

B-241

SM3A-1567

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NASA
SUPPORT MANUAL

APOLLO SUPPORT EQUIPMENT
MAINTENANCE

APOLLO TELEVISION
BENCH MAINTENANCE
EQUIPMENT
MODEL C14-175

(PART NO. 1756251-501)

CONTRACT NAS 9-150
EXHIBIT I; PARAGRAPH 10.9

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SECTION I

DESCRIPTION

1-1. This support manual provides maintenance coverage for the Apollo Television Bench Maintenance Equipment (TVBME), model No. C14-175, part No. 1756251-501, manufactured by the Astro-Electronics Division of the Radio Corporation of America, Princeton, New Jersey. The applicability of this manual is listed in the Index of Apollo Support Manuals and Procedures, SM1A-1.

1-2. The TVBME (figure 1-1) consists of components used to exercise and to monitor the performance of the Apollo Television Camera (ATVC), model No. ME901-0090-0010, ME901-0090-0020, and ME901-0090-0050. It also provides components for self-testing of the television-picture-monitoring function.

1-3. COMPONENTS AND ACCESSORIES.

1-4. The major components of the TVBME are identified and briefly described in table 1-1. Similar information for the accessories is provided in table 1-2.

1-5. LEADING PARTICULARS.

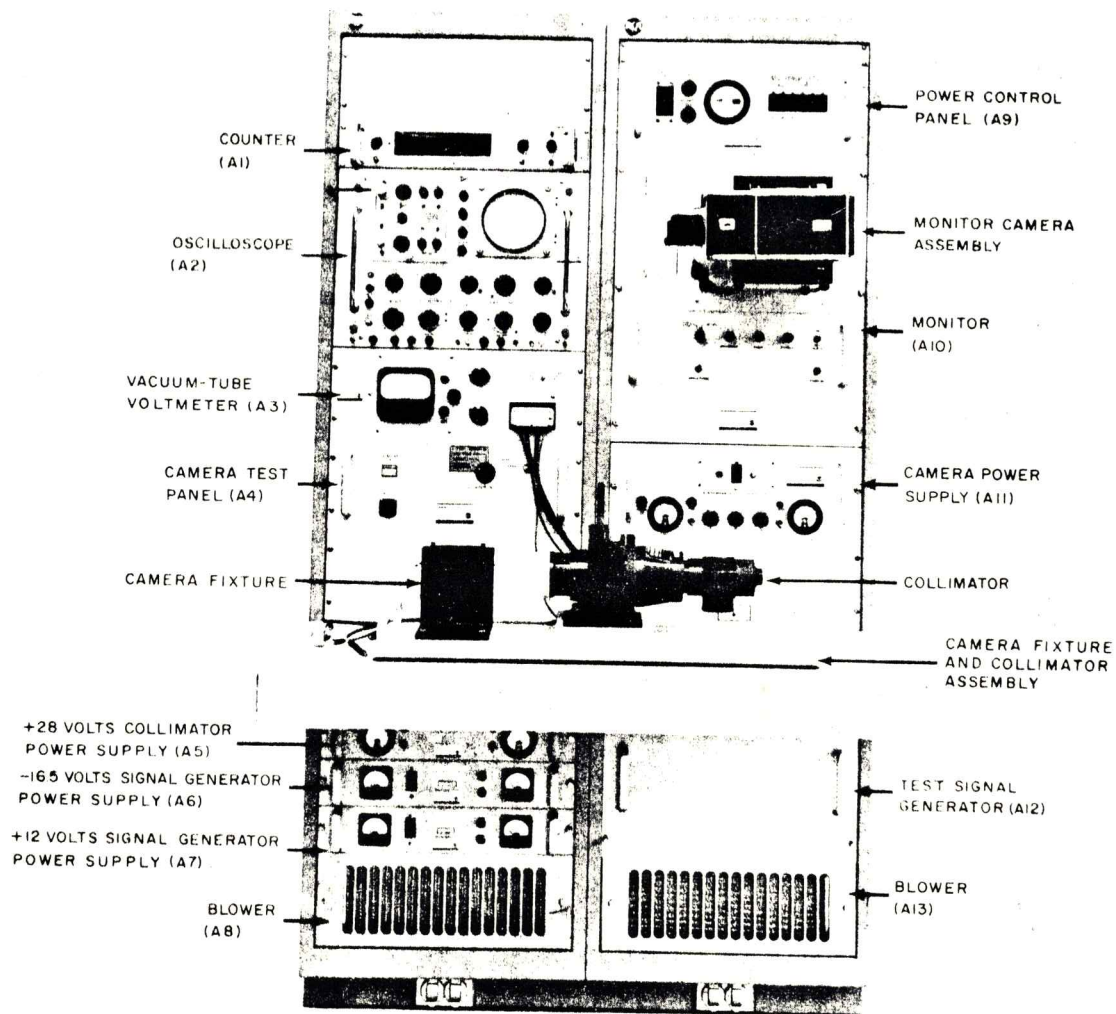
1-6. The major characteristics of TVBME operation are provided in table 1-3.

1-7. FUNCTIONAL DESCRIPTION. (See figure 9-1.)

1-8. The primary function of the TVBME is to exercise the ATVC and to process and display the resultant composite-video responses. Support functions include the functional self-testing of the TVBME, the control and distribution of operating power for the ATVC and the TVBME, and the monitoring functions of the standard test equipments. Paragraphs 1-9 through 1-18 describe major component operation as related to accomplishment of these functions.

1-9. MONITORING OF TV CAMERA PICTURES.

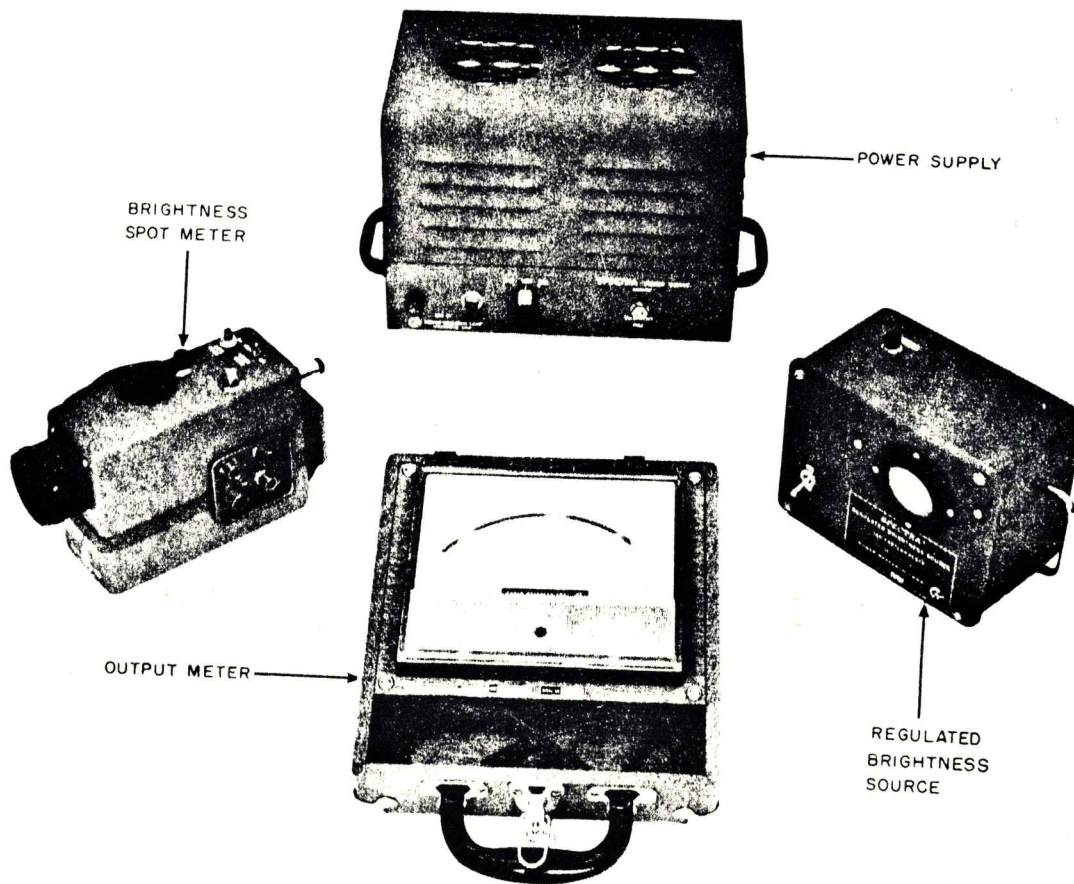
1-10. The collimator, mounted in the proper relative position with respect to the ATVC, projects a selected optical test pattern into the lens of the ATVC. The resulting composite-video signal, in electrical form, is routed through the camera test panel to the monitor. There, a television picture is produced that is synchronized with the signals extracted from the composite-video signal, and the detected television picture is displayed on the face of the kinescope. Using the monitor camera, a photographic record of this television presentation is obtained. The photograph is examined to determine whether the tested characteristics of the ATVC picture are satisfactory. This procedure can be repeated using the three separate test patterns supplied with the collimator to determine specific picture characteristics as follows: resolution, linearity, and gray-scale rendition.



64-6-02

Cabinets, Monitor Camera Assembly, and Collimator

Figure 1-1. Apollo Television Bench Maintenance Equipment (Sheet 1 of 2)



64-6-10

Spot Photometer

Figure 1-1. Apollo Television Bench Maintenance Equipment (Sheet 2 of 2)

Table 1-1. Major Components

Component	Part No.	Reference Designator	Function or Description
Counter	1704711-502	A1	Hewlett-Packard model No. 5532A: Used to measure periods and frequencies of ATVC signals.
Oscilloscope	1754811-1	A2	Tektronix model No. RM45A with plug-in unit type No. CA: Used to observe waveforms of the ATVC and the TVBME.
Vacuum-tube voltmeter	1754813-2	A3	Hewlett-Packard model No. 410BR: Used to measure ATVC voltages and resistances.
Camera test panel	1756204-501	A4	Selects the composite-video input to the monitor and controls the application of power to the ATVC. Provides a multi-pin jack for making power and composite-video connections to the ATVC.
Positive 28 volts collimator power supply	1755275-501	A5	Lambda model No. LE-101M-1558: Provides regulated 28-volt d-c power for the collimator.
Negative 16.5 volts signal generator power supply	1755277-501	A6	Lambda model No. LT-2095AM-1605: Provides regulated -16.5-volt d-c power for the test signal generator.
Positive 12 volts signal generator power supply	1755278-501	A7	Lambda model No. LT-1095 AM-1605: Provides regulated 12-volt d-c power for the test signal generator.
Blower	1754812-1	A8 and A13	McLean Engineering Laboratories: Circulates cooling air through the cabinets.

Table 1-1. Major Components (Continued)

Component	Part No.	Reference Designator	Function or Description
Power control panel	1756200-501	A9	Controls application of and provides overload protection for primary power required by the TVBME components. Records elapsed operating time and indicates blower failures.
Monitor	1756206-501	A10	Displays television information on a kinescope. Provides controls for operation and adjustment of the television presentation.
Camera power supply	1755274-501	A11	Lambda model No. LE-101FM-1557 (modified to incorporate automatic over-voltage control): Provides regulated zero-to 36-volt d-c operating power for the ATVC. Unless disabled, the special over-voltage circuit turns "off" the power supply if the output voltage attempts to rise above the pre-set maximum of 31 volts.
Test signal generator	1756220-501	A12	Generates composite-video test signals to check operation of the monitor.
Monitor camera assembly	1756278-501	—	Photographs selected frames of the video information displayed on the monitor.
Camera Fixture and Collimator Assembly	1756682-501	—	The collimator, Farrand part No. 117470, is used to project optical test images into the lens of the ATVC. The camera fixture provides adjustable mechanical mounting to support the ATVC in proper alignment with respect to the collimator.
Spot Photometer	1755782-501 thru 1755782-504	—	Photo Research Corp. Spectra Model UB 1/2: Used to measure the brightness of the collimator light source and of the television display on the monitor.

Table 1-3. Leading Particulars

Dimensions and Weight of Cabinets

Height	77.5 inches
Width of both cabinets	42.12 inches
Weight of both cabinets, including components	1150 pounds
Depth of work shelf	18 inches
Height of work shelf	30 inches

Input-Power Requirements

Line-voltage range	114 to 120 volts ac
Line current	30 amperes
Line frequency	60 cycles per second
Phase	Single, 3 wires

Operating Environment

Temperature	60 to 80° F
Humidity	60 ± 15% at 70 ± 10° F
Altitude	6000 feet (maximum)

Cooling of Cabinets	Two 300-cubic-feet-per-minute blowers
-------------------------------	---------------------------------------

Television Display Characteristics

Type	Slow-scan television
Width of raster, adjustable	7.2 inches (nominal)
Height of raster, adjustable	5.4 inches (nominal)
Aspect ratio of raster	4 to 3
Frame rate	10 frames per second
Line rate	320 lines per frame
Resolution, minimum	500 lines at center of raster 300 lines at corners of raster
Gray-scale rendition, minimum	Seven levels, including black and white
Shading, maximum	5 percent of peak video amplitude

Television Signal Input

Type	Composite video (video and synchronizing signals)
Voltage range	Zero to 2.0 ± 0.1 volts dc

Table 1-3. Leading Particulars (Continued)

Television Signal Input (Continued)

Video bandwidth	2 megacycles
Synchronizing signal, tip level	Zero volt dc
Black level	0.46 ± 0.01 volts dc
Porch level	1.0 ± 0.1 volts dc
White level, maximum	2.0 ± 0.1 volts dc
Input impedance	100 ohms

Vertical-synchronizing signal

Pulse width	2.50 ± 0.25 milliseconds
Pulse repetition frequency	10 pulses per second

Horizontal-synchronizing signal

Pulse width	16 ± 5 microseconds
Pulse repetition frequency	3200 pulses per second

Kinescope

Size	10-inch diameter
Phosphor, type	P4
Deflection, type	Electromagnetic
Focusing, type	Electrostatic
ULTOR voltage	20 kilovolts

D-C Power Output

Source	Camera power supply
Type	Regulated
Range	Zero to 36 volts dc

Monitor Camera Assembly

Camera type	Graflex Crown Graphic "45" with Schneider, Angulon f/6.8, 90-mm lens in Prontor-Press self-cocking shutter
Camera back	Graphic Polaroid Back, Catalog No. 9108
Film, normally used	Type 47 (3000 speed)

Convenience Outlets

Type	Primary power, 3-pin
Number	2 pairs
Location	Base of cabinets
Current, maximum available	5 amperes

1-13. POWER CONTROL AND DISTRIBUTION.

