TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

TOPOGRAPHIC SUPPORT SYSTEM ANALYSIS SECTION MODEL ADC-TSS-12 NSN: 6675-01-105-5761

THIS MANUAL TOGETHER WITH TM 5-6675-323-14-1 SUPERSEDES
TM 5-6675-323-14 DATED 21 JUNE 1983

HEADQUARTERS, DEPARTMENT OF THE ARMY

3 SEPTEMBER 1985

WARNING

HIGH VOLTAGE is used in this equipment. DEATH ON CONTACT or severe injury may result if personnel fail to observe safety precautions.

Do not be misled by the term LOW VOLTAGE. Low voltage can cause serious injury or death.

Test procedures requiring the operator or maintenance personnel to investigate equipment or restore casualties with interlocks disconnected or covers removed may result in DEATH ON CONTACT if personnel fail to observe safety precautions.

Voltages in switches and circuit breaker panels may result in DEATH ON CONTACT if personnel fail to observe safety precautions.

Failure to ground the section or equipment may result in DEATH ON CONTACT if personnel fail to observe safety procedures.

For Artificial Respiration refer to FM 21-11.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Wear solvent-impermeable gloves and eye/face protective equipment when using solvent. Do not use near open flame or excessive heat. Flash point of solvent is 100° F to 138° F (38° C to 59° C).

WARNING

Rotating and spinning equipment may snag loose clothing, hair or jewelry resulting in SEVERE PERSONNEL INJURY.

WARNING

Attempting to move overweight or top heavy equipment that is unsecured may result in SEVERE PERSONNEL INJURY. Always have sufficient personnel and equipment to accomplish the task.

INTRODUCTION

This manual is divided into two volumes:

Volume 1, TM 5-6675-323-14-1 consists of Chapters 1 through 5 and Index.
Volume 2, TM 5-6675-323-14-2 consists of Chapters 6 through 16, Appendixes A through E, Glossary and Index.

The Appendixes and Glossary in Volume 2 are applicable to both volumes.

CHANGE

NO. 2

HEADQUARTERS
DEPARTMENTS OF THE ARMY
WASHINGTON, D. C., 25 MAY 1992

Operator's, Organizational, Direct Support and
General Support Maintenance Manual

TOPOGRAPHIC SUPPORT SYSTEM
ANALYSIS SECTION
MODEL ADC-TSS-12
NSN 6675-01-105-5761

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TM 5-6675-323-14-2, 3 September 1985 is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
C-1 and C-2	C-1 and C-2

2. Retain this sheet in front of manual for reference purposes.

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General, United States *Army*
Chief of Staff

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No. 1

HEADQUARTERS
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WASHINGTON, D.C., 8 July 1986

Operator's, Organizational, Direct Support and
General Support Maintenance Manual

TOPOGRAPHIC SUPPORT SYSTEM
ANALYSIS SECTION
MODEL ADC-TSS-12
NSN: 6675-01-105-5761

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Remove pages	Insert pages
i and ii	i and ii
15-9 through 15-12	15-9 through 15-12
B-5 through B-13/B-14	B-5 through B-13/B-14
C-1 and C-2	C-1 and C-2
C-5 through C-17/C-18	C-5 through C-17/C-18
D-1/D-2	D-1/D-2
E-1 through E-10	E-1 through E-10

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TECHNICAL MANUAL

NO. 5-6675-323-14-2

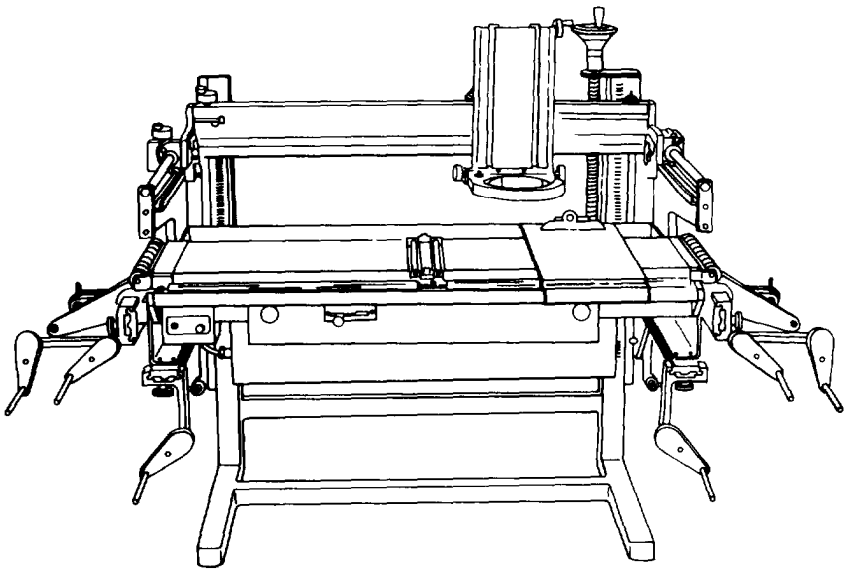
HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 3 September 1985

Operator's, Organizational, Direct Support And General Support Maintenance Manual

TOPOGRAPHIC SUPPORT SYSTEM
ANALYSIS SECTION, MODEL ADC-TSS-12
NSN: 6675-01-105-5761

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of away to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.



CHAPTER 6

SPLIT-STAGE LIGHT TABLE

Section I INTRODUCTION

6-1. GENERAL INFORMATION.

6-1.1 Scope.

a. Model Number and Equipment Name. Model MIM3-35100 Split-Stage Light Table.

b. Purpose of Equipment. To stereoscopically view aerial roll film for analysis and interpretation.

6-1.2 Reference Information.

Glossary

Collimation.	To make light rays parallel by adjustment of optical/mechanical system.
Interpupillary Distance	Distance between center of operator's eyes.
Stereo-Pair Photograph	Photographs taken of same object or area from two different positions.
Stereoscope.	Optical device to apparently super-impose two separate photographs.
Stereoscopic	An apparent three-dimensional image obtained when 2 two-dimensional photographs are viewed through stereoscope.
X-Axis	Horizontal or left-right direction.
Y-Axis	90° from X-axis in same plane or front-back direction.
Z-Axis	Vertical direction or up/down.

6-2. EQUIPMENT DESCRIPTION.

6-2.1 Equipment Characteristics, Capabilities, and Features.

a. Reel configurations for conventional, split-vertical, short, or long-loop film threading.

b. Accepts up to 1000 ft (304.80 m) of film; dual strand up to 5-1/2 in. (13.97 cm) wide; single strand up to 9-1/2 in. (24.13 cm) wide.

c. Variable-intensity light grids.

d. Electrically coupled clutches for movement of optical mounting in horizontal plane.

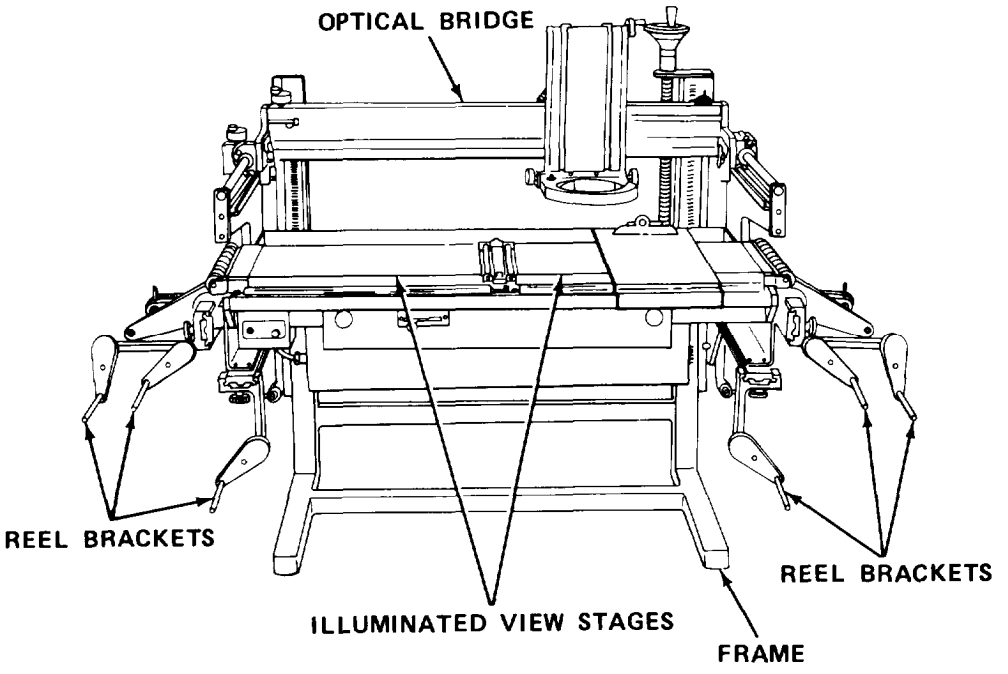
e. Safety clutch on optical mount prevents rapid movement of optical system toward view stages.

f. Variable stage height.

g. Optical bridge assembly is removable.

h. Masking assemblies contained in view stages.

6-2.2 Location and Description of Major Components.



OPTICAL BRIDGE. Mounts stereoscope.

REEL BRACKETS. Transport aerial roll film across view stages.

FRAME. Maintains alinement of components.

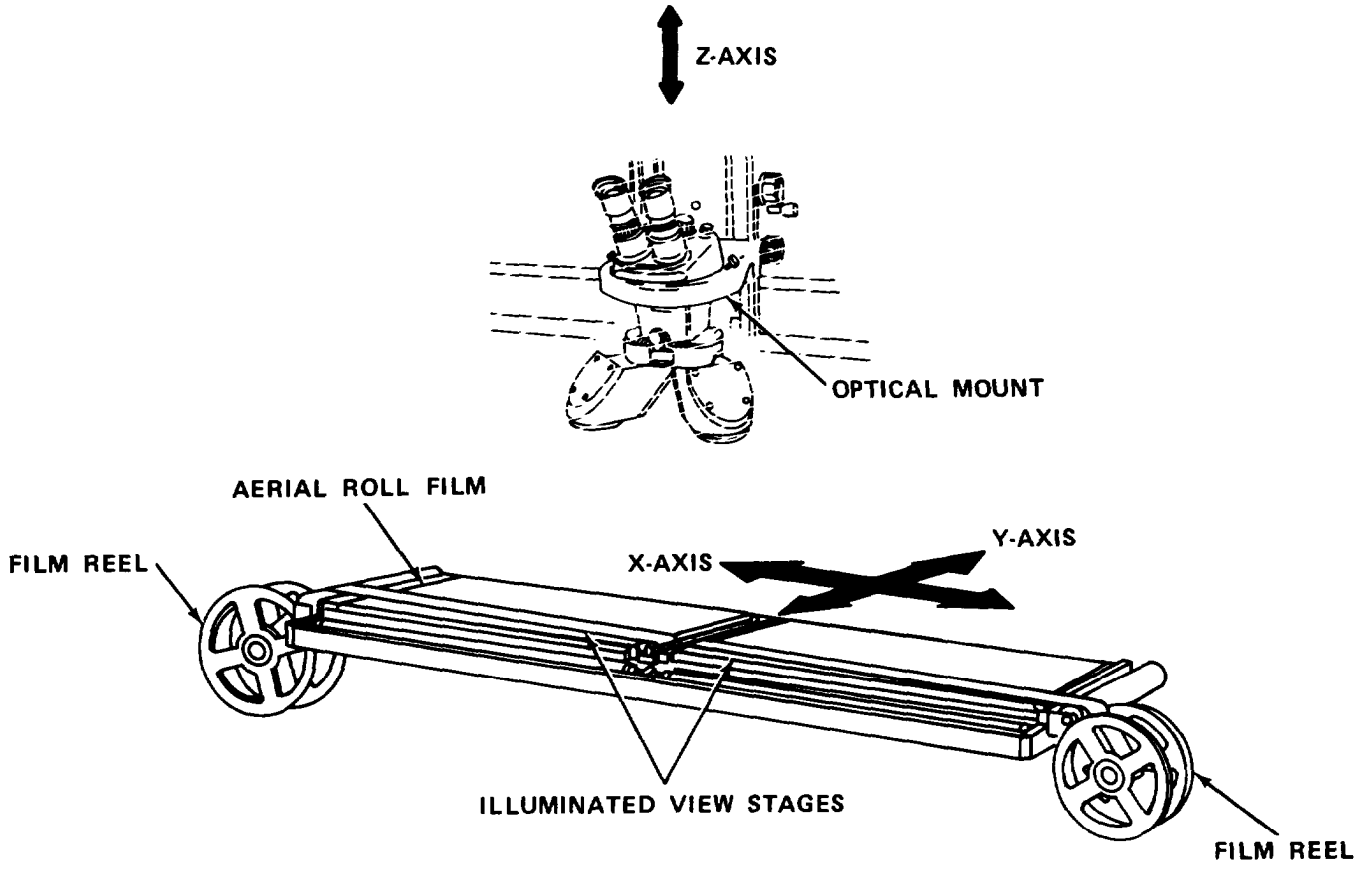
ILLUMINATED VIEW STAGES. Controlled-intensity light grids shine light through aerial roll film.

6-2.3 Equipment Data.

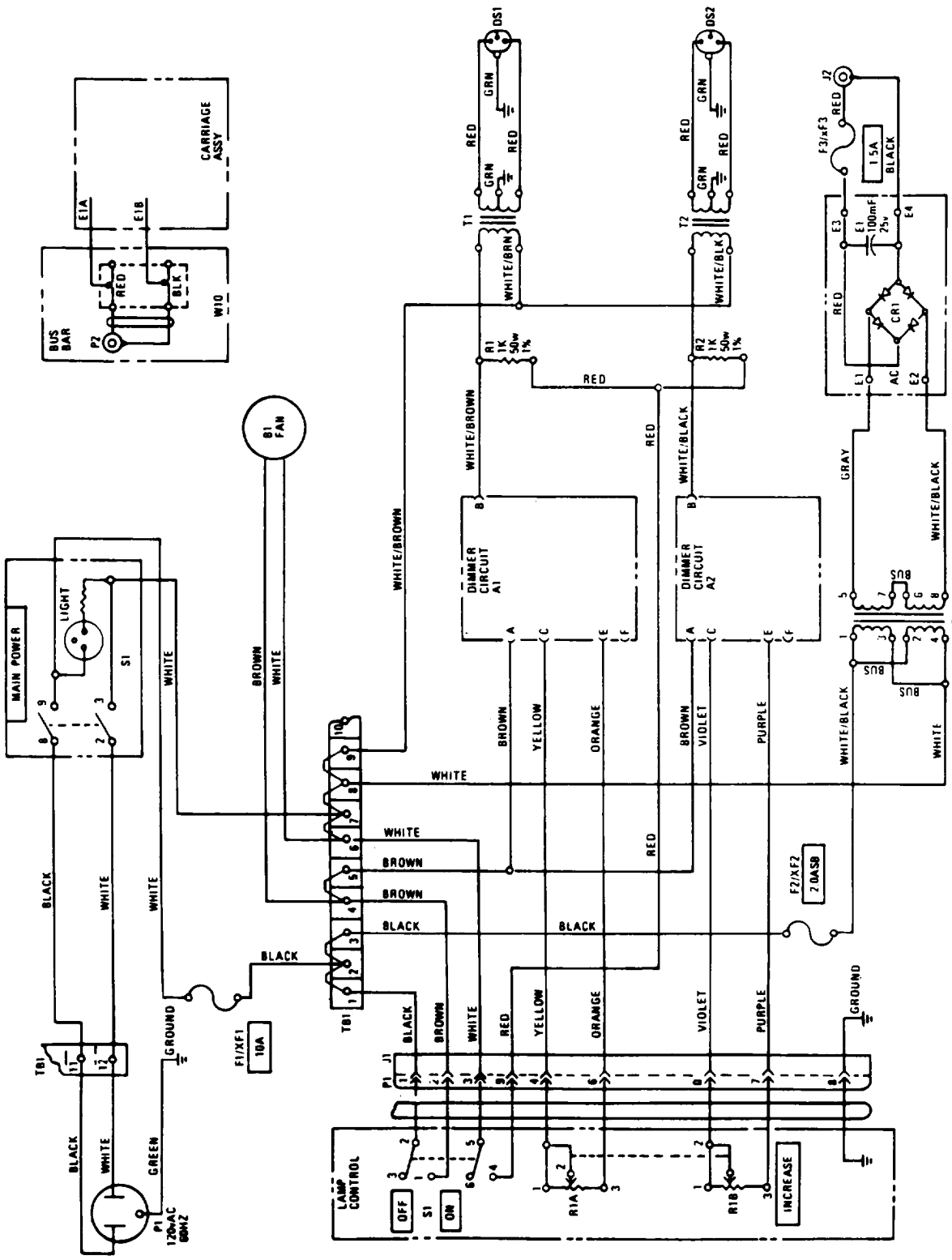
Dimensions	
Length	
Reel Brackets Removed	45-1/2 in. (115.57 cm)
With Reel Brackets	56-3/4 in. (144.15 cm)
Width	26-3/4 in. (67.95 cm)
Height	63-5/8 in. (161.61 cm)
Weight	360 lbs (163.3 kg)

Illumination	
Two Stages (Each Stage)	11 in. X 18 in. (27.95 cm x 45.72 cm)
Maximum Intensity	2500 ft lamberts (8566 cd/m2)
Dimming Control	Variable intensity to 20% of maximum illumination
Power Requirements	120 V, 50/60 Hz, 8 amps

6-3. TECHNICAL PRINCIPLES OF OPERATION.



6-3.1 General. Aerial roll film is manually moved between film reels, over rollers, across illuminated view stages. Optical mount moves stereoscope right-left (X-axis), front-back (Y-axis) or up-down (Z-axis) for analysis and interpretation of stereo-pair images on aerial roll film. Stereoscope movement is accurately controlled to maintain collimation over entire viewing area.

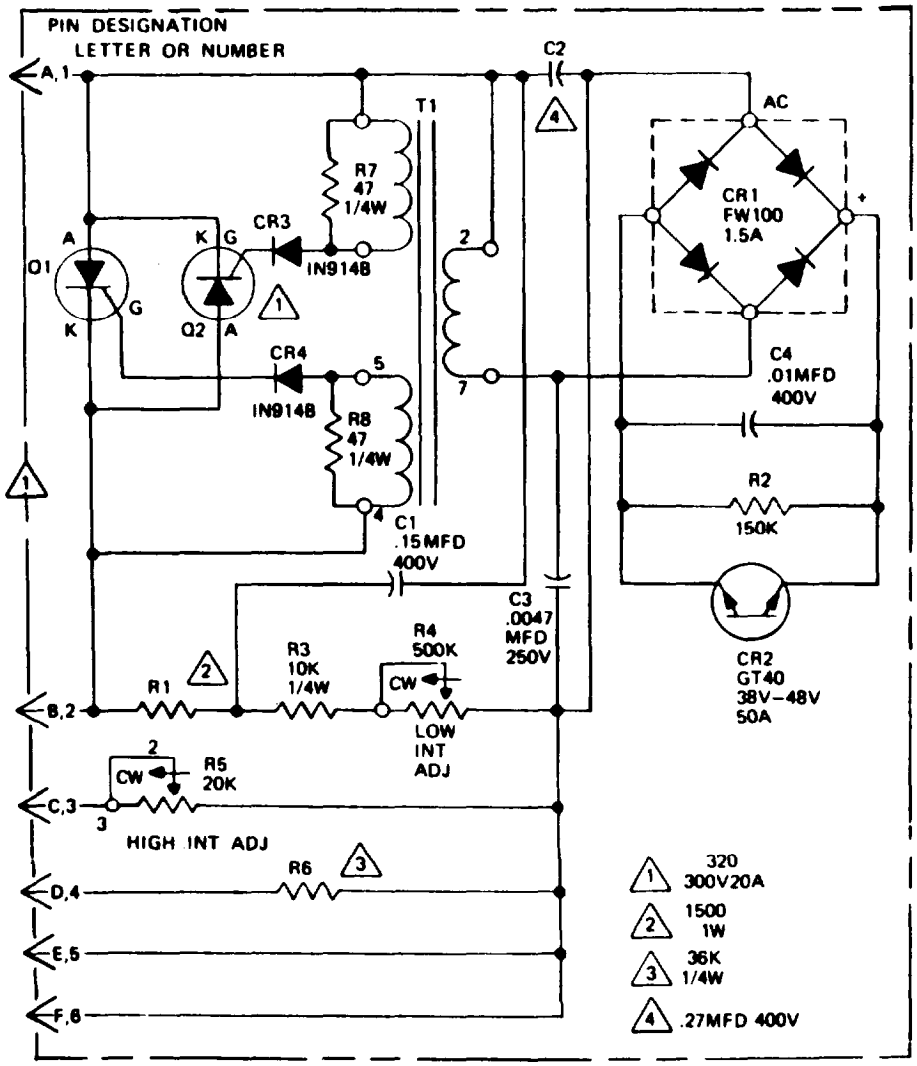


SPLIT-STAGE LIGHT TABLE
WIRING DIAGRAM

6-3.2 Detailed Theory of Operation.

a. Illumination. Two encapsulated, cold-cathode, argon mercury light grids each provide a maximum of 2500 ft lamberts of brightness through viewing surfaces. Intensity of light is controlled by a dimming circuit. Light can be reduced to 20-percent of maximum value.

(1) Current (120 V, 50/60 Hz) is passed through the main power switch. The illumination control panel on the switch operates the fan and light grids. The increase potentiometer controls voltage to the dimmer boards.



(2) Alternating current voltage enters the dimmer circuit boards through pin A and is transferred to pin B through silicon-controlled rectifier (SCR) Q1 or Q2 which determines the amount of the ac sine wave voltage that is applied to the external high-voltage transformer to light the grid lamp. The SCR's prevent all of each ac half-wave from being transferred, but when triggered allow current to flow during the remaining portion of each half sine wave until the zero crossing point is reached, whereupon the SCR is turned off and the ac waveform is again blocked.

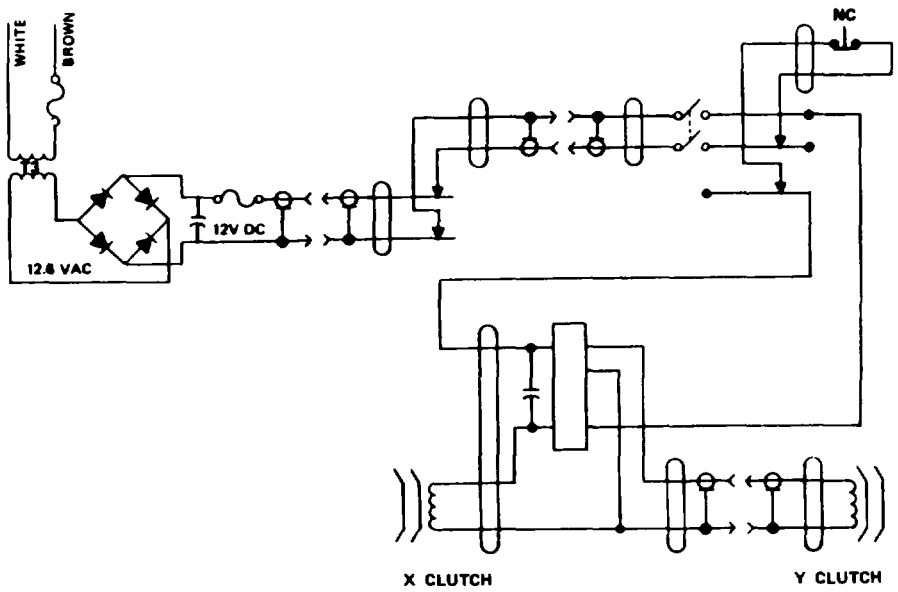
(3) When the ac voltage enters the control board, it is applied to C1 and R1 which provide a slight delay in the input voltage, which is applied to the timing circuit composed of capacitor C2, resistors R4, R3, R5, and external potentiometer 1R1. (Note that resistor R6 is not used in this application.)

(4) As the delayed ac voltage is applied across capacitor C2, the capacitor begins to charge at a rate depending upon the setting of potentiometer 1R1. The voltage across C2 also appears across rectifier CR1 and trigger diode CR2. When the trigger diode reaches the breakover voltage of 43 ±5 V, it conducts to complete the path across rectifier bridge CR1. This forms a closed loop circuit through capacitor C2, the primary of pulse transformer T1, and rectifier CR1, and current flows until capacitor C2 is discharged. The discharge time is very fast and a short duration pulse is generated, shaped by capacitor C3.

(5) The pulse current flowing through the primary of pulse transformer T1 induces a voltage across the appropriate secondary which is applied through diode CR3 or CR4 to the gates of SCR Q2 or Q1 respectively. When either SCR is triggered, it allows the rest of the ac half-wave to pass to external grid lamp transformer 1T1 through pin B. The SCR will continue to conduct until the ac half-wave reaches the zero crossing point, at which time it turns off.

b. Clutch Control.

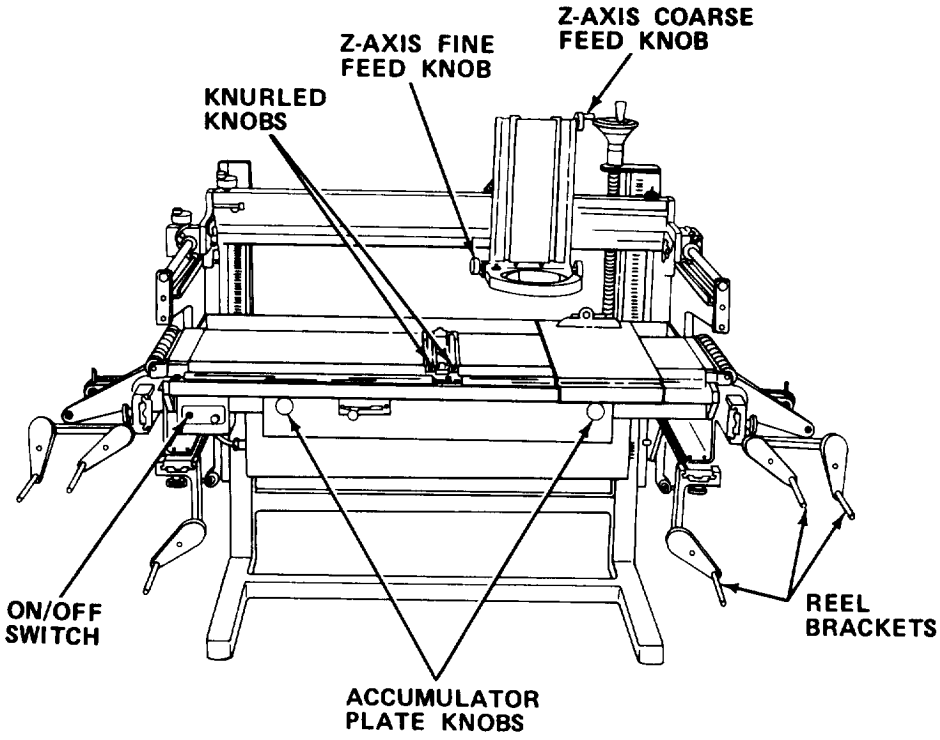
(1) X- and Y-axes manual motion controls are connected through electrically operated clutches to chain drives. Power to the clutches may be interrupted to decouple chain drives and permit rapid movement of the optical mount in the X- and Y-axes.



(2) Voltage, 120 V, 50/60 Hz, is stepped down to 12.6 V ac in the transformer, rectified in PCA A4 to 12 V dc. Current passes through the quick-disconnect, brushes to the quick-disconnect, and clutch power switch. The momentary switch on the optical carriage is normally on except when depressed by the operator. Twelve volts dc passes through the brushes to the series-connected clutches. Note that the quick-disconnect separates the Y-axis clutch from the circuit.

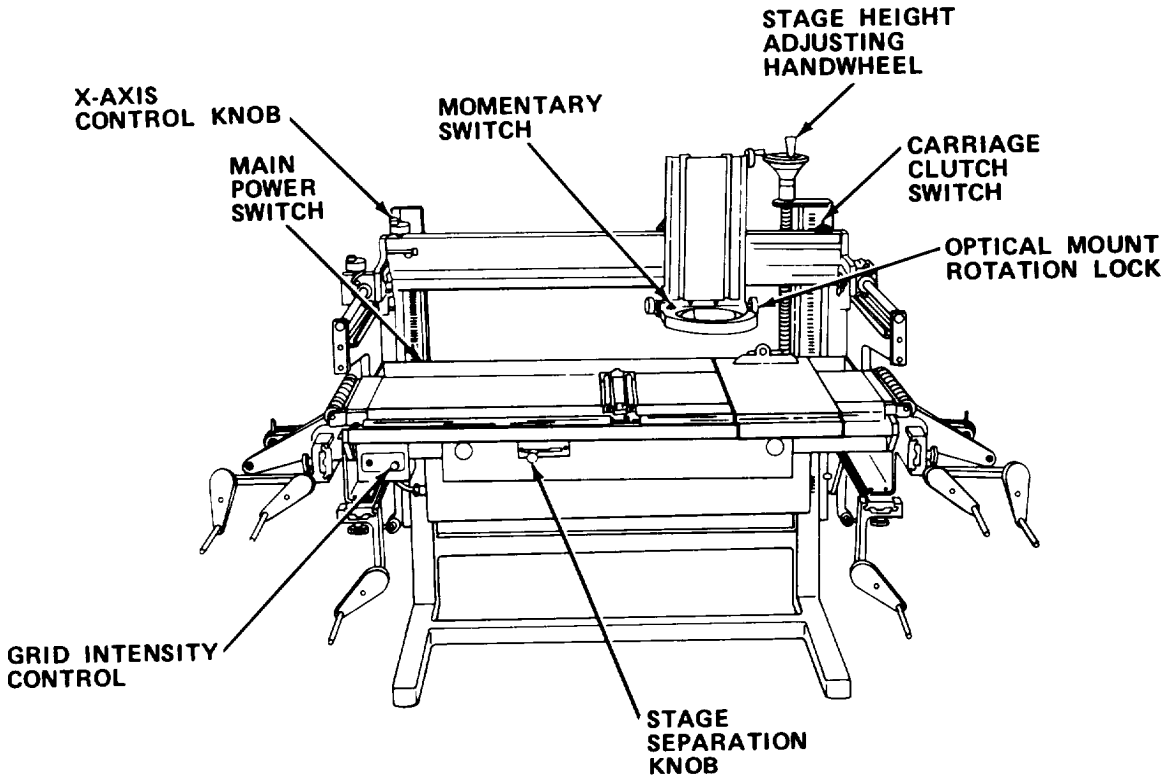
Section II OPERATING INSTRUCTIONS

6-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Knurled Knobs	Retract masking assemblies.
Z-Axis Fine Feed Knob	Moves optical mount up or down for fine adjustment.
Z-Axis Coarse Feed Knob	Moves optical mount up or down. (Mount can be pulled up manually, but cannot be pushed down.)
Reel Brackets	Support film reels and manually transport film across view stages.

Control or Indicator	Function
Accumulator Plate Knobs	Secure accumulator plates. Releasing knobs permits access to accumulator rollers under viewing surface.
ON/OFF Switch	Controls power to fan, lights, and clutches.



X-Axis Control Knob	Moves optical mount to left or right when power is supplied to electrical clutches.
Carriage Clutch Switch	Provides power to electrical clutches.
Stage Height Adjusting Handwheel	Moves stage up or down for operator comfort.

Control or Indicator	Function
Optical Mount Rotation Lock	Locks inner ring to allow mounted optics to be rotated and locked.
Momentary Switch	Uncouples electrical clutches, permitting rapid movement of optical mount in X or Y direction.
Stage Separation Knob	Moves left view stage to permit access to center film rollers.
Grid Intensity Control	Increases or decreases light intensity for both right and left light grids.
Main Power Switch	Controls power to table.

6-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

6-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Cheesecloth (Item 7, Appendix E)	ar
Chamois	1 ea
Lens Cleaning Liquid (Item 6, Appendix E)	ar

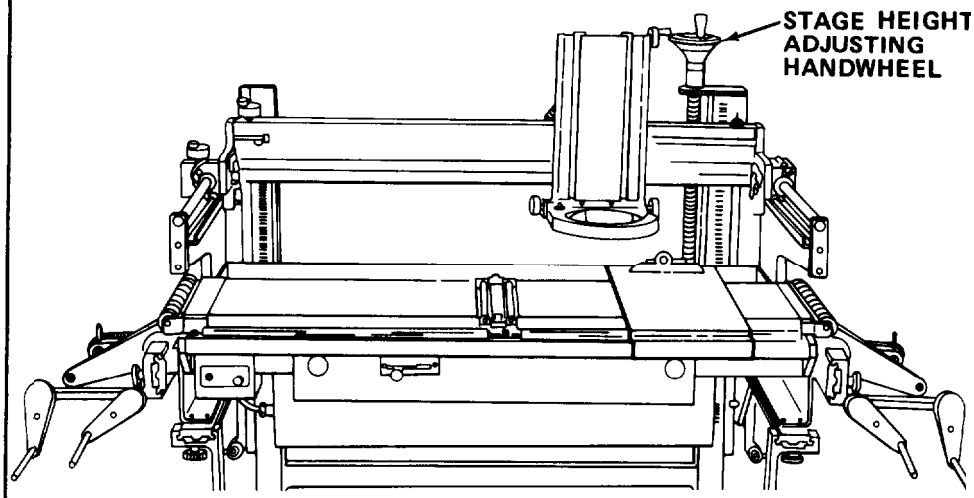
Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before **W - Weekly** **AN - Annually** **(Number) - Hundreds of Hours**
D - During **M - Monthly** **S - Semiannually**
A - After **Q - Quarterly** **BI - Biennially**

ITEM NO.	INTER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE	



WARNING

Unplug power cord before servicing split-stage light table. Failure to do so may result in death or serious injury.

NOTE

The side braces must be removed before performing PMCS on split-stage light table (paragraph 6-6.1).

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

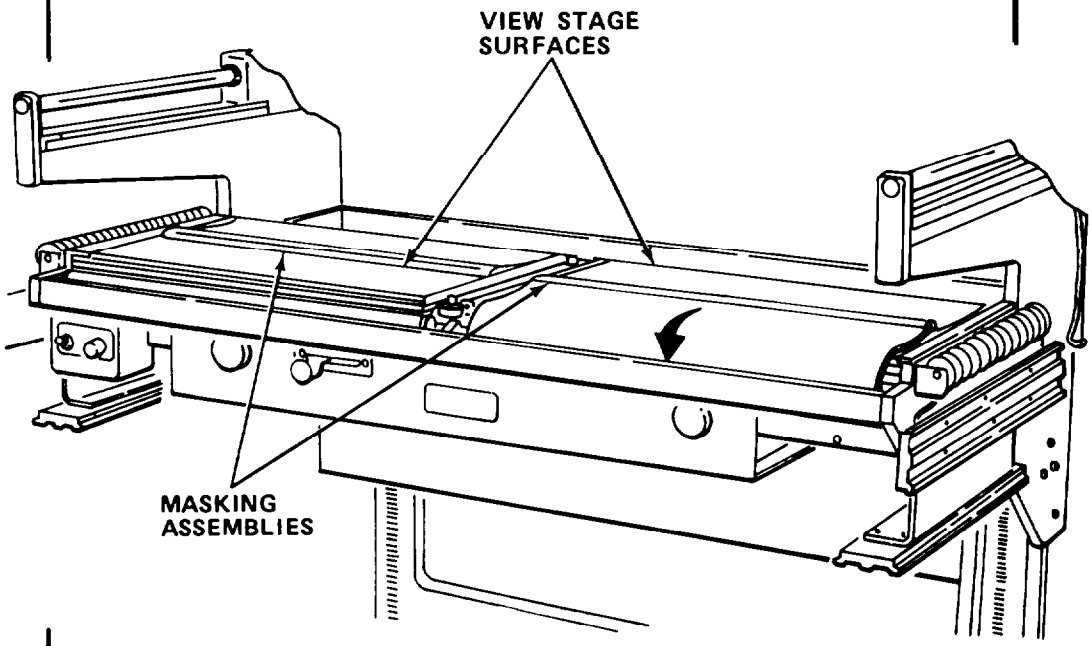
B . Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
Bl - Biennially

{Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
1	B	Inspect Stage Height Adjusting Handwheel. Rotate left and right. Check for free movement of gear mechanism. Check that view stage height changes.	View stage binds.



2	B	Inspect Masking Assemblies. Retract four masking assemblies into wells by rotating knurled knobs. Check that knobs move freely and that assemblies are not torn.	

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

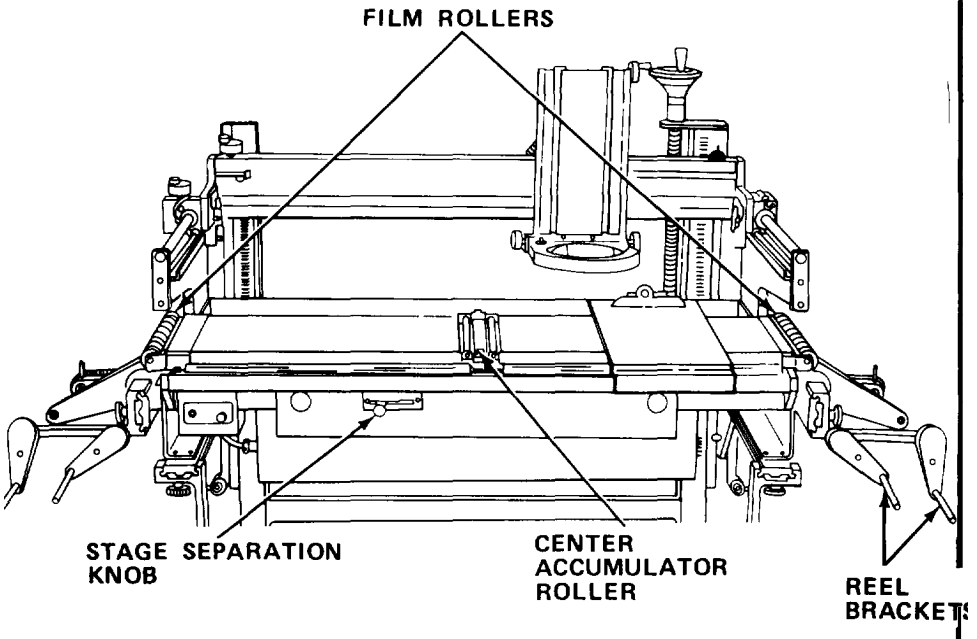
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
3	B	Inspect View Stage Surfaces.	
		1. Check view stage surfaces for dust or dirt. Clean with moistened cheesecloth. Dry with chamois.	
		2. Check view stage surfaces for cracks or scratches.	View stage is damaged.
			
4	B	Inspect Stage Separation Knob.	
		Move knob to right (notched position) and then to left. Check for freedom of movement.	Stages are frozen in place.
5	B	Inspect Film Rollers.	
		Inspect rollers for scratches and abrasions.	

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A- After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

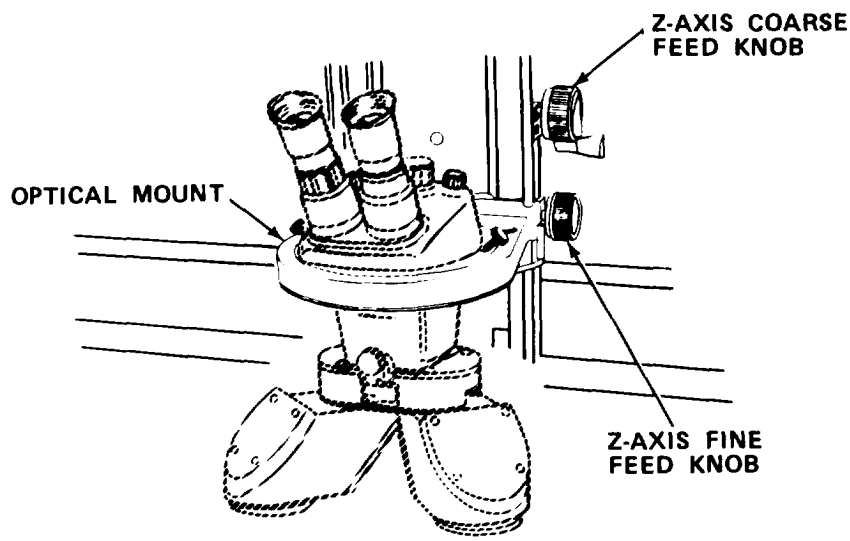
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
6	B	Inspect Reel Brackets. Check for security of mounting, free movement of spindles, and slight end-play of reels.	Reel brackets are missing or broken.
		 	
		NOTE Make sure spring clips securing optical mount are disengaged.	
7	B	Inspect Optical Mount. Check that optical mount can be moved left-right (X-axis), front-back (Y-axis), and up, but cannot be pushed down.	Optical mount binds or slips.

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before W - Weekly AN - Annually (Number) - Hundreds of Hours
D - During M - Monthly S - Semiannually
A - After Q - Quarterly Bl - Biennially

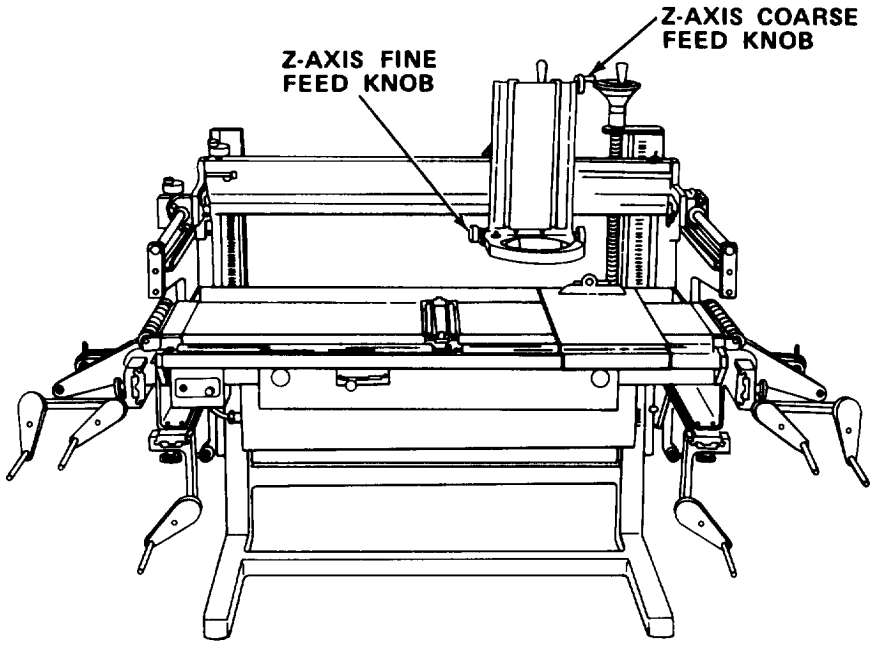
ITEM NO.	IN-TER VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
8	B	Inspect Z-Axis Coarse Feed Knob and Z-Axis Fine Feed Knob.	
		Rotate both controls and check that optical mount moves up and down freely.	Z-axis binds.
			
		WARNING Do not use equipment with defective or worn wiring. Death or serious injury may result.	
9	B	Inspect Power Cord and Wiring.	
		Inspect for breaks, tears, frayed wiring or broken connectors.	Wiring is defective or worn.

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M . Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennually

(Number} - Hundreds of Hours

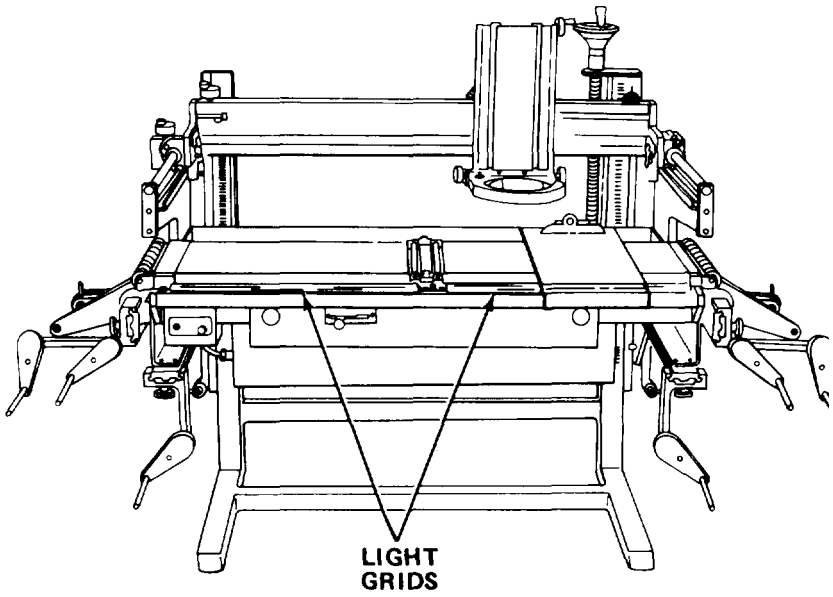
ITEM NO.	IN-TER VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
10	B	Inspect Light Grids.	
			
		Plug in power cord. Turn main power on. Set light grid ON/OFF switch to ON. Check that both light grids light.	One or both light grids do not light.

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
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W - Weekly
M - Monthly
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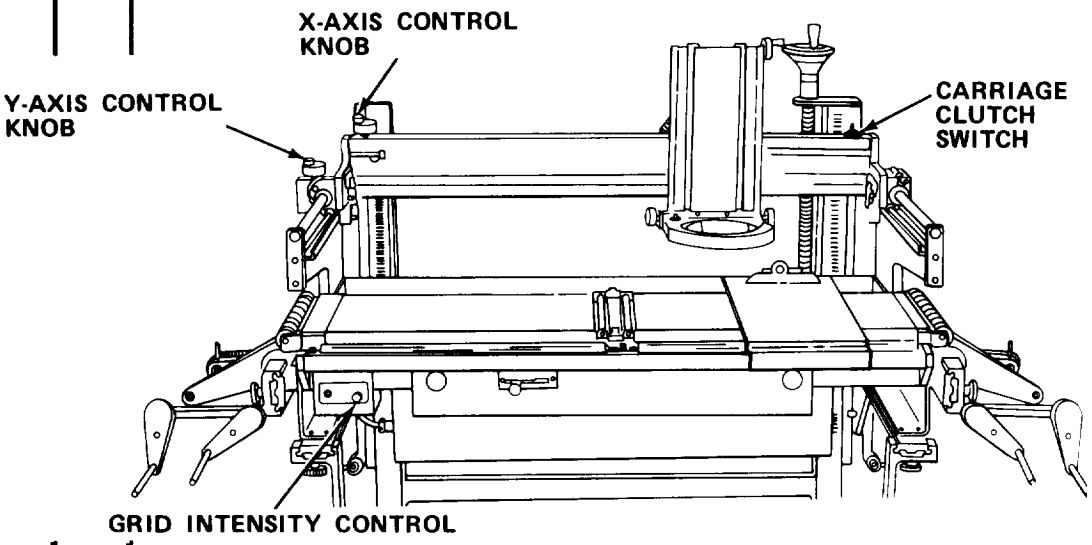
(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SPLIT-STAGE LIGHT TABLE - Cont	
11	B	Inspect Grid Intensity Control.	



Turn control fully right. Check that light intensity of both grids increases and continues to increase until control reaches maximum. Turn control gradually left. Check for even decrease in intensity.

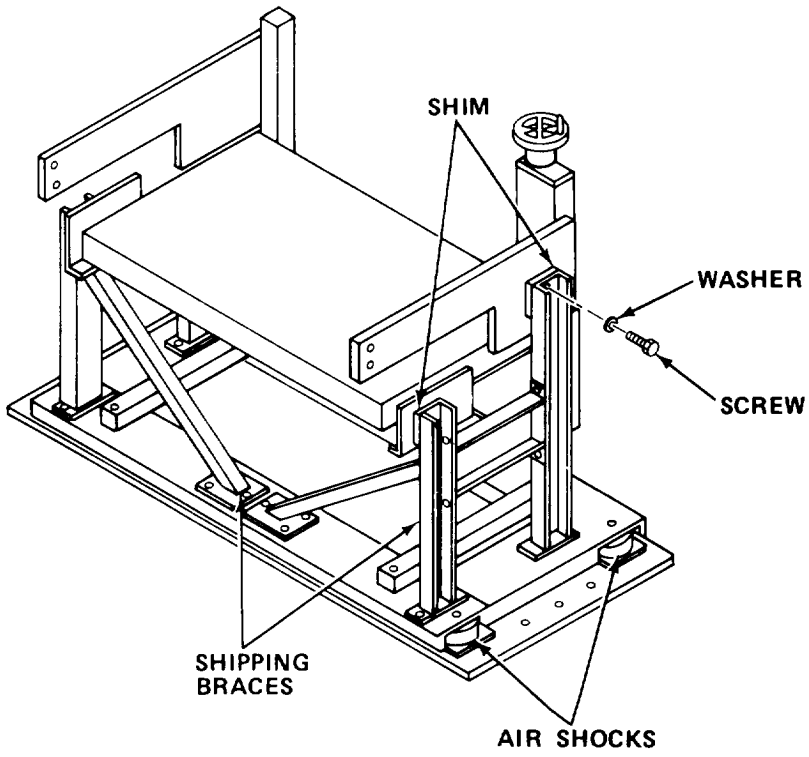
12	B	Inspect Clutch Switch, X-Axis and Y-Axis Control Knobs.	
		Check for tight connections at clutch switch connectors. Turn power on. Set carriage clutch switch to ON. Rotate X-Axis and Y-Axis control knobs. Check that optical mount moves left-right and front-back.	Clutch is inoperative. X- and Y-axis controls are inoperative.

6-6. OPERATION UNDER USUAL CONDITIONS.

6-6.1 Assembly and Preparation for Use.

NOTE

Do not remove side braces until there is a mission that requires the use of the lower reel brackets. When required, remove 22 capscrews and washers from sides and base of table. Remove braces from under table.



a. Remove side braces.

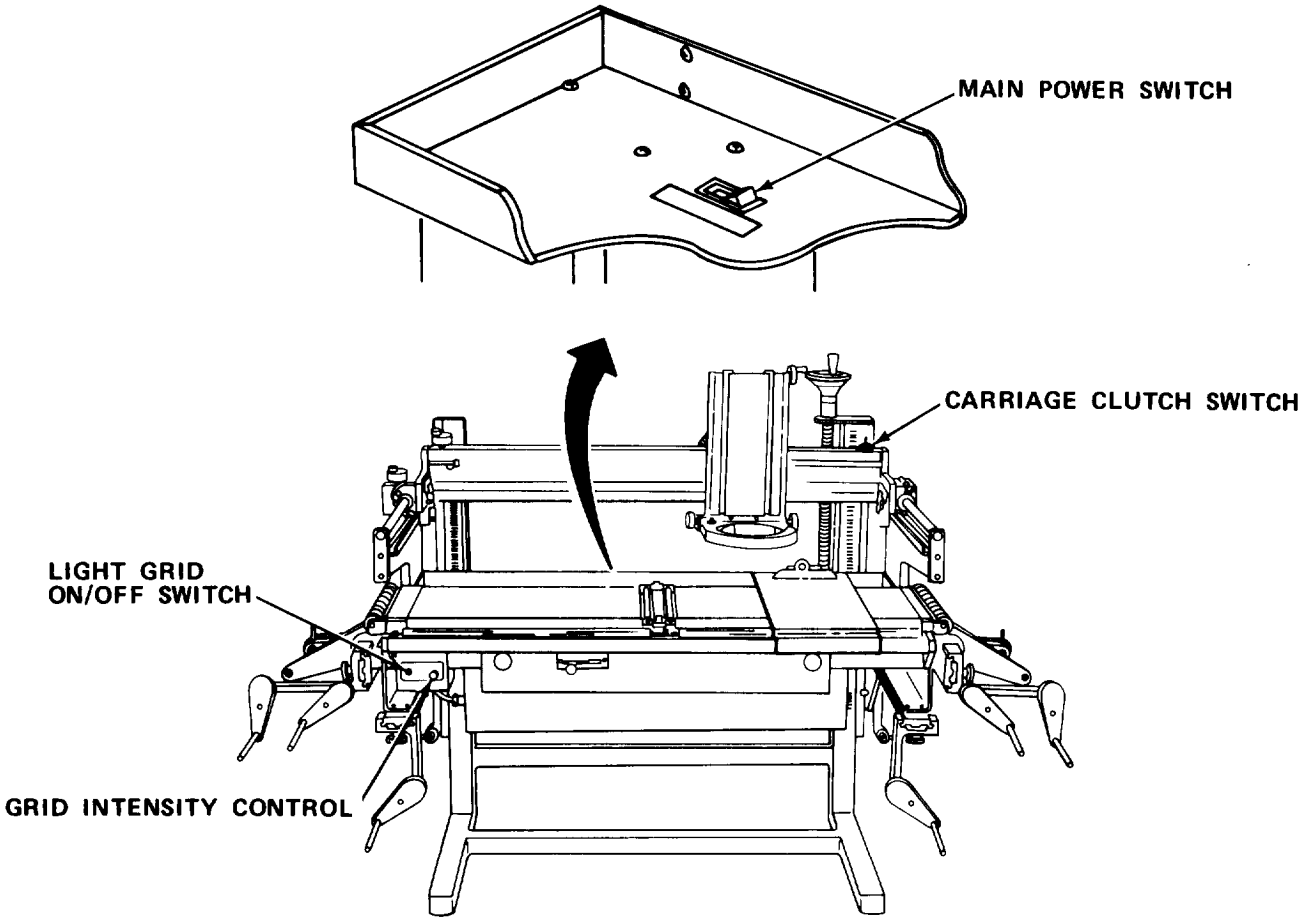
(1) Remove top eight capscrews and washers from sides of braces.

