in the Differential Mode.

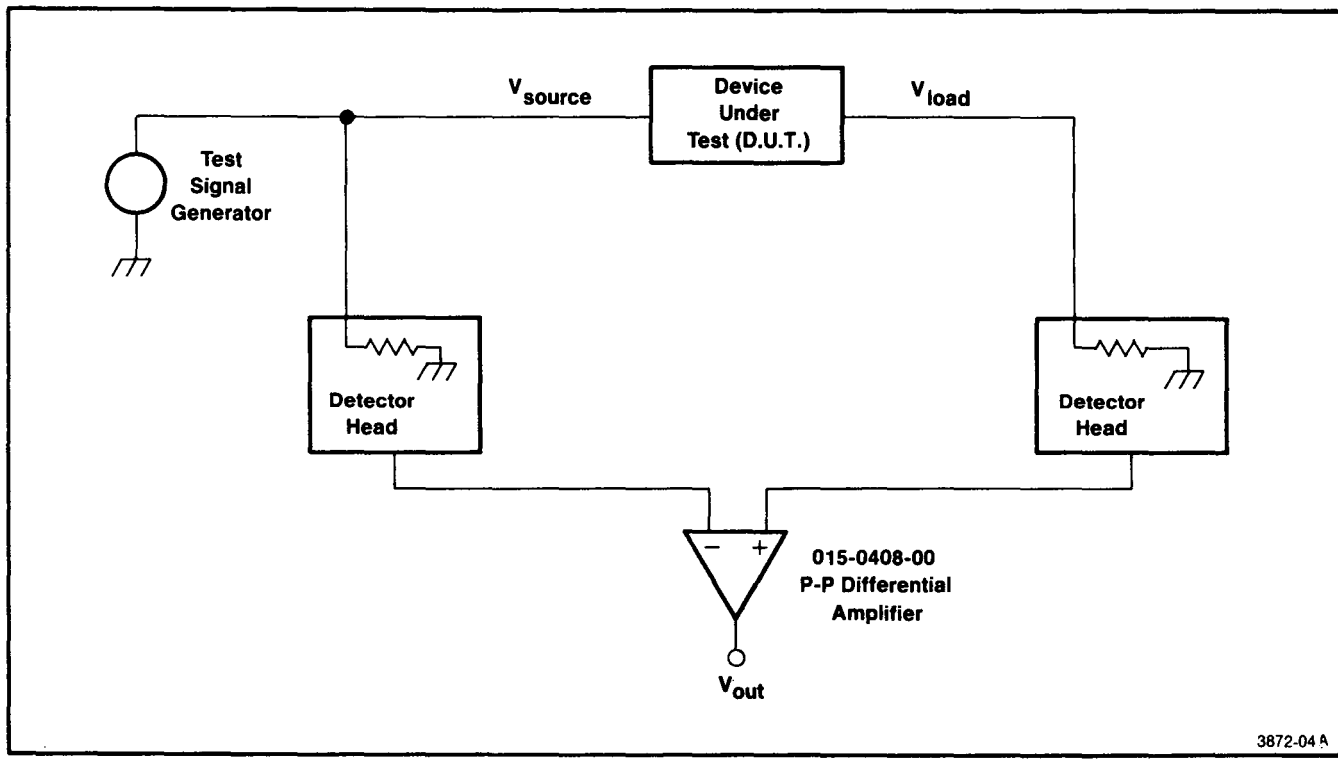


Fig.2-6. Differential Detection Configuration.

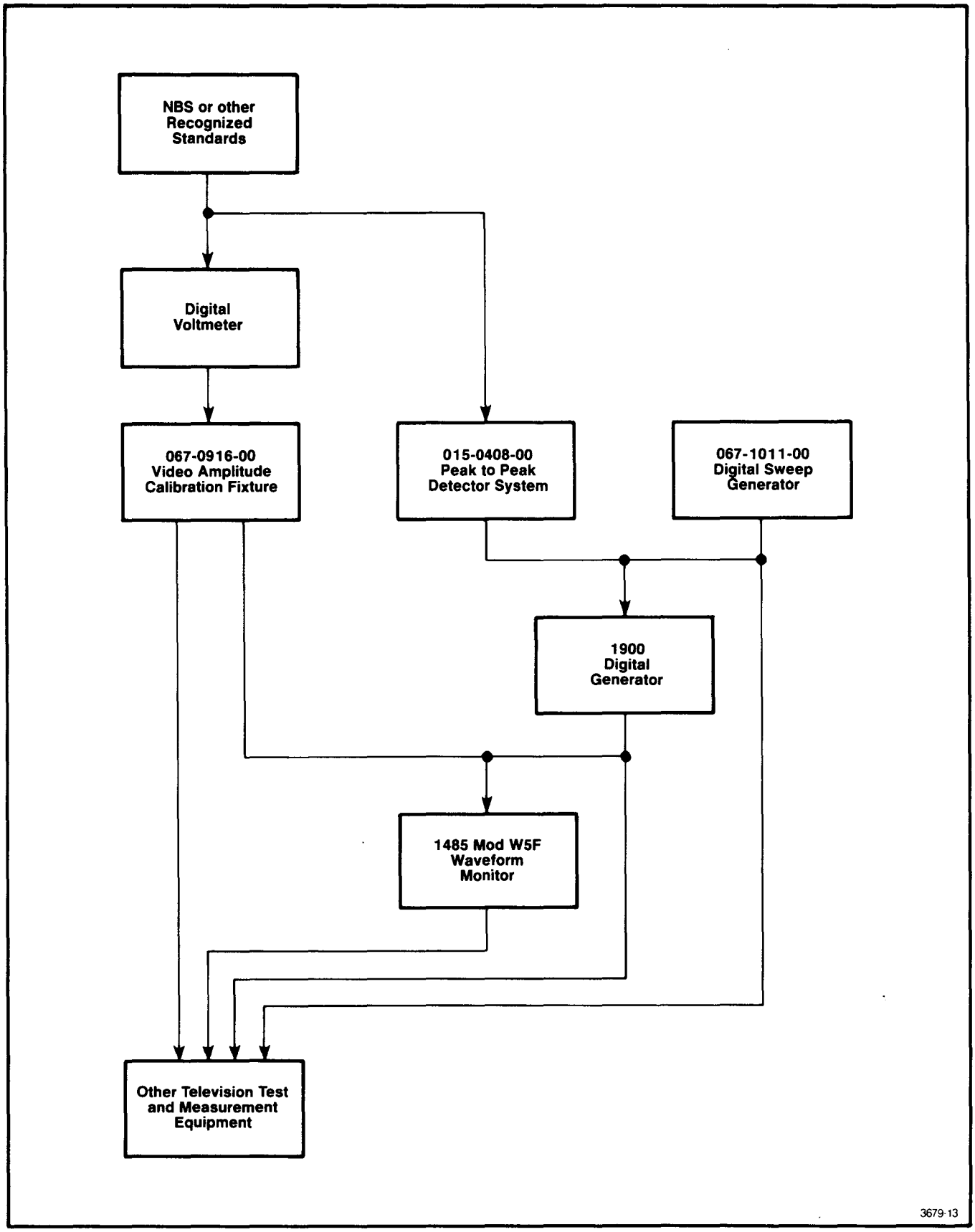


Fig. 2-7. NBS Traceability Explanation.

NBS Traceability

The Tektronix 067-1011-00 Digital Sweep Generator is part of a set of calibration fixtures which can be used to provide NBS-traceable for television signal measurements. The path for attaining NBS traceability is illustrated in Fig. 2-7. A digital voltmeter and the 067-0916-00 Video amplitude Calibration Fixture are transfer standards to allow accurate and traceable low frequency amplitude measurements with a Tektronix 1485 MOD W5F Waveform Monitor. The digital sweep generator in conjunction with the 015-0408-00 Peak-To-Peak Detector System allows accurate and traceable measurement of the Tektronix 1900 Test Signal Generator response. Combining the low frequency measurements with the high frequency measurements yields a complete systematic approach to establishing accurate video amplitude measurements.

FREQUENCY RESPONSE CHARACTERIZATION

The 015-0413-00 Detector Head

One Detector Head is included as a standard accessory with the 015-0408-00 Peak-To-Peak Detector Amplifier. A second head can be ordered separately for differential measurement applications. Additional heads can be ordered as spares. Each 015-0413-00 Detector Head is separately packaged with a verification graph of its particular frequency response. (An example graph is illustrated in the Performance Check Section.) The information in this graph can be used to optimize the flatness response of a signal source at a frequency point between 25 kHz and 50 MHz. Typical response of the Peak-To-Peak Detector System is of such accuracy that only small improvements will be gained by compensating for the small amount of error in the Detector Head.

Zero Impedance Response vs 75 ohm Response

The 015-0413-00 Peak-to-Peak Detector Head provides very close to a 75 ohm load to the AC input source. This is evidenced by the return loss being greater than 46 dB. There is, however, a small capacitance in parallel with the detector head input. This capacitance has no effect on detector frequency response when the

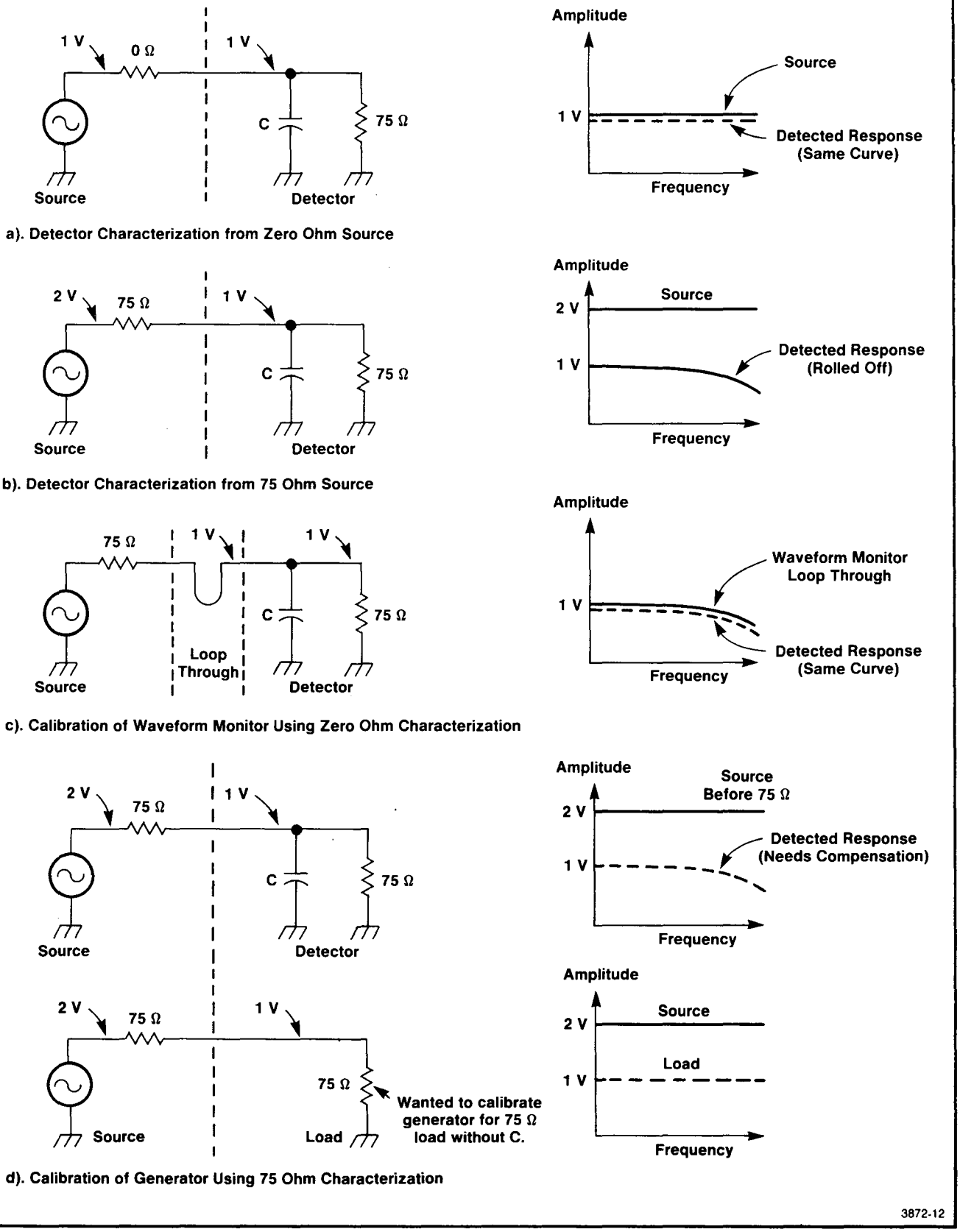


Fig. 2-8. Zero Ohms vs 75 Ohms Characterization.

detector is driven from a zero ohm source (pure voltage source), as shown in Fig. 2-8a, but will cause a slight roll off when the detector is driven from a 75 ohm source, as shown in Fig. 2-8b. By characterizing the detector at zero ohms, this capacitance is effectively cancelled. When used in a 75 ohm circuit, the detector will display the same output as if the detector capacitance were just part of the circuit being tested. Depending on the application, it may be desirable to have the detector head charaterized for zero impedance response as shown in Fig. 2-8c, or characterized for 75 ohm response as shown in Fig. 2-8d. The frequency response curve supplied with each detector head is for a zero impedance source. The differences in zero impedance and 75 ohm characterizations are very small, typically 0.03% at 30 MHz, 0.05% at 50 MHz, and imperceptible below 5 MHz. These errors are less than the tranfer uncertainies in deriving the detector characterization and normally need not be taken into account. For very demanding applications and for sake of completeness, it may be desirable to understand the differences in the two detector characterizations and their applications.