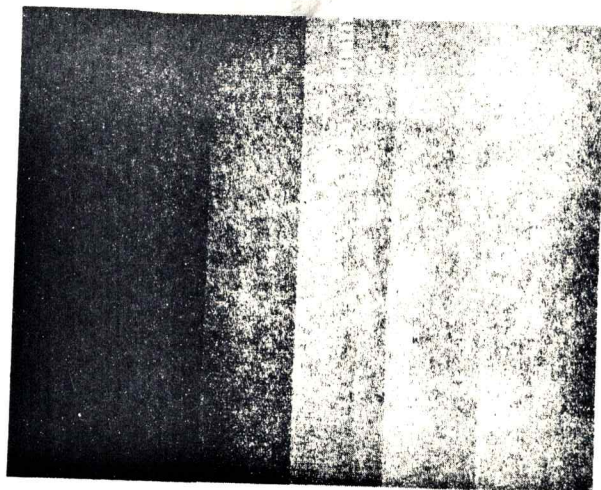
1-14. The power control panel controls the application and distribution of 117-volt, 60-cycle primary power within the TVBME. The primary power is received through line filters FL1 and FL2 and applied to circuit breakers within the power control panel. The line filters attenuate input and output radio-frequency interference signals, and the circuit breakers control the application of power to all TVBME components.

1-15. Four d-c power supplies provide the regulated voltages for operation of the ATVC and TVBME. The outputs of three supplies are normally set at +28, -16.5, and +12 volts dc. The +28 volts dc is provided to the collimator. The -16.5 and +12 volts dc are provided to the test signal generator. The output of the fourth supply which is applied to the ATVC can be adjusted between zero and 36 volts dc.

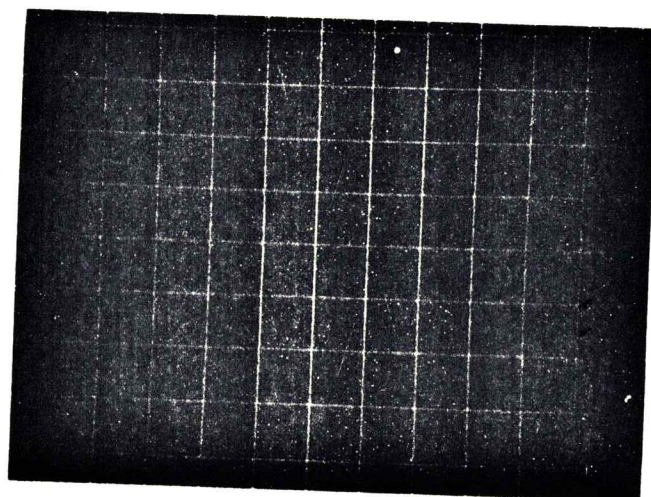
1-16. MONITORING FUNCTIONS OF STANDARD TEST EQUIPMENT.

1-17. The counter, vacuum-tube voltmeter, and oscilloscope may be used to measure and check signals available at test jack J351 on the ATVC. The test plug assembly (part No. 1758883-501) supplied with the TVBME is plugged into the test jack on the ATVC to facilitate connection of the test equipment.

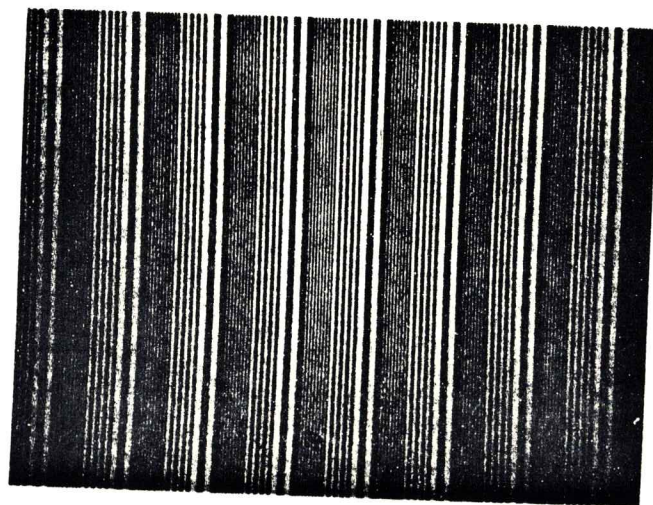
1-18. The oscilloscope is also used to monitor the composite-video signals supplied to the monitor. Test plug P6, located on the left side of the cabinet, is normally connected to the vertical input of the oscilloscope for this purpose.



A. Gray-Scale Test Pattern



B. Linearity Test Pattern



C. Horizontal-Resolution Test Pattern

Figure 1-2. Television Displays of Test Signal Generator Test Signals

SECTION II

SPECIAL TOOLS AND TEST EQUIPMENT

2-1. SPECIAL TOOLS.

2-2. There are no special tools required for maintenance of the TVBME.

2-3. TEST EQUIPMENT.

2-4. STANDARD TEST EQUIPMENT.

2-5. A Simpson model No. 270 multimeter or equivalent is required to perform measurements during the functional test procedure.

2-6. SPECIAL TEST EQUIPMENT.

2-7. There is no special test equipment required for maintenance of the TVBME.

SECTION III

OPERATION AND FUNCTIONAL TEST

3-1. This section provides descriptions of the controls and indicators for the non-standard components, the functional test procedure, and operation procedures.

3-2. CONTROLS AND INDICATORS.

3-3. The controls and indicators of the power control panel, monitor, and camera test panel are illustrated in figures 3-1, 3-2, and 3-3, respectively. Tables 3-1, 3-2, and 3-3 describe each control and indicator. The tables are keyed to the callouts appearing in the respective illustrations.

3-4. FUNCTIONAL TEST PROCEDURE.

3-5. EQUIPMENT SETUP.

CAUTION

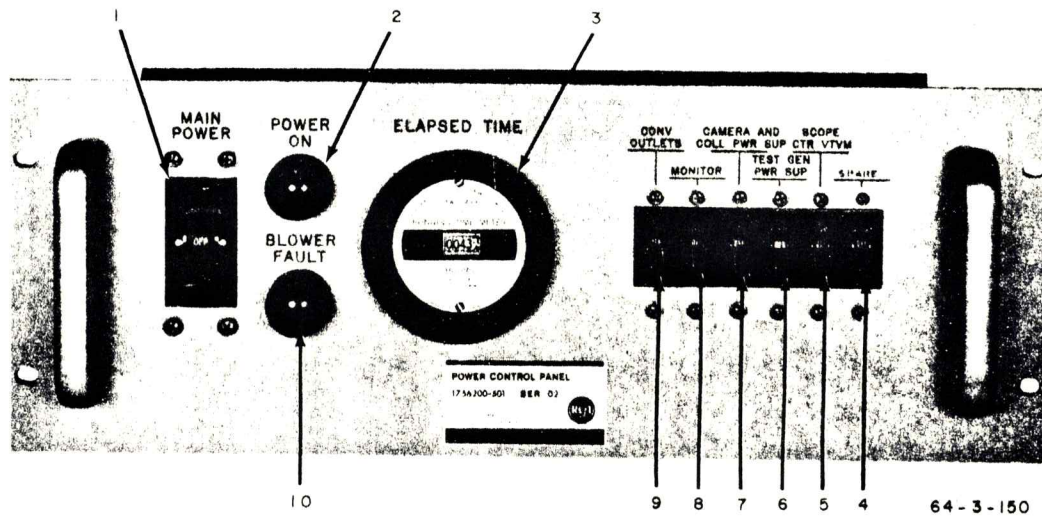
Primary 117-volt power should not be made available to the TVBME until specified.

3-6. Inspect the TVBME and verify the following conditions in the order presented:

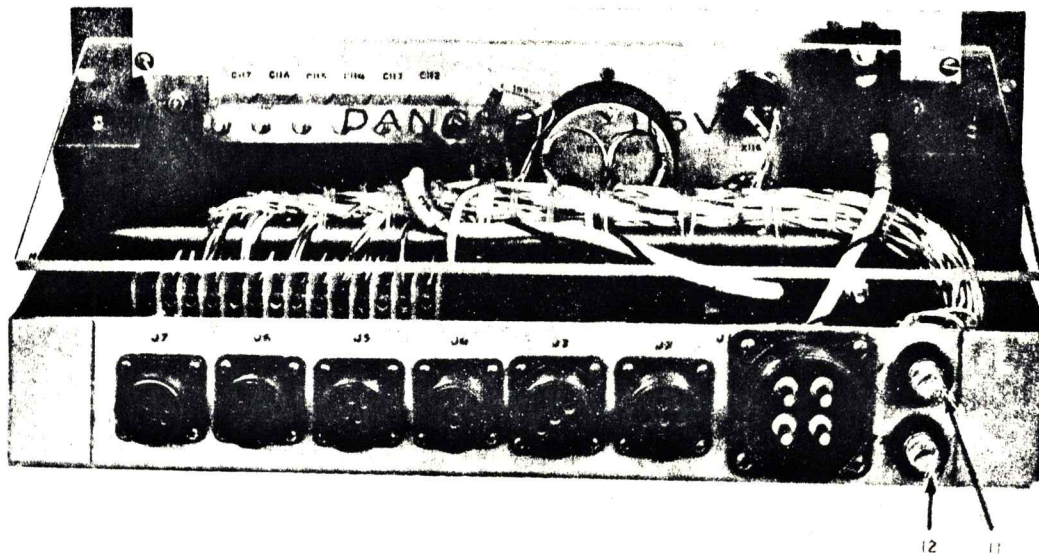
- a. The cabinets are securely bolted to the floor or mounting surface.
- b. All cabinet-mounted components are securely installed and properly interconnected. (See figures 1-1 and 9-1.)
- c. The collimator with lens cap in place is properly located on the work shelf.
- d. Test cable W2 (part No. 1758920-501) is connected to the CAMERA jack on the camera test panel.
- e. The monitor camera assembly is attached to the monitor.
- f. All commercial components have calibration tags that have not expired.
- g. The external and internal controls of the TVBME are set to initial positions as listed in table 3-4. (The initial positions for the controls not listed in table 3-4 are not important.)

Table 3-1. Power Control Panel Controls and Indicators

Key	Control or Indicator	Type	Function
1	MAIN POWER circuit breaker (CB1)	Magnetic	When set to ON position, applies primary power to the power control panel and both blowers.
2	POWER ON indicator lamp (DS1)	Green	When lighted, indicates primary power is applied to the power control panel and both blowers.
3	ELAPSED TIME meter (M1)	Digital readout	Indicates total elapsed operating time to nearest tenth of an hour.
4	SPARE circuit breaker (CB7)	Magnetic	Not used.
5	SCOPE CTR VTVM circuit breaker (CB6)	Magnetic	When set to ON position, makes primary power available for the oscilloscope, counter, and vacuum-tube voltmeter.
6	TEST GEN PWR SUP circuit breaker (CB5)	Magnetic	When set to ON position, makes primary power available for the -16.5 and +12 volts signal generator power supplies
7	CAMERA AND COLL PWR SUP circuit breaker (CB4)	Magnetic	When set to ON position, makes primary power available for the camera power supply and the +28 volts collimator power supply.
8	MONITOR circuit breaker (CB3)	Magnetic	When set to ON position, makes primary power available for the monitor.
9	CONV OUTLETS circuit breaker (CB2)	Magnetic	When set to ON position, applies primary power to the two pairs convenience outlets.
10	BLOWER FAULT indicator lamp (DS2)	Red	When lighted, indicates improper operation of either or both blowers.
11	F1 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F1) for blower A13.
12	F2 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F2) for blower A8.