(2) Remove shims.

(3) Save screws, washers, and shims for reuse.

(4) Remove tiedown strap.

b. Release air from air shocks.



c. Plug in power cord, and turn main power switch ON.

d. Set ON/OFF switch to ON and turn grid intensity control fully right.

e. Set carriage clutch switch to ON.

NOTE

Light grids require at least 15 minutes to warm up.

f. Place stereoscope in optical mount.

(1) Remove shipping bracket.

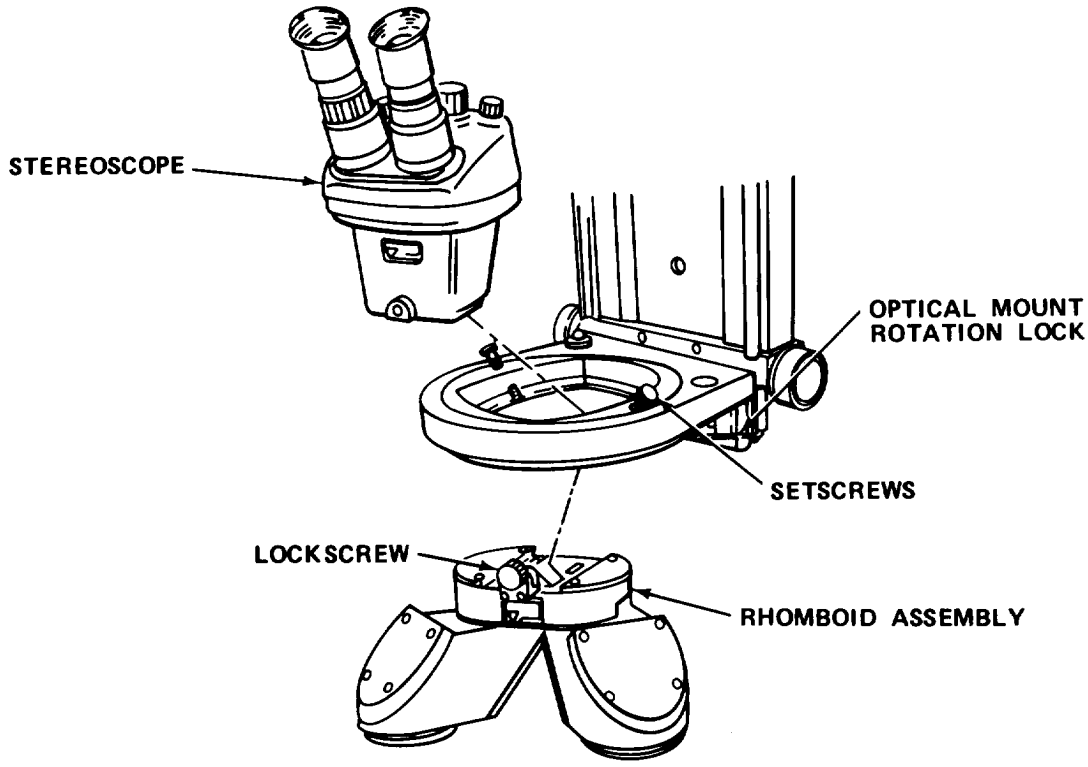
(2) Lift optical mount to at least midpoint of travel.

(3) Loosen two setscrews.

(4) Insert stereoscope and tighten two setscrews.

(5) Connect rhomboid assembly and tighten locking screw.

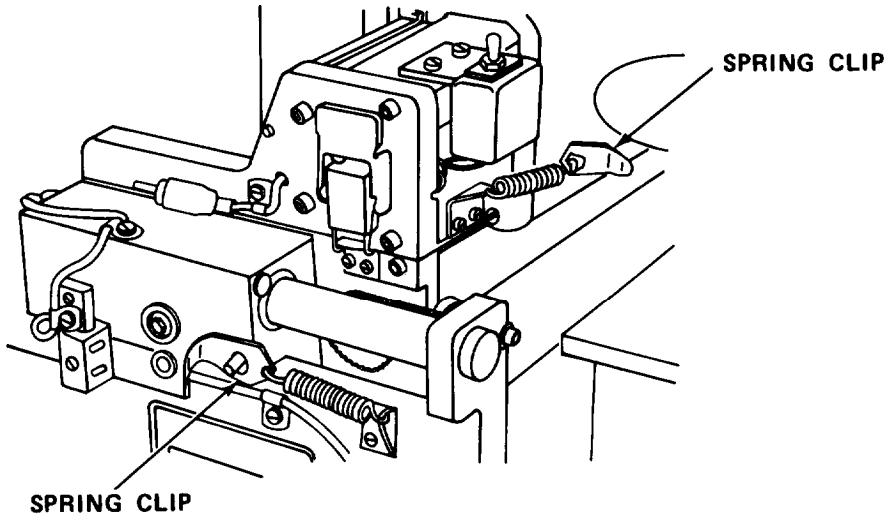
(6) Lock stereoscope in place with optical mount rotation lock.



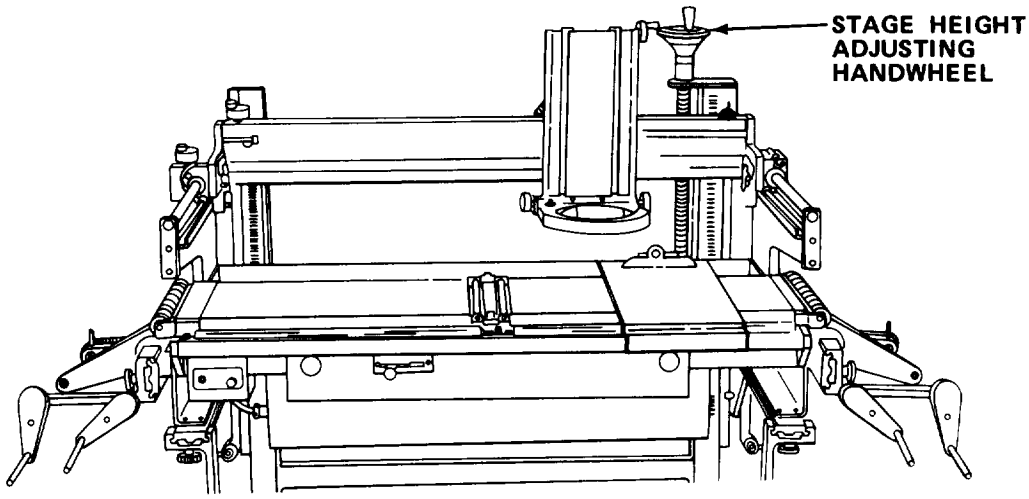
(7) Remove plastic dust protectors.

(8) Install eyepieces.

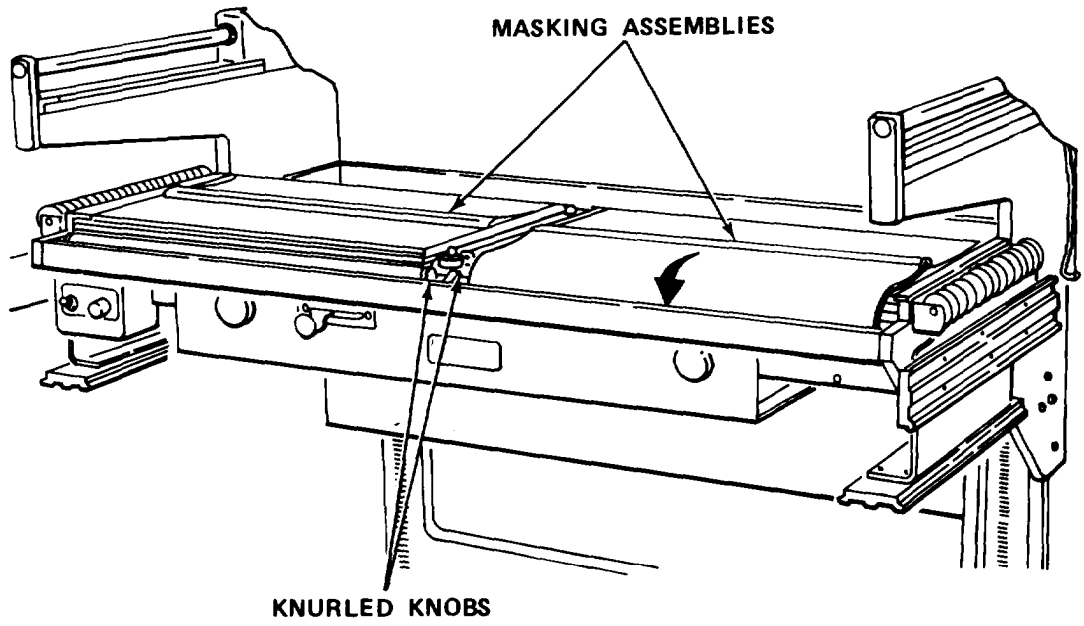
(9) Install eyeguards, if desired.



g. Free optical mount by moving spring clips.



h. Rotate stage height adjusting handwheel left or right to raise or lower view stage to be comfortable for the operator.

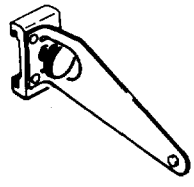


i. Rotate knurled knobs until masking assemblies are retracted into their wells.

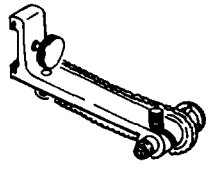
NOTE

This step is required if reel brackets have been removed for preventive maintenance, storage, or shipment.

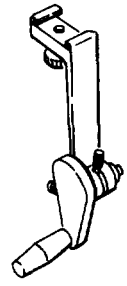
j. Mount reel brackets.



CENTER IDLER BRACKET

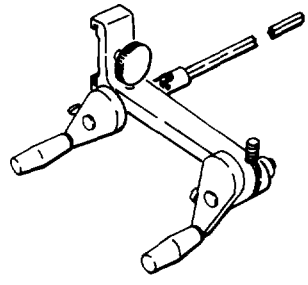


REAR BRACKET T-2-10-DC



DRIVER BRACKET T-1-10

IDLER REEL BRACKET T-1-10

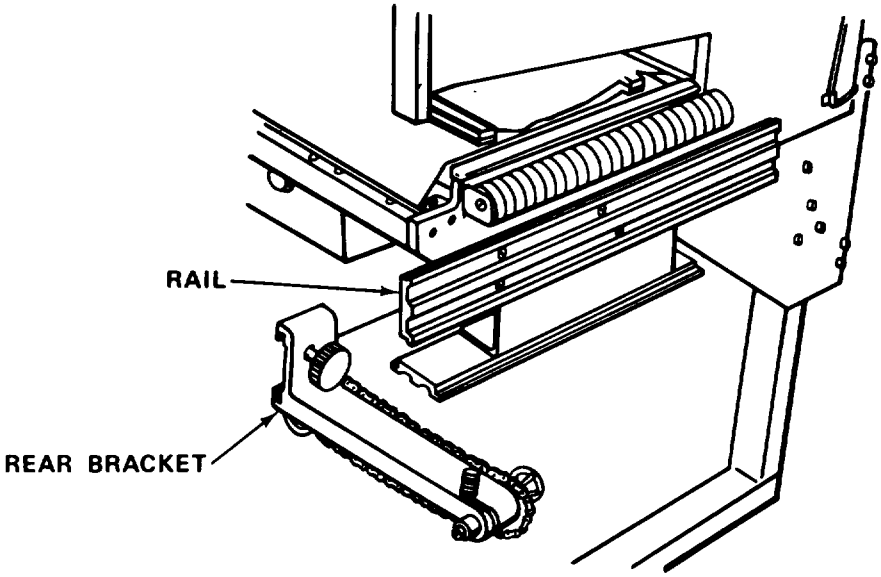


FRONT BRACKET T-2-10-DC

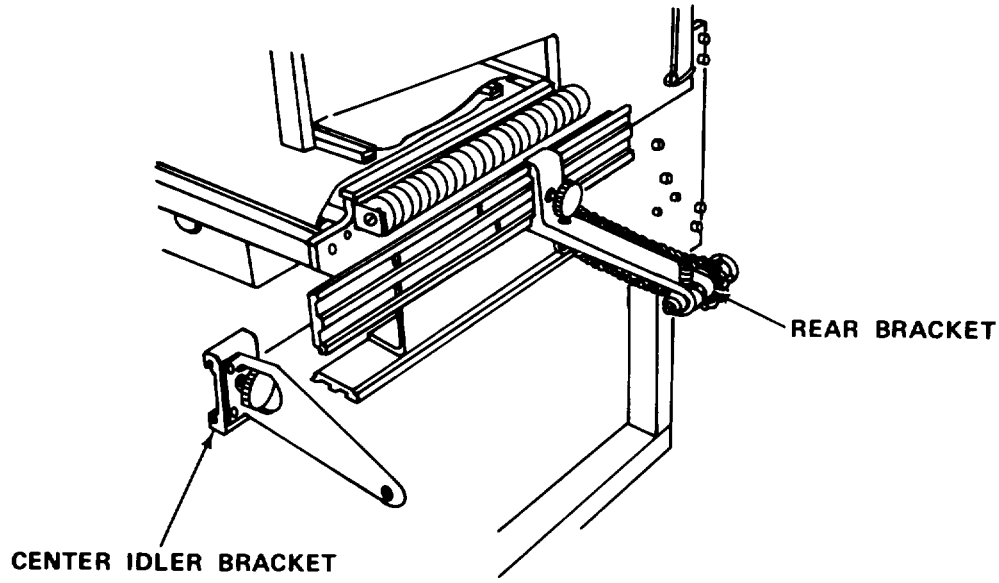
NOTE

T-2-10-DC brackets are used to transport dual film strands. T-1-10 brackets are used to transport single film strands and as take-up brackets for split vertical film.

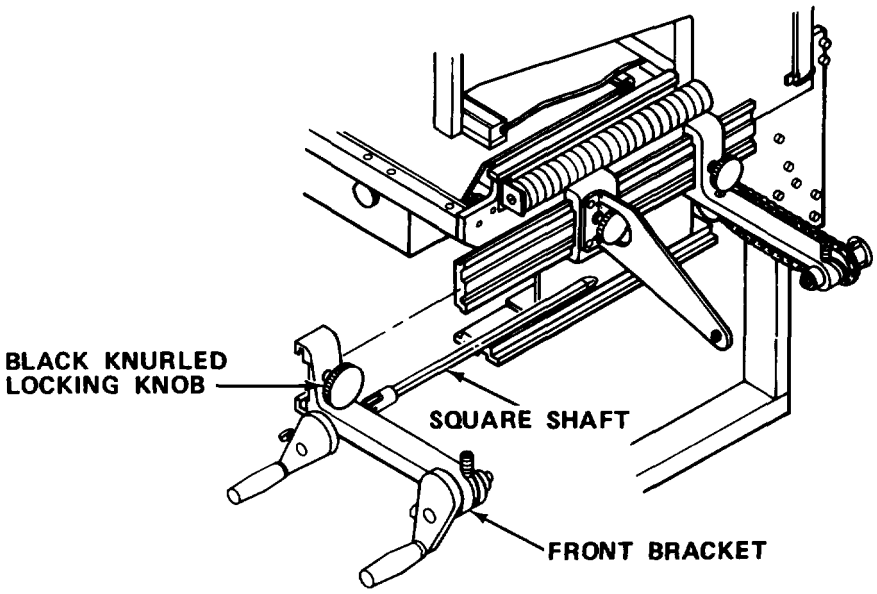
(1) Install T-2-10-DC brackets.



(a) Slide each rear reel bracket to rear of rail.



(b) Slide each center idler bracket into position on rail near center of rail. Aline bearings with spindle tip of each rear bracket.

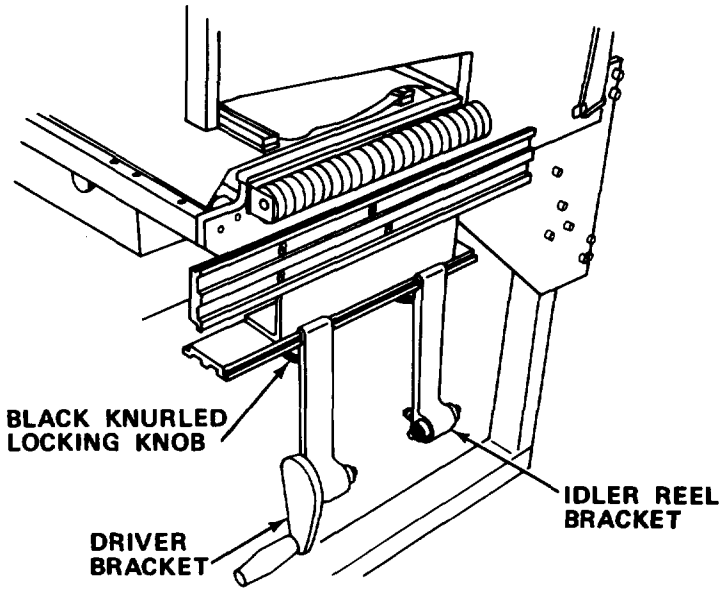


(c) Slide each front bracket on rail. Guide square shaft of bracket into hole in center sprocket of rear bracket.

(d) Aline front bracket base with front edge of rail.

(e) Turn black knurled locking knobs.

(2) Install T-1-10 brackets.

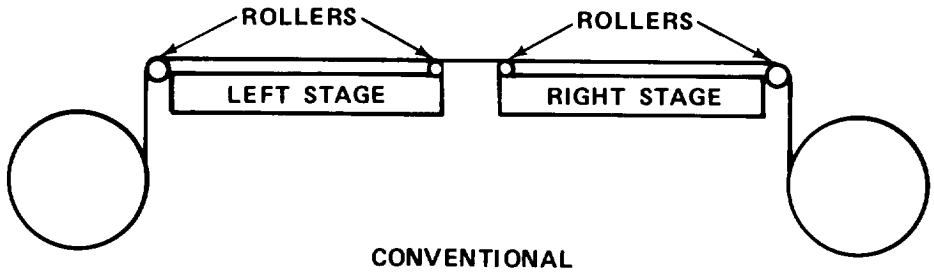


(a) Slide idler reel bracket to rear of lower rail. Spindle tip faces front.

(b) Slide driver bracket on lower rail, crank facing front. Aline front of bracket with front of rail.

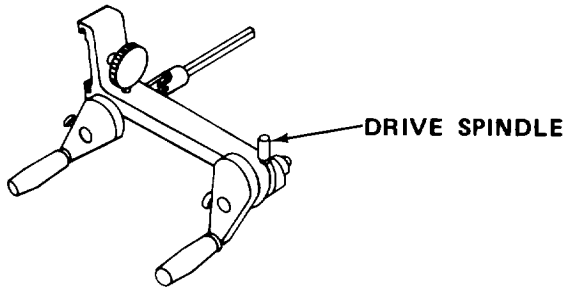
(c) Tighten black knurled locking knobs.

k. Thread film.



CONVENTIONAL

(1) Conventional threading.



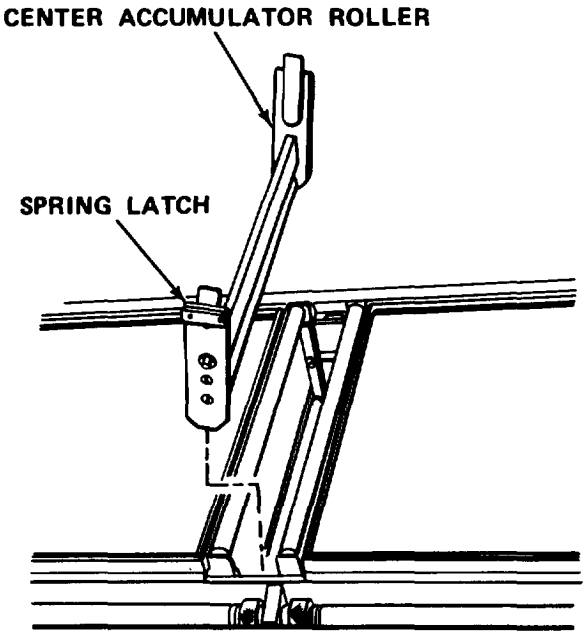
(a) Extend drive spindles on all drive reel brackets by turning grooved spindle-retracting knob to upper locked position.

(b) Insert film supply reel between front bracket and center idler bracket. Front bracket drive spindle engages key slot on reel.

(c) Loosen black knurled locking knob on center idler bracket. Move bracket toward film reel, and engage bearing on bracket with center hole in reel. Adjust position so that film reel is securely held and has very slight end-play.

(d) Tighten black knurled locking knob on center idler bracket.

(e) Install take-up reel at opposite end of table using same procedure.



(f) Remove center accumulator roller by pinching spring-loaded latches and lifting from between view stages.

(g) Move stage separation knob to right. Make sure that view stages close and knob locks into slot.

(h) Thread film leader over rollers across view stage to take-up reel.

(i) Adjust drag brake knobs on crank handles until film tension is suitable for operator's use.

NOTE

Perform steps (j) through (n) to view dual film strips.

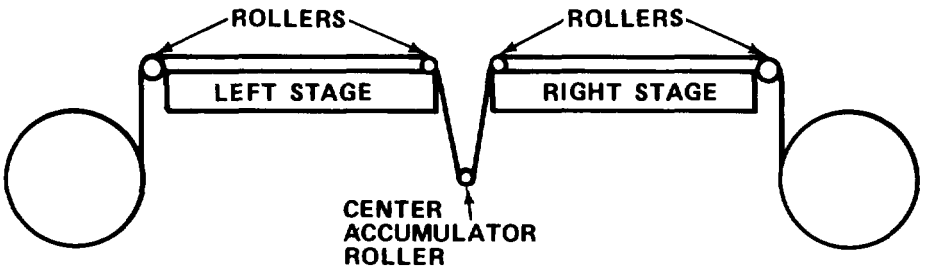
(j) Mount rear film supply reel on idler bracket. Reel key slot engages bearing on idler bracket.

(k) Slide rear driver bracket to front until drive spindle engages reel key slot.

(l) Tighten black knurled locking knob on driver bracket.

(m) Install take-up bracket at opposite end of split-stage light table.

(n) Thread rear film strand.



SHORT LOOP TAKE-UP

(2) Short loop take-up threading.

NOTE

After film is threaded conventionally, the following steps will provide a short loop take-up.

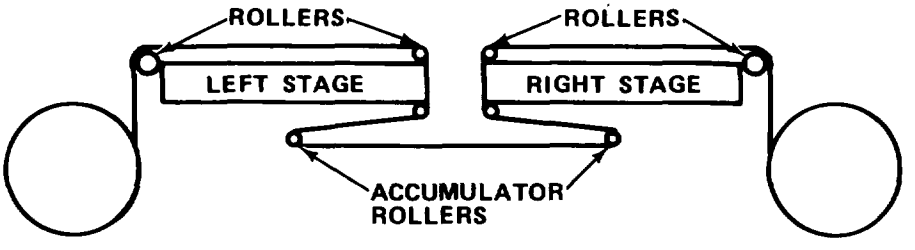
(a) Push stage separation knob down and to the left. Make sure that view stages separate.

(b) Loosen drag brake knobs on reel brackets.

(c) Start short film loop.

(d) Insert center accumulator roller over film between view stages. Pinch spring-loaded latches and latch into position.

(e) Adjust drag brake tension on reel brackets until film tension is suitable for operator's use.



LONG LOOP TAKE-UP

(3) Long loop take-up threading.

CAUTION

Do not close view stages when film is threaded in long loop position. Damage to film may result.

(a) Push stage separator knob down and to the left. Make sure that view stages separate.

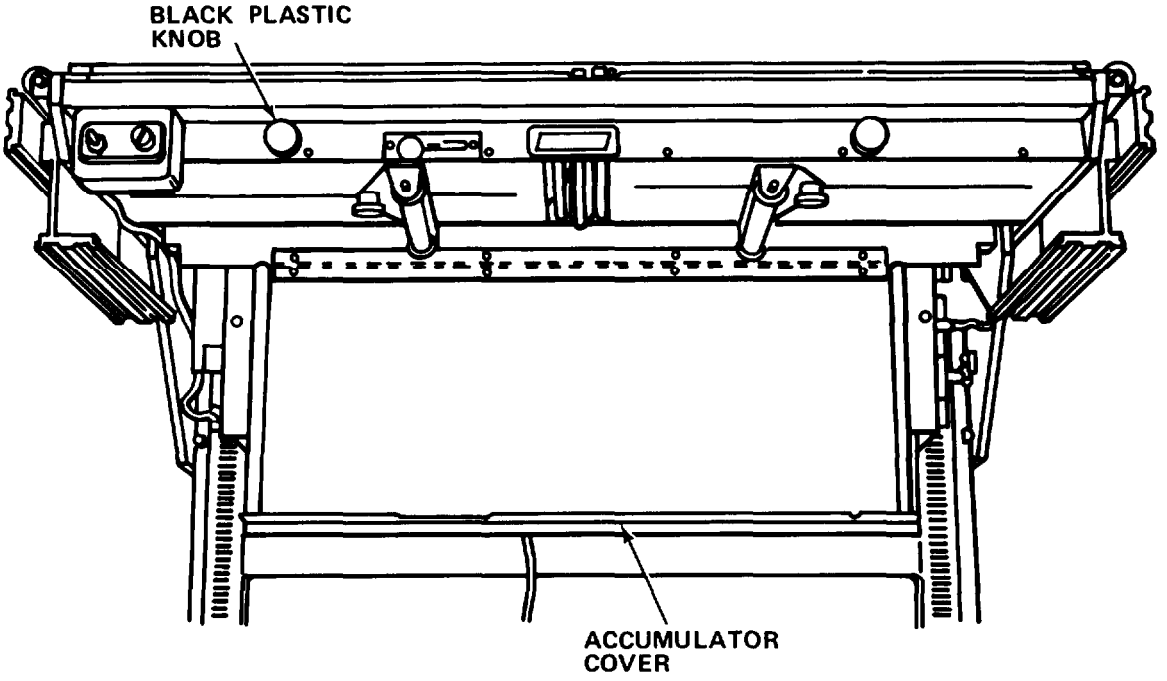
(b) Remove center accumulator roller by pinching spring-loaded latches and lifting from between view stages.

(c) Insert film supply reel between front bracket and center idler bracket. Front bracket drive spindle engages key slot on reel.

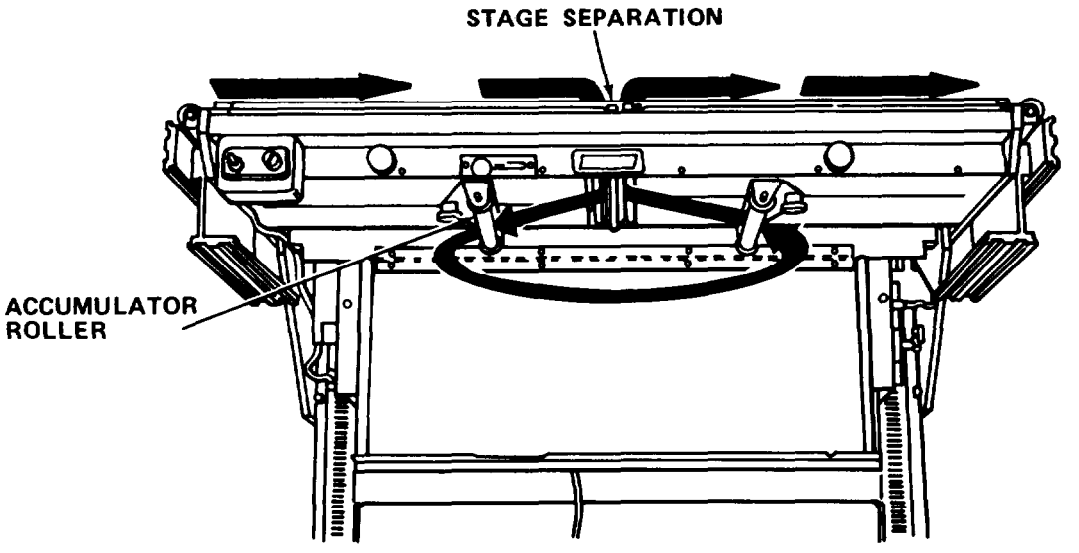
(d) Loosen black knurled locking knob on center idler bracket. Move bracket toward film reel, and engage bearing on bracket with center hole in reel. Adjust position so that film reel is securely held and has very slight end-play.

(e) Tighten black knurled locking knob on center idler bracket.

(f) Install take-up reel at opposite end of table using same procedure.



(g) Loosen black plastic knobs on film accumulator cover, and let cover drop down.



(h) Thread film across view stage, down through stage separator, and over accumulator roller.

CAUTION

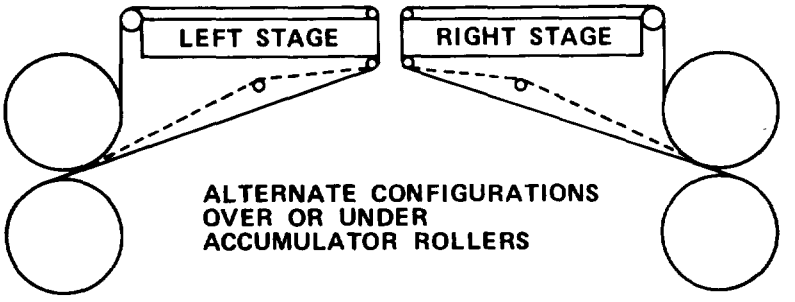
Do not catch film on any hardware while threading. Damage to film may result.

(i) Continue threading the film across to second accumulator roller. Thread film over roller, up through stage separation, and across second view stage to take-up reels.

(j) Loosen locking knobs, and adjust accumulator rollers for desired length of take-up loop. Tighten locking knobs.

(k) Adjust drag brake knobs on reel brackets until film tension is suitable for operator's use.

(l) Close film accumulator cover, and secure by tightening knobs.



SPLIT VERTICAL TAKE-UP

(4) Split vertical take-up threading.

(a) Remove center idler brackets.

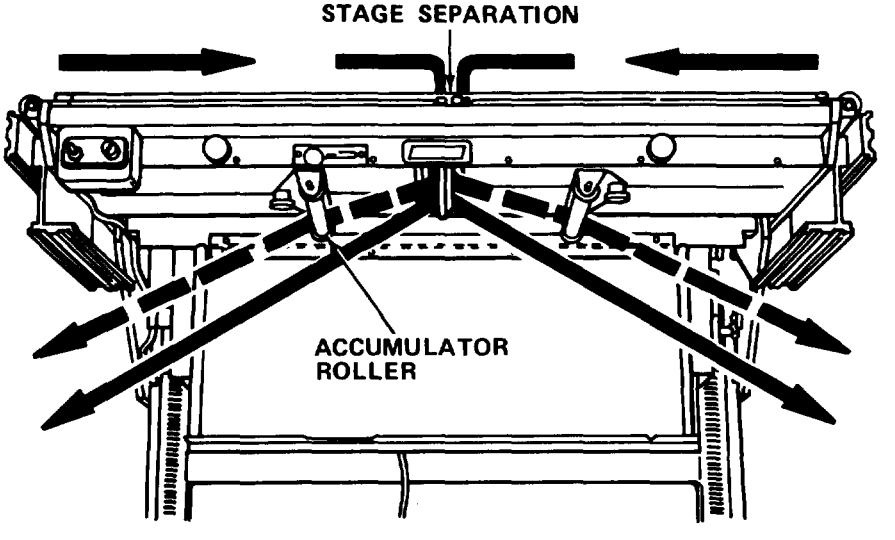
(b) Mount supply reels on top rails.

(c) Mount take-up reels on bottom rails.

(d) Push stage separation knob down and to the left. Make sure that view stages separate.

(e) Remove center accumulator roller by pinching spring-loaded latches and lifting from between view stages.

(f) Loosen black plastic knobs on film accumulator cover. Let cover drop down.



(g) Thread film leader from supply reel, across view stage, down through stage separation, over accumulator roller, and directly to take-up reel.

(h) Adjust drag knobs on reel brackets until film tension is suitable for operator's use.

(i) Move rollers to far left and right travel positions, and tighten locking knobs.

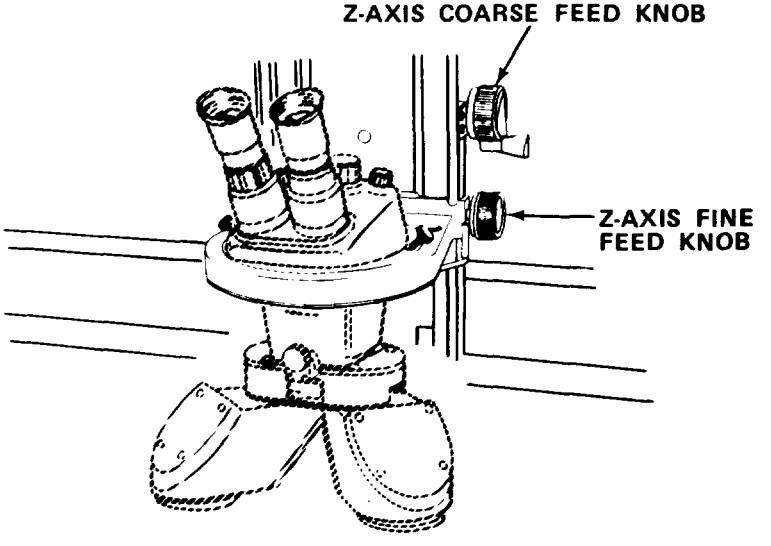
CAUTION

Do not close stage separation. Damage to film may result.

Install clipboard over viewing surfaces, if desired.

6-6.2 Operating Procedures.

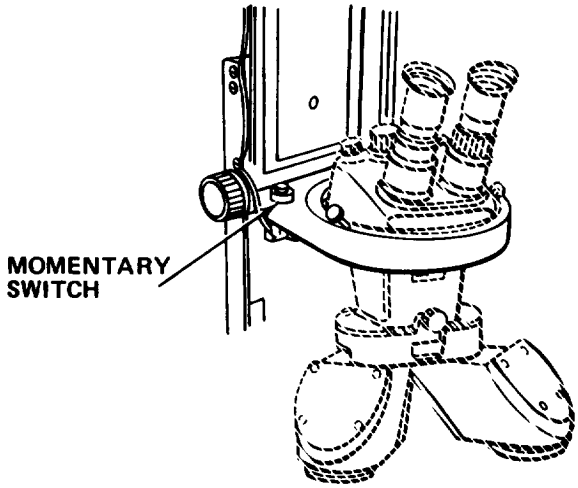
a. Adjust light grid intensity to comfortable illumination level.



b. Position optics at approximate viewing level:

(1) Rotate Z-axis coarse feed knob to left or right.

(2) Rotate Z-axis fine feed knob to obtain operating position.



c. Position optics to approximate horizontal position:

(1) Press momentary switch and hold.

(2) Move mount left, right, forward, or back while switch is pressed.

(3) Use X-axis control knob for fine positioning in left-right direction.

(4) Use Y-axis control knob for fine positioning in front-back direction.

d. Shut down light table.

(1) Rewind film on reel.

(2) Remove film reels.

(3) Set ON/OFF switch to OFF.

(4) Set carriage clutch switch to OFF.

(5) Set main power switch to OFF.

(6) Cover view stages with masking assemblies.

(7) Unplug power cord.

CAUTION

Do not touch optical surfaces with bare fingers. Fingerprints will hinder equipment performance.

(8) Move optical mount to far right rear position.

(9) Secure optical mount with spring clips.

(10) Remove and store eyepieces.

(11) Remove and store optics.

(12) Remove and store reel brackets.

(13) Remove and store clipboard.

(14) Lower optical mount. Install shipping bracket.

(15) Cover with dust cover.

6-6.3 Preparation for Movement.

a. Perform all light table shutdown steps (paragraph 6-6.2d), except covering with dust cover.

b. Reinstall all mounting (red-painted) brackets and tighten bolts.

c. Cover light table with dust cover.

6-7. OPERATION UNDER UNUSUAL CONDITIONS. Operation of the split-stage light table is limited to conditions that will not damage aerial roll film or stereoscopes.

Section III OPERATOR MAINTENANCE

6-8. LUBRICATION INSTRUCTIONS.

CAUTION

Unnecessary or improper attempts to lubricate the split-stage light table will damage film, bearings, or internal components.

No lubrication is authorized at the operator's level. Maintenance procedures at direct support level require limited lubrication of chains and precision bearings when there is a reason to perform corrective action requiring the removal of components.

6-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the split-stage light table, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all the possible malfunctions that may occur, nor all test/inspections and corrective actions. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

Table 6-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. FAN DOES NOT RUN. LIGHT GRIDS DO NOT WORK. CARRIAGE CLUTCHES DO NOT WORK.
Step 1. Check that power cord is plugged in.
(a) If plugged in, proceed to step 2.
(b) Plug power cord in correctly.
Step 2. Check circuit breakers.
(a) If circuit breakers are on, refer to organizational maintenance.
(b) Reset circuit breakers.

Table 6-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
2. CLUTCHES DO NOT OPERATE. GRID LIGHTS OPERATE. Step 1. Check if carriage clutch switch is off. (a) If on, proceed to step 2. (b) Turn on switch. Step 2. Check if fuses are damaged or blown. Replace defective fuses (paragraph 6-10.1).
3. OPTICAL RESOLVING POWER IS LIMITED. FILM IMAGE IS DISTORTED WHEN CARRIAGE POSITION IS MOVED. Replace stereoscope. (a) If distortion is eliminated, evacuate defective stereoscope through normal maintenance channels. (b) If distortion is not eliminated, refer to direct/general support maintenance.

6-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the split-stage light table. Personnel required are listed only if the task requires more than one.

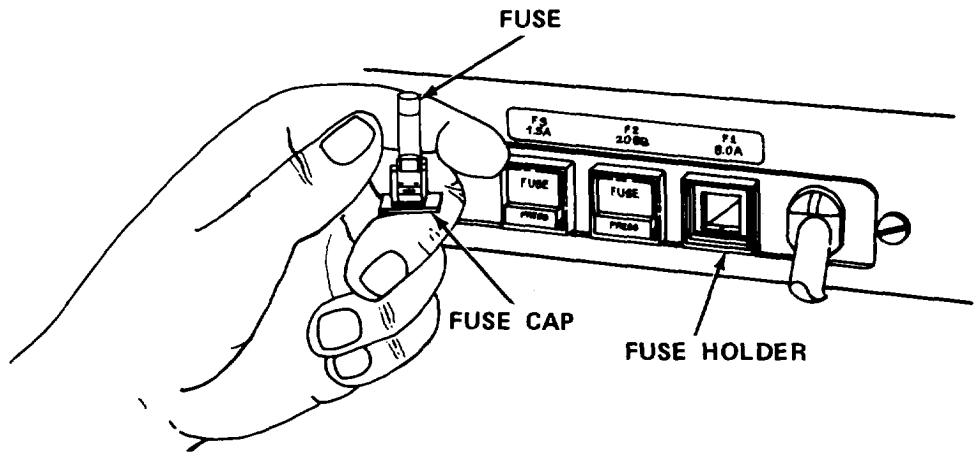
b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

6-10.1 Replace Fuse(s).

MOS: 81Q, Terrain Analyst

SUPPLIES: Fuse (8 amp)
Fuse (1.5 amp)
Fuse (2 amp, SI0-BI0)



WARNING

To prevent death or serious injury from electrical shock, unplug power cord before servicing equipment.

a. Turn power off and unplug power cord.

b. Press on fuse holder bottom to release fuse cap.

c. Inspect fuse for burned/broken element.

d. Discard defective fuse.

CAUTION

- New fuse must be of equal value to fuse removed.
- If new fuse burns out immediately, do not operate equipment until electrical fault is isolated and repaired, or serious equipment damage will occur.

e. Install new fuse of equal value and configuration.

f. Push fuse holder with new fuse into receptable until fuse holder latches.

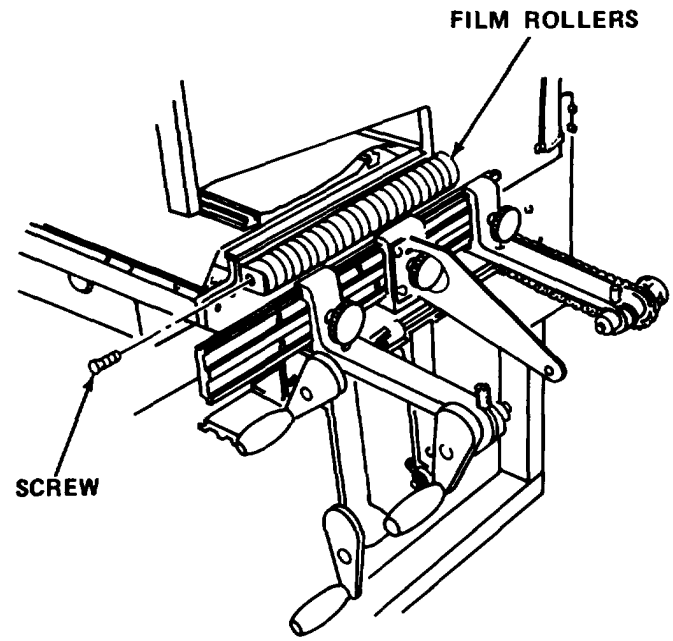
9. Plug in power cord and turn power on.

6-10.2 Replace Film Rollers.

MOS: 81Q, Terrain Analyst

TOOLS: 9/64 in. Flat Tip Screwdriver

SUPPLIES: Film Rollers



a. Remove screw from end of film roller assembly.

b. Slide defective rollers off assembly.

c. Install new film rollers on assembly.

d. Reinstall assembly and secure with screw.

Section IV ORGANIZATIONAL MAINTENANCE

6-11. LUBRICATION INSTRUCTIONS. This equipment requires no lubrication at the organizational level.

6-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT.

6-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

6-12.2 Special Tools; Test, Measurment, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools List and Appendix B of this manual.

6-12.3 Repair Parts. Repair parts are listed in Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

6-13. SERVICE UPON RECEIPT.

6-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

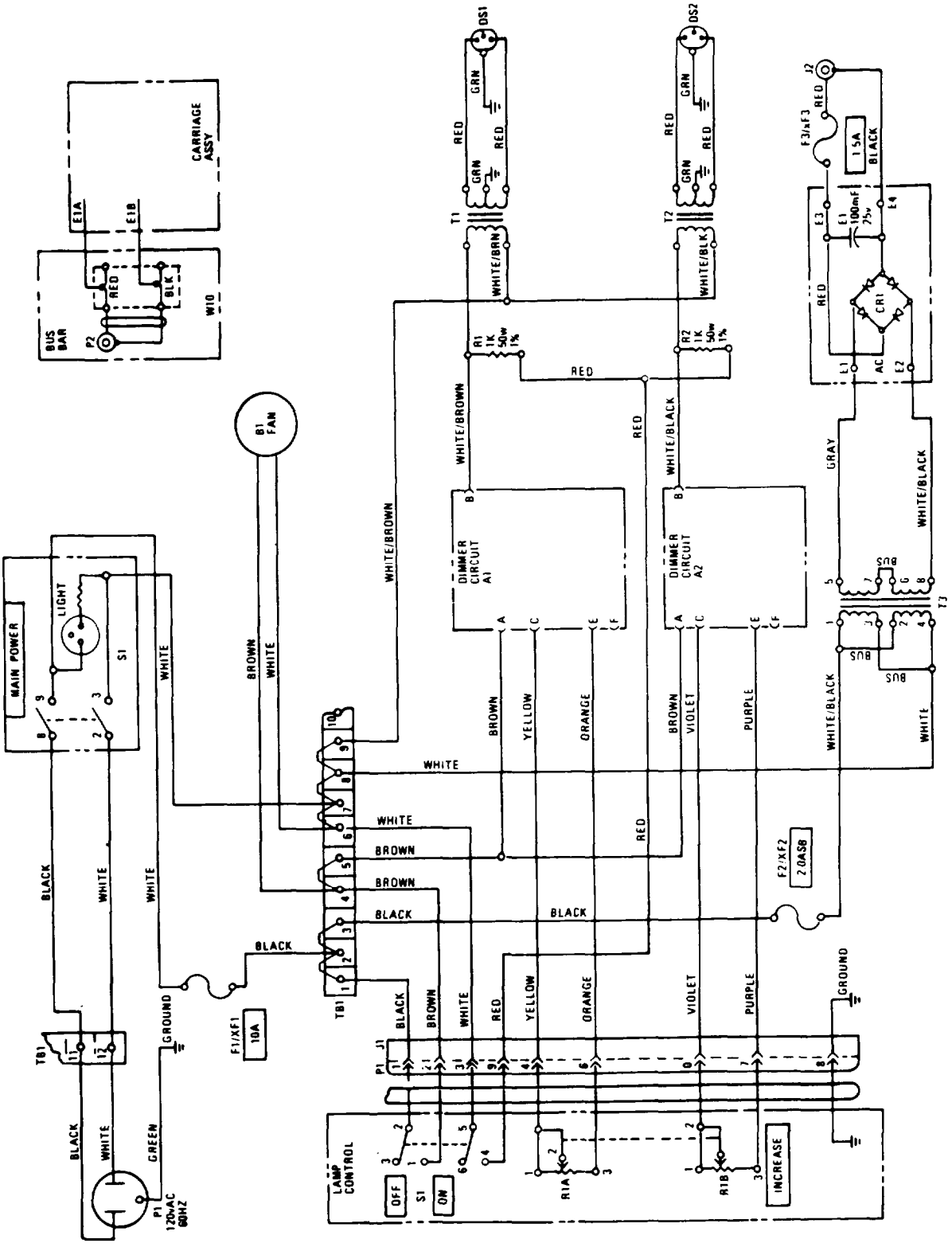
6-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

6-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.



d. If the split-stage light table does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedure for dead receptacle (Table 1-4).

Table 6-3. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

1. LIGHT GRID, FAN MOTOR, AND CARRIAGE CLUTCH SWITCHES ARE INOPERATIVE.

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing the split-stage light table.

Step 1. Remove two quick-disconnect screws and remove cover from power panel.

Step 2. Perform continuity check for ON/OFF switch at terminal board.

If no continuity is present, replace ON/OFF switch (paragraph 6-16.1).

2. LIGHT GRID INTENSITY WILL NOT CHANGE.

Perform continuity check for potentiometer.

(a) If no continuity is present, replace potentiometer (paragraph 6-16.2).

(b) Notify direct support maintenance for reversal of dimmer card connector or replacement of dimmer circuit card.

3. ONLY ONE LIGHT GRID LIGHTS.

Inspect connections to light grid.

(a) Tighten loose connections.

(b) Notify direct support maintenance for replacement of dimmer circuit card.

4. FAN MOTOR WILL NOT RUN. LIGHT GRIDS AND CLUTCHES WORK.

Notify direct support maintenance for replacement of fan.

Table 6-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
5. FAN OPERATES. CLUTCHES DO NOT OPERATE.	
Perform continuity check for carriage clutch switch.	If no continuity is present, notify direct support maintenance for replacement of carriage clutch switch.
6. CLUTCHES DO NOT OPERATE. LIGHT GRID OPERATES.	
Step 1. Set carriage clutch switch to OFF.	
Step 2. Perform continuity check for carriage assembly.	If no continuity is present, notify direct support maintenance for replacement of carriage clutch switch.
Step 3. Perform continuity check for X-axis brushes.	If no continuity is present, replace brushes (paragraph 6-16.4).
7. X-, Y-, OR Z-AXIS CHAINS JUMP SPROCKETS.	
Inspect for slack in chain.	Notify direct support maintenance for tightening of chain.
8. X-, Y-, OR Z-AXIS CONTROLS ARE SLUGGISH.	
Step 1. Inspect chain for too much tension.	Notify direct support maintenance for loosening of chain.
Step 2. Inspect chains for dirt.	Notify direct support maintenance for servicing of chain.
Step 3. Inspect worm gears and bearings.	Notify direct support maintenance for servicing of worm gears and bearings.

6-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance functions for the split-stage light table. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

6-16.1 Replace ON/OFF Switch.

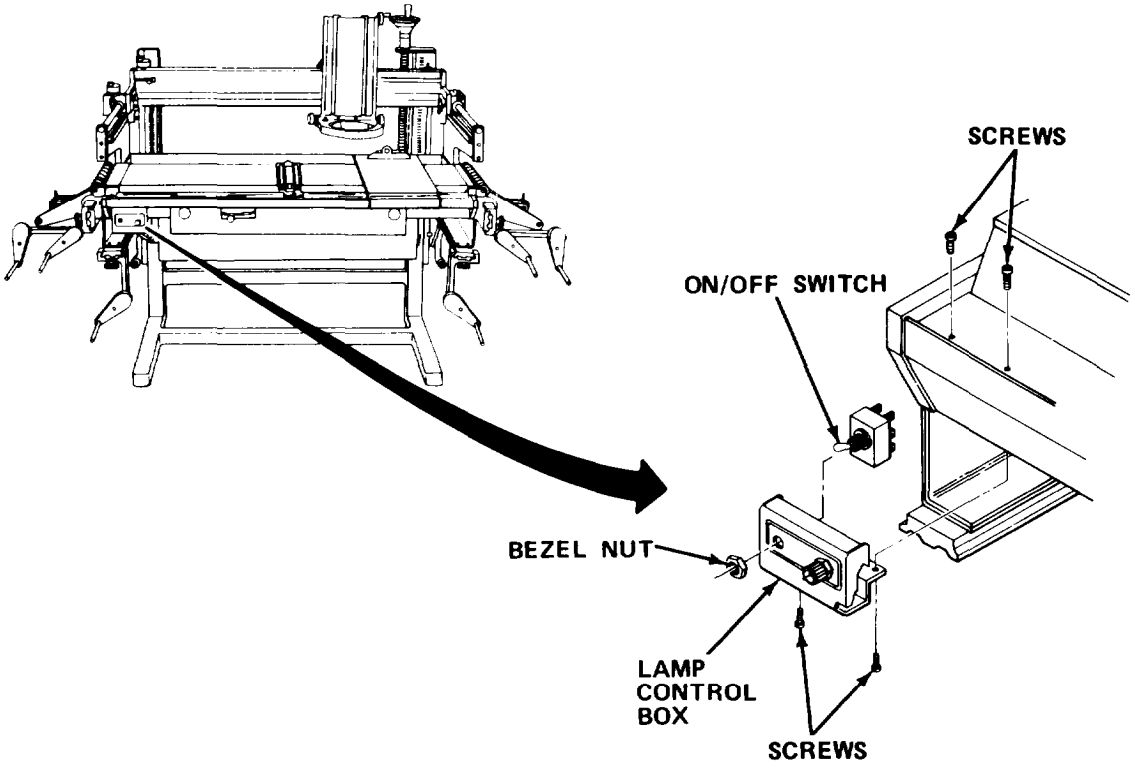
MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 7/64 in. Hex Head Key Wench
7/16 in. Open End Wrench
Soldering Iron

SUPPLIES: Toggle Switch
Solder (Item 24, Appendix E)

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.



a. Turn power off and unplug power cord.

b. Remove four screws and move cover to expose rear of lamp control box.

c. Remove bezel nut. Withdraw ON/OFF switch from back.

NOTE

Wiring is connected to cover and switches.

d. Tag and desolder wires from ON/OFF switch.

e. Solder wires to new ON/OFF switch.

f. Install new ON/OFF switch and secure with bezel nut.

NOTE

Be certain wires are not loose, crossed, or disconnected before securing cover. Green (ground) wire is connected to cover screw.

g. Reinstall cover and secure with four socket head screws.

