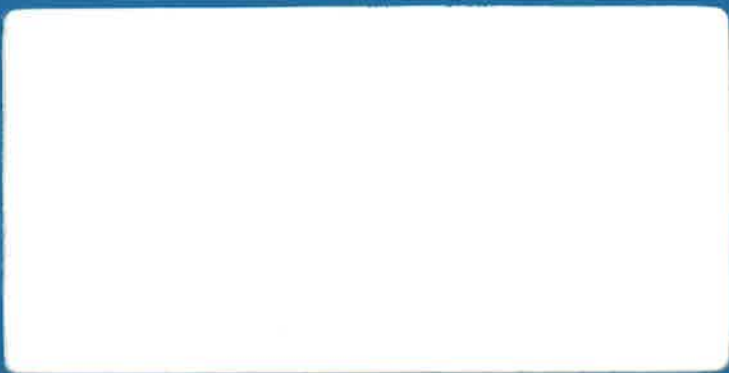


Tektronix[®]
COMMITTED TO EXCELLENCE

COMPARATOR

015-0310-01

INSTRUCTION MANUAL



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Tektronix[®]
COMMITTED TO EXCELLENCE

COMPARATOR

015-0310-01

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____

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Tektronix warrants that this product is free from defects in materials and workmanship. The warranty period is one (1) year from the date of shipment. Tektronix will, at its option, repair or replace the product if Tektronix determines it is defective within the warranty period and if it is returned, freight prepaid, to a service center designated by Tektronix.


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WARNING

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

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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.

As Marked on Equipment

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

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

SYMBOLS

In This Manual



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

As Marked on Equipment



DANGER — High voltage.



Protective ground (earth) terminal.



ATTENTION — refer to manual.

Grounding the Product

This product is grounded through the grounding lead of the connector cable.

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 connector specified for your product.

Refer connector changes 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

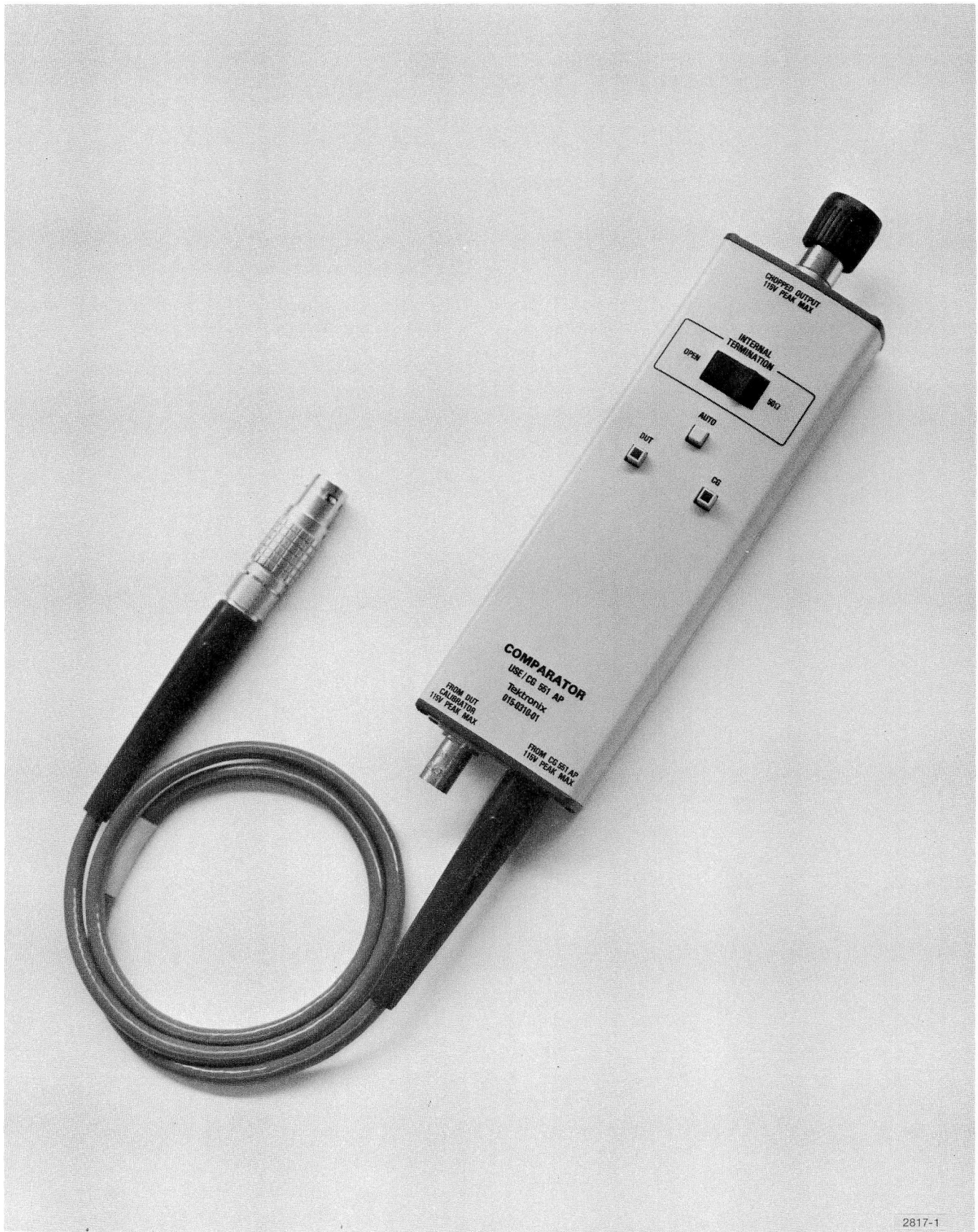
Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

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.

Comparator Head 015-0310-(01 & Up)



2817-1

The Comparator Use/CG 551AP 015-0310-(01 & Up)

SPECIFICATION

Description

The Comparator is an accessory that connects directly to the main OUTPUT of the CG 551AP Programmable Calibration Generator. The unknown signal to be compared with the CG 551AP output signal is connected to the FROM DUT CALIBRATOR input on the Comparator. The CHOPPED OUTPUT connector on the Comparator is connected to an oscilloscope; the oscilloscope must have a 1 M Ω impedance.

The Comparator circuit alternately switches (automatically or manually) each of the two signal sources to the oscilloscope and a comparison of signals is obtained with reference to the same ground point. A visual signal comparison is possible when these signals are routed to the oscilloscope through the Comparator CHOPPED OUTPUT connector. Each signal may also be viewed separately.

A switch, INTERNAL TERMINATION, is used to select a 50 Ω termination for the device under test (DUT) and the CG 551AP.

Accessories

This instruction manual is the only accessory for the Comparator.

Performance Conditions

The electrical characteristics are valid only if the Comparator has been calibrated at an ambient temperature between +20°C and +30°C and is operating at an ambient temperature between 0°C and +50°C, unless otherwise noted.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in the Calibration section of this manual.

Items listed in the Supplemental Information column are not verified in this manual.

**Table 1-1
ELECTRICAL CHARACTERISTICS**

Characteristics	Performance Requirements	Supplemental Information
Input		
Ac Voltage		
CG and DUT	$\pm 40 \mu\text{V}$ to $\pm 100 \text{ V}$.	
AUTO	$\pm 100 \text{ mV}$ to $\pm 100 \text{ V}$.	
Signal Frequency	10 Hz to 1 MHz Squarewave.	
Dc Voltage		
CG, DUT, and AUTO	+100 mV to +100 V.	
Resistance		Selected by INTERNAL TERMINATION switch.
Open	Unterminated (the resistance of the oscilloscope input).	
50 Ω	50 Ω , $\pm 1\%$ in 50 Ω position. Maximum input voltage is $\pm 5 \text{ V}$ peak in the 50 Ω position.	
Chop Parameters		
CG, DUT, or AUTO, controlled via GPIB or pushbuttons.		
Frequency		30 Hz, $\pm 10 \text{ Hz}$ (AUTO mode).
AUTO Timeout		
Internally selectable.		
0.5 minute	35 seconds, $\pm 33\%$.	
1.0 minute	70 seconds, $\pm 33\%$.	
2.0 minutes	140 seconds, $\pm 33\%$.	
Power Requirements		
Voltage		-10.5 Vdc to -12 Vdc.
Current		130 mA maximum.

Table 1-2
ENVIRONMENTAL

Characteristics	Description
Temperature	Meets MIL-T-28800B, class 5.
Operating	0° to +50°C.
Non-operating	-55°C to +75°C.
Humidity	90-95% RH for 5 days to 50°C. Exceeds MIL-T-28800B, class 5.
Altitude	Exceeds MIL-T-28800B, class 3.
Operating	4.6 Km (15,000 ft).
Non-operating	15 Km (50,000 ft).
Vibration	0.64 mm (0.0252") 10 Hz to 55 Hz, 75 minutes. Meets or exceeds MIL-T-28800B, class 3.
Shock	50 g's (1/2 sine), 11 ms, 18 shocks. Meets or exceeds MIL-T-28800B, class 3.
Bench Handling	45° or 4" or equilibrium, whichever occurs first. Meets MIL-T-28800B, class 3.
EMI Compatibility	Meets MIL-T-28800B, class 3
Conducted Emissions	MIL-STD-461A when performed in accordance with MIL-STD-462 with following exception:
Conducted Susceptibility	
Radiated Emissions	
Radiated Susceptibility	Radiated emissions tested to 30 dB above specification from dc to 700 MHz.
Electrical Discharge	20 kV maximum. Charge applied to each protruding area of the product under test except the output terminals.
Transportation	Qualified under National Safe Transit Association Pre-shipment Test Procedures 1A-B-1 and 1A-B-2.
Vibration	25 mm (1") at 270 rpm for 1 hour.
Package Drop	10 Drops from 91 cm (3 ft).
Cable	
Flex Life	10,000 cycles at 120° flex with 0.68 kg (1.5 lb) weight.
Pull Test	15.88 kg (35 lbs) axial pull at 1 minute duration.

Table 1-3
PHYSICAL CHARACTERISTICS

Characteristics	Description
Finish	Light and dark gray painted metal.
Net Weight	0.32 kg, (0.7 lbs).
Overall Dimensions	254 mm (10.0") L x 53.4 mm (2.102") W x 27.8 mm (1.094") H.

OPERATING INSTRUCTIONS

Introduction

The Comparator is an accessory designed to operate with the CG 551AP Programmable Calibration Generator. The attached cable connects directly to the CG 551AP front panel OUTPUT connector. The signal to be compared with the CG 551AP output signal is connected to the FROM DUT CALIBRATOR bnc connector. The CHOPPED OUTPUT bnc connector connects directly to an oscilloscope for viewing purposes.

Connecting to the CG 551AP

CAUTION

Use care when connecting the Comparator plug to the CG 551AP to avoid pin misalignment and possible connector damage.

Observe the positioning dot on the Comparator plug and align this dot with the positioning dot on the outside ring of the CG 551AP OUTPUT connector. Insert the plug into the connector.

An internal jumper is available to set the duration of AUTO mode (Timeout) for the Comparator. This unit is shipped with the jumper in the 1 minute Timeout position. The jumper can be user modified for the 0.5 or 2 minutes Timeout by qualified personnel. The jumper is generally used in the 0.5 minute position to make a minimum number of signal checks when using the Comparator. The jumper in the 2 minutes position, is used to make a maximum number of signal checks when using the Comparator. The Timeout feature prolongs the life of the relay contacts.

CAUTION

Never operate the Comparator with the jumper removed.

This accessory is calibrated and ready to use when received.