When using the detector to calibrate a waveform monitor with a loop-through input, as shown in Fig. 2-8c, the objective is to have a flat frequency response test signal at the input to the waveform monitor, which is the same as flat frequency response at the input to the detector. The detector indicates errors in the source generator plus errors due to detector loading. If a variable amplitude discrete frequency output sinewave generator is used, the amplitude of the generator may be manually adjusted to correct both errors. The zero impedance characterization should be used for this application, because it shows the response directly at the detector input rather than the response before a 75 ohm source resistor.

When using the detector to calibrate a video generator or other device under test and the objective is to have a flat response when operating into a pure 75 ohm load, the 75 ohm characterization of the detector should be used. In this application, shown in Fig. 2-8d, the detected output should not be set to have flat response with the detector's capacitive loading in circuit. Rather, the detected output should be set to roll off to match the 75 ohm characterization curve. In this manner, the generator will have a flat response when the detector's capacitive loading is removed and the generator is operated into a pure 75 ohm load.

SECTION 3

THEORY OF OPERATION

General

The 015-0408-00 Peak-To-Peak Detector System consists of a Detector Amplifier and one or two 015-0413-00 Detector Heads. The main function of the Detector System, peak-to-peak rectification of a sinewave signal, is performed by the Detector Head. The remaining circuitry in the Detector Amplifier serves primarily to correct for errors in the Detector Head. The circuits will be explained in terms of the detailed system block diagram, Figure 3-1.

Detector Head

The Detector Head is a peak-to-peak rectifier with a 75-ohms input and high impedance output. The output is a dc voltage which follows the envelope of the ac input signal. Due to dynamic impedance changes of the diodes in the Detector Head, the output dc level has a gain error that is a function of signal level. The dynamic gain errors and the dc offset will be corrected by the Detector Amplifier.

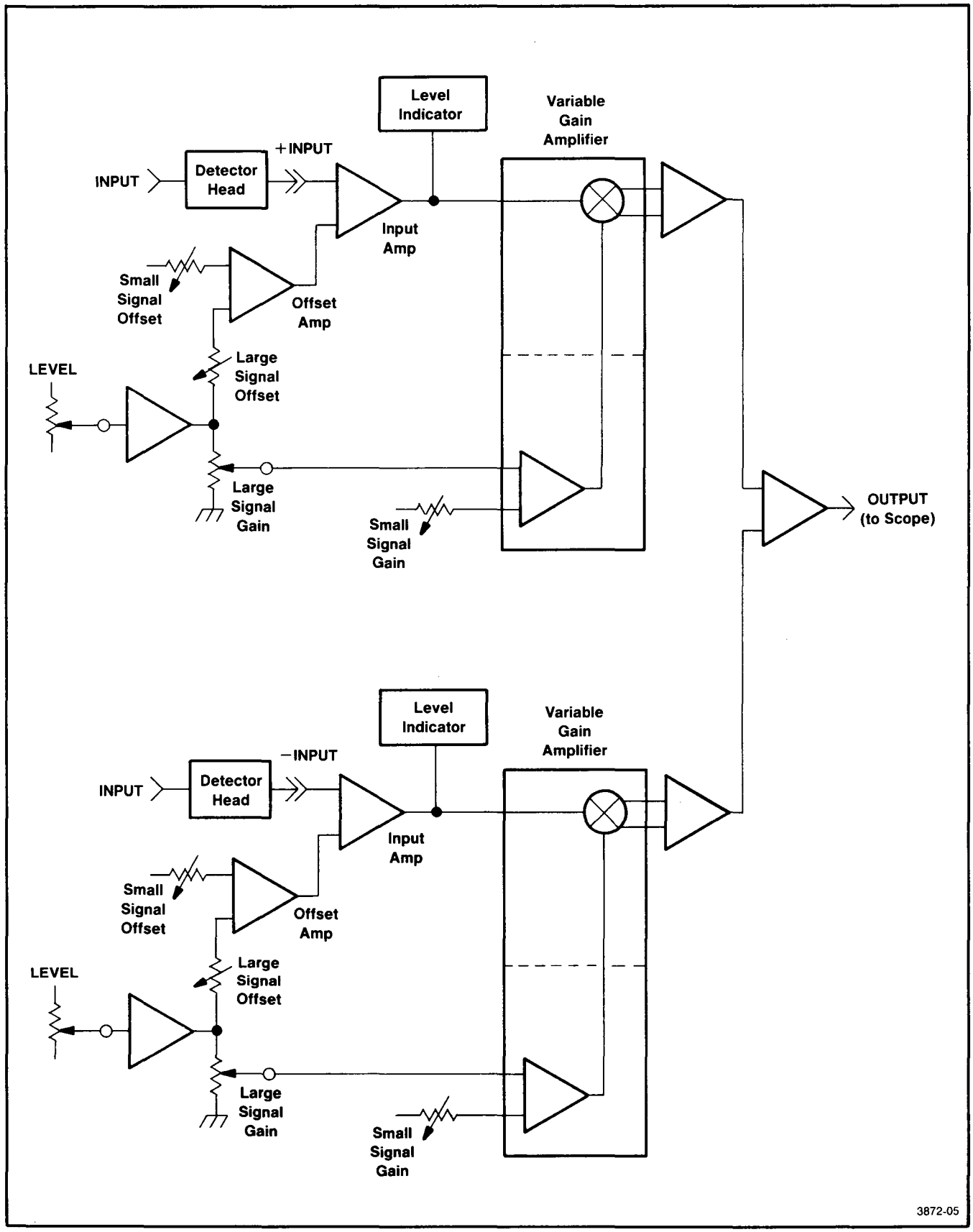


Fig.3-1. Detailed System Block Diagram.

Detector Amplifier Basic Function

An ideal detector would have

$$\frac{\text{DC OUTPUT VOLTAGE}}{\text{AC INPUT VOLTAGE}} = 1$$

Due to the diode's turn on voltage and dynamic impedance, a real detector has a curved and offset characteristic.

Since the 015-0408-00 Detector Amplifier is intended for relative frequency response measurements (not absolute amplitude measure- ments), the curve is offset by the LEVEL control to bring the point of interest back to 0 volts dc.

Then the same setting of the LEVEL control is used to tell a variable gain amplifier what gain correction to apply to tilt the curve back to a 1:1 slope at the desired operating point.

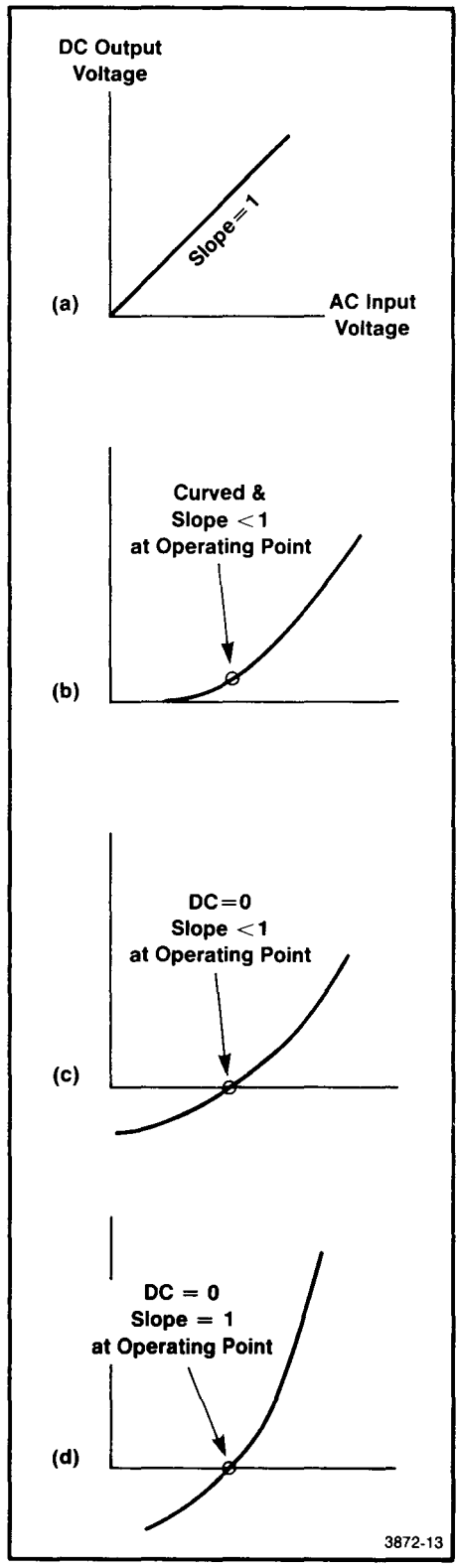


Fig.3-2. Detector Amplifier Function

015-0413-00 P-P Detector Amplifier

Input Amplifier

The input amplifier,u722 and U732, provides a high input impedance buffer for the Detector Head output. The offset amplifier output is added to the Detector Head output to provide an envelope with the most positive voltage at 0 Vdc.

Level Indicator

The level indicator Q713, U714, Q630, and U723 senses the most positive voltage of the envelope and drives three front panel LED's to indicate correct setting of the front panel LEVEL control. The green LED indicates that the LEVEL control is properly set to match input signal amplitude. Envelope peaks at the OUTPUT of the Detector Amplifier will then be at 0 Vdc.

The Red LED's indicate that the LEVEL control needs to be adjusted up or down. The LED's are switched off when the corresponding input channel is not used.

Offset Amplifier

The Offset Amplifier U420 and U433 adds the small signal offset voltage and the large signal offset voltage to provide a combined offset correction voltage to the input amplifier.

Note that, since the LEVEL control voltage is zero for small signals, the Large Signal Offset adjustment has no effect for small signals. Therefore, if the Small Signal Offset adjustment is made before the Large Signal Offset adjustment, no further interactive adjustment will be necessary.

LEVEL Control

The LEVEL control U413 and U431 selects a dc control voltage which drives the peak signal envelope offset and dynamic gain error correction circuitry. It moves the peak level of the envelope into the area of optimal dynamic gain correction, as well as the area of zero offset out, so the oscilloscope won't need a preamp with a variable offset.

The LEVEL control operates between 0 and +15 volts, and the output of the level control buffer provides 0 to +10 volts dc. The correspondence of level control voltage to input signal levels is summarized in Table 3-1.

Table 3-1
LEVEL CONTROL CORRESPONDENCE

Input Signal	Input Signal P-P Amplitude	Setting Of Level Control	Level Control Buffer Output
Small	0.25 Vac	0 Vdc	0 Vdc
Large	1.0 Vac	+15 Vdc	+10 Vdc

Variable Gain Amplifier

The gain control input of the multiplier integrated circuit U607 and U628 adds the Small Signal Gain control voltage to a variable gain control voltage derived from the LEVEL control buffer. The resulting control voltage is used as the multiplication coefficient to provide first order correction of the dynamic gain errors of the detector head.

Output Amplifier

The envelope signal from the - INPUT is subtracted from the + INPUT to provide a difference output from U613 nominally centered at ground on envelope peaks.

Power Supply

The 015-0408-00 uses two unregulated supply sources from the power supply module (TM500-series mainframe) to form + or - 15 Vdc regulated voltage supplies.

The +33.5 V unregulated supply drives U310, which provides a precise 10 V reference for the +15 V and -15 V regulator circuits.

The +33.5 V and -33.5 V supplies are also shunt-regulated by Zener diodes VR213 and VR341 to produce the +20 V and -20 V supplies used only for the op-amps in the +15 V and -15 V supplies.

The +33.5 V and the -33.5 V supplies are used as a source for the +15 V and -15 V regulated supplies.

Regulator Circuit Details

The +15 V regulated supply contains an amplifier (U300) configured as a non-inverting amplifier with a voltage follower consisting of Q200 and Q110. The input signal to the op-amp is 6 V, which is divided down from the 10 V reference. The amplifier operates with a gain of 2.5, giving an output of 14.99 V. Q200 and Q110 provide current gain and unity-voltage gain at the output of the supply. CR200, CR201, and CR300 are used in conjunction with R201 to limit output current. The -15 V regulated supply functions similarly, except that op-amp U330 is configured as an inverting amplifier with a gain of 1.5.

SECTION 4

CALIBRATION

Introduction

The procedures in this section provide the steps necessary to ensure the proper operation of the 015-0408-00 Peak-To-Peak Detector Amplifier. Limits, tolerances, and waveform information appearing in these procedures are not instrument specifications except where they agree with those listed in Section 1 Specifications.

