I. BUBBLE MEMORY

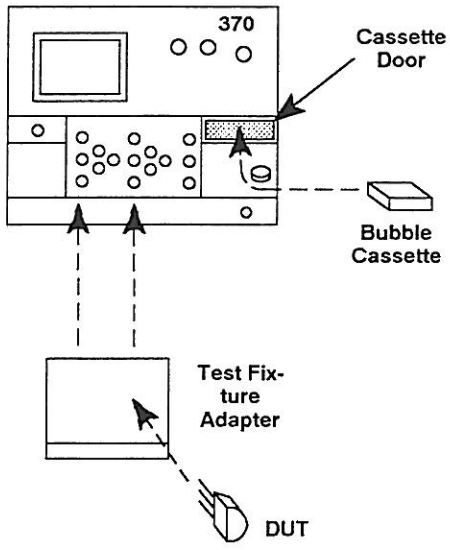
Equipment Required (see Table 4–3):

- Transistor (2N3904)
- Test Fixture Adapter (A1007)

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

I1 SETUP CONDITIONS



370 settings:

Initialize the 370.

6065-465

Installing the Bubble Memory Cassette

a. Install a bubble memory cassette in the 370.

The cassette used to initialize the 370 may be used for the remainder of this step if it has memory locations available.

Examining Memory Index Operation

b. Install a Test Fixture Adapter (A1007) on the 370.

c. Install a transistor (2N3904) in the right socket of the adapter and close the protective cover.

d. Change the following 370 settings:

DISPLAY
  VERTICAL
    CURRENT/DIV . . . . . 1 mA COLLECTOR
STEP GENERATOR
  STEP/OFFSET AMPLITUDE . . . . . 10 µA
Protective Cover . . . . . Open
LEFT-RIGHT-STANDBY . . . . . RIGHT

e. **EXAMINE** the MEMORY INDEX window for sequentially increasing or decreasing numbers as the MEMORY INDEX selector is pressed up or down.

Examining STORE Mode Operation

f. Set the MEMORY INDEX to a number (e.g., 2) and note the number for later use.

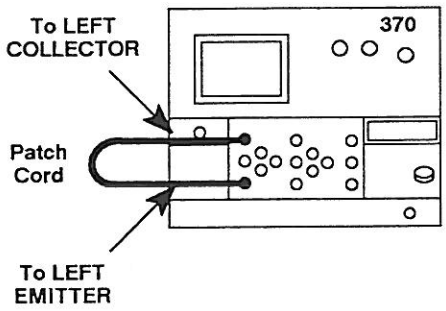
g. Rotate the COLLECTOR SUPPLY VARIABLE control to display a characteristic curve.

H10. Examining the Limiter Indicator in Current Mode

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications.*

H10 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
MAX PEAK VOLTS 80
MAX PEAK POWER WATTS 220
LEFT-RIGHT-STANDBY ..... LEFT

6065-464

Examining the Limiter at 220 W

a. **EXAMINE** the LIMITER indicator beside the COLLECTOR SUPPLY VARIABLE control for illumination when the COLLECTOR SUPPLY VARIABLE is rotated clockwise.

Examining the Limiter at 50 W

b. Change the following 370 settings:

DISPLAY
VERTICAL CURRENT/DIV .... 50 mA COLLECTOR
COLLECTOR SUPPLY
MAX PEAK POWER WATTS 50
VARIABLE 0%

c. **EXAMINE** the LIMITER indicator beside the COLLECTOR SUPPLY VARIABLE control for illumination when the COLLECTOR SUPPLY VARIABLE is rotated clockwise.

Examining Limiter at 10 W

d. Change the following 370 settings:

DISPLAY
VERTICAL
CURRENT/DIV ..... 5 mA COLLECTOR
COLLECTOR SUPPLY
MAX PEAK POWER WATTS 10
VARIABLE 0%

e. **EXAMINE** the LIMITER indicator beside the COLLECTOR SUPPLY VARIABLE control for illumination when the COLLECTOR SUPPLY VARIABLE is rotated clockwise.

Removing the Setup

f. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

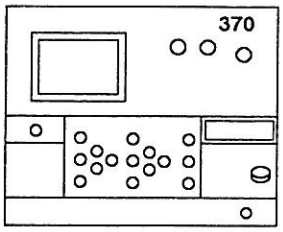
g. Remove the Patch Cord from the 370.

H9. Examining the Limiter Indicator in Voltage Mode

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

H9 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
MAX PEAK VOLTS 400

6065-463

Examining the Limiter Indicator for LOW Range

j. **EXAMINE** the LIMITER indicator beside the COLLECTOR SUPPLY VARIABLE control for illumination when the COLLECTOR SUPPLY VARIABLE is rotated clockwise.

Examining the Limiter Indicator for HIGH Range

k. Change the following 370 setting:

COLLECTOR SUPPLY
MAX PEAK VOLTS HIGH-LOW . . . . . HIGH

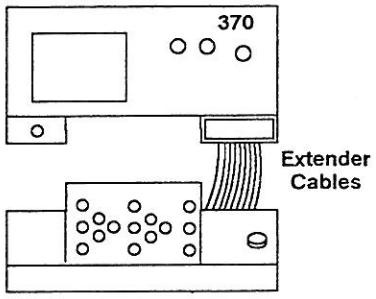
l. **EXAMINE** the LIMITER indicator beside the COLLECTOR SUPPLY VARIABLE control for illumination on when the COLLECTOR SUPPLY VARIABLE is rotated clockwise.

H8. Checking the Timer Board Ouput

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

H9 SETUP CONDITIONS



370 settings:

Then set the following controls as indicated.

POWER ..... OFF

Test Equipment settings:

Digital Multimeter:
Mode ..... DC Volts
Test Oscilloscope:
Vertical sensitivity ..... 2 V/division
Horizontal ..... 20 ms/division
Trigger slope ..... Negative slope (-)

6065-472

Removing the Test Fixture Module

a. Remove the 370 Test Fixture Module from the 370 mainframe.

NOTE

For details on removing the Test Fixture Module, see the instructions under "Component Removal and Replacement" in Section 4, Maintenance.

b. Connect two extender cables between the 370 mainframe and the test fixture module.

Checking ARC(L) Output

c. Connect the oscilloscope probe to J168B pin 8 on the A60 Timer Board.

d. Change the following 370 setting:

POWER ..... ON

e. With the Protective Cover in place, open and close the Protective Cover several times.

f. **CHECK** that each time the Protective Cover is opened or closed, the voltage monitored by the oscilloscope transitions to a low TTL level and remains at this level for 80 to 120 ms.

Installing the Test Fixture Module

g. Change the following 370 setting:

POWER ..... OFF

h. Remove the oscilloscope probe and the extender cables and re-install the Test Fixture Module.

i. Change the following 370 setting:

POWER ..... ON

Adjusting 80 V Looping

f. Change the following 370 settings:

DISPLAY
HORIZONTAL VOLTS/DIV ..... 10 V COLLECTOR
COLLECTOR SUPPLY
MAX PEAK POWER WATTS 50
MAX PEAK VOLTS 80
VARIABLE 100%
LOOPING COMPENSATION ..... Minimum trace width

g. **EXAMINE** the displayed trace for the beginning to be at one point.

If the beginning is not at one point, the following adjustment is necessary.

h. **ADJUST** 80 V Looping adjustment R502 on the A8 HV Relay Board to match the trace start points.

Installing the Test Fixture Module

NOTE

If step H8 will be performed, do H8 before replacing the Test Fixture Module.

i. Change the following 370 setting:

POWER ..... OFF

j. Remove the extenders and re-install the Test Fixture Module.

k. Change the following 370 setting:

POWER ..... ON

H7b. Adjusting Looping Compensation–Alternate Method (A9R500, A8R504, A8R502)

IMPORTANT:

Only perform this step if satisfactory looping compensation cannot be obtained with the preceding step (H7a).

Removing the Test Fixture Module

a. Change the following 370 setting:

POWER ..... OFF

b. Remove the 370 Test Fixture Module from the 370 mainframe.

NOTE

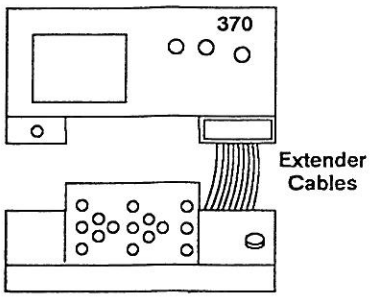
For details on removing the Test Fixture Module, see the instructions under "Component Removal and Replacement" in Section 4, Maintenance.

c. Connect two extender cables between the 370 mainframe and the test fixture module.

d. Change the following 370 setting:

POWER ..... ON

H7b SETUP CONDITIONS



370 settings:

Set the following controls as indicated.

Protective Cover ..... Closed
DISPLAY
Mode ..... NON-STORE
VERTICAL
CURRENT/DIV ..... 1 µA COLLECTOR
MAG MODE ..... X1 VERT
COLLECTOR SUPPLY
VARIABLE 100%
MAX PEAK POWER WATTS 220
DISPLAY
MAG OFFSET ..... Press the INCR button ten times to place the trace at graticule center
MAG MODE ..... X10 VERT
LOOPING COMPENSATION ..... Minimum trace width

6065-472

Adjusting 16 V Looping

NOTE

See **Test Point and Adjustment Locations 2** *in Section 7 for the location of the adjustments associated with this step.*

e. **ADJUST** Looping Comp adjustment R500 on the A9 LV Relay Board and 16V Looping adjustment R504 on the A8 HV Relay Board to match trace start points.

f. **EXAMINE** the displayed trace for optimum overlay of the two loops.

If the overlay is not optimum, the following adjustment is necessary.

Adjusting 80 V Looping

g. **ADJUST** 80V Looping adjustment R502 on the A8 HV Relay Board for optimum overlay of the loops.

Set the front-panel LOOPING COMPENSATION control for minimum trace width.

NOTE

If satisfactory looping compensation cannot be obtained with this step, perform the following alternate step, H7b.

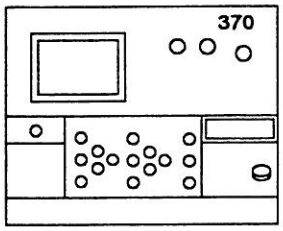
H7a. Examining Looping Compensation

Adjusting 16 V and 80 V Looping Compensation (A8R504, A8R502)

IMPORTANT:

The characteristics examined in this step are provided as examples of typical instrument operation to aid in the adjustment of R502 and R504; *they are not specifications*.

H7a SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
VERTICAL
CURRENT/DIV ..... 1 μA COLLECTOR
MAG MODE ..... X1 VERT
COLLECTOR SUPPLY
VARIABLE 100%
MAX PEAK POWER WATTS 220
Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

6065-461

Examining 16 V Looping

a. Press the DISPLAY MAG OFFSET INCR button ten times to move the trace to graticule center.

b. Set the front-panel LOOPING COMPENSATION control for a slightly open loop.

c. **EXAMINE** the displayed trace for optimum overlay of the two loops (see Figure 4-6). If the overlay is not optimum, the following adjustment is necessary.

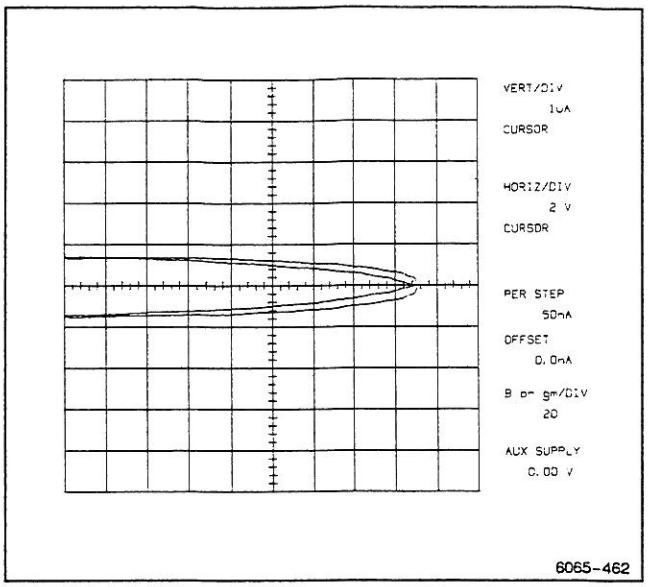


Figure 4-6. Looping compensation display.

Adjusting 16 V Looping

NOTE

See **Test Point and Adjustment Locations 2** *in Section 7 for the location of the adjustments associated with this step.*

d. **ADJUST** 16V Looping adjustment R504 on the A8 HV Relay Board for optimum overlay of the loops.

Examining 80 V Looping

e. Change the following 370 settings:

DISPLAY
HORIZONTAL VOLTS/DIV ..... 10 V COLLECTOR
COLLECTOR SUPPLY
MAX PEAK POWER WATTS 50
MAX PEAK VOLTS 80
VARIABLE 100%
LOOPING COMPENSATION ..... Slightly open loop

Table 4–26
Series Resistor Check

COLLECTOR SUPPLY HIGH–LOW	MAX PEAK VOLTS Setting	MAX PEAK POWER WATTS Setting	Digital Multimeter Reading
LOW	16	220	0.16 Ω to 0.36 Ω
LOW	16	50	1.3 Ω to 1.4 Ω
LOW	16	10	6.08 Ω to 6.72 Ω
LOW	16	2	30.4 Ω to 33.6 Ω
LOW	16	0.4	152 Ω to 168 Ω
LOW	16	0.08	760 Ω to 840 Ω
LOW	400	10	3.8 kΩ to 4.2 kΩ
LOW	400	2	19 kΩ to 21 kΩ
LOW	400	0.4	95 kΩ to 105 kΩ
LOW	400	0.08	475 kΩ to 525 kΩ
HIGH	2000	50	20 kΩ[1] to 22 kΩ[1]
HIGH	2000	10	96 kΩ[1] to 106 kΩ[1]
HIGH	2000	2	466 kΩ[1] to 512 kΩ[1]
HIGH	2000	0.4	2.15 MΩ[2] to 2.38 MΩ[2]
HIGH	2000	0.08	7.91 MΩ[2] to 8.75 MΩ[2]

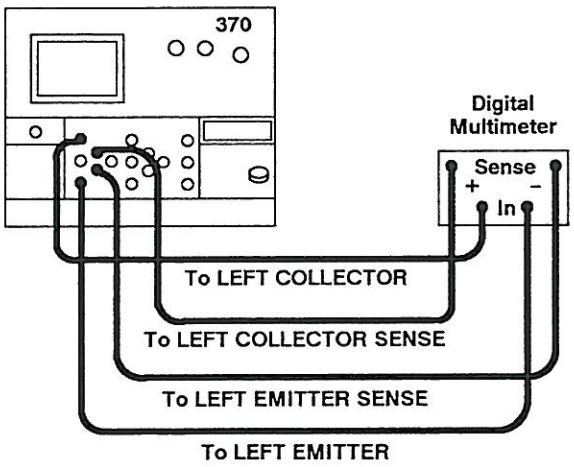
[1]Includes 1 kΩ collector supply transformer resistance.
[2]Includes 25 MΩ horizontal sense attenuator resistance in parallel.