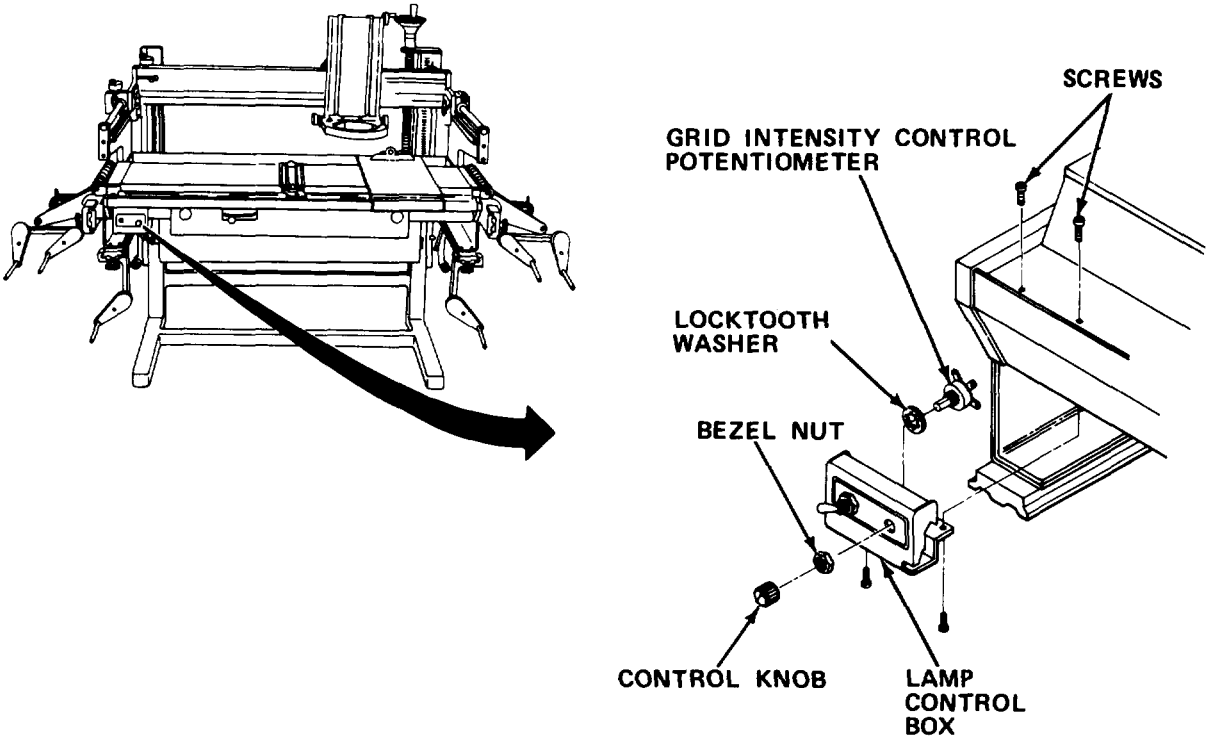
h. Plug in power cord and turn power on.

6-16.2 Replace Grid Intensity Control Potentiometer.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 7/64 in. Hex Head Key Wrench
1/2 in. Hex Head Key Wrench
1/2 in. Open End Wrench
Soldering Iron

SUPPLIES: Potentiometer
Solder (Item 24, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off, and unplug power cord.

b. Remove screws and move cover to expose rear of lamp control box.

c. Loosen socket head screws and remove control knob.

NOTE

Wiring is connected to cover and switches.

d. Remove bezel nut.

e. Tag and desolder wires from potentiometer.

f. Withdraw grid intensity control potentiometer and locktooth washer from rear of control box.

g. Solder wires to new grid intensity control potentiometer.

h. Install potentiometer and locktooth washer and secure with bezel nut.

i. Reinstall control knob and tighten socket head screws.

NOTE

Be certain wires are not loose, crossed, or disconnected before securing cover. Green (ground) wire is connected to cover screws.

j. Reinstall cover on lamp control box and secure with socket head screws.

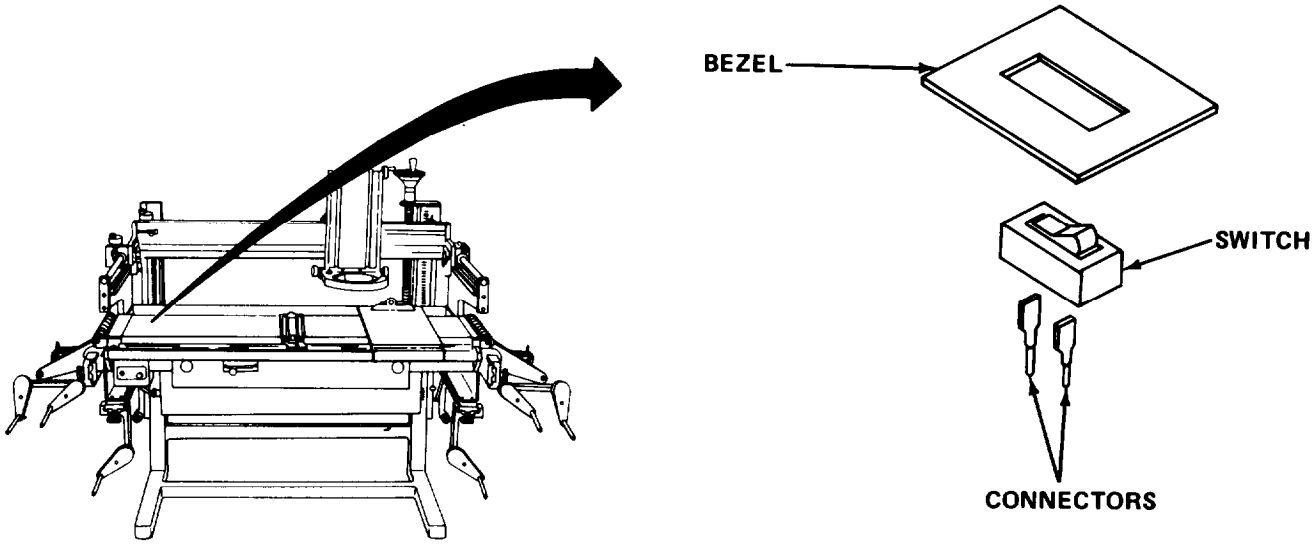
k. Plug in power cord and turn power on.

6-16.3 Replace Main Power Switch.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver

SUPPLIES: Power Switch



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

b. Loosen quick-disconnect screws and remove front cover.

c. Release switch from bezel retaining clip.

d. Tag and disconnect wires from switch.

e. Connect wires to new switch.

f. Insert switch into bezel retaining clip.

9. Reinstall front cover and secure with quick disconnect screws.

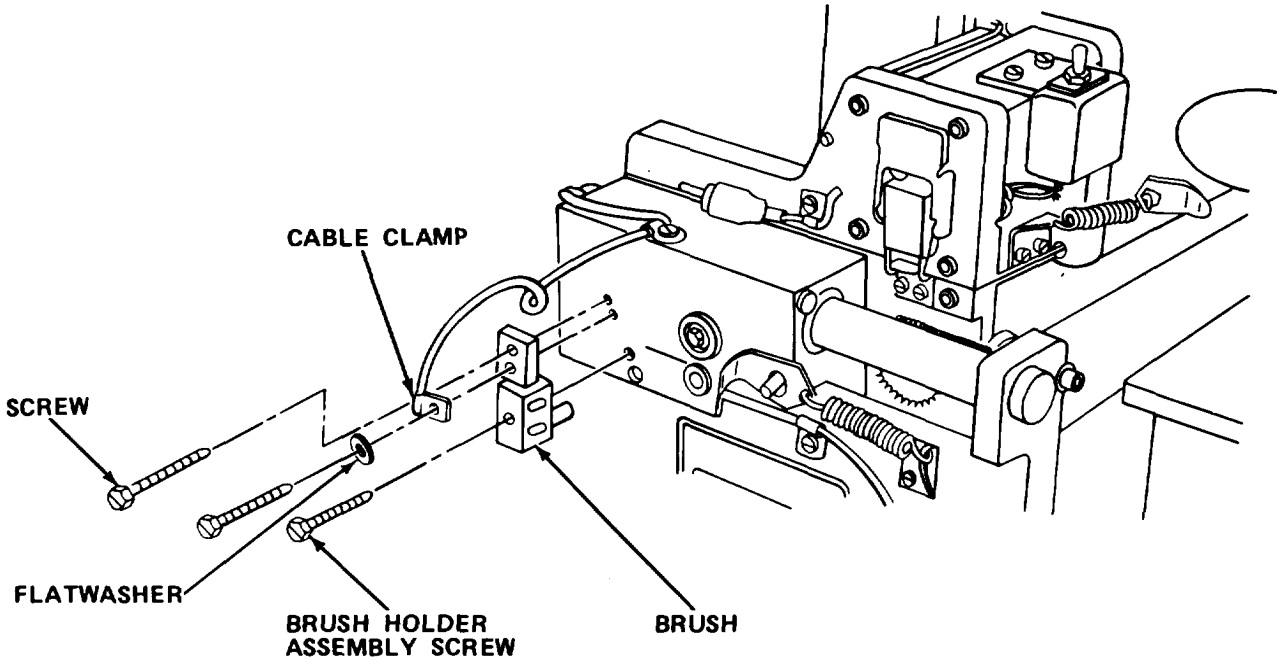
h. Plug in power cord and turn power on.

6-16.4 Replace Brush.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 0.070 in. Jeweler's Screwdriver
9/64 in. Flat Tip Screwdriver
5/16 in. Combination Wrench
Soldering Iron

SUPPLIES: Brush
Solder (Item 24, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

NOTE

Two brush holder assemblies are used (X- and Y-axes). Procedure for replacement of either X- or Y-axis brush is same.

a. Turn power off and unplug power cord.

b. Remove screw and flat washer from cable clamp adjacent to brush. Remove cable clamp.

c. Remove screw and lift brush holder assembly from contact strips.

d. Carefully note parts' relationship and disassemble brush holder.

e. Desolder electrical connections to brush.

f. Solder new brush to electrical connections.

g. Reassemble brush holder.

h. Aline brush holder hole with mounting hole and secure with screw.

i. Reinstall cable clamp and flat washer and secure with screw.

j. Plug in power cord and turn power on.

6-16.5 Remove/Install Split-Stage Light Table.

MOS: 41B, Topographic Instrument Repair Specialist

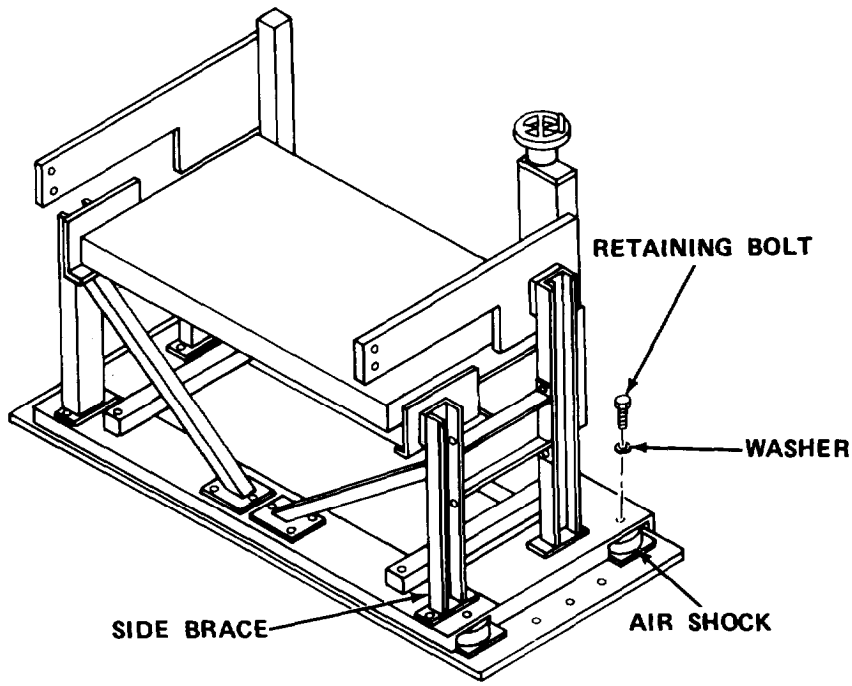
PERSONNEL: Two persons are required to perform this procedure.

TOOLS: Socket Wrench Set (1/2 in. Drive)

SUPPLIES: Split-Stage Light Table

a. Turn power off and unplug power cord.

b. Coil and tape power cable.



c. Deflate air shocks to allow access to retaining bolts. Remove retaining bolts from air shocks.

d. Block table frame.

e. Remove side braces.

(1) Remove capscrews and washers from sides and base of table.

(2) Remove shims.

(3) Slide braces out from underneath table.

f. Remove bolts securing rear legs of table.

g. Remove bolts securing front legs of table.

WARNING

Serious injury to personnel or damage to equipment may occur unless two or more personnel are used to remove and install the split-stage light table. This equipment weighs 360 lbs.

h. Slide defective table to center aisle and remove from section.

i. Install new table and secure front legs with bolts.

j. Secure rear legs of table with bolts.

k. Reinstall shims and side braces, and secure with capscrews and washers.

CAUTION

Do not inflate air shocks over 70 psi or damage to equipment could result.

l. Reinstall four retaining bolts in air shocks. Inflate air shocks.

m. Remove tape and uncoil power cord.

n. Plug in power cord and turn power on.

6-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

6-18. REPAIR PARTS, SPECIAL TOOLS: TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT.

6-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

6-18.2 Special Tools; Test, Measurements, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and Appendix B of this manual.

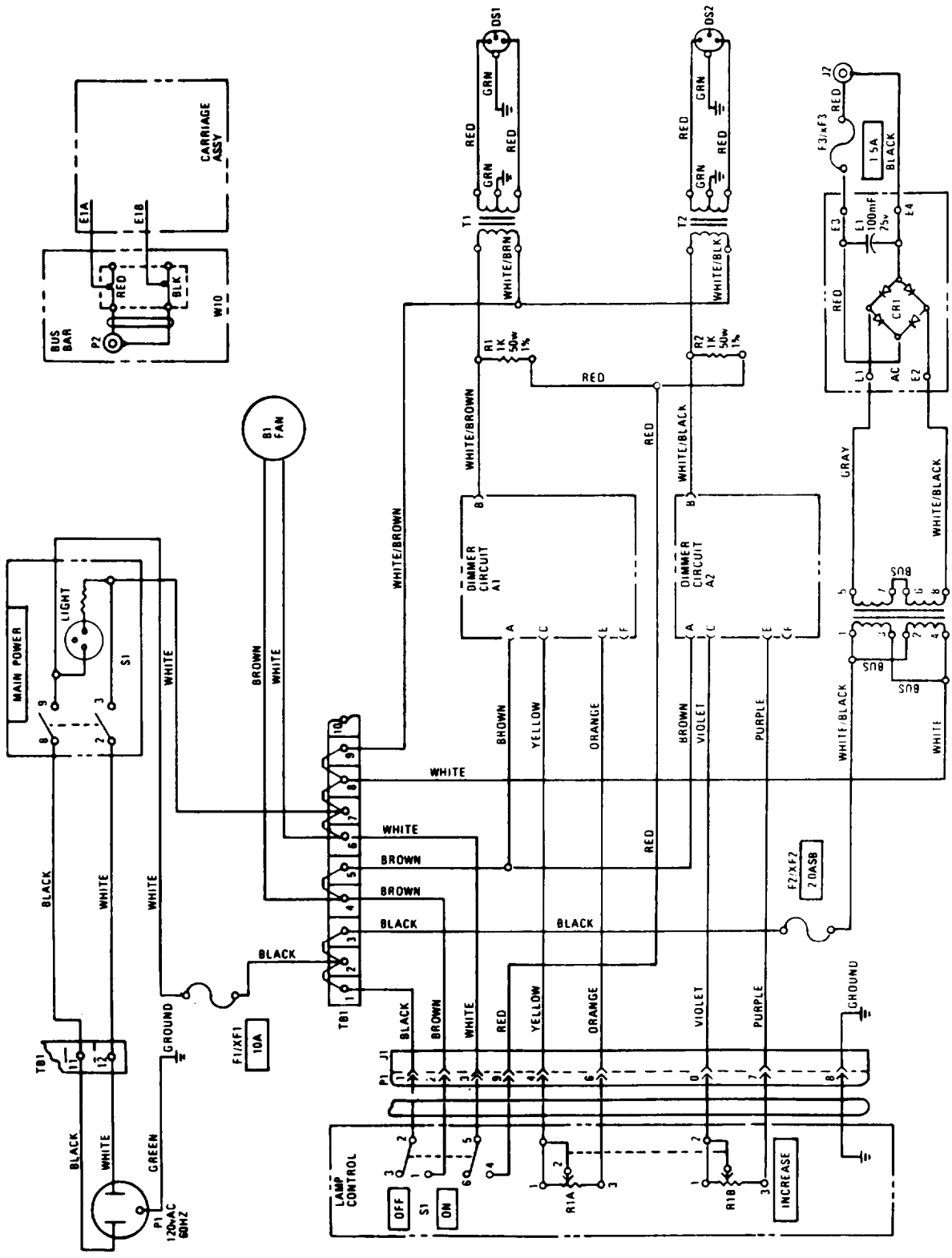
6-18.3 Repair Parts. Repair parts for this equipment are listed in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering direct/general support maintenance for this equipment.

6-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING PROCEDURES.

a. Direct/general support troubleshooting procedures cover the most common malfunctions that may be repaired at the direct/general support level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used at lower levels should be conducted in addition to the direct/general support troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.



SPLIT-STAGE LIGHT TABLE WIRING DIAGRAM

Table 6-4. DIRECT/GENERAL SUPPORT TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. LIGHT GRIDS ARE TOO DIM OR TOO BRIGHT.	Measure light intensity to determine if high and low level potentiometers on card Al or A2 are out of adjustment.	Adjust light grid intensity to 2500 and 500 ft lamberts (paragraph 6-20.1).
2. Z-AXIS MOVEMENT IS SLUGGISH OR HARD TO MOVE.	Test for free movement without binding.	If movement binds or lugs, adjust, and lubricate Z-axis as required (paragraph 6-20.4).
3. LIGHT GRID LIGHTS BUT INTENSITY WILL NOT CHANGE.	Reverse connector to dimmer card.	**NOTE** Dimmer card connector is not keyed and may be reversed. If card is reversed, grid lamp will operate at maximum intensity and lamp intensity will not change. (a) Mark card and connector to indicate proper connection. (b) Replace dimmer circuit assembly (paragraph 6-20.8).

6-20. MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance functions for the split-stage light table. Personnel required are listed only if the task requires more than one.

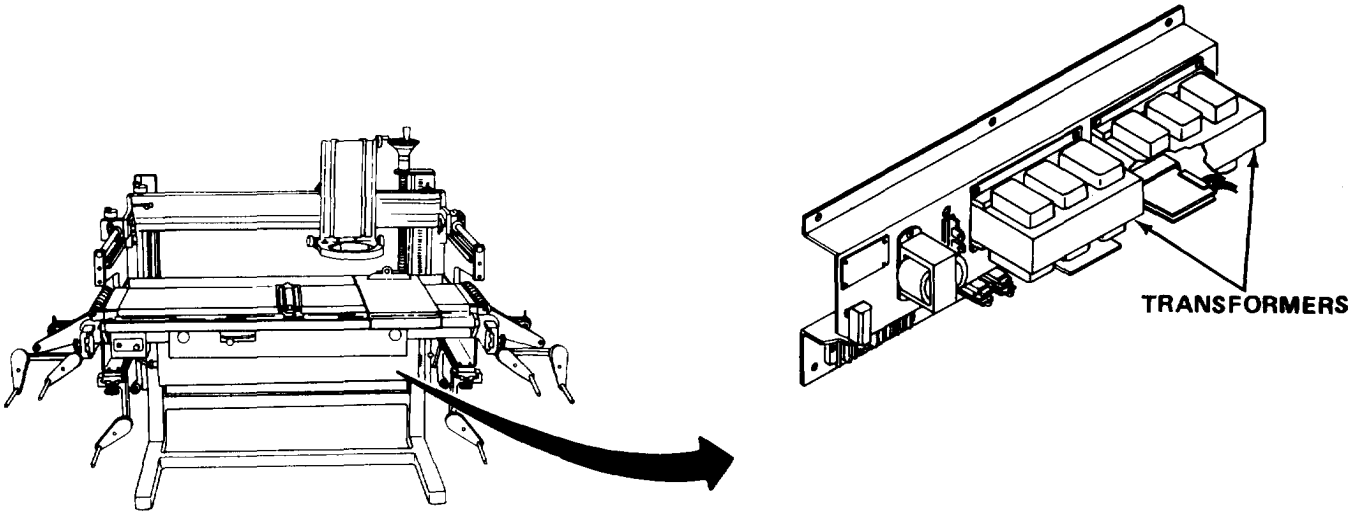
b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

6-20.1 Adjust Light Grids.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Photometer (LM150A or equivalent)
9/64 in. Flat Tip Screwdriver



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

b. Loosen quick-disconnect screws and remove cover.

c. Be sure wiring is tight and transformers are properly connected.

WARNING

- When voltage is applied to the split-stage light table, 9000 V are present inside power box. This voltage is lethal.
- Use extreme caution when working inside power box while equipment is on. Touch only those components that you are specifically directed to touch. Failure to do so may result in death or serious injury.

NOTE

Do not leave equipment unattended when power is on.

d. Plug in power cord and turn main power switch ON.

e. Set ON/OFF switch to ON.

f. Turn grid intensity control fully right (maximum intensity).

g. Allow 45 minutes for equipment to warm up. Do not leave equipment during warm-up period.

h. Set photometer at center of one view stage surface.

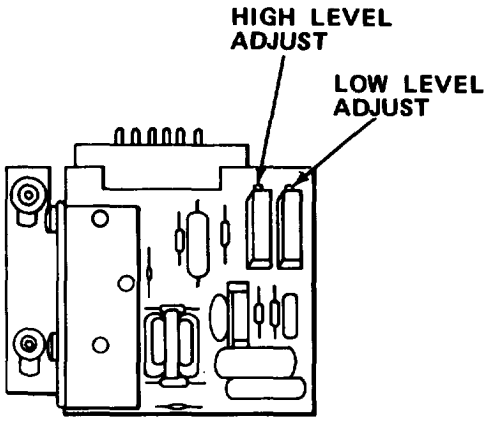
CAUTION

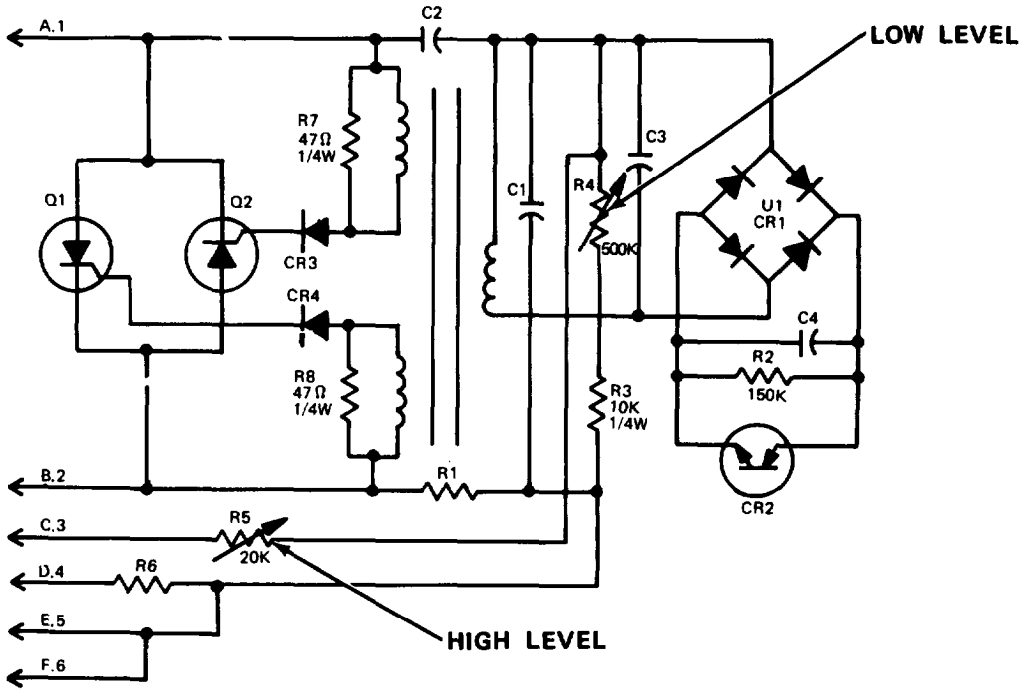
Do not leave light grid intensity set over 2500 foot lamberts. Intensity over 2500 foot lamberts will shorten grid lamp life.

NOTE

Poorly adjusted resistor may require many complete turns to adjust.

i. Carefully turn screw in high level adjustment resistor to adjust light Intensity to 2500 foot lamberts.





j. Turn grid intensity control fully left.

k. Carefully turn screw in low level adjustment resistor until light output is 500 foot lamberts.

l. Recheck high intensity by turning INCREASE potentiometer knob fully right and readjust as required.

m. Repeat procedure for other light grid. Adjust so that light grids are as equal as possible.

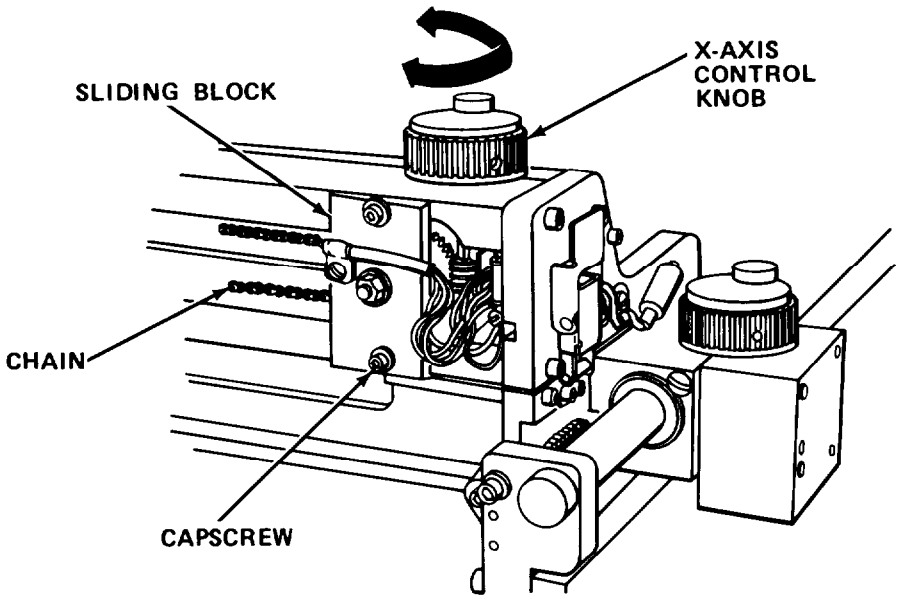
n. Turn main power switch and ON/OFF switch to OFF.

o. Reinstall cover and tighten screws.

6-20.2 Adjust X-Axis Chain.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Hex Head Key Wrench



a. Turn power off.

b. Set carriage clutch switch to OFF.

c. Loosen capscrews on sliding block until block can be moved.

d. Move block with fingers toward end of carriage until chain is tight.

e. Hold block with one hand and tighten capscrews.

f. Turn power on. Set carriage clutch switch to ON.

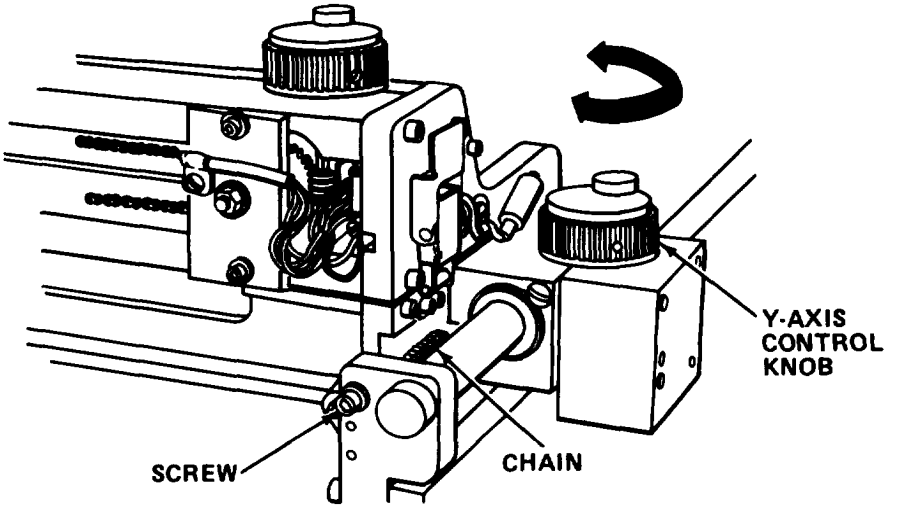
g. Move optical mount to left and right with X-axis control knob. If motion is jerky, chain is too tight. If sprockets jump links, chain is too loose.

h. Readjust as required until optical mount moves smoothly to left and right.

6-20.3 Adjust Y-Axis Chain.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Hex Head Key Wrench



a. Turn power off.

b. Set carriage clutch switch to OFF.

c. Turn screws on left and right side equal amounts. Turning to right tightens chain. Turning to left loosens chain.

NOTE

Seven spring washers are under each bolt. Amount of adjustment is limited.

d. Turn power on and set carriage clutch switch to ON.

e. Rotate Y-axis control knob to bring optical mount forward and back. Chain jumps sprockets if too loose. Carriage jerks if too tight.

f. Readjust if necessary.

6-20.4 Service Z-Axis.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver

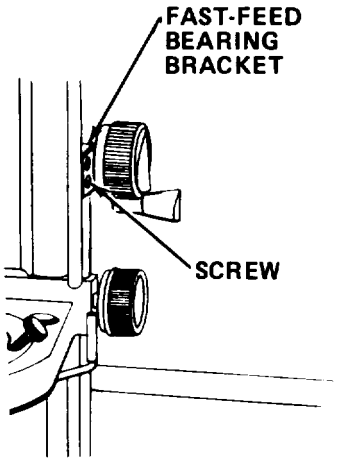
SUPPLIES: Bearing Cleaner (Item 5, Appendix E)
Cheesecloth (Item 7, Appendix E)
General Purpose Lubricating Oil (Item 14, Appendix E)

WARNING

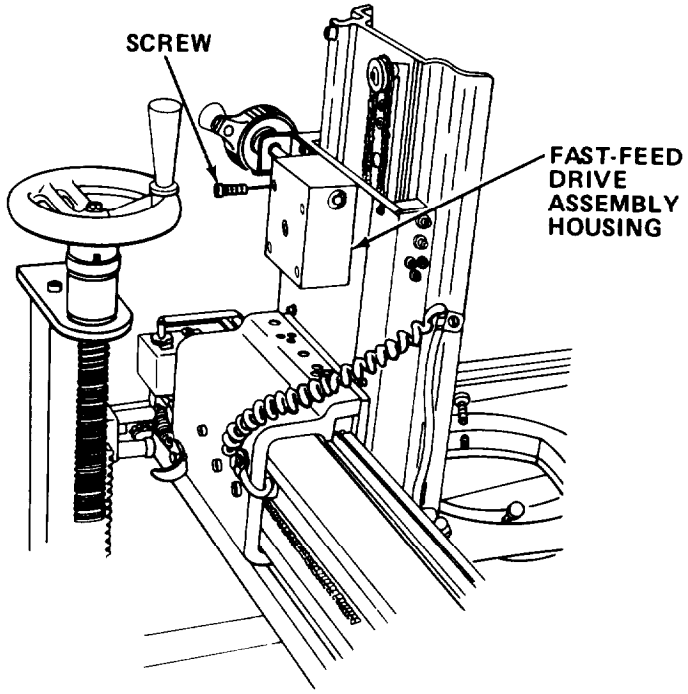
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

b. Lift optical mount to upper limit of travel.



c. Remove screws to release fast-feed bearing bracket.



d. Remove capscrews and lift off fast-feed drive assembly housing.

CAUTION

To prevent damage to photographic film, do not allow lubricant or solvent to contact any surface other than that being serviced.

e. Clean exposed worm gear and worm with bearing cleaner.

f. Dry exposed worm gear and worm.

g. Spray worm and worm gear with lubricant. Wipe off excess lubricant.

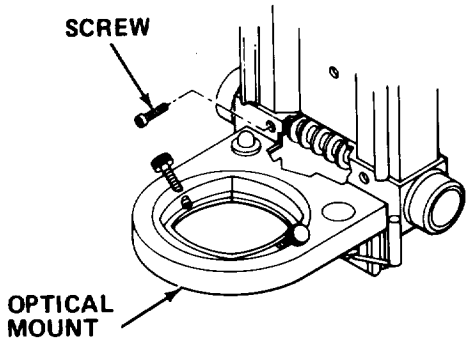
h. Reinstall fast-feed drive assembly. Secure with capscrews.

i. Reinstall fast-feed bearing bracket. Secure with screws.

j. Remove optics and move optical mount to lowest limit of travel.

NOTE

Do not proceed unless collimation equipment is available.



k. Support optical mount while removing screws.

CAUTION

Be careful not to drop bearings when lifting gear housing assembly.

l. Lift optical ring assembly and gear housing assembly clear. Set on work surface.

m. Disengage chain from sprocket.

NOTE

Do not lose any shims on sprocket shaft.

n. Lift worm gear and attaching parts from split-stage light table, and set on work surface.

o. Remove bearing caps and lift worm free.

p. Spray worm gears with bearing cleaner. Wipe up excess cleaner.

q. Reinstall worm on worm gear and reinstall bearing cap.

r. Reinstall worm gear assembly. Be sure all shims are on sprocket shaft.

s. Reengage chain and sprocket.

t. Reinstall optical mount gear housing. Secure with screws.

u. Test motion by moving Z-axis coarse feed knob.

v. Recollimate optical mount (paragraph 6-20.12).

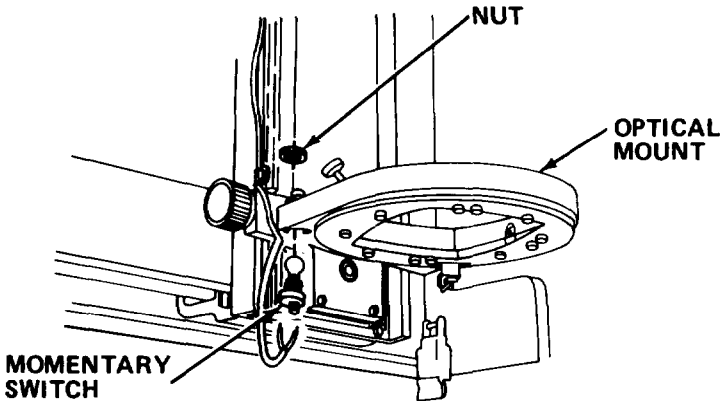
w. Plug in power cord.

6-20.5 Replace Momentary Switch.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver
5/8 in. Open End Wrench
Soldering Iron
Multimeter

SUPPLIES: Momentary Switch
Solder (Item 24, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

b. Raise optical ring assembly to maximum height.

c. Remove cable clamps.

d. Remove nut.

e. Remove momentary switch and wire by withdrawing through bottom of optical mount.

f. Tag and desolder wires from switch.

g. Solder wires to new switch.

NOTE

Be sure to connect wires so that operation of switch interrupts continuity in line. Use multimeter to test continuity.

h. Install momentary switch and secure with nut. Avoid twisting switch body as nut is tightened.

i. Install cable clamps.

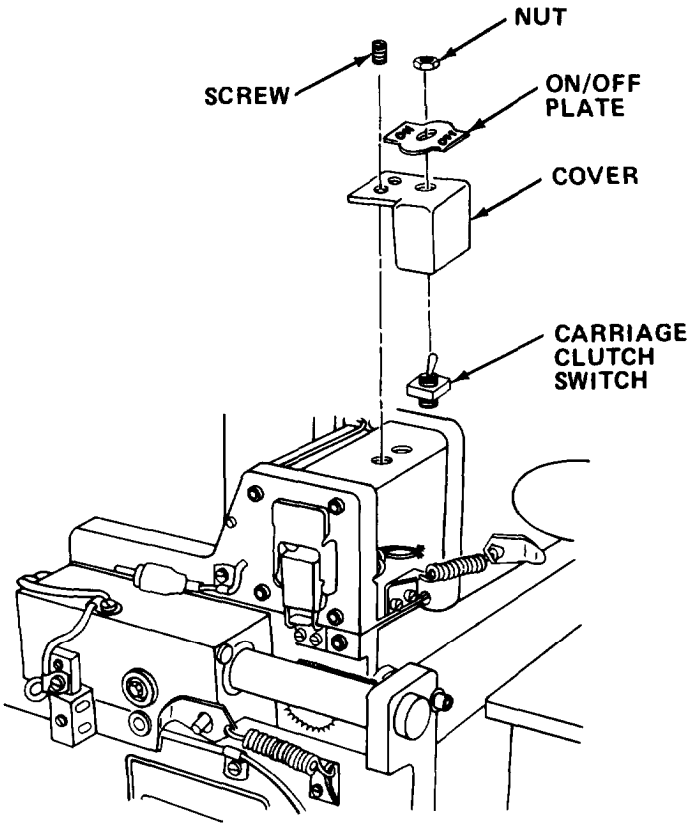
j. Plug in power cord, and turn power on.

6-20.6 Replace Carriage Clutch Switch.

MOS: 416, Topographic Instrument Repair Specialist

TOOLS: 9/16 in. Open End Wrench
9/64 in. Flat Tip Screwdriver
Soldering Iron

SUPPLIES: Carriage Clutch Switch
Solder (Item 24, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

b. Remove screws.

c. Lift cover and carriage clutch switch free.

d. Remove securing nut and withdraw carriage clutch switch from cover.

e. Tag and desolder wires from switch.

f. Solder wires to new carriage clutch switch.

g. Insert carriage clutch switch through hole in cover and secure with nut.

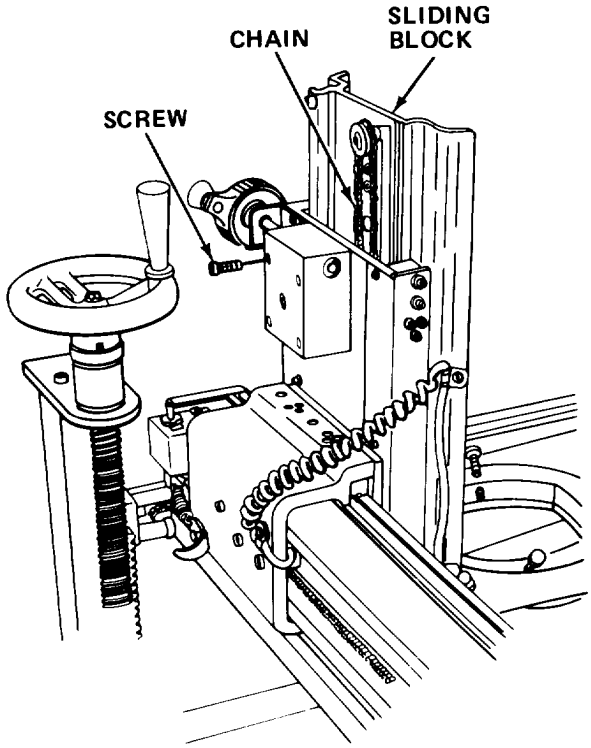
h. Reinstall cover and secure with screws.

i. Plug in power cord and turn power on.

6-20.7 Adjust Z-Axis Chain.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver



a. Turn power off and set carriage clutch switch OFF.

b. Lift optical ring assembly to point at least 2-1/2 in. (6.35 cm) above lower limit.

c. Loosen screws.

d. Pull sliding block upward to tighten chain.

e. Tighten screws to hold adjustment.

f. Move optical mount from upper limit to lower limit, and observe chain movement. If chain jumps sprockets, it is too loose. If optical mount does not move smoothly, chain is too tight.

g. Readjust, if necessary.

h. Mount stereoscope.

i. Use Z-axis coarse feed knob to move optical mount up and down. Observe movement.

CAUTION

Remove stereoscope before readjusting chain; weight of stereoscope may cause mount to drop and damage viewing stages.

j. Remove stereoscope.

k. Readjust chain, if necessary.

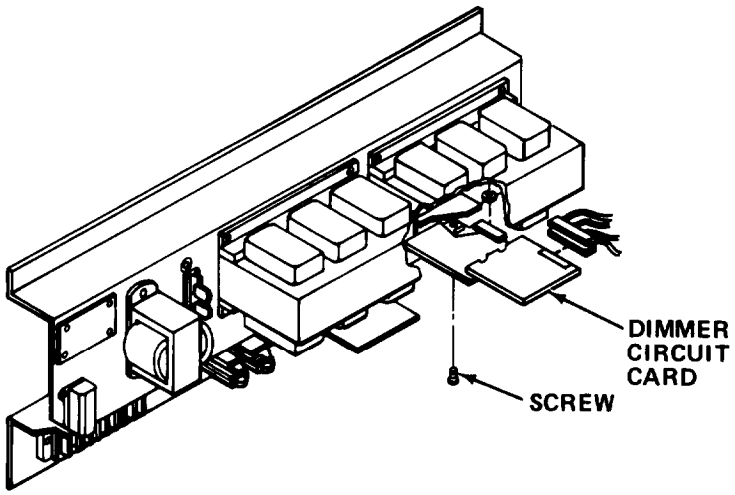
l. Turn power on.

6-20.8 Replace Dimmer Circuit Card.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 5/32 in. Offset Flat Tip Screwdriver
9/64 in. Flat Tip Screwdriver

SUPPLIES: Dimmer Circuit Card
Heat Sink Compound (Item 13, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.

b. Loosen two quick-disconnect screws and remove front cover.

c. Loosen two screws and remove rear cover.

d. Remove defective dimmer card.

e. Apply heat sink compound to dimmer circuit card mounting bracket.

f. Install new dimmer circuit card by alining pins carefully and pressing into position. Secure with screws.

g. Reinstall rear cover and tighten screws.

h. Reinstall front cover and tighten quick-disconnect screws.

i. Plug in power cord.

j. Turn power on and allow grids to warm up.

k. Adjust light grids (pararaph 6-20.1).

6-20.9 Replace Transformer.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver
Soldering Gun

SUPPLIES: Transformer
Solder (Item 24, Appendix E)

WARNING

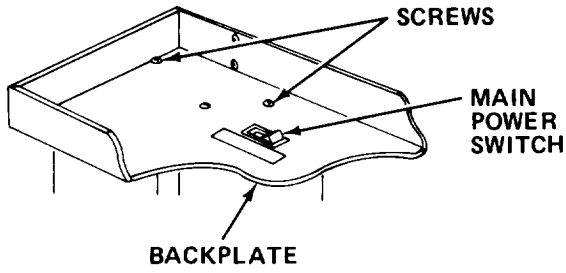
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

NOTE

The same procedure is used to replace transformer T1 and T2.

a. Turn power off and unplug power cord.

b. Loosen screws and remove front cover.



c. Remove quick-disconnect from power panel.

d. Remove main power switch from backplate by releasing switch from bezel retaining clip.

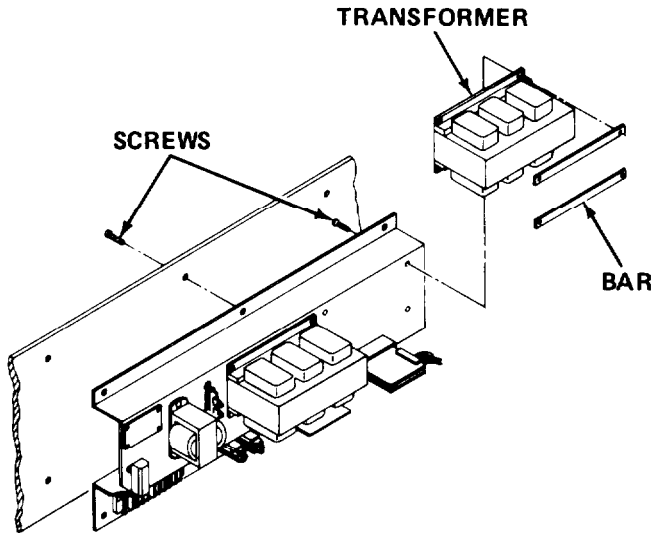
CAUTION

Power panel must be supported when screws are removed from backplate. Damage to equipment will result if power panel falls.

e. Remove screws from main power switch backplate.

f. Lower power panel.

g. Remove screws securing back cover.



h. Tag and desolder wires from transformer.

i. Remove screws securing bars and transformer.

j. Reinstall bars on new transformer.

k. Install new transformer and secure with screws.

l. Solder wires and check that all connections are tight.

m. Raise power panel and secure to main power switch backplate with screws.

n. Reinstall main power switch and secure with bezel retaining clip.

o. Reinstall quick-disconnect to power panel.

p. Reinstall front and back covers and secure with screws.

q. Plug in power cord and turn power on.

6-20.10 Replace Fan.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 9/64 in. Flat Tip Screwdriver
5/16 in. Open End Wrench
Wire Cutters

SUPPLIES: Fan
Wire Ties

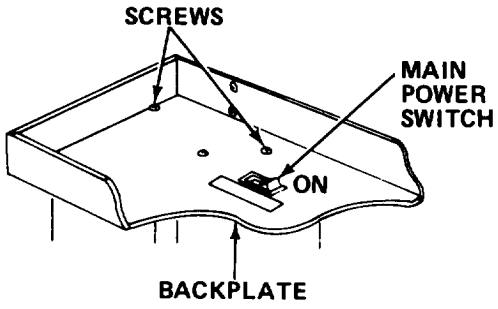
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.

b. Loosen screws and remove connector from below fan.

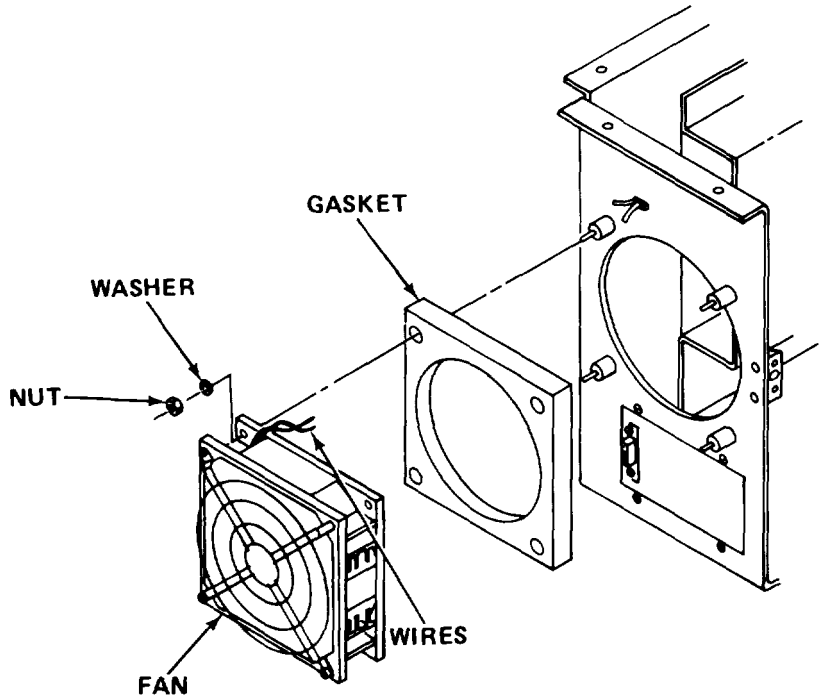
c. Remove quick-disconnect from power panel.



d. Remove main power switch from backplate by releasing switch from bezel retaining clip.

e. Remove screws from main power switch backplate.

f. Lower power panel.



g. Disconnect wires from bottom of terminals 4 and 6.

h. Cut wire ties on terminal assembly.

i. Cut wires at fan grid assembly as close as possible to fan. Discard old wiring.

j. Remove nuts and washers securing fan.

k. Remove defective fan. Retain sponge gasket.

l. Thread wires for new fan through housing. Attach terminal lug of white wire to terminal 6 and brown wire to terminal 4.

m. Install new fan with old gasket in place. Secure with nuts and washers.

n. Raise power panel and secure to main power switch backplate with screws.

o. Reinstall main power switch and secure with bezel retaining clip.

p. Reinstall quick-disconnect to power panel.

q. Reinstall connector below fan and secure with two screws.

r. Plug in power cord and turn power on.

6-20.11 Replace Light Grid Assembly.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Hex Head Key Wrench Set
3/16 in. Flat Tip Screwdriver
9/64 in. Flat Tip Screwdriver
Diagonal Cutting Pliers
Soldering Iron

SUPPLIES: Light Grid Assembly
Solder (Item 24, Appendix E)

WARNING

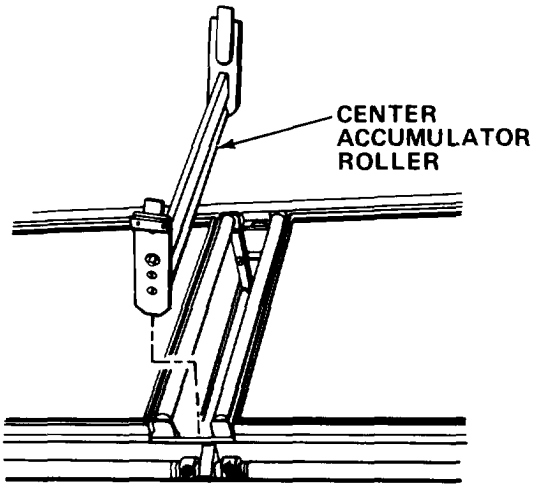
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing equipment.

a. Turn power off and unplug power cord.

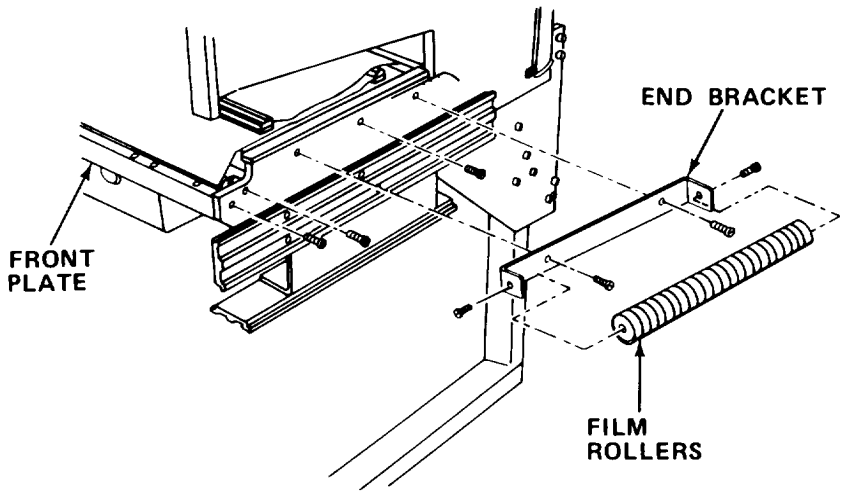
b. Loosen screws and remove front cover from power panel.

c. Retract masking assemblies into their wells by rotating knurled knobs.

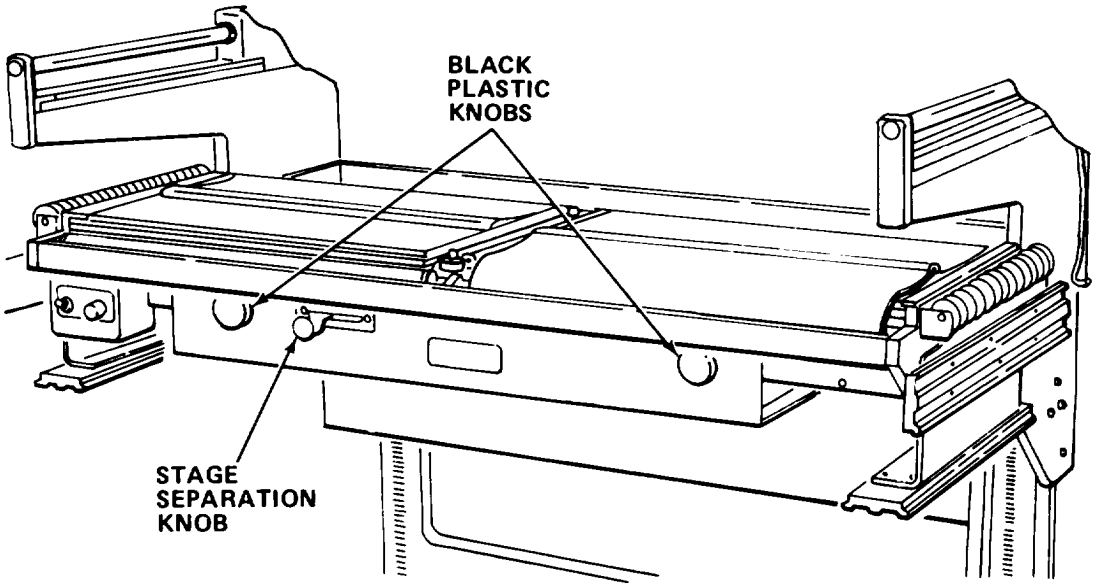
d. Remove screw from end of each film roller. Remove film rollers.



e. Remove center accumulator roller from between view stages by pinching tabs and lifting free.



f. Remove screws securing end brackets and plate. Remove end brackets. Note two screws are on left view stage and three screws are on right view stage.