The Performance and Functional Check Procedure verifies the Performance Requirements of Section 1 as well as provides all the checks necessary to determine proper functional operation of the Generator.

The Adjustment Procedure follows the Performance Check in this section.

Names of front panel controls, connectors, and indicators of the 015-0408-00 Detector Amplifier appear in all capitals, e.g., LEVEL. Control and connector names on test equipment and internal names of the Amplifier have only the first letter capitalized, e.g., Small Signal Offset.

The 015-0413-00 Detector Head Performance

Every Detector Head is NBS-traceable. Each one is tested, verified, and its performance graphed (see Fig. 4-1) in a Tektronix standards laboratory. A brief description of the procedure used by the Tektronix standards laboratory is provided here for general information only. Because of the standards equipment and methods necessary to ensure NBS-traceability, the Detector Head should be returned to Tektronix for any repair or performance verification. No performance checks or adjustments for frequency response characteristics are provided in this manual.

MODEL#: TEK 015-0413-00
SER. #: 2

DATE: 12-8-81
CAL BY: KWF
CAL AT:58-248

Frequency response measured at 700 mVp-p from zero ohm source impedance.

FREQ.	RESP(%)
25.0 kHz	-0.16
50.0 kHz	-0.06
100.0 kHz	-0.02
200.0 kHz	0.01
500.0 kHz	0.00
1.0 MHz	REF
2.0 MHz	-0.01
5.0 MHz	-0.02
10.0 MHz	-0.02
20.0 MHz	0.01
30.0 MHz	0.02
50.0 MHz	0.25

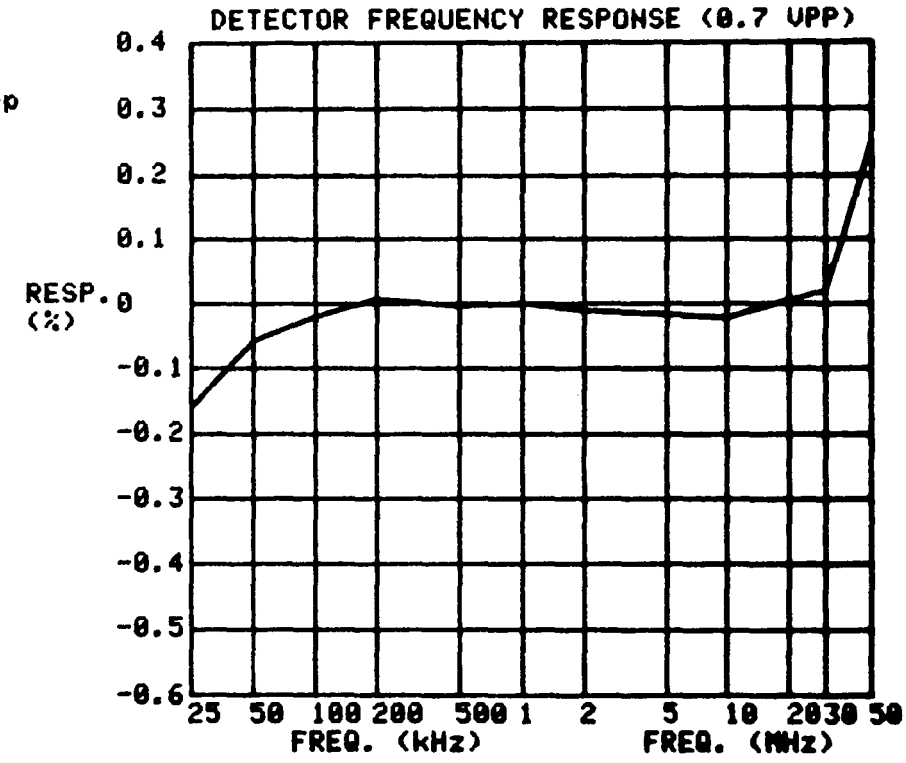


Fig.4-1. Typical Graph Accompanying each Detector Head (015-0413-00).

015-0408-00 P-P Detector Amplifier

In the Tektronix standards laboratory, the 015-0413-00 Peak-to-Peak Detector Head frequency response is measured from 25 kHz to 50 MHz, relative to a 1-MHz reference. Characterization at zero impedance results in smaller uncertainties than characterization at 75 ohms with the test procedures used by the Tektronix standards laboratory. Therefore, a zero impedance characterization is supplied with the Detector Head. Refer to Section 2 Operating Considerations for more information on zero impedance vs. 75-ohm characterization. A recommended standard for characterization of the detector head is a thermal converter, such as the Fluke A55-0.5V. The signal source used is equivalent to a constant voltage zero impedance source. The source signal is filtered to reduce uncertainties due to harmonic distortion, and is then fed through a Genrad 874-T adapter. Standing waves from the center of the adapter are taken into account, with the detector assumed to be a purely resistive 75-ohm load. Typical errors due to this assumption are 0.01% at 10 MHz and 0.25% at 50 MHz. Due to the complexity of the test setup, it is recommended that the Detector Head be returned to Tektronix if performance verification and re-characterization are required.

The best check of Detector Head performance is in actual applications such as checking the frequency response of a 1900 Digital Test Signal Generator, as shown in Fig. 2-2 in Section 2, or a Device-Under-Test, as shown in Fig. 2-4. Unexpected or unusual frequency response errors, inability to compensate large and small signal offsets with the Detector Amplifier LEVEL controls, or poor return loss suggest deterioration of Detector Head performance. In cases such as these, try another Detector Head. If the detector heads do not have similar characteristics, return the defective Head to Tektronix. Refer to the text on "Parts Ordering And Replacing" in Section 5 Maintenance.

Detector Amplifier Test Method Overview

In the following procedures, the Detector Amplifier is checked or adjusted to the characteristics of the Detector Head. First, the LEVEL control ranges are checked or adjusted by using a stable subcarrier. Then, the envelope gains are checked or adjusted by mixing two subcarrier signals, 100 Hz apart, producing a beat frequency on the test oscilloscope for accurate gain evaluation. The beat frequency should be close to 100 Hz to provide adequate resolution on the oscilloscope display and to avoid high-frequency rolloff effects in the Detector Amplifier.

These procedures can be readily done using either NTSC or PAL equipment.

Test Equipment Required

See Table 4-1 for the required test equipment and recommended examples to perform these procedures. If equipment different from the example is used, it must meet or exceed the listed key performance capability. Be sure to do the Performance Check Procedure to ensure proper functional operation following any repair.

TABLE 4-1

TEST EQUIPMENT REQUIRED

Description	Performance Requirement	Example
Sinewave Signal Generator No. 1	NTSC or PAL Subcarrier, +/-10 Hz. Sufficient peak-to-peak amplitude to provide 0.25 V and 1.0 V signals at input to a Video Differential Amplifier after appropriate attenuation.	NTSC Application: Tektronix 1410/SPG2 or Tektronix 1900. PAL Application: Tektronix 1411/SPG12.
Sinewave Signal Generator No. 2	Sinewave output must be settable to be 100 Hz, + or - 10 Hz, away from the Subcarrier of Generator No.1. Sufficient peak-to-peak amplitude to provide 40 mV at input to a Video Differential amplifier after appropriate attenuation.	NTSC Application: Tektronix 067-0546-0 NTSC Vectorscope Test Unit (or another 1410/SPG2 Generator See "Special Procedures" text.) cedures" text). PAL Application: Tektronix 067-0570-01 PAL Vectorscope Test Unit (or another 1411/SPG2 Generator. See "Special Proccedure" text.)
Video Differential Amplifier	75 ohm output, 75 ohm isolated inputs, A-B mode. 1:1 input to output gain.	Tektronix 1480 Series Waveform Monitor.
Amplitude Calibrator	0.1% accuracy, squarewave, NBS traceable.	Tektronix 067-0916-00 Video Amplitude Calibration Fixture.
Oscilloscope	Overdrive recovery capabilities equal to Tektronix 7A13. At least 5 mV/div deflection and 1 ms/div sweep speed.	Tektronix 7603 mainframe; 7B53A Timebase; 7A13 Differential Comparator Amplifier.
Return Loss Bridge	DC to 10 MHz; 75-ohm input.	Tektronix Part No. 015-0149-00
Constant Amplitude Sinewave Generator	250 kHz to above 5 MHz. At least 1 V p-p output. Low frequency reference position.	Tektronix SG 503

TABLE 4-1 (Cont.)

TEST EQUIPMENT REQUIRED

Description	Performance Requirement	Example
Fixed Attenuators	Sufficient attenuation to provide 40 mV, 0.25 V, or 1.0 V at the Video Differential Amplifier inputs when used in series with a variable, linear-tapered attenuator.	Typically, two 50 ohm, 5X attenuators, Tektronix part number 011-0060-02.
Variable Attenuators (2)	250 ohms, linear-taper, BNC connectors grounded to mounting box.	Must be constructed. See "Special Procedures".
75-ohm Coaxial Cables (4)		Tektronix part number 012-0074-00.
Power Module		Tektronix TM503.
Extender Cable	TM500-compatible	Tektronix part number 067-0645-02.

Special Procedures

100 Hz Beat Frequency Signal Source. A second sinewave signal source 100 Hz away from the 3.579545 MHz signal of a 1410/SPG2 could be achieved by temporarily misadjusting another Tektronix 1410/SPG2 Test Signal Generator. General purpose cw generators such as an SG 503 typically do not have stability of setting. A frequency counter with at least an 8-digit display and capable of resolving 1 Hz out of 3.579545 MHz will be needed for this adjustment. (An example would be a Tektronix DC508A Option 1 Counter, which can be housed in the same TM500 Power Module as the Detector Amplifier. Another example would be a Hewlett-Packard 5326A Option 011.)

015-0408-00 P-P Detector Amplifier

Remove the second 1410's top cover to gain access to the A23 Subcarrier Lock board (fifth board from the left) of the SPG2. Without extending the board from the mainframe, locate the Oscillator Frequency trimpot R456 at the very front of the board. After at least 20 minutes warm-up, connect the counter to the Subcarrier Output of the SPG2 and note the frequency. Then adjust R456 for 3.579645 MHz or 3.579445 MHz on the counter. Allow the generator to stabilize at this new setting before using it in the 015-0408-00 Detector Amplifier procedures. When it is no longer needed, reset the Subcarrier Output to the previously noted original frequency.

For a PAL application, this same methodology can be applied to a Tektronix 1411/SPG12 Test Signal Generator and the PAL Subcarrier of 4.43361875 MHz.

Variable Attenuator. Two of these devices are needed and must be constructed as shown in Fig. 4-2. Individual parts are available from Tektronix:

	Description	Tektronix Part No.
1.	250 ohm, linear taper potentiometer	311-0702-00
2.	Accessory housing (without electrical components). Equipped with bnc connectors. Dimensions: 1-1/2" x 7/8" X 7/8"	011-0081-00

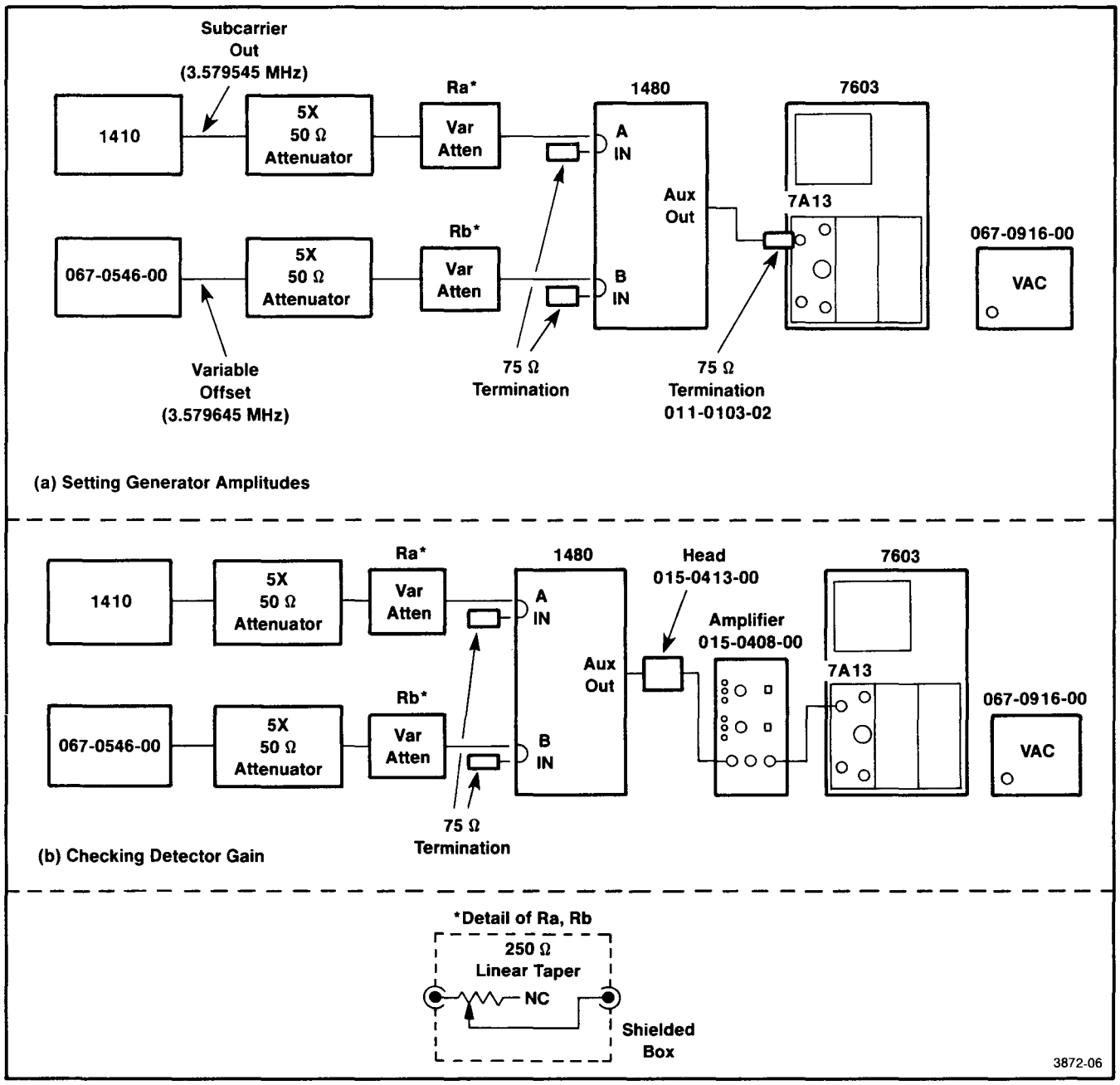


Fig.4-2. Calibration Hookup Arrangement.