H6. Checking Series Resistance

Specifications:

- Minimum series resistance values for the 16, 80, 400, and 2000 MAX PEAK VOLTS settings are 0.26 Ω, 6.4 Ω, 160 Ω, and 20 kΩ respectively.
- Maximum series resistance values are 800 Ω, 20 kΩ, 500 kΩ, and 12.5 MΩ.
- Series Resistance accuracy is the greater of ±5% or 0.1 Ω, and applies to the following resistance values (in Ω): 0.26, 1.3, 6.4, 32, 160, 800, 4 k, 20 k, 100 k, 500 k, 12.5 M.
- The MAX PEAK POWER WATTS selector selects the following settings (in W): 220, 50, 10, 2, 0.4, 0.08.

H6 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
HORIZONTAL
VOLTS/DIV ..... 200 V COLLECTOR
COLLECTOR SUPPLY
MAX PEAK POWER WATTS 220
POLARITY ..... AC
Protective Cover ..... Open
LEFT-RIGHT-STANDBY ..... LEFT

Test Equipment settings:
Digital Multimeter:
Mode ..... Resistance

6065-460

Checking Resistance Accuracy

a. **CHECK** that the digital multimeter reading is within the limits specified in Table 4-26 for each combination of MAX PEAK VOLTS AND MAX PEAK POWER WATTS settings.

Removing the Setup

b. Disconnect the digital multimeter from the 370.

IF UNIT FAILS F6 SERIES RESISTANCE
REPLACE K214 ON A9 BOARD.

Table 4–25
Collector Supply Short Circuit Current

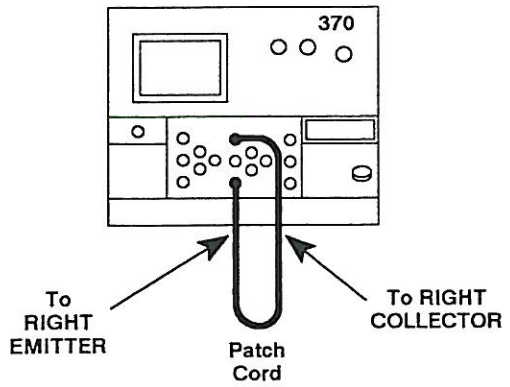
MAX PEAK VOLTS Setting	MAX PEAK POWER WATTS	VERTICAL CURRENT/DIV Setting	HORIZONTAL VOLTS/DIV Setting	Vertical CURSOR Readout
16 V	220	2 A	2 V	≥10 A
80 V	220	500 mA	10 V	≥2 A
400 V	220	100 mA	50 V	≥400 mA
2000 V	50	20 mA	200 V	≥50 mA

H5. Checking Collector Supply Short Circuit Current

Specification:

- Maximum Peak Current is ≥10 A for the 16 V COLLECTOR SUPPLY, ≥2 A for 80 V, 400 mA for 400 V, and 50 mA for 2000 V.

H5 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
MAX PEAK POWER WATTS 220
VARIABLE 100%
LEFT-RIGHT-STANDBY . . . . . RIGHT
CURSOR Mode . . . . . DOT

6065-459

Checking 16 V Maximum Current

a. Use the CURSOR arrow position buttons to set the cursor dot to the top of the trace.

b. **CHECK** that the vertical CURSOR readout is within the limits specified in Table 4-25.

Checking 80 V Maximum Current

c. Change the following 370 settings:

DISPLAY
VERTICAL CURRENT/DIV . . . . . 500 mA
COLLECTOR SUPPLY
MAX PEAK VOLTS 80
VARIABLE 100%

d. **CHECK** Short Circuit Current for 80 MAX PEAK VOLTS by repeating parts a and b.

Checking 400 V Maximum Current

e. Change the following 370 settings:

DISPLAY
HORIZONTAL VOLTS/DIV . . . . . 50 V COLLECTOR
VERTICAL CURRENT/DIV . . . . . 100 mA
COLLECTOR SUPPLY
MAX PEAK VOLTS 400
VARIABLE 100%

f. **CHECK** Short Circuit current for 400 MAX PEAK VOLTS by repeating parts a and b.

Checking 2000 V Maximum Current

g. Change the following 370 settings:

DISPLAY
VERTICAL CURRENT/DIV . . . . . 20 mA
COLLECTOR SUPPLY
MAX PEAK VOLTS LOW-HIGH . . . . . HIGH
VARIABLE 100%

h. **CHECK** Short Circuit Current for 2000 MAX PEAK VOLTS by repeating parts a and b.

Removing the Setup

i. Change the following 370 settings:

COLLECTOR SUPPLY
MAX PEAK VOLTS LOW-HIGH . . . . . LOW
LEFT-RIGHT-STANDBY . . . . . STANDBY

j. Remove the patch cord from the 370.

Table 4–24
Collector Supply Max Peak Volts

MAX PEAK VOLTS Setting	HORIZONTAL VOLTS/DIV Setting	Horizontal CURSOR Readout Limits	Maximum Spot Width (Ripple)
16	2 V	16.00 V to 17.60 V	320 mV
80	10 V	80.00 V to 88.00 V	1.6 V
400	50 V	400.0 V to 440.0 V	8.0 V
2000	500 V	2000 V to 2200 V	40 V

Checking 2000 MAX PEAK VOLTS

g. Change the following 370 settings:

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 500 V COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK VOLTS LOW-HIGH ..... HIGH
  VARIABLE 100%

h. **CHECK** the horizontal CURSOR readout for a reading within the limits given in Table 4-24 for 2000 MAX PEAK VOLTS.

Checking 2000 MAX PEAK VOLTS Ripple

i. Change the following 370 settings:

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 500 V COLLECTOR
    Mode ..... NON-STORE
COLLECTOR SUPPLY
  POLARITY ..... + DC
DISPLAY
  MAG MODE ..... HORIZ X1.

j. With the Collector Supply VARIABLE remaining at 100%, use the MAG DECR button to move the displayed spot near the center of the bottom line of the graticule.

k. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X10

l. **CHECK** the displayed spot for its width to be within the limit given in Table 4-24 for 2000 MAX PEAK VOLTS.

Checking 400 MAX PEAK VOLTS Ripple

m. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X1
  MAG OFFSET ..... ZERO
  HORIZONTAL VOLTS/DIV ..... 50 V COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK VOLTS LOW-HIGH ..... LOW
  MAX PEAK VOLTS 400
  VARIABLE 100%

n. With the Collector Supply VARIABLE remaining at 100%, use the MAG DECR button to move the displayed spot near the center of the bottom line of the graticule.

o. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HOPRIZ X10

p. **CHECK** the displayed spot for its width to be within the limit given in Table 4-24 for 400 MAX PEAK VOLTS.

Checking 80 MAX PEAK VOLTS Ripple

q. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X1
  MAG OFFSET ..... ZERO
  HORIZONTAL VOLTS/DIV ..... 10 V COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK VOLTS 80
  VARIABLE 100%

r. With the Collector Supply VARIABLE remaining at 100%, use the MAG DECR button to move the displayed spot near the center of the bottom line of the graticule.

s. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X10

t. **CHECK** the displayed spot for its width to be within the limit given in Table 4-24 for 80 MAX PEAK VOLTS.

Checking 16 MAX PEAK VOLTS Ripple

u. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X1
  MAG OFFSET ..... ZERO
  HORIZONTAL VOLTS/DIV ..... 2 V COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK VOLTS 16
  VARIABLE 100%

v. With the Collector Supply VARIABLE remaining at 100%, use the MAG DECR button to move the displayed spot near the center of the bottom line of the graticule.

w. Change the following 370 settings:

DISPLAY
  MAG MODE ..... HORIZ X10

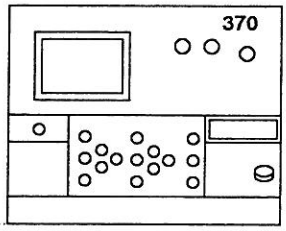
x. **CHECK** the displayed spot for its width to be within the limit given in Table 4-24 for 16 MAX PEAK VOLTS.

H4. Checking Collector Supply Max Peak Volts Range, Accuracy, and Ripple

Specifications:

- MAX PEAK VOLTS selections include 16, 80, 400, and 2000.
- MAX PEAK VOLTS accuracy for the COLLECTOR SUPPLY is + 10% and −0% for the 16, 80, 400, and 2000 V settings.
- DC Mode Ripple is 2% or less of the voltage or 0.1% of the full range voltage.

H4 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
MAX PEAK POWER WATTS 50
VARIABLE 100%
CURSOR Mode . . . . . DOT
Protective Cover . . . . . Closed

6065-458

Checking 16 Max Peak Volts

a. Use the CURSOR position arrows to set the cursor dot to the right end of the trace extending along the bottom horizontal graticule line from the lower left corner.

b. **CHECK** the horizontal CURSOR readout for a reading within the limits given in Table 4-24 for 16 MAX PEAK VOLTS.

Checking 80 MAX PEAK VOLTS

c. Change the following 370 settings:

DISPLAY
HORIZONTAL VOLTS/DIV . . . . 10 V COLLECTOR
COLLECTOR SUPPLY
MAX PEAK VOLTS 80
VARIABLE 100%

d. **CHECK** the horizontal CURSOR readout for a reading within the limits given in Table 4-24 for 80 MAX PEAK VOLTS.

Checking 400 MAX PEAK VOLTS

e. Change the following 370 settings:

DISPLAY
HORIZONTAL VOLTS/DIV . . . . . 50 V COLLECTOR
COLLECTOR SUPPLY
MAX PEAK VOLTS 400
VARIABLE 100%

f. **CHECK** the horizontal CURSOR readout for a reading within the limits given in Table 4-24 for 400 MAX PEAK VOLTS.

Examining –LEAKAGE POLARITY

l. Change the following 370 setting:

COLLECTOR SUPPLY
POLARITY ..... –LEAKAGE
VARIABLE 0%

m. **EXAMINE** the display for the spot to move from the upper right corner–along the top horizontal graticule line–as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise to 100%.

Examining +DC POLARITY

n. Change the following 370 settings:

COLLECTOR SUPPLY
POLARITY ..... +DC

o. **EXAMINE** the display for the spot to move from the lower left corner–along the bottom horizontal graticule line–as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise to 100%.

Examining +LEAKAGE POLARITY

p. Change the following 370 setting:

COLLECTOR SUPPLY
POLARITY ..... +LEAKAGE
VARIABLE 0%

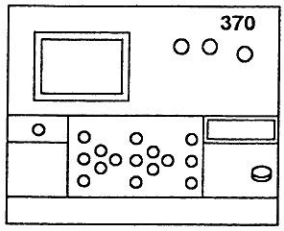
q. **EXAMINE** the display for the spot to move from the lower left corner–along the bottom horizontal graticule line–as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise to 100%.

H3. Examining the Protective Cover Interlock and Polarity Settings

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

H3 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
VARIABLE 100%
CURSOR Mode ..... DOT

6065-458

Examining the Protective Cover Interlock and Warning Indicators

a. **EXAMINE** the display for the horizontal trace to extend along the bottom horizontal graticule line from the lower left corner.

b. Change the following 370 setting:

Protective Cover ..... Open

c. **EXAMINE** the 370 for the following:

- The displayed trace returns to a spot in the lower left corner
- The DISABLED LED turns on
- The WARNING LED turns off

d. Change the following 370 settings:

Protective Cover ..... Closed

e. **EXAMINE** the 370 for the following:

- The displayed spot returns to a trace
- The DISABLE LED turns off
- The WARNING LED turns on

Examining AC POLARITY

f. Change the following 370 settings:

COLLECTOR SUPPLY
POLARITY ..... AC
VARIABLE 100%

g. **EXAMINE** the display for a horizontal trace starting from graticule center and extending out of the display area.

Examining – POLARITY

h. Change the following 370 settings:

COLLECTOR SUPPLY
POLARITY ..... –
VARIABLE 100%

i. **EXAMINE** the display for a horizontal trace extending along the top horizontal graticule line from the upper right corner.

Examining –DC POLARITY

j. Change the following 370 settings:

COLLECTOR SUPPLY
POLARITY ..... –DC
INTENSITY ..... VISIBLE DISPLAY

k. **EXAMINE** the display for the spot to move from the upper right corner–along the top horizontal graticule line–as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise to 100%.

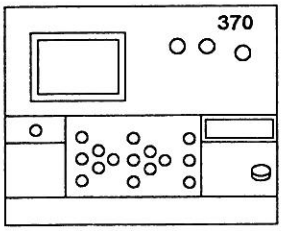
H2. Adjusting Collector Supply Gain (A6R401)

IMPORTANT:

The characteristic examined in this step is provided as an example of typical instrument operation to aid in the adjustment of R401.

Although not a specification, Collector Supply Gain may affect the accuracy of MAX PEAK VOLTS when checked in step H4.