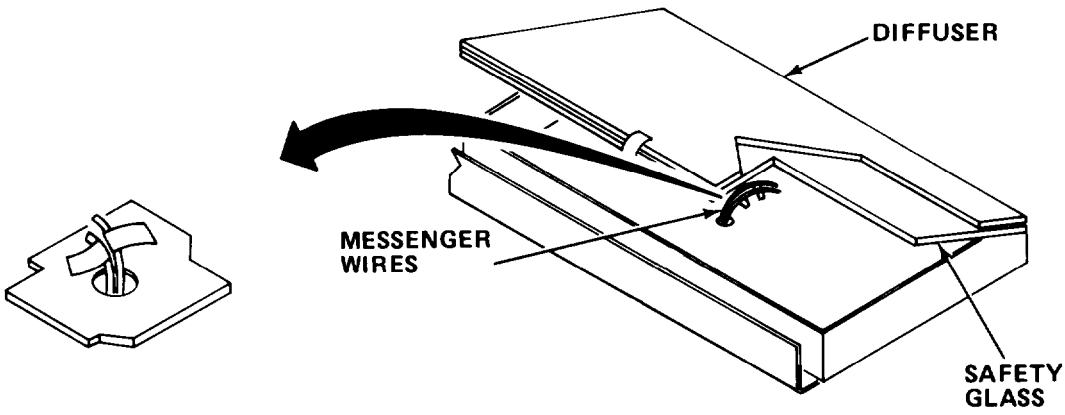
g. Loosen knobs to allow bottom plate to fall free.

h. Remove screws and stage separation plate to locate access hole. Remove screw and stage separation knob.

i. Remove screws securing ON/OFF switch assembly.

j. Remove capscrews to release front plate from end plates.

k. Remove screws and washers securing front plate.



l. Move defective grid until wires are accessible inside light box. Disconnect green wire.

m. Loosen capscrews and washers and remove middle roller as an assembly from view stage. Attach to new grid assembly.

n. Splice red wires from new grid assembly to exposed red wire from defective assembly. Thread new wires to transformer terminal.

o. Desolder old wires from terminal and remove from splice. Solder new wires to transformer terminal. Attach green wire to ground.

p. Ground ON/OFF switch to table chassis. Plug in power cord. Turn main power switch ON.

q. Turn ON/OFF switch to ON. Check that grid assembly lights. Turn main power switch to OFF. Unplug power cord.

r. Reinstall front plate and secure with screws and washers.

s. Reinstall ON/OFF switch assembly. Secure with screws.

t. Aline stage separation knob and view stage. Secure with screw.

u. Reinstall stage separation plate and secure with screws.

v. Reinstall end plates and brackets. Secure to left view stage with screws. Secure to right view stage with screws.

w. Reinstall center accumulator roller.

x. Raise bottom plate and secure with knobs.

y. Reinstall film rollers. Secure with screw on end of each film roller.

z. Plug in power cord and turn power on.

aa. Adjust light grid intensity (paragraph 6-20.1).

ab. Reinstall front cover on power panel and tighten two screws.

ac. Collimate split-stage light table (paragraph 6-20.12).

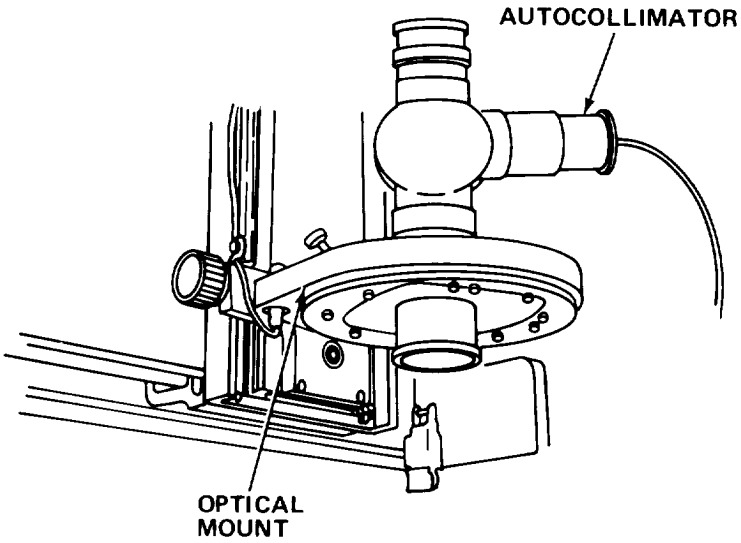
6-20.12 Collimation.

MOS: 41B, Topographic Instrument Repair Specialist

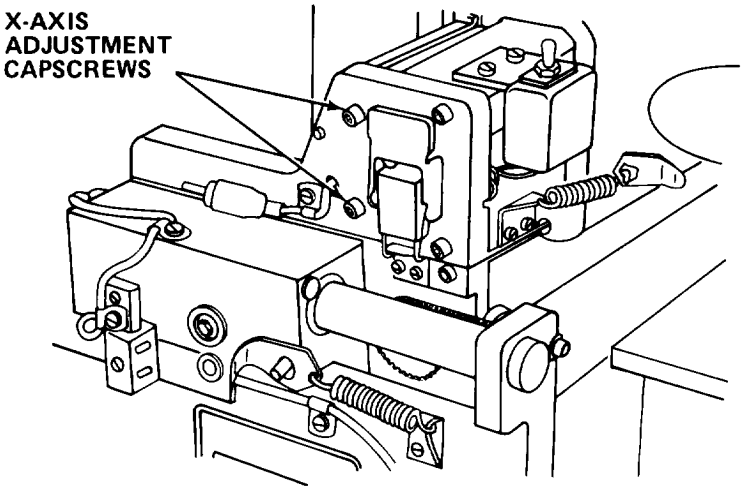
TOOLS: Autocollimator
Adjustable Wrench
9/64 in. Flat Tip Screwdriver

NOTE

- Make sure that all attaching hardware is tight before attempting to collimate split-stage light table.
- Collimation should be performed after movement to new site or when tests indicate collimation is required.



a. Mount autocollimator in optical mount.



b. Loosen capscrews securing X-rail to end support plates. Tighten lower, rear screws at each end. Three other screws on each end should be snug.

c. Fold piece of thick paper over right-hand, rear, upper edge of X-rail to protect surface. Fit wrench over protected section of X-rail.

d. Move optical mount to right-hand stop. Move carriage between front and rear stops. Check collimation.

e. If collimation is outside ± 5 minutes of arc, use wrench to turn X-rail to bring collimation within limits. Tighten upper front attaching screw on X-rail support plate on right-hand end securely.

f. Move optical mount to left-hand stop, and repeat procedure for left-hand end of carriage assembly.

g. Check Y-axis collimation at point near center of table. Readjust X-rail, if necessary.

h. Tighten all four attaching screws on both X-rail support plates, and recheck collimation in Y-axis.

i. Move carriage assembly so that autocollimator mirror is near rear end of stage glass. Move optical mount between left-hand and right-hand limits while checking collimation.

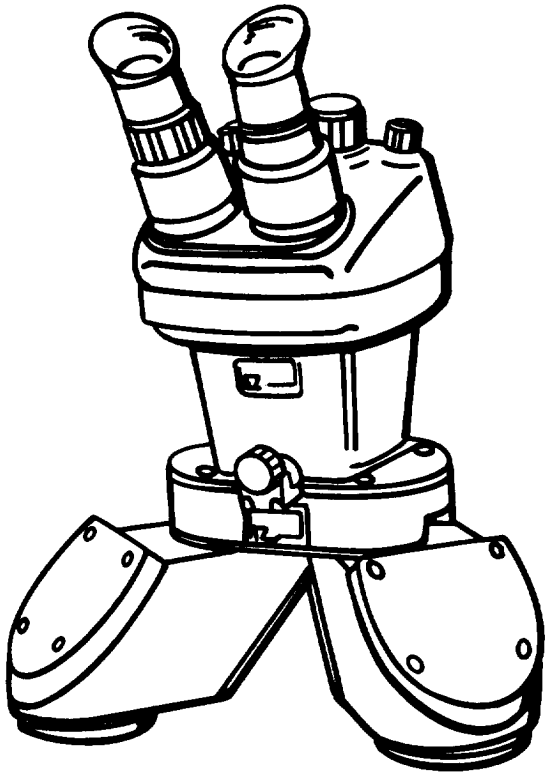
j. Move carriage assembly so that autocollimator mirror is near front end of stage glass. Move optical mount between left-hand and right-hand limits while checking collimation.

k. If collimation is outside of ± 3 minutes of arc, move optical mount to point just below uppermost limit of travel.

l. Loosen capscrews attaching vertical carriage to X-bearing housing assembly.

m. Tip vertical carriage assembly slightly to left or right as required to bring collimation along X-axis within limits.

n. Tighten capscrews and recheck collimation.



CHAPTER 7

ZOOM STEREOSCOPE 95R

Section I INTRODUCTION

7-1. GENERAL INFORMATION.

7-1.1 Scope.

a. Model Number and Equipment Name. Model 95R Zoom Stereoscope.

b. Purpose of Equipment. Component of photointerpretation system. Provides stereoscopic (three-dimensional) view of photographs.

7-2. EQUIPMENT DESCRIPTION.

7-2.1 Equipment Characteristics, Capabilities, and Features.

a. Magnifies strip, film clip, or stereo-pair photographs.

b. Creates an apparent three-dimensional model of the photographs for interpretation by operator.

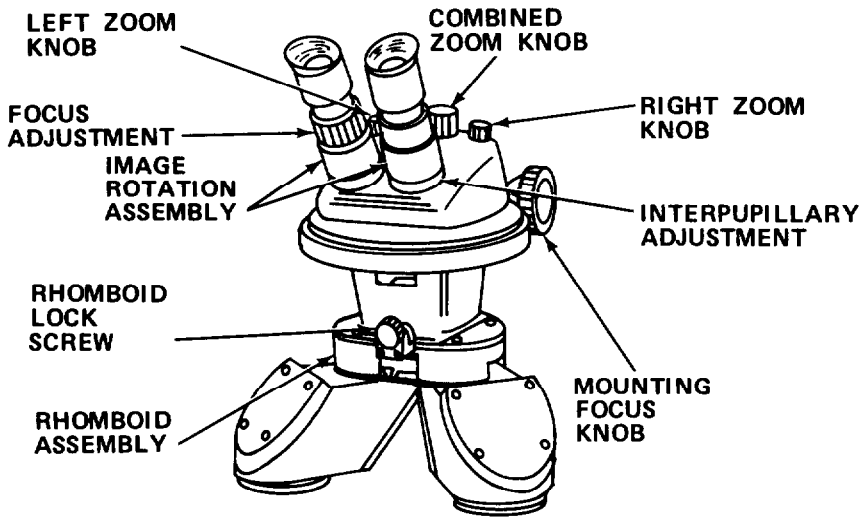
c. Optically rotates randomly oriented, uncut film for optimum stereo images.

7-2.2 Equipment Data.

Width	11.0 in. (27.9 cm)
Depth	9.0 in. (22.9 cm)
Height	12.0 in. (30.5 cm)
Weight	5.5 lbs (2.5 kg)
Magnification	2.5X to 10.6X
Field of View	3.08 in. (7.82 cm) to 0.37 in. (9.3 mm)

Section II OPERATING INSTRUCTIONS

7-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Focus Adjustment	Focuses left eyepiece.
Left Zoom Knob	Magnifies left image.
Combined Zoom Knob	Magnifies images equally.
Right Zoom Knob	Magnifies right image.
Interpupillary Adjustment	Moves eyepieces closer or further from each other for operator comfort.
Mounting Focus Knob	Raises or lowers optical mount for right eye focus.
Rhomboid Assembly	Separates images. Includes two rhomboid arms. (Must be removed to mount or dismount stereoscope in optical mount).
Rhomboid Lock Screw	Secures rhomboid to body.
Image Rotation Assembly	Rotates left or right apparent image through 360 degrees.

7-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

7-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Watchmaker's Blower	1 ea
Lens Dusting Brush	1 ea
Lens Paper (Item 12, Appendix E)	ar
Lens Cleaning Fluid (Item 6, Appendix E)	ar
Cotton Swabs (Item 8, Appendix E)	ar

Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before **W - Weekly** **AN - Annually** **(Numbed - Hundreds of Hours**
D - During **M - Monthly** **S - Semiannually**
A - After **Q - Quarterly** **BI - Biennially**

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM STEREOSCOPE 95R	
1	B	Inspect Rhomboid Arms.	
		Check for freedom of movement.	Rhomboid arms are jammed or broken.
2	B	Inspect Eyepiece Tubes.	
		Check for freedom of movement.	

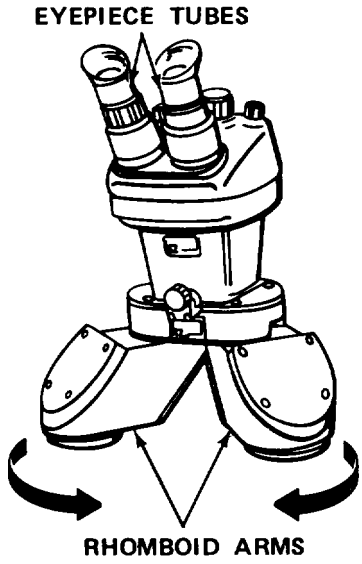


Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before W - Weekly AN - Annually (Number) - Hundreds of Hours
D - During M - Monthly S - Semiannually
A - After Q - Quarterly BI - Biennially

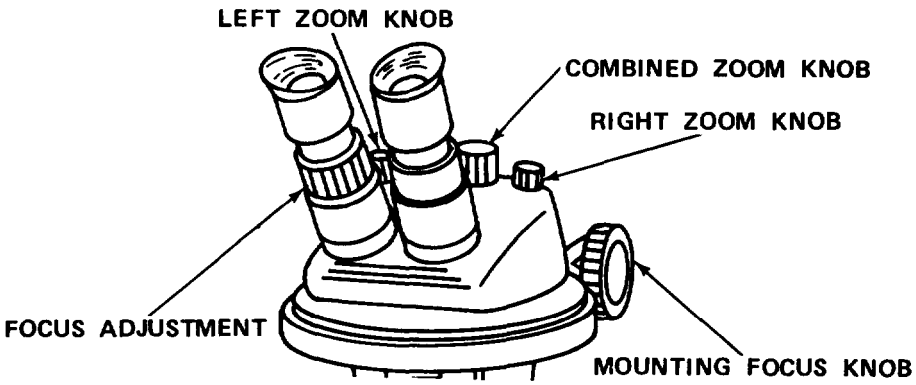
ITEM NO.	IN-TERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM STEREOSCOPE 95R - Cont	
3	B	Inspect Right, Left, and Combined Zoom Knobs.	
			
		Turn knobs fully to right. Pull combined zoom knob up. Rotate left and right zoom knobs. Observe left and right images change size. Turn knobs fully to right. Adjust knobs until images are equal in size.	Images do not change size or cannot be matched in size.
4	B	Inspect Mounting Focus Knob and Focus Adjustment.	
		Move mounting focus knob on optical mount until right eye image is clearly focused. Move focus adjustment on left eyepiece to focus left eye image.	Unable to focus right image.

Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

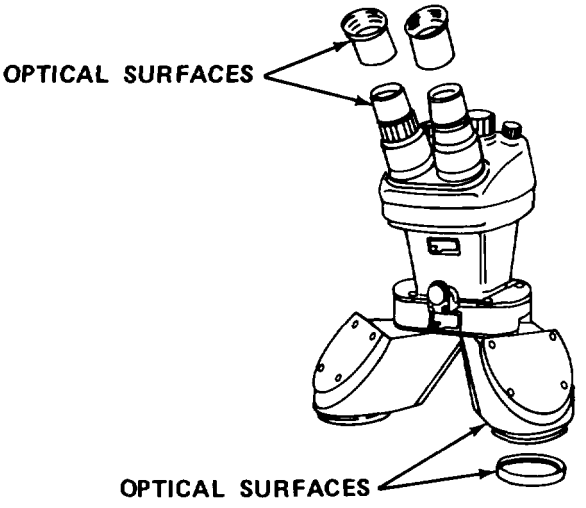
B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM STEREOSCOPE 95R - Cont	
4	B	Inspect Mounting Focus Knob and Focus Adjustment - Cont	



CAUTION

- Dirt and dust on optical surfaces will hinder equipment's performance.
- Do not wipe optical surfaces until dust and foreign matter have been removed.
- Do not touch optical surfaces with bare fingers.
- Do not use lens tissue treated with silicone to clean optical surfaces.

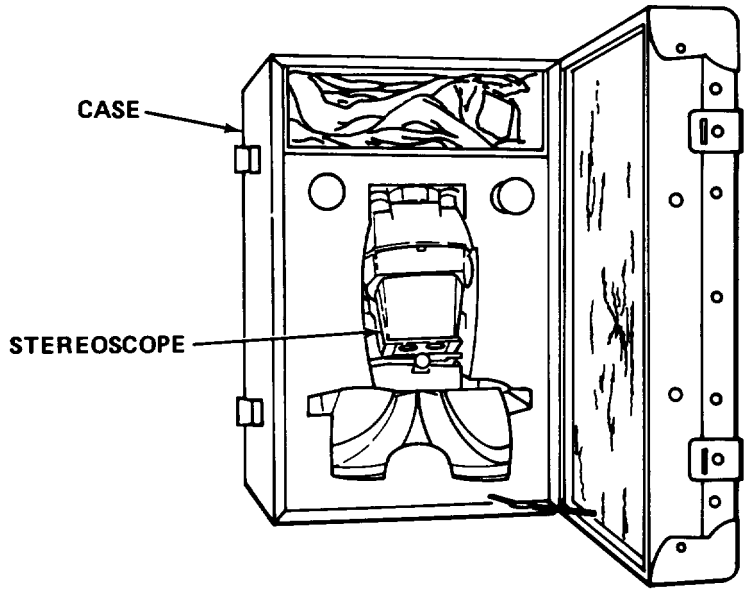
Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before W - Weekly AN - Annually (Number) . Hundreds of Hours
D - During M - Monthly S - Semiannually
A - After Q - Quarterly Bl - Biennially

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment Is Not Readyl Available If:
		ZOOM STEREOSCOPE 95R - Cont	
5	B	Inspect Optical Surfaces. 1. Use watchmaker's blower to remove all dust, dirt, and foreign matter from exposed optical surfaces. Slightly dampen lens tissue with lens cleaner. 2. Gently wipe exposed optical surfaces. Use circular motion starting from center of glass and working to edge. Clean interval mirror surfaces of rhomboid assembly with cotton swabs. Do not attempt to clean remaining internal mirror surfaces.	

7-6. OPERATION UNDER USUAL CONDITIONS.

7-6.1 Assembly and Preparation for Use.

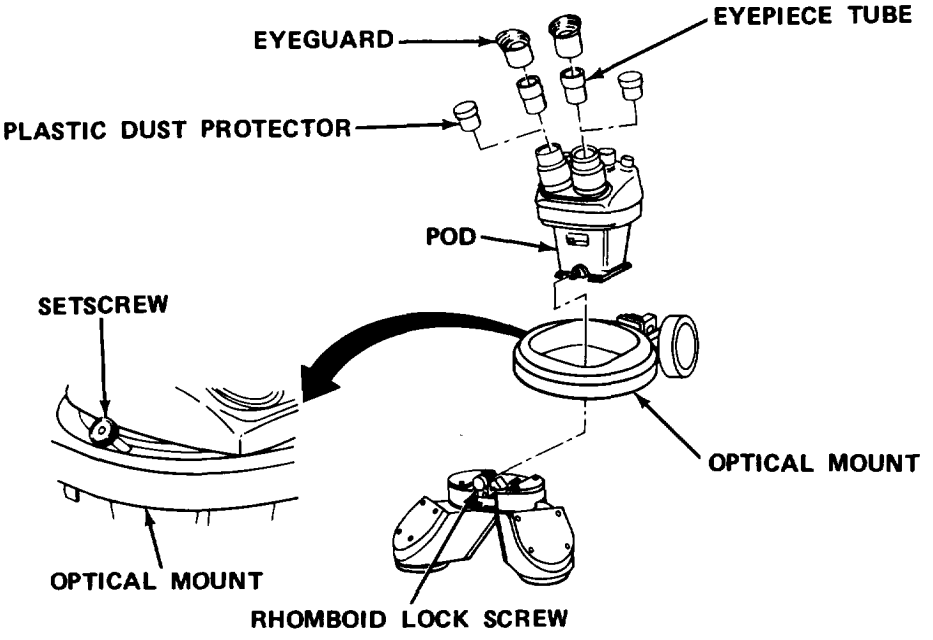


a. Remove stereoscope case from storage and place on hard surface.

CAUTION

- Dirt and dust on optical surfaces will hinder equipment's performance.
- Do not touch optical surfaces with bare fingers.
- Do not wipe optical surfaces until dust and foreign matter have been removed.

b. Remove stereoscope from case.



c. Place pod into optical mount with eyepiece holes toward operator.

d. Lock pod into optical mount by tightening setscrews.

e. Aline rhomboid dovetail on pod. Slide rhomboid onto pod until rhomboid lock screw contacts hole.

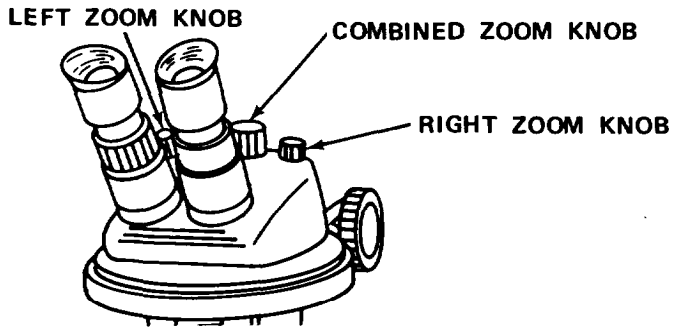
f. Secure rhomboid to pod by turning rhomboid lockscrew to right until finger tight.

g. Select either 10X (short) or 20X (long) eyepiece tubes from case and place on work surface.

h. Remove two plastic dust protectors from eyepiece holes in pod. (Store dust protectors for reuse). Insert eyepieces into eyepiece holes.

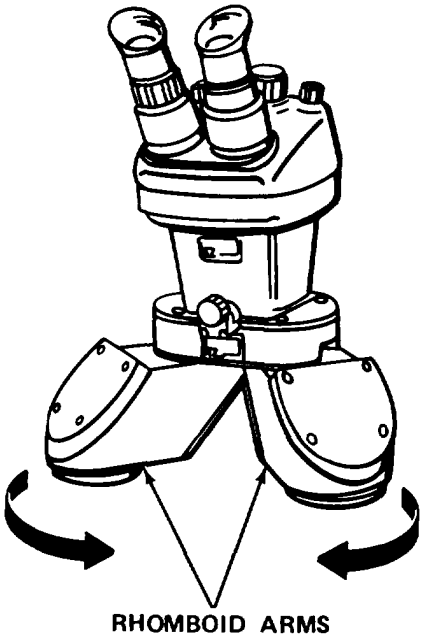
i. Install eyeguards, if desired.

7-6.2 Operating Procedures.

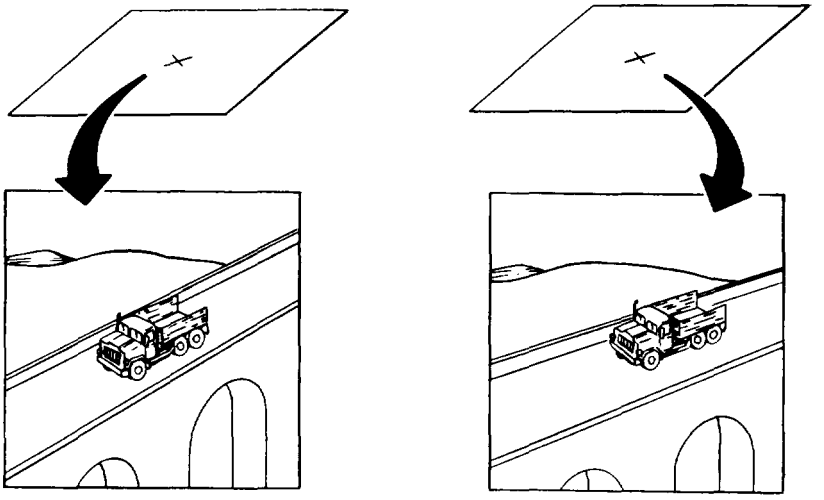


a. Focus .

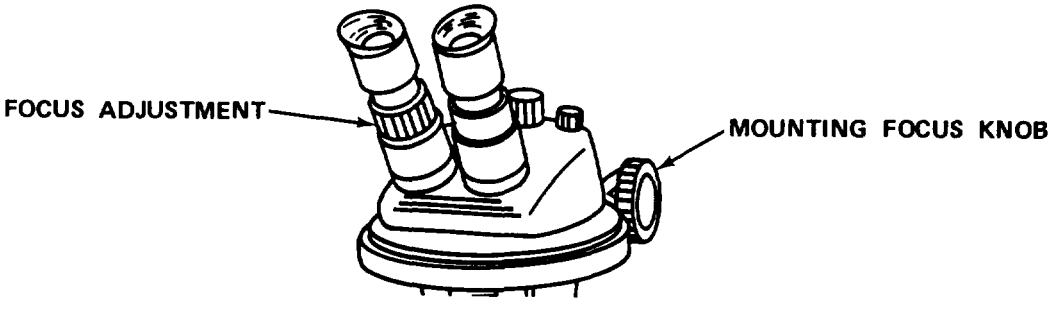
(1) Set right and left individual zoom knobs and combined knob to their midpoint positions.



(2) Swing rhomboid arms together to minimum separation. Place a stereo pair of photographs under rhomboid arms on work surface.



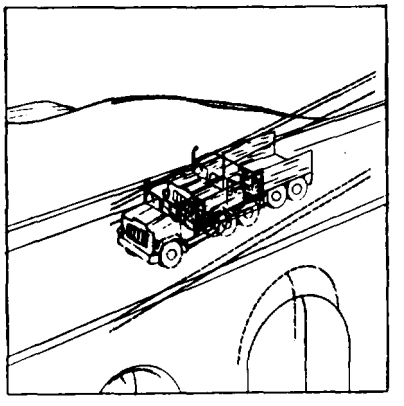
(3) Adjust rhomboid arms and photographs so that object in left photograph is seen by left eye and identical object in right photograph is seen by right eye.



(4) Turn mounting focus knob to obtain clear vision in right eye. Adjust focus adjustment to obtain clear vision in left eye.

(5) Move eyepiece tubes toward or away from each other until two fields of view merge. (Check by closing right, then left eye; field should be completely visible without head movement.)

b. Change Magnification.



(1) Set all zoom knobs to same setting (photographs are same scale).

(a) Rotate zoom knobs fully to right. Pull up combined zoom knob.

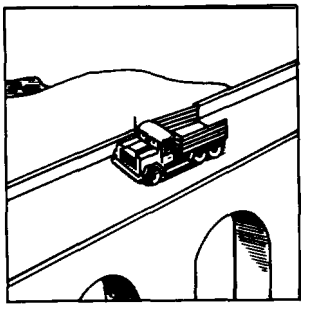
(b) Set combined zoom knob to full right and push down.

(c) Rotate combined zoom knob to change magnification.

(2) Change image size (right and left photographic scales are different).

(a) Lift combined zoom knob to uppermost limit.

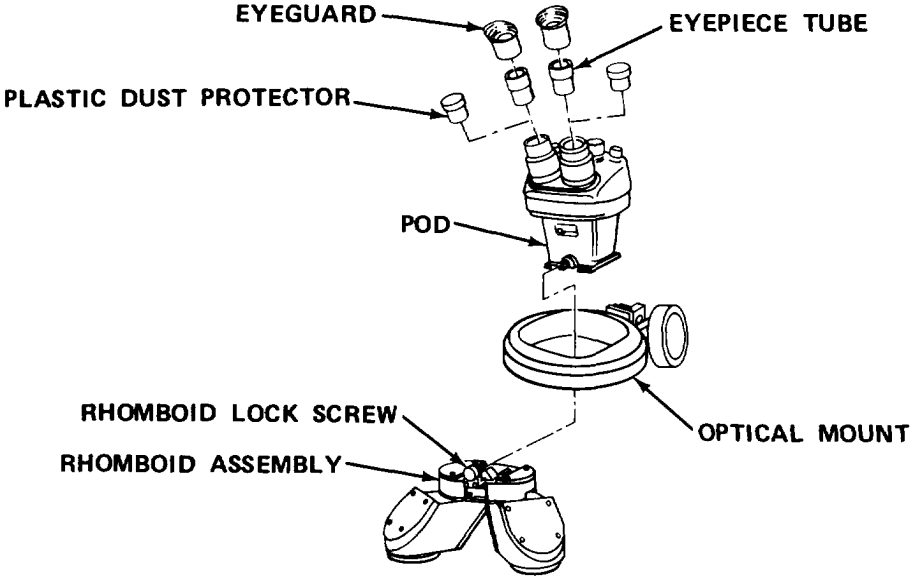
(b) Adjust left and right zoom knobs until photographic images are same size.



(c) Adjust each image using pod controls, and rotate each image with image rotation. When images are equal in size and rotation, the images merge together in an apparent three-dimensional object. Push combined zoom knob down.

(3) Install attachment lenses (if required). The 2X attachment lenses double the magnification and halve the field of view.

7-6.3 Preparation for Movement.



CAUTION

- Internal components of stereoscope are precisely alined. Instrument must be protected from shock, jolts, and sudden or extreme temperature changes. Damage to equipment or misalinement may occur. When not in use, zoom stereoscope should be stored in transport case.
- Do not touch optical glass surfaces with fingers. Fingerprints will cause images to blur.

a. Place transport case on work surface.

b. Remove eye guards (if installed) and store in case.

c. Remove eyepiece tubes, and inspect lenses for dirt, dust, or smudges. Clean if dirty. Store-in transport case.

CAUTION

Failure to use dust protectors may result in loss of optical properties or mechanical problems.

d. Place plastic dust protectors in eyepiece tube holes.

Loosen rhomboid lock screw by turning to left until screw threads are clear of pod.

f. Slide rhomboid free of pod and place rhomboid in transport case.

g. Unlock pod from optical mount by loosening setscrews and lift free.

h. Place stereoscope in case. Check that all components are in case. Secure case and store case in designated space.

7-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

7-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

7-9. TROUBLESHOOTING PROCEDURES. Troubleshooting procedures at operator level are limited to cleaning of optical glass surfaces to obtain clear vision or improve optical performance. Failure of optical system requires the zoom stereoscope to be exchanged for an instrument in proper working order.

7-10. MAINTENANCE PROCEDURES. There are no operator maintenance procedures assigned for this equipment.

Section IV ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

7-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

7-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

7-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

7-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

7-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

7-13. SERVICE UPON RECEIPT.

7-13.1 Checking Unpacked Equipment.

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

7-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

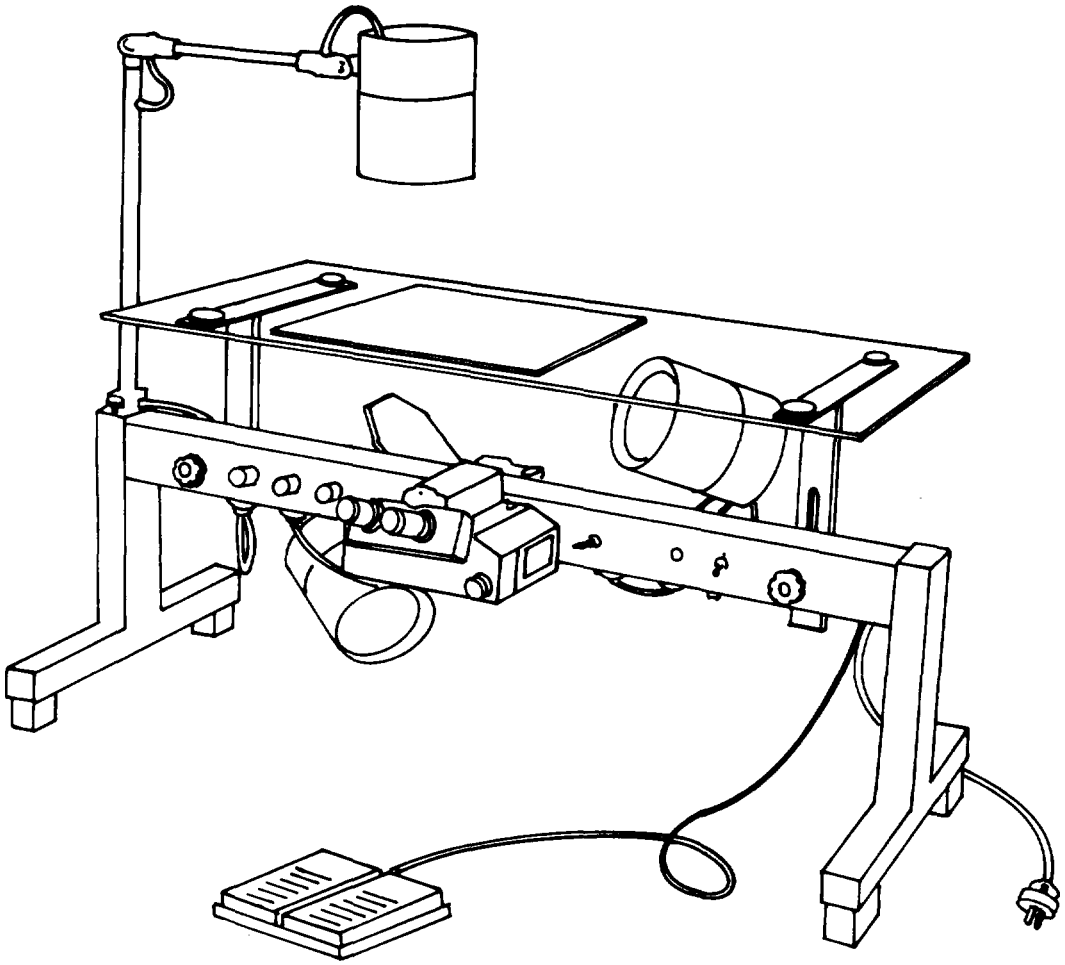
7-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

7-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

7-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.



CHAPTER 8

ZOOM TRANSFER SCOPE

Section I INTRODUCTION

8-1. GENERAL INFORMATION.

8-1.1 Scope.

a. Model Number and Equipment Name. Model ZT4-H Zoom Transfer Scope.

b. Purpose of Equipment. To optically superimpose photographic image on map or chart.

8-2. EQUIPMENT DESCRIPTION.

8-2.1 Equipment Characteristics, Capabilities, and Features.

a. Optically matches map and photographic scale.

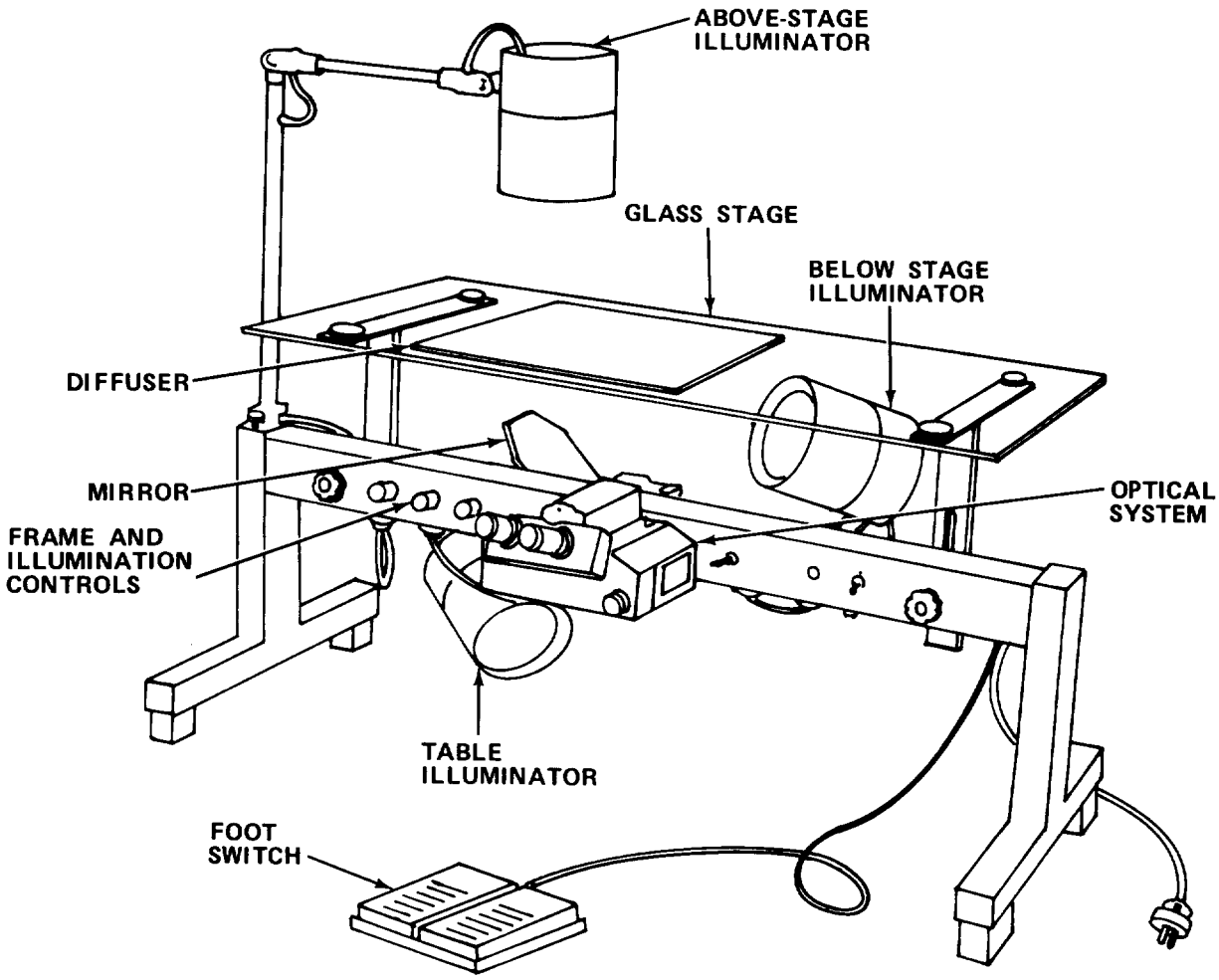
b. Optically rotates or stretches image.

c. Uses photographs, transparencies, or other material to form image.

d. Has zoom control magnification.

e. Has foot on/off control of illuminators.

8-2.2 Location and Description of Major Components.



ABOVE-STAGE ILLUMINATOR. Illuminates top of glass stage.

GLASS STAGE. Supports item from which image is to be formed. Transparent to permit light to shine through it.

BELOW-STAGE ILLUMINATOR. Illuminates bottom of glass stage.

OPTICAL SYSTEM. Contains magnification, focusing, rotation, and stretch controls, prisms, and lenses.

TABLE ILLUMINATOR. Illuminates work surface and map.

FRAME AND ILLUMINATION CONTROLS. Supports other equipment and contains electrical controls.

FOOT SWITCH. Turns off stage or table illumination when pedal is pressed.

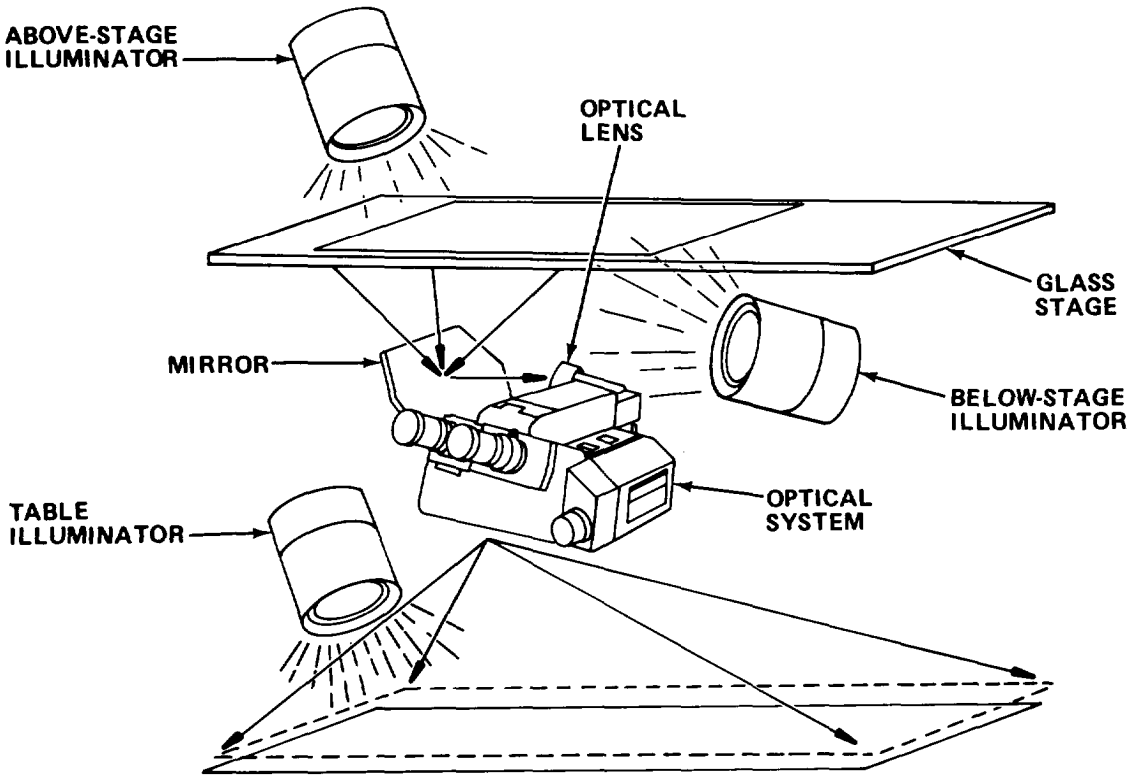
MIRROR. Directs light from glass stage to optical system.

DIFFUSER. Flattens object on glass stage and provides even light on top of stage.

8-2.3 Equipment Data.

Zoom Range	lX to 7X
Optical Rotation	360°
Optical Stretch Correction	1:1 to 2:l
Power Requirements	110 V, 60 Hz
Illumination	Three 150 W flood lamps
Map Field of View	7.49 in (19.0 cm)

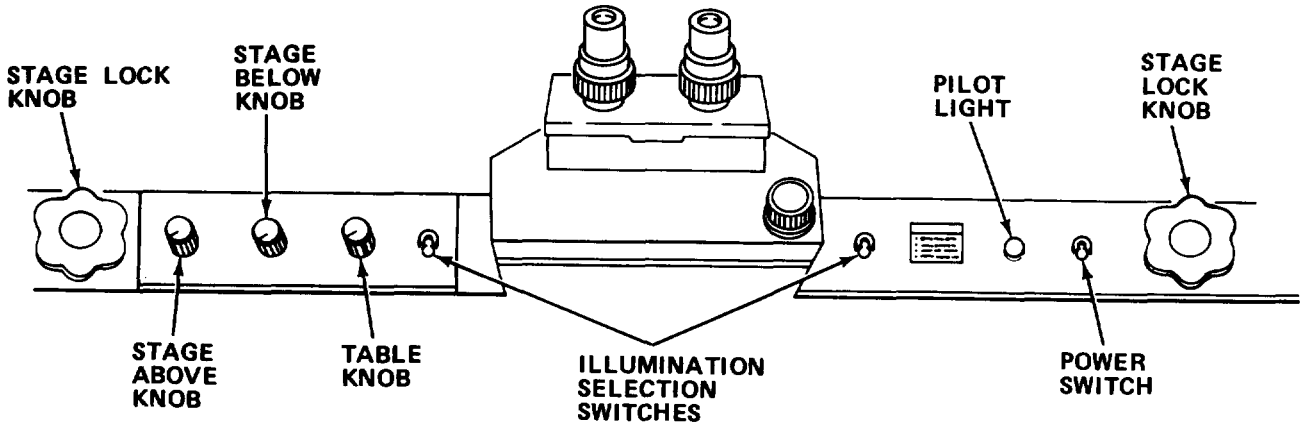
8-3. TECHNICAL PRINCIPLES OF OPERATION.



8-3.1 General. The above-stage illuminator or below-stage illuminator shines light on the transparency or photograph mounted on the glass stage. The image of the transparency or photograph is reflected from the mirror into the optical lens. The optical system magnifies, rotates or distorts the reflected image to match the map. The operator illuminates the map with the map illuminator and views through the optical system. The operator's view of the map has an apparent image of the photograph superimposed on it.

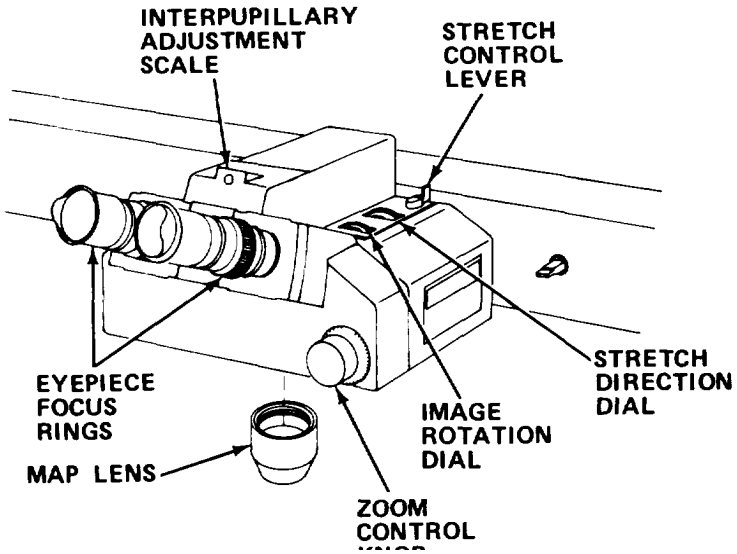
Section II OPERATING INSTRUCTIONS

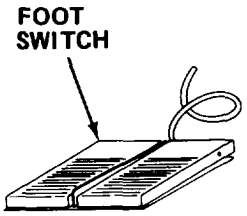
8-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Stage Lock Knobs	Locks glass stage at focusing height.
STAGE BELOW Knob	Controls on/off and intensity of illuminator shining on underside of glass stage.
Pilot Light	Indicates when power is on.
POWER Switch	Controls power to zoom transfer scope.
Illumination Selection Switches	Selects STAGE illumination, TABLE illumination, or BOTH.
TABLE Knob	Controls on/off and intensity of table illuminator.
STAGE ABOVE Knob	Controls on/off and intensity of illuminator shining on top of glass stage.

8-4. DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS - Cont





Control or Indicator	Function
Interpupillary Adjustment Scale	Indicates distance between eyepieces.
Stretch Control Lever	Selects 1- or 2- power distortion or stretch.
Stretch Direction Dial	Rotates direction of distortion or stretch through 360 .
IMAGE ROTATION Dial	Rotates image through 360 .
ZOOM CONTROL Knob	Selects image magnification.
Map Lens	Adjusts to 1 or 0.7 power.
Eyepiece Focus Rings	Each eyepiece may be focused independently to compensate for operator's eyesight.
Foot Switch	Interrupts illumination to stage or table when activated.

8-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

8-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by peforming periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Watchmaker's Blower	1 ea
Lens Brush	1 ea
Chamois	1 ea
General Purpose Liquid Detergent (Item 9, Appendix E)	ar
Lens Paper (Item 12, Appendix E)	ar
Lens Cleaner (Item 6, Appendix E)	ar
Cheesecloth (Item 7, Appendix E)	ar

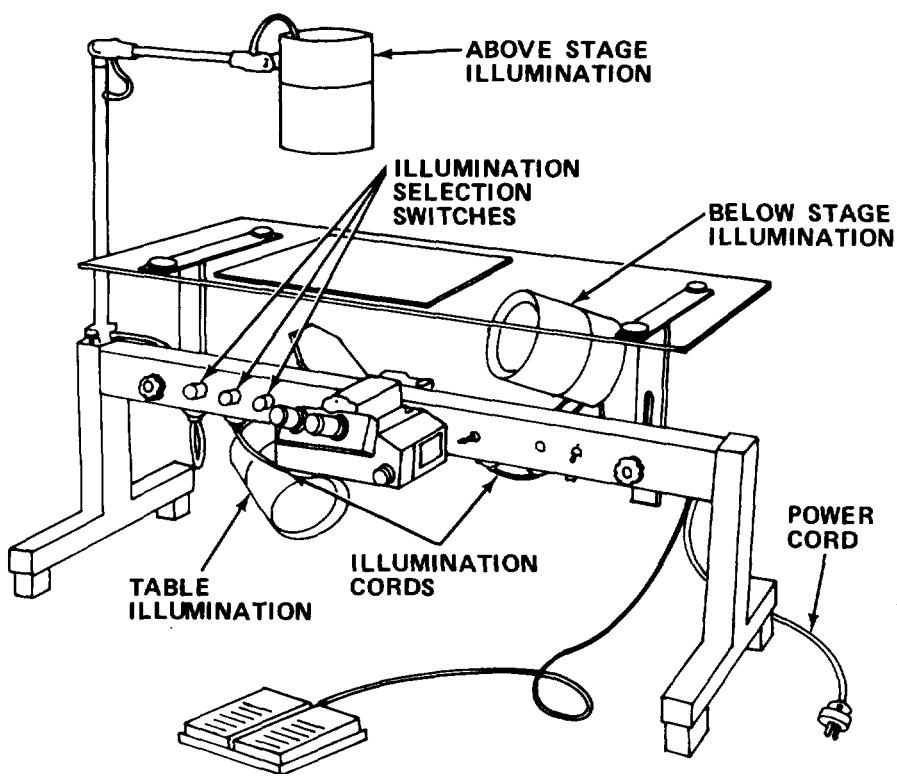
Table 8-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before	W - Weekly	AN - Annually	(Number) - Hundreds of Hours
D - During	M - Monthly	S - Semiannually	
A - After	Q - Quarterly	Bl - Biennially	

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM TRANSFER SCOPE	
1	B	**Inspect.**	



WARNING

Do not use equipment with defective wiring or cords. Defective wiring or cords connected to power source can cause death or serious injury.

Table 8-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B . Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM TRANSFER SCOPE - Cont	
1	B	Inspect - Cont	
		1. Check illuminator cords, power cord, and wiring for defects, kinks, burns, and broken plugs.	Wiring is defective.
		2. Check above-stage, below-stage, and table illuminators for working lights.	Illuminators are inoperative.
		3. Check illuminator selector switches for proper Set illuminator selector switchs to STAGE, BOTH, and TABLE. In TABLE position, only the table is illuminated; in STAGE position, only the stage is illuminated; in BOTH position, table and stage are illuminated.	
		4. Check eyepieces, attachment lens, mirror, and map lens for chips, cracks, dirt, dust, and fingerprints. Clean by carefully wiping with lens paper.	Optics are missing or broken.