Front View

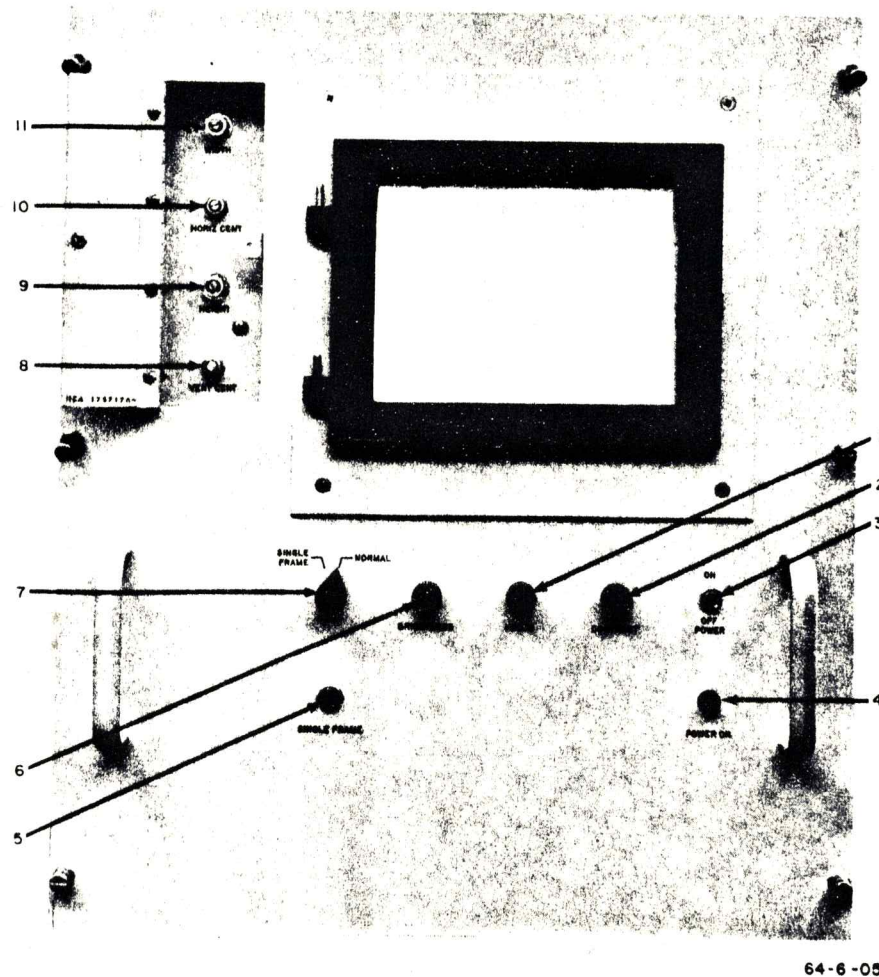


Back View

Figure 3-1. Power Control Panel Controls and Indicators

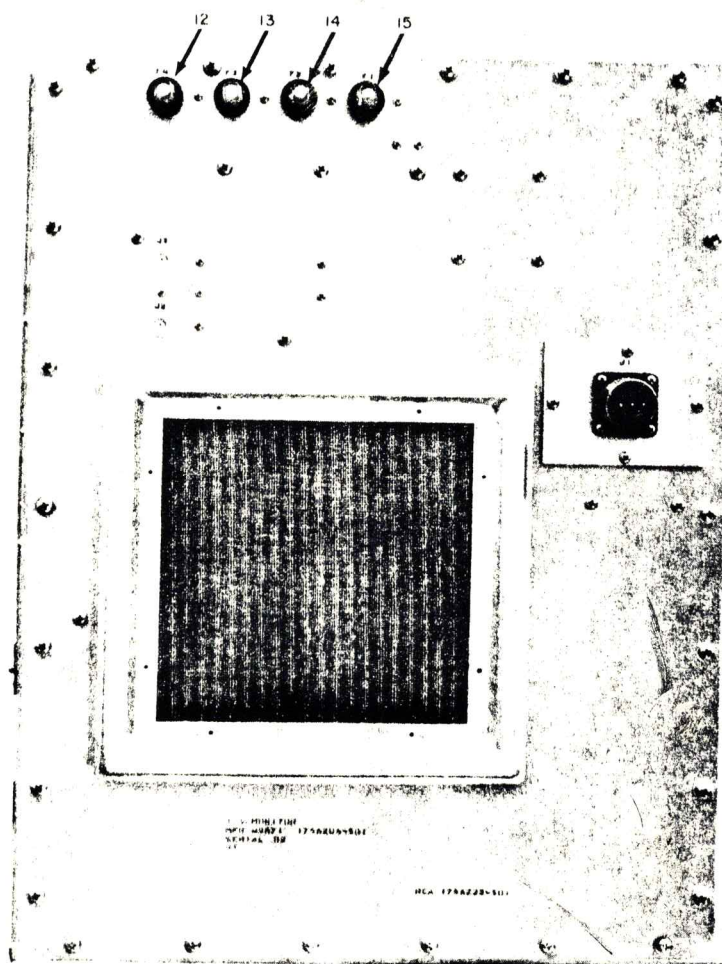
Table 3-2. Monitor Controls and Indicators

Key	Control or Indicator	Type	Function
1	FOCUS control (R102)	Potentiometer	Adjusts focus of the television presentation.
2	CONTRAST control (R92)	Potentiometer	Adjusts black-to-white differentiation of the television presentation.
3	POWER switch (CB1)	Circuit breaker	When set to ON position, applies primary power to the monitor.
4	POWER ON indicator lamp (DS1)	Green	When lighted, indicates primary power is applied to the monitor.
5	SINGLE FRAME switch (S1)	Pushbutton	If mode switch (7) is in SINGLE FRAME position, initiates one scan of the television raster when pressed and released.
6	BRIGHTNESS control (R98)	Potentiometer	Adjusts brightness of the television presentation.
7	Mode switch (S2)	Rotary	When set to NORMAL position, places the monitor in continuous-display mode. When set to SINGLE FRAME position, places the monitor in single-frame-display mode and under control of the SINGLE FRAME switch (5).
8	VERT CENT. control (R104)	Potentiometer	Adjusts the vertical position of the kinescope raster.
9	HEIGHT control (R105)	Potentiometer	Adjusts the height of the kinescope raster.
10	HORIZ CENT. control (R95)	Potentiometer	Adjusts the horizontal position of the kinescope raster.
11	WIDTH control (R93)	Potentiometer	Adjusts the width of the kinescope raster.
12	F4 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F4) in the -25-volt vertical-deflection power supply.
13	F3 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F3) in the +25-volt vertical-deflection power supply.
14	F2 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F2) in the -25-volt horizontal-deflection power supply.
15	F1 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F1) in the +25-volt horizontal-deflection power supply.



Front View

Figure 3-2. Monitor Controls and Indicators (Sheet 1 of 2)



64-6-07

Back View

Figure 3-2. Monitor Controls and Indicators (Sheet 2 of 2)

WARNING

Proper grounding of the TVBME cabinets is required to prevent the buildup of dangerous voltage levels. If 3-wire power with proper earth grounding is not available, the busbar in the TVBME cabinets must be grounded with a grounding strap.

h. Primary power cable W1 (part No. 1758285-501) is connected between the TVBME and the 117-volt power source.

i. The 117-volt power source is energized.

3-7. TEST PROCEDURE.

3-8. PRIMARY POWER CONTROL. (See figure 3-1.) Proceed as follows:

a. Set the MAIN POWER circuit breaker (1) to ON position.

b. Verify that the POWER ON indicator lamp (2) lights.

c. Verify that the BLOWER FAULT indicator lamp (10) lights for a short period and then goes out.

d. Verify that the ELAPSED TIME meter (3) is running.

e. Set the SCOPE CTR VTVM circuit breaker (5) to ON position.

f. Set the SELECTOR switch on the vacuum-tube voltmeter (1, figure 3-6) in AC position.

g. Verify that the power indicator lamp (green) on the vacuum-tube voltmeter lights.

h. Set the POWER switch on the oscilloscope (1, figure 3-5) to "up" position (on).

i. Verify that the power indicator lamp (green) on the oscilloscope lights.

j. Set the power switch on the counter (1, figure 3-4) to ON position.

k. Verify that the Nixie lamps on the counter light.

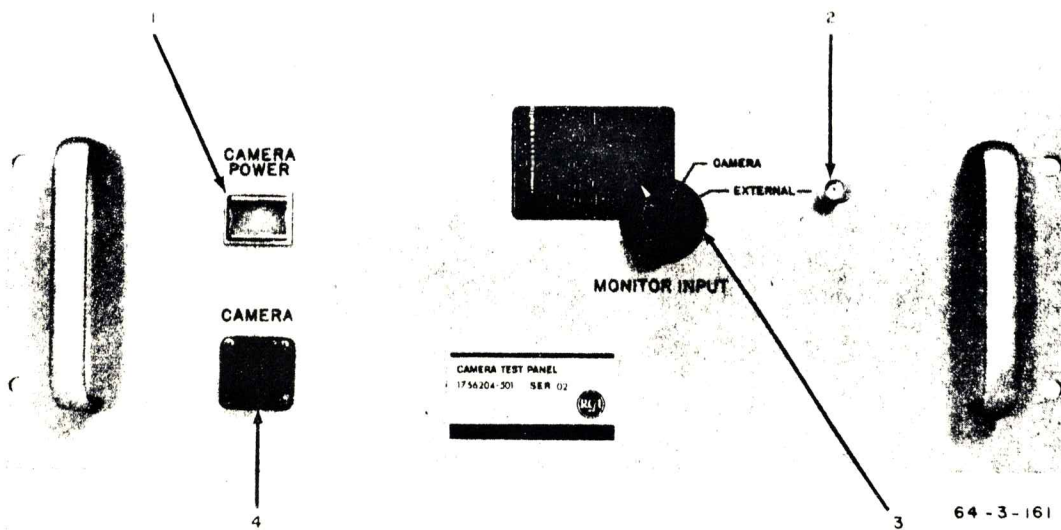
l. Set the CONV OUTLETS circuit breaker (9) to ON position.

m. Using a multimeter, check for 117 volts ac (nominal) at the convenience outlets located at the bottom of each cabinet.

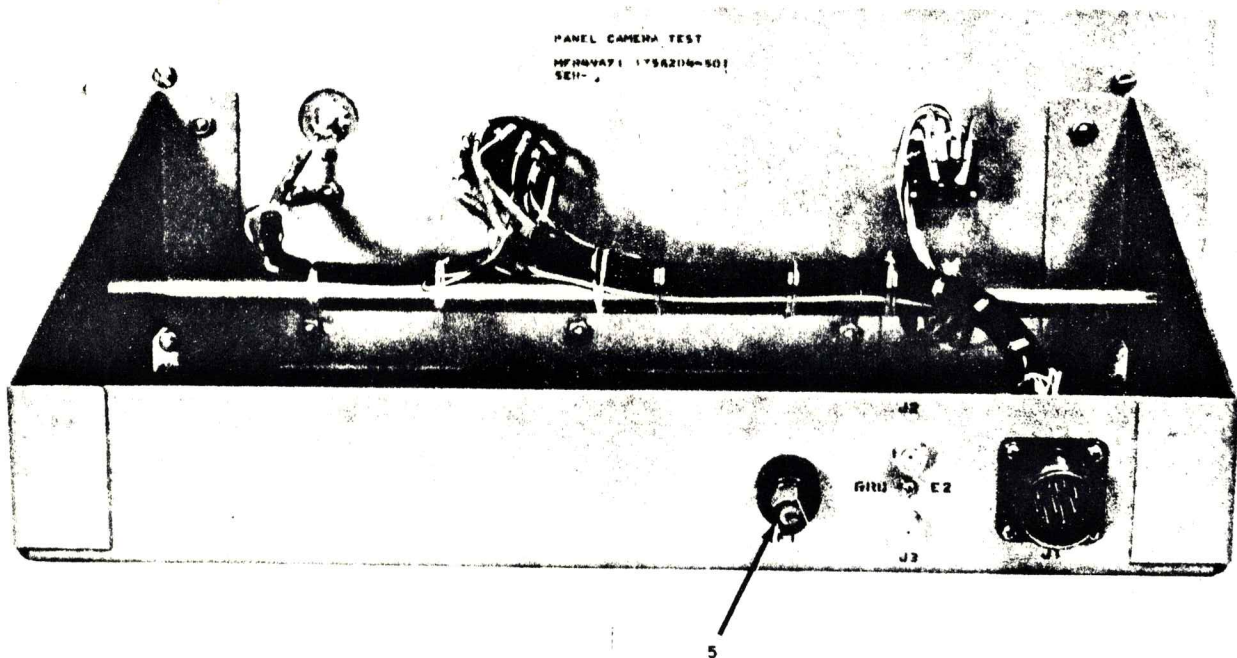
n. Set the following circuit breakers to ON position: MONITOR (8), CAMERA AND COLL PWR SUP (7), and TEST GEN PWR SUP (6).

Table 3-3. Camera Test Panel Controls and Indicators

Key	Control or Indicator	Type	Function
1	CAMERA POWER indicator/switch (A1)	Alternate-action pushbutton	When pressed (lighted), connects d-c operating power to the CAMERA jack (4) for the ATVC.
3	MONITOR INPUT switch (S1)	Rotary	<p>When set to HORIZONTAL RESOLUTION, LINEARITY, or GRAY SCALE position of the TEST SIGNALS group, enables generation of the corresponding test signal in the test signal generator and routes this signal to the monitor.</p> <p>When set to CAMERA position, disables the test outputs of the test signal generator and routes the composite-video signal of the ATVC, received via the CAMERA jack (4), to the monitor.</p> <p>When set to EXTERNAL position, disables the test outputs of the test signal generator and routes the composite-video signal, received via the coaxial jack (2) on the front panel, to the monitor.</p>
5	F1 indicator/fuse	Gas tube	When lighted, indicates an open fuse (F1) in the d-c power line to the ATVC.