H2 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  HORIZONTAL
    VOLTS/DIV . . . . . 200 V COLLECTOR
COLLECTOR SUPPLY
  POLARITY . . . . . +DC
  MAX PEAK VOLTS LOW-HIGH . . . . . HIGH
  MAX PEAK POWER WATTS 50
CURSOR Mode . . . . . DOT
Protective Cover . . . . . Closed

6065-457

Adjusting Collector Supply Gain

a. Change the following 370 setting:

COLLECTOR SUPPLY
  VARIABLE . . . . . Position the displayed spot on the graticule line that forms the right graticule edge.

b. **EXAMINE** the horizontal CURSOR readout for a reading of 2000 V. If the horizontal CURSOR readout is not 2000 V, the following adjustment is necessary.

NOTE

See **Test Point and Adjustment Locations 2** *in Section 7 for the location of the adjustment associated with this step.*

c. **ADJUST** CS Gain adjustment R401 on the A6 Collector Supply Board for a horizontal CURSOR readout of 2000 V.

R401 can be adjusted through the access hole in the protective shield.

Adjusting Collector Supply Offset

f. Change the following Test Equipment setting:

DIGITAL MULTIMETER
MODE ..... DC VOLTAGE

g. Connect the digital multimeter test leads to pin 1 and pin 3 of P62. (These are the COLLECT-OUT and ground pins.)

h. Change the following 370 setting:

POWER ..... ON

i. **ADJUST** CS OFFSET adjustment R412 on the A6 Collector Supply Board for a digital multimeter readout of 0.0 mV ±1 mV.

j. Change the following 370 settings:

COLLECTOR SUPPLY
POLARITY ..... + DC
MAX PEAK POWER WATTS ..... 220 W
VARIABLE 100%
CURSOR ..... DOT

k. **CHECK** that the Horizontal CURSOR readout displays a reading of 16.0 to 17.6 V. If not, readjust CS OFFSET for a CURSOR reading within that range.

Removing the Setup

l. Change the following 370 setting:

POWER ..... OFF

m. Remove the digital multimeter test leads from the 370.

n. Replace the electrical shield.

o. Change the following 370 setting:

POWER ..... ON

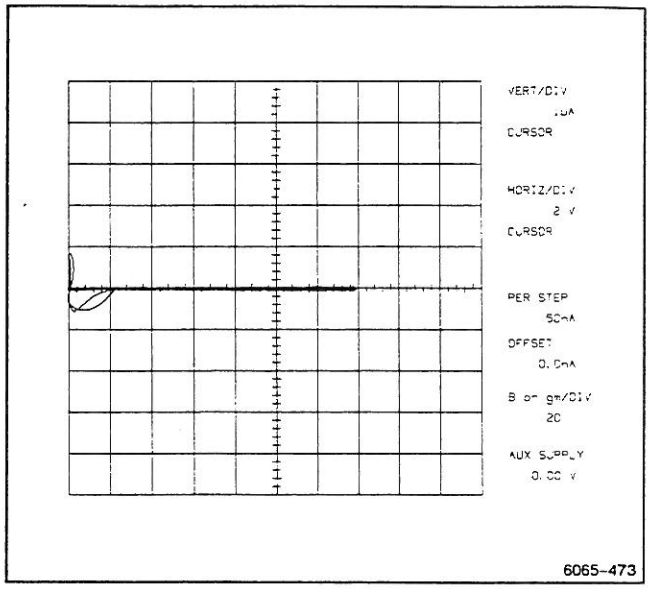


Figure 4–5. Switching noise display.

H. COLLECTOR SUPPLY

Equipment Required (see Table 4-3):	• Digital Multimeter • Extender Cables (2; for an alternate step)

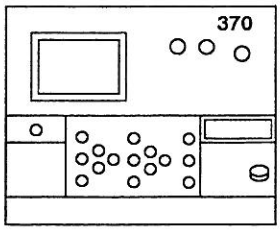
H1. Examining Collector Supply Variable Operation

Adjusting Collector Supply Offset (A6R412)

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

H1 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  Mode ..... NON-STORE
VERTICAL
  CURRENT/DIV ..... 1 μA COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 50
Protective Cover ..... Closed

6065-455

Examining Collector Supply Variable Operation

a. **EXAMINE** the display, as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise, for the spot to become a horizontal line starting in the lower left corner and extending continuously to the right along the bottom horizontal graticule.

b. Change the following 370 settings:

LOOPING COMPENSATION ..... Minimum looping
COLLECTOR SUPPLY
  VARIABLE 0%

c. **EXAMINE** the LED display beside the COLLECTOR SUPPLY VARIABLE control and note that it lights up and extends toward 100 % as the COLLECTOR SUPPLY VARIABLE control is rotated clockwise.

Removing the Electrical Shield

d. Change the following 370 settings:

POWER ..... OFF

WARNING

To avoid electric shock hazard, be certain the 370 POWER switch is set to OFF before removing or replacing the electrical shield and connecting the digital multimeter to the 370.

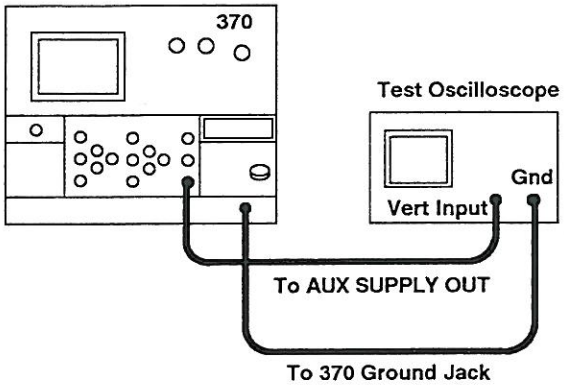
e. Use a #1 Pozidrive screwdriver to remove the electric shield on the left side of the 370 that covers the A6 Collector Supply Board. (These are three shields on the left side; remove the rear shield.)

G3. Checking Aux Supply Ripple and Noise

Specification:

- Displayed Ripple and Noise is less than 50 mV peak to peak.

G3 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following control as indicated.

AUX SUPPLY ..... +40.00 V

Test Equipment settings:

Test Oscilloscope
- Vertical Sensitivity ..... 10 mV/division
- Vertical Coupling ..... AC
- Horizontal ..... 5 ms/division
- Trigger ..... Auto

6065-454

Checking Ripple and Noise

a. **CHECK** that any ripple or noise displayed on the test oscilloscope does not exceed 50 mV peak to peak.

b. Change the following 370 setting:

AUX SUPPLY ..... -40.00 V

Press FAST and the AUX SUPPLY down arrow button to set the AUX SUPPLY to -40.00 volts.

c. **CHECK** that any ripple or noise displayed on the test oscilloscope does not exceed 50 mV peak to peak.

Removing the Setup

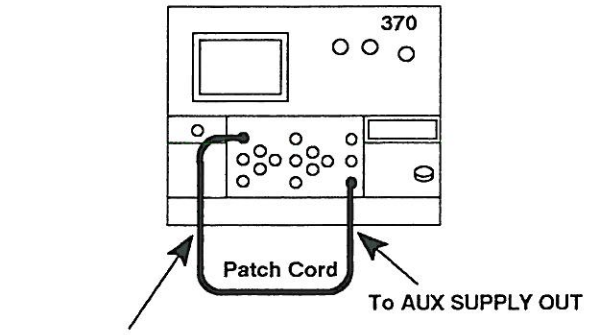
d. Disconnect the test oscilloscope from the 370.

G2. Checking Aux Supply Maximum Output Current

Specification:

- Output Current is 10 mA for AUXILIARY SUPPLY output between −40 V and +40 V, and at least 100 mA between −20 V and +20 V.

G2 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  VERTICAL
    CURRENT/DIV ..... 5 mA COLLECTOR
  HORIZONTAL
    VOLTS/DIV ..... 10 V COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 0.4
  MAX PEAK VOLTS 80
  POLARITY ..... AC
AUX SUPPLY ..... 40.0 V
LEFT-RIGHT-STANDBY ..... LEFT
CURSOR Mode ..... DOT

6065-453

Checking 10 mA at ±40 V

a. **CHECK** that the vertical CURSOR readout is between −9.37 and −10.70 mA.

b. Change the following 370 setting:

AUX SUPPLY ..... −40.00 V

Press and hold the FAST and AUX SUPPLY down arrow button to set the AUX SUPPLY to −40.00 V.

c. **CHECK** that the vertical CURSOR readout is between 9.37 and 10.70 mA.

Checking 100 mA at ±20 V

d. Change the following 370 settings:

DISPLAY
  VERTICAL
    CURRENT/DIV ..... 50 mA COLLECTOR
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 10
AUX SUPPLY ..... +20.00

e. **CHECK** that the vertical CURSOR readout is at least −100 mA.

f. Change the following 370 setting:

AUX SUPPLY ..... −20.00 V

Press and hold the FAST and AUX SUPPLY down arrow button to set the AUX SUPPLY to −20 V.

g. **CHECK** that the vertical CURSOR readout is at least 100 mA.

h. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

Removing the Setup

i. Remove the patch cord from the 370.

f. Change the following 370 setting:

AUX SUPPLY . . . . . +40.00 V (as indicated in the AUX SUPPLY readout)

Press and hold the FAST and AUX SUPPLY up arrow button to set the AUX SUPPLY to +40.00 V.

g. **CHECK** that the digital multimeter measurement is within the limits given in Table 4–23 for +40.00 V.

Removing the Setup

h. Disconnect the digital multimeter leads from the 370.

G. AUX SUPPLY

Equipment Required (see Table 4–3):

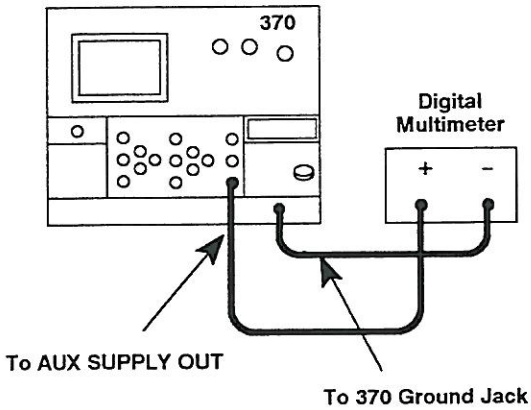
- Test Oscilloscope
- Digital Multimeter

G1. Checking Aux Supply Accuracy, Resolution, and Range

Specifications:

- The Aux Supply is accurate to less than (50 mV + 1.5% of the total output).
- Resolution is 20 mV.
- Range is from −40 V to +40 V.

G1 SETUP CONDITIONS



370 settings:

Initialize the 370.

Test Equipment settings:
Digital Multimeter
Mode ..... DC Voltage

6065-452

Checking Accuracy

a. **CHECK** that the AUX SUPPLY readout on the 370 display is 0.00 V.

b. **CHECK** that the digital multimeter reading is within the limits given in Table 4–23 for 0.00 V.

Table 4–23
AUX SUPPLY Accuracy

AUX SUPPLY Readout	Digital Multimeter Reading
0.00 V	±0.05 V
−40.00 V	−39.35 to −40.65 V
+40.00 V	+39.35 to +40.65 V

Checking Resolution

c. **CHECK** that each time one of the AUX SUPPLY arrow buttons (up or down) is pressed, the AUX SUPPLY readout and digital multimeter reading change by 20 mV.

Checking Range

d. Change the following 370 setting:

AUX SUPPLY ..... −40.00 V (as indicated in the AUX SUPPLY readout)

Press and hold the FAST and AUX SUPPLY down arrow button to set the AUX SUPPLY to −40.00 V.

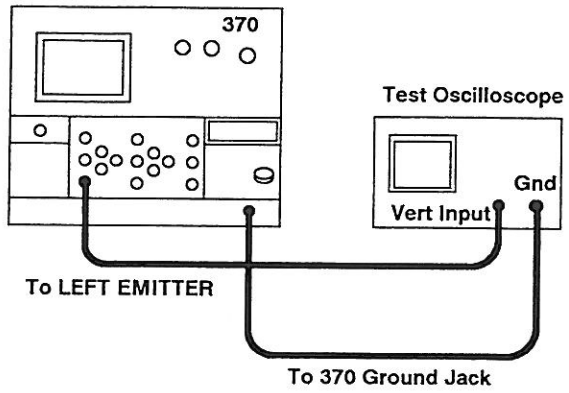
e. **CHECK** that the digital multimeter measurement is within the limits given in Table 4–23 for −40.00 V.

F20. Examining Emitter Configuration Selections for Internal and External Step Generator Operation

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

F20 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 1 V
NUMBER OF STEPS 10
CONFIGURATION ..... EMITTER STEP GEN
Protective Cover ..... Open

Test Equipment settings:
Test Oscilloscope:
Vertical sensitivity ..... 2 V/division
Horizontal ..... 10 ms/division
Trigger ..... Auto

6065-456

Examining Internal Operation for LEFT

a. **EXAMINE** the test oscilloscope for a step waveform display.

Examining Internal Operation for RIGHT

b. Connect the test oscilloscope between the RIGHT E (Emitter) and ground jacks.

c. **EXAMINE** the test oscilloscope for a step waveform display.

Examining External Operation for RIGHT

d. Change the following 370 settings:

CONFIGURATION ..... EMITTER OPEN (EXT)

e. Use a patch cord to connect the STEP GEN OUT and EXT BASE or EMITTER IN jacks.

f. **EXAMINE** the test oscilloscope for a step waveform display.

Examining External Operation for LEFT

g. Connect the test oscilloscope between the LEFT E (Emitter) and ground jacks.

h. **EXAMINE** the test oscilloscope for a step waveform display.

Removing the Setup

i. Disconnect the test oscilloscope and remove the patch cord from the 370.

Examining BASE OPEN CONFIGURATION for LEFT

l. Disconnect the patch cord.

m. **EXAMINE** the test oscilloscope for no step waveform to be displayed.

Examining BASE OPEN CONFIGURATION for RIGHT

n. Connect the test oscilloscope between the RIGHT B (Base) and ground jacks.

o. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... RIGHT

p. **EXAMINE** the test oscilloscope for no step waveform to be displayed.