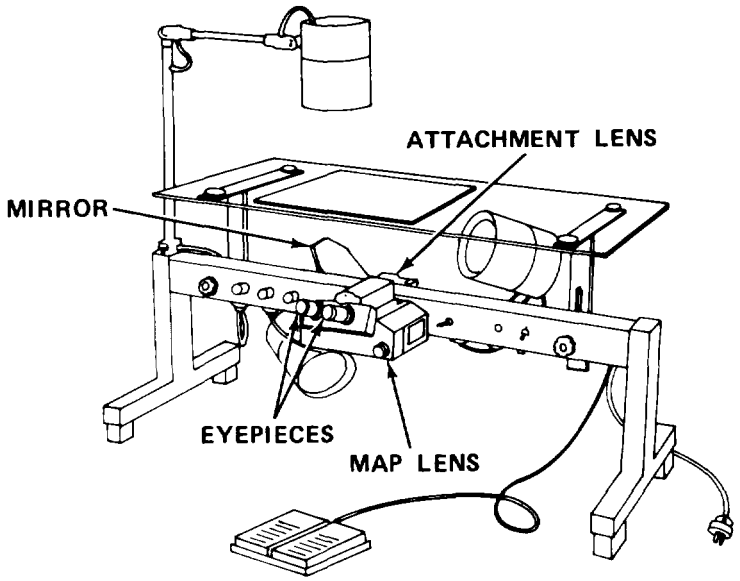


Table 8-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

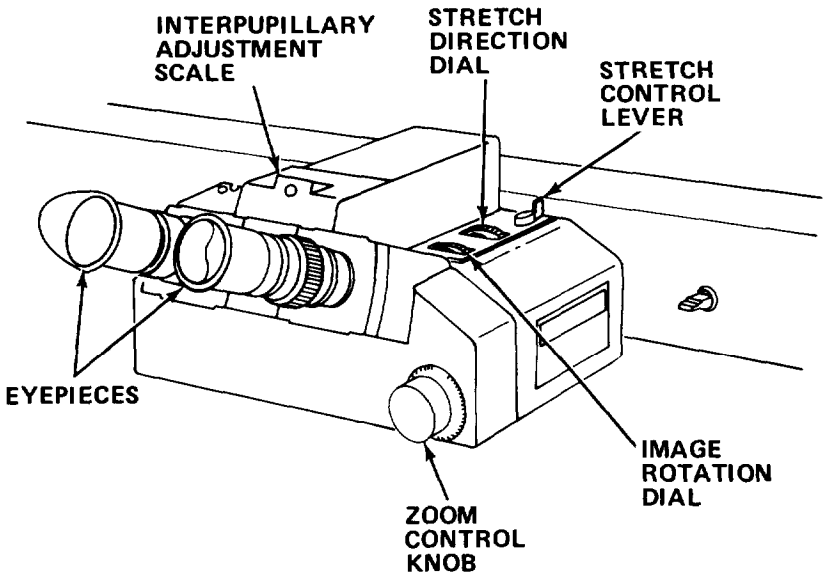
B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.		ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM TRANSFER SCOPE - Cont	
1	B	Inspect - Cont	



5. Check STRETCH CONTROL lever, STRETCH DIRECTION dial, IMAGE ROTATION dial, and ZOOM CONTROL knob for rotation and freedom of movement for each control.

NOTE

Do not remove eyepieces.

6. Check that each eyepiece moves freely in and out of its eyepiece tube.

7. Check INTERPUPILLARY ADJUSTMENT scale and verify that eyepieces move toward or away from each other.

Table 8-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
B I - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ZOOM TRANSFER SCOPE - Cont	
1	B	Inspect - Cont	

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

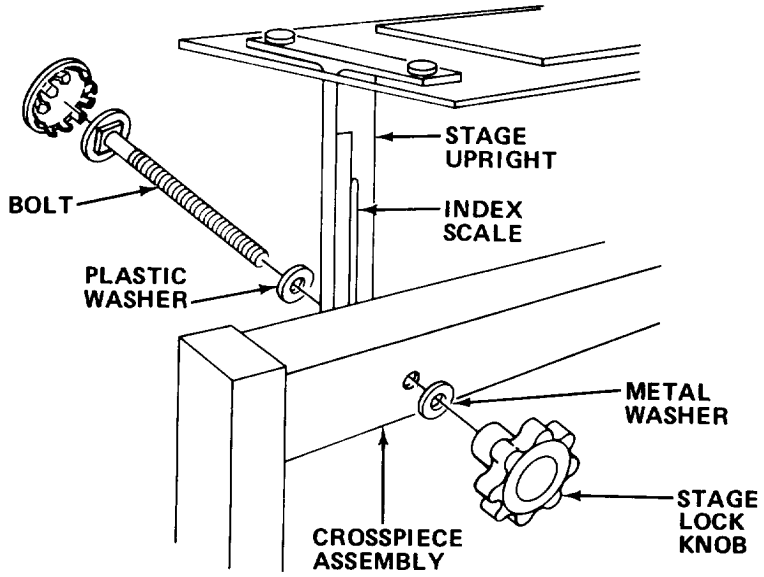
CAUTION

- Dirt and dust on optical surfaces will hinder equipment's performance.
- Do not wipe optical surfaces until dust and foreign matter have been removed.
- Do not touch optical surfaces with bare fingers.

8. Check top and bottom of glass stage and optical surfaces for dirt, dust, and fingerprints. Use watchmaker's blower to remove dust and dirt from exposed surfaces. Clean with cheesecloth moistened with warm liquid detergent solution diluted at least 10:1. Use distilled water for dilution if possible. Wipe surface dry with clean cheesecloth. Wipe with chamois to remove water spots.

8-6. OPERATION UNDER USUAL CONDITIONS.

8-6.1 Assembly and Preparation for Use.



a. Remove zoom transfer scope from transport case.

b. Set zoom transfer scope on flat work surface.

c. Attach glass stage:

(1) Remove stage lock knobs, bolts, and washers from crosspiece assembly.

(2) Position stage upright with arms facing toward rear.

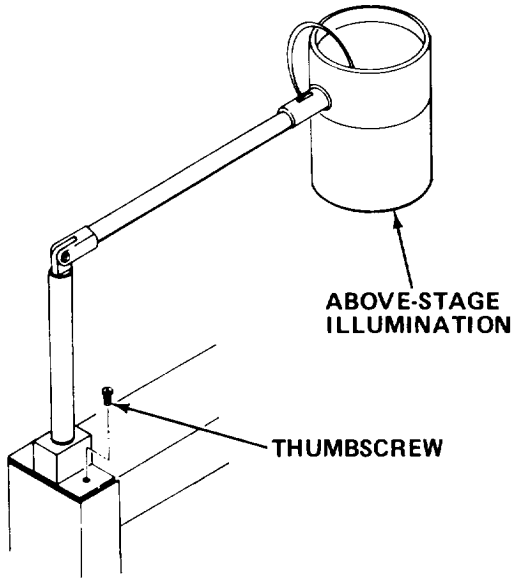
(3) Thread bolts with plastic washers through stage arms and crosspiece assembly.

(4) Place metal washer and knob on threaded end of bolt. Tighten knob.

(5) Observe index (focusing) scale on front of upright, and aline prefocused mark or common mark on each upright with top of crosspiece.

(6) Place diffuser hold-down plate on glass stage.

d. Attach above-stage illuminators.

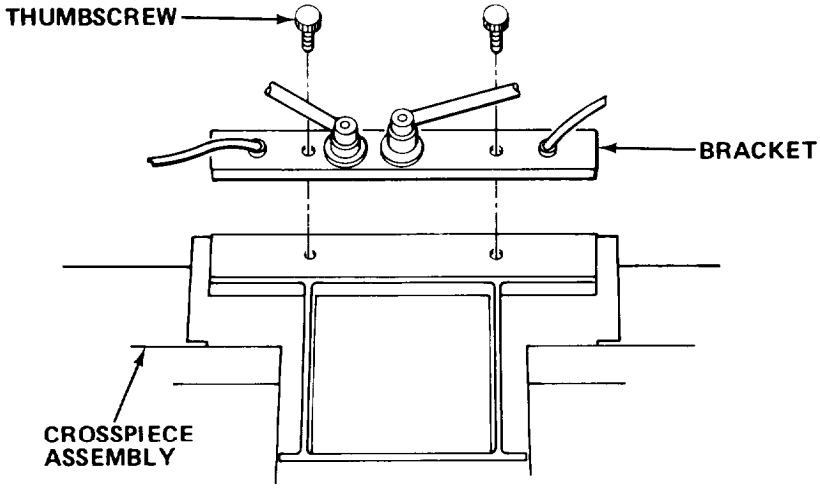


(1) Mount above-stage illuminator on left side of transfer scope.

(2) Secure with thumbscrews.

(3) Plug illuminator cord into receptacle.

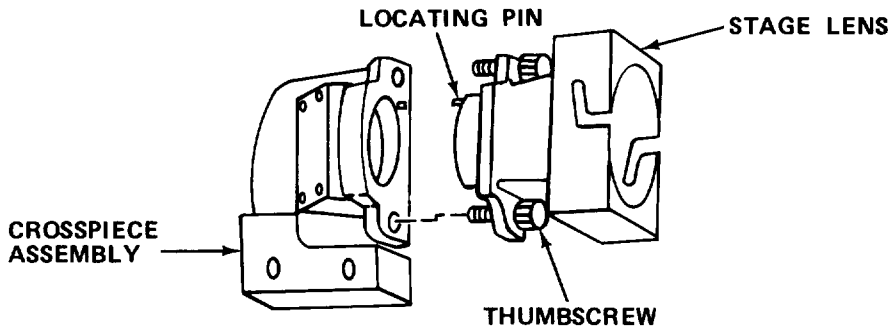
e. Attach table and stage illuminators.



(1) Attach bracket to underside of crosspiece assembly with thumbscrews.

(2) Plug illuminator cords into receptacles.

f. Attach stage lens to back of crosspiece assembly.

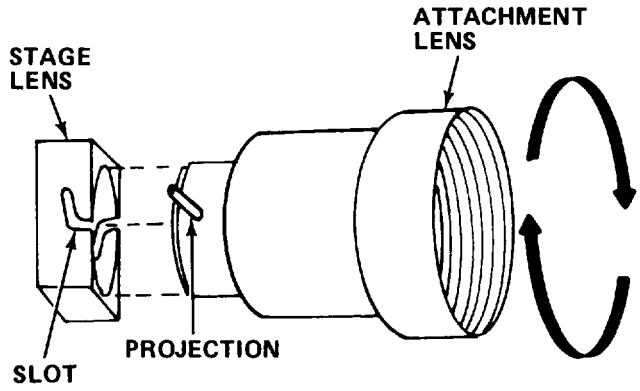


(1) Aline stage lens locating pin with hole in mount.

(2) Seat stage lens fully in mount.

(3) Tighten two thumbscrews.

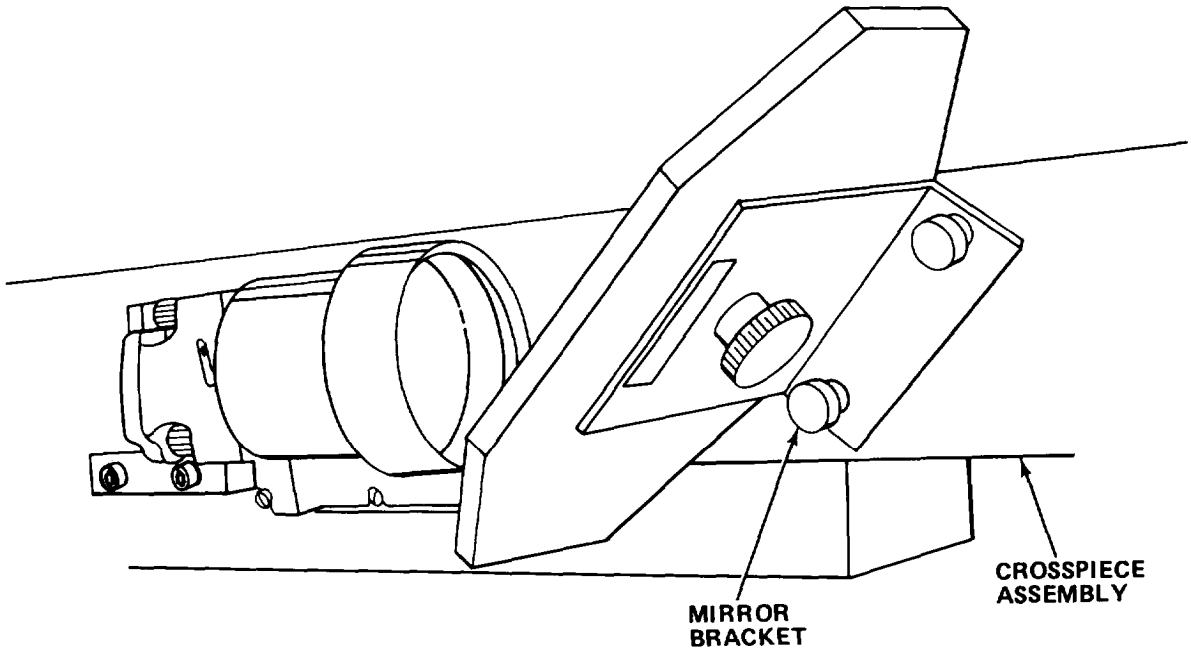
g. Ansert attachment lens into stage lens.



(1) Aline projections with slots in stage lens.

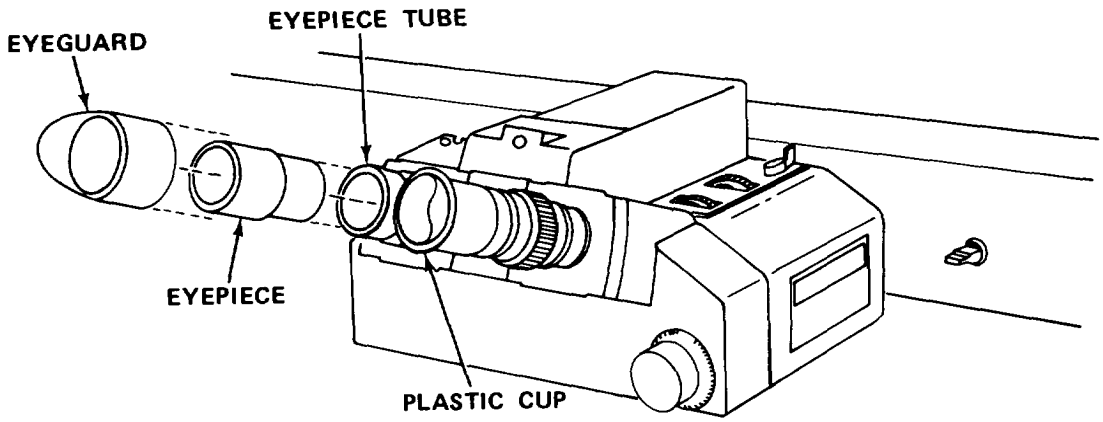
(2) Insert attachment lens.

(3) Twist right to lock.



h. Attach mirror bracket to outer holes on back of crosspiece assembly.

i. Insert eyepieces.

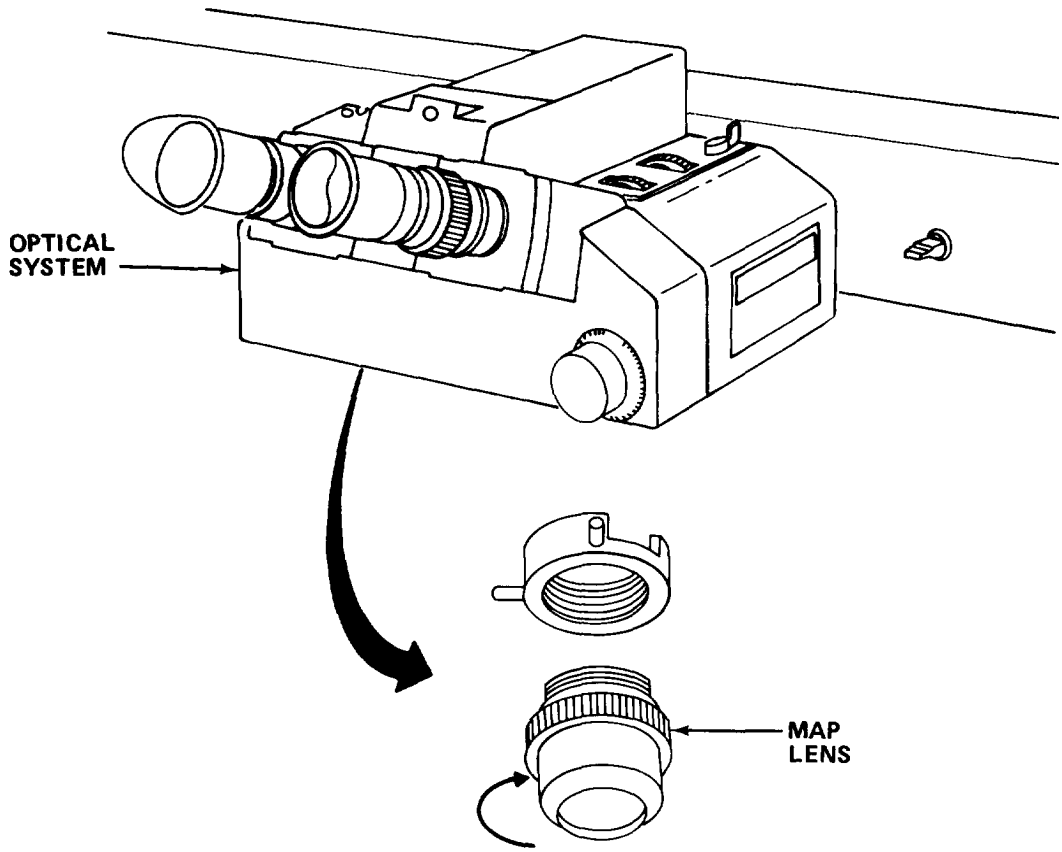


(1) Remove Plastic cups.

(2) Insert eyepieces into eyepiece tubes, pushing in until fully seated.

(3) Place eye guards on eyepieces.

j. Attach map lens.



(1) Place threaded end into hole located on underside of optical system.

(2) Turn right until lens is fully screwed into fixture.

NOTE

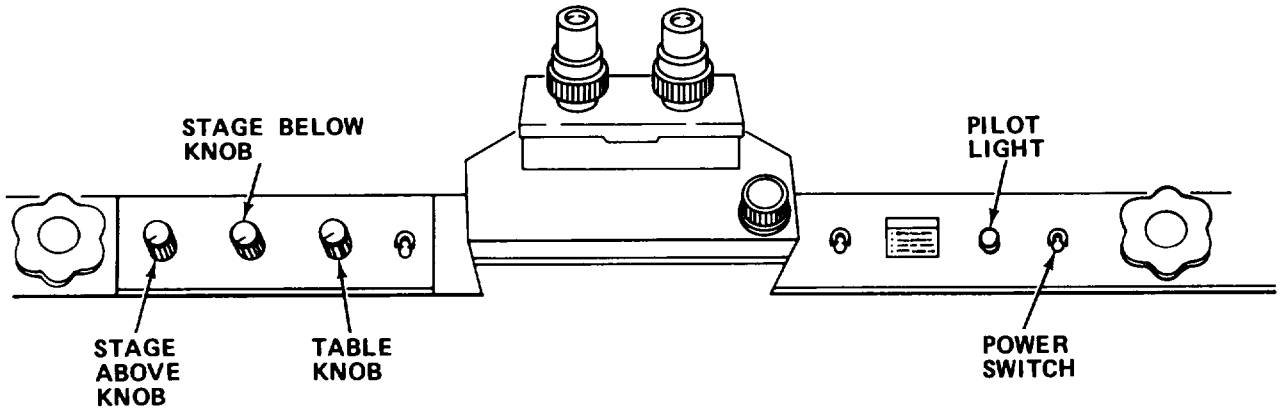
The legs on the end of the zoom transfer scope should be left folded up when the 1X or accessory 2X or 4X map lens are used. The legs should be extended only if the accessory 0.75X map lens is used.

8-6.2 Operating Procedures.

a. Preliminary Procedures.

(1) Plug in power cord.

(2) Turn on power switch.



(3) Check that pilot light is on.

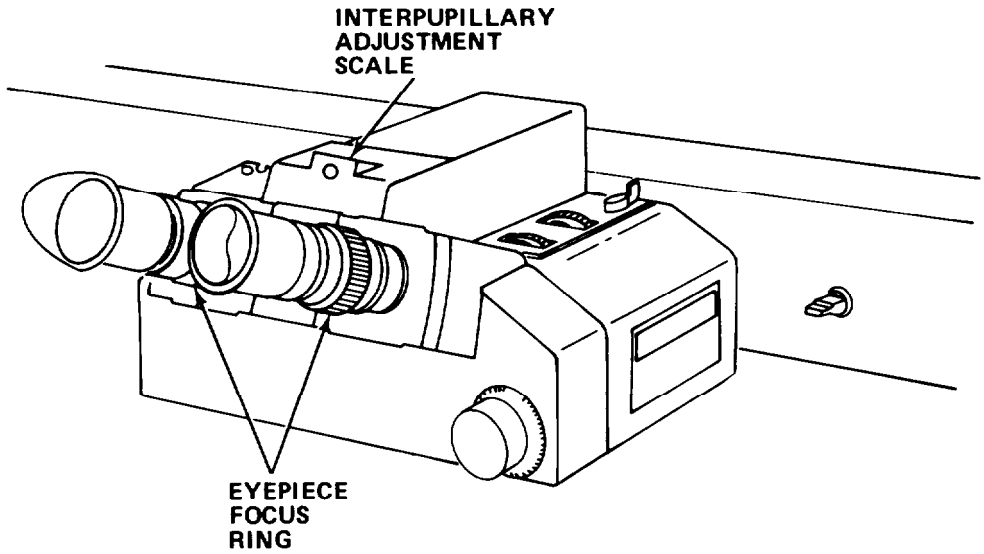
(4) Turn STAGE ABOVE knob right and be sure that top illuminator is on. Turn left to OFF.

(5) Turn STAGE BELOW knob right and be sure that middle illuminator is on. Turn left to OFF.

(6) Turn TABLE knob right and check that bottom illuminator is on. Leave illuminator on.

(7) Place suitable map or material on work surface under map lens.

(8) Set interpupillary distance and focus.



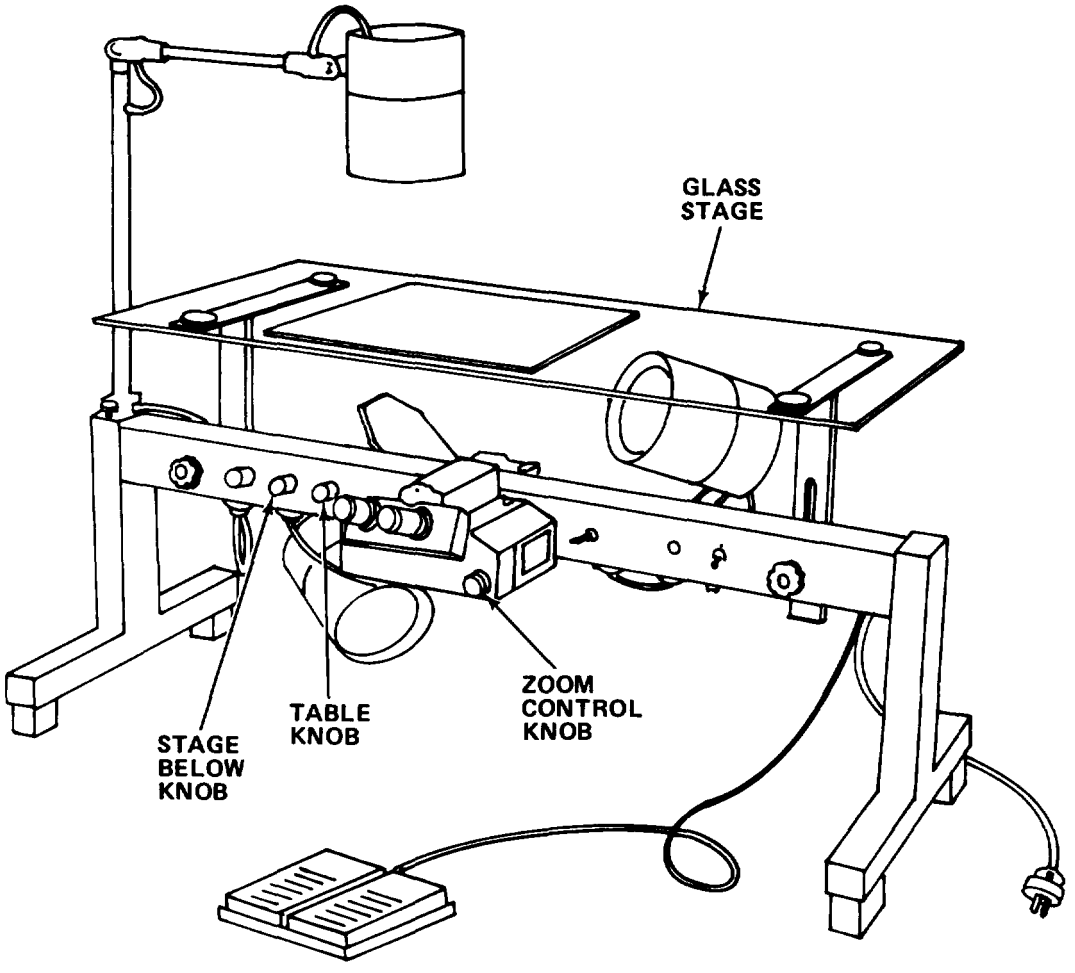
(a) Move interpupillary adjustment scale to left or right until operator has full field of view with both eyes. Note indexing on interpupillary adjustment scale for future use.

NOTE

If operator wears eyeglasses and correction is spherical, operator may focus eyepieces to compensate for his vision.

(b) Focus each eyepiece by turning eyepiece focus ring until sharpest image is seen in each eye. Verify focus by closing each eye in turn.

(9) Focus stage:



NOTE

This step is not required if stage uprights have been marked to indicate best focus for attachment lens in use. Refocus stage when attachment lenses are changed.

(a) Place object with fine detail or resolution target facing downward on glass stage.

(b) Turn TABLE knob left to OFF.

(c) Turn STAGE BELOW knob to right to illuminate object or target from below.

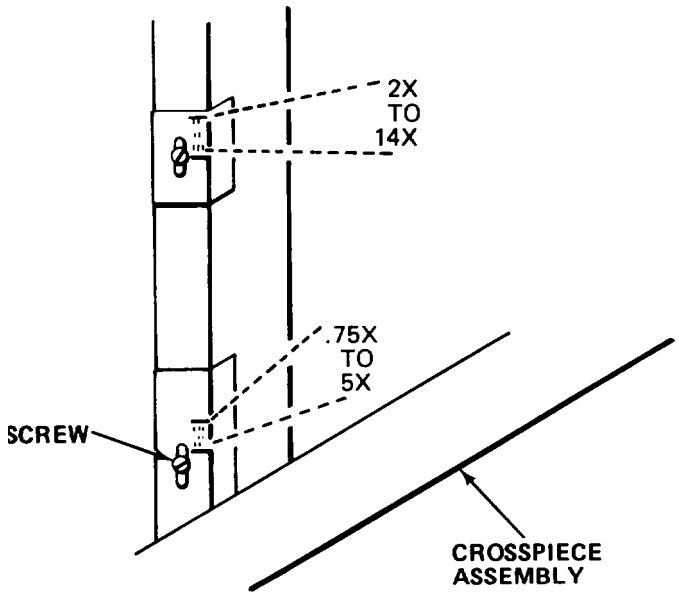
(d) Set ZOOM CONTROL knob to highest reading.

(e) Alternately loosen stage lock knobs and move stage up or down keeping readings on each scale equal.

(f) Record high and low readings where image of stage target just starts to go out of focus.

(9) Set stage height halfway between high and low reading.

(10) Adjust index mark.



(a) Loosen screw.

(b) Move mark up or down until index line is level with crosspiece.

(c) Tighten screw.

b. Operation.

(1) Select and position material to be used.

(a) For photographic revision of map, place photograph on glass stage and place map on table.

(b) For map generalization, place large-scale map on glass stage and place small-scale map on table.

(2) Determine photographic and map lens power. Lowest power provides greatest field of view; highest power provides greatest detail.

NOTE

Photograph and map must be at same relative scale in order to make accurate cartographic corrections.

(a) Determine map scale and photograph scale.

Example: 200 Scale: 1 in. on map equals 200 ft of terrain.

1 in. = 1 mi: 1 in. on map equals 1 mi of terrain.

RF 1:24,000: Reduction factor of map. 1 in. of map equals 24,000 in of terrain.

(b) Determine reduction factor (RF) of both photograph and map.

Example: 200 Scale = RF = 1/2400: 1 in. on map equals 2400 in. of terrain (200 ft = 2400 in).

1 in. = 1 mi = RF= 1/63,360: 1 in. on map equals 63,360 in. of terrain. (1 mi = 5280 = 63,360 in.)

(c) Determine matching scale S. Use RF of photograph as 1/P and RF of map as 1/M. Then the scale S can be expressed as photograph reduction factor (P) over the map reduction factor (M).

S = 1/M Divided By 1/P or S = P/M

Example: Photograph RF = 1:80,000; Map RF = 1:24,000.

Thus P = 80,000; M = 24,000; and
S = 80,000/24,000 = 3.3.

(d) Use the value of S to determine map lens and photograph magnification:

S Value	Map Lens	Photograph Magnification
1-7	1X	1X-7X
2-14	1X	2X-14X

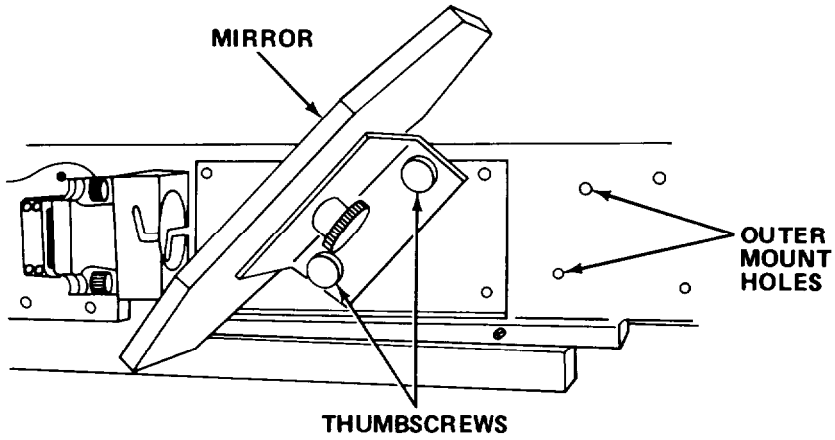
Example: If 3.3 is value of S, then map lens of 1X and either 1X-7X attachment lens or 2X-14X (without attachment lens) may be used.

(3) Set magnification:

NOTE

The following steps should be taken if it is necessary to convert the zoom transfer scope to the 2X-14X range of magnification.

(a) Remove attachment lens.

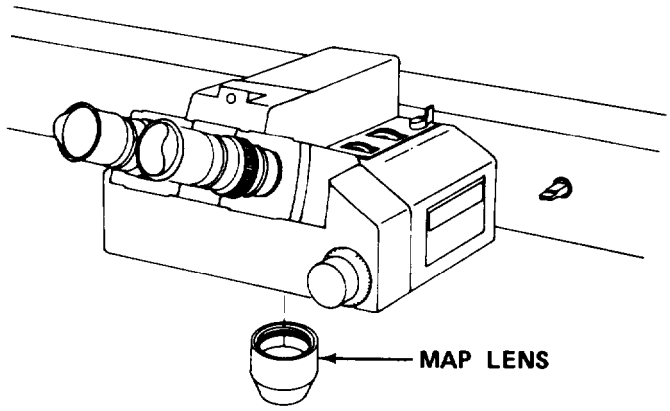


(b) Move mirror from outer mounting holes to inner mounting holes.

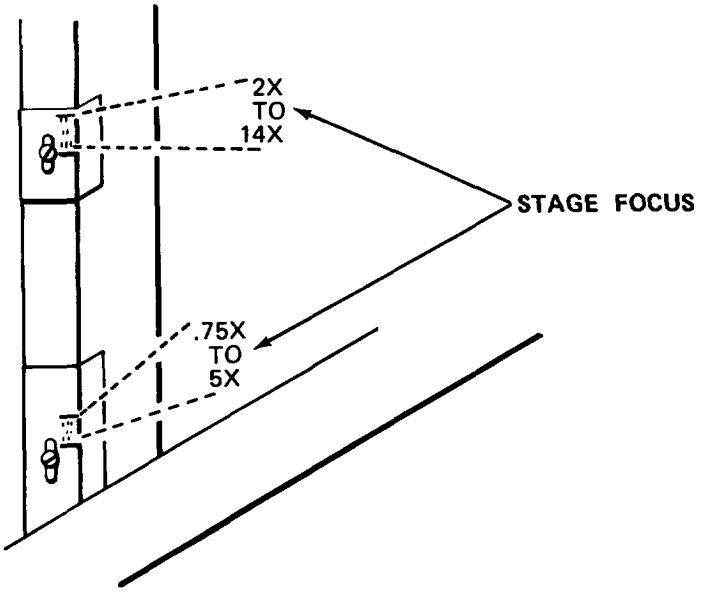
(c) Tighten thumbscrews.

(d) Lower glass stage to 2X to 14X index and refocus glass stage.

(e) Set 2X to 14X index plate.

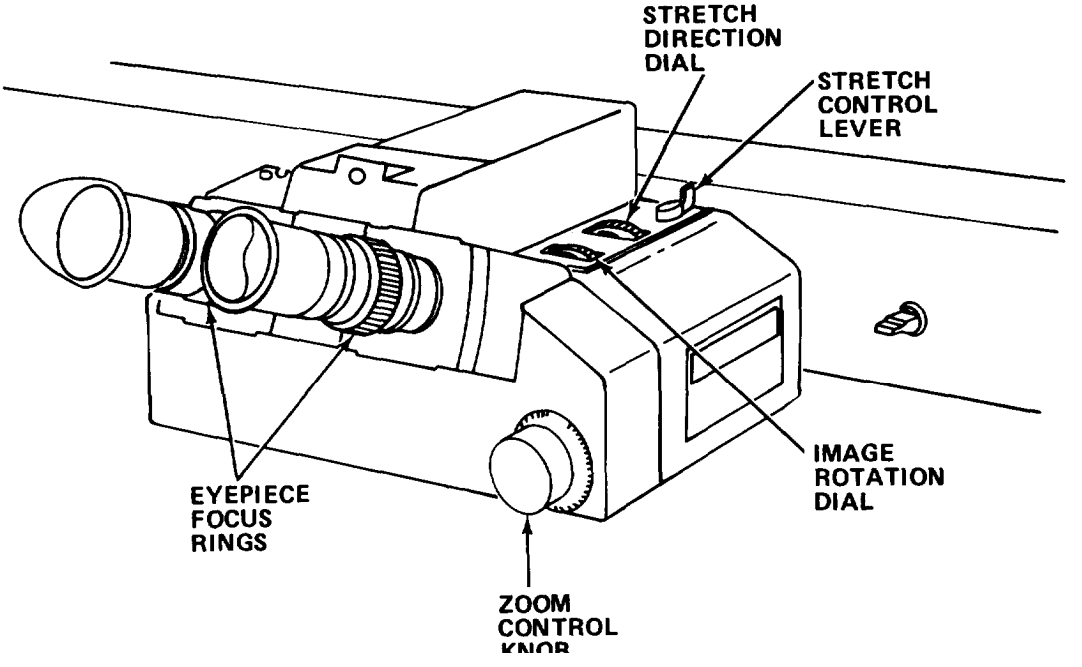


(f) Adjust map lens. Turn lower knurled ring fully left for 1X. Turn lower knurled ring fully right for 0.7X.



(4) Check that stage focus is at proper magnification setting.

(5) Set optical controls.



(a) Set IMAGE ROTATION dial to 0 and move object on glass stage to left or right. If image movement is reverse of object's movement, turn IMAGE ROTATION dial until 0 appears again.

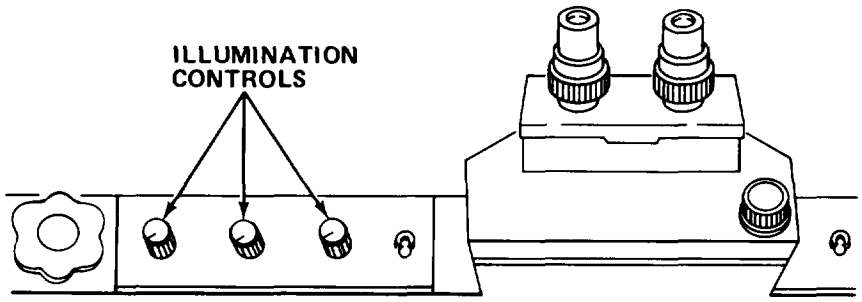
(b) Set zoom control knob to 1X.

(c) Set STRETCH control lever to 1X.

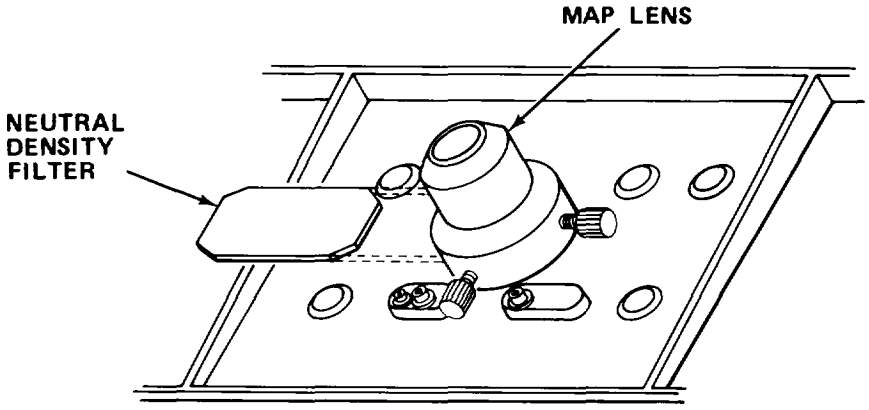
(d) Set STRETCH DIRECTION dial to 0.

(6) Position lamps so lamps shine on field of view.

(7) Focus eyepiece if required.



(8) Adjust intensity. Turn illumination controls until both glass stage and table can be comfortably viewed.



NOTE

In brightly lit room, neutral density filter may be inserted in slot above map lens to improve map image.

(9) Match images.

NOTE

Flipping either ILLUMINATION SELECTOR switch up or down will illuminate glass stage or table. Images not in register will jump. Foot switch will also turn off either stage or map illuminator when pedal is depressed.

(a) Pick common feature on both maps and place it in center of field of view of each viewing system (stage and table).

(b) Rotate IMAGE ROTATION dial to move images so lines, such as streets, rivers, etc, are parallel. Then be sure adjacent objects are also parallel.

CAUTION

To avoid damage to the map lens, do not overtighten or back adjustment screws out of threads.

(c) Move map on table left, right, forward, or backward to roughly aline image in X-Y direction. Then turn X-and Y-adjustment screws for precise alinement.

(10) Match scale of stage image. and map.

(a) Pick feature near edge of field of view, and change zoom magnification until both features are alined.

(b) When point near edqe is chosen, pick second point near opposite edcie and change zoom magnification until one-half-the coincident distance is-covered to second point.

(11) Repeat match. Continue to match images. Match scales until best fit between map and image is obtained.

(12) Use STRETCH control lever. Set STRETCH control lever to 1X or 2X, and rotate STRETCH DIRECTION dial to improve fit between map and image.

(13) Repeat match using the following summary:

NOTE

Each adjustment will change previous adjustments slightly, so matching steps must be repeated until best compromise fit is obtained.

(a) Image Rotation - Approximate orientation.

(b) Zoom - Approximate scale.

(c) Stretch/Stretch Direction - Match shapes.

(d) Image Rotation - Aline lines.

(e) Stretch Direction - Aline lines perpendicular to lines in previous step.

(f) Stretch - Match shapes.

(9) Zoom - Match scale.

(h) Repeat as required.

CAUTION

To protect optical system from dust, dirt, and fingerprints when transfer scope is not in use, dust cover must be used.

(14) Cover optical system with dust cover.

8-6.3 Preparation for Movement.

a. Remove dust cover and place in transport case.

b. Remove map lens.

c. Remove eye guards and eyepieces.

d. Place plastic cups in eyepiece tubes.

e. Remove mirror.

f. Remove attachment lens.

g. Remove stage lens.

h. Detach table and below-stage illuminators.

i. Remove above-stage illuminator.

j. Remove diffuser.

k. Remove glass stage.

1. Place zoom transfer scope and equipment in transport case, and secure case.

8-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed to operate only in a controlled environment.

Section III OPERATOR MAINTENANCE

8-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

8-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the zoom transfer scope, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 8-2. TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. IMAGES BLURRED, POOR CONTRAST, OR RESOLUTION.	Inspect optical system and glass stage for fingerprints and dirt.	(a) Clean optical surfaces and glass stage. (b) If problem remains, notify direct/general support maintenance.
2. ILLUMINATORS DO NOT WORK. PILOT LIGHT IS OFF.	Step 1. Check if power cord is not plugged in and POWER switch is off.	(a) Plug in power cord and turn POWER switch on. (b) Reset circuit breakers.
	Step 2. Visually check fuses for damage or broken filaments.	(a) Replace defective fuses (paragraph 8-10.3). (b) Refer to direct/general support maintenance.
3. ONE ILLUMINATOR DOES NOT WORK.	Check if illuminator connector is not properly seated in receptacle.	(a) Seat connector properly. (b) Replace lamp (paragraph 8-10.2). (c) If problem remains, notify direct/general support maintenance.
4. ILLUMINATORS WORK. PILOT LIGHT IS OFF.	Notify direct/general support maintenance.	

8-10. MAINTENANCE PROCEDURES.

This section contains instructions covering operator maintenance functions for the zoom transfer scope. Personnel required are listed only if the task requires more than one.

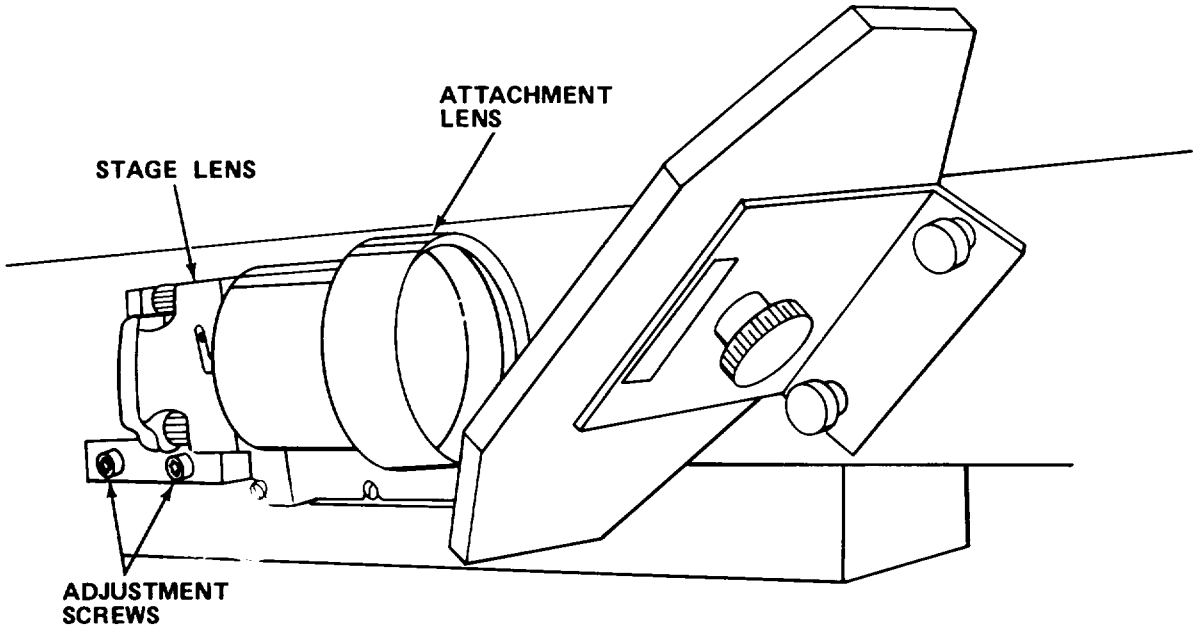
b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

8-10.1 Adjust Drag.

MOS: 81Q, Terrain Analyst

TOOLS: Hex Head Key Wrench Set



a. Rotate attachment lens and stage lens to vertical and horizontal positions. Observe if gravity pulls lenses down or if tension is too great to easily move lenses.

b. Use a hex head key wrench on adjustment screws. Turning wrench to right tightens adjustment screw, increasing drag. Turning to left loosens adjustment screw, decreasing drag.

c. Test adjustment by positioning lenses. Observe that lenses retain position. Movement must be firm but not too tight.

8-10.2 Replace Lamp.

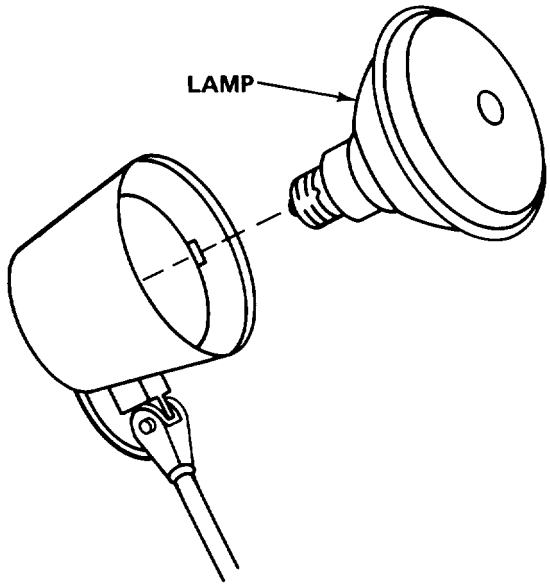
MOS: 81Q, Terrain Analyst

SUPPLIES: Lamp

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing zoom transfer scope.

a. Turn off power and unplug power cord.



b. Unscrew and dispose of defective lamp.

c. Install new lamp.

d. Plug in power cord and turn on power.

8-10.3 Replace Fuse.

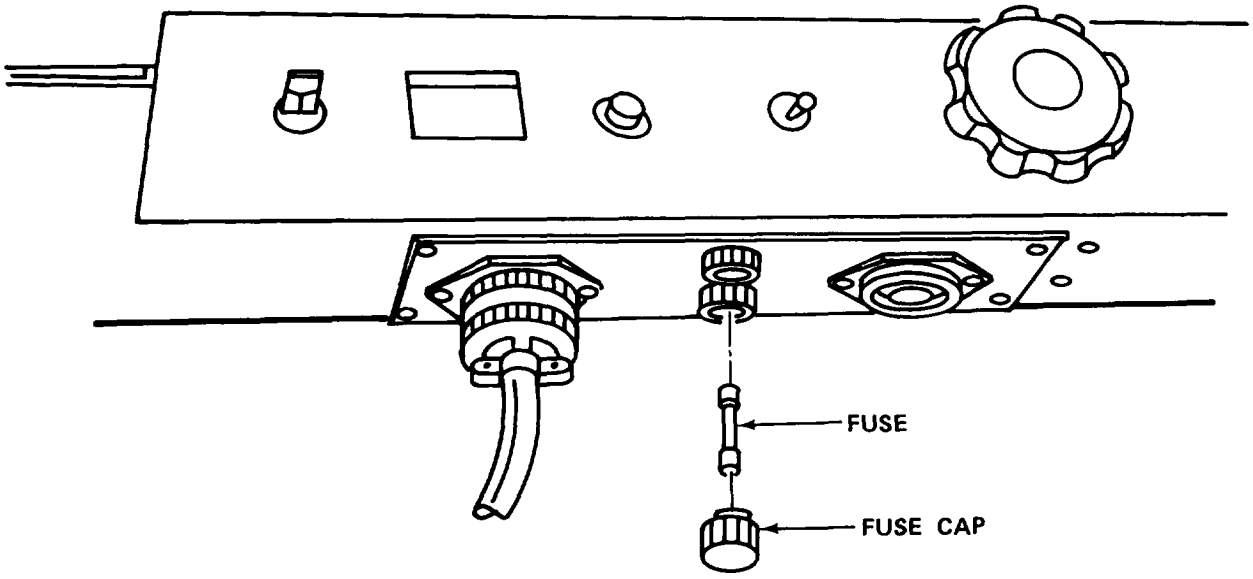
MOS: 81Q, Terrain Analyst

SUPPLIES: Fuse

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing zoom transfer scope.

a. Turn off power and unplug power cord.



b. Turn fuse cap left and remove.

c. Remove defective fuse.

d. Install new fuse into fuse cap.

e. Reinstall fuse cap. Turn right to lock.

f. Plug in power cord and turn on power.

Section IV ORGANIZATIONAL MAINTENANCE

8-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

8-12. REPAIR PARTS, SPECIAL TOOLS: TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

8-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

8-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

8-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

8-13. SERVICE UPON RECEIPT.

8-13.1 Checking Unpacked Equipment.

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

8-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned to this equipment.

8-15. ORGANIZATIONAL TROUBLESHOOTING. There are no organizational troubleshooting procedures assigned for this equipment.

8-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

8-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

SECTION V DIRECT/GENERAL SUPPORT MAINTENANCE

8-18. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

8-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

8-18.2 Special Tools: Test, Measurement. and Diagnostic Equipment; and Supprt. Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

8-18.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering direct/general support maintenance for this equipment.

8-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING PROCEDURES.

a. Direct/general support troubleshooting procedures cover the most common malfunctions that may be repaired at the direct/general support level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used at lower levels should be conducted in addition to the direct/general support troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

For unidentified malfunctions, use the following schematic or the foldout located at the end of this manual for further fault analysis.

d. If the zoom transfer scope does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedures for dead receptacle (Table 1-4).

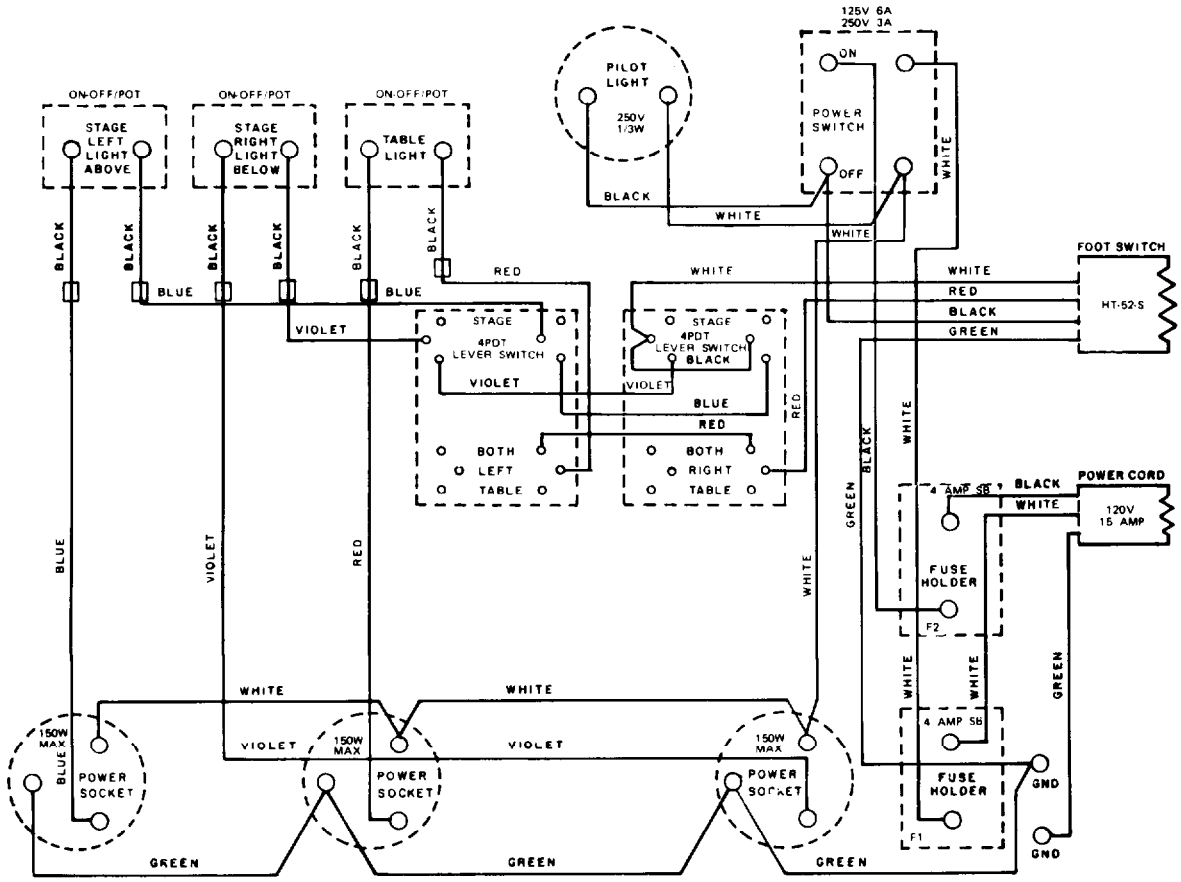


Table 8-3. DIRECT/GENERAL SUPPORT TROUBLESHOOTING

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. PILOT LIGHT IS OFF.

   Check fuse for continuity with multimeter.

   Replace fuse (paragraph 8-10.3).