Front View



Back View

Figure 3-3. Camera Test Panel Controls and Indicators

Table 3-4. Initial Positions for Component Controls

Component	Figure and Key	Control	Initial Position
Power control panel	3-1, 1 and 4 through 9	All circuit breakers	OFF
Monitor	3-2, 3 6 2	POWER switch BRIGHTNESS control CONTRAST control	OFF Mid-position (approximate) Mid-position (approximate)
Counter	3-4, 1 2 3 4	Toggle switch Slide switch Toggle switch EXT - INT toggle switch	Left (not ON) 115 Left (not STORAGE) INT
Oscilloscope	3-5, 1 2	POWER switch Toggle switch	Down (not ON) Up (not CHOPPED BLANKING)
Vacuum-tube voltmeter	3-6, 1	SELECTOR switch	OFF
Positive 28 volts collimator power supply	3-7, 1 2 3 4 5	Toggle switch INDICATOR SELECTOR switch VOLTAGE CONTROLS CURRENT CONTROL INPUT FREQ SWITCH	Down (not ON) VOLTAGE REGULATED 28 volts 0.5 ampere 45-66 cps
Negative 16.5 volts signal generator power supply	3-8, 1 2 3 4	Circuit breaker DC VERNIER CONTROL Toggle switch A-B Toggle switch C-D	OFF Maximum counterclock- wise B C

Table 3-4. Initial Positions for Component Controls (Continued)

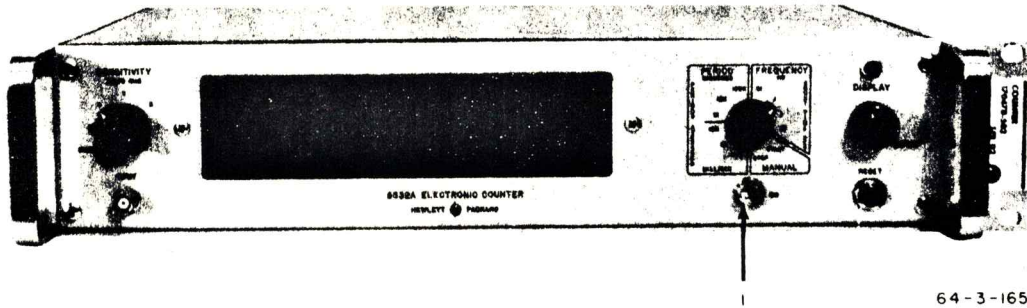
Component	Figure and Key	Control	Initial Position
Positive 12 volts signal generator power supply	3-8, 1	Circuit breaker	OFF
	2	DC VERNIER CONTROL	Mid-position (approximate)
	3	Toggle switch A-B	A
	4	Toggle switch C-D	D
Camera power supply	3-9, 1	0-31VDC: 0-36VDC switch	0-31VDC
	2	Circuit breaker	OFF
	3	INDICATOR SELECTOR switch	VOLTAGE REGULATED
	4	I AMPERES control	Maximum clockwise
	5	Δ V VOLTS control	Zero (0)
	6	V VOLTS control	28 volts
	7	Toggle switch	Down (not ON)
	8	INPUT FREQ SWITCH	45-66 CPS

3-9. POWER SUPPLIES. Check the four power supplies as described in paragraphs 3-10 through 3-13.

3-10. Camera Power Supply. (See figure 3-9.) Proceed as follows:

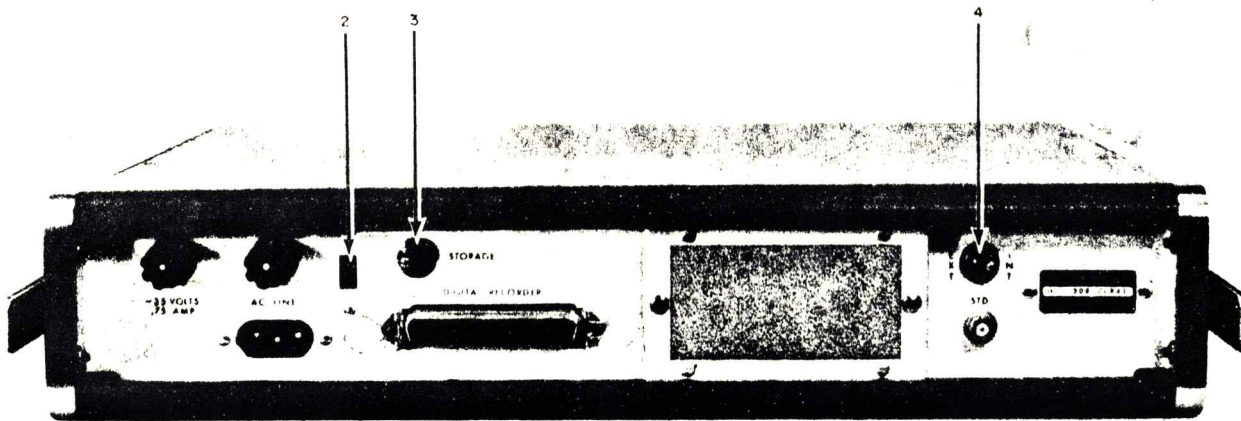
- a. Set the toggle switch (7) to ON position.
- b. Set the circuit breaker (2) to ON position.
- c. Verify that the POWER indicator lamp (green) lights
- d. Slowly increase the output voltage as read on the OUTPUT VOLTAGE meter by turning the V VOLTS control (6) clockwise. When the output reaches 31 volts dc, the over-voltage protection circuit should cause the circuit breaker (2) to return to OFF position and the POWER indicator lamp to go "out." If the circuit fails to operate, or operates at a voltage other than 31 volts dc, the 0. V ADJ. control may require adjustment.
- e. Turn the V VOLTS control (6) counterclockwise one-half turn.
- f. Set the circuit breaker (2) to ON position.
- g. Using the V VOLTS control (6) and the OUTPUT VOLTAGE meter, adjust the output to 28 volts.

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64-3-165

Front View



64-3-165

Back View

Figure 3-4. Counter

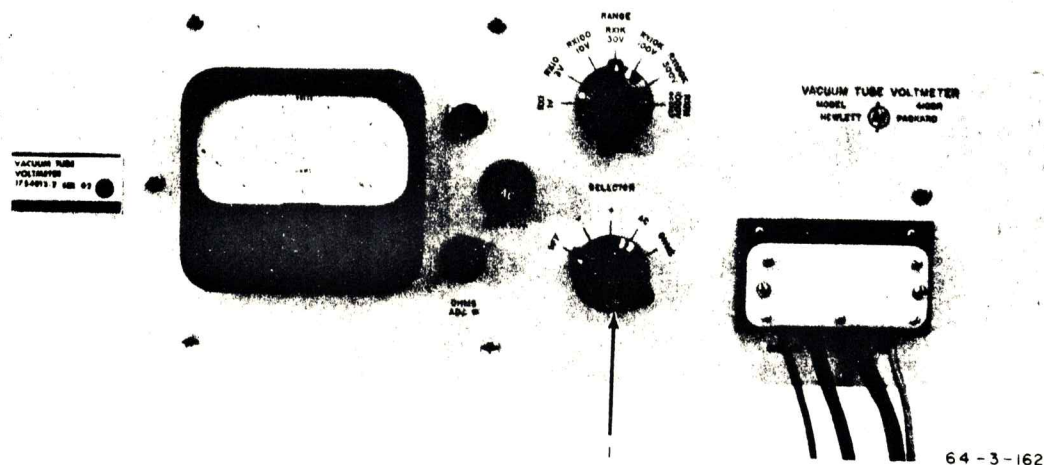


Figure 3-6. Vacuum-Tube Voltmeter

3-11. Positive 28 Volts Collimator Power Supply. (See figure 3-7.) Proceed as follows:

- a. Set the toggle switch (1) to ON position
- b. Verify that the POWER indicator lamp lights.
- c. Using the VOLTAGE CONTROLS (3), adjust the output as read on the OUTPUT VOLTAGE meter to 28 volts.

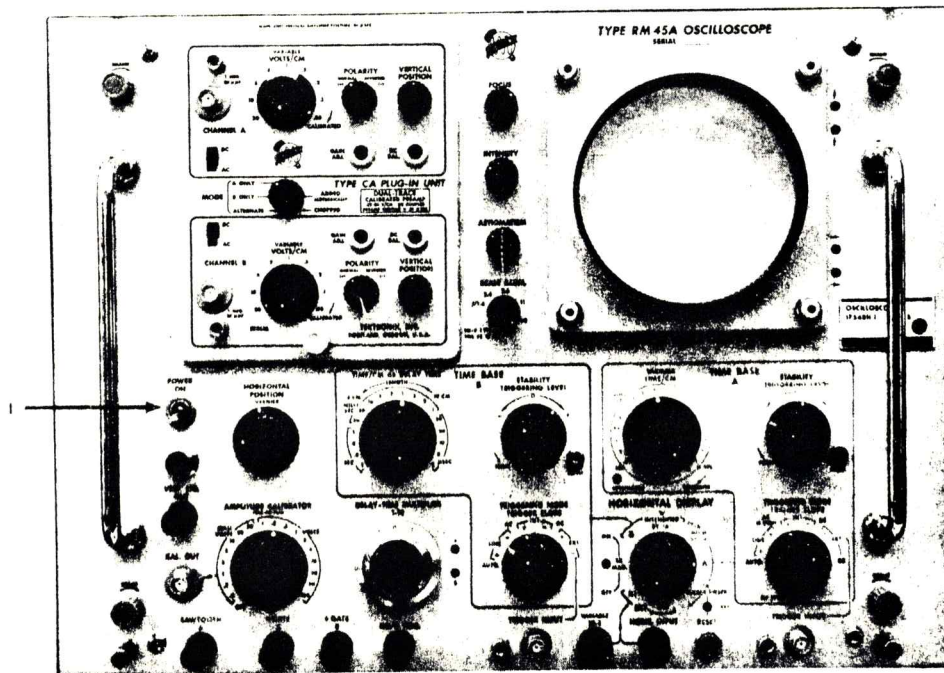
3-12. Negative 16.5 Volts Signal Generator Power Supply. (See figure 3-8.) Proceed as follows:

- a. Set the circuit breaker (1) to ON position.
- b. Verify that the POWER ON indicator lamp lights.
- c. Using the DC VERNIER CONTROL (2), adjust the output as read on the OUTPUT VOLTAGE meter to -16.5 volts.

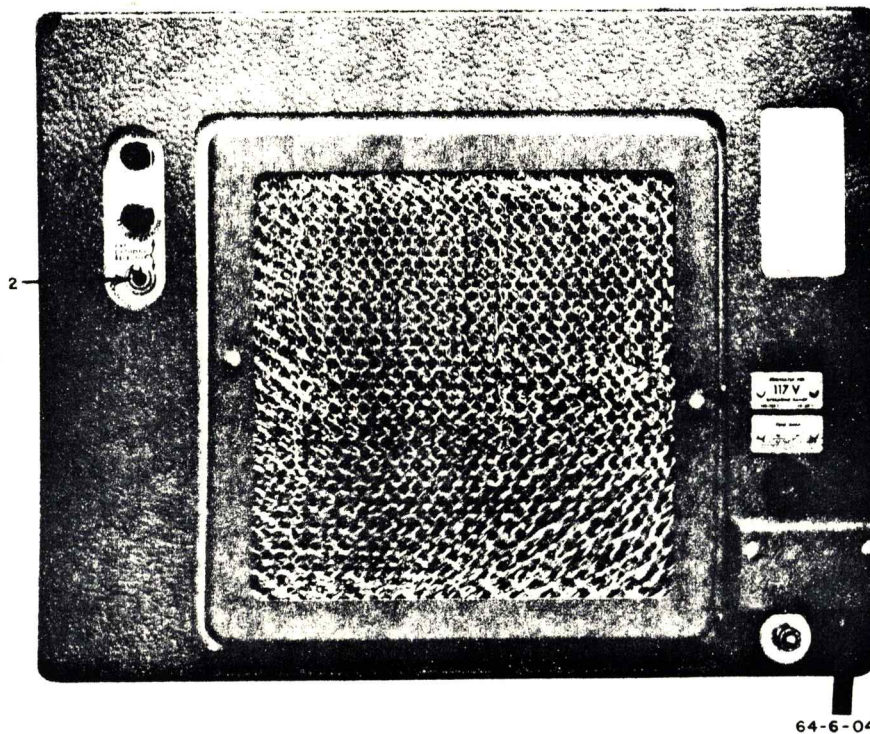
3-13. Positive 12 Volts Signal Generator Power Supply. (See figure 3-8.) Proceed as follows:

- a. Set the circuit breaker (1) to ON position.
- b. Verify that the POWER ON indicator lamp lights.
- c. Using the DC VERNIER CONTROL (2), adjust the output as read on the OUTPUT VOLTAGE meter to 12 volts.