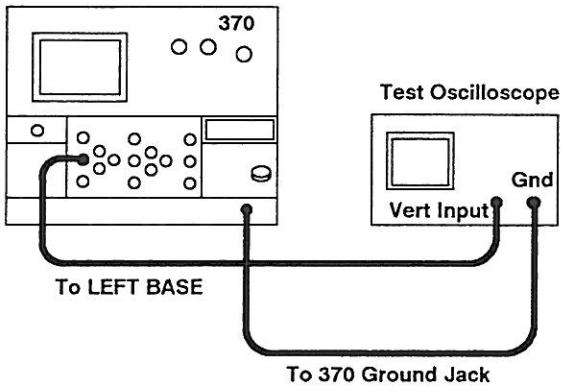
F19. Examining Base Configuration Selections for Internal and External Step Generator Operation

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications.*

The following procedure checks operation of the relays that carry the Step Generator signal to the Test Fixture Adapter Jacks.

F19 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 1 V
NUMBER OF STEPS 10
Protective Cover ..... Open

Test Equipment settings:
Test Oscilloscope:
Vertical sensitivity ..... 2 V/division
Horizontal ..... 10 ms/division
Trigger ..... Auto

6065-451

Examining Internal Operation for LEFT

a. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

b. **EXAMINE** the test oscilloscope display for a step waveform.

Examining Internal Operation for RIGHT

c. Connect the test oscilloscope between the RIGHT B (Base) and ground jacks.

d. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... RIGHT

e. **EXAMINE** the test oscilloscope display for a step waveform.

Examining External Base Input for RIGHT

f. Change the following 370 setting:

CONFIGURATION ..... BASE OPEN (EXT)

g. Use a patch cord to connect the STEP GEN OUT and EXT BASE or EMITTER IN jacks.

h. **EXAMINE** the test oscilloscope display for a step waveform.

Examining External Base Input for LEFT

i. Connect the test oscilloscope between the LEFT B (Base) and ground jacks.

j. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

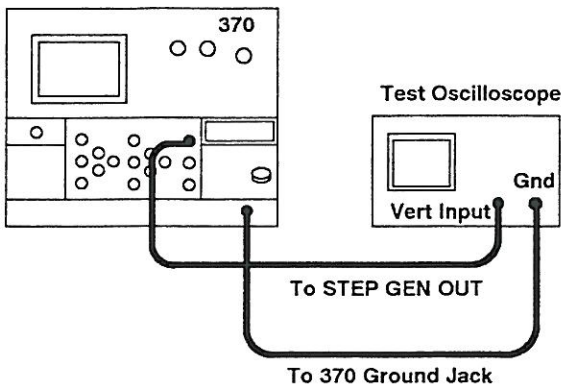
k. **EXAMINE** the test oscilloscope display for a step waveform.

F18. Checking Step Rate

Specifications:

- Step Rate is twice the line frequency when COLLECTOR SUPPLY POLARITY is set to +⌒ or −⌣
- Step Rate is equal to the line frequency when COLLECTOR SUPPLY POLARITY is set to AC∿.

F18 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

STEP GENERATOR
- STEP/OFFSET AMPLITUDE . . . . . 1 V
- NUMBER OF STEPS 10

Protective Cover . . . . . Open

Test Equipment settings:

Test Oscilloscope:
- Vertical sensitivity . . . . . 2 V/division
- Horizontal . . . . . 10 ms/division
- Trigger Mode . . . . . Auto

6065-450

Checking +⌒ Step Rate

a. **CHECK** that the interval between steps displayed on the Test Oscilloscope is approximately 8.3 ms (when the power line frequency is 60 Hz) or approximately 10 ms (when the power line frequency is 50 Hz).

Checking AC ∿ Step Rate

b. Change the following 370 setting:

COLLECTOR SUPPLY
POLARITY . . . . . AC ∿

c. **CHECK** that the interval between steps displayed on the Test Oscilloscope is approximately 16.6 ms (when line frequency is 60 Hz) or approximately 20 ms (when line frequency is 50 Hz) .

Checking −⌣ Step Rate

d. Change the following 370 setting:

COLLECTOR SUPPLY
POLARITY . . . . . −⌣ .

e. **CHECK** that the interval between steps displayed on the Test Oscilloscope is approximately 8.3 ms (when the power line frequency is 60 Hz) or approximately 10 ms (when the power line frequency is 50 Hz), and that the staircase waveform displayed on CRT is inverted.

Removing the Setup

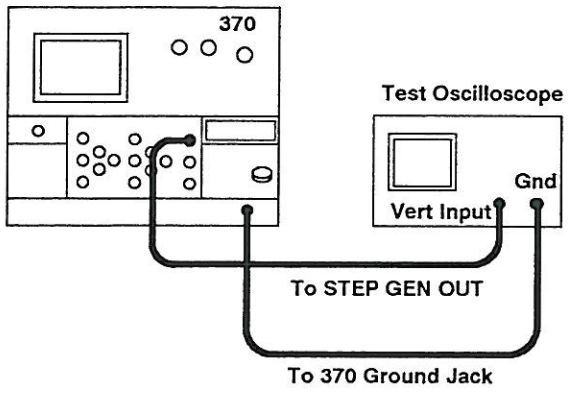
f. Disconnect the Test Oscilloscope from the 370.

F17. Checking PULSE Width

Specification:

- Pulse Width is 80 s ±10% for the SHORT setting of the PULSE selector and 300 s ±10% for the LONG setting.

F17 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

STEP GENERATOR
- STEP/OFFSET AMPLITUDE ..... 2 V
- NUMBER OF STEPS 1
- PULSE ..... SHORT

Test Equipment settings:

Test Oscilloscope
- Vertical sensitivity ..... 2 V/division
- Horizontal ..... 20 µs/division
- Trigger mode ..... Auto

6065-449

Checking SHORT PULSE Width

a. **CHECK** that the pulse width is 80 µs ±10% (as measured by the test oscilloscope).

Checking LONG PULSE Width

b. Change the following 370 and Test Equipment settings:

370:

STEP GENERATOR
- PULSE ..... LONG

Test Equipment:

Test Oscilloscope
- Horizontal ..... 50 µs/division

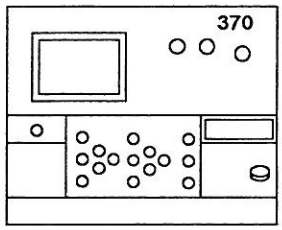
c. **CHECK** that the pulse width is 300 µs ±10%.

F16. Examining Single Measurement Mode Operation

IMPORTANT:

The characteristics examined in this step are examples of typical instrument operation; *they are not specifications*.

F16 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
MODE ..... NON-STORE
HORIZONTAL VOLTS/DIV ..... STEP GEN
STEP GENERATOR
NUMBER OF STEPS 10
COLLECTOR SUPPLY
POLARITY ..... AC

6065-448

a. Press the MEASUREMENT SINGLE button once.

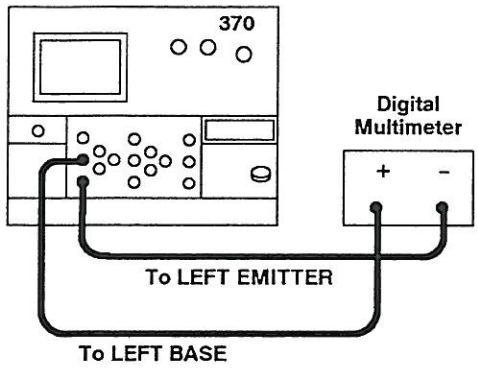
b. **EXAMINE** the CRT for a spot scanning from left to right.

F15. Checking Maximum Opposing OFFSET Current

Specification:

- Maximum opposing offset current is less than 10 mA.

F15 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
HORIZONTAL
VOLTS/DIV ..... 2 V BASE/EMITTER
STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 2 V
NUMBER OF STEPS 0
OFFSET ..... –20 V
COLLECTOR SUPPLY
POLARITY ..... AC
Protective Cover ..... Open

Test Equipment settings:
Digital Multimeter:
Mode ..... DC Current

6065-446

Checking Without INVERT

a. Set the LEFT-RIGHT-STANDBY switch to LEFT.

b. **CHECK** for a Digital Multimeter reading of less than 10 mA when the STEP/OFFSET AMPLITUDE control is rotated through its range (2 V to 50 mV).

Checking With INVERT

c. Change the following 370 setting:

STEP GENERATOR
POLARITY INVERT ..... On

The INVERT indicator will light up.

d. **CHECK** for a Digital Multimeter reading less than 10 mA when the STEP/OFFSET AMPLITUDE control is rotated through its range (2 V to 50 mV).

Removing the Setup

e. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

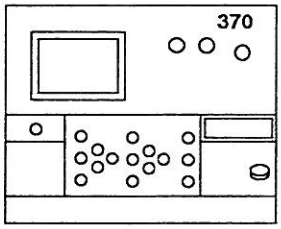
f. Disconnect the Digital Multimeter leads from the 370.

F14. Checking Maximum Opposing Volts and Maximum Voltage for Current Mode

Specifications:

- Maximum Opposing Volts in Current Mode is less than 7 volts.
- Maximum Voltage is at least 10 volts.

F14 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 2 V BASE/EMITTER
STEP GENERATOR
  NUMBER OF STEPS 0
  OFFSET ..... –500 nA
COLLECTOR SUPPLY
  POLARITY ..... AC
  Cursor Mode ..... DOT

6065-445

Checking Maximum Opposing Volts Without INVERT

a. Set the LEFT-RIGHT-STANDBY switch to LEFT.

b. **CHECK** that the horizontal CURSOR readout is no more than –7.0 V when the STEP/OFFSET AMPLITUDE control is rotated through its range of 50 nA to 200 mA.

Checking Maximum Opposing Volts With INVERT

c. Change the following 370 settings:

STEP GENERATOR
  POLARITY INVERT ..... On

The indicator beside the INVERT button will light.

d. **CHECK** that the horizontal CURSOR readout is no more than +7.0 V when the STEP/OFFSET AMPLITUDE control is rotated through its range (50 nA to 200 mA).

Checking Maximum Voltage With INVERT

e. Change the following 370 settings:

STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 50 nA
  OFFSET AID ..... –500 nA
COLLECTOR SUPPLY
  MAX PEAK VOLTS 80

CHECK that the horizontal CURSOR readout is greater than –10 V when the STEP/OFFSET AMPLITUDE control is rotated throughout its range.

If the voltage is greater than –10.22 V, the horizontal CURSOR readout will be flashing.

Checking Maximum Voltage Without INVERT

f. Change the following 370 settings:

STEP GENERATOR
  POLARITY INVERT ..... Off

The indicator beside the INVERT button will go out.

g. **CHECK** that the horizontal CURSOR readout is greater than +10 V when the STEP/OFFSET AMPLITUDE control is rotated through its range (50 nA to 200 mA).

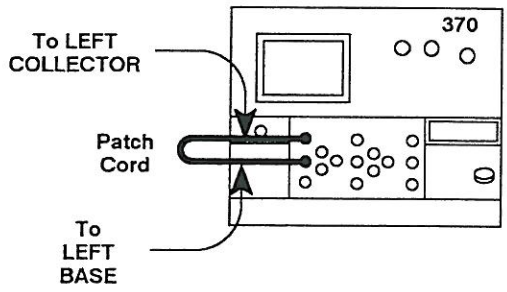
If the voltage is greater than +10.22 V, the horizontal CURSOR readout will be flashing.

F13. Checking the Current Limiter

Specification:

- Short Circuit Current Limit accuracy is +50% to −20% for the 20 mA, 100 mA, 500 mA, and 2 A settings of the LIMIT selector.

F13 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 10 V COLLECTOR
  VERTICAL
    CURRENT/DIV ..... 10 mA COLLECTOR
STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 2 V
  NUMBER OF STEPS 10
  OFFSET ..... 20 V
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 220
  POLARITY ..... AC
  CURSOR Mode ..... DOT
Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

6065-444

a. **CHECK** that the vertical CURSOR readout is within the limits given in Table 4-22 for each combination of settings for the STEP GENERATOR LIMIT and VERTICAL CURRENT/DIV controls.

Table 4-22
Current Limiter

STEP GENERATOR LIMIT	VERTICAL CURRENT/ DIV	Vertical CURSOR Readout
20 mA	10 mA	−16 mA to −30 mA
0.1 A	50 mA	−80 mA to −150 mA
0.5 A	200 mA	−400 mA to −750 mA
2 A	1 A	−1.8 A to −3 A

Removing the Setup

b. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

c. Remove the Patch Cord from the 370.

Checking 10 V Without INVERT

g. Change the following 370 settings:

LEFT-RIGHT-STANDBY ..... STANDBY
DISPLAY
  HORIZONTAL VOLTS/DIV ..... 5 V COLLECTOR
  VERTICAL CURRENT/DIV ..... 1 A COLLECTOR
STEP GENERATOR
  POLARITY INVERT ..... Off
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 10
  MAX PEAK VOLTS 16
LEFT-RIGHT-STANDBY ..... LEFT

h. Set the COLLECTOR SUPPLY VARIABLE control to display a curve similar to that shown in Figure 4–4.

i. Use the CURSOR position buttons to position the cursor dot to the point at which the trace begins its upward excursion.

j. **CHECK** that the horizontal CURSOR readout is at least 10.00 V and that the vertical CURSOR readout at least –2 A.

Checking 10 V With INVERT

k. Change the following 370 settings:

STEP GENERATOR
  POLARITY INVERT ..... On

The INVERT indicator will light.

l. Use the CURSOR position (arrow) buttons to position the cursor dot to the point at which the trace begins its downward excursion.

m. **CHECK** that the horizontal CURSOR readout is at least –10 V and that the vertical CURSOR readout is at least 2 A.

Removing the Setup

n. Change the following 370 settings:

COLLECTOR SUPPLY
  VARIABLE 0%
LEFT-RIGHT-STANDBY ..... STANDBY

o. Remove the patch cord from the 370.