2. ONE ILLUMINATOR DOES NOT WORK.

   Step 1. Check for 120 V ac at illuminator receptacle input.

   (a) If voltage is present, replace receptacle (paragraph 8-20.7).

   (b) If voltage is not present, proceed to step 2.

   Step 2. Check for correct voltage range at the potentiometer output terminals.

Table 8-3. DIRECT/GENERAL SUPPORT TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
2. ONE ILLUMINATOR DOES NOT WORK - Cont	
	(a) With multimeter leads in place, slowly rotate illuminator knob fully right and fully left. Observe for 0-120 V ac between fully left position and fully right position. If correct voltage range is not present, repair or replace wiring between potentiometer and receptacle.
	(b) If correct voltage range is present, proceed to step 3.
Step 3. Check for 120 V ac input at potentiometer.	
	(a) If correct voltage is not present, proceed to Step 4.
	(b) If correct voltage is present, replace potentiometer (paragraph 8-20.5).
Step 4. Check wiring for continuity between switch and potentiometer.	
	Repair or replace wiring.
3. ILLUMINATORS WORK BUT PILOT LIGHT IS OFF.	
Check for correct voltage at pilot light leads.	
	(a) If correct voltage is present, check wiring.
	(b) If not present, replace pilot light (paragraph 8-20.2)

8-20. MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance functions for the zoom transfer scope. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

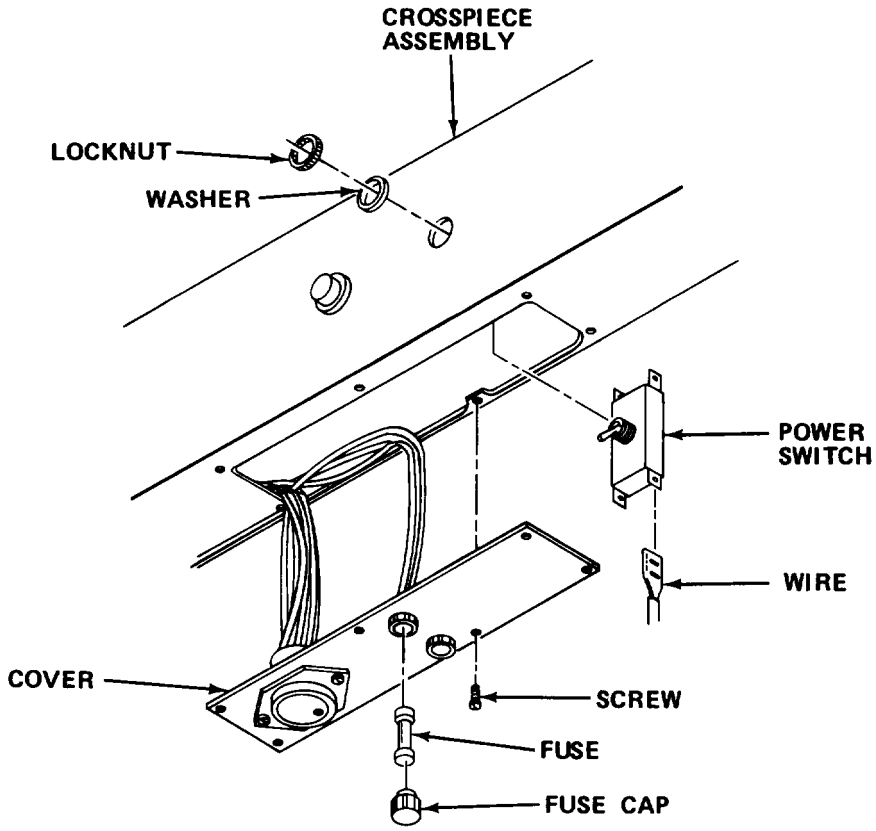
INDEX - Cont

8-20.1 Replace Power Switch.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Power Switch



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power switch.

b. Unplug power cord.

c. Unplug below-stage illuminator cord.

d. Remove fuse caps and fuses.

e. Remove screws from cover on underside of crosspiece assembly. Move cover to allow access to power switch.

f. Remove locknut and washer securing power switch to control panel.

g. Remove power switch through underside of crosspiece assembly.

h. Tag and disconnect wires from defective power switch.

i. Connect wires to new power switch.

j. Position power switch in crosspiece assembly.

k. Reinstall washer and locknut securing power switch to control panel.

l. Reinstall cover on underside of crosspiece assembly.

m. Reinstall fuses and fuse caps.

n. Plug in below-stage illuminator cord.

o. Plug in power cord.

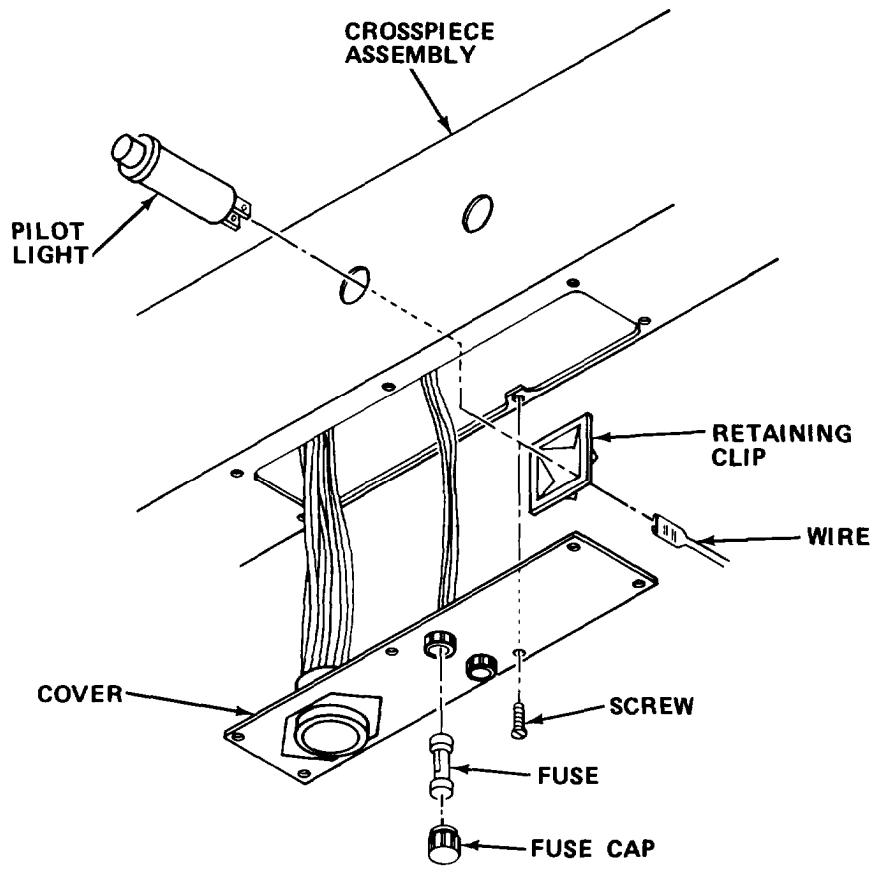
p. Turn power on.

8-20.2 Replace Pilot Light.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Pilot Light



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.

b. Unplug below-stage illuminator cord.

c. Remove fuse caps and fuses.

d. Remove screws from cover on underside of crosspiece assembly. Move cover to allow access to pilot light.

e. Tag and disconnect wires from pilot light.

f. Remove retaining clip. Remove defective pilot light.

g. Position new pilot light through hole on crosspiece assembly.

h. Reinstall retaining clip.

i. Connect wires to pilot light.

j. Reinstall cover on crosspiece assembly and secure with screws.

k. Reinstall fuses and fuse caps.

l. Plug in below-stage illuminator cord.

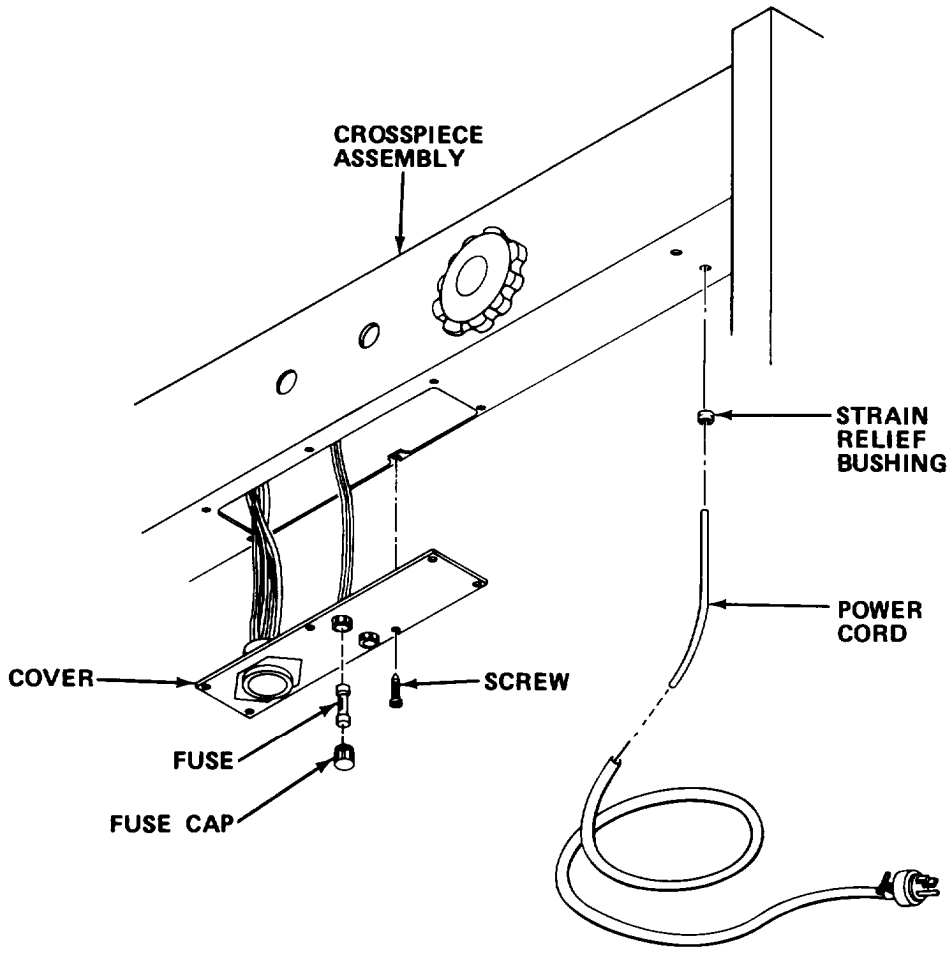
m. Plug in power cord and turn power on.

8-20.3 Replace Power Cord.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Straight Nose Pliers

SUPPLIES: Power Cord



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.

b. Unplug below-stage illuminator cord.

c. Remove fuse caps and fuses.

d. Remove screws from cover on underside of crosspiece assembly.

e. Release strain relief bushing from power cord.

f. Push sufficient power cord into crosspiece assembly to allow access to terminal connectors.

g. Tag and disconnect wires from fuse holders and ground.

h. Remove defective power cord through hole in crosspiece assembly.

i. Install new power cord through hole in crosspiece assembly.

j. Connect wires to ground and fuse holders.

k. Reinstall strain relief bushing on power cord.

l. Reinstall cover on underside of crosspiece assembly and secure with screws.

m. Reinstall fuses and fuse caps.

n. Plug in below-stage illuminator cord.

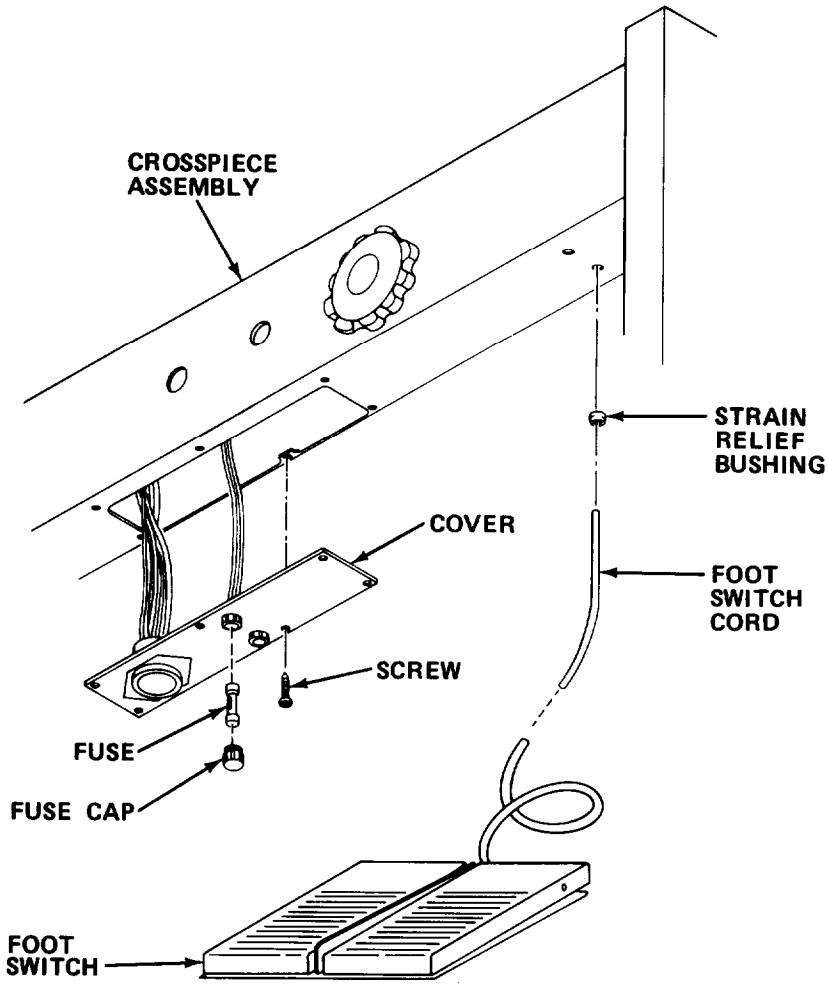
o. Plug in power cord and turn power on.

8-20.4 Replace Foot Switch.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Straight Nose Pliers

SUPPLIES: Foot Switch



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.

b. Unplug below-stage illuminator cord.

c. Remove fuse caps and fuses.

d. Remove screws from cover on underside of crosspiece assembly.

e. Release strain relief bushing on foot switch cord.

f. Push foot switch cord into crosspiece assembly to allow for give.

g. Tag and disconnect foot switch wiring from scope.

h. Thread foot switch cord through hole in crosspiece assembly and remove defective foot switch.

i. Install cord for new foot switch through hole in crosspiece assembly.

j. Connect wiring to scope.

k. Reinstall strain relief bushing on foot switch cord.

l. Reinstall cover on underside of crosspiece assembly and secure with screws.

m. Reinstall fuses and fuse caps.

n. Plug in below-stage illuminator cord.

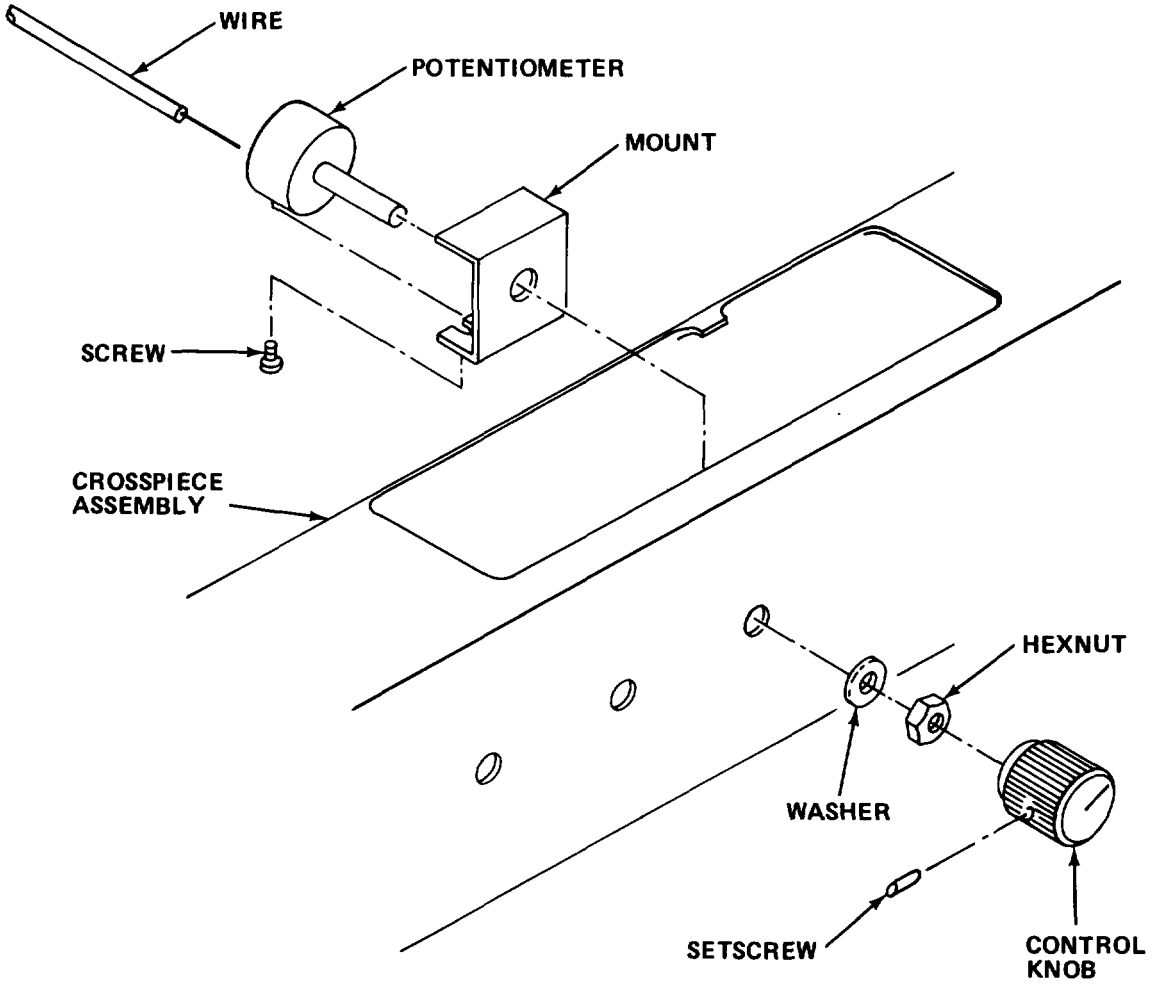
o. Plug in power cord and turn on power.

8-20.5 Replace Illuminator Control Potentiometer.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Hex Head Key Wrench Set
9/16 in. Open End Wrench
Soldering Iron

SUPPLIES: Illuminator Control Potentiometer.
Solder (Item 24, Appendix E)



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power switch and unplug power cord.

b. Unplug above-stage and table illuminator cords.

c. Remove screws from cover on underside of crosspiece assembly. Move cover to allow access to potentiometer.

d. Loosen setscrews on illuminator control knob. Remove knob, nut, and washer.

e. Remove potentiometer through underside of crosspiece assembly.

f. Loosen screw on potentiometer and remove mount.

g. Tag and desolder wires.

h. Solder wires to new potentiometer.

i. Reinstall mount and tighten screw.

j. Position potentiometer in crosspiece assembly.

k. Reinstall washer and hex nut. Reinstall knob and tighten setscrews.

l. Reinstall cover on underside of crosspiece assembly and secure with screws.

m. Plug in above-stage and table illuminator cords.

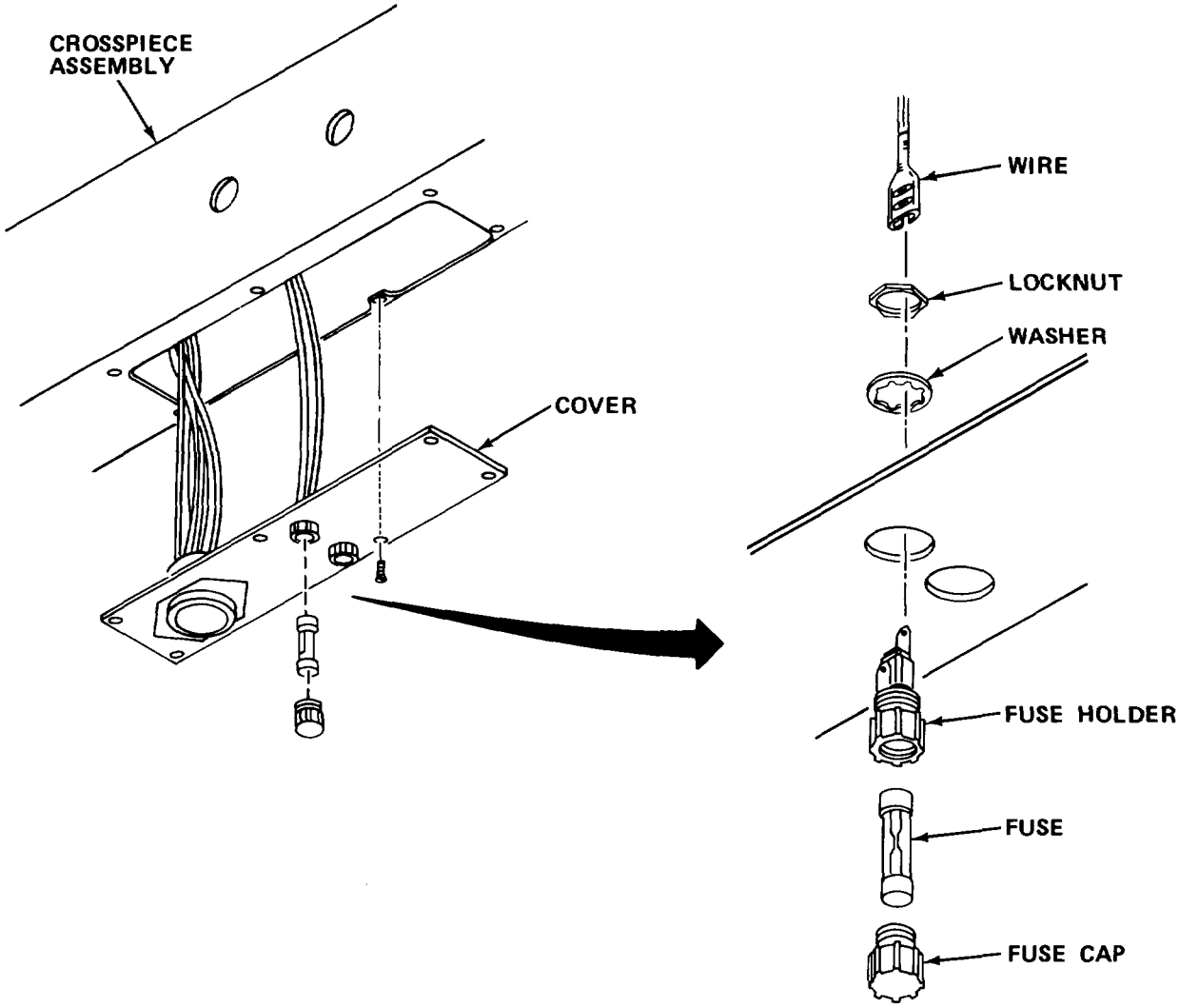
n. Plug in power cord and turn on power.

8-20.6 Replace Fuse Holder.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
9/16 in. Open End Wrench

SUPPLIES: Fuse Holder



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.

b. Unplug below-stage illuminator cord.

c. Remove fuse caps and fuses.

d. Remove screws from cover on underside of crosspiece assembly. Move cover to allow access to fuse holder.

e. Tag and disconnect wires from fuse holder.

f. Remove locknut and washer securing fuse holder to crosspiece assembly. Remove defective fuse holder.

g. Install new fuse holder and secure with washer and locknut.

h. Connect wires to fuse holder.

i. Reinstall cover on underside of crosspiece assembly and secure with screws.

j. Reinstall fuses and fuse caps.

k. Plug in below-stage illuminator cord.

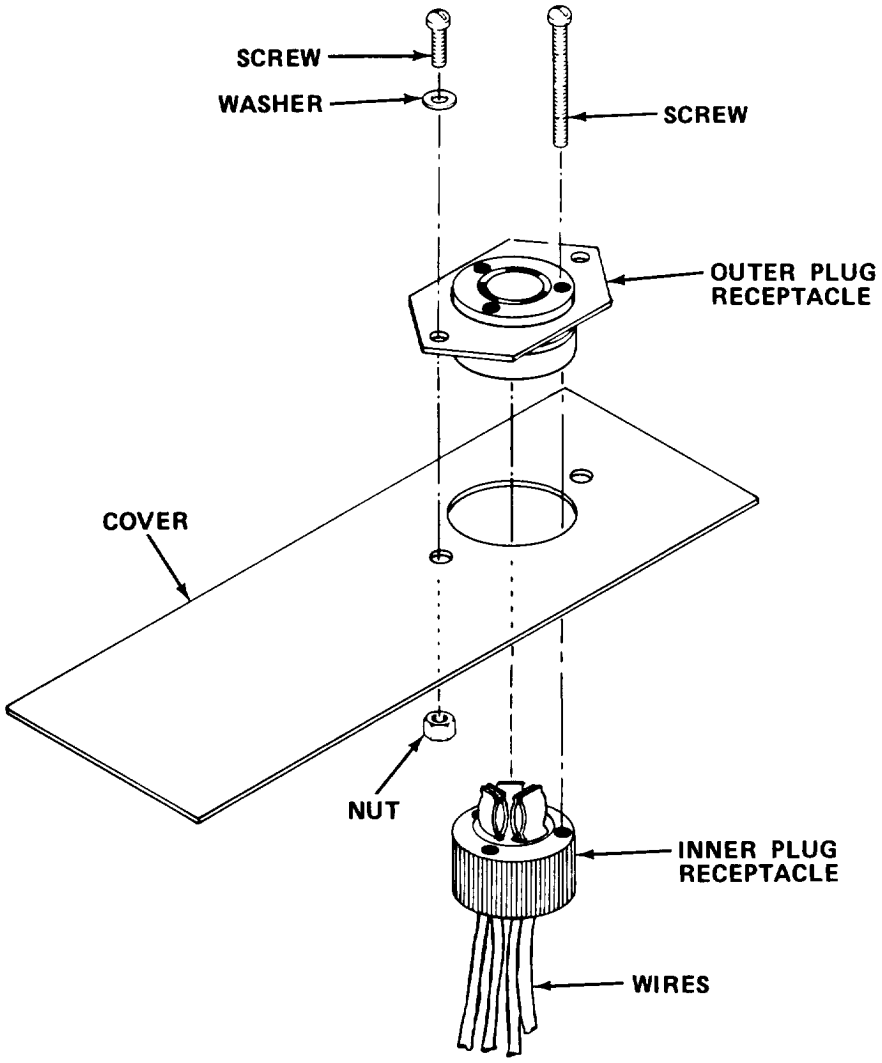
l. Plug in power cord and turn on power.

8-20.7 Replace Illuminator Plug Receptacle.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver

SUPPLIES: Illuminator Plug Receptacle



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.

b. Unplug illuminator cord(s).

c. Remove fuse caps and fuses, if necessary.

d. Remove screws from cover on underside of crosspiece assembly.

e. Remove screws securing outer plug receptacle to inner plug receptacle.

f. Remove screws, washers, and nuts securing outer plug receptacle to cover.

g. Tag and disconnect wires from inner plug receptacle.

h. Remove screws securing new outer plug receptacle to new inner plug receptacle.

i. Connect wires to new inner plug receptacle and tighten screws.

j. Install new outer plug receptacle on cover, and secure with screws, washers, and nuts.

k. Connect inner and outer plug receptacles and secure with screws.

l. Reinstall cover on underside of crosspiece assembly and secure with screws.

m. Replace fuses and fuse caps, if removed.

n. Plug in illuminator cord(s).

o. Plug in power cord and turn on power.

8-20.8 Replace Illuminator Selector Switch.

MOS: 41B, Topographic Instrument Repair Specialist

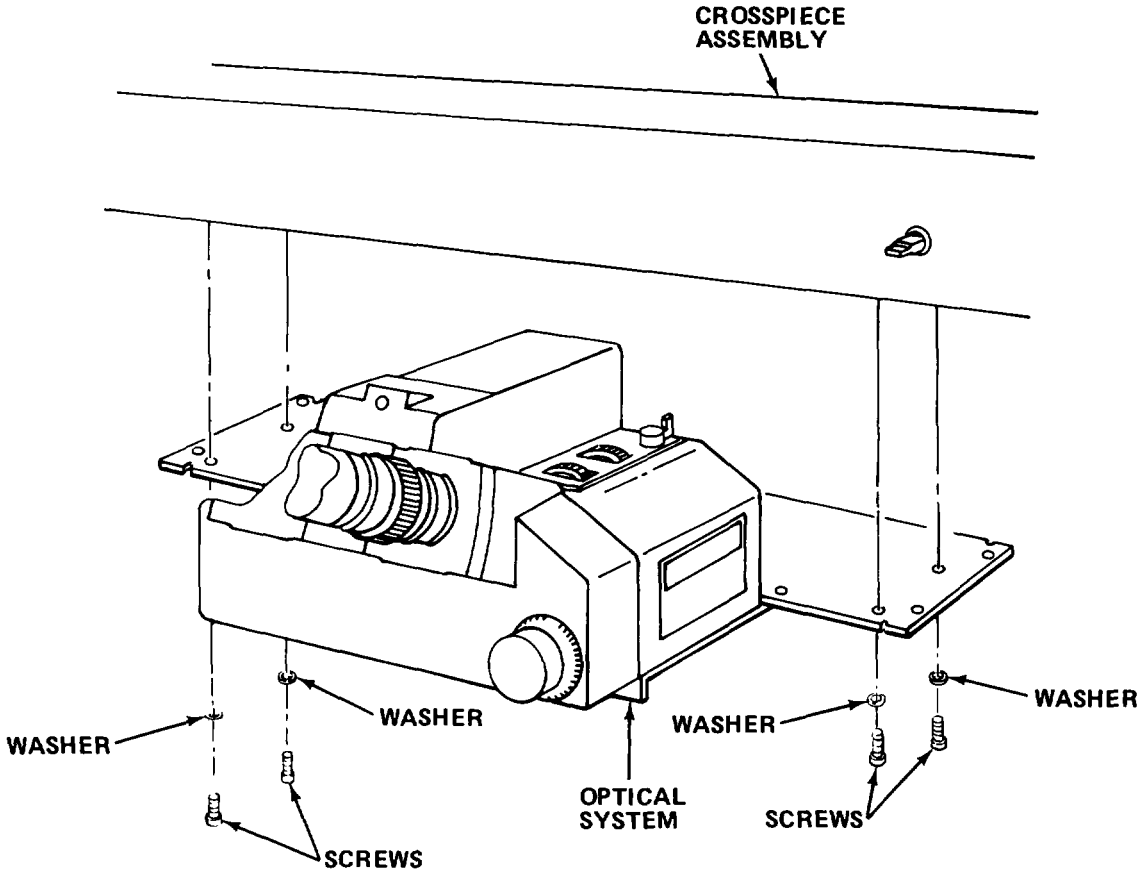
TOOLS: Hex Head Key Wrench Set
Soldering Iron

SUPPLIES: Illuminator Selector Switch
Solder (Item 24, Appendix E)

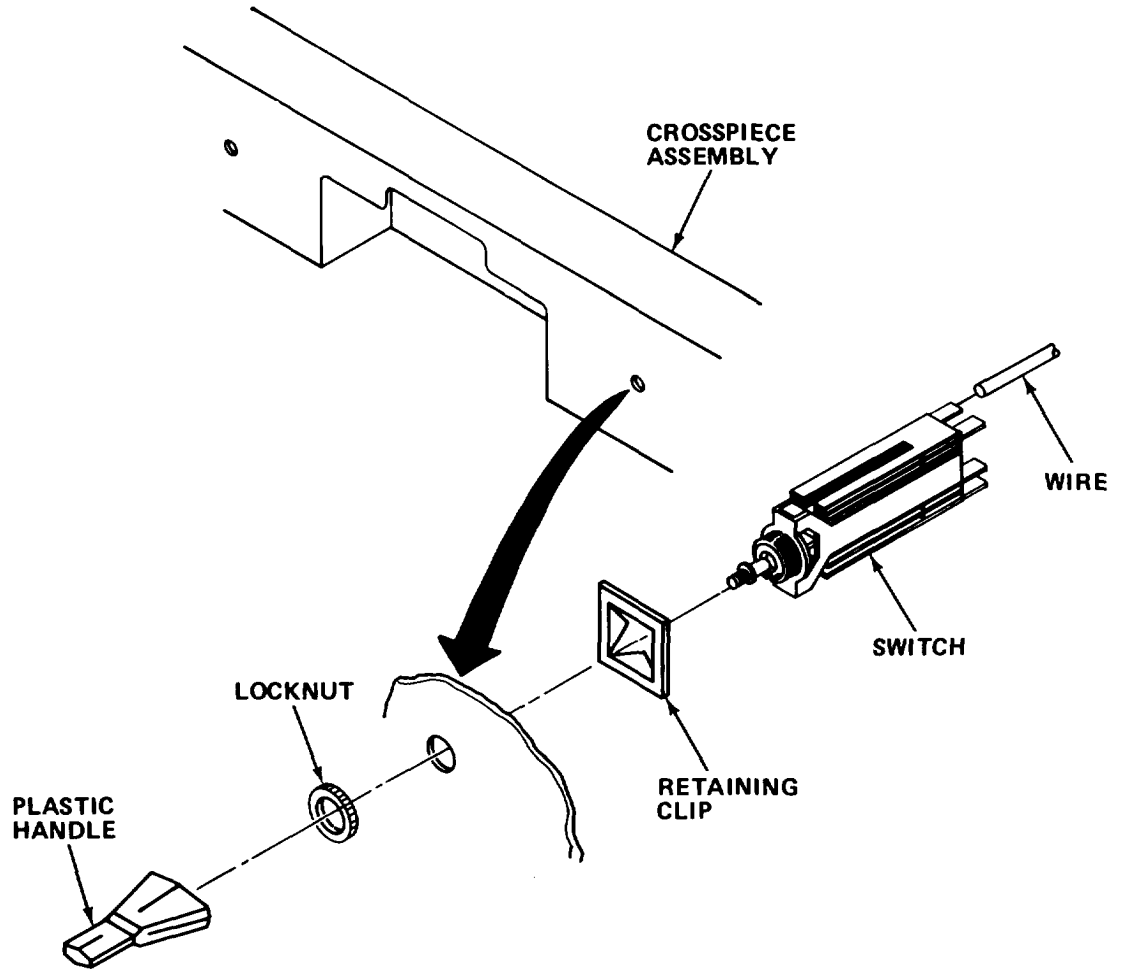
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.



b. Remove screws, washers, and optical system from underside of crosspiece assembly.



c. Unscrew plastic handle on switch.

d. Remove locknut and retaining clip.

e. Remove switch through underside of crosspiece assembly.

f. Tag and desolder wires from defective switch.

g. Solder wires to new switch.

h. Position switch in crosspiece assembly.

i. Reinstall retaining clip and locknut.

j. Reinstall plastic handle on switch.

k. Reinstall optical system and secure with washers and screws.

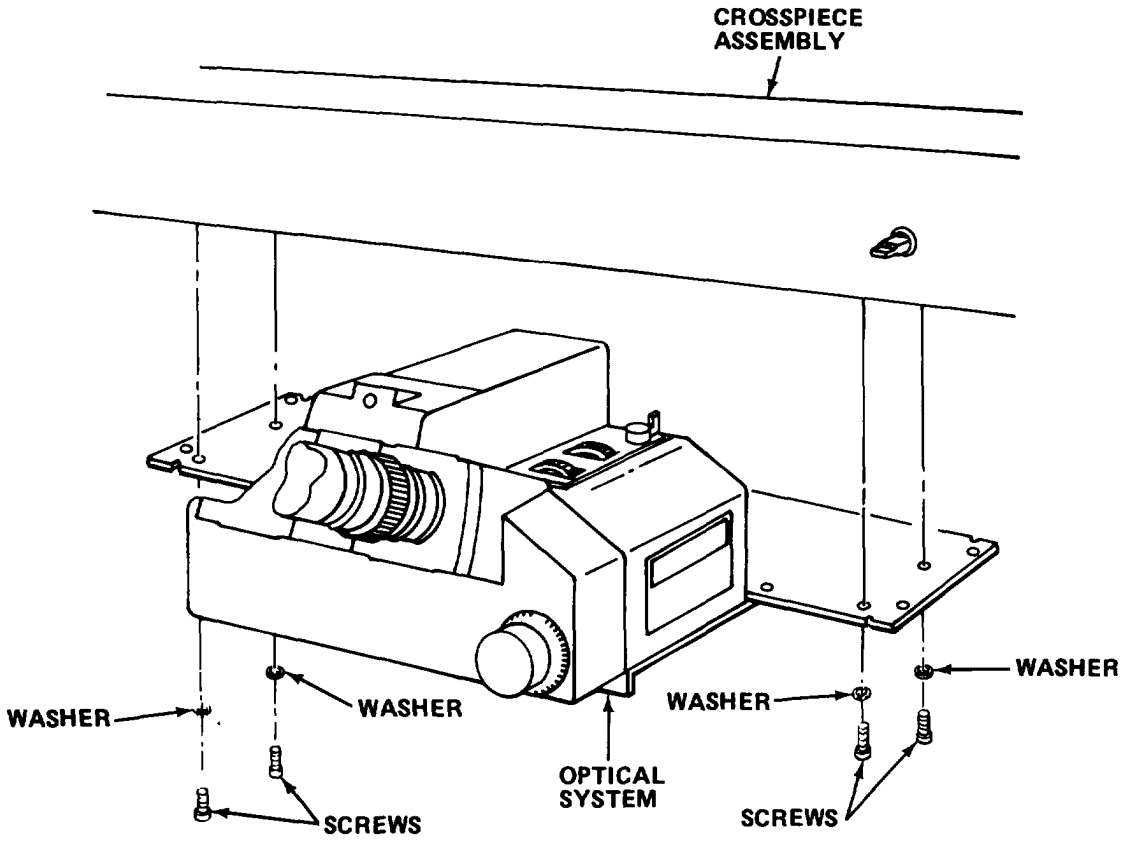
l. Plug in power cord and turn on power.

8-20.9 Replace Optical System.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Hex Head Key Wrench Set

SUPPLIES: Optical System



WARNING

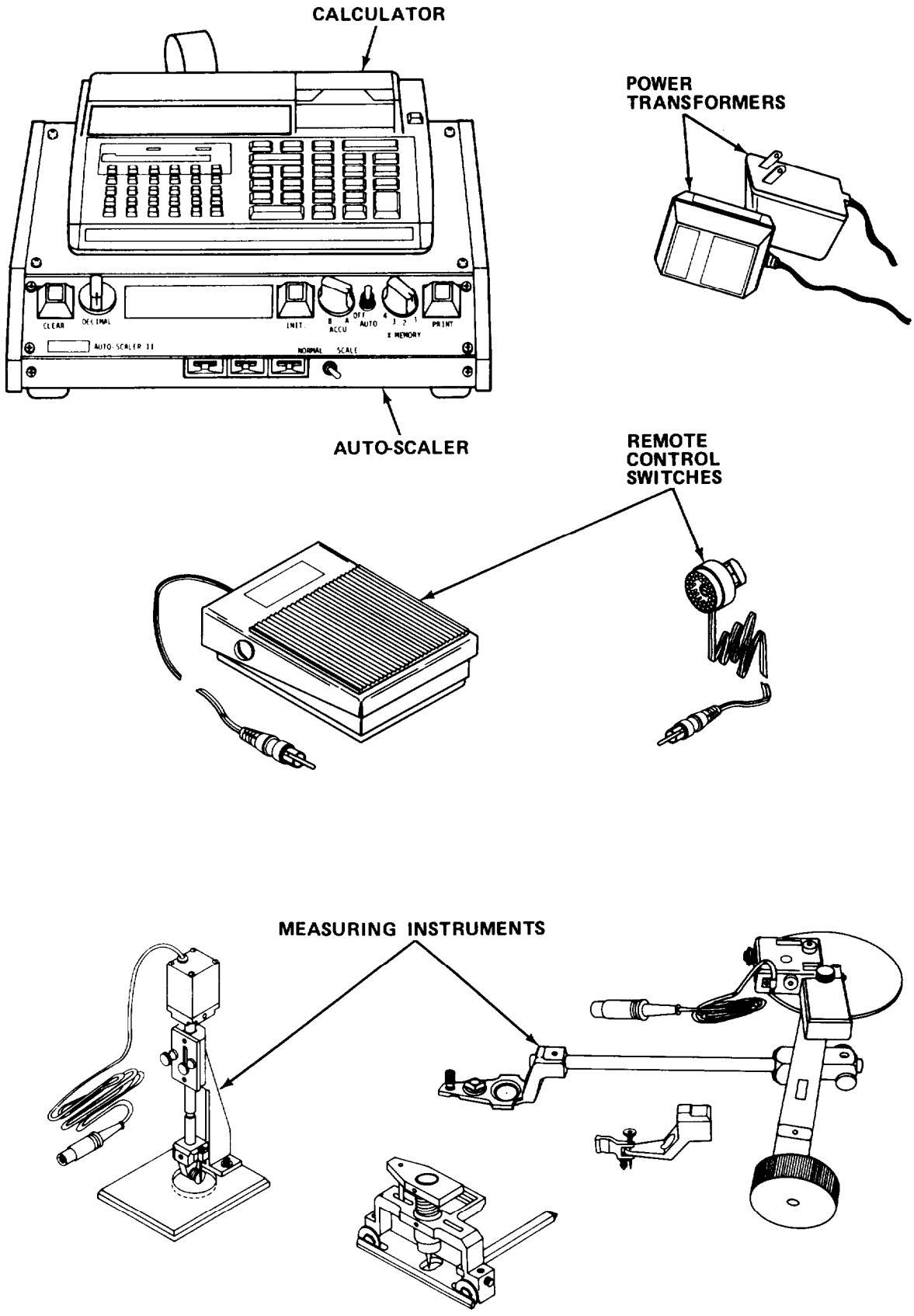
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn off power and unplug power cord.

b. Remove screws and washers securing optical system to bottom of crosspiece assembly. Remove defective optical system.

c. Install new optical system and secure with screws and washers.

d. Plug in power cord and turn on power.


CALCULATOR
POWER
TRANSFORMERS
CLEAR
DECIMAL
INIT.
B
A
ACCU
OFF
AUTO
4
3
2
1
X MEMORY
PRINT
AUTO-SCALER II
NORMAL
SCALE
AUTO-SCALER
REMOTE
CONTROL
SWITCHES
MEASURING INSTRUMENTS

CHAPTER 9

QUANTITY PROCESSING SYSTEM (QPS)

Section I INTRODUCTION

9-1. GENERAL INFORMATION.

9-1.1 Scope.

Model Number and Equipment Name. Model L2501 Quantity Processing System (QPS).

b. Purpose of Equipment. To provide electronic estimation, in proper units and scale, of area, perimeter, distance, and volume of geographic shapes found on maps, drawings and aerial photographs.

9-1.2 Reference Information. Numerical values shown on the Calibration Records Sheet, which is supplied with your QPS, must be used to successfully operate the equipment.

9-1.3 Glossary.

Constant	Factor used to convert electronic measurement counts of the planimeter or linear measuring probe, to desired unit of measurement.
Contour	Closed loop on contour map. Indicates height by interval.
Contour Interval	Difference in elevation of two consecutive contour lines.
Contour Method	Estimates volume of fill or cut from its contours.
Cut	Excavation or depression-like formation.
Daylighted Contour	Point or edge where cut becomes fill or fill becomes cut.
Fill	Embankment or hilly formation.

Planimeter	Instrument that provides data used to estimate area of geometric shape by tracing its boundary line.
QPS	Quantity Processing System
R_L or R2	Alinement reading of linear measuring probe representing total number of pulse counts emitted by probe, per unit of length.
R_T or R_1	Alinement reading of planimeter representing total number of pulse counts derived by measuring area described by a test rule.
Scale Ratio	Ratio between given distance on map or drawing to corresponding distance on ground.
Slope	Natural or artificial incline or slant of ground.
Subroutine	Distinct routine or program. Part of larger routine or program that will perform its own distinct functions when used.
Test Rule	Device used to aline planimeter and obtain a constant factor.
μ	Resolution factor for linear measuring probe or planimeter at specified tracer arm length. Represents smallest area or length measuring instrument can measure. Measuring instrument emits single pulse count for each unit.

9-2. EQUIPMENT DESCRIPTION.

9-2.1 Equipment Characteristics, Capabilities, and Features. Provides electronic estimation, in scale, of area, perimeter, distance, and volume of geometric shapes on maps, drawings, aerial photographs etc. The equipment has the following capabilities and features.

a. Calculator provides for data storage and manipulation.

b. Automatically estimates distance, area, or volume as measuring instrument is moved.

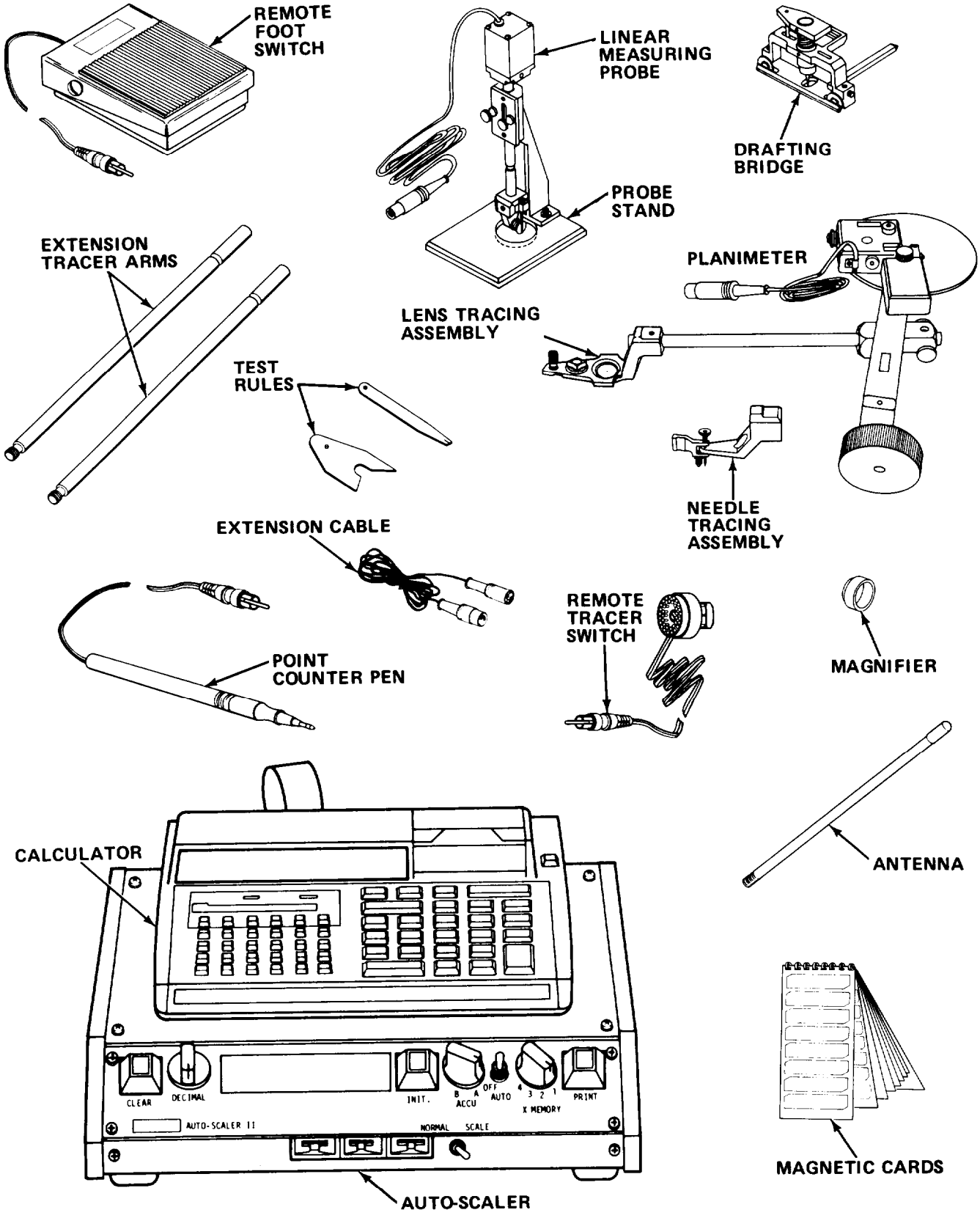
c. Displays results of measurement in proper scale and units.

d. Prints measurement automatically or on command.

e. Planimeter provides for measurement of surface area and volume.

f. Linear measuring probe provides for measurement of distances.

9-2.2 Location and Description of Major Components.



REMOTE FOOT SWITCH . Enables operator to remotely control four auto-scaler functions: Print, Clear, Actuate, or Initiate.

LINEAR MEASURING PROBE. Hand held or stand held measuring instrument. Measures distance.

PROBE STAND. Metal stand that holds linear measuring probe to secure its fixed position during measurements.

DRAFTING BRIDGE. Provides mount for planimeter encoder for use during measurements or detailed layout work.

PLANIMETER. Wheel mounted measuring instrument. Measures surface area and volume.

LENS TRACING ASSEMBLY. Assembly mounted on end of planimeter tracer arm. Traces lines by centering with a small dot printed on center of lens.

NEEDLE TRACING ASSEMBLY. Assembly mounted on end of planimeter tracer arm. Used to provide polar compensation in tracing measurements.

REMOTE TRACER SWITCH. Mounted on planimeter or drafting bridge. Enables operator to remotely control four auto-scaler functions: Print, Clear, Actuate, or Initialize. Provides remote operation of auto-scaler command switches.

MAGNIFIER. Placed over lens of lens tracing assembly to improve visibility of fine lines.

ANTENNA. Holds signal cables out of way of planimeter.

PREPROGRAMMED CARDS. Magnetic cards containing instructions to calculate, store, print, and display measurement input.

MAGNETIC CARDS. Blank cards used for recording original programs.

AUTO-SCALER. Counts pulses from measuring instruments. Displays count. Interfaces with calculator.

CALCULATOR. Calculates measurements according to program data. Displays results of measurements. Prints measurement results.

POINT COUNTER PEN. Pen that contains transducer. Pen emits one pulse for each stroke (count) made during count measurement.

EXTENSION CABLE. Used with planimeter to extend its reach.

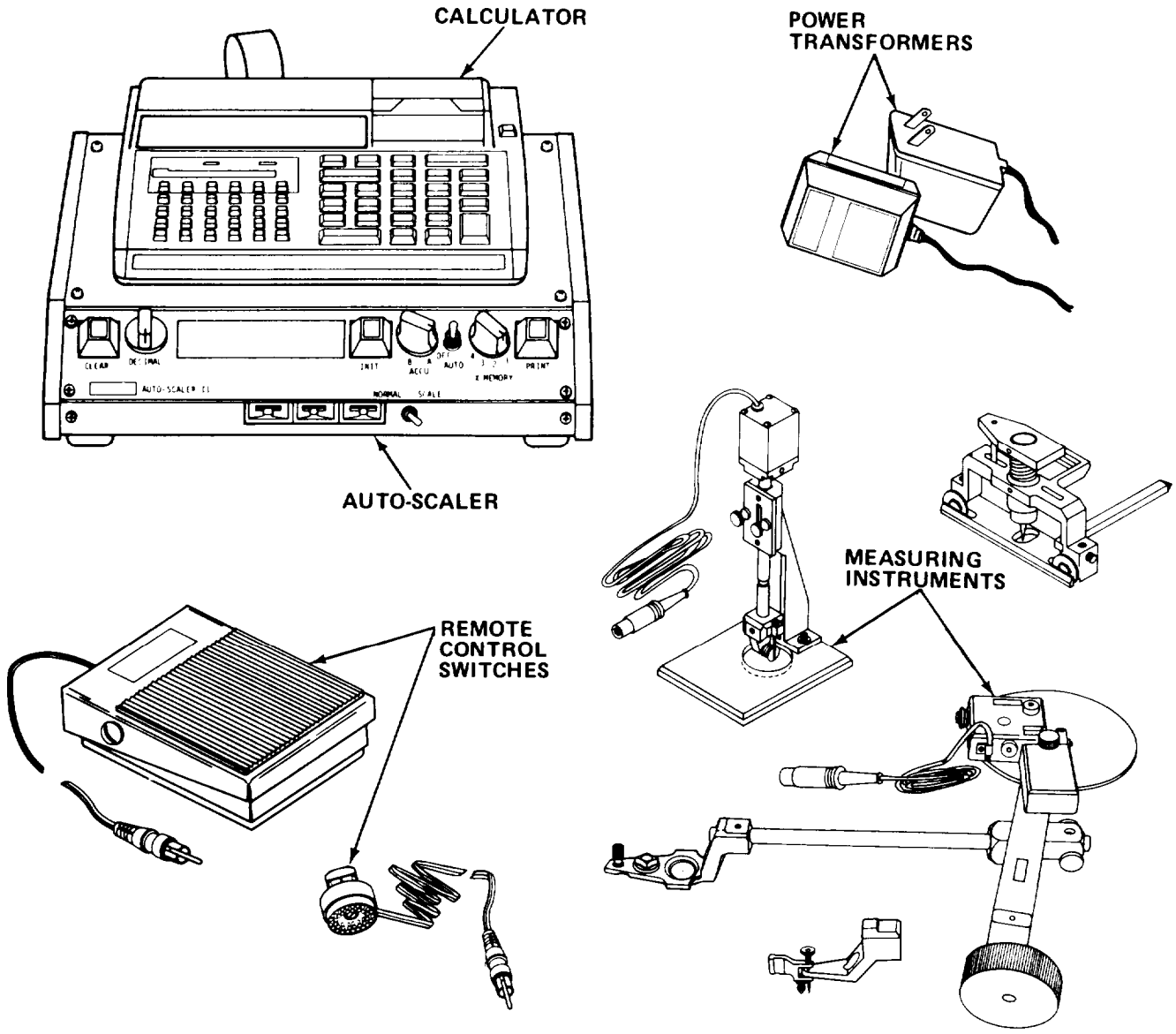
TEST RULES. Metal plates of specific lengths. Used for alinement and testing of planimeter.