Preliminary Procedures

Install the optional accessory flexible extender cable in the TM500 Power Module and connect it to the 015-0408-00 Detector Amplifier outside the host Power Module. Turn on all equipment, including the test gear, and allow at least 20 minutes warm-up and stabilization.

Refer to the Parts Location foldouts in the back of the manual for test point and adjustment location information.

PERFORMANCE AND FUNCTIONAL CHECK PROCEDURES

Setting Reference Amplitudes

Throughout the following procedures, leave the Video Differential Amplifier (the 1480-Series Waveform Monitor in Fig. 4-2) in the A-B mode at all times. When one signal source amplitude is being set, disconnect the other signal source from the appropriate input. By using this technique, the input-to-output gain of the 1480 will be constant.

Use only the non-inverting input of the vertical differential amplifier in the test oscilloscope when establishing the subcarrier signal source amplitudes, when evaluating the output of the Detector Amplifier, and when calibrating the oscilloscope's vertical deflection, using the Amplitude Calibrator.

Step 1. Check 0.25 V offset LEVEL Control Range

a) Select the Manual mode of the 067-0916-00 Video Amplitude Calibrator (VAC) and set it for a 0.25 V output. Connect it to the non-inverting input of the 7A13 and set the deflection factor so that the calibration signal spans exactly six major divisions on the oscilloscope display. (Use the Variable Volts/Div control of the vertical amplifier to achieve this calibration.)

b) Hook-up the 1410 only in Fig. 4-2a. Set the 3.579545 MHz sinewave for 0.25 V p-p amplitude using the variable attenuator Ra.

c) As in Fig. 4-2b, replace the 75-ohm termination at the noninverting input of the 7A13 with the 015-0413-00 Detector Head and the 015-0408-00 Detector Amplifier. Do not hook up the 067-0546-00 at this time.

d) Connect the Detector Head to the +INPUT channel of the Detector Amplifier. Turn the +INPUT LEVEL control fully counterclockwise. Push in the ENABLE button and check that the green LED lights up.

e) Repeat part d) for the -INPUT channel.

Step 2. Check 1.0V Offset LEVEL Control Range

a) Repeat the procedure in Step 1 a) and b) except set the calibration amplitude for 1.0 V and the sinewave signal source amplitude for 1.0 V. Remove any fixed attenuators as necessary.

b) Repeat Step 1, parts c) through e), except turn the LEVEL controls fully clockwise.

Step 3. Check 0.25 V Envelope Gains

a) Select the Manual mode of the 067-0916-00 Video Amplitude Calibrator and set it for a 40 mV output. Connect it to the non-inverting input of the 7A13 and set the deflection factor such that the calibration signal spans exactly six major divisions on the oscilloscope display. (Use the Variable Volts/Div control on the 7A13 to achieve this calibration.)

b) Remove the 067-0916-00 input to the 7A13 and hook up the equipment as in Fig. 4-2a for the 067-0546-00 only. Do not connect the 1410 to the A Input.

c) Adjust the variable attenuator Rb such that a 3.579645 (or 3.579445) MHz signal spans the same six divisions on the display. DO NOT change the 7A13 settings to achieve this display. Make any amplitude changes using appropriate fixed attenuators and the variable attenuator Rb.

d) Set up the equipment as in Fig. 4-2b for the 1410 only. Disconnect the 067-0546-00 from the -B Input. With the Detector +INPUT LEVEL control fully ccw, adjust variable attenuator Ra such that the green LED of the +INPUT channel comes on. Disconnect the 1480 from the 7A13.

e) Repeat part a) except set the 067-0916-00 output to calibrate the oscilloscope for an 80 mV amplitude at 6 major divisiions.

f) Remove the 067-0916-00 from the 7A13 and reconnect the equipment as in Fig. 4-2b.

g) Check that the beat frequency envelope output from the Detector Amplifier is 80 mV p-p, within 8 mV, on the display.

h) Check that the most positive envelope peak is at 0V dc, within 0.1 V (most negative peak for -INPUT).

i) Repeat this step for the -INPUT channel of the 015-0408-00 Detector Amplifier.

Step 4. Check 1.0 V Envelope Gains.

a) Repeat Step 3, part d) except that the LEVEL controls must be turned fully clockwise.

b) Reconnect the equipment as in Fig. 4-2b and repeat parts g) through i).

Step 5. Check Return Loss.

a) Install the 015-0149-00 Return Loss Bridge on the vertical inputs of the test oscilloscope differential comparator plug-in unit.

b) Connect a 5-MHz sinewave signal, approximately 1 V in amplitude, from the constant amplitude sinewave generator via a 50 ohm coaxial cable and a 50 ohm to 75 ohm minimum loss attenuator, to the signal input connector on the 015-0149-00 Return Loss Bridge.

c) Connect the matched 75 ohm terminations (supplied with the return loss bridge) to the end of each coaxial cable of the return loss bridge.

d) Set the test oscilloscope deflection factor to 0.2 V/Div with both + and - inputs set for dc coupling (differential operation). Set the test oscilloscope time base for a free-running display.

e) Remove one matched 75 ohm termination from a coaxial cable on the return loss bridge and adjust the constant amplitude sinewave generator for a 1 Volt (5-division), 5-MHz sinewave signal as displayed on the test oscilloscope. Replace the matched 75 ohm termination.

f) Set the test oscilloscope deflection factor to 1 mV/Div.

g) Set the constant amplitude sinewave generator frequency to its reference position (approx. 50 kHz). The test oscilloscope display amplitude should be 1 mV (1 major division) or less. Then, check the display amplitude while increasing the generator frequency upwards to 5 MHz.

NOTE

If the test oscilloscope display amplitude exceeds 1 mV when performing part g), the return loss bridge Balance control should be adjusted for minimum residual amplitude. Note amplitude of any residual signal after adjusting the Balance control.

h) Connect the 015-0413-00 Detector Head to the 015-0408-00 Detector Amplifier +INPUT connector. Disconnect the matched 75 ohm termination from the end of the Return Loss Bridge Unknown coaxial cable. Attach the Unknown (measuring) cable to the 015-0413-00 Detector Head Input Connector.

i) CHECK - the test oscilloscope display amplitude. Amplitude should not exceed 5.0 mV (-46 dB), plus the residual amplitude noted in part g (and the NOTE following) of this step.

ADJUSTMENT PROCEDURE

Refer to the circuit board illustration on the back of the block diagram section in the foldout section at the rear of the manual for adjustment locations.

Setting Reference Amplitudes

Throughout the following procedures, leave the Video Differential Amplifier (the 1480-Series Waveform Monitor in Fig. 4-2) in the A-B mode at all times. When one signal source amplitude is being set, disconnect the other signal source form the appropriate input. By using this technique, the input-to-output gain of the 1480 will be constant.

Use only the non-inverting input of the vertical differential amplifier in the test oscilloscope when establishing the subcarrier signal source amplitudes and when evaluating the output of the Detector Amplifier. Use the inverting input when calibrating the oscilloscope's vertical deflection, using the Amplitude Calibrator.

Step 1. Adjust 0.25 V offset LEVEL Control Ranges -R415, R425.

a) Select the Manual mode of the 067-0916-00 Video Amplitude Calibrator (VAC) and set it for a 0.25 V output. Connect it to the non-inverting input of the 7A13 and set the deflection factor so that the calibration signal spans exactly six major divisions on thae oscilloscope display. (Use the Variable Volts/Div control of the vertical amplifier to achieve this calibration.)

b) Hook-up for the 1410 only in Fig. 4-2a. Set the 1410's 3.579545 MHz sinewave for 0.25 V p-p amplitude using the variable attenuator Ra.

c) As in Fig. 4-2b, replace the 75-ohm termination at the non-inverting input of the 7A13 with the 015-0413-00 Detector Head and the 015-0408-00 Detector Amplifier. Do not hook up the 067-0546-00 at this time.

d) Connect the Detector Head to the +INPUT channel of the Detector Amplifier. Turn the +INPUT LEVEL control fully counterclockwise. Push in the ENABLE button and adjust R415, Small Signal (0.25 V) Offset, until the green LED lights up.

e) Repeat part d) for the -INPUT channel except adjust R425.

Step 2. Adjust 1.0 V Offset LEVEL Control Ranges -R607, R640.

a) Repeat the procedure in Step 1 a) and b) except set the calibration amplitude for 1.0 V and the sinewave signal source amplitude for 1.0 V. Remove any fixed attenuators as necessary.

b) Repeat Step 1, parts c) through e) except turn the LEVEL control full clockwise and adjust R607, Large Signal (1.0 V) Offset, until the green LED lights up for the +INPUT. Adjust R640 for the -INPUT.

Step 3. Adjust 0.25 V Envelope Gains -R401, R636.

a) Select the Manual mode of the 067-0916-00 Video Amplitude Calibrator and set it for a 40 mV output. Connect it to the non-inverting input of the 7A13 and set the deflection factor such that the calibration signal spans exactly six major divisions on the oscilloscope display.

(Use the Variable Volts/Div control on the 7A13 to achieve this calibration.)

b) Remove the 067-0916-00 input to the 7A13 and hook up the equipment as in Fig. 4-2a for the 067-0546-00 only. Do not connect the 1410 to the A Input.

c) Adjust the variable attenuator Rb such that a 3.579645 (or 3.579445) MHz signal spans the same six divisions on the display. DO NOT change the 7A13 settings to achieve this display. Make any amplitude changes using appropriate fixed attenuators and the variable attenuator Rb.

d) Set up the equipment as in Fig. 4-2b for the 1410 only. Disconnect the 067-0546-00 from the -B Input. With the Detector +INPUT LEVEL control fully counterclockwise adjust variable attenuator Ra such that the green LED of the +INPUT channel comes on. Disconnect the 1480 from the 7A13.

e) Repeat part a) except set the 067-0916-00 output to calibrate the oscilloscope for an 80 mV amplitude at 6 major divisions.

f) Remove the 067-0916-00 from the 7A13 and reconnect the equipment as in Fig. 4-2b.

g) Adjust R401, Small Signal (0.25 V) Gain, until the beat frequency envelope output from the Detector Amplifier is 80 mV p-p on the display.

h) Check that the most positive envelope peak is at 0 V dc, within 0.1 V (most negative peak for the -INPUT).

i) Repeat this step for the -INPUT channel of the 015-0408-00 Detector Amplifier. Adjust R636 Small Signal (0.25 V) Gain for the -INPUT.

Step 4. Adjust 1.0 V Envelope Gains-R606, R641.

a) Repeat Step 3, part d) except that the LEVEL controls must be turned fully clockwise.

b) Reconnect the equipment as in Fig. 4-2b and repeat parts g) through i). Adjust R606, Large Signal (1.0 V) Gain for the +INPUT and R641, Large Signal (1.0 V) Gain for the -INPUT.

SECTION 5

MAINTENANCE

Preventive Maintenance

Preventive maintenance steps performed on a regular basis will improve the reliability of the 015-0408-00 Peak-to-Peak Detector Amplifier. However, checks of the semiconductors in the absence of a malfunction are not recommended as preventive maintenance measures. The recommended time for performing preventive maintenance is just before instrument adjustment. Customer maintainance of the 015-0413-00 Peak-To-Peak Dector Head is not recommended.

Cleaning

CAUTION

Do not use acetone, MEK, MIBK, benzene, toluene, carbon tetracholoride, tricholroethylene, methyl alcohol, methylene chloride, sulphuric acid, or Freon compounds for cleaning the 015-0408-00. Use only clean water and a mild detergent.