Controls and Connectors (Refer to Fig. 2-1)

- ① **CHOPPED OUTPUT (115 V PEAK MAX).**
This bnc connector is the output for the DUT and CG 551AP signals and is connected directly to the oscilloscope for signal viewing purposes.
- ② **INTERNAL TERMINATION.**
This rocker switch selects the impedance match for the device under test (DUT). The USE FOR 50 Ω LOAD pushbutton on the CG 551AP front panel must be lit for a 50 Ω impedance match. (± 5 V peak maximum input voltage).
- ③ **AUTO.**
When pressed, this pushbutton allows comparison of signals from the DUT with the CG 551AP test signal, on an oscilloscope display.
- ④ **CG.**
When lit, this pushbutton allows the test signal from the CG 551AP to be displayed.
- ⑤ **DUT.**
When lit, this pushbutton allows the device under test signal to be displayed.
- ⑥ **FROM DUT CALIBRATOR (115 V PEAK MAX, 10 W MAX).**
This bnc connector is the input for the device under test signal.

General Operating Information

The internal circuitry of the Comparator alternately connects signals from the CG 551AP (CG) and device under test (DUT) to the oscilloscope. The signals are referenced to the same ground point.

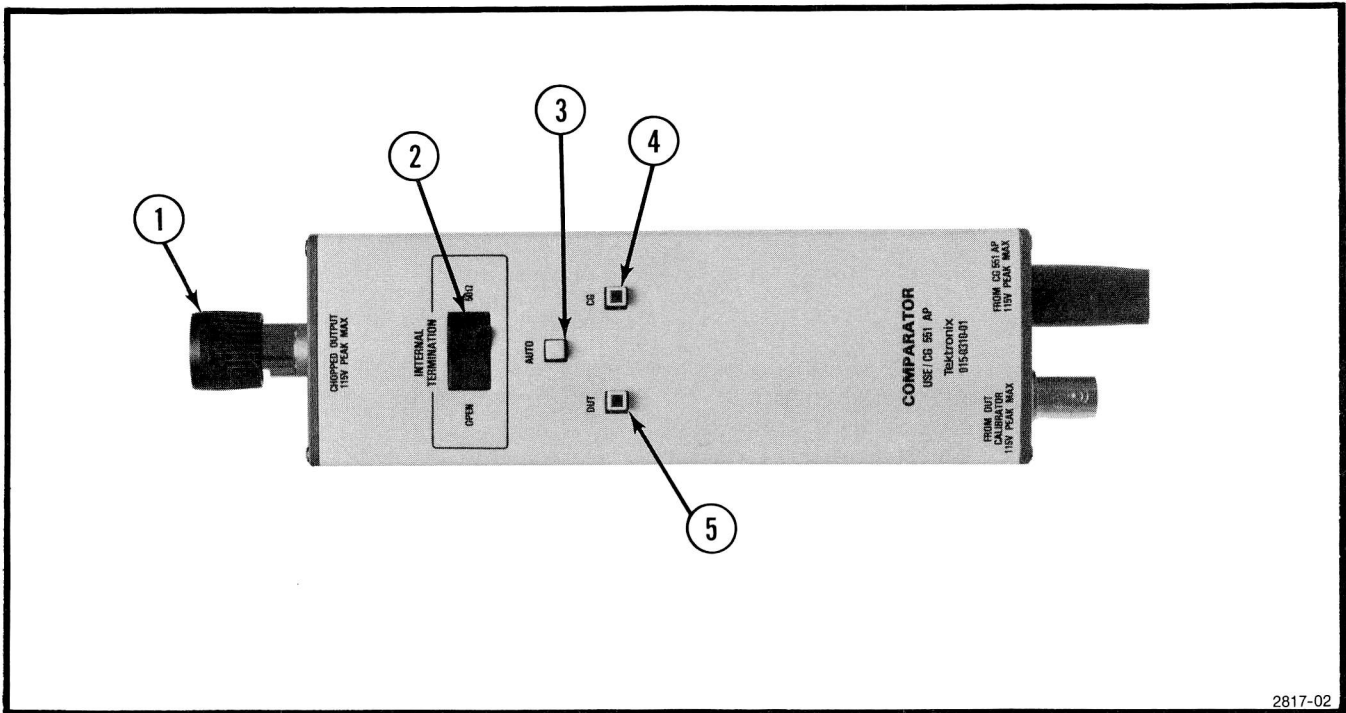


Fig. 2-1. Comparator Head controls and connectors.

On the CG 551AP front panel, with the VARIABLE pushbutton illuminated, the UNITS/DIV and VARIABLE controls can be adjusted so that the CG 551AP OUTPUT signal matches the unknown (DUT) signal. Any error is then displayed on the CG 551AP. The CG 551AP was designed to measure oscilloscope gain error. If a voltage error measurement is desired, a correction factor must be used to determine the percentage error. When the CG 551AP and the Comparator are used to measure an unknown voltage from the device under test (DUT), use the following formulas:

With a displayed error of 9.9% LOW on the CG 551AP

$$x = \frac{-9.9}{100} = -.099$$

$$\text{Output voltage error} = \frac{+.099}{1 - .099} = +.109 = 10.9\%$$

$$\text{Actual CG 551AP output voltage} = \frac{-x}{1+x}$$

$$\text{with } x = \frac{\text{Displayed error in percent}}{100}$$

Examples:

with a displayed error of 9.9% HIGH on the CG 551AP

$$x = \frac{+9.9}{100} = +.099$$

Using the formula:

$$\text{Output voltage error} = \frac{-.099}{1 + .099} = -.090 = -9\%$$

Other typical voltage errors:

CG 551AP Display	Actual Voltage Error	CG 551AP Display	Actual Voltage Error
1% HIGH	-.99%	1% LOW	+1.01%
2% HIGH	-1.96%	2% LOW	+2.04%
3% HIGH	-2.91%	3% LOW	+3.09%
4% HIGH	-3.85%	4% LOW	+4.17%
5% HIGH	-4.76%	5% LOW	+5.26%

The Comparator can provide a 50 Ω impedance match for signals up to 5 V in amplitude. If the DUT signal is derived from a 50 Ω source, a rocker switch on the Comparator, in the 50 Ω position, is used to terminate both inputs in a 50 Ω, 1 W impedance. The USE FOR 50 Ω LOAD pushbutton on the CG 551AP must be lit when this termination is used.

When signals greater than 5 V amplitude are compared, the rocker switch must be in the OPEN position before connecting the unknown signal to the Comparator.

CAUTION

The maximum power capability of the source connected to the FROM DUT CALIBRATOR bnc connector must be limited to 10 watts. The maximum power dissipation by the Comparator is limited to 1 W under any operating conditions.

Repackaging Information

If shipping this instrument to a Tektronix Service Center for service or repair, attach a tag showing owner (with address) and the name of an individual to contact. Include the complete instrument serial number and a description of the service required.

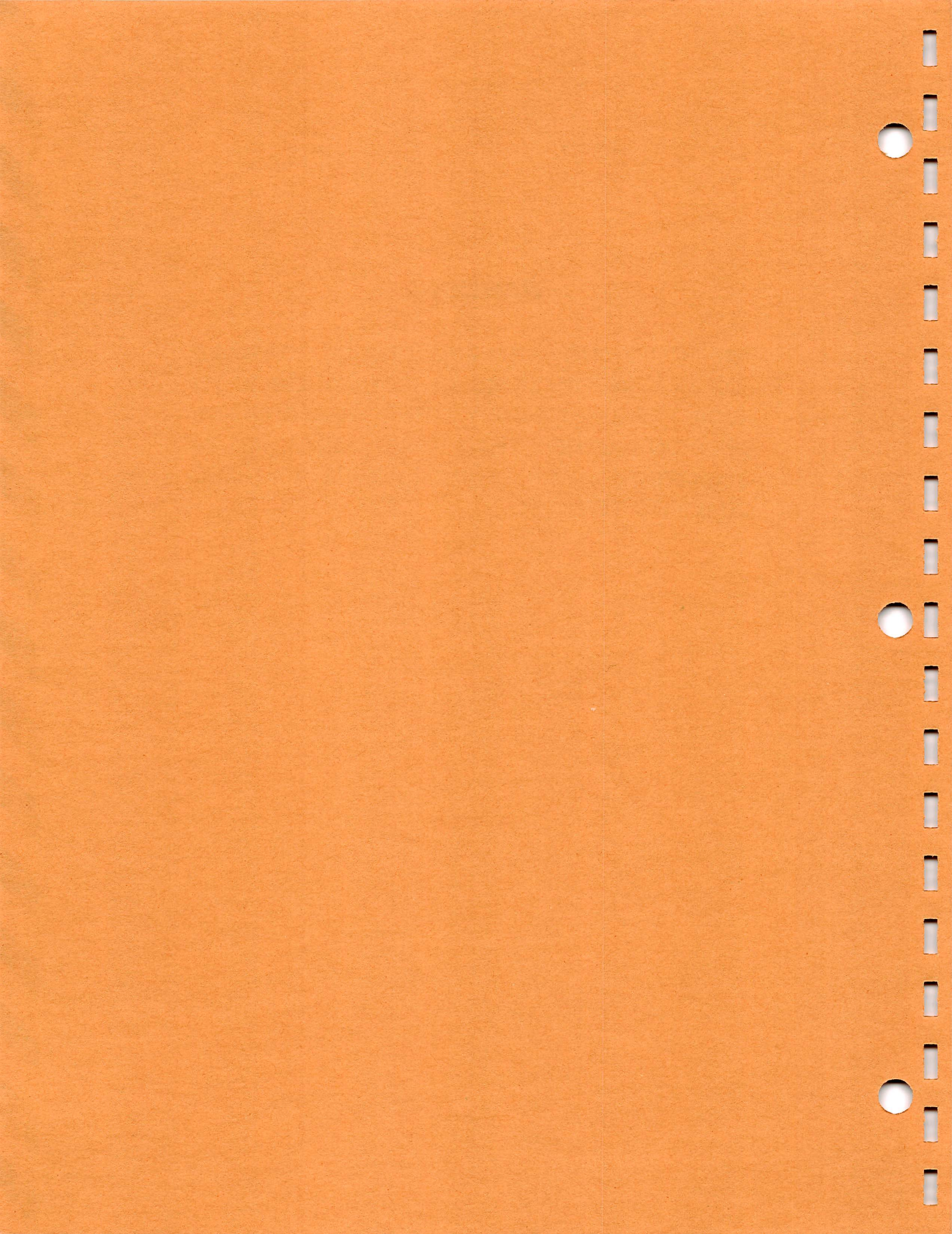
Save and reuse the package in which the instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a corrugated carton having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Use a carton having a test strength of at least 200 pounds.
2. Surround the instrument with protective polyethylene sheeting.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial staples.



WARNING

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THEORY OF OPERATION

Introduction

Power, control logic, and signal input to the Comparator is obtained from the CG 551AP OUTPUT connector, (see Fig. 3-1) through two leads and a coaxial cable in the Comparator head cable. The two leads provide chassis ground and -12 V. The operating modes for the Comparator are programmed by the CG 551AP sending pulses over the -12 V line.