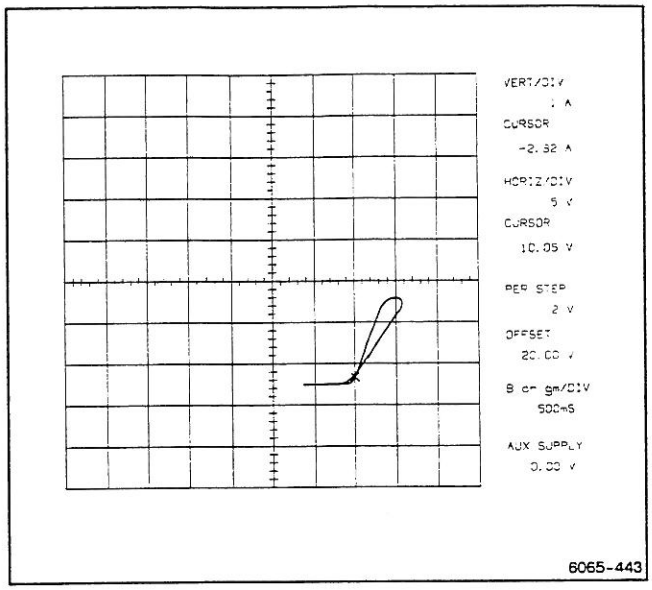


Figure 4–4. Second test display for maximum current check.

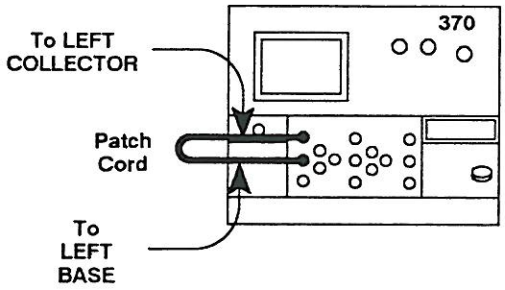
14 CAL JUMPER 1-2

F12. Checking Maximum Current in Voltage Mode

Specification:

- Maximum Current in Voltage Mode is 2 A for 10 volts or less, 10 mA for 40 V.

F12 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 10 V COLLECTOR
  VERTICAL
    CURRENT/DIV ..... 5 mA COLLECTOR
STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 2 V
  NUMBER OF STEPS 10
  OFFSET ..... 20 V
  LIMIT ..... 2 A
COLLECTOR SUPPLY
  VARIABLE 0%
  MAX PEAK VOLTS 80
  MAX PEAK POWER WATTS 0.4
  POLARITY ..... AC
  CURSOR Mode ..... DOT
Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

6065-441

Checking 40 V Without INVERT

a. Set the COLLECTOR SUPPLY VARIABLE control so the negative travel of the outside right vertical line of the displayed waveform extends past the second horizontal graticule line below graticule center (see Figure 4-3).

b. Use the CURSOR position buttons to position the cursor dot at the bottom of the outside right vertical line of the displayed waveform (see Figure 4-3).

c. **CHECK** the horizontal CURSOR readout for a reading between 39.34 and 40.66 V and the vertical CURSOR readout for a reading greater than -9.37 mA.

Checking 40 V with INVERT

d. Change the following 370 setting:

STEP GENERATOR
  POLARITY INVERT ..... On

e. Use the CURSOR position buttons to position the cursor dot to the top of the displayed waveform's outside left vertical line.

f. **CHECK** the horizontal CURSOR readout for a reading between -39.34 and -40.66 V and the vertical CURSOR readout for a reading greater than 9.37 mA.

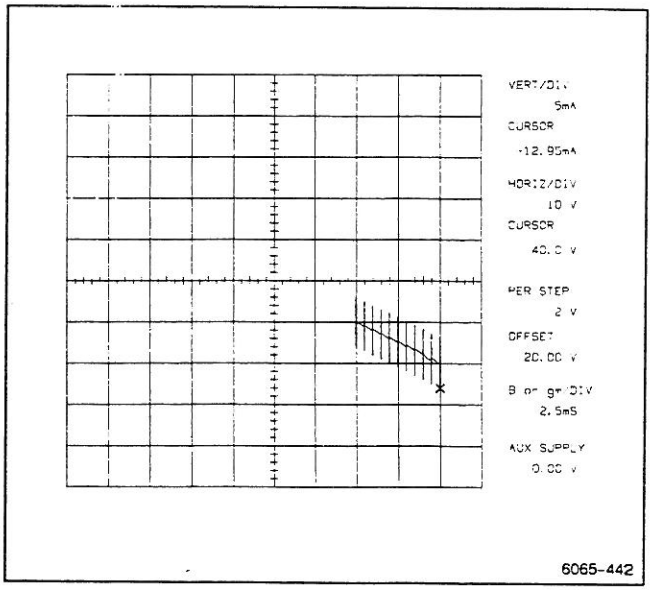


Figure 4-3. First test display for maximum current check, left collector and left base connected.

Checking Maximum OFFSET Without INVERT

g. Change the following 370 setting:

STEP GENERATOR
POLARITY INVERT . . . . . Off

The INVERT indicator will go out.

h. **CHECK** that the digital multimeter measurement is within the limits shown in Table 4-21 under Maximum OFFSET for each setting of the STEP/OFFSET AMPLITUDE control.

Removing the Setup

i. Change the following 370 settings:

LEFT-RIGHT-STANDBY . . . . . STANDBY

j. Remove the digital multimeter leads from the 370.

Table 4-21
Step Generator Maximum Offset Voltage

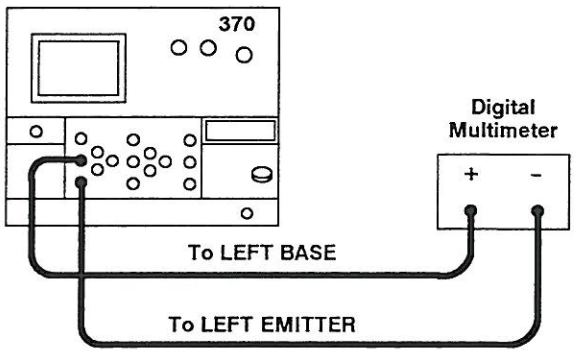
STEP/OFFSET AMPLITUDE Setting	Digital Multimeter Reading (Zero OFFSET)	Digital Multimeter Reading (Maximum OFFSET)
2 V	0.0 ± 61 mV	± 19.64 to ± 20.36 V
1 V	0.0 ± 31 mV	± 9.82 to ± 10.18 V
500 mV	0.0 ± 16 mV	± 4909 to ± 5091 mV
200 mV	0.0 ± 7 mV	± 1963 to ± 2037 mV
100 mV	0.0 ± 4 mV	± 981 to ± 1019 mV
50 mV	0.0 ± 2.5 mV	± 490 to ± 510 mV

F11. Checking Maximum Opposing OFFSET Voltage and Absolute Accuracy in Voltage Mode

Specification:

- Maximum Opposing Offset Voltage is 10 times the STEP AMPLITUDE setting.
- Absolute accuracy is less than (1.5% of the total output + 3% of the STEP AMPLITUDE setting + 1 mV).

F11 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 2 V BASE/EMITTER
STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 2 V
  NUMBER OF STEPS 0
COLLECTOR SUPPLY
  POLARITY ..... AC
Protective Cover ..... Open

Test Equipment settings:
Digital Multimeter:
  Mode ..... DC Voltage

6065-440

Checking Zero OFFSET Without INVERT

a. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

b. **CHECK** that the digital multimeter measurement is within the limits shown in Table 4-21 under No OFFSET for each setting of the STEP/OFFSET AMPLITUDE control.

Checking Zero OFFSET With INVERT

c. Change the following 370 setting:

STEP GENERATOR
  POLARITY INVERT ..... On

The indicator above the INVERT button will light up.

d. **CHECK** that the digital multimeter measurement is within the limits shown in Table 4-21 under No OFFSET for each setting of the STEP/OFFSET AMPLITUDE control.

Checking Maximum OFFSET With INVERT

e. Change the following 370 settings:

STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 2 V
  OFFSET AID ..... -20 V

f. **CHECK** that the Digital Multimeter measurement is within the limits shown in Table 4-21 under Maximum OFFSET for each setting of the STEP/OFFSET AMPLITUDE control.

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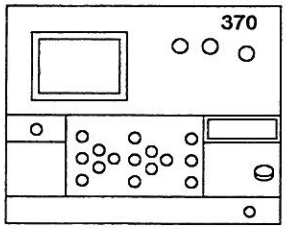
F10. Checking OFFSET Polarity

Specifications:

- OFFSET polarity corresponds with the COLLECTOR SUPPLY polarity when STEP GENERATOR POLARITY INVERT is disabled.
- OFFSET polarity is opposite the COLLECTOR SUPPLY when INVERT is selected or CONFIGURATION is set to COMMON BASE.
- STEP GENERATOR POLARITY INVERT is disabled when CONFIGURATION is set to COMMON BASE.

F10 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
HORIZONTAL
VOLTS/DIV ..... 2 V BASE EMITTER
STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 1 V
NUMBER OF STEPS 0
COLLECTOR SUPPLY
POLARITY ..... AC
Cursor Mode ..... DOT

6065-439

Checking AID OFFSET Polarity

a. Press and hold the STEP GENERATOR OFFSET AID button.

b. **CHECK** that the spot moves continuously to the right and the horizontal CURSOR readout increases continuously.

Checking OPPOSE OFFSET Polarity

c. Press the STEP GENERATOR OFFSET AID and OPPOSE buttons simultaneously.

The offset is reset to zero and the spot returns to graticule center.

d. Press and hold the STEP GENERATOR OFFSET OPPOSE button.

e. **CHECK** that the spot moves continuously to the left and the horizontal CURSOR readout decreases continuously.

Checking Polarity INVERT

f. Change the following 370 settings:

STEP GENERATOR
POLARITY INVERT ..... On
OFFSET ..... Press the AID and OPPOSE buttons simultaneously to reset the offset is zero.

g. Press and hold the STEP GENERATOR OFFSET AID button.

h. **CHECK** that the spot moves continuously to the left as the horizontal CURSOR readout decreases continuously.

i. Change the following 370 settings:

STEP GENERATOR
OFFSET ..... Press the AID and OPPOSE buttons simultaneously to reset the offset is zero.

j. Press and hold the STEP GENERATOR OFFSET OPPOSE button.

k. **CHECK** that the spot moves continuously to the right and the horizontal CURSOR readout increases continuously.

Checking COMMON BASE CONFIGURATION

l. Change the following 370 setting:

COLLECTOR SUPPLY
CONFIGURATION ... COMMON BASE/STEP GEN

m. **CHECK** that the STEP GENERATOR POLARITY INVERT indicator remains lit.

n. **CHECK** that OFFSET polarity is opposite the COLLECTOR SUPPLY polarity by repeating the Polarity INVERT check, parts g through k.

Replacing the Store/Non-Store Jumper

o. Change the following 370 setting:

POWER ..... OFF

p. Remove the A3 A/D Board.

See **Test Point and Adjustment Locations 1** *for the location of A3 and jumper J34. For details on removing and replacing Plug-In Boards, see the instructions under "Component Removal and Replacement" in Section 4, Maintenance.*

q. Move jumper J34 from pins 2-4 to pins 1-2.

r. Replace the A3 A/D Board and the circuit board retainers across the top of the card cage.

s. Change the following 370 setting:

POWER ..... ON

Changing the Setup

i. Connect a patch cord from the Left Collector jack (C) to the Left Base jack (B).

j. Change the following 370 settings:

STEP GENERATOR
POLARITY ..... + (non-inverted)
STEP/OFFSET AMPLITUDE ..... 100 mA
CURSOR
Mode ..... CROSS
LEFT-RIGHT-STANDBY ..... LEFT

Checking 100 mA

k. Use the CURSOR positioning buttons (↑↓) to position the vertical cursor to intersect the spot on the display.

l. **CHECK** that the vertical CURSOR readout is -.983 to -2.078 A.

Checking 200 mA

m. Change the following 370 setting:

STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 200 mA.

n. **CHECK** that the vertical CURSOR readout is -1.922 to -1.016 A

NOTE

Maximum 370 Step Generator current is 2 amperes; therefore, the 100 mA and 200 mA STEP GENERATOR STEP/OFFSET AMPLITUDE settings have the same performance requirement.

Table 4-20
Step Generator Maximum Current

STEP/OFFSET AMPLITUDE	Digital Multimeter Reading (±)
50 nA	.98 to 1.18 µA
100 nA	1.96 to 2.03 µA
200 nA	3.93 to 4.07 µA
500 nA	9.83 to 10.17 µA
1 µA	19.67 to 20.33 µA
2 µA	39.34 to 40.66 µA
5 µA	98.35 to 101.65 µA
10 µA	196.7 to 203.3 µA
20 µA	393.4 to 406.6 µA
50 µA	983.5 to 1016.5 mA
100 µA	1.967 to 2.033 mA
200 µA	3.934 to 4.066 mA
500 µA	9.835 to 10.165 mA
1 mA	19.67 to 20.33 mA
2 mA	39.34 to 40.66 mA
5 mA	98.35 to 101.65 mA
10 mA	196.7 to 203.3 mA
20 mA	393.4 to 404.6 mA
50 mA	983.5 to 1016.5 mA

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F9. Checking Maximum Current Output

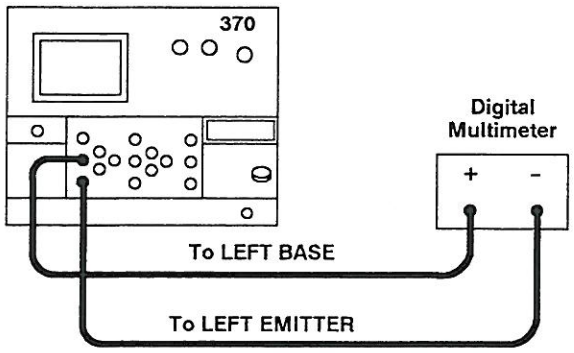
Specification:

- Maximum current output is 20 times the STEP AMPLITUDE setting, except at 200 mA, where it is 10 times the setting.

IMPORTANT:

If the previous step was not performed, complete the instructions given under Moving the Store/Non-Store Jumper, at the beginning of Step F5, before proceeding with this step.