Exterior. Loose dust may be removed with a soft cloth or dry brush. Water and a mild detergent may be used; however, abrasive cleaners should never be used.

Interior. Cleaning the interior of the unit should precede adjustment, since the cleaning process could alter the settings of calibration adjustments. Use low-velocity compressed air to blow off accumulated dust. Hardened dirt can be removed with a soft dry brush, cotton-tipped swab, or a cloth dampened in a solution of water and mild detergent.

Lubrication

Push-button switches should receive occasional spray applications of "No Noise" lubricant and cleaner.

Adjustment

After cleaning or repairs, do the performance check as described in Section 4 of this manual. If all functions are within specification, no adjustment is needed. If one or more of the specifications are not met, calibrate the instrument as directed in Section 4.

TROUBLESHOOTING AIDS

Theory of Operation

Section 3 of this manual explains circuit operation at a detailed block diagram level. It is a troubleshooting aid when used in conjunction with the circuit diagrams.

Diagrams

A block diagram and detailed circuit diagrams are located on foldout pages in the Diagram section. The circuit diagrams show the component value and assigned circuit reference numbers of each component. The first page of the Diagram section defines the circuit symbols and reference designators used in the manual.

Circuit Board Illustrations

To identify electrical components when troubleshooting, turn to the Parts Location illustration that is located on the back of a foldout page at the left of the related circuit diagrams. Component values, descriptions, and ordering data are given in the Replaceable Electrical Parts list.

Component and Wiring Color Codes

Colored stripes or dots on electrical components signify electrical values, tolerances, etc., according to EIA standards. Components not color coded usually have information printed on the body.

Testing Equipment

Refer to Section 4 for a list of equipment required for Performance Check and Adjustment.

TROUBLESHOOTING TECHNIQUES

This troubleshooting procedure is arranged in an order that checks the simple trouble possibilities before proceeding to extensive troubleshooting.

Control Settings

Incorrect control settings can appear to be an equipment problem. If there is any question about the correct function or operation of any control, see the operation instructions in Section 2.

If the 015-0408-00 is operating as part of an interconnected system or test setup, also check control settings of the other instruments in the setup. Check for proper interconnections between the power module and the plug-in module. Check that the signal is properly connected and that the interconnecting cables and signal source are not defective. Check the power source.

If the power module is suspected, try substituting another known to be a good power module.

Visual Check

Remove the covers from the 015-0408-00 and look for broken wires, loose or unsoldered connections, or damage to the circuit boards. If components damaged from overheating are found, determine the cause of overheating before replacing the component; otherwise, the new component may also be damaged.

Fuses

There are two miniature radial lead plug-in fuses, F120 and F130, at the rear end of the main board that should be checked with an ohmeter before going any further.

Static-Sensitive Components

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 5-1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments. Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

3. Discharge the static voltage from your body by wearing a grounded wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together whenever possible.

6. Pick up components by the body, never by the leads.

7. Do not slide the components over any surface.

Table 5-1

RELATIVE SUSCEPTIBILITY TO
STATIC DISCHARGE DAMAGE

Semiconductor Classes		Relative Susceptibility Levels (*)
Microcircuits with MOS inputs	(most sensitive)	1
Schottky TTL		2
High-frequency bipolar transistors		3
Linear microcircuits		4
Low-power Schottky TTL		5
TTL	(least sensitive)	6

* Voltage equivalent for levels:

1 = 100 to 500 V
2 = 500V
3 = 400 to 500 V
4 = 400 to 1000 V (est.)
5 = 900 V
6 = 1200 V

(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

8. Avoid handling components in areas that have a floor or work surface capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only special antistatic suction-type or wick-type desoldering tool.

Test Equipment

Before using any test equipment to make measurements on static-sensitive components or assemblies, be certain that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

Circuit Isolation

Note the symptom. It often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by making waveform and voltage measurements.

Incorrect operation of all circuits often means trouble in power supplies. Using a multimeter, check first for correct voltages of the individual regulated supplies according to the circuit diagrams and adjustment procedures. Then check the unregulated supplies of the power modules. Defective components elsewhere in the instrument can appear as power supply problems. In these instances, suspected circuits should be disconnected from apparently bad power supplies one at a time to narrow the search.

Voltages and Waveforms

Often defective components can be located by using waveform and voltage indications when they appear on the circuit diagram and in the theory of operation sections. Such waveforms and voltage labels are typical indications and will vary between instruments.

Component Checking

If a component cannot be disconnected from its circuit, the effects of the associated circuitry must be considered when evaluating the measurement. Except for soldered-in transistors and integrated circuits, most components can be unsoldered and lifted at one end from the circuit board.

Transistors and Integrated Circuits (IC)

Turn the power switch off before removing or replacing any semiconductor. See Fig. 5-1 for semiconductor basing.

A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended since they do not check operation under simulated operating conditions. An antistatic suction-type desoldering tool can be used to remove soldered-in transistors and IC's; see component replacement procedure for details.

Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit description is essential to troubleshooting circuits containing integrated circuits. Operating waveforms, logic levels, and other operating information for the integrated circuits are given in the circuit description information. Use care when checking voltages and waveforms around the integrated circuits so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin in-line integrated circuits is with an integrated circuit test clip.

Replacement semiconductors should be of the original type or a direct replacement. Figure 5-1 shows the lead configuration of the semiconductors used in this instrument system.

Resistors

Check resistors with an ohmmeter. Resistor tolerances are given the Replaceable Electrical Parts list. Resistors do not normally need to be replaced unless the measured value varies widely from the value. Be aware that some of the more sophisticated resistors have an extra color band denoting ohmic value.

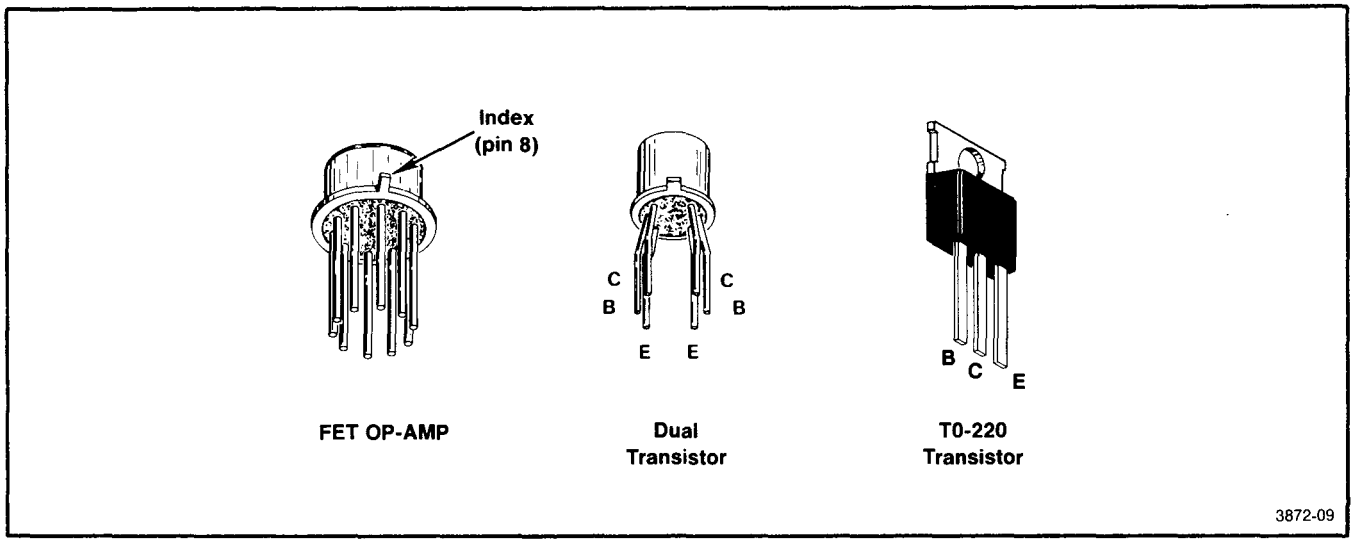


Fig.5-1. Uncommon Semiconductor Pinouts.

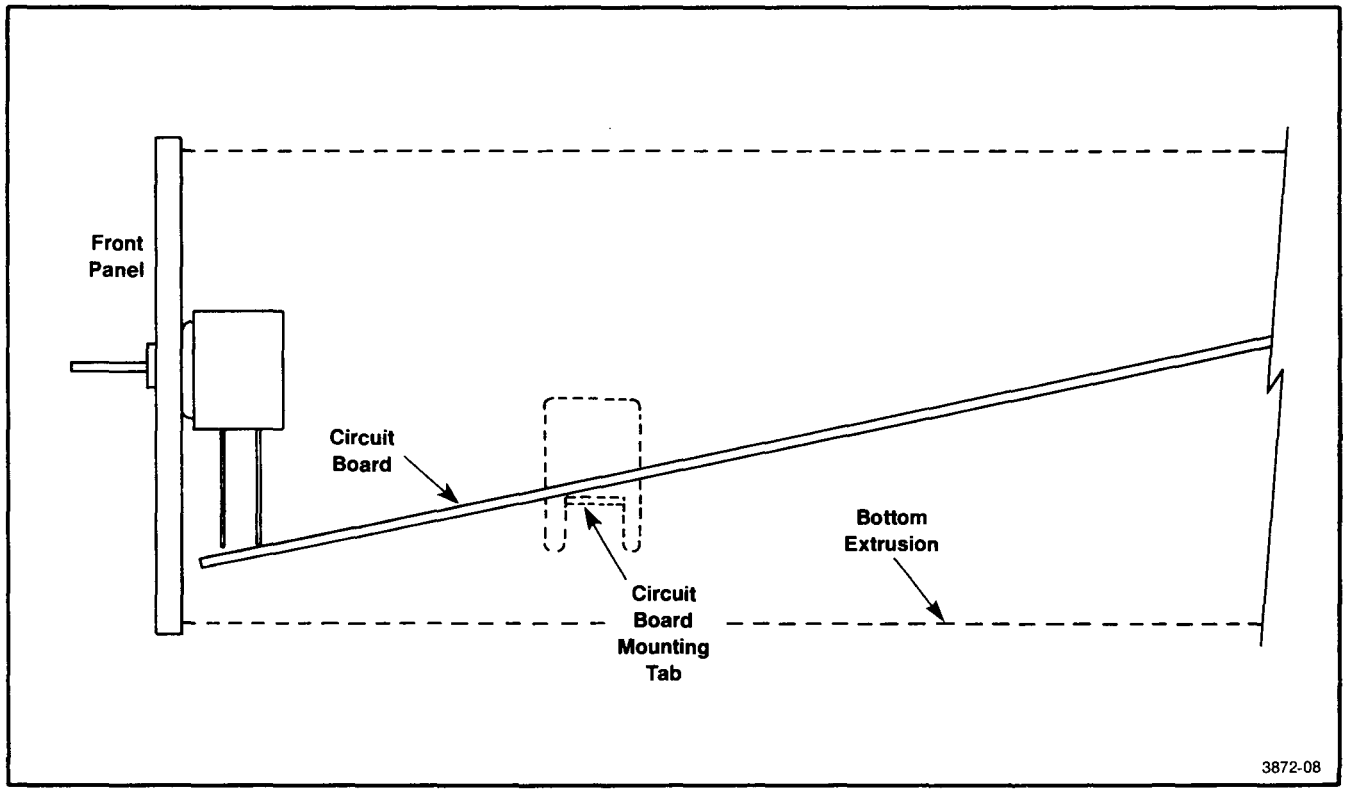


Fig.5-2. Installing Circuit Board after LEVEL Control Replacement.

Disassembly Hints

When removing the circuit board, it is easiest to leave the LEVEL controls soldered to the board and simply unnfasten them from the front panel. Shorting jumpers should be placed on the input pins of the board when unhooked from the shorting-BNC INPUT jacks to reduce possibility of static damage to the FET input amplifiers.

If the controls need replacement, they must first be attached to the front panel and tightened with the leads appropriately oriented. Figure 5-2 shows how the circuit board must then be slid under the leads on an angle, the leads started into their appropriate holes, and then the rear of the board can be lowered down to its mounts and fastened. After the board is screwed down tight, the control leads can be soldered and clipped.

PARTS ORDERING AND REPLACING

Detector Head

The 015-0408-00 Peak-To-Peak Detector system is supplied with one Detector Head. If a replacement Head is needed, or an additional Detector Head is required for differential measurements, order 015-0413-00 Peak-To-Peak Detector Head.

Standard Parts

All electrical and mechanical replacement parts can be obtained through the local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally. Before purchasing or ordering replacement parts, check the Replaceable Parts lists for value, tolerance, rating, and description. When selecting replacement parts, it is important to remember that the physical size and shape of the component may affect its performance in an instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect the instrument performance.

Special Parts

Some parts are manufactured or selected by Tektronix, Inc., to satisfy particular requirements, or are manufactured for Tektronix, Inc. to our specifications. Most of the mechanical parts used in this system have been manufactured by Tektronix, Inc. Order all special parts directly from the local Tektronix Field Office or representative.