EXTENSION TRACER ARMS. Extend reach of planimeter tracing assembly.

9-2.3 Equipment Data.

Quantity Processing System	
Total Weight	25 lbs (11.4 kg)
Power Requirements	
Calculator	110 V, 60 Hz
Auto-Scaler	110 V, 60 Hz
Linear Measuring Probe	
Weight	0.25 lb (0.11 kg)
Smallest measurable length	0.0014 in. (0.0356 mm)
Planimeter	
Weight	12 lbs (5.4 kg)
Maximum reach of tracer arm	45 in. (114.3 cm)
Smallest measurable length	0.002 in. (0.051 mm)
Smallest measurable area	0.0017 in2 (.011 cm^2)
Calculator	
Weight	2.5 lbs (1.14 kg)
Number of memory register	26
Program length	224 steps max
Operating time with battery	3 to 6 hours max
Battery Charge Time	6 hours (calculator off) 17 hours (calculator on)

9-3. TECHNICAL PRINCIPLES OF OPERATION. The QPS consists of five major components which interface with each other. The calculator and auto-scaler can be used independently from the system. When used as a total system, the QPS can provide advanced measurement capabilities. The five major components of the QPS are the measuring instruments, auto-scaler, calculator, remote control switches and power transformers.



9-3.1 Measuring Instruments. Provide an approximate measurement of a line or area by translating the movement of measuring instruments during tracing into electronic pulses. Measurement pulses (counts) are emitted as long as the measuring instrument is moving. The pulses (counts) are sent to the auto-scaler. There are four measuring instruments: planimeter, linear measuring probe, point counter pen and drafting bridge.

a. Planimeter. Used to trace the perimeter or boundary line of a plane figure. Pulses emitted during tracing are sent to the auto-scaler and counted. The count is then used in calculating the estimated area or volume measurement of the figure.

b. Linear measuring probe. Used to measure the length (distance) of curved or straight lines. The linear measuring probe emits pulses per unit of length measured. The pulses are sent to the auto-scaler and counted. The count is then used in calculating the estimated length or distance of line measured.

c. Point counter pen. Used to count items of a similar type found on a map, blueprint, plan, etc. Each time the point counter pen is stroked in counting, the transducer in the pen emits a signal pulse which is sent to the auto-scaler for totaling.

d. Drafting bridge. A layout instrument and mount for the encoder of the planimeter. When the encoder is moved from the planimeter and mounted on the drafting bridge, it can be used for linear measurement and detailed layout work.

9-3.2 Auto-Scaler. Processes pulses emitted by measuring instruments. The pulses are input into the rear of the auto-scaler through the applicable input jack (El, E2, or POINT COUNT). There are two modes of entry to the auto-scaler, NORMAL and SCALE. This is determined by the NORMAL/SCALE switch. When switch is on NORMAL, pulses bypass the scaler circuit and are applied to the decade up/down counter. When the switch is on SCALE, pulses are first input into the scaler circuit before counting. The auto-scaler has five functional components: scaler, decade up/down counter, LED display, calculator interface circuit, and command switches.

Scaler. Enables operator to perform a scale reduction of the pulse count. When activated by NORMAL/SCALE switch, the scaler uses a correction constant to divide input pulses. The correction constant is input by setting dials. Pulses are then sent to the decade up/down counter.

b. Decade up/down counter. Counts pulses received from the measuring instruments or scaler circuit. It counts up or down, depending on the direction that the measuring instrument is moved. The pulse count is continuously output to the calculator interface circuit and scaler LED display.

c. LED display. Displays current total of the decade up/down counter. The decimal place for the display is controlled by the DECIMAL switch.

d. Calculator interface circuit. Converts the pulse count into data compatible with the calculator and then transmits it through a ribbon cable to the calculator. Converts and transmits signals from the command switches. When switch is on AUTO, data is automatically and continuously transmitted to the calculator. When switch is on MAN, data is transmitted only when the PRINT command is received from the PRINT X command switch on the calculator.

e. Command switches. Control the operating modes of the auto-scaler, data transmission, and remote operation of the calculator. There are six command switches: CLEAR, PRINT, INIT, X MEMORY, MAN/AUTO, and ACCU.

(1) CLEAR. Command is sent to clear LED display on calculator and LED display and decade up/down counter on auto-scaler.

(2) PRINT. Command sent to signal calculator to implement instructions of subroutine E, stored in memory, which prints the pulse count data. PRINT also initiates transmission of that data for printing when auto-scaler is in MAN.

(3) INIT. Command sent to signal calculator to implement subroutine D, which resets memory data registers for the next set of data.

(4) X MEMORY. Has four settings: 1, 2, 3, and 4. Tells the calculator which primary register memory location (1, 2, 3, or 4), and its contents, is to be used in calculations.

(5) MAN/AUTO. Determines the mode of data transmission for the auto-scaler.

(6) B/ACCU/A/OFF. Controls the operating status of the decade up/down counter. There are four possible settings: OFF, A, ACCU, and B. OFF turns the auto-scaler OFF. A enables the decade up/down counter to increment the count, B enables it to decrement the count, and ACCU freezes the decade up/down counter at its current total.

9-3.3 Calculator. Performs manipulations and calculations on pulse count data, prints results and intermediate steps in the proper units on command, and stores data and programs. There are six functional parts: memory, logic circuitry, keyboard, LED display, magnetic card reader, and printer.

Memory. Stores pulse count data, constants, results of calculations, and subroutines containing programmed instructions (for using pulse count data and constants). In order to use the QPS, the programs with instructions for performing calculations are entered into the calculator memory. The memory is divided into three parts: automatic memory stack, storage registers, and program memory.

b. Automatic memory stack. Has four available locations (X, Y, Z, and T) which are used by the operator and the calculator in performing calculations. The logic circuitry uses the automatic memory stack in performance of its instructions and to store intermediate results of calculations.

c. Storage registers. Used to store special numbers such as pulse counts and constants. Each register can hold one constant number or command. Primary register R1 is directly connected to the calculator interface circuitry in the auto-scaler. Contents of storage registers are affected only by the keyboard or program command. The INIT signal begins a program which commands the calculator to clear the storage registers. The storage registers are divided into two parts: 16 primary registers and 9 secondary registers. The primary registers contain data and constants that need to be readily available and accessible for use. The MEMORY 1, 2, 3, or 4 signal is a release command for the contents of the corresponding primary register, R1, R2, R3, or R4. The remaining 12 primary registers are only used when operating programs. The secondary registers contain data that is not immediately needed. They are only accessible through the use of the special command key P ≷ S.

d. Program memory. Stores the instructions of a complete program or subroutine. Programs and subroutines are entered into the memory either manually, keyed in from the keyboard, or from a preprogrammed magnetic card. The programs are recalled by command each time new information must be processed. A subroutine automatically processes data and implements recorded instructions.

e. Logic circuitry. Performs all calculations, commands, and data and signal transfers. The logic circuitry is the interface for all external inputs, including auto-scaler signals, and directs all operations of the calculator.

f. Keyboard. Gives operator direct access and control of the calculator operation. Pressing a key results in the corresponding command or signal being sent to the logic circuitry and memory. The keyboard has two modes: **PRGM** (program) and **RUN.** In **PRGM,** all keystroke signals are entered into the memory and sent to the logic circuitry which identifies the location on the keyboard of the function, letter, or number the keystroke signal represents. In **RUN,** all keyboard signals are sent to the logic circuitry for implementation or transfer.

g. LED display. Displays last entry mode into calculator or contents of any memory register when commanded. Also provides all the visual indications of error conditions that may exist and the key code of each step of a program when being entered or run.

h. Magnetic card reader. Used to store programs and subroutines on magnetic cards. Reads and loads contents of preprogrammed cards into calculator memory.

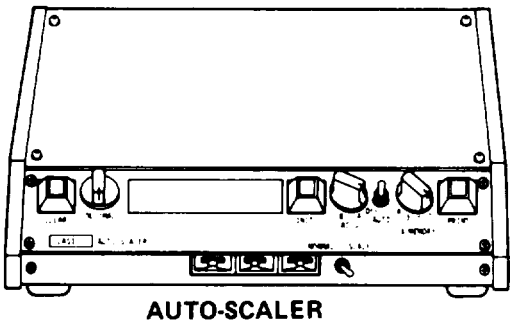
i. Printer. Provides hard copy of any data, calculation results, or program steps.

9-3.4 Remote Control Switches. The planimeter pushbutton remote tracer switch and foot switch enable the operator to remotely activate two of four possible signals: CLEAR, PRINT, INIT, or ACCU. The signals that the switches control depend on which input jacks the switches are plugged into.

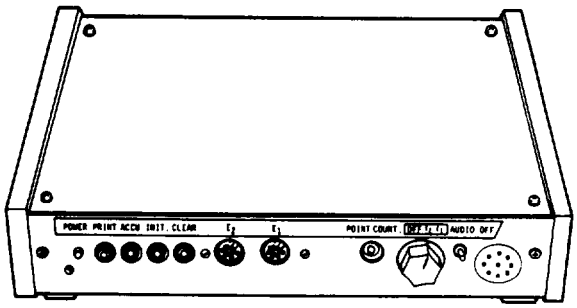
9-3.5 Power Transformers. Converts ac power to dc power on the auto-scaler. The calculator uses ac power.

Section II OPERATING INSTRUCTIONS

9-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



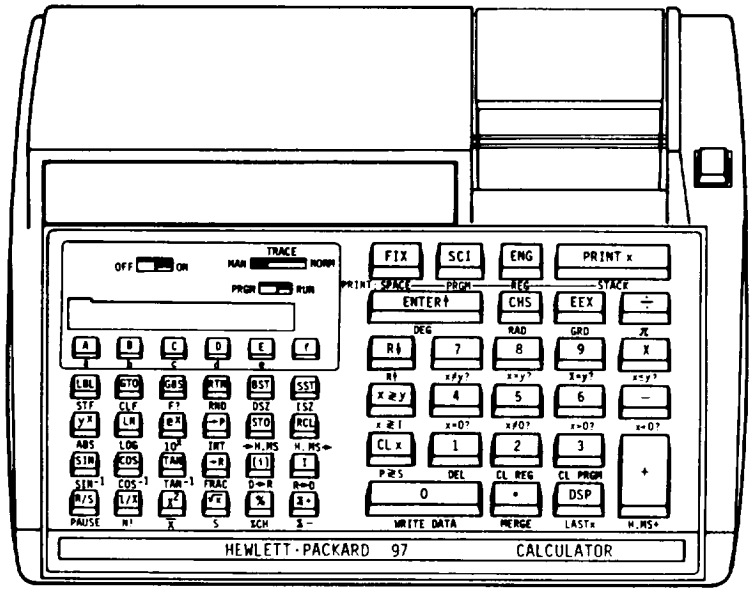
AUTO-SCALER



Key	Control or Indicator	Function
	CLEAR button	Clears all displays and memories.
	DECIMAL switch	Selects position of decimal point in auto-scaler display.
	LED indicator light	Indicates when pulse count is positive,
	LED display	Displays current pulse count total.
	SCALE dials	Inputs three most significant figures of constant into scaler.
	NORMAL/SCALE	In NORMAL, pulse count is not scaled.
		In SCALE, activates internal scaling circuit.
	INIT button	Sends initialize command signal to calculator.

Key	Control or Indicator	Function
	B/ACCU/A/OFF	Controls pulse counter: A: Count up B: Count down ACCU: Freeze count OFF: Turns auto-scaler off.
	MAN/AUTO switch	Controls pulse count sent to calculator. MAN count is sent when PRINT is activated. AUTO count is sent automatically.
	X MEMORY switch	Selects memory register 1, 2, 3, or 4 to be used in calculator.
	PRINT switch	Sends print command to calculator and auto-scaler.
	POWER supply jack	Input for power transformer plug.
	PRINT input jack	Input for remote tracer switch or foot switch plug, used to activate print command.
	ACCU input jack	Input for foot switch or remote tracer switch plug used to activate actuate command.
	INIT input jack	Input for foot switch plug used to activate initialize command.
	CLEAR input jack	Input for foot switch plug used to activate clear command.
	E_2 encoder socket	Input for linear measuring probe.
	E_1 encoder socket	Input for planimeter.
	POINT COUNT input jack	Input for point counter pen.

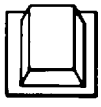
Key	Control or Indicator	Function
	OFF/E_2/E_1 switch	Selects input from linear measuring probe, plani - meter, or turns on input.
	AUDIO/OFF switch	Used to turn audio alarm on or off.
	Audio alarm	Emits audible tone each time pulse (stroke count) is received from point counter pen.



CALCULATOR

NOTE

Numbers, letters, symbols, and words that are on top of the calculator keys will be boxed throughout the text.

	LED Display	Displays numbers or message.
	Paper Advance Button	Advances printer paper.
OFF  ON	OFF/ON Switch	Turns calculator on or off.

Key	Control or Indicator	Function
MAN TRACE NORM	MAN/TRACE/NORM switch	Selects operating mode for printer. MAN : Print only when commanded. TRACE : Prints intermediate and final calculations as they are performed. NORM : Prints entry-by-entry records of entries and commands.
PRGM RUN	PRGM/RUN switch	Selects operating mode of calculator. RUN : Operates normally, PRGM : Used to manually enter program.
f	Function prefix key	Shifts next keystroke to activate function written beneath a key.
ENTER↑ **DEG**	Enter/Degrees key	ENTER : Value in X-register is stored in Y-register. DEG : Instructs calculator that units for all angles and trig calculations will be in degrees.
PRINT X	Print X/Stack key	PRINT X : Value of display is printed.
PRINT:STACK	Print/Stack	STACK : Used to print contents of entire automatic memory stack.

Key	Control or Indicator	Function
[FIX] **PRINT:SPACE**	FIX/SPACE key	[FIX] : Fixes decimal point of LED display to one position. SPACE : Instructs printer to advance paper one line.
[ENG] **PRINT:REG**	Engineering Notation/ Register key	[ENG] : Instructs LED display to display all numbers in engineering notation. PRINT:REG : Instructs printer to print contents of all primary storage registers.
[CHS] **RAD**	Change Sign/Radians key	[CHS] : Change sign of number or exponent in X-register (LED display). RAD : Instructs calculator that units for all angles and trig calculations will be in radians.
[EEX] **GRD**	Exponents/grads key	[EEX] : Numbers keyed in after pressing EEX are to be displayed as exponents of 10. GRD : Instructs calculator that units for all angles and trig calculations will be in grads.
[÷]	Divide arithmetic/π key	[÷] : Divides number in Y-register by number in X-register.
π		π : Enters value of pi into X-register.

Key	Control or Indicator	Function
[x] x ≤ y?	Multiply arithmetic/X<Y? key	[x]: Multiplies number in Y-register by number in X-register. X≤ y?: Used in program. Compares numbers in X- and Y-memories. If X is less than or equal to Y, next step in program is performed. If X is not less than or equal to Y, test is negative and calculator skips next step in program.
[-] **X<0?**	Subtract arithmetic/X<0? key	[-]: Subtracts number in X-memory from number in Y-memory. X<0?: Used in programs to compare number in X-register to 0. If X is less than 0, calculator performs next program step. If X is not less than 0, calculator skips next program step.
[+] **H. MS+**	Add arithmetic/Hours, Minutes, Seconds key	[+]: Adds number in X-register to number in Y-register. H.MS+: Adds hours, minutes, and seconds, or degrees, minutes and seconds in the Y-register to those displayed in the X-register.
[R↓] **R↑**	R↓/R↑ roll stack key	[R↓]: Instructs calculator to roll down contents of automatic memory stack (X, Y, Z, and T) into X-register. Each time new number is displayed, old one moves to top of stack. First value moved is in Y-register.

Key	Control or Indicator	Function
		f/1: Instructs calculator to roll up contents of automatic memory stack (X, Y, Z, and T) into X-register, starting with number in T-register.
[X≷Y] X≷I	X≷Y/X≷I manipulation key	[X≷Y] : Interchanges numbers in X- and Y-memory registers. X≷I : Interchanges numbers in X- and I-memory registers.
[CL X] P≷S	Clear X/P≷S key	[CL X] : Clears contents of X-memory register (LED display) to zero. P≷S : Interchanges contents of primary memory registers with contents of secondary memory registers.
[0] WRITE DATA	0/Write Data key	[0] : Enters number 0 into X-memory register (LED display). WRITE DATA : If a magnetic card is passed through the card reader immediately after this operation, the contents of the storage registers are recorded on the card.
[·] MERGE	Decimal Point/Merge key	[·] : Enters decimal point in desired position in X-memory (LED display) register. MERGE : Merges, rather than overwrites, data on program from magnetic card with data or program in calculator.

Key	Control or Indicator	Function
[1] **DEL**	1/Delete key	q : Enters number 1 into desired position in X register (LED display). DEL : Deletes current instructions from program memory. All subsequent instructions moved up one step.
[2] **CL REG**	2/Clear register key	[2] : Enters number 2 into desired position in X-register (LED display). CL REG : Clears contents of all primary memory registers.
[3] **CL PRGM**	3/Clear program key	El : Enters number 3 into desired position in X-register (LED display). CL PRGM : (In PRGM) Clears calculator's program memory down to all [R/S] (Run/Stop) instructions, and clears all flags. Sends calculator to step 000 and instructs it to operate in [FIX] [2] and DEG mode.
[6] **X > 0 ?**	6/X > O? key	[6] : Enters number 6 into desired position in X-register (LED display). X>0? : Used in program. Compares number in X-memory register to 0. If X is greater than 0, calculator executes next program step. If X is 0 or less than 0, calculator skips next program step and executes the following step.

Key	Control or Indicator	Function
7 X≠Y?	7/X≠Y key	7 : Enters number 7 into desired position in X-register (LED display). X≠Y? : If X is not equal to Y, calculator skips one step before continuing program.
8 X=Y?	8/X=Y? key	8 : Enters number 8 into desired position in X-register (LED display). X=Y? : If X equals Y, calculator will execute next instruction in program.
4 X=0?	4/X=0? key	4 : Enters number 4 into desired position in X-register (LED display). X=0? : Compares number in X-register to 0. If X equals 0, calculator executes next program step. If X is not 0, calculator skips next step and executes the following step.
5 X≠0?	5/X≠0? key	5 : Enters number 5 into desired position in X-register (LED display). X≠0? : Compares number in X-register to 0. If X is not 0, calculator executes next program step. If X is 0, calculator skips next step and executes the following step.

Key	Control or Indicator	Function
[9] X=Y?	9/X-Y? Key	[9] : Enters number 9 into desired position in X-register (LED display). X=Y? : Compares number in X-register to Y-register. If X is equal to Y, calculator executes next program step. If not, it skips the next step and executes the following step.
[A] a [B] b [C] c [D] d [E] e	A/a through E/e **NOTE** Small letter labels a through e are called with [f] prefix key.	Used to assign user-defined labels. With calculator in PRGM, pressing [LBL] and label key or [LBL], [f], and label key assigns that label to routine or subroutine within a program. In RUN, calculator searches program memory for that label. Calculator begins execution of program memory at that point. [GTO] or [GSB] followed by label key or [f], label key: Calculator stops execution, searches memory for designated label, and begins execution there.

Key	Control or Indicator	Function
LBL STF	Label/Set Flag key	LBL : In PRGM, enters label designation A/a through E or 0 through 9 into program step. In RUN, calculator searches program memory for designated label and begins execution there. STF : Followed by flag designation 0, 1, 2, or 3, sets designated flag.
GTO CLF	Go to/Clear flag key	GTO : When calculator is in PRGM, GTO followed by 0 and three digit step number sets calculator to three digit step number of program memory. No instructions are executed. When calculator is in RUN, GTO followed by . and three-digit step number sets calculator to three-digit step number of program memory. No instructions are executed. In RUN, followed by label designator A/a through E/e or 0 through 9, sends calculator to first designated label in memory. CLF : Followed by flag designation 0, 1, 2, or 3, clears designated flag.

Key	Control or Indicator	Function
RCL H.MS→	Recall/Hours, Minutes, Seconds key	RCL : Followed by address of memory register, places value of that register into X-register (LED display). H.MS : Converts hours, minutes, seconds, or degrees, minutes, seconds displayed in X-register to decimal hours or degrees.
SIN SIN^{-1}	Sin/Arc Sine trig key	SIN : Computes sine of number in X-register. SIN^{-1}: Computes arc sine of number in X-register.
COS COS^{-1}	Cosine/Arc Cosine trig key	COS : Computes cosine of number in X-register. COS^{-1}: Computes arc cosine of number in X-register.
(i) D→R	Register/D-R key	(i) : Subtracts 1 from contents of storage register specified by value in I. Skips one step if value is then O. D → R: Converts degrees displayed in X-register to radians.
RTN RND	Return/round key	RTN : Followed by 000, returns calculator to step 000 of program memory. When encountered as step in program or subroutine, returns calculator to first step of that program or subroutine.

Key	Control or Indicator	Function
		RND : Rounds mantissa of 10-digit number in X-register to that of actual value seen in display.
[BST] DSZ	Back Step/Decrement and Skip if 0 key	[BST] : In PRGM, moves calculator back one step in program memory to previous input. In RUN, stops program and moves calculator back one program step in memory. Original X-register contents return when key is released. DSZ : Followed by [I] subtracts 1 from contents of [I] .
[STO] →H.MS	Store/Hours, Minutes, Seconds key	[STO] : Followed by address key ([0] through [9] or [A] through [E]), stores displayed number in corresponding primary memory register: R through R_9, R_A through R_E or I. →H.MS : Converts decimal hours or degrees in X-register to hours, minutes, seconds or degrees, minutes and seconds.
[I] R→D	I-Register/R-D key	[I] : Recalls number in I-register into X-register. R - D : Converts radians in X-register to degrees.

Key	Control or Indicator	Function
[R/S] PAUSE	Run/Stop/Pause key	[R/S] : In RUN, begins program execution. If program is already running, pressing [R/S] stops program. If encountered in program as program step, program stops at that point. PAUSE : Momentarily stops running program and transfers control to keyboard for 1 sec.
[SCI] **PRINT:PRGM**	Scientific notation/ Print Program key	[SCI] : Selects scientific notation display. PRINT:PRGM : Prints program.
[GSB] **F?**	Go to subroutine/flag key	[GSB] : Causes calculator to begin executing instructions. F? : Is flag true? When followed by designator, it tests flag. Clears flags after testing.
[SST] **ISZ**	Single step/increment	[SST] : Moves calculator forward one step in program memory. ISZ : Increments value in I register.
[→R] **FRAC**	Polar magnitude/fraction	[R] : Converts polar magnitude X and angle Y in X- and Y-registers to rectangular X and Y coordinates. FRAC : Leaves only fractional portion of number in X-register.

Key	Control or Indicator	Function
y^x ABS	Exponent/absolute value	y^x : Raises number in Y-register to power of number of X-register. ABS : Gives absolute power of number in X-register.
LN LOG	Natural logarithm	LN : Computes natural logarithm of number in X-register. LOG : Computes common logarithm of number in X-register.
e^x 10^x	Antilogarithm/common	e^x : Natural antilogarithm. Raises e to power of number in X-register. 1 0^x : Common antilogarithm. Raises 10 to power of number in X-register.
→P INT	Polar, rectangular conversion/integer	→P : Converts X and Y rectangular coordinates placed in X- and Y-registers to polar magnitude and angle. INT : Leaves only integer part of number in X-register.
TAN TAN^{-1}	Tangent/arc tangent	TAN : Computes tangent of value in X-register. TAN-1 : Computes arc tangent of number in X-register.
1/X N!	Reciprocal/factoral	1/X : Computes reciprocal of number in X-register. N! : Computes factoral of number in X-register.

Key	Control or Indicator	Function
[x²] $\bar{X}$	Square/average	[x²]: Computes square of number in X-register. $\bar{X}$: Computes mean (average) of X and Y values.
[√x] S	Square root/standard deviation	[√x] : Computes square root of number in X-register. S: Computes sample standard deviations of X and Y values.
[Σ+] Σ-	Accumulate/subtract	[Σ+] : Accumulates numbers from X- and Y-registers into secondary storage registers. Σ- : Subtracts X and Y values from storage registers.
[DSP] LAST X	Display/recall	[DSP] : Followed by number key, selects number of displayed digits. LAST X: Recalls number displayed before previous operation back into X-register
[%] % CH	Percent/change	[%] : Computes X% of Y. % CH: Computes percent of change from number in Y-register to number in X-register.

9-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

9-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Brush	1 ea
Cheesecloth (Item 7, Appendix E)	ar
Calculator Head-Cleaning Card	1 ea
Isopropyl Alcohol (Item 4, Appendix E)	ar
Cotton Swabs (Item 8, Appendix E)	ar

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before **W - Weakly** **AN - Annually** **(Number) - Hundreds of Hours**
D - During **M - Monthly** **S - Semiannually**
A - After **Q . Quarterly** **BI - Biennially**

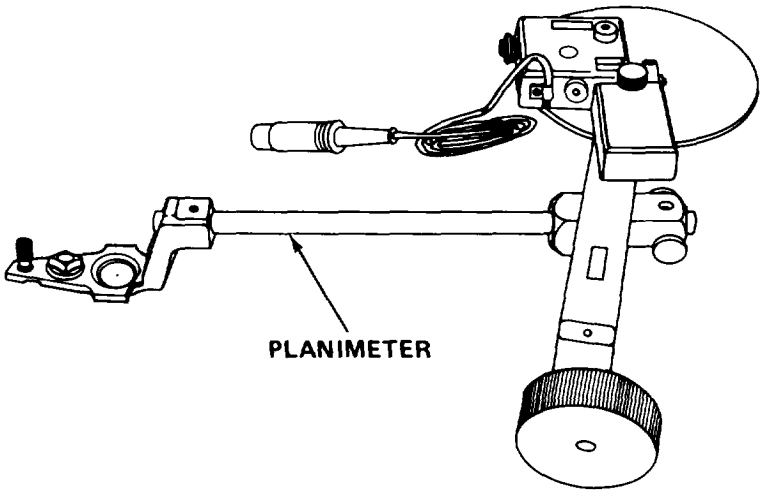
ITEM NO	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER)	
			
1	B	Inspect Planimeter.	
		1. Check wheels, lens tracing assembly, axle, and paper disk for dirt, cracks, and breaks. Clean with soft brush. Replace paper disk as needed (paragraph 9-10.4).	Components are dirty or broken.
		2. Check planimeter drive gears for dirt or breaks. Check for jammed or loose drive gears.	Drive gears are damaged.
		3. Check teflon guide washer underneath tracing lens for cracks, dirt, or looseness. Clean with soft brush. Replace teflon guide washer as needed (pararaph 9-10.2).	Teflon guide washer is dirty or cracked.

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A-After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannuelly BI - Biennially | (Number) - Hundreds of Hours

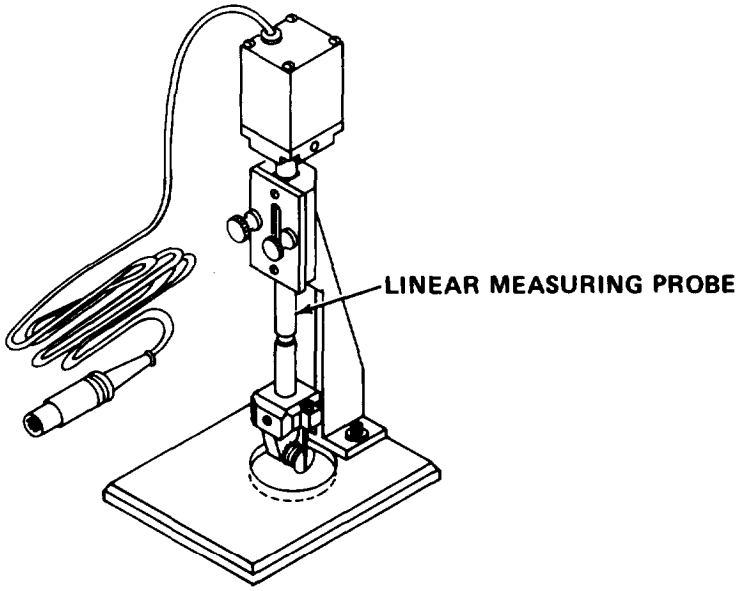
ITEM NO	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
2	B	Inspect Linear Measuring Probe.	
			
		1. Check case, stand, guiding wheel, and gears for cracks, breaks, or dirt. Clean with soft brush.	Linear measuring probe is damaged.
		2. Clean base of measuring probe with soft brush.	
		3. Remove dirt from linear measuring probe gears with soft brush.	Linear measuring probe is dirty.

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B . Before
D - During
A - After

W - Weekly
M . Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

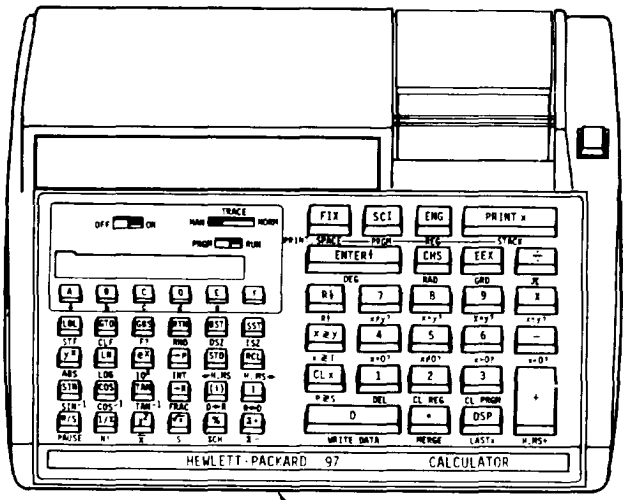
ITEM NO	IN-TER VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
3	B	**Inspect Calculator.**	
		 CALCULATOR	
		1. Inspect keyboard, battery pack, display, and casing for cracks or breaks. Replace calculator as needed.	Calculator is damaged,
		CAUTION Do not allow alcohol to touch any part of the calculator. Damage to calculator could result.	
		2. Inspect calculator battery pack contacts. Clean with cotton swabs moistened with alcohol.	Battery pack contacts are dirty.

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

ITEM NO,	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
3	B	Inspect Calculator - Cont	
		3. Inspect ribbon cable and power jacks for cracks or breaks.	Ribbon cable or power jacks are damaged.
		4. Wipe dirt and dust from calculator with soft cloth.	
		CAUTION Use head cleaning card only after continued use of preprogrammed card. Head cleaning card is abrasive. Damage to calculator reader could result.	
		5. Clean magnetic card reader heads with head cleaning card.	
3	M	Wipe magnetic cards with soft cloth moistened with alcohol.	

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

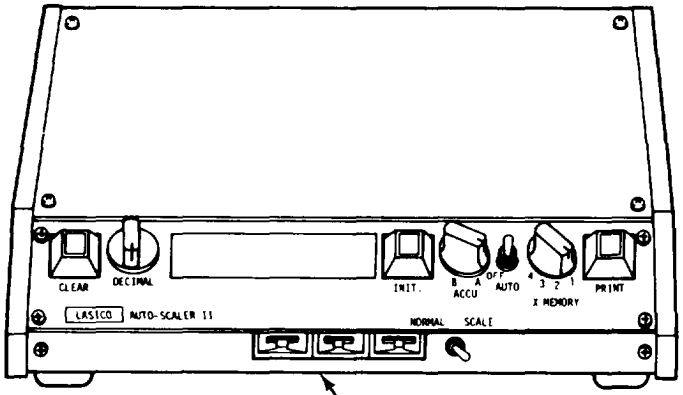
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
4	B	Inspect Auto-Scaler.	
		 AUTO-SCALER	
		1. Inspect front panel, back panel, and casing for dirt, cracks, or breaks. Clean with soft brush.	Auto-scaler is damaged.
		2. Inspect power jacks on back of auto-scaler for breaks or loose fittings.	Power jacks are broken or loose.

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before, D - During, A - After | W - Weekly, M - Monthly, Q - Quarterly | AN - Annually, S - Semiannually, BI - Biannually | (Number) - Hundreds of Hours

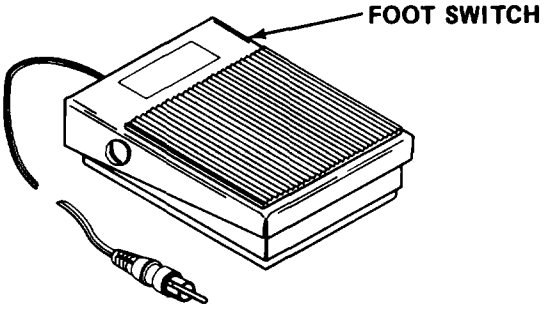
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANITITY PROCESSING SYSTEM (PLANIMETER) - Cont	
5	B	Inspect Foot Switch.	
			
		1. Inspect foot switch for cracks or breaks.	Foot switch is damaged.
		2. Inspect foot switch cord for frays or breaks.	Foot switch cord is damaged.

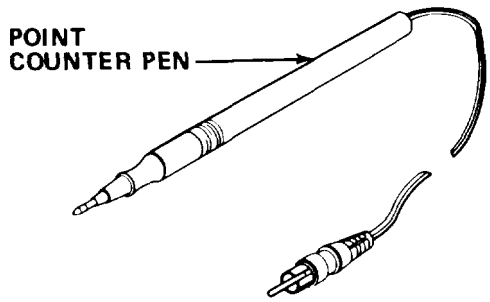
Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

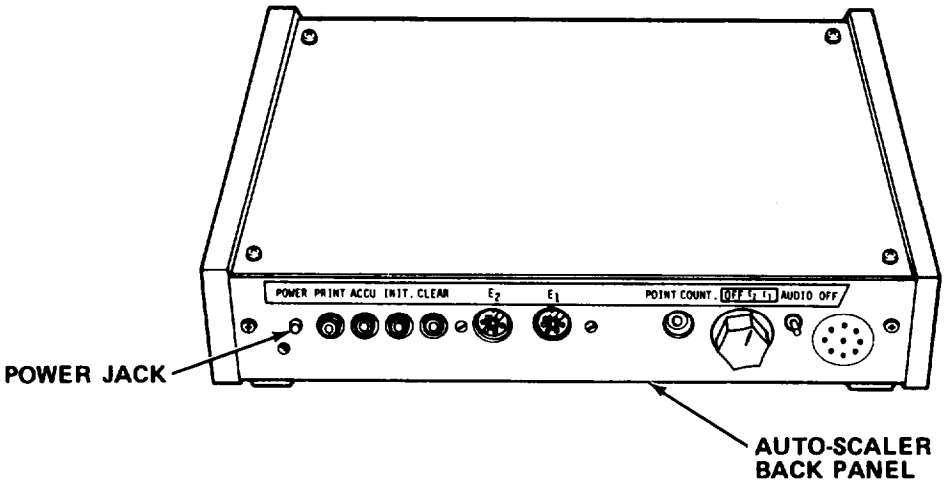
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
6	B	Inspect Point Counter Pen.  1. Inspect pen for cracks or breaks. 2. Inspect point counter pen cord for breaks or frays.	Point counter pen is damaged. Point counter pen cord is damaged.

9-6. OPERATION UNDER USUAL CONDITIONS.

9-6.1 Assembly and Preparation for Use.

a. Remove auto-scaler from case. Set on table near drawing, map, or photograph to be measured.

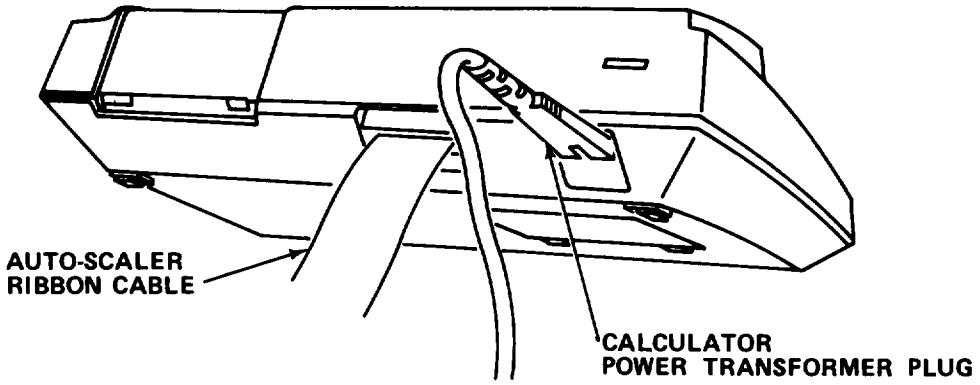
b. Remove calculator from case. Place on top of auto-scaler with keyboard facing front of auto-scaler.



CAUTION

Do not plug power transformer into power supply rated over 125 V ac. Permanent damage to auto-scaler may occur.

c. Plug auto-scaler power transformer plug into power supply jack on auto-scaler back panel.



CAUTION

Arrows on calculator and ribbon cable must aline. Damage to calculator may occur if cable is plugged in backward.

d. Plug auto-scaler ribbon cable into cable jack in back of calculator.

CAUTION

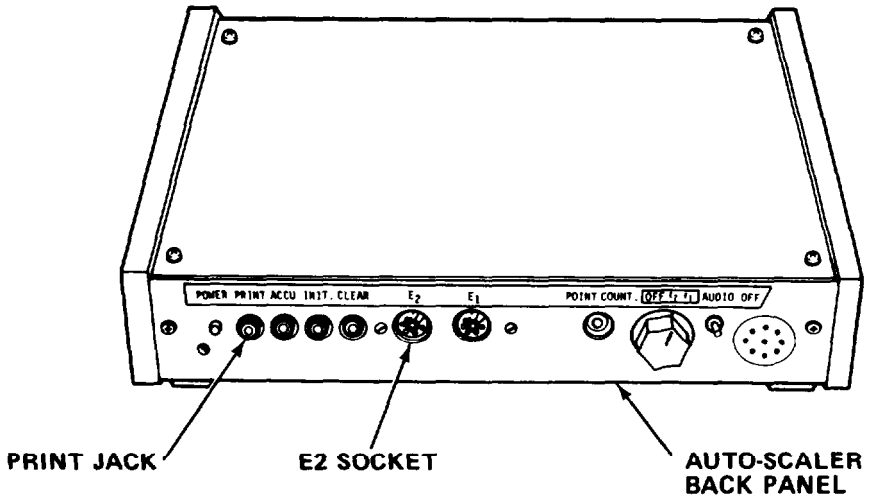
Do not plug power transformer into power supply rated over 125 V ac. Permanent damage to calculator may occur.

e. Plug calculator power transformer into power jack on calculator back panel.

CAUTION

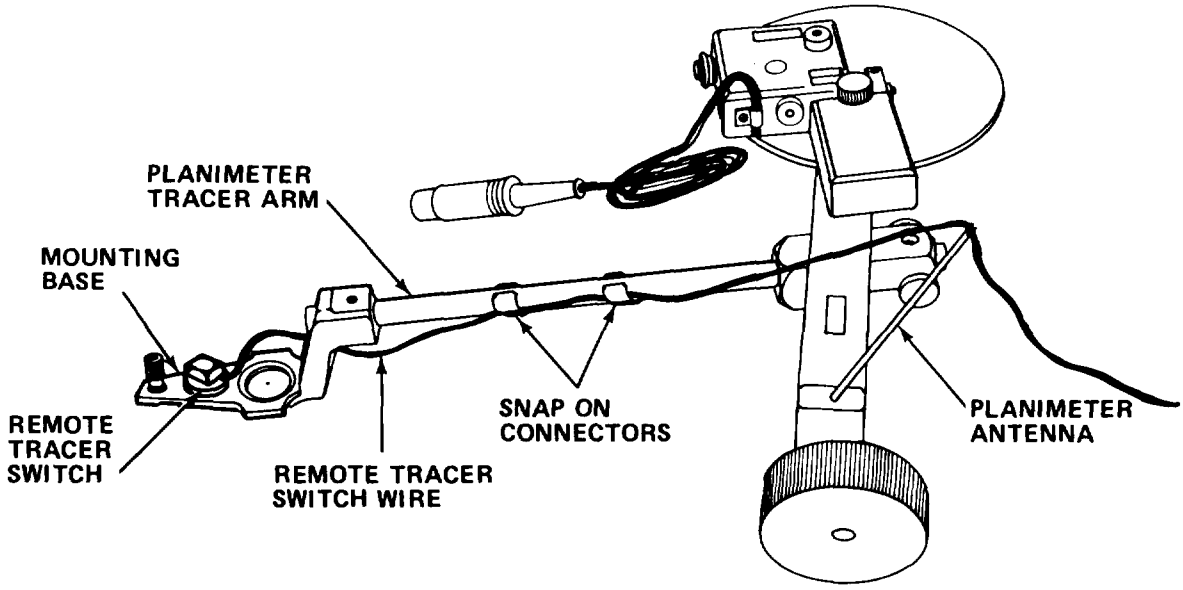
Always carry planimeter by top. Damage to planimeter o rmisalinement may occur.

f. Carefully remove planimeter from case. Place planimeter on table near auto-scaler.



g. Plug planimeter into E_2 encoder socket on auto-scaler back panel.

h. Remove remote tracer switch from case. Plug into PRINT input jack on auto-scaler back panel.

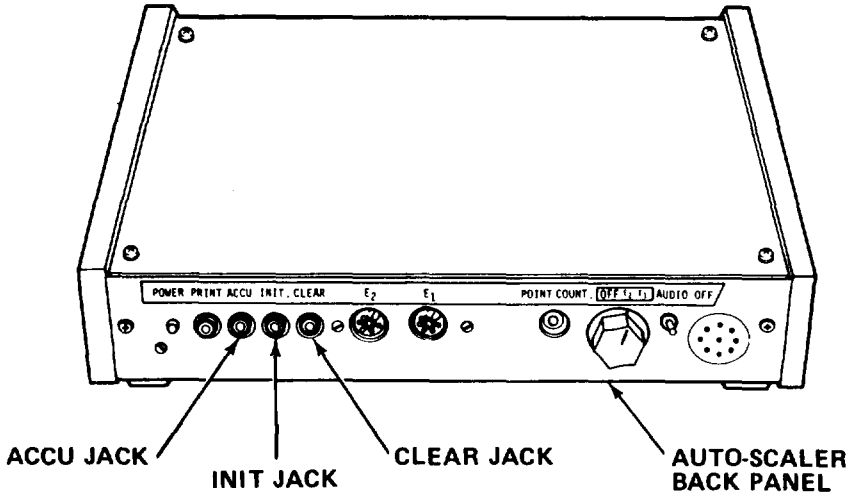


i. Mount remote tracer switch on mounting base at end of planimeter tracer arm by pressing against mounting base.

j. Remove planimeter antenna from case. Screw into hole on top of planimeter body.

k. Attach remote tracer switch wires to tracer arm with snap-on connectors.

l. Remove cap from antenna and guide remote tracer switch wires through slotted end of antenna. Replace cap.



m. Remove foot switch from carrying case. Plug into CLEAR, INIT, or ACCU input jack on auto-scaler back panel.

n. If using point counter pen, remove from case. Plug into POINT COUNT jack on auto-scaler back panel.

o. If using linear measuring probe, remove from case. Plug into E_1 encoder socket on auto-scaler back panel.

p. Plug both power transformers into 120 V ac outlets.

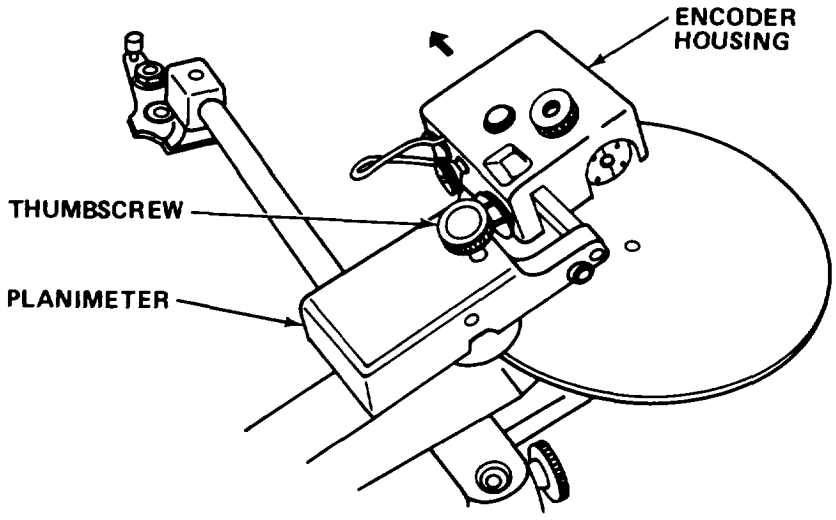
9-6.2 Operating Procedures. The QPS provides for estimation of distance, area, perimeter and volume of geographic shapes found on maps, drawings, and aerial photographs. It is precisely set and alined at the factory. Factory determined values, necessary for accurate calculations and estimations, are different for each QPS. The formulas and values on the Calibration Records Sheet, provided with the equipment, must be used in order to obtain correct results from measurements.

INDEX OF OPERATING PROCEDURES

INDEX OF OPERATING PROCEDURES - Cont

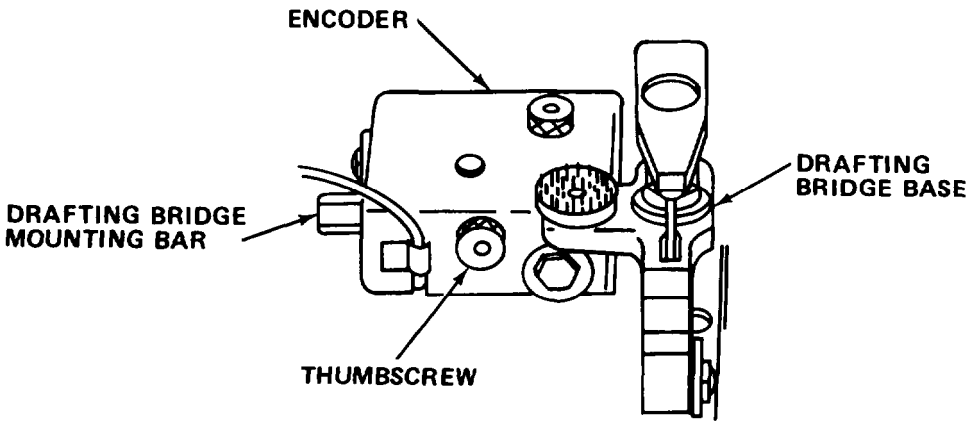
INDEX OF TABLES

a. Mounting drafting bridge assembly.



(1) Loosen thumbscrew holding encoder housing on planimeter.

(2) Grasp encoder housing and slide off mounting bar.



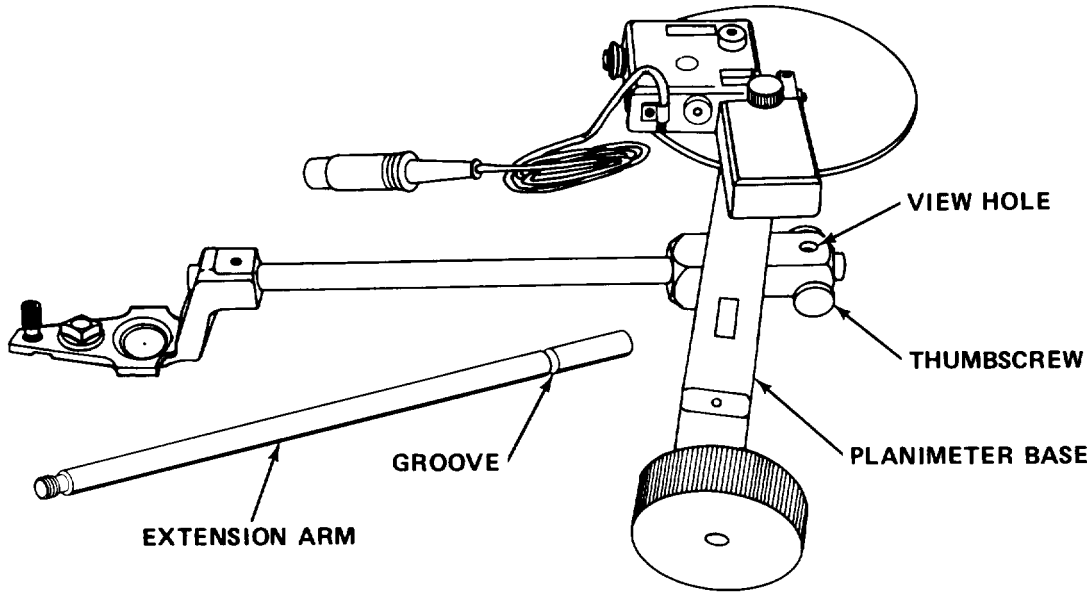
(3) Slide encoder onto drafting bridge mounting bar until it fits snugly against drafting bridge base.

(4) Tighten thumbscrew to secure.

(5) Remove remote tracer switch from end of planimeter.

(6) Mount remote tracer switch on mounting base of drafting bridge.

b. Mount tracer arm extension assembly.



(1) Remove desired lengths of tracer arm extension from case.

CAUTION

Do not release hold on planimeter when tracer arm is removed. Planimeter will turn on its side. Damage to planimeter disk may occur.

(2) Loosen two thumbscrews at back of tracer arm.

(3) Hold tracer arm with one hand. With other hand, slide tracer arm out of planimeter base.

(4) While still holding planimeter, slide one end of extension arm into tracer arm slot on planimeter base. Move extension arm until groove in end lines up with view hole in tracer arm slot.

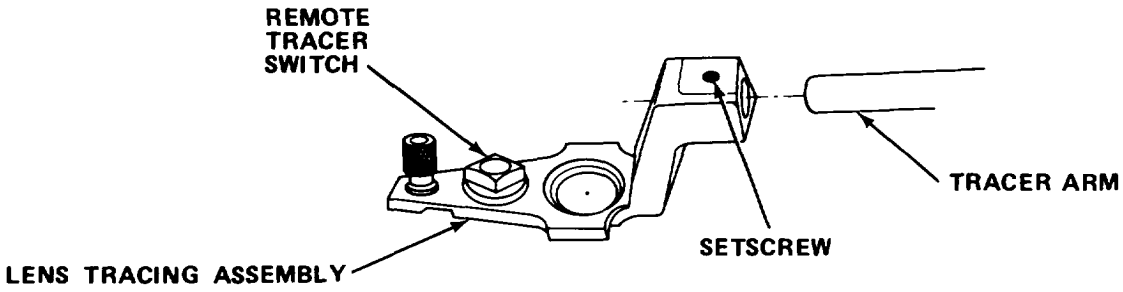
NOTE

Different tracer arm lengths with same tracer arm can be obtained by loosening two thumbscrews and sliding tracer arm in and out of its slot. Tracer arm lengths should be premarked short, medium, or long. If any other tracer arm length is desired, planimeter must be realined.

(5) Tighten two thumbscrews to secure tracer arm extension. Be sure lens tracing assembly is flat on table surface.

(6) Readjust encoder and remote tracer switch wires through antenna.

c. Mounting needle tracing assembly.