F9 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  Mode ..... NON-STORE
  VERTICAL
    CURRENT/DIV ..... 500 mA COLLECTOR
STEP GENERATOR
  NUMBER OF STEPS 10
  OFFSET ..... 500 nA
COLLECTOR SUPPLY
  MAX PEAK POWER WATTS 220
  POLARITY ..... AC
MEASUREMENT ..... SINGLE
Protective Cover ..... Open

Test Equipment settings:
Digital Multimeter
  Mode ..... DC Current

6065-437

Checking 50 nA through 50 mA

a. Change the following 370 settings (in the given sequence):

LEFT-RIGHT-STANDBY ..... LEFT
MEASUREMENT ..... Press the SINGLE button until the reading on the Digital Multimeter no longer increases (typically 11 times).

b. **CHECK** that the digital multimeter reading is within the limits given in Table 4-20 for 50 nA.

c. Change the following 370 setting:

STEP GENERATOR
  POLARITY INVERT ..... On
MEASUREMENT ..... Press the SINGLE button until the reading on the Digital Multimeter no longer increases (typically 11 times).

d. **CHECK** that the digital multimeter reading is within the limits given in Table 4-20 for 50 nA.

e. Change the following 370 setting:

STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... Next setting
MEASUREMENT ..... Press the SINGLE button until the reading on the Digital Multimeter no longer increases (typically 11 times).

f. **CHECK** that the digital multimeter reading for each STEP GENERATOR STEP/OFFSET setting in Table 4-20 is within the given limits when STEP GENERATOR POLARITY INVERT is enabled and disabled (inverted and non-inverted).

g. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

h. Disconnect the digital multimeter leads from the 370.

CAUTION

The current meter recommended for this step will only accept input levels of 1.999 amperes and below. The remainder of this step checks the two highest STEP/OFFSET AMPLITUDE settings.

Table 4–19
Maximum Voltage Output

STEP/OFFSET AMPLITUDE	Digital Multimeter Reading
50 mV	0.982 to 1.018 V
100 mV	1.966 to 2.034 V
200 mV	3.933 to 4.067 V
500 mV	9.834 to 10.166 V
1 V	19.67 to 20.33 V
2 V	39.34 to 40.66 V

c. Change the following 370 setting:

STEP GENERATOR
STEP/OFFSET AMPLITUDE . . . . . Next setting (see Table 4–19).
MEASUREMENT . . . . . Press the SINGLE button several times to maximize the digital multimeter reading.

d. **CHECK** that the digital multimeter is within the tolerance given for the STEP GENERATOR OFFSET/AMPLITUDE setting in Table 4–19.

e. Repeat c and d for each STEP/OFFSET AMPLITUDE setting in Table 4–19.

Removing the Setup

f. Change the following 370 setting:

LEFT–RIGHT–STANDBY . . . . . STANDBY

g. Disconnect the digital multimeter leads from the 370.

IMPORTANT:

If step F9 will not be performed, complete the instructions given under Replacing the Store/Non-Store Jumper, at the end of Step F9, before proceeding to another step or ending the procedure.

F8. Checking Maximum Voltage Output and STEP AMPLITUDE Control Range

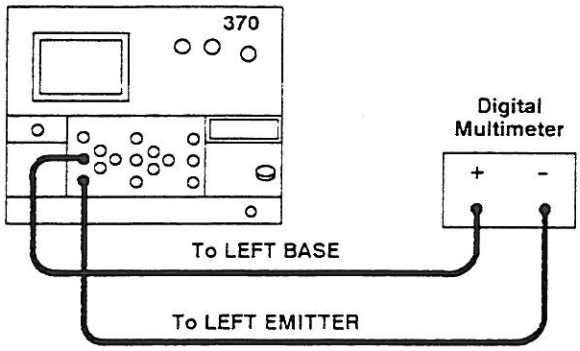
Specifications:

- Maximum voltage output is 20 times the STEP AMPLITUDE setting.
- STEP AMPLITUDE control range is 50 mV to 2 V in a 1-2-5 sequence.

IMPORTANT:

If the previous step was not performed, complete the instructions given under Moving the Store/Non-Store Jumper, at the beginning of Step F5, before proceeding with this step.

F8 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
HORIZONTAL
VOLTS/DIV ..... 2 V BASE/EMITTER
STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 50 mV
NUMBER OF STEPS 10
OFFSET ..... 500 mV
COLLECTOR SUPPLY
POLARITY ..... AC
MAX PEAK POWER WATTS 10
MEASUREMENT ..... SINGLE
LEFT-RIGHT-STANDBY ..... LEFT
Protective Cover ..... Open

Test Equipment settings:
Digital Multimeter
Mode ..... DC Voltage

6065-436

Checking Maximum Voltage

a. Change the following 370 setting:

MEASUREMENT ..... Press the SINGLE button several times to maximize the digital multimeter reading.

The Digital Multimeter reading should be approximately 1.000 V.

b. **CHECK** that the digital multimeter reading is between 0.982 and 1.018 V (see Table 4-19).

Checking OPPOSE OFFSET Range

i. Change the following 370 settings (in the given sequence):

STEP GENERATOR
STEP/OFFSET AMPLITUDE . . . . . 50 nA
INVERT . . . . . On
OFFSET . . . . . Simultaneously press the STEP GENERATOR OPPOSE and AID buttons to reset OFFSET to 0.0 nA.

j. Press the REPEAT button once. The dot will move down one division to the second line of the graticule.

k. **CHECK** the digital multimeter for a reading within the limits shown in Table 4-18, under **(No OFFSET)**, for each setting of the STEP/OFFSET AMPLITUDE control. Repeat j. for each setting change.

IMPORTANT:

If step F8 or F9 will not be performed, complete the instructions given under Replacing the Store/Non-Store Jumper, at the end of Step F9, before proceeding to another step or ending the procedure.

Table 4–18
Step Generator Current Mode Accuracy and Offset Range

STEP/OFFSET AMPLITUDE Setting (±)	Digital Multimeter Reading Limits with No OFFSET (±)	Digital Multimeter Reading Limits with Maximum OFFSET (±)
50 nA	47 nA to 53 nA	490 nA to 510 nA
100 nA	94 nA to 107 nA	981 nA to 1019 nA
200 nA	188 nA to 212 nA	1963 nA to 3037 nA
500 nA	476 nA to 524 nA	4909 nA to 5091 nA
1 µA	954 nA to 1046 nA	9.819 µA to 10.18 µA
2 µA	1.909 µA to 2.091 µA	19.64 µA to 20.36 µA
5 µA	4.774 µA to 5.226 µA	49.1 µA to 50.9 µA
10 µA	9.549 µA to 10.451 µA	98.2 µA to 101.8 µA
20 µA	19.10 µA to 20.90 µA	196.4 µA to 203.6 µA
50 µA	47.75 µA to 52.25 µA	491 µA to 509 µA
100 µA	95.50 µA to 104.50 µA	982 µA to 1018 µA
200 µA	191.00 µA to 209.0 µA	1964 µA to 2036 µA
500 µA	477.5 µA to 522.5 µA	4910 µA to 5090 µA
1 mA	955.0 µA to 1045.0 µA	9.82 mA to 10.18 mA
2 mA	1.910 mA to 2.090 mA	19.64 mA to 20.36 mA
5 mA	4.775 mA to 5.225 mA	49.1 mA to 50.9 mA
10 mA	9.550 mA to 10.450 mA	98.2 mA to 101.8 mA
20 mA	19.10 mA to 20.90 mA	196.4 mA to 203.6 mA
50 mA	47.75 mA to 52.25 mA	491 mA to 509 mA
100 mA	95.50 mA to 104.50 mA	982 mA to 1018 mA
200 mA	191.0 A to 209.0 A	1964 mA to 2036 mA

Checking Accuracy of Steps 2 through 10

d. **CHECK** that each time MEASUREMENT REPEAT is pressed, the displayed spot moves one division higher and the new digital multimeter current reading is within the limits given in Table 4–17.

Checking Resolution

e. Change the following 370 setting:

STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 500 μA

f. **CHECK** that each time the STEP GENERATOR OFFSET AID button is pressed, the OFFSET readout and digital multimeter reading change 5 μA.

Checking AID OFFSET Range

g. Change the following 370 settings:

STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 50 nA
OFFSET ..... Press both the FAST and AID buttons until the PER STEP readout indicates the maximum level (500 nA).

Also reset to Single Mode, if necessary

h. **CHECK** the digital multimeter for a reading within the limits shown in Table 4–18, under **(Maximum OFFSET)**, for each setting of the STEP/OFFSET AMPLITUDE control.

Table 4–17
Step Generator Current Mode Incremental Accuracy

Step	Digital Multimeter Reading	Difference Between Adjacent Steps
0	-0.030 mA to +0.030 mA	
1	0.955 mA to 1.045 mA	1 mA ± 15 μV
2	1.94 mA to 2.06 mA	1 mA ± 15 μV
3	2.92 mA to 3.08mA	1 mA ± 15 μV
4	3.91 mA to 4.09 mA	1 mA ± 15 μV
5	4.90 mA to 5.11 mA	1 mA ± 15 μV
6	5.88 mA to 6.12 mA	1 mA ± 15 μV
7	6.86 mA to 7.14 mA	1 mA ± 15 μV
8	7.85 mA to 8.15 mA	1 mA ± 15 μV
9	8.83 mA to 9.17 mA	1 mA ± 15 μV
10	9.82 mA to 10.18 mA	1 mA ± 15 μV

F7. Checking STEP GENERATOR Current Mode Accuracy, Offset Control Range, and Offset Control Resolution

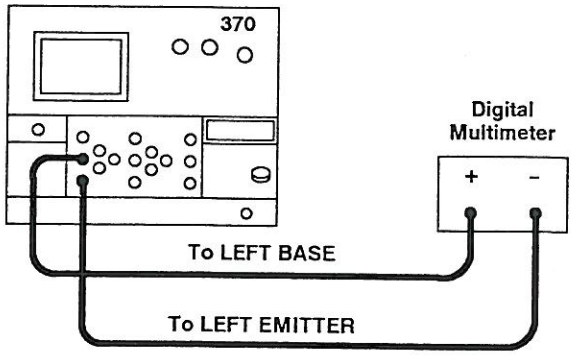
Specifications:

- Incremental Accuracy is 1.5%.
- Absolute Accuracy is less than (1.5% of the total output + 3% of the STEP AMPLITUDE setting + 1 nA).
- OFFSET Control Range is variable from −10 times to +10 times the STEP AMPLITUDE setting.
- OFFSET Control Resolution is 1% of the STEP AMPLITUDE setting.
- AMPLITUDE Range is 50 nA to 200 mA in a 1-2-5 sequence of 21 steps.

IMPORTANT:

If the previous step was not performed, complete the instructions given under Moving the Store/Non-Store Jumper, at the beginning of Step F5, before proceeding with this step.

F7 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
- Mode ..... NON-STORE
- VERTICAL CURRENT/DIV ..... STEP GEN
- HORIZONTAL
  - VOLTS/DIV ..... 2 V BASE/EMITTER

STEP GENERATOR
- STEP/OFFSET AMPLITUDE ..... 1 mA
- NUMBER OF STEPS 10

COLLECTOR SUPPLY
- MAX PEAK POWER WATTS 220

Protective Cover ..... Open
LEFT-RIGHT-STANDBY ..... LEFT

Test Equipment settings:

Digital Multimeter
- Mode ..... DC Current

6065-438

Checking Accuracy of Steps 0 and 1

a. **CHECK** that the digital multimeter reading is 0 mA ±30 μA.

b. Press MEASUREMENT REPEAT once. Note that the displayed spot moves one division higher.

c. **CHECK** that the digital multimeter reading is between 0.955 and 1.045 mA and the difference between Step 0 and Step 1 is 1 mA ±15 μA.

g. **CHECK** STEP MULTI .1X accuracy for INVERT by repeating parts c through f. (For INVERT, the spot will move in the opposite direction).

h. Change the following 370 settings:

MEASUREMENT . . . . . Press the SINGLE button to return to Step 0.

IMPORTANT:

If steps F7, F8, and F9 will not be performed, complete the instructions given under Replacing the Store/Non-Store Jumper, at the end of Step F9, before proceeding to another step or ending the procedure.

Table 4-16
STEP MULTI .1X Accuracy

Step	Digital Multimeter Reading	Difference Between Adjacent Steps
0	0.00 mV±11.0 mV	
1	100.0 mV±12.5 mV	100.0 mV±1.5 mV
2	200.0 mV±14.0 mV	100.0 mV±1.5 mV
3	300.0 mV ±15.5 mV	100.0 mV ±1.5 mV
4	400.0 mV ±17.0 mV	100.0 mV ± 1.5 mV
5	500.0 mV ±18.5 mV	100.0 mV ± 1.5 mV
6	600.0 mV ±20.0 mV	100.0 mV ± 1.5 mV
7	700.0 mV ±21.5 mV	100.0 mV ± 1.5 mV
8	800.0 mV ±23.0 mV	100.0 mV ± 1.5 mV
9	900.0 mV ±24.5 mV	100.0 mV ± 1.5 mV
10	1.000 V ±26.0 mV	100.0 mV ± 1.5 mV

F6. Checking Step Multi .1X Accuracy

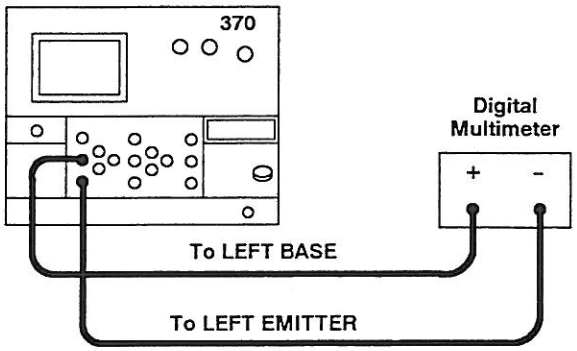
Specification:

- Accuracy with STEP MULTI .1X pressed is less than (1.5% of total output + 10% of the STEP AMPLITUDE setting + 1 mV).
- Incremental accuracy is 1.5%.

IMPORTANT:

If the previous step was not performed, complete the instructions given under Moving the Store/Non-Store Jumper, at the beginning of Step F5, before proceeding with this step.

F6 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
- Mode ..... NON-STORE
- HORIZONTAL
- VOLTS/DIV ..... 1 V BASE/EMITTER
- MAG ..... HORIZ X10.