Ordering Procedure

When ordering replacement parts from Tektronix, Inc. please include the following minimum information:

1. Instrument type (015-0408-00 Peak-To-Peak Detector Amplifier)

2. Instrument serial number (for example, B010165).

3. A description of the part (if electrical, include the circuit number).

4. Tektronix part number.

Please do not return any instruments or parts before receiving directions from Tektronix, Inc.

A listing of Tektronix Field Offices, Service Centers, and Representatives can be found in the Tektronix Products catalog and supplements.

SECTION 6

OPTIONS

There are no options to the 015-0408-00 Peak-To-Peak Detector Amplifier.

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

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

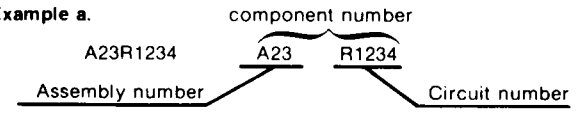
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

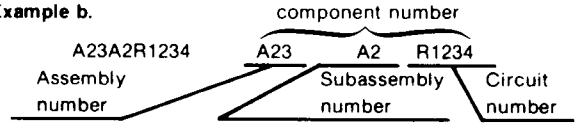
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

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.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

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
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
24355	ANALOG DEVICES INC.	RT 1 INDUSTRIAL PK,P O BOX 280	NORWOOD, MA 02062
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-7262-00			CKT BOARD ASSY:DETECTOR AMPLIFIER	80009	670-7262-00
A1C200	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C210	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C211	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C213	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C240	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C241	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C242	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C310	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C340	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C342	290-0145-00			CAP.,FXD,ELCTLT:10UF,+75-10%,50V	56289	30D106G050CB9
A1C343	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C400	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C402	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C403	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C404	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C408	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C410	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C412	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C413	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C414	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C422	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C424	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C425	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C430	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C431	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C433	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C503	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C510	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C511	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C512	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C513	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C520	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
A1C524	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C525	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C531	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C532	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C533	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C534	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C610	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C612	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
A1C630	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C636	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C637	290-0105-00			CAP.,FXD,CER DI:100UF,+75-10%,6V	00853	556DB101U0068
A1C714	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C715	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C732	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C733	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C800	290-0105-00			CAP.,FXD,CER DI:100UF,+75-10%,6V	00853	556DB101J0068
A1C801	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1C820	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
A1C822	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
A1C831	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
A1C840	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
A1C915	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A1CR200	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR201	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1CR222	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR223	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR224	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR300	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1F120	159-0102-00			FUSE,CARTRIDGE:WIRE LEAD,0.4A,FAST-BLOW	75915	273.400
A1F130	159-0102-00			FUSE,CARTRIDGE:WIRE LEAD,0.4A,FAST-BLOW	75915	273.400
A1F135	159-0102-00			FUSE,CARTRIDGE:WIRE LEAD,0.4A,FAST-BLOW	75915	273.400
	----- -----			(SPARE)		
A1F136	159-0102-00			FUSE,CARTRIDGE:WIRE LEAD,0.4A,FAST-BLOW	75915	273.400
	----- -----			(SPARE)		
A1Q110	151-0476-00			TRANSISTOR:SILICON,NPN	02735	68430
A1Q130	151-0482-00			TRANSISTOR:SILICON,PNP	80009	151-0482-00
A1Q200	151-0407-01			TRANSISTOR:SILICON,NPN	80009	151-0407-01
A1Q223	151-0406-02			TRANSISTOR:SGC7282,SCREENED	80009	151-0406-02
A1Q630	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0232-00
A1Q713	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0232-00
A1R200	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R201	307-0056-00			RES.,FXD,CMPSN:4.3 OHM,5%,0.50W	01121	EB43G5
A1R212	301-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.50W	01121	EB9115
A1R220	307-0056-00			RES.,FXD,CMPSN:4.3 OHM,5%,0.50W	01121	EB43G5
A1R221	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R241	301-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.50W	01121	EB9115
A1R300	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
A1R301	321-0951-02			RES.,FXD,FILM:5.52K OHM,0.5%,0.125W	24546	NA55D33R2F
A1R302	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
A1R330	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
A1R331	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A1R332	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
A1R333	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816G54900F
A1R400	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816G54900F
A1R401	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R402	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A1R403	321-0315-00			RES.,FXD,FILM:18.7K OHM,1%,0.125W	91637	MFF1816G18701F
A1R411	321-0724-00			RES.,FXD,FILM:13.6K OHM,1%,0.125W	91637	CMF110216G13601F
A1R412	321-0299-00			RES.,FXD,FILM:12.7K OHM,1%,0.125W	91637	MFF1816G12701F
A1R414	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
A1R415	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R420	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	91637	MFF1816G56200F
A1R421	321-0418-00			RES.,FXD,FILM:221K OHM,1%,0.125W	91637	MFF1816G22102F
A1R423	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	24546	NA4D1004F
A1R425	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R426	321-0724-00			RES.,FXD,FILM:13.6K OHM,1%,0.125W	91637	CMF110216G13601F
A1R431	321-0418-00			RES.,FXD,FILM:221K OHM,1%,0.125W	91637	MFF1816G22102F
A1R432	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
A1R433	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A1R435	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	91637	MFF1816G56200F
A1R445	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	24546	NA4D1004F
A1R500	321-0290-00			RES.,FXD,FILM:10.2K OHM,1%,0.125W	91637	MFF1816G10201F
A1R501	321-0307-00			RES.,FXD,FILM:15.4K OHM,1%,0.125W	91637	MFF1816G15401F
A1R502	321-0724-00			RES.,FXD,FILM:13.6K OHM,1%,0.125W	91637	CMF110216G13601F
A1R503	321-0307-00			RES.,FXD,FILM:15.4K OHM,1%,0.125W	91637	MFF1816G15401F
A1R504	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
A1R505	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A1R510	321-0276-00			RES.,FXD,FILM:7.32K OHM,1%,0.125W	91637	MFF1816G73200F
A1R511	321-0290-00			RES.,FXD,FILM:10.2K OHM,1%,0.125W	91637	MFF1816G10201F
A1R513	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W	91637	MFF1816G28701F
A1R514	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	91637	MFF1816G56200F

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1R521	321-0290-00			RES.,FXD,FILM:10.2K OHM,1%,0.125W	91637	MFF1816G10201F
A1R522	321-0307-00			RES.,FXD,FILM:15.4K OHM,1%,0.125W	91637	MFF1816G15401F
A1R523	321-0307-00			RES.,FXD,FILM:15.4K OHM,1%,0.125W	91637	MFF1816G15401F
A1R524	321-0724-00			RES.,FXD,FILM:13.6K OHM,1%,0.125W	91637	CMF110216G13601F
A1R525	321-0276-00			RES.,FXD,FILM:7.32K OHM,1%,0.125W	91637	MFF1816G73200F
A1R530	321-0290-00			RES.,FXD,FILM:10.2K OHM,1%,0.125W	91637	MFF1816G10201F
A1R540	321-0265-00			RES.,FXD,FILM:5.62K OHM,1%,0.125W	91637	MFF1816G56200F
A1R541	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W	91637	MFF1816G28701F
A1R600	321-0259-00			RES.,FXD,FILM:4.87K OHM,1%,0.125W	91637	MFF1816G48700F
A1R601	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	91637	MFF1816G22600F
A1R602	321-0302-00			RES.,FXD,FILM:13.7K OHM,1%,0.125W	91637	MFF1816G13701F
A1R603	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R604	321-0223-00			RES.,FXD,FILM:2.05K OHM,1%,0.125W	91637	MFF1816G20500F
A1R605	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R606	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R607	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R608	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	91637	MFF1816G22600F
A1R610	321-0085-03			RES.,FXD,FILM:75 OHM,0.25%,0.125W	24546	NC55C75R0C
A1R611	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816G54900F
A1R612	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816G54900F
A1R614	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
A1R615	321-0463-00			RES.,FXD,FILM:649K OHM,1%,0.125W	91637	MFF1816G64902F
A1R616	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
A1R617	321-1648-00			RES.,FXD,FILM:600K OHM,1%,0.125W	91637	MFF1816G0002E
A1R618	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
A1R619	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R620	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	91637	MFF1816G22600F
A1R621	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	91637	MFF1816G22600F
A1R622	321-0302-00			RES.,FXD,FILM:13.7K OHM,1%,0.125W	91637	MFF1816G13701F
A1R623	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R624	321-0223-00			RES.,FXD,FILM:2.05K OHM,1%,0.125W	91637	MFF1816G20500F
A1R625	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R626	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A1R627	321-0302-00			RES.,FXD,FILM:13.7K OHM,1%,0.125W	91637	MFF1816G13701F
A1R628	321-0259-00			RES.,FXD,FILM:4.87K OHM,1%,0.125W	91637	MFF1816G48700F
A1R630	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R631	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
A1R632	321-0299-00			RES.,FXD,FILM:12.7K OHM,1%,0.125W	91637	MFF1816G12701F
A1R633	321-0315-00			RES.,FXD,FILM:18.7K OHM,1%,0.125W	91637	MFF1816G18701F
A1R634	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
A1R635	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
A1R636	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R640	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R641	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
A1R700	321-0302-00			RES.,FXD,FILM:13.7K OHM,1%,0.125W	91637	MFF1816G13701F
A1R701	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R702	321-0223-00			RES.,FXD,FILM:2.05K OHM,1%,0.125W	91637	MFF1816G20500F
A1R703	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R709	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R710	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
A1R711	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A1R712	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
A1R713	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A1R714	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A1R715	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A1R720	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R721	321-0223-00			RES.,FXD,FILM:2.05K OHM,1%,0.125W	91637	MFF1816G20500F

Replaceable Electrical Parts—015-0408-00

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1R722	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R723	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R724	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A1R725	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A1R726	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
A1R730	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
A1R731	321-1648-00			RES.,FXD,FILM:600K OHM,1%,0.125W	91637	MFF1816G0002F
A1R732	321-0463-00			RES.,FXD,FILM:649K OHM,1%,0.125W	91637	MFF1816G64902F
A1R812	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A1R813	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
A1R814	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A1R817	321-0301-00			RES.,FXD,FILM:13.3K OHM,1%,0.125W	91637	MFF1816G13301F
A1R818	321-0292-00			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816G10701F
A1R819	321-0292-00			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816G10701F
A1R820	321-0556-00			RES.,FXD,FILM:6.04M OHM,1%,0.125W	01121	CC6044FY
A1R821	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R822	321-0556-00			RES.,FXD,FILM:6.04M OHM,1%,0.125W	01121	CC6044FY
A1R830	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
A1R831	321-0301-00			RES.,FXD,FILM:13.3K OHM,1%,0.125W	91637	MFF1816G13301F
A1R833	321-0556-00			RES.,FXD,FILM:6.04M OHM,1%,0.125W	01121	CC6044FY
A1R834	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R835	321-0556-00			RES.,FXD,FILM:6.04M OHM,1%,0.125W	01121	CC6044FY
A1R840	321-0292-00			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816G10701F
A1R841	321-0292-00			RES.,FXD,FILM:10.7K OHM,1%,0.125W	91637	MFF1816G10701F
A1R920	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
A1S800	260-1224-00			SWITCH,PUSH:2PDT,PUSH-PUSH	80009	260-1224-00
A1S815	260-1224-00			SWITCH,PUSH:2PDT,PUSH-PUSH	80009	260-1224-00
A1U300	156-0067-12			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	04713	MC1741CU
A1U310	156-1249-00			MICROCIRCUIT,LI:VOLTAGE REFERENCE	24355	AD40227
A1U330	156-0067-12			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	04713	MC1741CU
A1U402	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U413	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U420	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U425	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U431	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U433	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U607	156-0407-02			MICROCIRCUIT,LI:4-QUAD MULTI,SCREENED	04713	MC1495LDS
A1U613	156-0512-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0512-02
A1U628	156-0407-02			MICROCIRCUIT,LI:4-QUAD MULTI,SCREENED	04713	MC1495LDS
A1U714	156-0158-07			MICROCIRCUIT,LI:DUAL OPNL AMPL,SCREENED	04713	MC1458UDS
A1U722	156-0770-02			MICROCIRCUIT,LI:OPERATIONAL AMPL,CHK	80009	156-0770-02
A1U723	156-0158-07			MICROCIRCUIT,LI:DUAL OPNL AMPL,SCREENED	04713	MC1458UDS
A1U732	156-0770-02			MICROCIRCUIT,LI:OPERATIONAL AMPL,CHK	80009	156-0770-02
A1VR213	152-0291-00			SEMICOND DEVICE:ZENER,1W,20V,5%	04713	1N3027B
A1VR341	152-0291-00			SEMICOND DEVICE:ZENER,1W,20V,5%	04713	1N3027B

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:

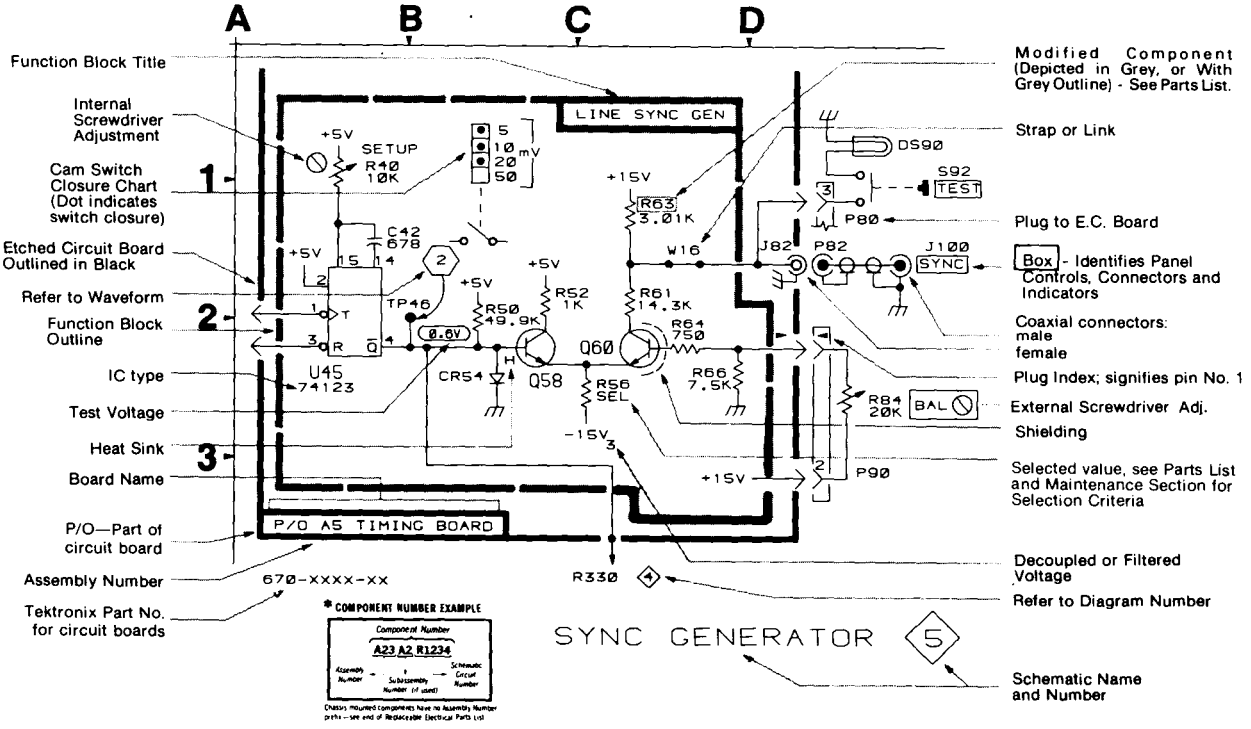
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

The information and special symbols below may appear in this manual.

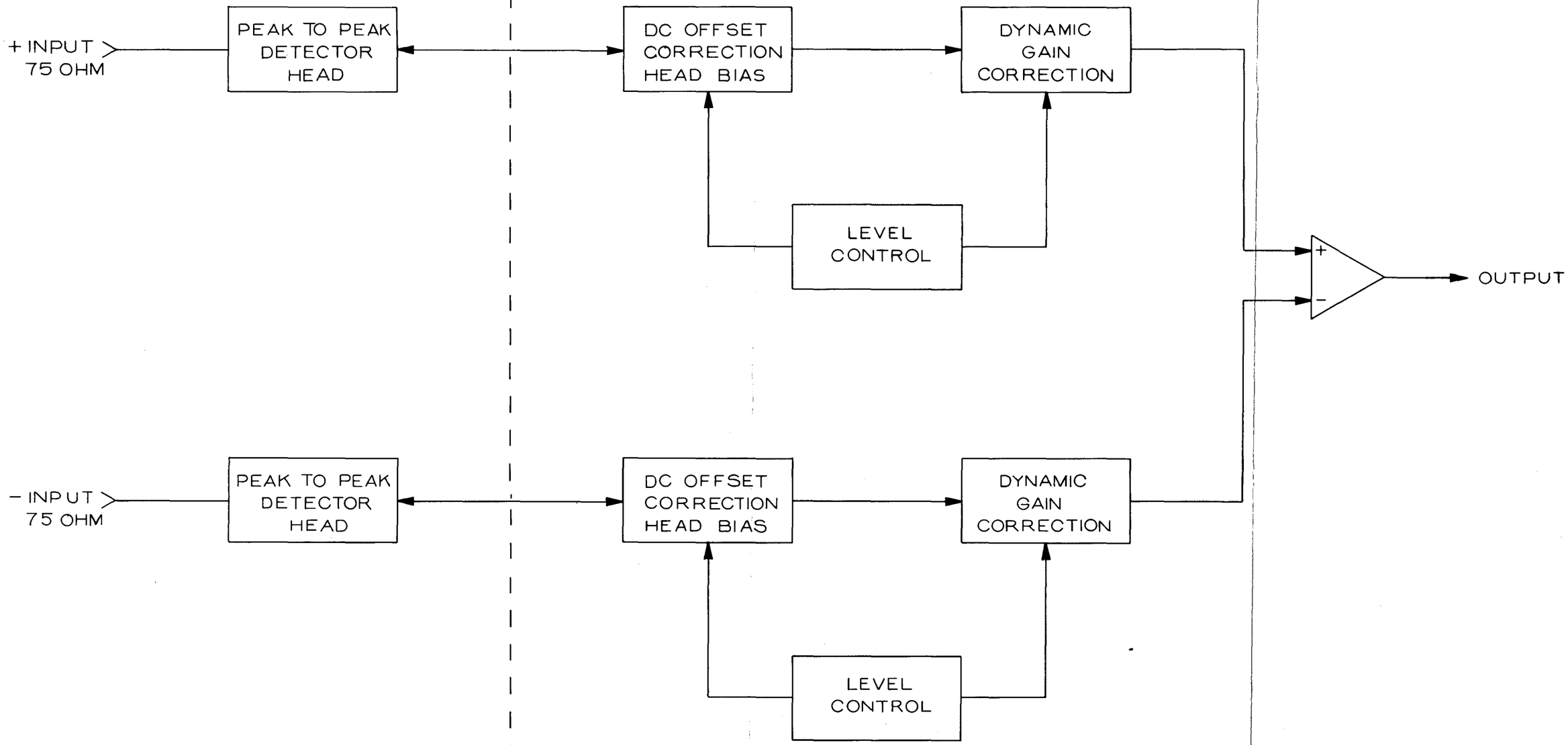
Assembly Numbers and Grid Coordinates

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).

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.

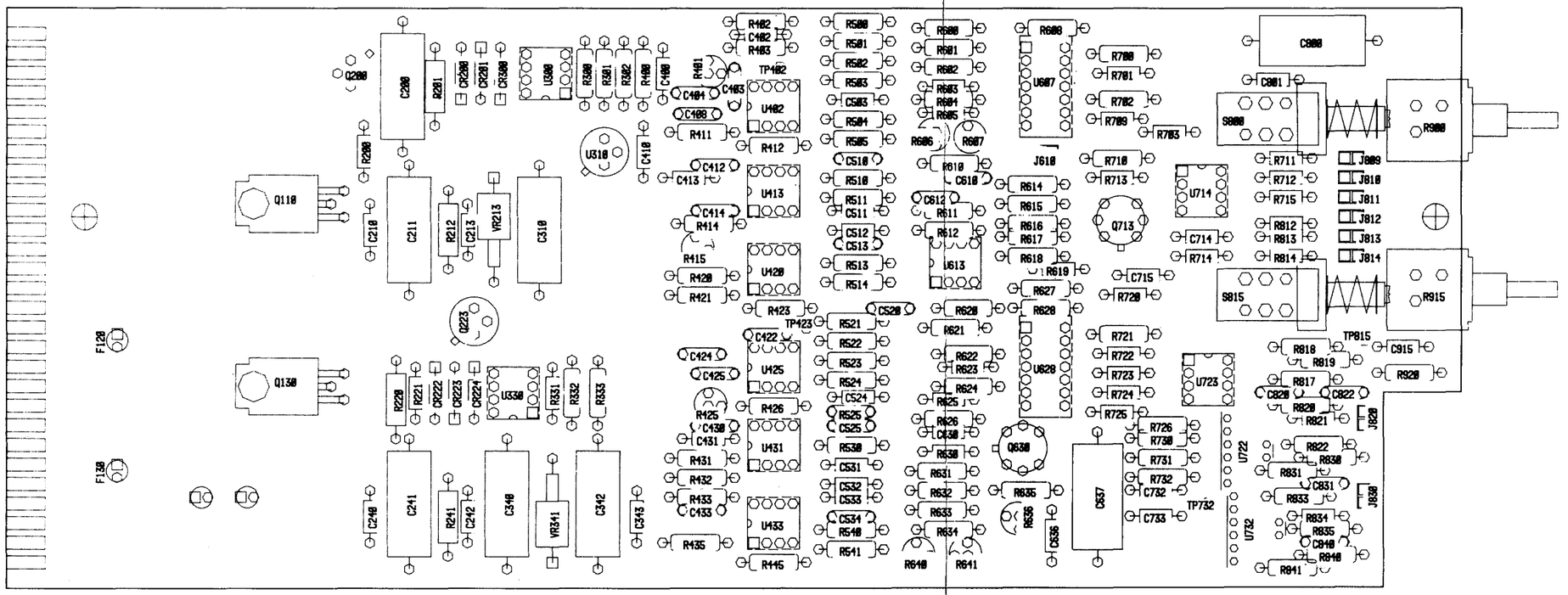


@



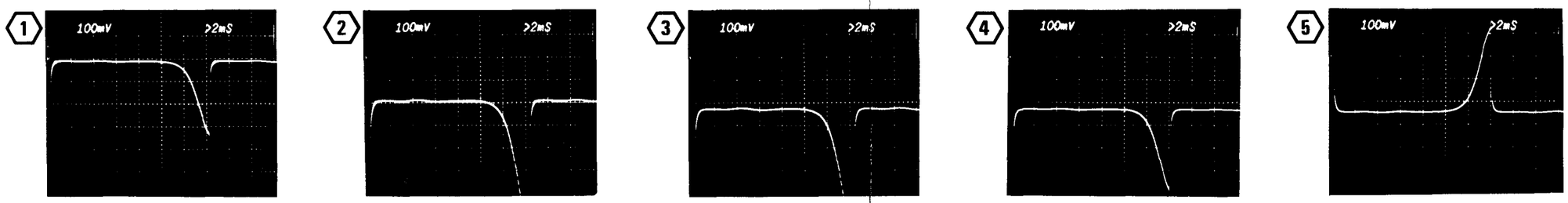
015-0413-00 & 015-0408-00

BLOCK DIAGRAM



3872-10

Fig. 8-1. A1 Detector Amplifier Board.



NOTE:
Waveforms taken with 714 mV p-p field sweep input applied to 015-0413-00 Detector Head.
Waveform 4 using + input. Waveform 5 using − input.
Horizontal axis is approximately 1 MHz/div. Graticule centerline is equal to 0 V.

DETECTOR HEAD 015-0413-00

WAVEFORMS

+ INPUT FROM 015-0413-00

- INPUT FROM 015-0413-00

LEVEL FOR +INPUT

LEVEL FOR -INPUT

ENABLE FOR +INPUT

ENABLE FOR -INPUT

OUTPUT

DO NOT TERMINATE

NOTE:
WAVEFORMS (4) USING +INPUT
WAVEFORMS (5) USING -INPUT
WAVEFORMS TAKEN WITH 714 mV FIELD SWEEP INPUT TO 015-0413-00 DETECTOR HEAD

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

Static Sensitive Devices
See Maintenance Section

U722 LF356 · U732 LF356 · U413 LM308 · U420 LM308 · U431 LM308 · U433 LM308 · U607 MC1495 · U628 MC1495 · U714A 1458 · U714B 1458 · U723A 1458 · U723B 1458 · Q713 232 DUAL · Q630 232 DUAL · U402 LM308 · U613 LM308 · U425 LM308 · U300 741 · U330 741 · U310 AD581JH 10V REFERENCE

LARGE SIGNAL (1.0V) OFFSET · SMALL SIGNAL (0.25V) OFFSET · LARGE SIGNAL (1.0V) GAIN · SMALL SIGNAL (0.25V) GAIN

DECOUPLING

+15V	-15V
C413	C511
C431	C524
C512	C533
C532	C536
C733	C715
	C732

F135 0.4A SPARE · F136 0.4A SPARE

+33V DC UNREGULATED FROM TM500 MAINFRAME · GROUND FROM TM500 MAINFRAME · -33V DC UNREGULATED FROM TM500 MAINFRAME

RED (HIGH) DS72 · GRN DS71 · RED (LOW) DS70 · GRN DS51 · RED (HIGH) DS52 · GRN DS51 · RED (LOW) DS50

A1 DETECTOR AMPLIFIER

015-0408-00 PEAK TO PEAK DETECTOR

@ 3872-101

DETECTOR HEAD & AMPLIFIER

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
13103	THERMALLOY COMPANY, INC.	2021 W VALLEY VIEW LANE P O BOX 34829	DALLAS, TX 75234
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24931	SPECIALITY CONNECTOR CO., INC.	2620 ENDRESS PLACE	GREENWOOD, IN 46142
71159	BRISTOL SOCKET SCREW, DIV. OF AMERICAN CHAIN AND CABLE CO., INC.	P O BOX 2244, 40 BRISTOL ST.	WATERBURY, CT 06720
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
87308	N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
93907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORD, IL 61101
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP.	135 W. MAGNOLIA BLVD.	BURBANK, CA 91502