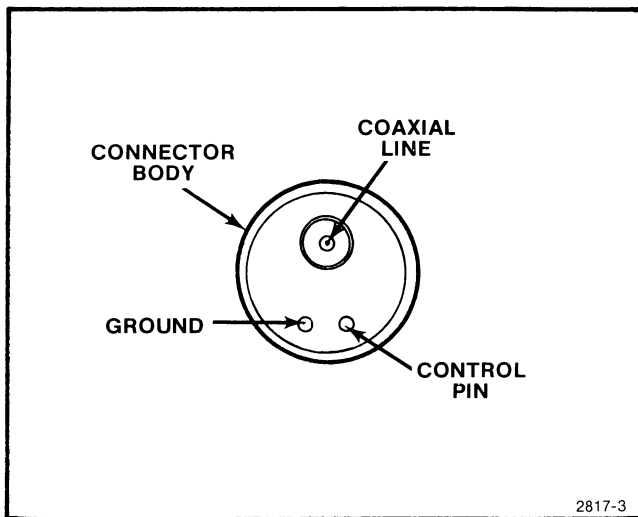


Fig. 3-1. CG 551AP OUTPUT connector (front view).

After connecting the Comparator, the CG 551AP circuitry senses the particular head connected. Refer to the Head Sense Circuit in the CG 551AP Instruction Manual for further details.

The CG 551AP control pin has approximately $+0.6$ Vdc when the Comparator is connected. When this voltage is sensed by the CG 551AP circuitry, the programming commands are executed. Refer to the Head Programming Circuit in the CG 551AP Instruction Manual for further details.

The approximate 10 mA current drawn by resistors R1325 and R1326 assures continued sensing of the Comparator when the -12 V is applied by the CG 551AP.

The voltage drop across diode CR1325 provides isolation from the -12 V supply, creating a -11 V supply for comparator use. Capacitor C1226 provides the -11 V power during control pulse times.

Input To Select CG 551AP

When the single positive-going pulse is received on the -12 V line from the CG 551AP, (refer to Fig. 3-2) Q1227 and Q1224 are off. Transistor Q1225 is either on or off, depending upon the level at pin 6 of U1215 which puts a high or low on pin 11 of U1310B. Transistor Q1223 is off.

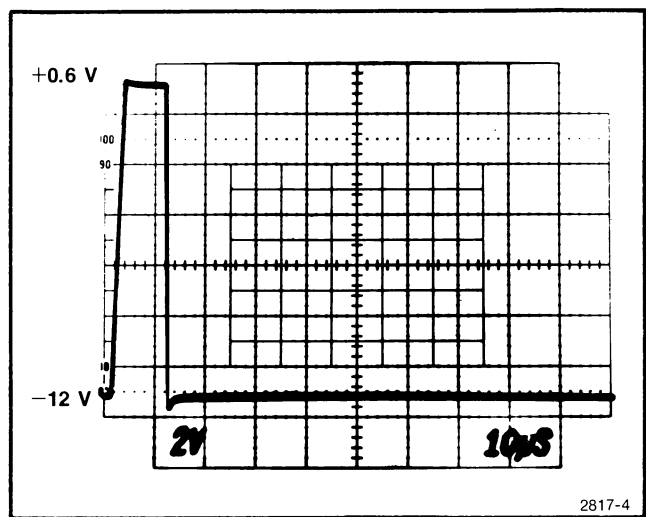


Fig. 3-2. Program to CG 551AP.

As the pulse reaches the $+0.6$ V level, transistor Q1227 is fully on, which turns Q1224 on. This action turns Q1225 off. Transistor Q1227 drives the base of Q1223. Components R1304, C1303, R1305, and R1306 establish the proper time constant for the signal at pin 10 of U1310A and B to reset U1310A and B. When reset occurs on U1310B, pin 13 goes low causing U1215A and F to turn on Q1111. Transistor Q1111 activates K1120 which connects the CG 551AP calibrated signal to the CHOPPED OUTPUT. When reset occurs on U1310A, pin 2 goes high causing pin 10 of U1215D to go low. Pin 6 of U1215C goes high causing transistor Q1225 to turn off as Q1224 turns on.

After the pulse on the -12 V line disappears, Q1227 and Q1224 are off and Q1225 is conducting. The signal at pin 11 of U1310B is low. The circuit (with K1120 closed) is ready for the next command signal.

Manual control of the above described operation, is achieved by pressing the CG pushbutton, S1126, which grounds pin 10 of U1310B causing a logic low on pin 13.

Theory of Operation—Comparator Head 015-0310-(01 & Up)

This, in turn, causes U1215A and F to turn on transistor Q1111 activating relay K1120.

Input To Select Device Under Test

When two input pulses are received from the CG 551AP, (see Fig. 3-3) circuit operation is identical to the single pulse operation for the first pulse. As the second pulse level goes to +0.6 V, transistors Q1227 and Q1224 turn on. Transistor Q1223 turns on but a reset does not occur in U1310B because of the long time constant set up by components R1304 and C1303. Transistor Q1225 is turned off causing the clock input, U1310B pin 11 to go high. Pin 12 of U1310B goes low, causing U1215E and B to turn on Q1112. Transistor Q1112 being turned on activates relay K1100. The comparator is now accepting signals from the device under test (DUT).

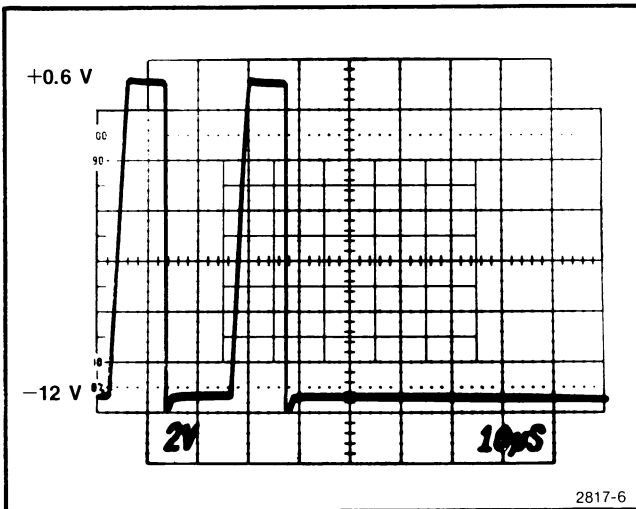


Fig. 3-3. Program to device under test.

Again, if desired, manual control for connecting the device under test can be accomplished by pressing the DUT pushbutton, S1106, which grounds pin 8 of U1310B. Grounding Pin 8 of U1310B causes pin 12 to go low, enabling U1215E and B. Transistor Q1112 turns on, activating relay K1100, connecting the DUT to the CHOPPED OUTPUT.

Alternating Input Selection (Automatic)

When three pulses are received from the CG 551AP (see Fig. 3-4), operation for the first two pulses is as

described previously. On the third pulse, U1310B is clocked into its initial, single pulse state. However, since there is no reset, the rising edge of the transition on pin 12 of U1310B clocks U1310A pin 2 low. The oscillator circuit, U1215C and U1215D with associated components, turns on and pulses the base of transistor Q1225 at approximately 30 Hz. This relatively slow switching rate causes U1310B outputs (Pins 13 and 12) to toggle, closing relays K1100 and K1120 at a 30 Hz rate. The oscillator output also drives a fourteen stage binary counter, U1201 with its output selectable for approximately 0.5, 1, and 2 minutes Timeout (factory set for 1 minute Timeout). With the Timeout selected by jumper connection, P1202, the binary counter drives the reset terminal of U1310A. When U1310A is reset, the counter resets and its state remains stable until the comparator is returned to the AUTO mode.

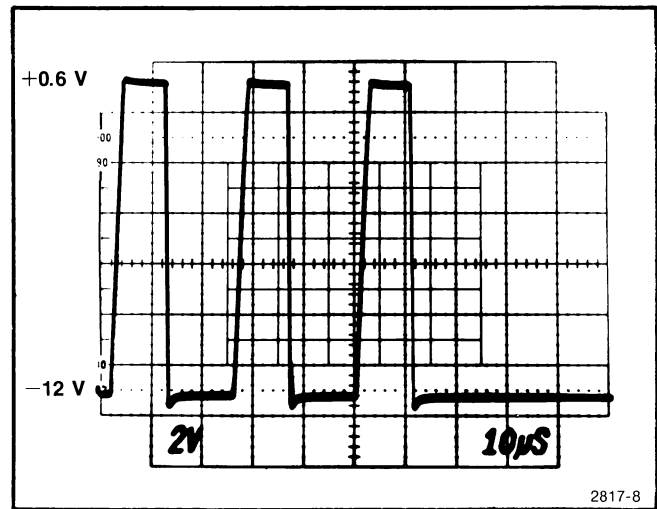


Fig. 3-4. Program to automatic.

Manual control for the automatic mode can also be achieved by pressing the AUTO pushbutton, S1110 which grounds pin 6 of U1310A. Grounding pin 6 of U1310A causes pin 2 to go low, turning on the oscillator. The oscillator pulses Q1225 which toggles U1310B, alternately driving the CG and DUT relays. The oscillator also drives the binary counter, which resets U1310A.

CALIBRATION

PERFORMANCE CHECK

Introduction

This procedure checks the electrical Performance Requirements as listed in the Specification section of this manual.

factory service center. Contact your local Tektronix Field Office or representative for further information.

Services Available

Tektronix, Inc. provides complete instrument repair and adjustment at local field service centers and at the

Test Equipment Required

The following test equipment listed in Table 4-1 or equivalent, is suggested to perform the Performance Check procedure.

Table 4-1
List of Test Equipment Requirements

Description	Minimum Specifications	Applications	Example
Power module	GPIB compatible	All tests.	Tektronix TM 506 (Mod JB) or TM 515 (MOD JB)
Programmable Calibration Generator, CG 551AP		All tests.	Tektronix CG 551AP
Calibrated signal source	Standard amplitude calibrator 200 μ V into 50 Ω .	All tests.	Tektronix PG 506, or equivalent
Oscilloscope mainframe		Check ac voltage and frequency.	Tektronix 7603, or equivalent
Vertical plug-ins	1 MHz; 10 μ V/div	Check ac voltage and frequency.	Tektronix 7A22 and 7A26, or equivalent
Horizontal plug-in	Maximum sweep range 5 μ S/div	Check ac voltage and frequency.	Tektronix 7B53, or equivalent
Digital multimeter	Range, 200 mV dc	Check dc voltage.	Tektronix DM 501A, or equivalent
2.5 X Attenuator, 50 Ω	bnc connectors		Tektronix Part No. 011-0076-02
Probe, 10X, 1 M Ω		Check \pm 100 V ac voltage.	Tektronix P6075A, or equivalent
Adapter, bnc tip to probe		Check \pm 100 V ac voltage.	Tektronix Part No. 013-0084-01
Coaxial cable, 50 Ω bnc connectors		All tests.	Tektronix Part No. 012-0057-01
Adapter, bnc female to dual banana		Check dc voltage and resistance.	Tektronix Part No. 103-0090-00
Interconnect cable (2 meters long)	Meets IEEE 488-1978 standard	Check CG, DUT, and Auto functions via GPIB control.	Tektronix Part No. 012-0630-01
Controller	GPIB (IEEE 488)	Check CG, DUT, and Auto via GPIB control.	Tektronix 4050-series, or equivalent

**Calibration—Comparator Head 015-0310-(01 & Up)
Performance Check**

1. Check 40 μ V Input Voltage (CG and DUT)

NOTE

Refer to Fig. 4-1 for the following check:

a. Connect Comparator cable to CG 551AP front panel OUTPUT connector and set both units for a 50 Ω load. Press, to light, the CG pushbutton on the Comparator.

b. Set CG 551AP AMPLITUDE MODE to VOLTAGE, MULTIPLIER to 4, and FREQUENCY to 10 kHz. Set UNITS/DIV for a 10 μ V/Div display. Press to light the CG 551AP OUTPUT ON pushbutton.

c. Connect Comparator CHOPPED OUTPUT to 7A22 + input connector and set + input connector pushbutton to AC. Set the - input connector pushbutton to GND. Set LF-3 dB POINT control to DC and HF-3 dB POINT control to .1 MHz.

d. Set 7A22 VOLTS/DIV to 10 μ V. Turn on the oscilloscope and set the sweep and triggering controls for a non-triggered sweep rate, displaying two parallel lines. Position display to graticule center.

e. CHECK - crt display for 4 divisions of trace separation.

f. Set PG 506 internal Pulse-Dc switch to Pulse (1 kHz out) position (refer switch change to qualified personnel). Rotate PG 506 AMPLITUDE control to .2 mV with switch in STD AMPL position.

g. Connect PG 506 AMPL OUTPUT connector through a 50 Ω , 2.5 X attenuator to the FROM DUT CALIBRATOR connector on the Comparator.

h. Press to light the Comparator DUT pushbutton and set oscilloscope sweep and triggering controls for a non-triggered sweep rate displaying two parallel lines. Position display to graticule center.

i. CHECK—crt display for 4 divisions of trace separation.