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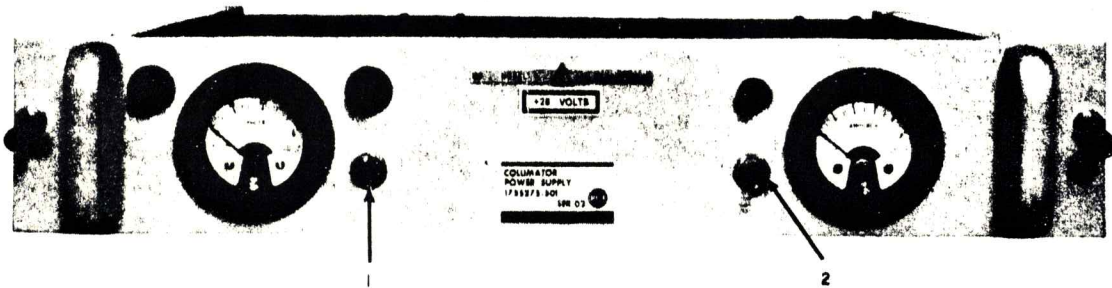
Front View



Back View

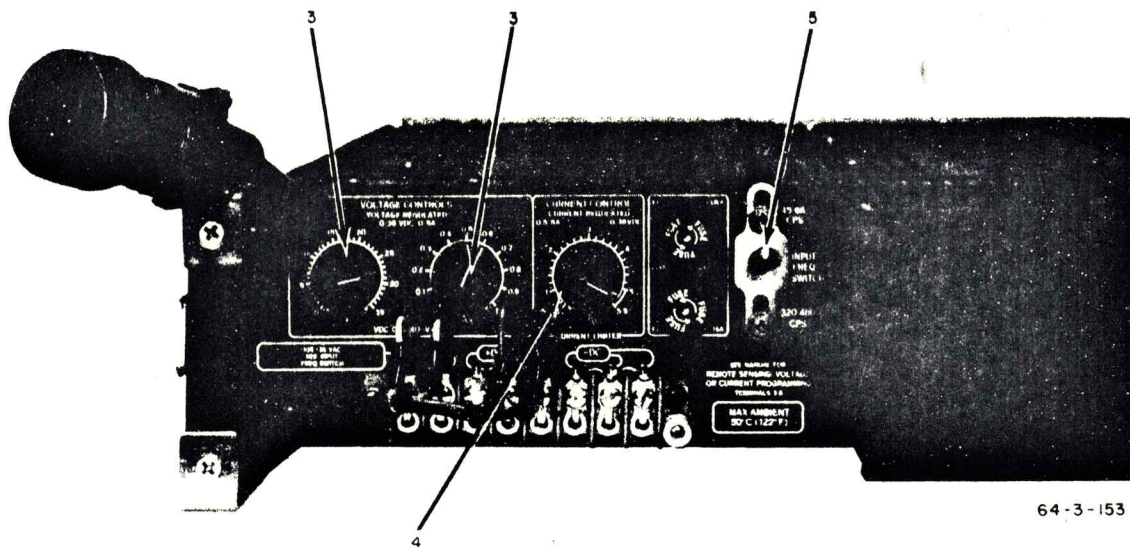
Figure 3-5. Oscilloscope

SM3A-1567



64-3-156

Front View

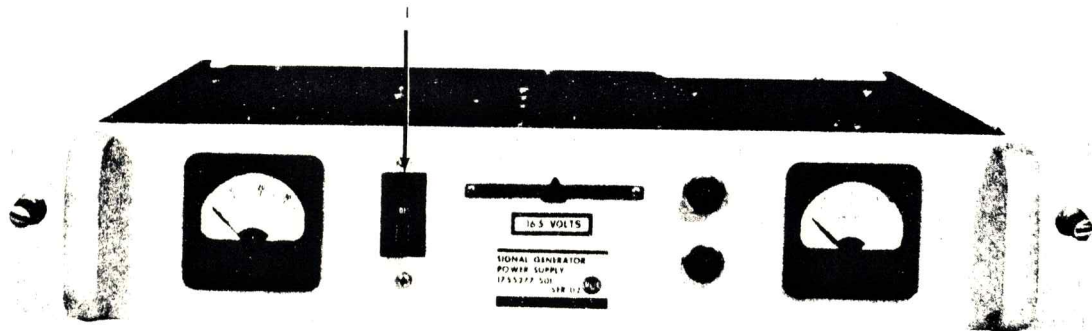


64-3-153

Back View

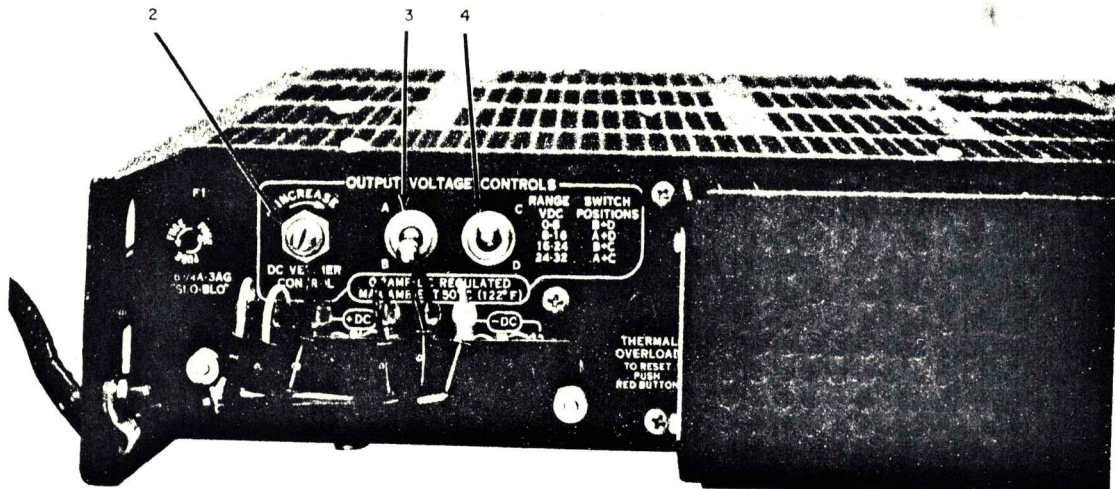
Figure 3-7. Positive 28 Volts Collimator Power Supply

SM3A-1567



64-3-155

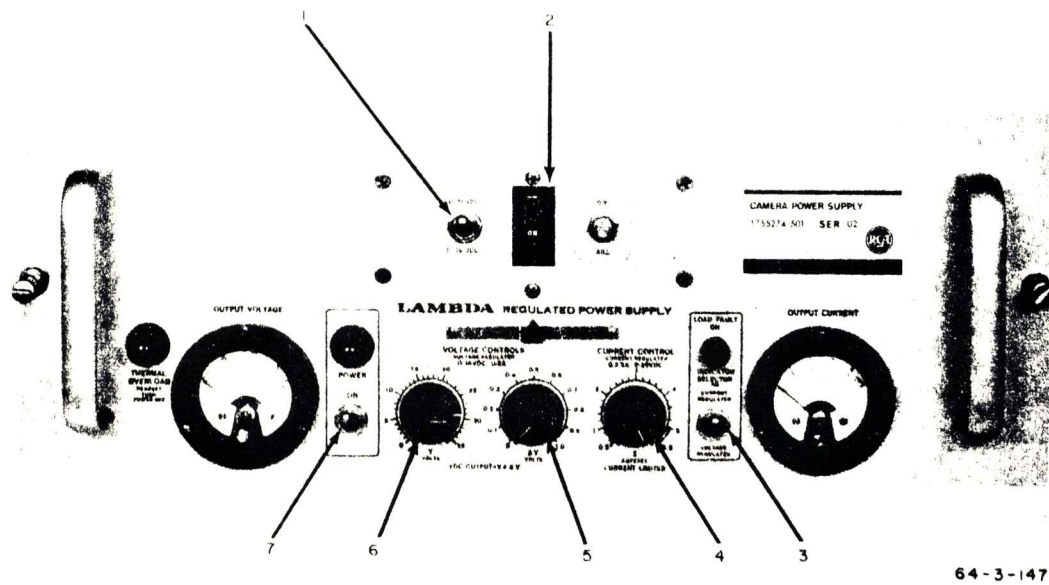
Front View



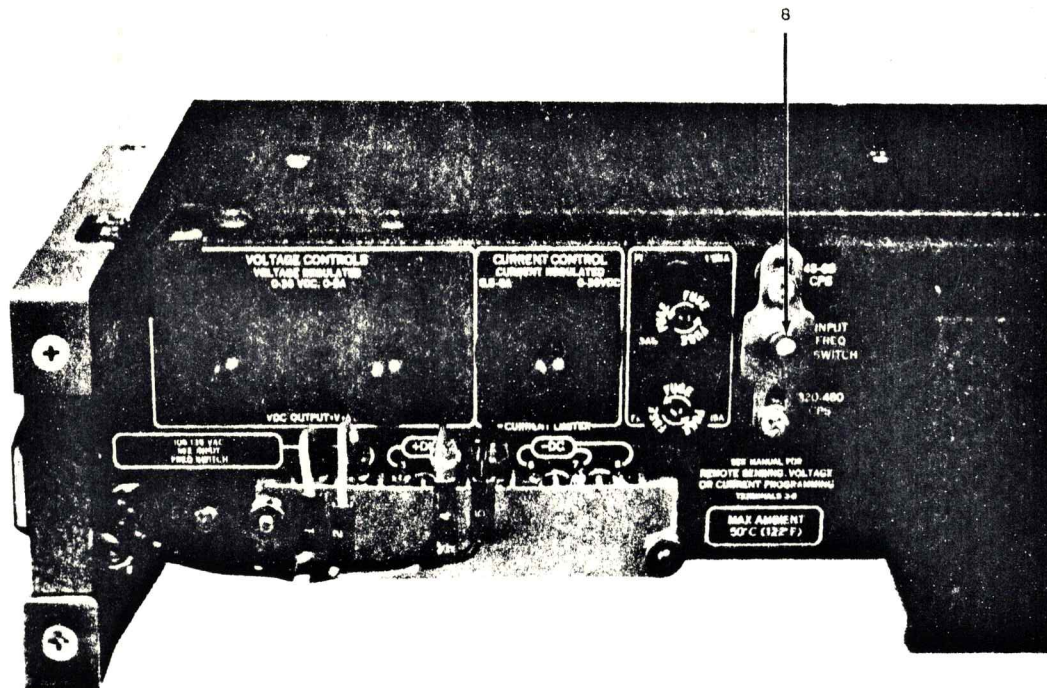
63-3-151

Back View

Figure 3-8. Negative 16.5 Volts Signal Generator Power Supply



Front View



Back View

Figure 3-9. Camera Power Supply

3-14. PICTURE-MONITORING FUNCTIONS. (See figure 3-2.) Proceed as follows:

- a. Set POWER switch (3) on the monitor to ON position. (To operate this switch, it must first be depressed fully downward and then raised slowly through the center position to the upper stop.)
- b. Verify that the POWER ON indicator lamp (4) lights.
- c. Set the mode switch (7) to NORMAL position.
- d. Set the MONITOR INPUT switch on the camera test panel (3, figure 3-3) to GRAY SCALE position.

NOTE

All of the oscilloscope displays of composite-video waveforms referenced in this procedure were obtained with the oscilloscope operated in the external synchronizing mode and with the external trigger signal obtained from a specific test point in the test signal generator. To duplicate any display which shows a vertical-synchronizing pulse at the beginning of the oscilloscope trace, use the signal from test jack A13J13 in the test signal generator (A12) for synchronization; if a horizontal-synchronizing pulse is shown at the beginning of the trace, use the signal from test jack A6J19.

- e. Connect test plug P6 to CHANNEL A input of the oscilloscope, and verify that the correct gray-scale waveforms shown in figure 3-10 can be obtained.
- f. Turn the CONTRAST control (2) on the monitor maximum counterclockwise.
- g. While observing the monitor presentation through the viewing part of the monitor camera assembly, turn the BRIGHTNESS control (6) to a point where the kinescope beam just cuts "off".
- h. Turn the CONTRAST control (2) to a point where the observed presentation appears to contain maximum white-to-black differentiation.
- i. Repeat steps g and h, as required, until the presentation of A of figure 1-2 is obtained.
- j. Adjust the FOCUS control (1) to obtain the sharpest television presentation. (This control has a very limited effect on focus.)

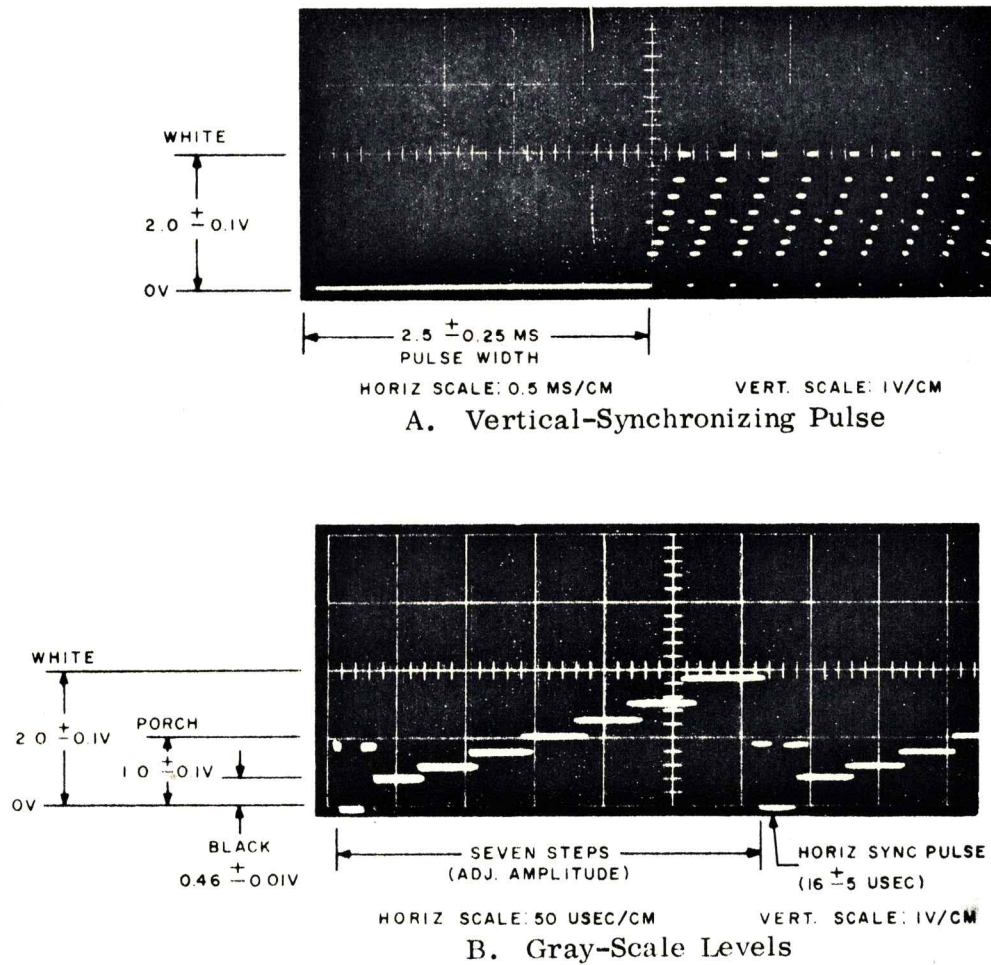


Figure 3-10. Gray-Scale Waveforms of Test Signal Generator

- k. Turn the BRIGHTNESS control (6) clockwise until the left edge of the picture is visible, and verify that the width of the television raster equals the width of the monitor screen. If width is incorrect, adjust the WIDTH control (11) as necessary.
- l. Verify that the height of the television raster equals the height of the monitor screen. If height is incorrect, adjust the HEIGHT control (9) as necessary.
- m. Verify that the raster is centered on the kinescope face. If centering is incorrect, adjust the HORIZ CENT. (10) and the VERT CENT.(8) controls as necessary. Turn the BRIGHTNESS control (6) counterclockwise until the left edge of the picture just disappears.