STEP GENERATOR
- STEP/OFFSET AMPLITUDE ..... 1 V
- NUMBER OF STEPS 10
- STEP MULTI .1X ..... ON

COLLECTOR SUPPLY ..... AC
- POLARITY .....
- MAX PEAK POWER WATTS 220

LEFT-RIGHT-STANDBY ..... LEFT
Protective Cover ..... Open

Test Equipment settings:
Digital Multimeter
- Mode ..... DC Voltage

6065-435

Checking Steps 0 and 1

a. Change the following 370 setting:

DISPLAY
MAG OFFSET ..... Press the DECR button once to position the spot on the line that forms the left graticule edge.

b. **CHECK** the digital multimeter for a reading of 0.00 mV ±11 mV (as shown in Table 4–16 for Step 0).

c. Change the following 370 settings:

MEASUREMENT ..... Press the SINGLE button to move the spot 1 division to the right.

d. **CHECK** the digital multimeter for a reading of 100 mV ±12.5 mV and that the reading for Step 1 differs from the reading for Step 0 by 100 mV ±1.5 mV (as shown in Table 4–16 for Step 1).

Checking Steps 2 through 9

e. **CHECK** that for each time the spot is advanced one division with the MEASUREMENT SINGLE button, the new digital multimeter reading and the voltage difference from the previous reading are within the limits given in Table 4–16.

Checking INVERT

f. Change the following 370 settings:

MEASUREMENT ..... Press the SINGLE button to return to Step 0.

DISPLAY
MAG ..... Press the OFFSET INCR button twice to place the spot on the line that forms the right graticule edge.

STEP GENERATOR
POLARITY INVERT ..... On

Checking Steps 0 and 1

f. **CHECK** that the digital multimeter reading is 0.000 V ±31 mV (as shown in Table 4-15).

g. Change the following 370 setting:

MEASUREMENT ..... Press the MEASUREMENT SINGLE button to move the displayed spot 1 division to the right

The SINGLE button may need to be pressed twice to move the spot one division from the beginning point.

h. **CHECK** that the digital multimeter reading is 1.000 V ±46 mV and that the reading for Step 1 differs from the reading for Step 0 by 1.000 V ±15 mV (as shown in Table 4-15).

Checking Steps 2 through 9

i. **CHECK** that for each time the spot is advanced one division with the MEASUREMENT SINGLE button, the new digital multimeter reading and the voltage difference from the previous reading are within the limits given in Table 4-15.

Checking INVERT

j. Change the following 370 setting:

MEASUREMENT ..... Press the MEASUREMENT SINGLE button to return to Step 0

k. Change the following 370 settings:

DISPLAY
MAG MODE ..... HORIZ X1
MAG OFFSET ..... Press the INCR button to position the spot on the line at the right graticule edge.
STEP GENERATOR
POLARITY INVERT ..... On

l. **CHECK** STEP GENERATOR step accuracy for INVERT by repeating parts f through i. (For INVERT, the spot will move in the opposite direction).

m. Change the following 370 setting:

MEASUREMENT ..... Press the SINGLE button to return to Step 0.

IMPORTANT:

If steps F6, F7, F8, and F9 will not be performed, complete the instructions given under Replacing the Store/Non-Store Jumper, at the end of Step F9, before proceeding to another step or ending the procedure.

Table 4-15
Step Generator Incremental Accuracy in Voltage Mode

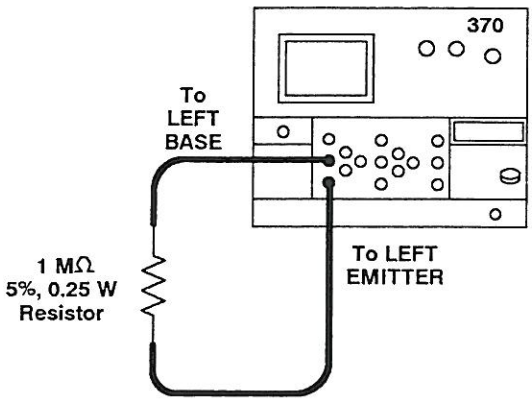
Step	Digital Multimeter Reading (±)	Difference Between Adjacent Steps (±)
0	0.000 V ±31 mV	
1	1.000 V ±46 mV	1.000 V ±15 mV
2	2.000 V ±61 mV	1.000 V ±15 mV
3	3.000 V ±76 mV	1.000 V ±15 mV
4	4.000 V ±91 mV	1.000 V ±15 mV
5	5.000 V ±106 mV	1.000 V ±15 mV
6	6.000 V ±121 mV	1.000 V ±15 mV
7	7.000 V ±136 mV	1.000 V ±15 mV
8	8.000 V ±151 mV	1.000 V ±15 mV
9	9.000 V ±166 mV	1.000 V ±15 mV
10	10.000 V ±181 mV	1.000 V ±15 mV

F4. Checking Current Mode Amplitude Range, Ripple and Noise

Specifications:

- Amplitude range in current mode is from 50 nA to 200 mA in a 1-2-5 sequence.
- Current Mode Ripple and Noise is less than 0.5% of the STEP AMPLITUDE setting + 10 nA.

F4 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
MAG MODE ..... X10 HORIZ
HORIZONTAL
VOLTS /DIV ..... 10 mV BASE/EMITTER
VERTICAL CURRENT/DIV .. 1 µA COLLECTOR
STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 50 nA
NUMBER OF STEPS 0
COLLECTOR SUPPLY
POLARITY ..... AC
LEFT-RIGHT-STANDBY ..... LEFT
Protective Cover ..... Open

6065-470

Checking 50 nA to 2 µA with 1 MΩ

Short leads

a. **CHECK** that the displayed spot is within the limit given in Table 4-14.

b. **CHECK** that the spot width for STEP/OFFSET AMPLITUDE settings between 100 nA and 2 µA is within the limits given in Table 4-14.

Checking 5 µA to 20 µA with 100 kΩ

c. Change the following 370 settings:

LEFT-RIGHT-STANDBY ..... STANDBY
Protective Cover ..... Open

d. Replace the 1 MΩ resistor with the 100 kΩ resistor.

e. Change the following 370 settings:

Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

f. **CHECK** that the spot width for STEP/OFFSET AMPLITUDE settings between 5 µA and 20 µA is within the limits given in Table 4-14.

Checking 50 µA to 200 µA with 10 kΩ

g. Change the following 370 settings:

LEFT-RIGHT-STANDBY ..... STANDBY
Protective Cover ..... Open

h. Replace the 100 kΩ resistor with the 10 kΩ resistor.

i. Change the following 370 settings:

Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

j. **CHECK** that the spot width for STEP/OFFSET AMPLITUDE settings between 50 µA and 200 µA is within the limits given in Table 4-14.

Checking 500 µA to 2 mA with 1 kΩ

k. Change the following 370 settings:

LEFT-RIGHT-STANDBY ..... STANDBY
Protective Cover ..... Open

l. Replace the 10 kΩ resistor with the 1 kΩ resistor.

m. Change the following 370 settings:

Protective Cover ..... Closed
LEFT-RIGHT-STANDBY ..... LEFT

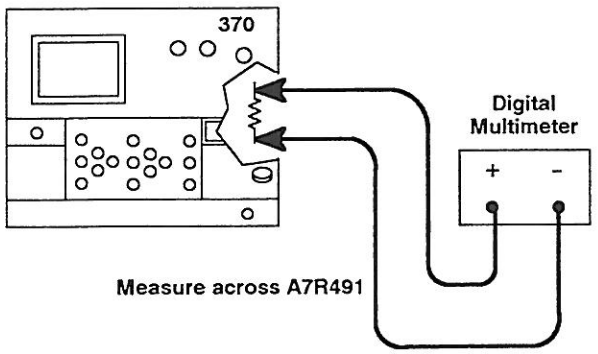
n. **CHECK** that the spot width for STEP/OFFSET AMPLITUDE settings between 50 µA and 2 mA is within the limits given in Table 4-14.

F3. Adjusting Bias (A7R467 for serial number 300200 and up)

IMPORTANT:

The characteristic examined in this step is provided as an example of typical instrument operation to aid in the adjustment of R467; it is not a specification.

F3 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
MAG ..... HORIZ X10
HORIZONTAL
VOLTS/DIV ..... 5 mV BASE/EMITTER
STEP GENERATOR
NUMBER OF STEPS 0
COLLECTOR SUPPLY
POLARITY ..... AC

Test Equipment settings:
Digital Multimeter
Mode ..... DC Volts

6065-469

NOTE

*See **Test Point and Adjustment Locations 2** for the location of the adjustment made in this step.*

a. **ADJUST** BIAS adjustment R467 on the A7 Step Generator Board for a Digital Multimeter reading of 6 mV.

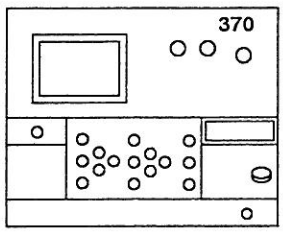
This adjustment sets bias current to the optimum level for long term reliability.

F2. Checking Voltage Mode Amplitude Range, Ripple and Noise

Specifications:

- Amplitude range in voltage mode is from 50 mV to 2 V in a 1-2-5 sequence.
- Voltage Mode Ripple and Noise is less than 0.5% of the STEP AMPLITUDE setting + 10 mV.

F2 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
MAG ..... X10 HORIZ
HORIZONTAL
VOLTS/DIV ..... 5 mV BASE/EMITTER
STEP GENERATOR
NUMBER OF STEPS 0
STEP/OFFSET AMPLITUDE ..... 50 mV
COLLECTOR SUPPLY
POLARITY ..... AC

6065-468

Checking Ripple and Noise

a. **CHECK** that for each setting of the STEP/ OFFSET AMPLITUDE control, the displayed spot is within the limits given in Table 4-13.

Table 4-13
Step Generator Voltage Mode Ripple and Noise

STEP/OFFSET AMPLITUDE	Maximum Spot Width
50 mV	10 mV
100 mV	11 mV
200 mV	11 mV
500 mV	13 mV
1 V	15 mV
2 V	20 mV

Checking Ripple and Noise for INVERT

b. Change the following 370 setting:

STEP GENERATOR
POLARITY INVERT ..... On

The indicator above the INVERT button will light.

c. **CHECK** that for each setting of the STEP/ OFFSET AMPLITUDE control, the displayed spot for INVERT is within the limits given in Table 4-13.

d. Change the following 370 settings:

DISPLAY
HORIZONTAL
VOLTS/DIV ..... 5 mV BASE/EMITTER
STEP GENERATOR
STEP/OFFSET AMPLITUDE ..... 5 mA
LEFT-RIGHT-STANDBY ..... LEFT

e. **CHECK** that for each setting of the STEP/OFFSET AMPLITUDE control, according to the Table, the spot (or end of the trace caused by the noise) remains within ±5 divisions.

If the spot is not within this limit, the following adjustment is necessary.

f. **ADJUST** Current Zero adjustment R603 on the A7 Step Generator Board as required for minimum spot (or trace) shift as the HORIZONTAL VOLTS/DIV and the STEP/OFFSET AMPLITUDE settings are changed as follows:

RESISTOR VALUE	HORIZONTAL VOLTS/DIV	STEP/OFFSET AMPLITUDE
1 kΩ	5 mV BASE	5 mA
1 kΩ	10 mV BASE	10 mA
1 kΩ	20 mV BASE	20 mA
100 Ω	50 mV BASE	50 mA
100 Ω	100 mV BASE	100 mA
100 Ω	200 mV BASE	200 mA

g. Remove the 1 kΩ resistor and close the Protective Cover.

F. STEP GENERATOR

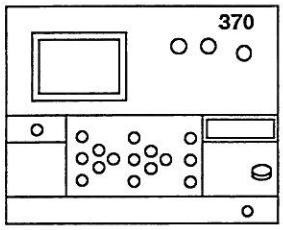
Equipment Required (see Table 4-3):

- Digital Multimeter
- Resistor, 10 MΩ, 5%, 0.25 W
- Resistor, 1 MΩ, 5%, 0.5 W
- Resistor, 100 kΩ, 0.1%, 0.125 W
- Resistor, 10 kΩ, 0.1%, 0.125 W
- Resistor, 1 kΩ, 0.1%, 0.125 W
- Resistor, 100 Ω, 0.1%, 0.125 W
- Resistor, 1.0 Ω, 0.1%, 3 W

F1. Adjusting Step Generator Zero

Adjusting Current Zero (A7R603 for serial number 300399 and up)

F1 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
MAG ..... X10 HORIZ
HORIZONTAL
VOLTS/DIV ..... 50 mV BASE/EMITTER
STEP GENERATOR
NUMBER OF STEPS 0
STEP/OFFSET AMPLITUDE ..... 500 mV
COLLECTOR SUPPLY
POLARITY ..... AC

6065-468

NOTE

See **Test Point and Adjustment Locations 2** *in Section 7 for the location of the adjustment associated with this step.*

Checking and Adjusting for Zero Output Volts

a. **CHECK** that while changing the setting of the STEP/OFFSET AMPLITUDE control between 500 mV and 200 mV, the spot (or the end of the trace caused by noise) does not move.

If the spot moves, the following adjustment is necessary.

b. **ADJUST** SG ZERO adjustment R310 on the A7 Step Generator Board as required for minimum spot (or trace) movement as the STEP/OFFSET AMPLITUDE setting is changed between 500 mV and 200 mV.

Checking and Adjusting for Zero Output Current

c. Connect the resistor in the Table to the Left Base and Left Emitter jacks and close the Protective cover.

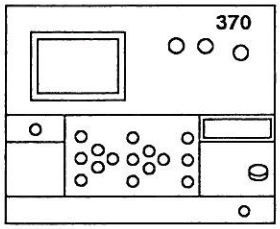
Only for S/N above 300398

E6. Checking Step Generator Display Accuracy and Range (Without Multiplier)

Specification:

- The step generator display is accurate to within 0.3 division of the graticule lines.
- Range of the step generator display is 1 step/division (without VERT X10 MAG MODE and without STEP GENERATOR STEP MULTI .1X).