2. Check 100 mV Ac Input Voltage (AUTO)

Maintain same setup as step 1 with the following exceptions:

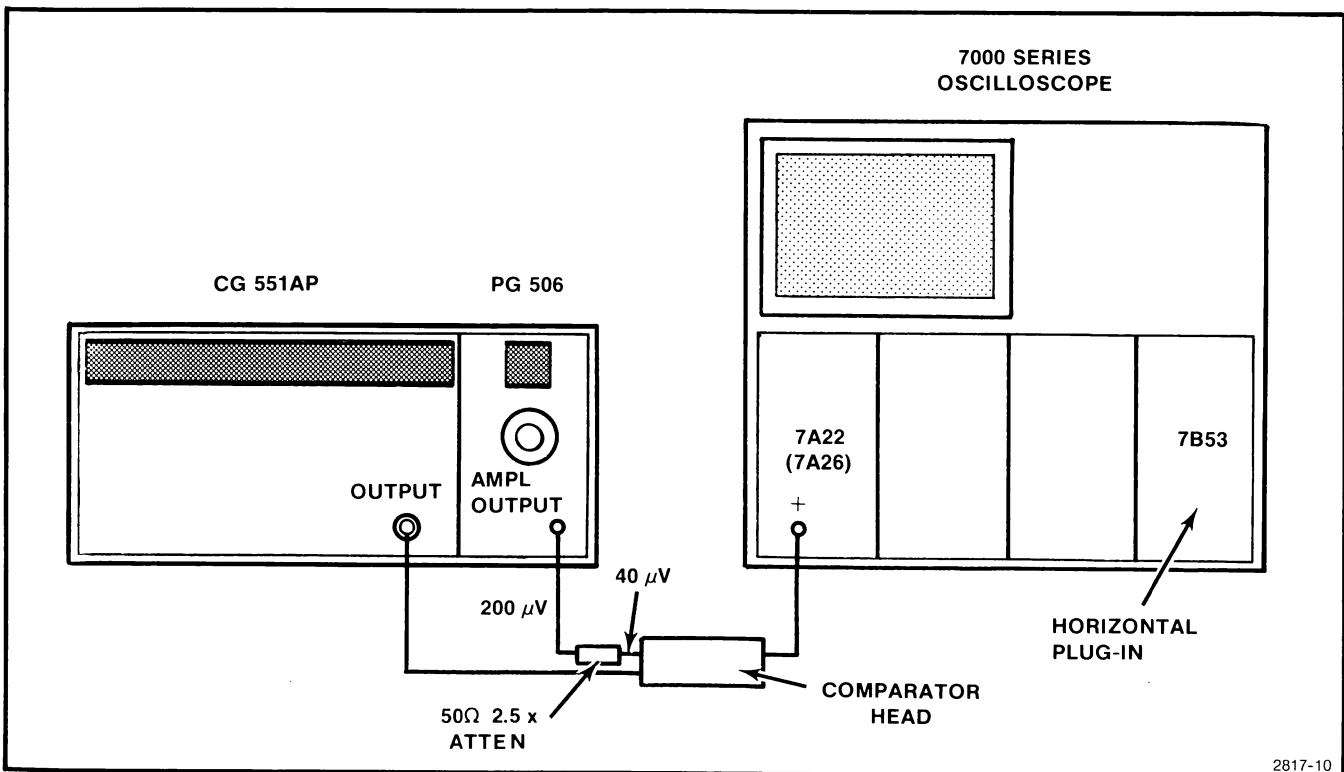


Fig. 4-1. Comparator Head Calibration and Performance Check set-up.

a. Set PG 506 AMPLITUDE control to .2 V. Remove 2.5X attenuator and connect PG 506 AMPL OUTPUT to the FROM DUT CALIBRATOR connector.

b. Set CG 551AP MULTIPLIER to 10 and UNITS/DIV for 10 mV/Div.

c. Press AUTO pushbutton on the Comparator.

d. Set 7A22 VOLTS/DIV switch to 20 mV and set oscilloscope sweep and triggering controls for a non-triggered sweep rate (horizontal plug-in) displaying two parallel lines. Position display to graticule center.

e. CHECK—crt display for 5 divisions of trace separation.

3. Check 100 V Ac Input Voltage (CG, DUT, and AUTO)

Maintain same setup as step 2 with the following exceptions:

a. Turn oscilloscope power off, disconnect the Comparator, and remove the 7A22 plug-in.

b. Insert 7A26 plug-in. Connect Comparator CHOPPED OUTPUT to a 10X probe through a probe tip to bnc adapter. Connect 10X probe to 7A26 CH 2 input connector.

c. Set 7A26 CH 2 controls to DC coupled, BW in FULL position, CH 2 POLARITY in + UP position, and VOLTS/DIV at 2.

d. Turn on the oscilloscope.

e. Switch Comparator INTERNAL TERMINATION switch to OPEN and press to light the DUT pushbutton.

f. Rotate PG 506 AMPLITUDE control to 100 V. Set oscilloscope sweep and triggering controls for a non-triggered sweep rate displaying two parallel lines. Position display to graticule center.

g. CHECK—crt display for 5 divisions of trace separation.

Calibration—Comparator Head 015-0310-(01 & Up) Performance Check

h. Set CG 551AP MULTIPLIER to 5 and UNITS/DIV switch for 20 V/Div.

i. Press to light CG pushbutton on Comparator and set sweep and triggering controls for a non-triggered sweep rate displaying two parallel lines.

j. CHECK—crt display for 5 divisions of trace separation.

k. Press Comparator AUTO pushbutton, and set oscilloscope triggering level and sweep rate for a display of two parallel lines and note chopped display of CG 551AP and DUT input signals.

4. Check Input Signal Frequency (10 Hz and 1MHz)

Maintain same set-up as in Step 3 with the following exceptions:

a. Make sure CG 551AP OUTPUT is off.

b. Remove 10X probe and adapter. Connect Comparator CHOPPED OUTPUT to 7A26 CH 2 input. Set 7A26 VOLTS/DIV to 1.

c. Set CG 551AP AMPLITUDE MODE to CURRENT, FREQUENCY to 10 Hz, MULTIPLIER to 5. Set CG 551AP UNITS/DIV switch for 20 mA/Div.

d. Switch Comparator INTERNAL TERMINATION to 50 Ω position and press to light the CG pushbutton. Press to light the CG 551AP OUTPUT ON pushbutton. Set oscilloscope sweep and triggering controls for a non-triggered sweep rate displaying two parallel lines. POSITION display to graticule center.

e. CHECK—10 Hz signal for 5 major graticule divisions of display.

f. Set CG 551AP FREQUENCY to 1 MHz and set the oscilloscope for a non-triggered sweep displaying two parallel lines.

g. CHECK—1 MHz signal for 5 major graticule divisions of display.

h. Press to light Comparator DUT pushbutton.

**Calibration—Comparator Head 015-0310-(01 & Up)
Performance Check**

i. Set PG 506 to HIGH AMPL and rotate PERIOD control to 10 ms. Turn PG 506 VAR control fully clockwise. Adjust PG 506 AMPLITUDE control for a display of 5 major graticule divisions.

j. CHECK—10 Hz signal for 5 major graticule divisions of display.

k. Rotate PG 506 PERIOD control to 1 MHz and turn PG 506 VAR control fully counterclockwise.

l. CHECK—1 MHz signal for 5 major graticule divisions of display.

5. Check Dc Voltage +100 mV to +100 V.

Refer to Check set-up (Fig. 4-2) for following steps:

a. Set DM 501 to 200 mV, DC V.

b. Set PG 506 internal Pulse-Dc switch to DC position (Refer switch change to qualified personnel only). Set to STD AMPL with AMPLITUDE control to .2 V.

c. Set CG 551AP AMPLITUDE MODE to VOLTS, FREQUENCY to DC, MULTIPLIER to 5. Press to light the CG 551AP OUTPUT ON pushbutton and make sure USE FOR 50 Ω LOAD light is on. Set UNITS/DIV switch for 20 mV/Div display readout.

d. Press to light the CG pushbutton on Comparator head. Make sure the Comparator INTERNAL TERMINATION switch is in the 50 Ω position.

e. CHECK—100 mV display readout on DM 501.

f. Press to light the DUT pushbutton on Comparator head.

g. CHECK—100 mV display readout on DM 501.

h. Set DM 501 to 200 V.

i. Switch Comparator INTERNAL TERMINATION to OPEN.

j. Set PG 506 to 100 V AMPLITUDE.

k. Set CG 551AP UNITS/DIV switch for 20 V/Div readout.

l. CHECK—DUT 100 V display readout on DM 501.

m. Press to light the CG pushbutton on Comparator Head.

n. CHECK—100 V display readout on DM 501.

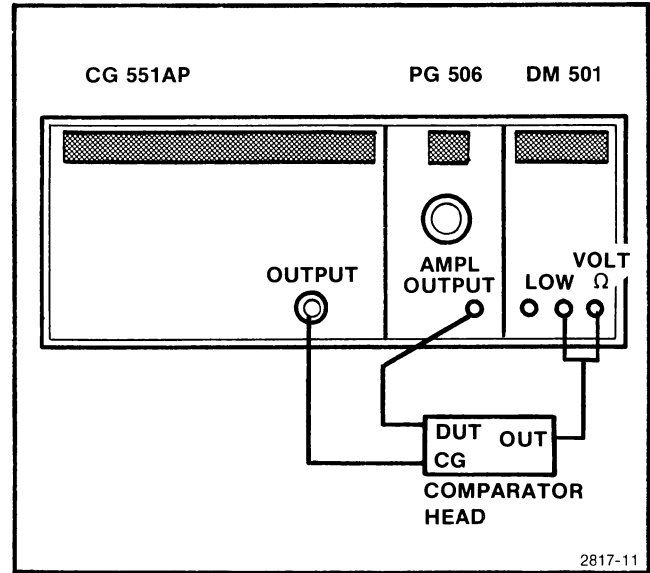


Fig. 4-2. Comparator Head Dc Voltage and Resistance Check set-up.

6. Check Internal Termination

Maintain same check step set-up (Fig. 4-2) with following exceptions:

a. Set CG 551AP AMPLITUDE MODE to VOLTAGE, MULTIPLIER to 1 and FREQUENCY to DC. Set UNITS/DIV switch for 1 V/Div readout. Be sure that the USE FOR 50 Ω LOAD pushbutton is off (not lighted) and OUTPUT is on.

b. Set DM 501 to 2 V, DC.

c. CHECK—DM 501A for 1.00 V display readout.

d. Switch Comparator to 50 Ω INTERNAL TERMINATION and press to light CG 551AP USE FOR 50 Ω LOAD pushbutton.

e. CHECK—DM 501A readout. This voltage reading must be between 0.99 V and 1.01 V.

f. Switch Comparator INTERNAL TERMINATION switch to OPEN.