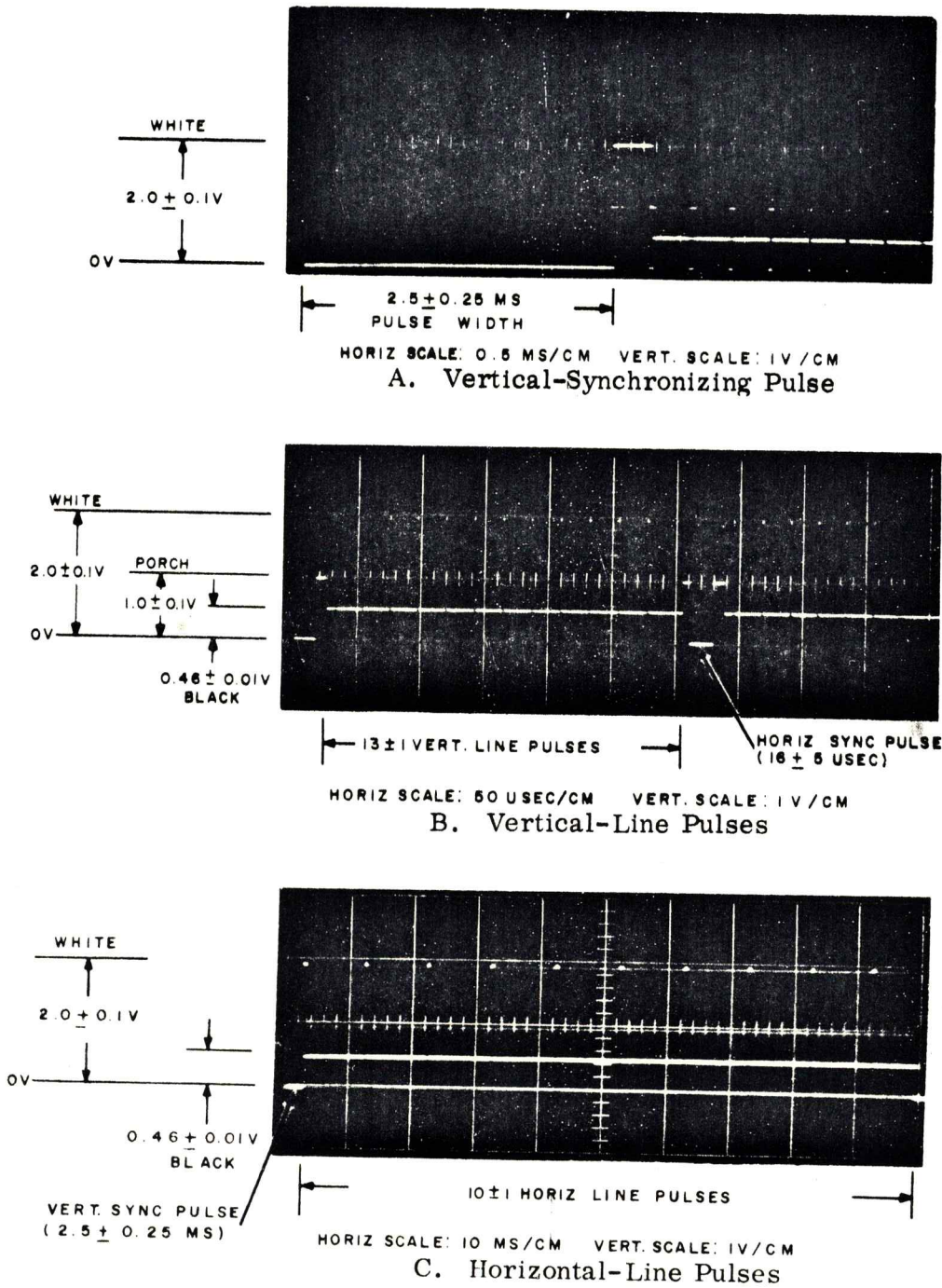


Figure 3-11. Linearity Waveforms of Test Signal Generator

n. Using the monitor camera, obtain a photograph of the television display.
(Refer to paragraph 3-23.)

o. Verify that the photograph of the gray-scale test pattern shows 7 vertical bars, graded in distinct steps from black on the left to white on the right. If this requirement is not met, take another photograph as described in step n after turning the BRIGHTNESS control (6) slightly clockwise and after turning the CONTRAST control (2) slightly counter-clockwise. Continue to take photographs until a satisfactory one is obtained.

p. Set the MONITOR INPUT switch on the camera test panel (3 figure 3-3) to LINEARITY position.

q. Verify that the correct linearity waveforms of figure 3-11 can be obtained.

r. Repeat step n and verify that the photograph of the linearity test pattern (B, figure 1-2) shows the following details:

1. There are 13 ± 1 vertical white lines.
2. There are 10 ± 1 horizontal white lines.
3. The measured spacing between adjacent lines should remain constant within 2 percent of the picture height.

s. Set the MONITOR INPUT switch on the camera test panel (3, figure 3-3) to HORIZONTAL RESOLUTION position.

t. Verify that the correct horizontal-resolution waveforms of figure 3-12 can be obtained.

u. Repeat step n and verify that the photograph of the horizontal-resolution test pattern (C, figure 1-2) shows the following details:

1. There are 8 ± 1 sets of vertical white (or black) lines.
2. Within each set there are three distinct types of vertical lines with different widths.
3. At the center of the raster, all vertical lines are clearly defined.
4. In the four corners of the raster, the medium-width vertical lines are distinguishable.

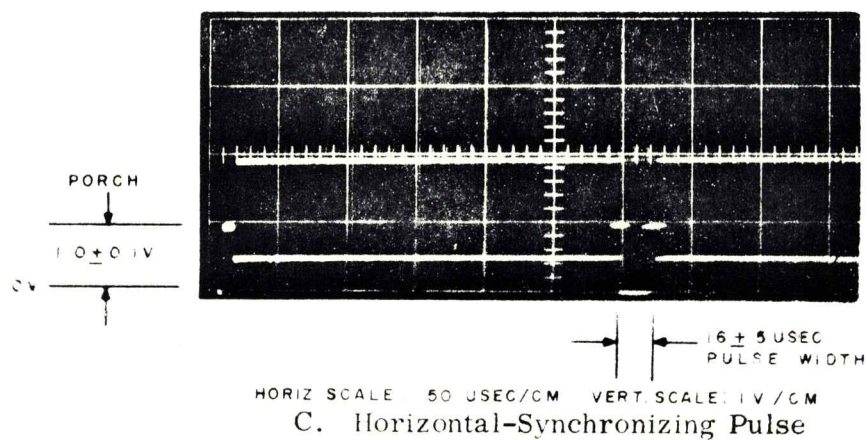
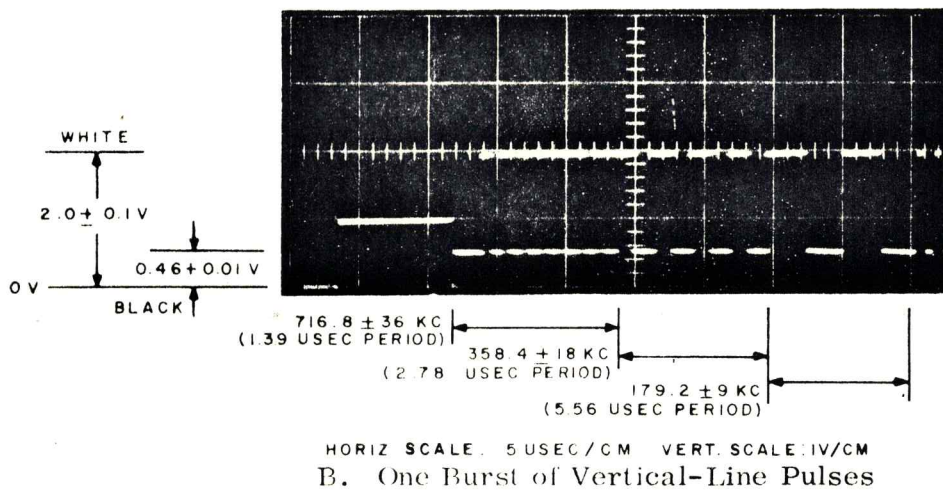
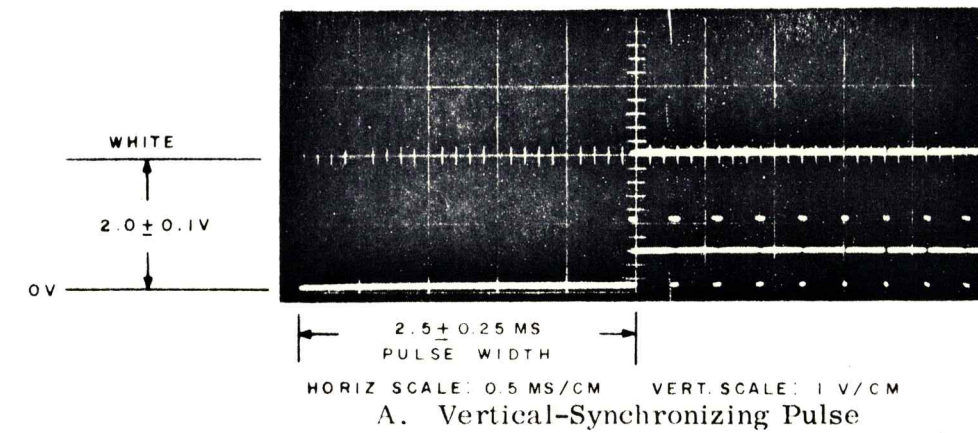


Figure 3-12. Horizontal-Resolution Waveforms of Test Signal Generator

3-15. COLLIMATOR. Proceed as follows:

- a. Set the toggle switch on the +28 volts collimator power supply (1, figure 3-7) to down position (not ON).
- b. Connect the COLLIMATOR POWER plug to the jack on the collimator. (This plug is located on the first panel above the work shelf in the right-hand cabinet.)
- c. Set the toggle switch on the collimator power supply (1, figure 3-7) to ON position.
- d. Verify that the collimator lamp lights.

3-16. D-C OUTPUT VOLTAGE FOR THE ATVC. Proceed as follows:

- a. Press the CAMERA POWER pushbutton on the camera test panel (1, figure 3-2) to the lighted (green) position.
- b. Using a multimeter, check for 28 volts dc between pins 1(+) and 2(-) and between pins 1(+) and 4(-) of the output plug of test cable W2 (part No. 1758920-501).
- c. Press the CAMERA POWER pushbutton on the camera test panel (1, figure 3-3) to the unlighted (off) position.
- d. Using a multimeter, check for zero volt dc between pins 1(+) and 2(-) of the output plug of test cable W2 (part No. 1758920-501).

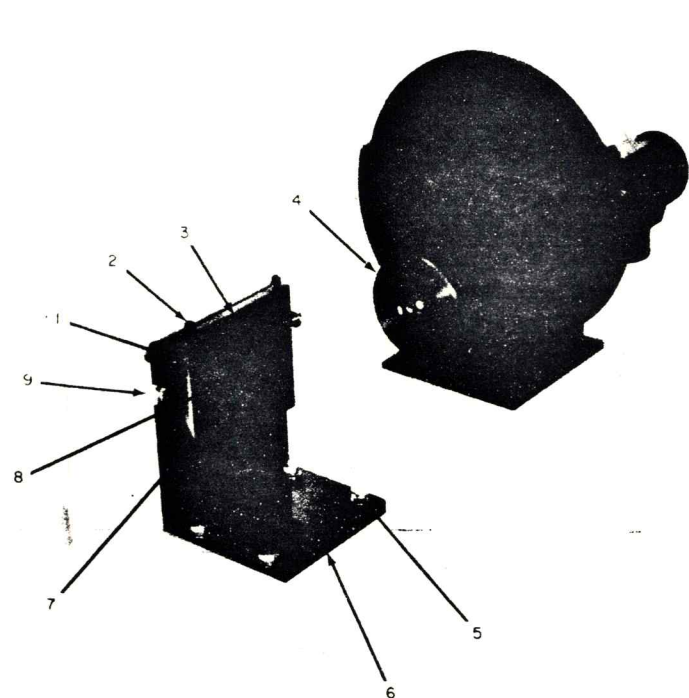
3-17. EQUIPMENT SHUTDOWN

3-18. ROUTINE SHUTDOWN. To accomplish a routine equipment shutdown, set the MAIN POWER circuit breaker on the power control panel (1, figure 3-1) to OFF position.

3-19. SHUTDOWN FOR STORAGE OR SHIPMENT. To accomplish a shutdown of equipment in preparation for storage or equipment, set the controls in the positions as listed in table 3-4.