E6 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
Mode ..... NON-STORE
HORIZONTAL
VOLTS/DIV ..... 1 V COLLECTOR
VERTICAL
CURRENT/DIV ..... STEP GEN
STEP GENERATOR
NUMBER OF STEPS 10
Protective cover ..... Closed

6065-433

a. Change the following 370 settings:

COLLECTOR SUPPLY
VARIABLE ..... Extend the longest trace to the right graticule edge
INTENSITY ..... Set as necessary

b. **CHECK** that the other traces do not deviate from the horizontal graticule lines by more than 0.3 division.

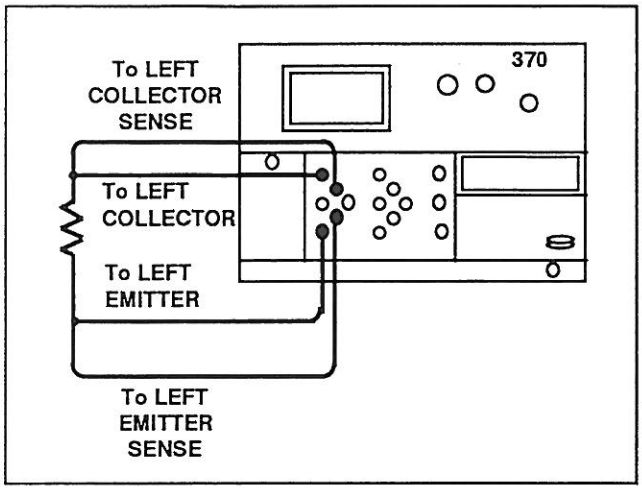


Figure 4-2. Resistor connection for checking accuracy.

Checking 1 A/div Accuracy

j. Change the following 370 settings:

DISPLAY
  VERTICAL
    CURRENT/DIV — 1A COLLECTOR
COLLECTOR SUPPLY
VARIABLE — Clockwise until the Horizontal CURSOR readout is the nearest as that noted in part d of this step. (Difference value should be within ± 0.50 mV).

k. Check that the Vertical CURSOR readout is within the range of 9.82 to 10.18 A.

l. Change the following 370 settings:

DISPLAY
  VERTICAL
    CURRENT/DIV — 2A COLLECTOR
COLLECTOR SUPPLY
VARIABLE — Clockwise until the Horizontal CURSOR readout is the nearest as that noted in part d of this step. (Difference value should be within ±0.50 mV).

m. Check that the Vertical CURSOR readout is within the range of 9.79 to 10.21 A.

Removing the Setup

n. Change the following 370 setting:

LEFT-RIGHT-STANDBY — STANDBY

o. Open the Protective Cover

WARNING

The resistor may be too hot to handle due to high current levels. To avoid injury, wait a few moments before removing the resistor.

p. Remove the resistor.

E5b. Checking STORE mode COLLECTOR CURRENT/DIV Accuracy for 500 mA/div through 2A/div (Alternate method)

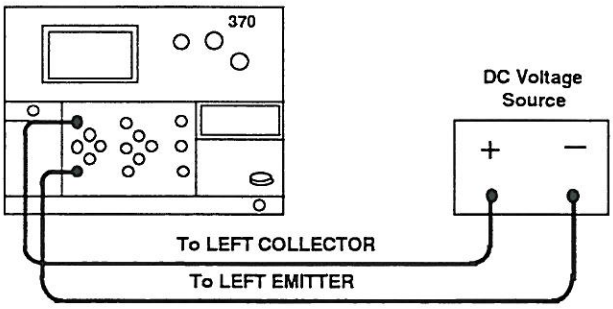
Specification:

See step E5a for accuracy and range specifications.

NOTE

This step is recommended for full scale measurement of CURRENT/DIV settings greater than 500mA/div.

E5b SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY	
MAG MODE	HORIZ X 10
VERTICAL	
CURRENT/DIV	500 mA COLLECTOR
HORIZONTAL	
VOLTS/DIV	5 mV COLLECTOR
ACQ MOD	AVG4
COLLECTOR SUPPLY	
POLARITY	+ DC
MAX PEAK VOLTS	400
CURSOR	
Mode	Dot
Protective cover	Open

Test equipment settings:

Precision Voltage Source	
Mode	DC Voltage
Output	125 mV

Checking Accuracy

a. Change the following 370 setting:

LEFT-RIGHT-STANDBY	LEFT
MAG OFFSET	Press the INCR button to move the dot to the center vertical graticule line.

b. Note the Horizontal CURSOR readout.

c. Change the following 370 and Test Equipment settings:

Precision Voltage Source	
Output	250 mV
370	
MAG OFFSET	Press the DECR button to move the dot to the center vertical graticule line.

d. Note the Horizontal CURSOR readout.

e. Change the following 370 and Test Equipment settings:

370	
COLLECTOR SUPPLY	
MAX PEAK VOLTS	16
MAX PEAK POWER WATTS	220
HORIZ MAG	X 1
Precision Voltage Source	
Output	Standby

f. Disconnect the Precision Voltage Source.

g. Connect the 0.025 Ω resistor as shown in Figure 4-2, then close the Protective cover.

h. Change the following 370 settings:

COLLECTOR SUPPLY	
VARIABLE	Clockwise until the Horizontal CURSOR readout is the nearest as that noted in part b of this step. (Difference value should be within ± 0.50 mV).

i. CHECK that the Vertical CURSOR readout is within the range of 4910 to 5090 mA.

Table 4-11
Collector Current/DIV Accuracy

VERTICAL CURRENT/ DIV	Current Source	Vertical CURSOR Readout
1 μA	0.00 μA	±0.03 μA
	10.00 μA	-9.82 to -10.18 μA
2 μA	0.00 μA	±0.06 μA
	20.00 μA	-19.64 to -20.36 μA
5 μA	0.00 μA	±0.15 μA
	50.00 μA	-49.10 to -50.90 μA
10 μA	0.00 μA	±0.3 μA
	100.0 μA	-98.2 to -101.8 μA
20 μA	0.00 μA	±0.6 μA
	200.0 μA	-196.4 to -203.6 μA
50 μA	0.00 μA	±1.5 μA
	500.0 μA	-491.0 to -509.0 μA
100 μA	0.00 μA	±3 μA
	1000 μA	-982 to -1018 μA
200 μA	0.00 μA	±6 μA
	2000 μA	-1964 to -2036 μA
500 μA	0.00 μA	±15 μA
	5000 μA	-4910 to -5090 μA
1 mA	0.00 μA	±0.03 mA
	10.00 mA	-9.82 to -10.18 mA
2 mA	0.00 μA	±0.06 mA
	20.00 mA	-19.64 to -20.36 mA
5 mA	0.00 μA	±0.15 mA
	50.00 mA	-49.10 to -50.90 mA
10 mA	0.00 μA	±0.3 mA
	100.0 mA	-98.2 to -101.8 mA
20 mA	0.00 μA	±0.6 mA
	200.0 mA	-196.4 to -203.6 mA

Table 4-11 (Cont.)
Collector Current/DIV Accuracy

VERTICAL CURRENT/ DIV	Current Source	Vertical CURSOR Readout
50 mA	0.00 μA	±1.5 mA
	500.0 mA	-491.0 to -509.0 mA
100 mA	0.00 μA	±3 mA
	1000 mA	-982 to -1018 mA
200 mA	0.00 μA	±6 mA
	1999 mA	-1963 to -2035 mA
500 mA	0.00 μA	±15 mA
	1999 mA	-1954 to -2044 mA
1 A	0.00 μA	±0.03 A
	1.999 A	-1.94 to -2.06 A
2 A	0.00 μA	±0.06 A
	1.999 A	-1.91 to -2.09 A

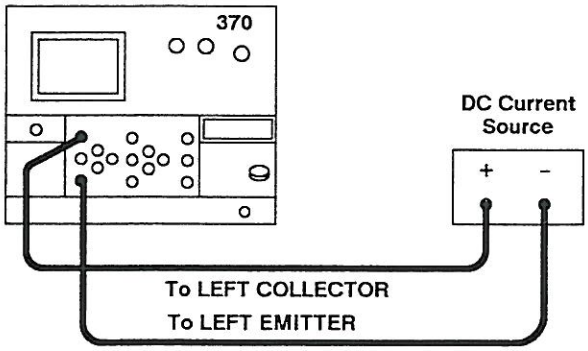
6

E5a. Checking STORE Mode COLLECTOR CURRENT/DIV Accuracy and Range

Specifications:

- STORE mode COLLECTOR CURRENT/DIV settings are accurate to within 1.5% of the readout + 0.03 division of the setting.
- The range of STORE mode COLLECTOR CURRENT/DIV settings is from 1 μA/division to 2 A/division in a 1–2–5 sequence of 20 steps.

E5a SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

DISPLAY
  VERTICAL
    CURRENT/DIV ..... 1 μA COLLECTOR
  HORIZONTAL
    VOLTS/DIV ..... 100 V COLLECTOR
COLLECTOR SUPPLY
  POLARITY ..... -
  MAX PEAK POWER WATTS 220
CURSOR
  Mode ..... DOT
LEFT-RIGHT-STANDBY ..... LEFT

Test Equipment settings:
Current Source
  Mode ..... DC Current
  Output 0.00

6065-429

a. **CHECK** that each setting of the VERTICAL CURRENT/DIV control listed in Table 4–11 produces a vertical CURSOR readout within the limits given for a Current Source setting of 0.00 μA (open circuit).

b. Change the following test equipment setting:

Current Source
  Output ..... 10.00 μA

c. **CHECK** that each combination of VERTICAL CURRENT/DIV and Current Source settings listed in Table 4–11 produces a vertical CURSOR readout within the given limits.

Removing the Setup

d. Change the following test equipment setting:

Current Source
  Output ..... 0.00 μA

e. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

f. Disconnect the DC current source from the 370.

g. Close the protective cover.

VERTICAL CURRENT/DIV setting and Precision Voltage Source for 250 kΩ of resistance.

Removing the Setup

o. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

p. Open the Protective Cover and remove the resistor.

q. Disconnect the DC voltage source from the 370.

r. Close the Protective Cover.

Table 4–10
Emitter Current Accuracy

Resistor	VERTICAL CURRENT/DIV Setting	Precision Voltage Source (V)	Vertical CURSOR Readout (nA)
25 MΩ	1 nA	0.000	0.00 ± 1.03
		0.500	8.82 to 11.18
	2 nA	0.000	0.00 ± 1.06
		1.000	18.64 to 21.36
	5 nA	0.000	0.00 ± 1.75
		2.500	48.10 to 51.90
2.5 MΩ	10 nA	0.000	0.0 ± 1.3
		0.500	97.2 to 102.8
	20 nA	0.000	0.0 ± 1.6
		1.000	195.4 to 204.6
	50 nA	0.000	0.0 ± 2.5
		2.500	490.0 to 510.0
250 kΩ	100 nA	0.000	0 ± 4
		0.500	981 to 1019
	200 nA	0.000	0 ± 6
		1.000	1964 to 2036
	500 nA	0.000	0 ± 15
		2.500	4910 to 5090

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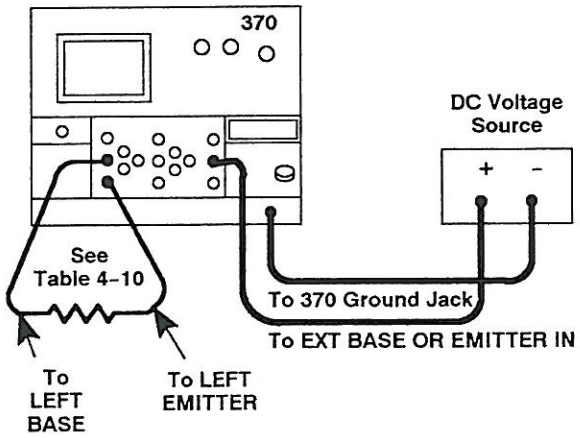
E4. Checking STORE Mode EMITTER CURRENT/DIV Accuracy and Range

Specifications:

- STORE mode EMITTER CURRENT/DIV settings are accurate to within 1.5% of the readout + 0.03 division of the setting +1 nA.
- The range of STORE mode EMITTER CURRENT/DIV settings is between 1 μA/division and 2 A/division in a 1-2-5 sequence of 20 steps.

E4 SETUP CONDITIONS



370 settings:

Initialize the 370; then set the following controls as indicated.

COLLECTOR SUPPLY
  POLARITY ..... + LEAKAGE
DISPLAY
  HORIZONTAL
    VOLTS/DIV ..... 100 V COLLECTOR
  VERTICAL
    CURRENT/DIV ..... 1 nA EMITTER
STEP GENERATOR
  STEP/OFFSET AMPLITUDE ..... 500 mV
  NUMBER OF STEPS 0
CONFIGURATION ..... BASE OPEN
CURSOR
  Mode ..... DOT
Protective Cover ..... Closed

Test Equipment settings:
Precision Voltage Source:
  Mode ..... DC Volts
  Output ..... 0.000 V

6065-428

Checking 1 nA to 5 nA with 25 MΩ

a. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

b. **CHECK** that the vertical CURSOR readout is within the limits listed in Table 4-10 for each combination of VERTICAL CURRENT/DIV setting and Precision Voltage Source for 25 MΩ of resistance.

Checking 10 nA to 50 nA with 2.5 MΩ

c. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

d. Open the Protective Cover and remove the 25 MΩ resistor.

e. Connect the 2.5 MΩ resistor to the Left Base and Left Emitter jacks.

f. Close the Protective Cover.

g. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

h. **CHECK** that the vertical CURSOR readout is within the limits listed in Table 4-10 for each combination of VERTICAL CURRENT/DIV setting and Precision Voltage Source for 2.5 MΩ of resistance.

Checking 100 nA to 500 nA with 250 kΩ

i. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... STANDBY

j. Open the Protective Cover and remove the 2.5 MΩ resistor.

k. Connect the 250 kΩ resistor to the Left Base and Left Emitter jacks.

l. Close the Protective Cover.

m. Change the following 370 setting:

LEFT-RIGHT-STANDBY ..... LEFT

n. **CHECK** that the vertical CURSOR readout is within the limits listed in Table 4-10 for each combination of