**Calibration—Comparator Head 015-0310-(01 & Up)
Performance Check**

- g. Set PG 506 AMPLITUDE to 1 V, STD AMPL.
- h. Push to light DUT Comparator pushbutton.
- i. CHECK—DM 501 for 1 V display reading.
- j. Switch Comparator INTERNAL TERMINATION to 50 Ω .
- k. Set PG 506 AMPLITUDE to 2 V, STD AMPL.
- l. CHECK—DM 501A display reading to be between 0.99 V and 1.01 V.

7. Check AUTO Timeout Function

(Factory shipped with jumper in 1 minute Timeout position)

Refer to Adjustment Locations, Fig. 8-2 for jumper details.

- a. Set CG 551AP AMPLITUDE MODE to VOLTAGE, MULTIPLIER to 1, and FREQUENCY to DC.
- b. Connect Comparator cable to the CG 551AP OUTPUT connector and press to light OUTPUT ON.
- c. Using a common Time-piece (wristwatch, etc.) with a seconds counter, time the AUTO (chop frequency) Timeout by following:

Press the Comparator AUTO pushbutton and commence timing when a visible blinking indication of the CG and DUT pushbutton lights occurs.

Stop timing when the CG and DUT pushbutton lights turn off.
- d. CHECK—that the AUTO Timeout is 70 seconds, ± 20 seconds (1 minute position).
- e. Place jumper in the 0.5 minute position.
- f. Repeat step c.

- g. CHECK—that the AUTO Timeout is 35 seconds ± 10 seconds.
- h. Place jumper in the 2.0 minutes position.
- i. Repeat step c.
- j. CHECK—that the AUTO Timeout is 140 seconds ± 45 seconds.

8. Check CG, DUT, or AUTO Via GPIB control

NOTE

Setting commands for the Comparator are contained in the Programming section of the CG 551AP Instruction Manual. Refer to the CG 551AP instruction manual (Vol. 1) for Talker/Listener programs that allow sending the Comparator setting commands to the CG 551AP.

- a. Connect the Comparator Head cable to the CG 551AP OUTPUT connector.
- b. Connect the GPIB bus from the power module to an appropriate controller. With the correct program commands, the Comparator head is programmed by the controller.
- c. CHECK—the Comparator operation for the COMP CG command. The Comparator CG pushbutton switch will light.
- d. CHECK—the Comparator operation for the COMP DUT command. The Comparator DUT pushbutton switch will light.
- e. CHECK—the Comparator operation for the COMP AUTO command. The Comparator will go into chopped operation.

This completes the Performance Check procedure.

C

C

C

MAINTENANCE

Mercury Wetted Relays (K1100 and K1120)

The manufacturer's specification for the mercury wetted relay contact (alternate open-close operation) is 24 hours continuous duty.

The following test indicates relay condition.

Test DUT Relay

Connect a dc level of approximately 1 V to the FROM DUT CALIBRATOR connector.

Make sure the CG 551AP OUTPUT pushbutton is off.

Connect the Comparator CHOPPED OUTPUT to an oscilloscope vertical input.

Press the AUTO pushbutton and adjust triggering level for a stable display.

Note display and replace relay if waveform differs from that in Fig. 5-1a.

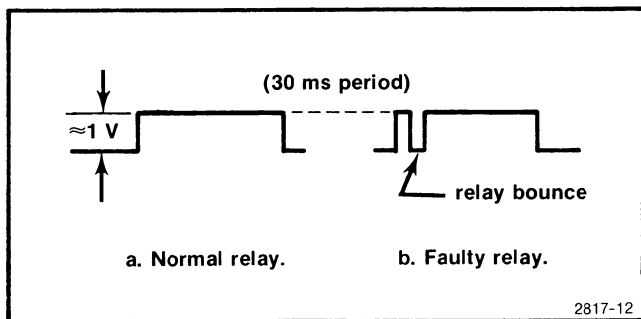


Fig. 5-1. Relay operation.

Test CG Relay

Disconnect the FROM DUT CALIBRATOR signal.

Set the CG 551AP front panel controls as follows:

Press to light AMPLITUDE MODE VOLTAGE pushbutton.

UNITS/DIV 1 V/DIV
VARIABLE OFF

Press 1 NUMBER OF DIVISIONS (MULTIPLIER) pushbutton.

Press to light DC pushbutton (FREQUENCY).

Press to light OUTPUT ON pushbutton.

USE FOR 50 Ω LOAD off

With the Comparator Head receiving the 1 Vdc signal, press the AUTO pushbutton and adjust the triggering level for a stable display.

Note display and replace relay if waveform differs from that in Fig. 5-1a.

Disassembly and Reassembly

NOTE

Refer to Fig. 5-2 for following procedures:

Top Cover Removal and Replacement

Remove four end screws (1)

Carefully lift top cover, clearing the pushbuttons and switch and remove.

To replace, carefully position top cover over pushbuttons and switch and secure cover with the four end screws.

Bottom Cover Removal and Replacement

Remove bottom screw (2)

Remove four end screws (3) and lift off bottom cover.

Replace cover by aligning circuit board with bottom cover screw opening and insert screw to secure the circuit board to cover.

Replace the four end screws.

Circuit Board Removal and Replacement

After removal of top and bottom covers, remove the single printed circuit board using the following steps:

1. Unsolder signal cables (2) from CHOPPED OUTPUT connector end of circuit board.

Maintenance—Comparator Head 015-0310-(01 & Up)

2. Unsolder power leads (2) from CG 551AP cable end of circuit board.
3. Unscrew two screws from the CHOPPED OUTPUT connector bracket (4) mounted on the circuit board.
4. Unsolder the connector center pin from the circuit board. This releases the connector bracket from the board.

CAUTION

Avoid the use of chemical cleaning agents that might leave a film or damage the plastic material used in this instrument. Use a nonresidue type of cleaner; preferably, isopropyl alcohol or totally denatured ethyl alcohol. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Replace the circuit board by following the above steps in reverse order.

Cleaning Instructions

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

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

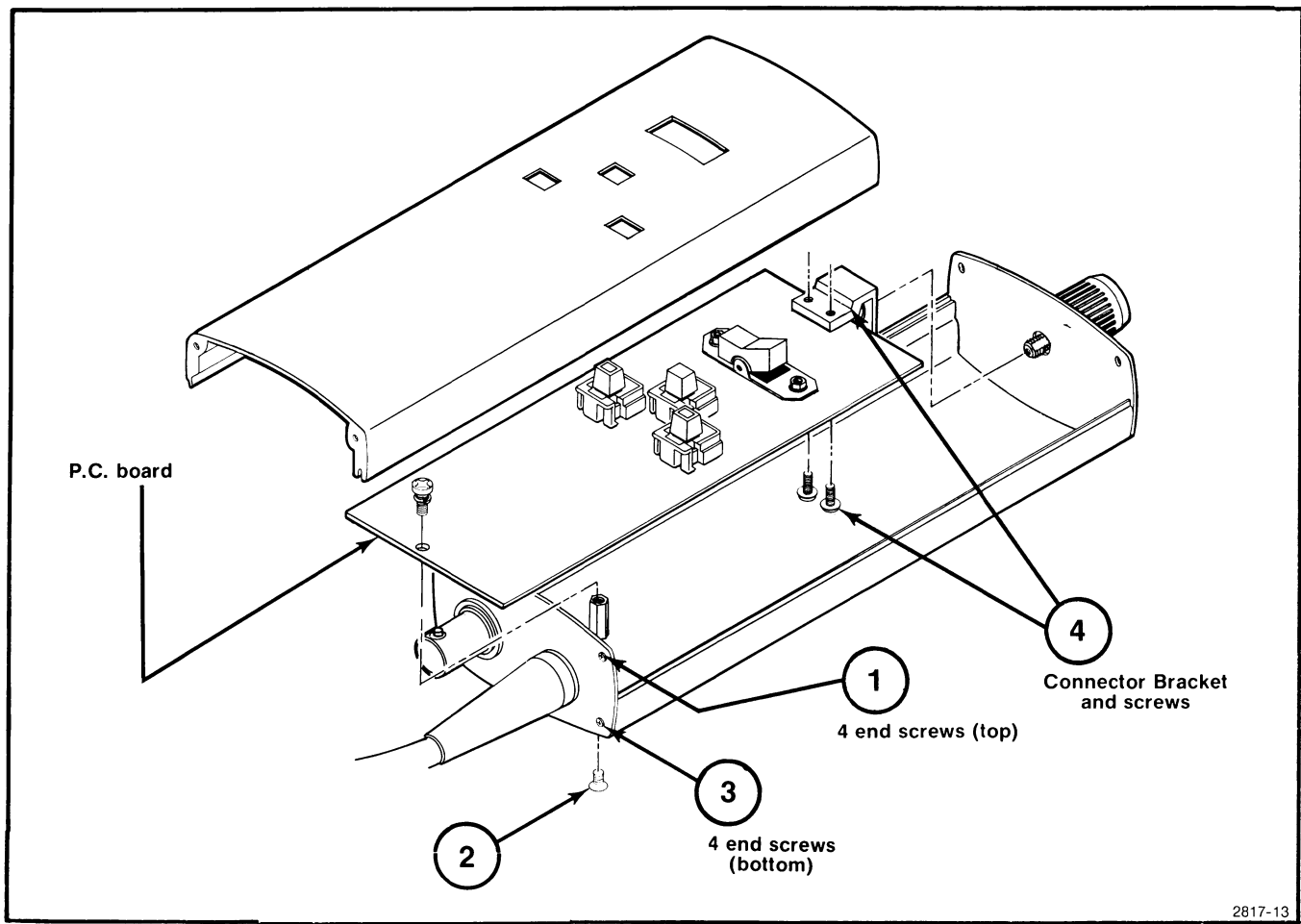


Fig. 5-2. Cover and circuit board removal and replacement.

Interior. Dust in the interior of the instrument should be removed occasionally, due to its electrical conductivity under high humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low pressure air then use a soft brush. If further cleaning is required, use a mild detergent and water solution, flushing well with clean water.

CAUTION

Do not clean the circuit board with water, air, or any solvent, unless the pushbutton switches are removed first. Any dirt forced or carried under the switch contacts can cause intermittent operation.

Drying can be accomplished with dry, low pressure air or by placing in an oven at 40° C to 60° C for approximately four hours.

After making minor board repairs, cleaning is best accomplished by carefully flaking or chipping the solder flux from the repaired area.

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

Obtaining Replacement Parts

Electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained from a local commercial source. Before purchasing or ordering parts from a source other than Tektronix, Inc., check the Replaceable Electrical Parts list for the proper value, rating, tolerance, and description.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., it is important to include all of the following information.

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

Static-Sensitive Components

CAUTION

Static discharge may damage semiconductor components 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 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.
8. Avoid handling components in areas that have a floor or work surface covering 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 tools.

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.

Table 5-1
RELATIVE SUSCEPTIBILITY TO
STATIC DISCHARGE DAMAGE

Semiconductor Classes	Relative Susceptibility Levels ^a
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFETs	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

*Voltage equivalent for levels:

1 = 100 to 500 V	4 = 500 V	7 = 400 to 1000 V (est.)
2 = 200 to 500 V	5 = 400 to 600 V	8 = 900 V
3 = 250 V	6 = 600 to 800 V	9 = 1200 V

(Voltage discharge from a 100 pF capacitor through a resistance of 100 Ω.)