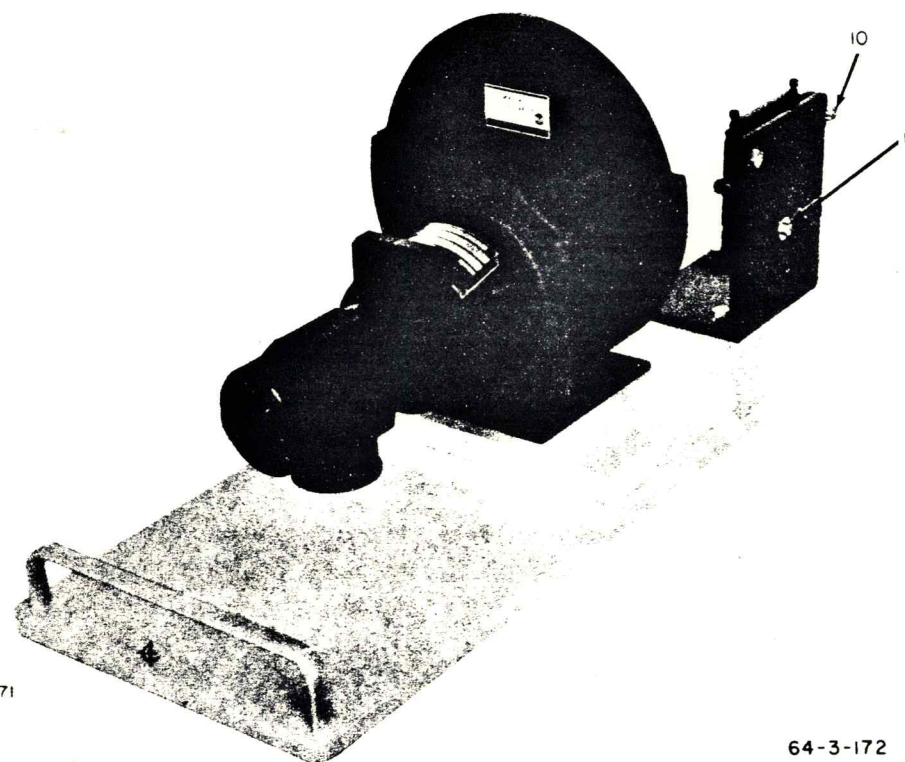
3-20. OPERATION.

3-21. CONNECTION TO THE ATVC. (See figure 3-13.)



Front Oblique View

64-3-171



Back Oblique View

64-3-172

- 1. Tilting Support
- 2. Allen Screw
- 3. Retaining Bar

- 4. Lens Assembly
- 5. Base Thumbscrew(4)
- 6. Camera Fixture

- 7. Yoke
- 8. Wedge Slot
- 9. Yoke Thumbscrew(2)

- 10. Back Thumbscrew(2)
- 11. Slot-head Screw

Figure 3-13. Collimator

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3-22. Proceed as follows:

NOTE

If the lens focus of the ATVC is not set at infinity, the results obtained with the collimator, as presently calibrated, will not be valid.

- a. Set the wide-angle lens of the ATVC at infinity.
- b. Remove the lens cap from the lens assembly (4) of the collimator.
- c. Loosen the four thumbscrews (5) on the base of the camera fixture (6) and slide the fixture to the left.
- d. Remove one allen screw (2) from the camera retaining bar (3) and swing the retaining bar away.
- e. Lower the wedge of the ATVC into the wedge slot (8) of the camera fixture until it seats firmly.
- f. Swing the camera retaining bar (3) into place and insert and tighten the allen screw (2).
- g. Slide the camera fixture (6) towards the lens of the collimator. If properly aligned in the vertical and horizontal direction, the collimator lens assembly (4) will mate with the lens rim of the ATVC. If not properly aligned, adjustments should be made as follows: for horizontal correction, loosen the four thumbscrews (5) on the base of camera fixture (6) and tighten them again after sliding the fixture to the desired horizontal position; for vertical correction, loosen the two thumbscrews (10) and the slot-head screw (11) on the back of the camera fixture and tighten them again after sliding the yoke (7) up or down to the desired vertical position.
- h. Connect the test plug assembly (part No. 1758883-501) to jack J351 on the ATVC.

CAUTION

Never connect test cable W2 (part No. 1758920-501) to the ATVC with +28 volts dc present at the CAMERA jack on the camera test panel.

- i. Connect test cable W2 (part No. 1758920-501) between jack J350 on the ATVC and the CAMERA jack on the camera test panel (4, figure 3-3).

j. Set the MONITOR INPUT switch on the camera test panel (3, figure 3-3) to CAMERA position.

k. See the MAIN POWER circuit breaker on the power control panel (1, figure 3-1) to ON position.

l. Set the ATVC "on-off" switch to the "on" position, and verify that a television presentation appears on the monitor. The presentation should not be tilted (right or left). To correct a tilted presentation, loosen the two thumbscrews (9) on the yoke (7) of the camera fixture (6) and then twist the tilting support (1) to the proper position and retighten the thumbscrews (9).

3-23. PHOTOGRAPHING TELEVISION DISPLAYS. (See figure 3-14.)

3-24. To obtain a suitable photograph of the television display, several trial photographs may have to be taken, with minor corrective adjustments being made after each trial. The following procedure describes the steps suggested to obtain the first photograph:

- a. Set the mode switch on the monitor (7, figure 3-2) to NORMAL position.
- b. Raise the latch pin (1) and swing the monitor camera assembly away from the face of the kinescope.
- c. Set the aperture control (4) to f/6.8 for focusing.
- d. Set the shutter speed control (2) to "T" (time exposure) position.
- e. Verify that the camera bed is retracted on its tracks to the rear of the assembly and that the front standard (3) is locked.
- f. Raise the latch pin (1) and gently swing the monitor camera assembly over the face of the kinescope; then lower the latch pin until it is engaged.
- g. Move the two slide bars (5) to the left and remove the camera back (8).
- h. Hold the focusing panel (part No. 1752454-1) against the back of the monitor camera assembly. Then move the two slide bars (5) to the right to lock it in place.
- i. Snap the focusing hood (part No. 1752455-1) into place on the back of the focusing panel, and depress the latch to open the focusing hood.
- j. Depress the SHUTTER RELEASE plunger (7) to open the lens shutter, and verify that a suitable image of proper brightness and contrast of the television display appears in the center of the focusing panel window. (Refer to steps f through j of paragraph 3-14.) Depress the SHUTTER RELEASE plunger to close the lens shutter.

k. Set the MONITOR INPUT switch on the camera test panel to HORIZONTAL RESOLUTION position and adjust the CAMERA FOCUS control (6) to obtain the sharpest image. (It may be necessary to adjust the position of the camera bed if proper focus is not within the range of the CAMERA FOCUS control.) Depress the SHUTTER RELEASE plunger (7) to close the lens shutter. Return the MONITOR INPUT switch to GRAY SCALE position.

l. Remove the focusing assembly as described, in step g.

m. Swing the monitor camera assembly away from the kinescope face (step b); set the aperture control (4) to the desired position (normally between f/11 and f/16) and swing the monitor camera into position again (step f). Set the shutter speed control (2) to "B" (bulb exposure) position.

n. Verify that the camera "blind" (opaque plate) is installed in the camera back.

o. Attach the camera back to the monitor camera assembly as described in step h.

p. Load the camera back with film in accordance with the instructions included in the film package. (Type 47 film, 10 second, 3000 speed is normally used.)

q. Remove the camera "blind" from the camera back.

r. Set the mode switch on the monitor (7, figure 3-2) to SINGLE FRAME position.

s. Depress and hold the SHUTTER RELEASE plunger (7).

NOTE

A television scan will not occur until the SINGLE FRAME pushbutton is released.

t. Depress and release the SINGLE FRAME pushbutton on the monitor (5, figure 3-2).

u. Release the SHUTTER RELEASE plunger (7).

v. Process and remove the photograph from the camera back in accordance with the instructions included in the film package. If this photograph is not satisfactory, slight adjustments of brightness and contrast as described in step o of paragraph 3-14 should be made before another photograph is taken.

SECTION IV

TROUBLE ANALYSIS

4-1. A trouble analysis table is provided in this section to aid in localizing malfunctions within the TVBME as detected during performance of the functional test procedure of section III. The trouble analysis procedure for the test signal generator, referenced in the TVBME trouble-analysis table, is provided to isolate malfunctioning plug-in modules.

4-2. TVBME TROUBLE ANALYSIS.

4-3. The trouble-analysis information for the TVBME is provided in table 4-1. This information is keyed to steps of the functional test procedure and includes trouble symptoms with corresponding possible causes and remedies. For increased speed and efficiency, the possible causes are listed in the order of their expected failure probability. Specific remedies for each trouble have been provided to support a field-level maintenance plan only. Those malfunctions considered beyond the scope of field maintenance have been identified as such.

4-4. TEST SIGNAL GENERATOR TROUBLE ANALYSIS.

4-5. Defective modules in the test signal generator can be isolated by sequentially replacing the modules until the malfunction is eliminated. If the malfunction cannot be eliminated by module replacement, the test signal generator must be replaced.

Table 4-1. TVBME Trouble Analysis

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-8, step b	POWER ON indicator on power control panel does not light	a. Indicator lamp b. MAIN POWER circuit breaker c. Cabinet wiring	a. Replace lamp b. Replace power control panel c. Not reparable at this level of maintenance
Para. 3-8, step c	BLOWER FAULT indicator lamp on power control panel operates as follows: a. Does not light momentarily, upon turn-on b. Remains lighted	a. Indicator lamp b. Vane switch in blower A8 or A13 c. Cabinet wiring a. Clogged air filters in blower A8 or A13 b. Fuse F1 or F2 c. Vane switch or blower motor in blower A8 or A13 d. Cabinet wiring	a. Replace lamp b. Replace blower c. Not reparable at this level of maintenance a. Clean air filter (Refer to section VIII, table 8-1) b. Replace fuse c. Replace blower d. Not reparable at this level of maintenance
Para. 3-8, step d	ELAPSED TIME meter on power control panel does not operate	a. Meter movement b. Cabinet wiring	a. Replace power control panel b. Not reparable at this level of maintenance

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-8, step g	Power indicator lamp (green) on vacuum-tube voltmeter does not light	a. Fuse b. Indicator lamp c. SCOPE CTR VTVM circuit breaker d. Circuit in vacuum-tube voltmeter e. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace vacuum-tube voltmeter e. Not reparable at this level of maintenance
Para. 3-8, step i	Power indicator lamp (green) on oscilloscope does not light	a. Fuse b. Indicator lamp c. SCOPE CTR VTVM circuit breaker d. Circuit in oscilloscope e. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace oscilloscope e. Not reparable at this level of maintenance
Para. 3-8, step k	Nixie lamps on counter do not light	a. Fuse b. Nixie lamp c. SCOPE CTR VTVM circuit breaker d. Circuit in counter e. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace counter e. Not reparable at this level of maintenance
Para. 3-8, step m	Absence of 117 volts ac at convenience outlets	a. CONV OUTLETS circuit breaker b. Cabinet wiring	a. Replace power control panel b. Not reparable at this level of maintenance

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-10, step c	POWER indicator lamp (green) on camera power supply does not light	<ul style="list-style-type: none"> a. Incorrect output voltage setting b. Fuse F2 c. Indicator lamp d. CAMERA AND COLL PWR SUP circuit breaker e. Circuit in camera power supply f. Cabinet wiring 	<ul style="list-style-type: none"> a. Turn the V VOLTS control to zero and set the circuit breaker to ON position b. Replace fuse c. Replace lamp d. Replace power control panel e. Replace camera power supply f. Not reparable at this level of maintenance
Para 3-10, step d	No output voltage from camera power supply or improper operation of automatic over-voltage protection function	<ul style="list-style-type: none"> a. Incorrect output voltage setting b. Fuse F1 or F2 c. CAMERA AND COLL PWR SUP circuit breaker d. Circuit in camera power supply e. Cabinet wiring 	<ul style="list-style-type: none"> a. Turn the V VOLTS control to zero and set the circuit breaker to ON position b. Replace fuse c. Replace power control panel d. Replace camera power supply e. Not reparable at this level of maintenance

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-11, step b	POWER indicator lamp on +28 volts collimator power supply does not light	a. Fuse F2 b. Indicator lamp c. CAMERA AND COLL PWR SUP circuit breaker d. Circuit in +28 volts collimator power supply e. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace +28 volts collimator power supply e. Not reparable at this level of maintenance
Para. 3-11, step c	No output voltage from +28 volts collimator power supply	a. Fuse F1 or F2 b. CAMERA AND COLL PWR SUP circuit breaker c. Circuit in +28 volts collimator power supply d. Cabinet wiring	a. Replace fuse b. Replace power control panel c. Replace +28 volts collimator power supply d. Not reparable at this level of maintenance
Para. 3-12, steps b and c	POWER ON indicator does not light or no output voltage from -16.5 volts signal generator power supply	a. Fuse F1 b. Indicator lamp c. TEST GEN PWR SUP circuit breaker d. Circuit in -16.5 volts signal generator power supply e. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace -16.5 volts signal generator power supply e. Not reparable at this level of maintenance