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-	015-0408-00			1		ACCESSORY PKG:PEAK DETECTOR	80009	015-0408-00
-1	337-1399-00			2		. SHLD,ELECTRICAL:SIDE	80009	337-1399-00
-2	366-1189-00			2		. KNOB:GRAY	80009	366-1189-00
						(ATTACHING PARTS)		
	213-0246-00			2		. . SETSCREW:5-40 X 0.093 ITL BK OXD,HEX SKT	71159	OBD
						- - - * - - -		
-3	210-0583-00			2		. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-4	210-0940-00			2		. WASHER,FLAT:0.25 ID X 0.02 THK,STL	86928	OBD
-5	210-0046-00			2		. WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
-6	----- -----			2		. RES.,VAR,NONWIR:PNL,20K OHM,1W		
	----- -----			-		. (SEE A1R900,A1R915 REPL)		
-7	366-1690-00			1		. KNOB:SIL GY,0.53 X0.23 X 1.059	80009	366-1690-00
-8	131-1097-00			1		. CONNECTOR,RCPT,:BNC,FEMALE,CKT BOARD MT(J25)	24931	28JR220-2
-9	131-2010-00			2		. CONNECTOR,RCPT,:BNC,FEMALE,CKT BD MT(J21,23)	24931	S8J4200-2
-10	426-1072-00			2		. FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-11	366-1559-00			2		. PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-12	333-2868-00			1		. PANEL,FRONT:		80009 333-2868-0
-13	----- -----			4		. LT,EMITTING DIO:GREEN,560NM,40MA		
	----- -----			-		. (SEE A1DS50,A1DS52,A1DS70,A1DS72 REPL)		
-14	----- -----			2		. LT EMITTING DIO:RED,655NM,50MA		
	----- -----			-		. (SEE A1DS51,A1DS71 REPL)		
-15	386-4786-00			1		. SUBPANEL,FRONT:	80009	386-4786-00
						(ATTACHING PARTS)		
-16	213-0227-00			4		. SCR,TPG,THD FOR:6-32 X 0.50 DEG,FLH ST	83385	OBD
						- - - * - - -		
-17	105-0718-01			1		. BAR,LATCH RLSE:	80009	105-0718-01
-18	105-0719-00			1		. LATCH,RETAINING:PLUG-IN	80009	105-0719-00
						(ATTACHING PARTS)		
-19	213-0113-00			1		SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	93907	OBD
						- - - * - - -		
-20	384-1136-00			2		. EXTENSION SHAFT:0.95 INCH LONG	80009	384-1136-00
-21	426-0725-05			1		. FR SECT,PLUG-IN:TOP	80009	426-0725-05
-22	386-4278-00			1		. SUPPORT,FRAME:REAR AL	80009	386-4278-00
						(ATTACHING PARTS)		
-23	213-0192-00			2		. SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL	87308	OBD
						- - - * - - -		
-24	386-3657-01			2		. SUPPORT,PLUG IN:	93907	OBD
-25	426-0724-04			1		. FR SECT,PLUG-IN:BOTTOM	80009	426-0724-04
-26	426-0725-05			1		. FR SECT,PLUG-IN:TOP	80009	426-0725-05
-27	198-4592-00			6		. WIRE SET,ELEC:	80009	198-4592-00
	352-0169-00			12		. . HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
	131-0707-00			24		. . CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-28	175-2623-00			1		. CA ASSY,SP,ELEC:2,26 AWG,3.0 L	80009	175-2623-00
	352-0169-00			1		. . HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
	131-0707-00			2		. . CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-29	175-3158-00			1		. CA ASSY,SP,ELEC:2,26 AWG,6.0 L	80009	17-3158-00
	352-0169-03			1		. . CONN BODY,PL,EL:2 WIRE ORANGE	80009	352-0169-03
	131-0707-00			2		. . CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-30	175-3901-00			1		. CA ASSY,SP,ELEC:2,26 AWG,3.0 L	80009	175-3901-00
	352-0169-04			1		. . CONN BODY,PL,EL:2 WIRE YELLOW	80009	352-0169-04
	131-0707-00			2		. . CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-31	----- -----			1		. CKT BOARD ASSY:DETECTOR AMPLIFIER(SEE A1 REPL)		
						(ATTACHING PARTS)		
-32	213-0146-00			4		. SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
						- - - * - - -		
	----- -----			-		CKT BOARD ASSY INCLUDES:		
-33	131-0608-00			18		. . TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-34	131-0993-00			2		. . BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-35	214-0579-00			4		. . TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-36	342-0324-00			3		. . INSULATOR,DISC:TO-5 TRANSISTOR	13103	7717-5N-BLUE
-37	----- -----			2		. . SWITCH,PUSH:(SEE A1S800,A1S815 REPL)		
-38	361-0685-00			4		. . SPACER,SWITCH:0.365 INCH LONG	80009	361-0685-00
-39	136-0261-00			8		. . SOCKET,PIN TERM:FOR 0.22 INCH PIN	00779	1-331677-6
-40	----- -----			1		. . TRANSISTOR:(SEE A1Q110 REPL)		

Replaceable Mechanical Parts—015-0408-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-41	214-1914-00			1	. .	HEAT SINK,ELEC:	98978	PB1-ZCB
						(ATTACHING PARTS)		
-42	211-0507-00			2	. .	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-43	210-0457-00			2	. .	NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
-44	----- -----			1	. .	TRANSISTOR:(SEE A1Q130 REPL)		
-45	214-1914-00			1	. .	HEAT SINK,ELEC:	98978	PB1-ZCB
						(ATTACHING PARTS)		
-46	211-0507-00			2	. .	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-47	210-0457-00			2	. .	NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		

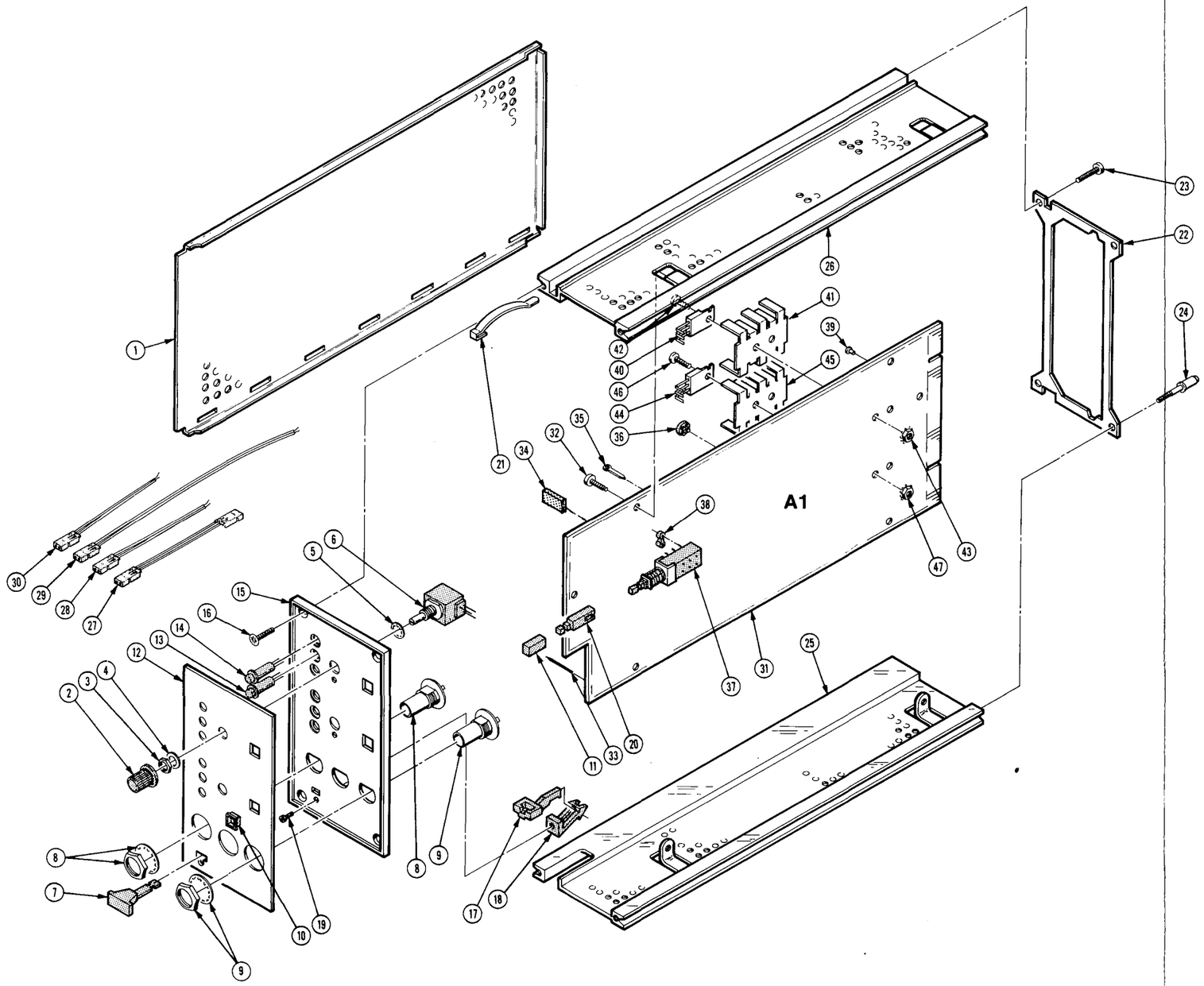


FIG. 1 EXPLODED

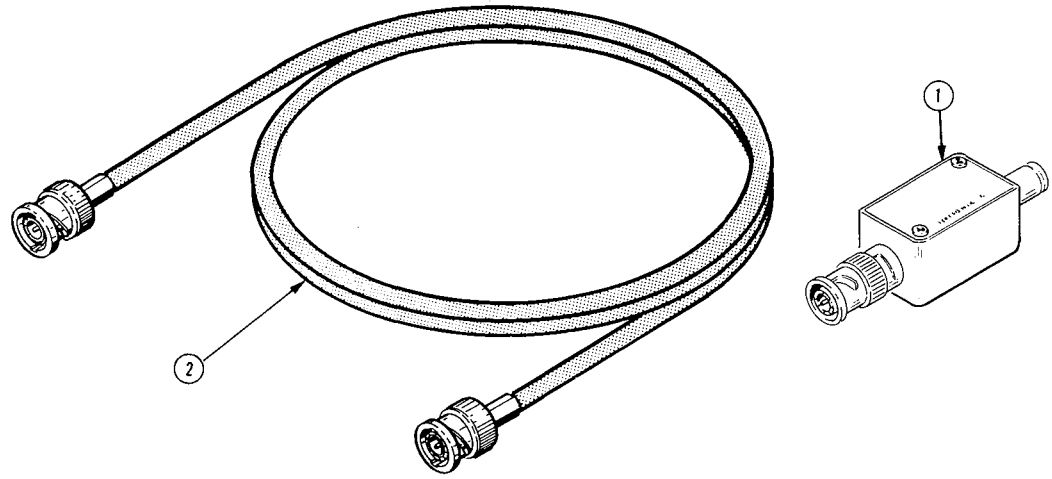


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
						STANDARD ACCESSORIES		
-1	015-0413-00			1		ACCESSORY PKG:PEAK TO PEAK DETECTOR HEAD	80009	015-0413-00
-2	012-0159-01			1		CABLE ASSY,RF:75 OHM COAX,72.0 L	80009	012-0159-01
	070-3872-00			1		MANUAL,TECH:	80009	070-3872-00

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.

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COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 3-23-83 Change Reference: C2/382 Rev.

Product: 015-0408-00 PEAK-TO-PEAK Manual Part No.: 070-3872-00

DESCRIPTION

MECHANICAL PARTS LIST CHANGES

SECTION 9 REPLACEABLE MECHANICAL PARTS, Page 9-3, Fig. & Index No. 1-8 and 1-9

ADD:

1-8 131-1097-00*

1-9 131-2010-00*

* (footnote) When replacing these connectors, discard the included lockwashers and replace with flat washers, Tektronix Part No. 210-0845-00. This is to avoid scratching the front-panel surface.

000-2775-00D

MODEL#: TEK 015-0413-00
SER. #: B010295

DATE: 9-23-86
CAL BY: DKL
CAL AT: 58-060

Frequency Response measured at 700 mVp-p from zero ohm source impedance.

FREQ.	RESP(%)
25.0 kHz	-0.21
50.0 kHz	-0.05
100.0 kHz	-0.01
200.0 kHz	0.01
500.0 kHz	0.00
1.0 MHz	REF
2.0 MHz	0.00
5.0 MHz	-0.02
10.0 MHz	-0.03
20.0 MHz	-0.04
30.0 MHz	-0.05
50.0 MHz	0.12