OPTIONS

There are no options available at this time.



REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

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.

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.

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

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

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.

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

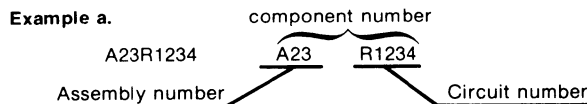
Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

ABBREVIATIONS

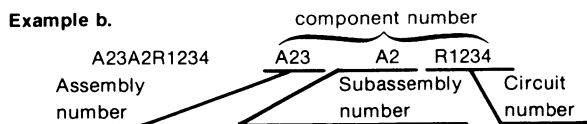
Abbreviations conform to American National Standard Y1.1.

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:



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

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.

Replaceable Electrical Parts—Comparator Head 015-0310-(01 & Up)

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
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
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 372	COLUMBUS, NE 68601
94696	MAGNECRAFT ELECTRIC COMPANY	P. O. BOX 609	CHICAGO, IL 60630
		5575 N LYNCH AVENUE	

Replaceable Electrical Parts—Comparator Head 015-0310-(01 & Up)

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10	670-6094-00		CKT BOARD ASSY:COMPARATOR	80009	670-6094-00
A10C1003	281-0766-00		CAP.,FXD,CER DI:100PF,20%,200V	72982	314-022X5P101M
A10C1022	281-0764-00		CAP.,FXD,CER DI:82PF,5%,100V	72982	8035D9AADCLG802J
A10C1023	281-0766-00		CAP.,FXD,CER DI:100PF,20%,200V	72982	314-022X5P101M
A10C1211	290-0183-00		CAP.,FXD,ELCTLT:1UF,10%,35V	90201	TAE105K035P1A
A10C1212	290-0183-00		CAP.,FXD,ELCTLT:1UF,10%,35V	90201	TAE105K035P1A
A10C1226	290-0745-00		CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1303	281-0812-00		CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10C1320	283-0190-00		CAP.,FXD,CER DI:0.47UF,5%,50V	72982	8141N077X7R0474J
A10C1328	281-0773-00		CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10CR1102	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1122	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1302	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1307	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1308	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1309	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1323	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1325	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1327	152-0141-02		SEMICONV DEVICE:SILICON,30V,50NA	01295	1N4152R
A10DS1105	150-1043-00		LT EMITTING DIO:RED,20MA,5V	50522	MV5774B
A10DS1125	150-1043-00		LT EMITTING DIO:RED,20MA,5V	50522	MV5774B
A10J1202	131-0608-00		TERMINAL,PIN:0.365 L X 0.25 PH,BRZ,GOLD PL (QUANTITY 6)	22526	47357
A10K1100	148-0131-00		RELAY, REED:100MA,28V,COIL 95 OHMS,5V	94696	W173 DIP-1
A10K1120	148-0131-00		RELAY, REED:100MA,28V,COIL 95 OHMS,5V	94696	W173 DIP-1
A10P1202	131-0993-00		BUS, CONDUCTOR:2 WIRE BLACK	00779	530153-2
A10Q1111	151-0435-00		TRANSISTOR:SILICON,PNP	80009	151-0435-00
A10Q1112	151-0435-00		TRANSISTOR:SILICON,PNP	80009	151-0435-00
A10Q1223	151-0188-03		TRANSISTOR:SILICON,PNP,SEL	80009	151-0188-03
A10Q1224	151-0190-05		TRANSISTOR:SILICON,NPN	80009	151-0190-05
A10Q1225	151-0190-05		TRANSISTOR:SILICON,NPN	80009	151-0190-05
A10Q1227	151-0190-05		TRANSISTOR:SILICON,NPN	80009	151-0190-05
A10R1002	325-0329-00		RES.,FXD,FILM:50 OHM,0.1%,1W	91637	CMF1/4 C50R00B
A10R1004	315-0470-00		RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
A10R1024	325-0329-00		RES.,FXD,FILM:50 OHM,0.1%,1W	91637	CMF1/4 C50R00B
A10R1025	315-0470-00		RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
A10R1026	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R1100	315-0181-00		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A10R1101	315-0181-00		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A10R1103	315-0301-00		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
A10R1104	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A10R1113	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1114	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1120	315-0181-00		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A10R1121	315-0181-00		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A10R1123	315-0301-00		RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
A10R1124	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A10R1213	315-0682-00		RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A10R1214	315-0682-00		RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A10R1220	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A10R1221	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A10R1301	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A10R1302	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A10R1304	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A10R1305	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A10R1306	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A10R1321	315-0183-00		RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835

Replaceable Electrical Parts—Comparator Head 015-0310-(01 & Up)

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10R1322	315-0683-00		RES., FXD, CMPSN: 68K OHM, 5%, 0.25W	01121	CB6835
A10R1324	315-0303-00		RES., FXD, CMPSN: 30K OHM, 5%, 0.25W	01121	CB3035
A10R1325	315-0152-00		RES., FXD, CMPSN: 1.5K OHM, 5%, 0.25W	01121	CB1525
A10R1326	315-0751-00		RES., FXD, CMPSN: 750 OHM, 5%, 0.25W	01121	CB7515
A10R1401	315-0303-00		RES., FXD, CMPSN: 30K OHM, 5%, 0.25W	01121	CB3035
A10R1402	315-0303-00		RES., FXD, CMPSN: 30K OHM, 5%, 0.25W	01121	CB3035
A10S1014	260-1875-00		SWITCH, ROCKER: DPDT, 5A, 120VAC	09353	U21-J1-Z-G
A10S1106	263-0019-01		ACTR ASSY, PB: MOMENTARY	80009	263-0019-01
A10S1110	263-0019-03		ACTR ASSY, PB: MOMENTARY	80009	263-0019-03
A10S1126	263-0019-01		ACTR ASSY, PB: MOMENTARY	80009	263-0019-01
A10U1201	156-0895-01		MICROCIRCUIT, DI: 14 BIT BINARY COUNTER	80009	156-0895-01
A10U1215	156-0494-01		MICROCIRCUIT, DI: HEX INVERTER, CHK	80009	156-0494-01
A10U1310	156-0366-01		MICROCIRCUIT, DI: DUAL D FLIP-FLOP CHK	80009	156-0366-01
A10VR1210	152-0227-00		SEMICONV DEVICE: ZENER, 0.4W, 6.2V, 5%	80009	152-0227-00
A10VR115	152-0227-00		SEMICONV DEVICE: ZENER, 0.4W, 6.2V, 5%	80009	152-0227-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

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

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

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

Abbreviations are based on ANSI Y1.1-1972.

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

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

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

Component Values

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

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μ F).

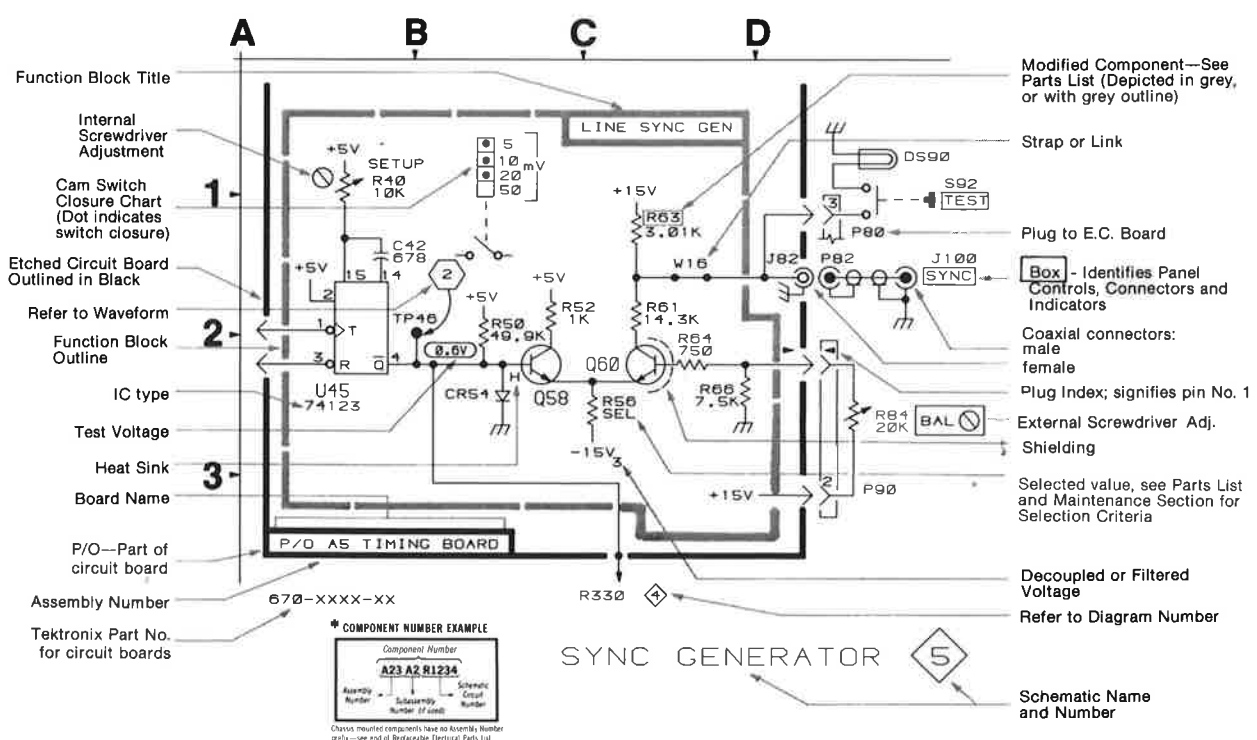
Resistors = Ohms (Ω).

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

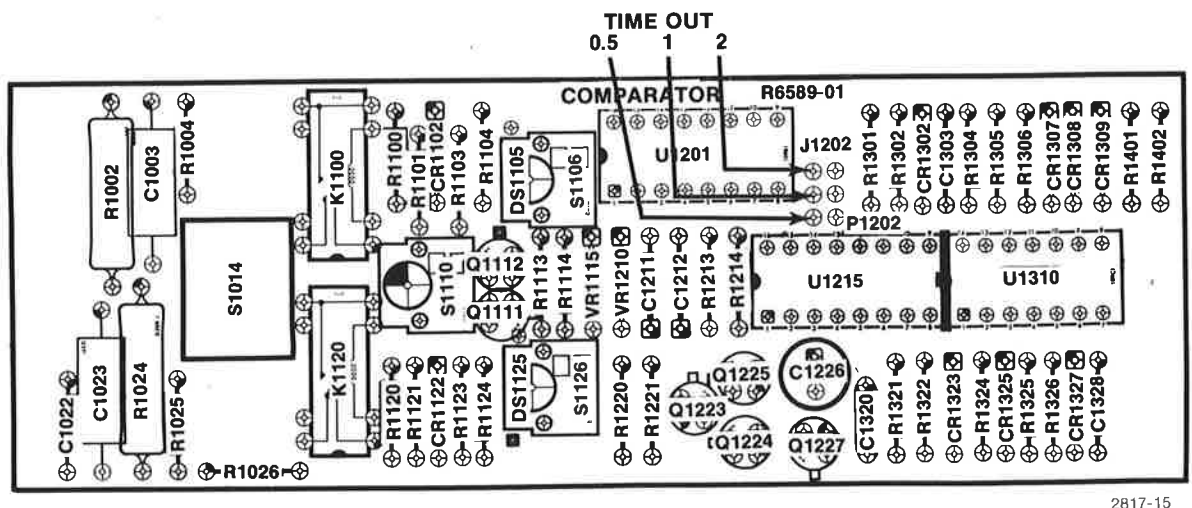
Assembly Numbers and Grid Coordinates

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.