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-13, steps b and c	POWER ON indicator lamp does not light or no output voltage from +12 volts signal generator power supply	<ul style="list-style-type: none"> a. Fuse F1 b. Indicator lamp c. TEST GEN PWR SUP circuit breaker d. Circuit in +12 volts signal generator power supply e. Cabinet wiring 	<ul style="list-style-type: none"> a. Replace fuse b. Replace lamp c. Replace power control panel d. Replace +12 volts signal generator power supply e. Not reparable at this level of maintenance
Para. 3-14, step b	POWER ON indicator lamp on monitor does not light	<ul style="list-style-type: none"> a. Indicator lamp b. MONITOR circuit breaker c. Circuit in monitor d. Cabinet wiring 	<ul style="list-style-type: none"> a. Replace lamp b. Replace power control panel c. Replace monitor d. Not reparable at this level of maintenance
Para. 3-14, step e	Improper or no gray-scale waveform at test plug P6	<ul style="list-style-type: none"> a. Improper adjustment of test signal generator b. Module in test signal generator c. Switch in camera test panel d. Cabinet wiring 	<ul style="list-style-type: none"> a. Adjust test signal generator as described in section VII, paragraph 7-1. b. Troubleshoot test signal generator as described in paragraph 4-4. c. Replace camera test panel d. Not reparable at this level of maintenance

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-14, steps f through m	Not possible to obtain proper television raster using adjustments	Circuit in monitor	Replace monitor
Para 3-14, step o	Unsatisfactory gray-scale presentation on kinescope	Circuit in monitor	Replace monitor
Para. 3-14, step q	Improper or no linearity waveform at test plug P6	a. Module in test signal generator b. Switch in camera test panel	a. Troubleshoot test signal generator as described in paragraph 4-4 b. Replace camera test panel
Para. 3-14, step r	Unsatisfactory linearity presentation on kinescope	Circuit in monitor	Replace monitor
Para. 3-14, step t	Improper or no horizontal-resolution waveform at test plug P6	a. Module in test signal generator b. Switch in camera test panel	a. Troubleshoot test signal generator as described in paragraph 4-4 b. Replace camera test panel
Para. 3-14, step u	Unsatisfactory horizontal-resolution presentation on kinescope	Circuit in monitor	Replace monitor

Table 4-1. TVBME Trouble Analysis (Continued)

Functional Test Reference	Trouble Symptom	Possible Cause	Remedy
Para. 3-15, step d	Collimator lamp does not light	a. Collimator lamp b. Rheostat in collimator c. Cabinet wiring	a. Replace lamp b. Replace collimator c. Not reparable at this level of maintenance
Para. 3-16, step a	CAMERA POWER switch on camera test panel does not light (green)	a. Fuse F1 b. Indicator lamp c. CAMERA POWER switch d. Cabinet wiring	a. Replace fuse b. Replace lamp c. Replace camera test panel d. Not reparable at this level of maintenance
Para. 3-16, step b	Absence of 28 volts dc at output plug of test cable W2	a. Fuse F1 b. Test cable W2 c. CAMERA POWER switch d. Cabinet wiring	a. Replace fuse b. Replace cable c. Replace camera test panel d. Not reparable at this level of maintenance
Para. 3-16, step d	Presence of 28 volts dc at output plug of test cable W2 with CAMERA POWER switch not lighted (off)	CAMERA POWER switch	Replace camera test panel

SECTION V
REMOVAL AND INSTALLATION

5-1. REMOVAL AND INSTALLATION OF MODULES.

5-2. The modules are removed or installed using the module extractor tool (part No. 8753892-501). Before installation, use the pin straightener (part No. 8990345-1) to straighten any bent module pins.

5-3. REMOVAL OF THE KINESCOPE. (See figure 5-1.)

WARNING

To avoid possible serious injury, always wear thick gloves and shatter-proof glasses when handling the kinescope. To avoid an implosion, observe the following precautions: never lift the tube by its neck; always handle the tube gently; when working around or near the tube, always keep it covered with a heavy cloth.

5-4. Remove the kinescope as follows:

- a. Verify that the MAIN POWER circuit breaker on the power control panel is set to OFF position.

WARNING

Several men are required to handle the monitor since it weighs approximately 219 pounds.

- b. Remove the monitor from the cabinet and place it on a maintenance bench.
- c. Loosen the four retaining screws (5) and open the upper door (4) on the left side of the monitor.
- d. Disconnect the high-voltage connector (3) from the side of the kinescope.

- e. Using a grounding strap, momentarily ground the terminal of the high-voltage connector to remove any residual electrical charge. For the same reason, also ground the high-voltage terminal on the side of the kinescope.
- f. Loosen the twelve retaining screws (1) and remove the cover plate (2) from the top of the monitor.
- g. By reaching in from the top of the monitor, remove the connector shield at the base of kinescope shield and disconnect the kinescope-base connector.
- h. Remove the four screws from the beveled plate attached to the front of the monitor. (See figure 3-2).
- i. Remove the beveled plate, transparent shield, and rubber gasket.
- j. While supporting the kinescope by its face, push gently on the back of the kinescope base until the kinescope protrudes slightly from the front panel.

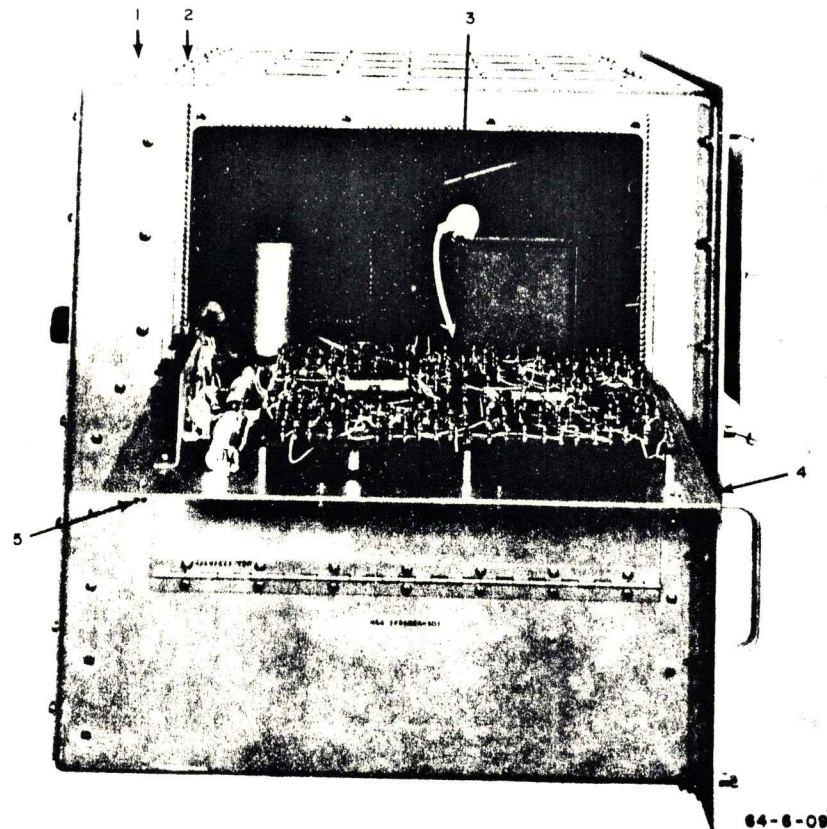
WARNING

Be sure to keep the kinescope horizontal until it is completely withdrawn from the front of the monitor. Putting any abnormal stress on the neck of the tube could cause the tube to break and implode.

- k. Grasping the kinescope securely, withdraw it from the monitor, keeping the kinescope horizontal until the neck of the tube has cleared the yoke.

5-5. INSTALLATION OF THE KINESCOPE.

5-6. The installation procedure for the kinescope is essentially the reverse of the removal procedure except that the kinescope must be twisted to the correct position to permit mating with the high-voltage connector and that DOW Corning No. 102 compound should be applied to the area surrounding the high-voltage terminal of the kinescope before making the high-voltage connection.



- | | |
|-----------------------------------|---------------------------|
| 1. Top-Cover Retaining Screw (12) | 3. High-Voltage Connector |
| 2. Top Cover Plate | 4. Upper Side Door |
| 5. Side-Door Retaining Screw (4) | |

Figure 5-1. Monitor, Left-Side View

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SECTION VI

REPAIR INSTRUCTIONS

6-1. Repair of the TVBME at field level maintenance is limited to replacement of the major components and accessories listed in section I, the modules in the test signal generator, and fuses and indicator lamps. Upon replacement, repeat the applicable steps of the functional test procedure of section III which will verify the repair.

SECTION VII

CALIBRATION AND ADJUSTMENT

7-1. ADJUSTMENT OF THE TEST SIGNAL GENERATOR. (See figure 7-1.)

7-2. Adjustment of the test signal generator consists of establishing the proper voltage levels in the horizontal-resolution, gray-scale, and linearity test signal outputs. With the equipment energized, proceed as follows:

a. Set the MONITOR INPUT switch on the camera test panel to GRAY SCALE position.

b. With the oscilloscope connected to test plug P6, obtain a display of the waveform shown in B of figure 3-10. Set the vertical scale to 0.5 volt per cm.

c. Adjust potentiometer A17R25 to obtain a white level of 2 ± 0.1 volts.

d. Adjust potentiometer A17R15 to obtain a porch level of $1.0 \pm .05$ volts.

e. Adjust potentiometer A17R5 to obtain a black level of 0.46 ± 0.05 volts.

f. Adjust the gray-scale-level potentiometers No. 1 through No. 5 to obtain nominal voltage levels as follows:

1. Potentiometer A17R10 for $0.72 \pm .05$ volts

2. Potentiometer A18R5 for $0.98 \pm .05$ volts

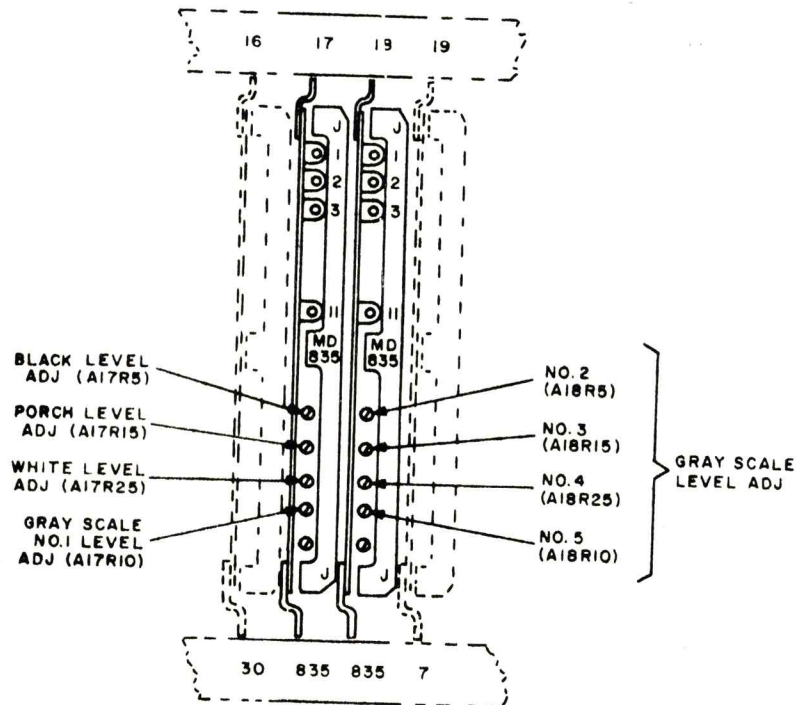
3. Potentiometer A18R15 for $1.24 \pm .05$ volts

4. Potentiometer A18R25 for $1.50 \pm .05$ volts

5. Potentiometer A18R10 for $1.76 \pm .05$ volts

7-3. CALIBRATION OF BRIGHTNESS CONTROLS.

7-4. The brightness controls on the collimator and on the monitor can be calibrated by taking measurements with the spot photometer.



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Figure 7-1. Location of Test Signal Generator Adjustments

SECTION VIII

PERIODIC INSPECTION AND SERVICE

8-1. INSPECTION AND SERVICE.

8-2. It is recommended that components of the TVBME be inspected at regular intervals as specified in Table 8-1. In addition, the functional test procedure of section III should be performed at least once a month.

Table 8-1. Inspection Requirements

Item	Recommended Inspection Frequency	Inspect For:
Work shelf and collimator	Daily	Accumulation of excessive dust or moisture. Forced air under medium pressure is recommended for dusting and drying.
Blowers (2)	Weekly	Clogged or dirty filters. Clean with soap (or detergent) and water when necessary. Dip or spray with fresh Filter Coat or Handicoater before installation.
All components	Monthly	<ul style="list-style-type: none"> a. Tags or stamps of the manufacturer (Radio Corporation of America) and NASA which indicate satisfactory condition are attached to all components and interconnecting cables. b. Accumulation of excessive dust or moisture. Forced air under medium pressure is recommended for dusting and drying.
Standard test equipment	Monthly	Calibration tags which indicate satisfactory condition are attached.

8-3. PREVENTIVE MAINTENANCE.

8-4. Exercising care in packing, handling, transporting, and operating the TVBME will aid in reducing maintenance requirements. Only qualified personnel should handle, maintain, and operate the equipment. When not in use, the equipment should be protected from dust and moisture. For prolonged out-of-use periods, store the equipment in an environmentally-controlled storage area.

8-5. PACKING AND UNPACKING.

8-6. The TVBME is a delicate equipment and must be handled and packaged accordingly to afford sufficient protection.

8-7. TRANSPORTATION.

8-8. Shipping information for the TVBME may be obtained in Apollo Support Manual SM2A-05-F2, Transportation and Handling Procedures.

A-1 CAMERA
POWER

1. LAMPS HAVE
GREEN BOOTS
2. SWITCH SHOWN
"IN" "ON" POSITION



NOTE
H

C - CLOSED
O - OPEN
SWITCH SHOWN
IN CIRCULAR
POSITION

Switch Position	TEST	CONTIN.				
		2	7	8	9	10
5	EXT	C	C	C	C	C
4	CH4	C	C	C	C	C
3	CH4	O	C	C	C	C
2	L.N.	O	C	C	O	C
1	MODE	O	C	O	C	C

CAMERA TEST PANEL
1756204-501 SER. 00000
WIRING DIAGRAM