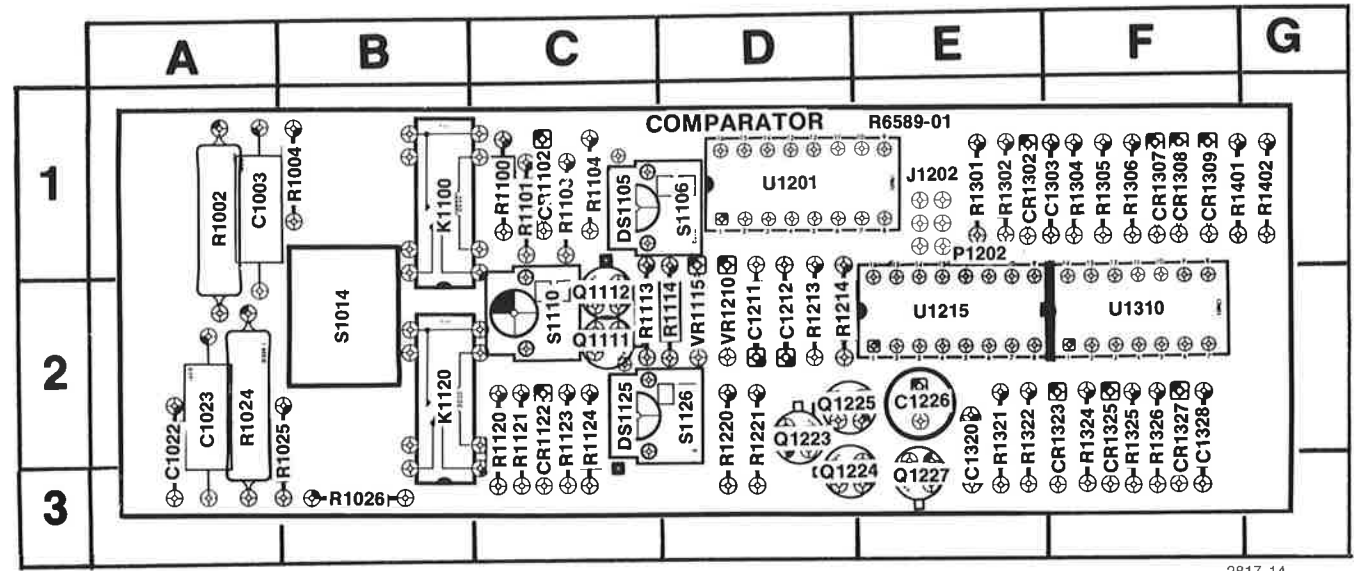
ADJUSTMENT LOCATIONS



2817-15

Fig. 8-2. Comparator Head board (A10).

PARTS LOCATION

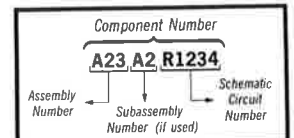


2817-14

Fig. 8-1. Comparator Head board (A10).

⊗ Static Sensitive Devices
See Maintenance Section

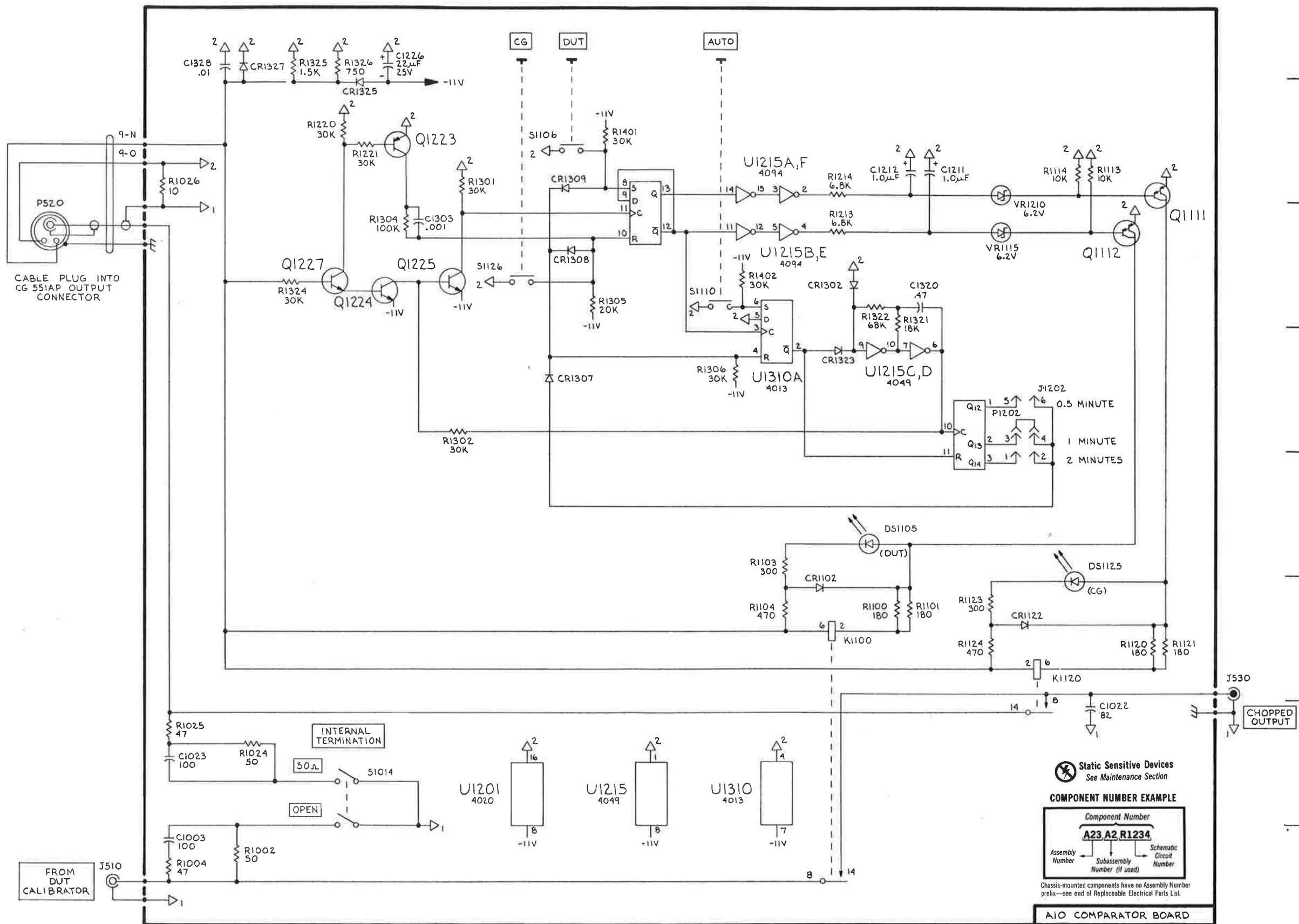
COMPONENT NUMBER EXAMPLE



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

A | B | C | D | E | F | H | J | K | L | M

1
2
3
4
5
6
7
8



COMPARATOR HEAD

CG 551AP

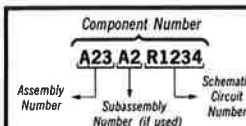
@
2B17-16

COMPARATOR HEAD

DD

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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

AIO COMPARATOR BOARD

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number
00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

```

1 2 3 4 5           Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    - - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    - - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
    - - - * - - -
  
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
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
89663	REESE, J. RAMSEY, INC.	71 MURRAY STREET	NEW YORK, NY 10007

Replaceable Mechanical Parts—Comparator Head 015-0310-(01 & Up)

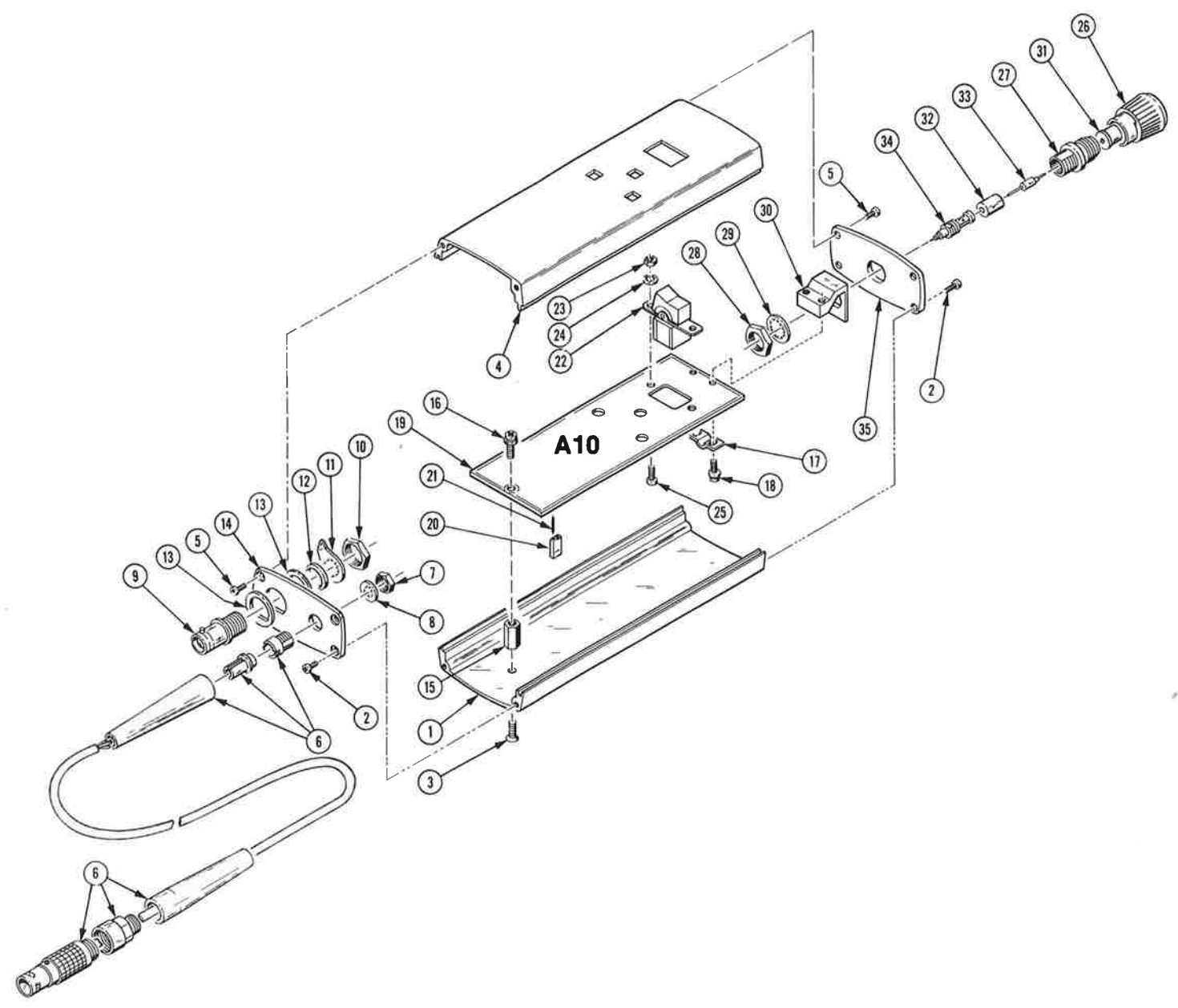
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	204-0772-01		1		BODY HALF, COMPA: BOTTOM (ATTACHING PARTS)	80009	204-0772-01
-2	211-0118-00		4		SCREW, MACHINE: 2-56 X 0.250 INCH, PNH STL	83385	OBD
-3	211-0105-00		1		SCREW, MACHINE: 4-40 X 0.188" 100 DEG, FLH STL - - - * - - -	83385	OBD
-4	204-0773-01		1		BODY HALF, COMPA: TOP (ATTACHING PARTS)	80009	204-0773-01
-5	211-0118-00		4		SCREW, MACHINE: 2-56 X 0.250 INCH, PNH STL - - - * - - -	83385	OBD
-6	175-2038-02		1		CA ASSY, SP, ELEC: 50 OHM COAX, 2, 30 AWG (ATTACHING PARTS)	80009	175-2038-02
-7	210-0583-00		1		NUT, PLAIN, HEX.: 0.25-32 X 0.312 INCH, BRS	73743	2X20317-402
-8	210-0046-00		1		WASHER, LOCK: INTL, 0.26 ID X 0.40" OD, STL - - - * - - -	78189	1214-05-00-0541C
-9	131-0955-00		1		CONNECTOR, RCPT, : BNC, FEMALE, W/HARDWARE (ATTACHING PARTS)	13511	31-279
-10	220-0495-00		1		NUT, PLAIN, HEX.: 0.375-32 X 0.438 INCH BRS	73743	OBD
-11	210-0255-00		1		TERMINAL, LUG: 0.391" ID INT TOOTH	80009	210-0255-00
-12	210-0840-00		1		WASHER, FLAT: 0.39 ID X 0.562 INCH OD, STL	89663	644R
-13	342-0117-00		2		INSULATOR, BSHG: 0.375 ID X 0.065 L, DELRIN - - - * - - -	80009	342-0117-00
-14	200-2097-04		1		COVER, END: REAR COMPARATOR ALUMINUM	80009	200-2097-04
-15	129-0419-00		1		POST, ELEC-MECH: HEX., 0.588 INCH LONG (ATTACHING PARTS)	80009	129-0419-00
-16	211-0116-00		1		SCR, ASSEM WSHR: 4-40 X 0.312 INCH, PNH BRS - - - * - - -	83385	OBD
-17	407-1983-01		1		BRACKET, COAX: BRASS (ATTACHING PARTS)		
-18	211-0180-00		2		SCR, ASSEM WSHR: 2-56 X 0.25 INCH, PNH BRS - - - * - - -	83385	OBD
-19	-----		1		CKT BOARD ASSY: COMPARATOR (SEE A10 EPL)		
-20	131-0993-00		1		. BUS, CONDUCTOR: 2 WIRE BLACK	00779	530153-2
-21	-----		6		. TERMINAL, PIN: (SEE A10J1202 EPL)		
-22	-----		1		. SWITCH, ROCKER: (SEE A10S1014 EPL) (ATTACHING PARTS)		
-23	210-0405-00		2		. NUT, PLAIN, HEX.: 2-56 X 0.188 INCH, BRS	73743	2X12157-402
-24	210-0001-00		2		. WASHER, LOCK: INTL, 0.092 ID X 0.18" OD, STL	78189	1202-00-00-0541C
-25	211-0022-00		2		. SCREW, MACHINE: 2-56 X 0.188 INCH, PNH STL - - - * - - -	83385	OBD
-26	205-0160-02		1		SHELL, ELEC CONN: W/ELEC CONN BODY SHELL	80009	205-0160-02
-27	204-0755-00		1		BODY, CONNECTOR: BNC, BRASS (ATTACHING PARTS)	80009	204-0755-00
-28	220-0495-00		1		NUT, PLAIN, HEX.: 0.375-32 X 0.438 INCH BRS	73743	OBD
-29	210-0012-00		1		WASHER, LOCK: INTL, 0.375 ID X 0.50" OD STL - - - * - - -	78189	1220-02-00-0541C
-30	220-0807-00		1		NUT BLOCK: (2) 2-56 THRU THD, ALUMINUM	80009	220-0807-00
-31	358-0072-00		1		INSULATOR, BSHG:	80009	358-0072-00
-32	342-0381-00		1		INSULATOR, BSHG: BNC	80009	342-0381-00
-33	131-2026-01		1		CONTACT, ELEC: W/PIN TERMINAL SOCKET		
-34	103-0195-01		1		ADAPTER, CONN: BNC TO CKT CD, W/RIGID COAX	80009	103-0195-01
-35	200-2097-03		1		COVER, END: FRONT, COMPARATOR	80009	200-2097-03
	175-2713-00		1		CABLE ASSY, RF: 50 OHM COAX, 6.0 L	80009	175-2713-00

C

C

C

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
	070-2817-00			1						MANUAL, TECH: INSTRUCTION 015-0310-01	80009	070-2817-00

ACCESSORIES

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

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

SERVICE NOTE

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

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

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

Comparison of Main Characteristics

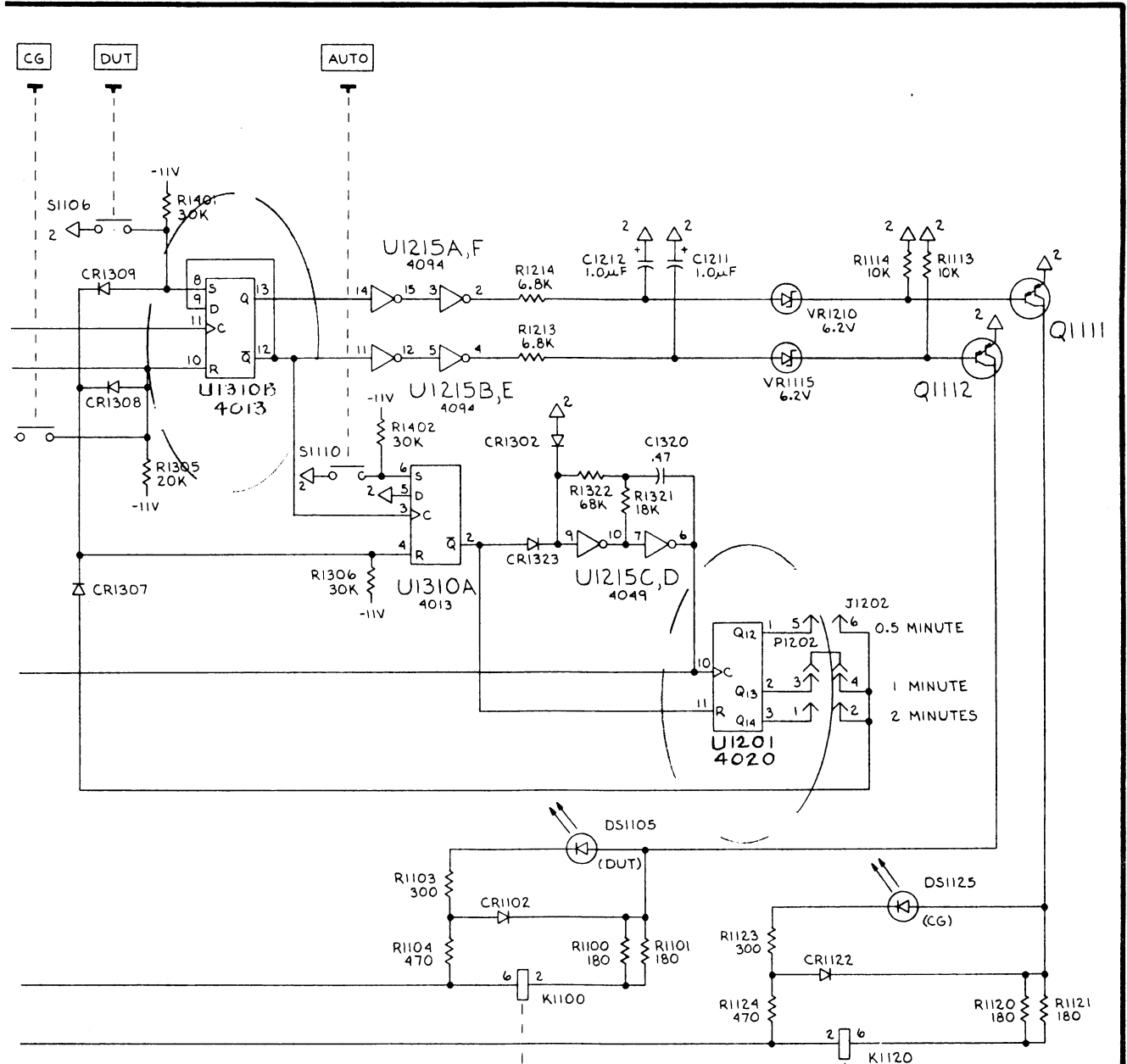
DM 501 replaces 7D13		
PG 501 replaces 107 108	PG 501 - Risetime less than 3.5 ns into 50 Ω. PG 501 - 5 V output pulse; 3.5 ns Risetime	107 - Risetime less than 3.0 ns into 50 Ω. 108 - 10 V output pulse 1 ns Risetime
PG 502 replaces 107 108 111	PG 502 - 5 V output PG 502 - Risetime less than 1 ns; 10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

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

DESCRIPTION

SCHMATIC CORRECTION

Add labels to microcircuits as shown below:



C

C

C

Product: COMPARATOR 015-0310-01 Date: 5-13-81 Change Reference: M43260
 Manual Part No.: 070-2817-00

DESCRIPTION

EFF SN B110316

REPLACEABLE ELECTRICAL PARTS AND SCHEMATIC CHANGES

CHANGE TO:

A10	670-6094-01	CKT BOARD ASSY:COMPARATOR
A10K1100	148-0142-00	RELAY,MERCURY
A10K1120	148-0142-00	RELAY,MERCURY
A10R1100	315-0241-00	RES.,FXD,CMPSN:240 OHM,5%,0.25W
A10R1101	315-0241-00	RES.,FXD,CMPSN:240 OHM,5%,0.25W
A10R1120	315-0241-00	RES.,FXD,CMPSN:240 OHM,5%,0.25W
A10R1121	315-0241-00	RES.,FXD,CMPSN:240 OHM,5%,0.25W

Change Comparator Head board as shown below.

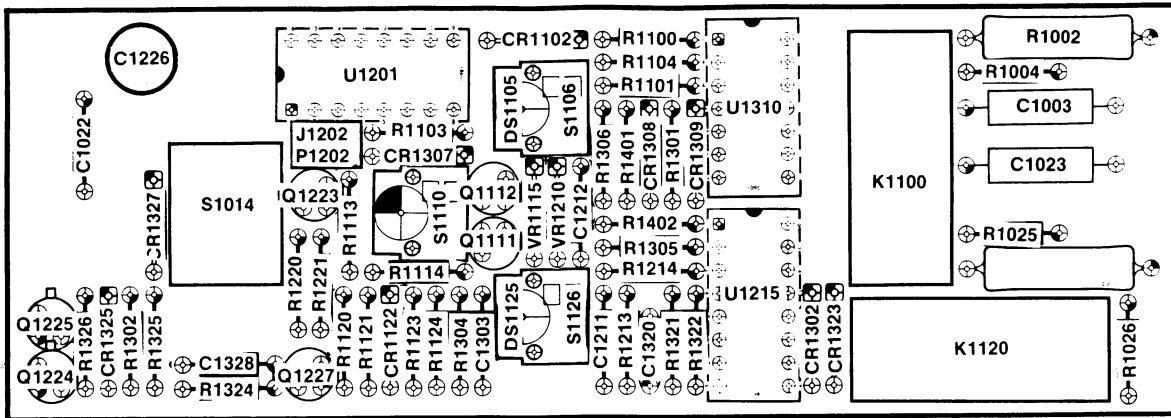


Fig. 8-1. Comparator Head board (A10).

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