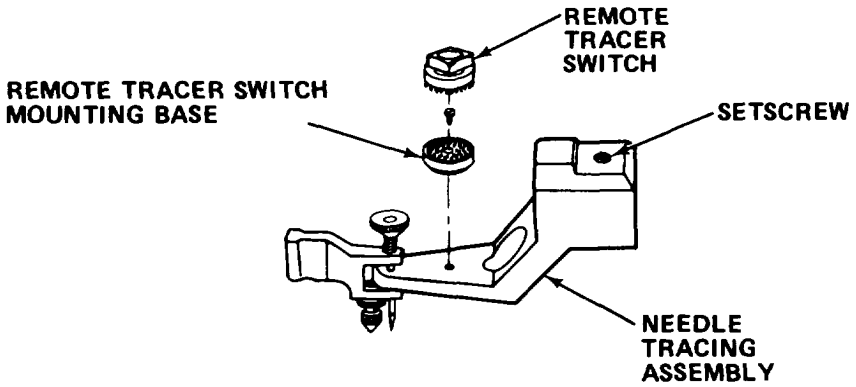


(1) Remove remote tracer switch from lens tracing assembly.

CAUTION

Hold tracer arm while removing lens tracing assembly. Planimeter will turn on its side. Damage to planimeter disk may occur.

(2) Loosen setscrew. Slide lens tracer assembly from tracer arm, remove.

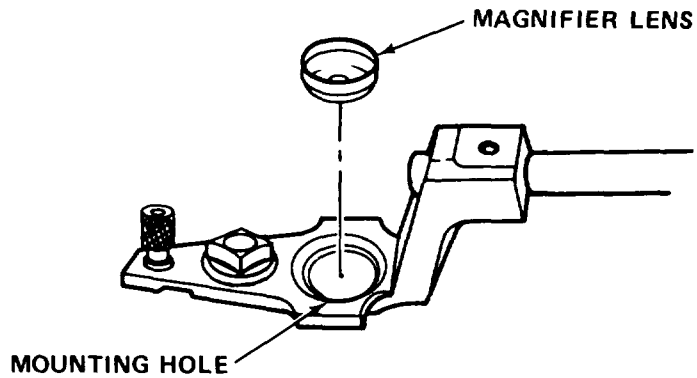


(3) Slide needle tracing assembly onto tracer arm. Tighten setscrew to secure.

(4) Screw remote tracer switch mounting base into needle tracing assembly. Snap remote tracer switch into needle tracing assembly.

d. Mounting magnifier in lens tracing assembly.

(1) Remove magnifier lens from carrying case.



CAUTION

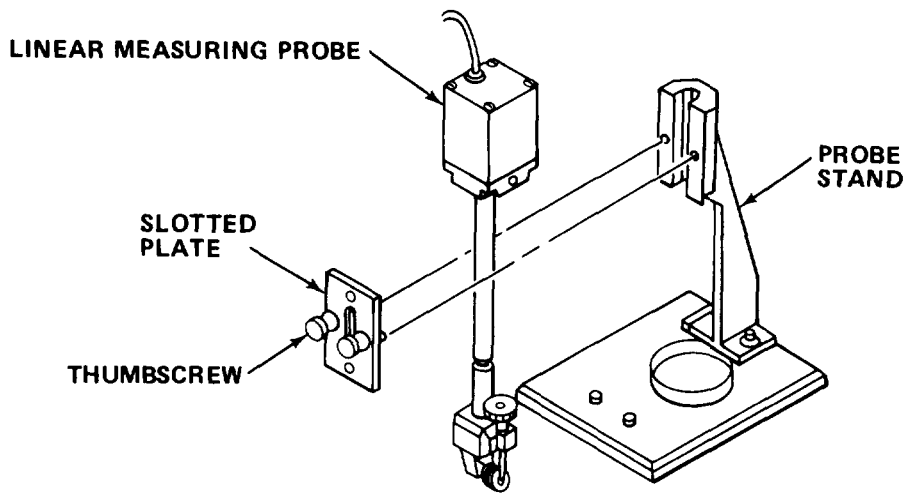
Do not touch optical surface with bare fingers. Viewing will be impaired.

(2) Holding lens by edges, drop into mounting hole.

(3) Press lens into place with finger wrapped in tissue.

e. Mounting linear measuring probe in stand.

(1) Remove linear measuring probe and probe stand from case.



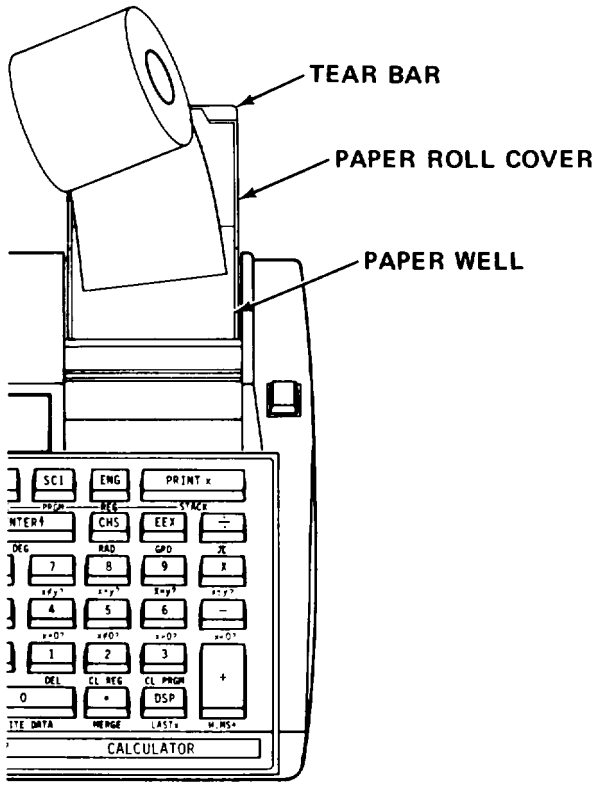
(2) Remove two thumbscrews on front of probe stand that hold slotted plate. Remove slotted plate.

(3) Place linear measuring probe into recess under slotted plate.

(4) Set linear measuring probe so that alinement stud is in center of recess and facing front.

(5) Reinstall slotted plate. Secure with two thumbscrews.

f. Installing paper in calculator.



(1) Open paper roll cover. Remove empty core from paper well.

(2) Remove first two inches of paper from new roll before installing.

(3) Fold and crease leading edge of paper.

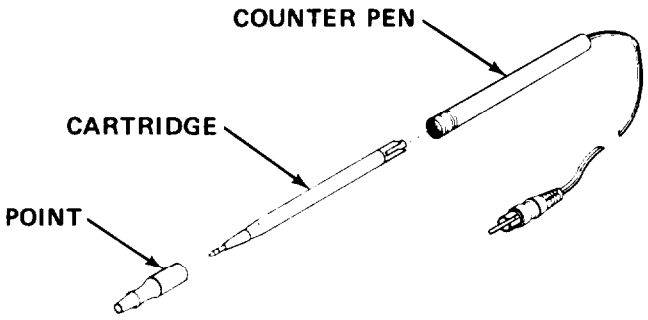
(4) Insert leading edge of paper into slot at bottom of paper well.

(5) Turn calculator OFF/ON switch to ON.

(6) Press paper advance button until leading edge of paper becomes visible beneath tear bar.

(7) Place roll of paper in paper well. Close paper roll cover.

g. Installing blank cartridge in point counter pen.



CAUTION

Cartridge is spring-loaded. Do not let spring fall out. Pen will not work without spring.

(1) Grasp point counter pen at both ends. Unscrew two halves of pen.

(2) Remove ink cartridge.

(3) Insert blank cartridge.

(4) Screw two halves of pen back together.

h. Loading magnetic cards.

(1) Turn calculator ON/OFF switch to ON.

(2) Turn MAN/TRACE/NORM switch to MAN.

(3) Turn PRGRM/RUN switch to RUN.

CAUTION

- Hold magnetic cards by the edge. Be sure hands are clean. Grease, oil, or other materials can damage magnetic cards.
- Do not continue to hold card after it is grasped by feed mechanism. Damage to magnetic card or calculator may occur.

(4) Insert magnetic card into reader. If calculator displays ERROR, press any key to clear.

(5) Pass side one of magnetic card through reader again.

(6) If calculator displays Crd, reverse card and load side two.

(7) Print out program to obtain record of program from magnetic card.

(a) Press [RTN] and [f] keys.

(b) Press **PRINT:PRGH** key.

NOTE

- Printout should have three columns. The first column is program step number, the second column is keystrokes entered, and the third column shows key codes for the key stroke entries.
- To stop printout at any point, press [R/S] key.
- To start over at beginning of program, press [RTN] key.

i. Manual program loading. Programs are loaded as a series of keystrokes. The calculator will display two groups of numbers during the course of programming. The three digit display to the left is the program step number. The digits to the right are key code numbers identifying keys pressed by row and column. Keystrokes that make up the program are stored in the program memory of the calculator. The program memory has a storage capacity of 224 steps.

(1) Turn calculator OFF/ON switch to ON.

(2) Turn MAN/TRACE/NORM switch to MAN.

(3) Turn PRGM/RUN switch to PRGM.

(4) Press [f] and CL PRGM keys.

NOTE

Pressing [f] and CL **PRGM** clears calculator memory of any previous programs.

(5) Determine and write down natural sequence of keystrokes that are required to perform functions in program.

(6) Assign program an identifying label by pressing [LBL] key followed by one of the following keys: q through [E], a through e, or [0] through [9].

NOTE

Two different programs cannot be given the same label on same magnetic card at same time in calculator memory.

(7) Key in keystrokes of program determined in step c.

NOTE

Except for the following seven functions, all functions can be recorded, [f] CL PRGM, [BST], [SST], [f] DEL, [GTO], [.], and [f] **PRINT:PRGM** are used to load, edit and modify programs.

(8) Print out program to verify.

(a) Press [RTN].

(b) Press [f] and **PRINT:PRGM** keys.

j. Printing out programs. All programs should be printed out. The printout can verify the program, and provide a copy of the program should the magnetic card get damaged or lost. The printout can be used to record a verified program onto a magnetic card.

(1) Load contents of magnetic card into calculator memory.

(a) Turn calculator ON/OFF switch to ON.

(b) Turn MAN/TRACE/NORM switch to MAN.

(c) Turn PRGM/RUN switch to RUN.

CAUTION

- Hold magnetic card by edge. Be sure hands are clean. Grease, oil, or other materials can damage magnetic card.
- Do not continue to hold card after it is grasped by feed mechanism. Damage to magnetic card or calculator may occur.

(d) Insert magnetic card into reader. If calculator displays error, press any key to clear.

(e) If calculator displays Crd, reverse card and load side two.

(2) To obtain printout of program now loaded into calculator memory:

(a) Press [RTN] key.

(b) Press [f] and **PRINT:PRGM** keys.

(c) To stop printout at any time, press [R/S] key.

(d) To return to beginning of program, press [RTN] key.

(3) To obtain printout of manually loaded program follow above steps after keying last keystroke.

(4) Use printout to verify program, and load magnetic card.

k. Recording program on magnetic card.

(1) Manually enter desired program into calculator memory (paragraph 9-6.2i).

(2) Obtain printout to verify program.

(a) Press RTN key.

(b) Press f and **PRINT:PRGM** key.

NOTE

If printout does not verify program, repeat steps (1) and (2).

(3) Set PRGM/RUN switch to PRGM. If display does not show 000 or 001, press BST key.

(4) Select unclipped and unmarked magnetic card from packet of cards.

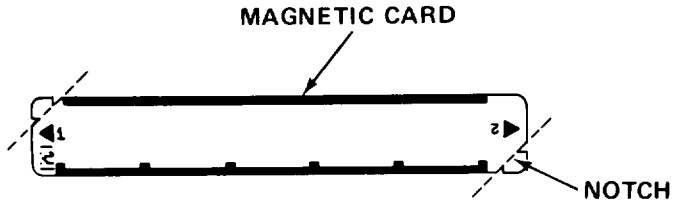
CAUTION

- Hold magnetic card by the edge. Be sure hands are clean. Grease, oil, and other materials can damage magnetic card.
- Do not continue to hold card after it is grasped by feed mechanism. Damage to magnetic card may occur.

(5) Load side one of magnetic card through reader. If display indicates ERROR, press any key to clear.

(6) Pass side one through reader again. If calculator displays Crd, reverse card and load side two.

(7) Print out program to verify.



(8) Mark magnetic card to identify program.

(9) To protect contents of magnetic card from being erased, cut corners of card along notches.

1. Alinement of planimeter with lens tracing assembly. Alinement of the planimeter provides information needed to make area and volume measurements. Using the testing procedure provides values needed to check alinement with factory determined values and provides a constant in determining additional measurements and calculations. Test measurement is made with the test rule. Measurement with the test rule traces a circle with a two inch radius. The area of that circle has a factory determined area A_T, found on the Calibration Records Sheet provided with the equipment.

(1) Assemble QPS using the planimeter with lens tracing assembly.

(2) Activate QPS:

(a) Plug foot switch into CLEAR input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_1, encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/ E_1 switch on back panel of auto scaler to E_1.

(l) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to AUTO.

(l) Set auto-scaler X-memory switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: 1 , STO , 1 , and ENTER↑ .

(3) Remove Y-shaped test rule from carrying case.

(4) Tape piece of paper to table.

(5) Draw a horizontal line 12 inches long.

(6) Place planimeter on paper so it straddles line drawn.

(7) Hold tracer arm in place and turn wheels on planimeter so that wheel axle forms 90 degree angle with tracer arm.

(8) Press point of Y-shaped test rule into paper on horizontal line.

(9) Place lens tracing assembly so that recessed end of Y-shaped test rule rests against edge of lens.

(10) Press edge of lens so that it rides against inside edges of test rule recess.

(11) Clear auto-scaler by pressing and releasing foot switch.

NOTE

If planimeter is allowed to slip, area measured will not be actual area of test rule, and results will be inaccurate.

(12) Keep lens firmly pressed against test rule. Slowly trace 360 degree circle by moving lens around center of test rule. Stop when you return to starting point.

(13) Repeat steps (9) through (12) four times. Reposition test rule at different point-on-line-after three rneasurernents.-

(14) Average the pulse counts shown on the LED display after test measurement to obtain R_T value.

NOTE

- If QPS is being initially alined with premarked tracer arm lengths, compare average R_T value to R_T value found on Calibration Record Sheet provided with equipment.
- Move lens tracer in 1/4 inch increment to bring "R_T value" within R_T value found on Calibration Record Sheet provided with equipment.
- If average R_T value is not within ±0.2% of factory determined R_T value the planimeter may be defective. Repeat alinement procedure. Notify direct/general support maintenance for service or replacement.
- If using preprogrammed cards, manual calculation of C_A (calibration constant) is not necessary.

(15) For manual calibration of C_A:

Press [SCI] key to perform the following equation.

$$C_A = \frac{(S_{HOR} \times S_{VERT}) \times A_T}{R_T}$$

S_{HOR} = Horizontal scale of shape to be measured.

S_{VERT} = Vertical scale of shape to be measured.

R_T = Area of test rule.

^{R}T = Average of pulse count reading.

^{S}HOR and ^{S}VERT are usually provided with map.

^{A}T is premark value on top of test rule.

^{R}T can be found on Calibration Records Sheet or from average measurements made with test rule

(16) Note value of actual area measured by test rule, which is premarked on top of test rule.

(17) Use test rule area and the scale ratio of shape to be measured to determine CA (calibration constant). CA is needed to perform various measurements.

m. Alinement of planimeter with needle tracing assembly.

(1) Alinement of the planimeter with the needle tracing assembly follows the same procedure as alinement of the planimeter with the lens tracing assembly (paragraph 9-6.21).

(2) The test measurement checks the alinement of the planimeter with the initial use of the needle tracing assembly.

(3) The needle on the needle tracing assembly fits into the hole on the long test rule to make test measurements.

(4) The average ^{R}T reading obtained by following the steps for the lens tracing assembly should be within ±0.2% of the R_T value given on Calibration Records Worksheet provided with equipment.

(5) The same formula is used to determine the calibration constant, ^{C}A.

n. Alinement of linear measuring probe. Provides information needed to make linear measurements. Using the testing procedure provides values needed to check alinement with factory determined values and provides a constant to use in determining additional measurements and calculations.

(1) Assemble QPS with the linear measuring probe.

(2) Activate QPS:

(a) Plug foot switch into CLEAR input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug linear measuring probe into E_1, encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to AUTO.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(P) Press following keys: STO , 1 and ENTER↑ .

(3) Tape piece of paper to table.

(4) Draw line exactly 10 inches long.

(5) Label ends of line A and B.

NOTE

Foot switch must remain depressed until ready to begin measurement, so that movement and handling of linear measuring probe will not increment counter.

(6) Press CLEAR button on auto-scaler. .

(7) Depress foot switch to initiate ACCU and freeze count at zero.

(8) Place linear measuring probe and stand so that pricking pin is at beginning mark of line.

(9) Release foot switch.

(10) Grasp probe body and roll linear measuring probe along length of line. Stop when needle is precisely at end of line.

(11) Press foot switch.

(12) Divide digital readout on LED display by 10 to determine alined pulse count reading, R_L.

(13) Record this number.

(14) Repeat steps (6) through (13) four times.

(15) Average the five pulse count results obtained from the LED display after each test measurement to obtain R_L value.

NOTE

If average R_L value is not within ±0.2% of factory determined R_L value, the linear measuring probe may be defective. Repeat alinement procedure. Notify direct/general support maintenance for service or replacement.

(16) Compare averaqe R_L value to R_L value found on Calibration Records Sheet provided-with equipment.

NOTE

If using preprogrammed card, Program III, manual calculation of C_L is not necessary.

(17) Use scale of map, plan, or blueprint being measured to determine C_L (calibration constant). C_L is needed to perform various measurements.

(18) Use the following equation to determine C_L.

$$C_L = S/R_L$$

S = Scale, in desired units for measurements.

R_L can be found on Calibration Records Sheet or from average of test measurements.

o. Measuring areas with planimeter.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(1) Set auto-scaler X MEMORY to 1.

(m) Set calculator OFF/ON to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program I, into calculator.

(4) Tape map or drawing to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm should be shortest one possible that will allow entire shape to be measured without moving planimeter.

(6) Aline planimeter with tracer arm length selected (paragraph 9-6.2 n).

(7) Record R_T value. This value is to be used in step (14).

NOTE

Factory determined R_T value is provided on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(8) Place planimeter near shape to remeasured so that length of tracer arm lies along imaginary line through center of shape.

(9) Set wheels so that their axles form 90 degree angle with tracer arm.

(10) Make practice trace to be sure tracer arm will cover area in one operation.

(11) Select starting point for measurement on shape where imaginary line crosses boundary of shape.

(12) Mark point.

(13) Set dot in lens tracing assembly over starting point.

(14) Enter into calculator horizontal and vertical scales of shape and R_T values.

(a) Key in horizontal scale; press [ENTER↑] .

(b) Key in vertical; press [ENTER↑] .

(c) Key in R_T value; press [B] .

(d) For results in square feet or square feet and acres, press [f] and d.

NOTE

- If R_T value is not entered, all results from calculator will be zero.
- When results are printed, the first area given will be in square feet, the second in acres.

(15) Clear auto-scaler by pressing CLEAR button.

(16) Trace boundary line of shape clockwise using dot in lens tracing assembly. Stop when you reach starting point.

(17) Press remote tracer switch to activate actuate function and freeze count.

(18) Press foot switch to activate PRINT command. Calculator will print area of shape in square feet or square feet and acres.

(19) To measure several shapes, keep foot switch and remote tracer switch depressed.

(20) Reposition planimeter to next shape and repeat steps (11), and (15) through (18).

(21) To change functions or change scale of next shape to remeasured, press and repeat steps (14) through (18).

p. Measuring areas to be added and/or subtracted.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/ E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(J) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(P) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

(3) Set up planimeter for area measurement (paragraph 9-6.20).

(4) To add areas being measured, in square feet or square feet and acres, press [C] .

(5) Reposition planimeter near next shape to be measured. Keep remote tracer switch depressed.

(6) Clear auto-scaler by pressing CLEAR button.

(7) Trace boundary line of shape using dot on lens tracing assembly. Stop when you reach starting point.

(8) Press foot switch to activate print command.

NOTE

Calculator will print data on area just measured. It prints area of single shape in square feet first, followed by area in square feet and acres. Current total areas are printed in same order.

(9) If area is to be subtracted instead of added, press [f] and **c** for Actuate routine. Repeat measurement procedure.

q. Measuring surface area of slope.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/ E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-sealer B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

(3) Set up planimeter for area measurement (paragraph 9-6.20).

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(4) Load preprogrammed card (paragraph 9-6.2h), Program I, into calculator.

(5) Tape map or drawing to be measured to table.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 9-6.20). Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(7) Position planimeter near shape to be measured so that tracer arm lies along imaginary line through center of shape.

(8) Set wheels so that their axles form 90 degree angle with tracer arm.

(9) Enter into calculator horizontal and vertical scales of shape and R_T value.

(a) Key in horizontal scale; press [ENTER↑] .

(b) Key in vertical scale; press [ENTER↑] .

(c) Key in R_T value; press [B] .

(d) Press [f] and **d** to obtain results in square feet or acres.

NOTE

Slope ratio should be given. Slope ratio can be determined by using the given horizontal scale and vertical scale.

$$\frac{\text{horizontal scale}}{\text{vertical scale}} \text{ invert to } \frac{\text{vertical scale}}{\text{horizontal scale}} = \text{scale ratio}$$

Example: $\frac{\text{horizontal scale}}{\text{vertical scale}} = \frac{10}{50} = 1/5$ invert to 5/1 or 5:1 scale ratio

(e) Key in ratio slope; press [f] and **b.**

(9) Press CLEAR button to clear auto-scaler.

(10) Trace boundary of shape using dot in lens tracing assembly. Stop when you reach the starting point.

(11) Press foot switch to activate PRINT command and freeze count.

NOTE

Calculator will print area of shape. Horizontal area in square feet will be printed first, followed by the true surface area in square feet.

(12) Keeping foot switch depressed, reposition planimeter near next shape to be measured.

(13) Repeat steps (9) through (11).

Measuring slopes to be added and/or subtracted. This procedure follows measuring surface area of slope (paragraph 9-6.2q) steps (1) through (9). After completing steps (1) through (9), follow the steps provided below to add or subtract from slope measurement obtained.

(1) If slope to be measured will be added, press [C].

(2) If slope to be measured will be subtracted, press [f] and **c.**

(3) Press CLEAR button to clear auto-scaler.

(4) Trace boundary of shape using dot in lens tracing assembly. Stop when you reach starting point.

(5) Depress foot switch to activate PRINT command and freeze count.

NOTE

Calculator will print horizontal and true slope surface area of shape last measured, followed by totals (added or subtracted) of horizontal and true slope surface areas.

(6) Keeping foot switch depressed, reposition planimeter near shape to be measured.

(7) Make next measurement.

(8) If change is made in planimeter function or if new scales or slope ratios are used, press q to initiate measurement. Begin measurement procedures.

s. Measuring areas without the calculator.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch on back of auto-scaler to E_2.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to OFF.

(3) Tape map or drawing to be measured to table.

(4) Select correct tracer arm length.

(5) If needed, aline planimeter for tracer arm length selected (paragraph 9-6.21). Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(6) Manually calculate alinement, C_A, using the following equation.

$C_A = S\ c^2 x\ u$

C_A = Alinement constant

$S\ C^2$ = Scale ratio squared (given on map being measured or determined by equation in paragraph 9-6.2q).

u = Value of one planimeter unit (factory determined value provided on Calibration Records Sheet provided with equipment.

(7) Enter three most significant digits of alinement constant, C_A, into auto-scaler using scaler dials.

(a) Set first most significant digit on left hand dial.

(b) Set second most significant digit on middle dial.

(c) Set third most significant digit on right hand dial.

Example: If C_A is 10.571, left hand dial should read 1, middle dial should read 0, and right hand dial should read 5.

(8) Set decimal selector according to value of first significant digit of alinement constant.

NOTE

- Decimal selector sets decimal place for auto-scaler LED display.
- If constant is one or greater, set decimal selector to 0.
- If constant is less than one, set decimal selector according to place value of first significant digit.

(9) Place planimeter near shape to remeasured so that length of tracer arm lies along imaginary line through center of shape.

(10) Set wheels so that their axles form 90 degree angle.

(11) Make practice trace to be sure tracer arm will cover area.

(12) Select starting point for measurement, and mark.

(13) Set dot of lens tracing assembly over starting point.

(14) Press CLEAR button to clear auto-scaler.

(15) Trace boundary line of shape using dot in lens tracing assembly. Stop when you return to starting point.

(16) Multiply numbers shown in auto-scaler LED display to obtain area of shape in square feet.

NOTE

- If first significant digit of CA is in ones column (one place to left of decimal point), multiply auto-scaler LED display by 10.
- If first significant digit is in tens column, multiply auto-scaler LED display by 100.
- If first significant digit is three or more places to left of decimal point, increase multiplication factor by 10 for each position it lies further to left.

t. Measuring lengths with linear measuring probe to be added and/or subtracted.

(1) Assemble QPS with linear measuring probe.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch On back panel of auto-scaler to E_1.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-sealer B/ACCU/A/OFF switch to A.

(j) Set auto-sealer MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to NORM.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program I, into calculator.

(4) Tape drawing or map to be measured to table.

(5) If needed, aline linear measuring probe (paragraph 9-6.21).

(6) Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(7) Key in scale of map or drawing to measured.

(8) Press [f] and **a** to call up (from memory) lengths routine for feet. Press [f] and **d** if printout in feet and inches is desired.

NOTE

Linear measuring probe stand is used to facilitate measurement using a straightedge.

(9) If needed, mount linear measuring probe in stand.

(10) Press CLEAR button to clear auto-scaler.

(11) Press foot switch. Do not release until ready to begin measurement.

(12) Position linear measuring probe so that pricking pin is at beginning of length to be measured. Release foot switch.

(13) Make measurement by tracing length of line with linear measuring probe.

(14) Press foot switch to initiate PRINT command and freeze count.

(15) To make another measurement, repeat steps (11) through (14).

(16) If additional lengths are to be added, Press f and c to initiate ACCU and addition subroutine.

(17) If additional lengths are to be subtracted, press f and e for ACCU and subtraction subroutine.

(18) To change scale or function with new measurement, press D to initiate calculator memory.

u. Layout work with linear measuring probe.

(1) Assemble QPS with linear measuring probe.

(2) Activate QPS.

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6. 2h), Program I, into calculator.

(4) Tape drawing or map to be measured and paper for layout to table.

(5) If needed, aline linear measuring probe (paragraph 9-6.2n). Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Record Sheets provided with equipment. Alinement is performed as a check.

(6) Key in scale of map or drawing on which measurements will be made.

NOTE

If layout is to be drawn to a different scale than original map or drawing, key in scale for layout.

(7) Press [f] and **a.**

(8) Press [f] and **d** for printout in feet and inches.

(9) Press CLEAR button to clear auto-scaler.

(10) Press foot switch. Do not release until ready to begin measurement.

(11) Position linear measuring probe so that pricking pin is at beginning of length to be measured.

(12) Release foot switch.

(13) Make measurement by tracing length of line with linear measuring probe.

(14) Depress, then release foot switch to initiate print command.

(15) Position linear measuring probe on layout sheet at beginning of line just measured.

(16) Press pricking pin.

(17) Press CLEAR button to clear auto-scaler.

(18) Using a straightedge as a guide, move linear measuring probe until auto-scaler LED display shows count total identical to previously measured line.

(19) When LED display shows the same count, stop linear measuring probe.

(20) Press pricking pin.

NOTE

Pricking pin marks identify beginning and end of lines being laid out.

(21) For each new line, repeat steps (7) through (20).

(22) To change scale or function, press D to initiate calculator memory.

v. Linear measuring probe measurements without the calculator

(1) Assemble the QPS with the linear measuring probe.

(2) Activate the QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(J) Set auto-sealer MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to OFF.

(m) Set auto-scaler NORMAL/SCALE switch to scale.

(3) Tape map or drawing to be measured to table.

(4) Calculate linear scale constant, C_L, using the following equation:

$$C_L = Sc / R_L$$

C_L = Linear scale constant

Sc = Scale of drawing or map

R_L = Alinement constant (found on Calibration Records Sheet provided with equipment)

(5) Enter three most significant digits of linear scale constant, C_L, into auto-scaler using scaler dials.

(a) Set first most significant digit on left hand dial.

(b) Set second most significant digit on middle dial.

(c) Set third most significant digit on right hand dial.

Example: If C_L is 10.571, left hand dial should read 1, middle dial should read 0, and right hand dial should read 5.

(6) Set decimal selector according to value of first significant digit of linear scale constant C_L.

NOTE

- Decimal selector switch sets decimal place for auto-scaler LED display.
- If constant is one or greater, set decimal selector to 0.
- If constant is less than one, set decimal selector according to place of first significant digit.

(7) Place linear measuring probe on line to be measured so that pricking pin is at starting point.

(8) Press CLEAR button to clear auto-scaler.

(9) Make measurement by tracing length of line with linear measuring probe.

(10) Press foot switch to activate ACCU and freeze count.

(11) Multiply number shown in auto-scaler LED display to obtain length of line in feet.

NOTE

- If first significant digit of C_L is in ones column (one place to left of decimal point), multiply auto-scaler LED display by 10.
- If first significant digit is in tens column, multiply auto-scaler LED display by 100.
- If first significant digit is three or more places to left of decimal point, increase multiplication factor by 10 for each position it lies further to the left.

w. Point counts with point counter pen and constants.

(1) Assemble QPS with point counter pen.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into wall outlet.

(f) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to OFF.

(g) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set auto-scaler B/ACCU/A/OFF switch to A.

(i) Set auto-scaler MAN/AUTO switch to MAN.

(j) Set auto-scaler X MEMORY switch to 1.

(k) Set calculator OFF/ON switch to ON.

(l) Set calculator MAN/TRACE/NORM switch to NORM.

(m) Set calculator PRGM/RUN switch to RUN.

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed card (paragraph 9-6.2h), Program I, into calculator.

(4) Tape drawing or map to remeasured to table.

(5) When multiplying counts by one constant, key in constant, pres ENTER↑ and A .

(6) Press CLEAR button to clear auto-scaler.

(7) Using point counter pen, make point count.

(8) Press PRINT to obtain results of count.

(9) To make point count with two to four constants, follow steps (1) through (4).

(10) When multiplying counts by two to four constants, key in each constant followed by ENTER↑ .

(11) After last constant has been keyed in, press ENTER↑, 1, and e.

(12) Press CLEAR button to clear auto-scaler.

(13) Using point counter pen, make point count.

(14) Press PRINT to obtain results of count.

(15) Change X MEMORY switch to 2.

(16) Press CLEAR button to clear auto-scaler.

(17) Using point counter pen, make point count.

(18) Press PRINT to obtain results of count.

(19) Repeat steps (13) through (18) if there is another constant being used.

x. Standard volume run using contour method.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder Socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug transformer power cord into back of calculator.

(f) Plug power cord into wall outlet.

(9) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to NORM.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program II, in calculator.

(4) Tape map or drawing to remeasured to table.

(5) Select correct tracer arm length.

NOTE

The tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 9-6.21).

(7) Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(8) Key in horizontal and vertical scales of contour map or photo and R_T value.

(a) Key in horizontal scale, press ENTER↑ .

(b) Key in vertical scale, press ENTER↑ .

(c) Key in R_T value, press ENTER↑ .

(9) Key in section interval of contours to be measured, and press ENTER↑ .

(10) Press A to call up subroutine A.

(11) Determine if object of contour is cut (excavation) or fill (embankment).

(a) If contour is fill, press B .

(b) If contour is cut, press f and **b.**

(12) Press INIT button to clear calculator.

(13) Key in value for elevation of first contour to be measured.

(14) Press C .

(15) Place planimeter at starting point of boundary line for measuring contour loop.

(16) Make practice trace to make sure tracer arm will cover area in one operation.

(17) Press CLEAR button to clear auto-scaler.

(18) Trace boundary line of contour loop with dot in lens tracing assembly. Stop when you reach starting point.

(19) Press and hold down remote tracer switch to activate PRINT command.

NOTE

- Calculator will print the following information after the first measurement:

  ***Elevation
  ***Section of contour loop

- Additional measurements will provide values for intermediate volume and total volume.

  0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(20) Move to next contour loop.

(21) Release remote tracer switch.

(22) Repeat steps (18) and (19) until desired volume is determined.

(23) To change contour interval when next loop to be measured is at a different interval, key in new interval. Press f and **a.**

(24) If last elevation is not even contour interval, key in value for last elevation. Press f and c. Repeat steps (18) through (23).

(25) To start a new run, press f or f and b to initiate memory. Repeat steps (12) through (18).

y. Merging volume runs.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into PRINT input jack on back panel of auto-scaler.

(c) Plug planimeter into E_1 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug transformer power cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_1

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to AUTO.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: 1. STO , 1 , and ENTER↑ .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program II, into calculator.

(4) Tape map or drawing to be measured to table.

(5) Select correct tracer arm length.

NOTE

The tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm selected (paragraph 9-6.21).

(7) Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(8) Key in horizontal and vertical scales of contour map or photo and R_T value.

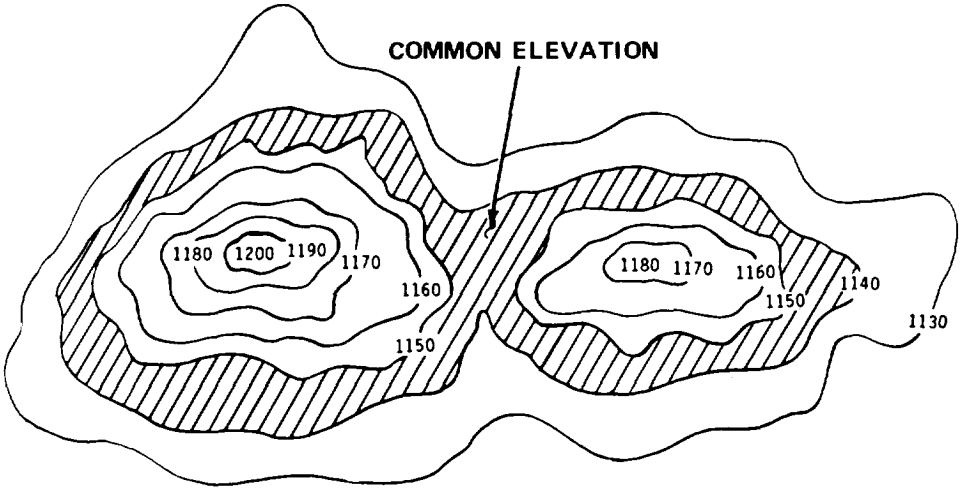
(a) Key in horizontal scale, press ENTER↑ .

(b) Key in vertical scale, press ENTER↑ .

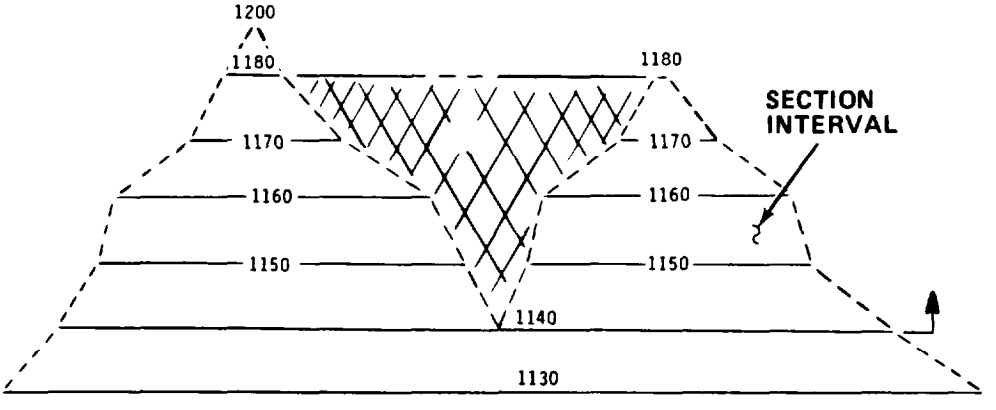
(c) Key in R_T value, press ENTER↑ .

NOTE

In contour map example of twin peak mountain, area is elevation where volumes merge into common base. Volume of left peak above merge point will be measured first.



NORMAL VIEW



SIDE VIEW

(9) Key in section elevation interval of contours to be measured. Press [A].

(10) If contour is a fill, press [B]. If contour is a cut, press [f] and **b.**

(11) Place planimeter at starting point of boundary line for measuring first contour.

(12) Press INIT key to clear calculator.

(13) Make practice trace to make sure tracer arm will cover area in one operation.

(14) Press CLEAR button to clear auto-scaler.

(15) Key in starting elevation and press [C] .

(16) Trace boundary line of contour loop with dot in lens tracing assembly. Stop when you reach starting point.

(17) Press and hold down remote tracer switch to activate PRINT command.

NOTE

- Calculator will print the following information after the first measurement:

  *** Elevation

- Additional measurements will provide values for intermediate volume and total volume.

  0.00 Area of contour loop
  0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(18) Press and hold down foot switch.

(19) Reposition planimeter to make measurement of next contour loop.

(20) Release foot switch.

(21) Repeat steps (17) through (21) for each consecutive loop measured before merge.

(22) To change contour interval when next loop to remeasured is at a different interval, key in new interval, press [f] and **a.**

(23) Repeat steps (18) through (24) for each of the independent volumes, until all independent volumes have been measured.

(24) Reposition planimeter for measuring merge volume, and repeat steps (18) through (24).

(25) To measure next object, press [D] , and repeat steps (8) through (24).

z. Diverging volume runs.

(1) Use merging volume runs (paragraph 9-6.2y) to begin procedure for diverging volume runs. Follow steps (1) through (16).

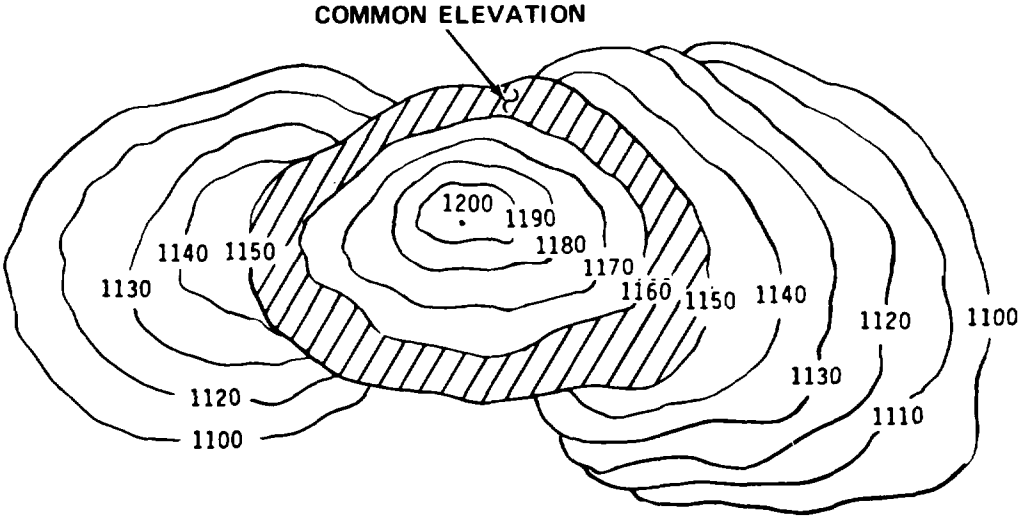
(2) Trace boundary lines of contour. Stop when you reach starting point.

(3) Move up or down contours until you reach last contour before split (diverging volume).

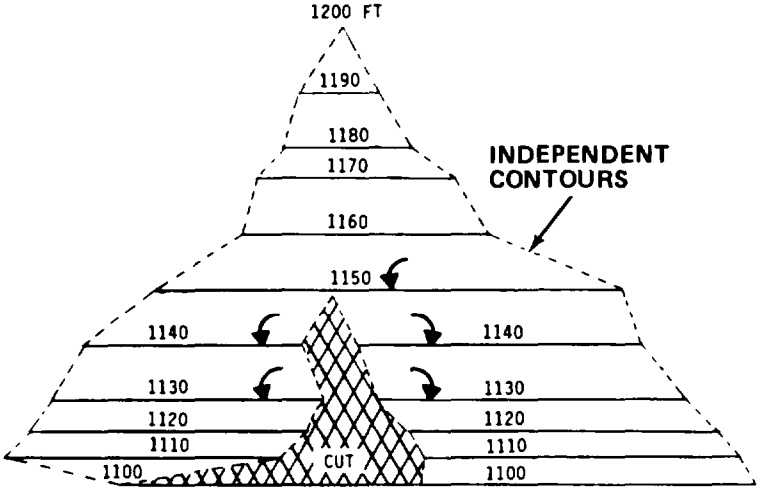
(4) Position planimeter to measure first contour adjacent to diverging cut.

(5) Trace boundary of first contour.

(6) Press and hold down foot switch to reposition planimeter over adjacent contour area.



NORMAL VIEW



SIDE VIEW

NOTE

- In contour map, example of diverging-cut ridge area is elevation where features of object diverge into two volumes.
- Contours adjacent to diverging cut represent independent portions of total volume of object. Each contour must be measured at each elevation interval. Total counts must be entered before PRINT command to prevent negative volume of cut being added to total.

(7) Release foot switch.

(8) Press remote tracer switch to activate print command.

(9) Key in elevation of first adjacent contour. Press [f] and **c.**

(10) Retrace first loop of short (smaller) side.

(11) Repeat steps (4) through (8) until last contour of short (smaller) side has been traced and printed.

(12) Reposition tracer arm to first adjacent contour on larger (higher) side.

(13) Press [f] and **c.** Enter [0] , [STO] , and [0].

(14) Trace contour.

(15) Press remote tracer switch to activate PRINT command.

(16) Repeat steps (4) through (8) until last contour of larger (higher) side has been traced and printed.

NOTE

- Calculator will print the following information after the first measurement:

  *** Elevation

- Additional measurements will provide values for area of contour, intermediate volume, and total volume.

  0.00 Area of contour
  0.00 Intermediate volume
  0.00 Total volume so far

(17) To measure new object, press [D] to initiate memory. Repeat steps (4) through (9).

aa. Vertical cross sections.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into PRINT input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER jack on back of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program II, into calculator.

(4) Tape map or drawing to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm lenqth should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 9-6.21).

NOTE

Factory determined R_T value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(7) Key in horizontal scale and vertical scale of contour map or photo and R_T value.

(a) Key in horizontal scale; press ENTER↑ .

(b) Key in vertical scale; press ENTER↑ .

(c) Key in R_T value; press ENTER↑ .

(8) Key in section interval of contours to be measured, press A.

(9) Determine if object contour described is cut (excavation) or fill (embankment).

(10) If object is fill, press B . If object is cut, press f and **b.**

(11) Press INIT to clear calculator.

(12) Key in value for elevation of first station point to be measured.

NOTE

If contour is cut, first station point elevation should be largest. If contour is fill, first station point elevation should be smallest.

(13) Press C .

(14) Place planimeter at starting point on boundary line of contour loop.

(15) Press CLEAR button to clear auto-scaler.

(16) Trace boundary line of contour loop with dot in lens tracing assembly. Stop when you reach starting point.

NOTE

When running vertical sections, odd stations (elevations) may occur. Odd stations may be keyed in by the following steps:

- Key in next station (elevation).
- Press f and **c.**
- Trace section.

(17) Press and hold down remote tracer switch to activate PRINT command.

(18) Move to next contour loop.

(19) Release remote tracer switch.

(20) Repeat steps (15) through (18) for each consecutive loop until desired volume is determined.

NOTE

- Calculator will print the following information after the first measurement:

  *** First station
  *** Section area

- Additional measurements will provide values for intermediate volume and total volume.

  0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(21) To start new run, press [D], and repeat steps (12) through (20).

ab. Volume erase procedure.

(1) If error in tracing was made and caught before initiating PRINT command:

(a) Reposition planimeter at starting point.

(b) Press CLEAR button to clear auto-scaler.

(c) Retrace boundary of contour.

(2) If error is caught after initiating PRINT command:

(a) Reposition planimeter at starting point.

(b) Press CLEAR, [f], and e.

(c) Retrace boundary of contour.

(3) If volume run is completed before error is caught, repeat entire volume run up to error. Elevation after incorrect section does not have to be rerun.

(a) Rerun volume starting from elevation section immediately above incorrect section down to error. Press [f] and **d** to initiate reload of volume run.

(b) Key in area of each section, read from previous printout that follows incorrect section. Press [ENTER↑] and [E].

ac. Out-of-phase adjustments.

NOTE

Out-of-phase adjustment is used when there is constant section interval, but sections are not even elevations.

(1) Determine phase differential.

NOTE

Program II automatically locates next even elevation from first section entered. Determine what this number is, and subtract it from desired second elevation. Result is phase differential.

Example: Running vertical sections at 100-ft intervals

```
  525  = Desired second elevation
- 600  =  Next even 100-ft elevation
  -75  = Phase differential
```

Example: Running contours at 10-ft intervals

```
 1215  = Desired second elevation
-1210  =  Next even 10-ft elevation
   +5  = Phase differential
```

(2) Key in phase differential.

(3) Press [f] and [P ≷ S].

(4) Press [STO] and **0.**

(5) Press [f] [P ≷ S].

ad. Linear measurements on aerial photographs of unknown scale or magnification. To make linear measurements of aerial photographs, there must be a known length of an object. This known factor is used to compute constants needed for measurements.

(1) Assemble QPS with measuring probe.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-sealer.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER jack on back of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to ACCU.

(j) Set auto-scaler MAN/AUTO switch to AUTO.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to MAN.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program IV, into calculator.

(4) Tape photograph to be measured to table.

(5) If needed, aline linear measuring probe (paragraph 9-6.2n). Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(6) Press CLEAR button to clear auto-scaler.

(7) Determine length constant, C_L (multiplier), using the following formula:

$$C_L = \frac{D}{R}$$

C_L = Length of constant

D = Length of known object

R = Counts generated by measuring length of known object

Example: On aerial photograph of unknown scale or magnification where a telephone line is visible, use the known distance between two telephone poles, 105 feet, for D in formula.

(1) With linear measuring probe, measure the known distance (between two telephone poles) to obtain R.

(2) The value shown on the auto-scaler LED display (5692) can be used for R in the formula

(3) Compute $C_L = \frac{D}{R}$ or $C_L = \frac{105}{5692}$

(4) Result is 0.02. Press DSP and 6 to display six decimal places, 0.018447 = C_L

(5) press PRINT to activate PRINT command.

(8) Key in C_L value (computed with known length of object in photograph being measured). Press STO , 1 and ENTER↑ .

(9) Press foot switch. Do not release until ready to begin measurement.

(10) Position linear measuring probe so that pricking pin is at beginning of length to be measured. Release foot switch.

(11) Make measurement by tracing length of line with linear measuring probe.

(12) Press PRINT↑X activate PRINT command and freeze count.

Area measurements on aerial photographs of unknown scale or magnification. To make area measurements of aerial photographs, there must be a known length of an object. This known factor must be used to compute constants needed for measurements.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(9) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(J) Set auto-scaler MAN/AUTO switch to AUTO.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to MAN.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] ,

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 9-6.2h), Program IV, into calculator.

(4) Tape photograph to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) Aline planimeter with tracer arm length selected (paragraph 9-6.2k). Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(7) Place planimeter near shape to remeasured so that length of tracer arm lies along imaginary line through center of shape. Set wheels so that axles form 90 degree angle with tracer arm.

(8) Make practice trace to be sure tracer arm will cover area in one operation.

(9) Determine area constant, C (multiplier), using the following formula:

$$C = \frac{(S_c)^2 \times A_T}{R_T}$$

C = Area of constant

A_T = Area of test rule (given on Calibration Record Sheet provided with equipment)

R_T = Encoder count for each revolution (given on Calibration Record Sheet provided with equipment)

S_c = Scale ratio

(a) Determine S_c by using the following formula:

$S_c = C_L \times R_L$

S_c = Scale ratio

C_L = Length constant (paragraph 9-6.2ad)

R_L = Counts per inch (given on Calibration Record Sheet provided with equipment)

(b) Example: Use given R_L value (724) on Calibration Record Sheet and C_L value (0.018447) obtained from linear measurements on aerial photographs (paragraph 9-6.2ad).

$S_c = 0.018447 \times 724 = 13.355628$

$(S_c)^2 = 178.372799$

(c) Use values provided on Calibration Record Sheet for A_T and R_T. For this example, the value for R_T is 2157 and AT is 12.54. The formula can now be computed on the calculator.

$$C = \frac{178.372799 \times 12.54}{2157} = \frac{2236.794903}{2157} = 1.036993$$

(d) Press [PRINT X] to activate PRINT command.

(10) Key in C value (computed with known length of object in photograph being measured). Press [STO] , [2] and [ENTER↑] .

(11) Set auto-scaler X MEMORY switch to 2.

(12) Trace boundary line of shape using lens tracing assembly. Stop when you reach starting point.

(13) Press [PRINT X] to activate PRINT command and freeze count.

NOTE

Following are tables providing information found on preprogrammed a magnetic cards. The tables can be used to verify proqrams or to program the calculator if preprogrammed cards are damaged or lost.

Table 9-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I, II, III, AND IV)

Label Key	Routine	Function and Usage Notes
	PROGRAM I	
[A]	Point Counts	Used to total point counts and multiply total by constant. Must be reinitiated if different count is to be used.
a	Lengths	Used to measure lengths with linear measuring probe or planimeter. Must be reinitiated if scales are changed.
[B]	Areas	Computes area of measurement. Prints area in square feet. Must be reinitiated if tracer arm length is changed.
b	Slope Area	Computes area of slope. Must be reinitiated if new slope ratios or scales are to be used.
[C]	ACCU +	Addition routine for adding slopes or areas.

Table 9-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I, II, III, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM I - Cont	
c	ACCU -	Subtraction routine for subtracting slopes or areas.
D	Initiate	Places zero in memory registers so they can be used for new input.
d	Inches/Acres	Converts computed area measurement into units of acres.
E	Print	Master print routine. Contains subroutines for printing results and data of other label routines in inches, square feet, or acres.
e	Memory Load	Loads constants 4, 3, 2, and 1 into memory stack.
	PROGRAM II	
A	Load Data	Used to enter horizontal and vertical scales of item to be measured and alinement data.
a	New Interval	Used to change or enter contour interval. Next even contour interval elevation for new interval is automatically determined.
B	Fill Routine	Sets system up for measurement and calculation of fill.
b	Cut Routine	Sets system up for measurement and calculation of cut.

Table 9-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I, II, III, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM II - Cont	
C	First Section	Automatically determines next even-valued section elevation from one being measured.
c	Next Section	Used anytime manual loading of next elevation is required. Used to run sections not on even elevation intervals.
D	Initiate	Stores zeros in memory registers so they can be used for new input.
d	Reload Stack	Used to rerun volume run where an incorrect section was entered; Resets memory stack for input of areas of sections that follow erroneous section on tape.
E	Print	Master print routine contains subroutines for printing results and data of other label routines.
e	Erase	Erases results and data for last (volume) contour trace made so incorrect intervals can be eliminated before volume run is completed. Calculator will reprint all data groups for previous section and ready itself for next measurement. Can only be used to erase one step at time.

Table 9-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAM I, II, III, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM III	
E	Print	Prints new value of X.
A B C D a, b, c, d	Load Register	Loads multiple constants or factors stored in registers 2-9 into register 1. Pressing corresponding label key loads new constant or factor into that register.
	PROGRAM IV	
A	Enter 1	Loads number 1 into memory.
B	Constant/Ratio	Computes constants C_L and S_c for aerial photographs.
C	C_L	Loads value of C_L into memory.
E	Print	Prints results of calculations.

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV)

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths		
001	LBL A	21 11	POINT COUNTS routine
002	STO A	35 11	Storage for constant
003	f SPACE	16-11	Space printer
004	1	01	
005	STO 1	35 01	Constant
006	CLX	-51	
007	STO I	35 46	Print indicator, I
008	RTN	24	Return to 001
009	LBL f a	21 16 11	LENGTHS routine
010	STO A	35 11	Scale (of map)
011	7	07	
012	2	02	Register
013	4	04	
014	f SPACE	16-11	Space printer
015	÷	-24	Register
016	STO 1	35 01	Constant
017	1	01	Input
018	STO I	35 46	Print indicator, I
019	RCL A	36 11	
020	f SPACE	16-11	Space printer
021	RTN	24	Return to 000
022	LBL B	21 12	AREAS routine
023	1	01	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
024	2	024 02	
025	.	025 -62	A_T, Area of test rule
026	5	026 05	
027	5	027 05	
028	X≷Y	028 -41	
029	R↓	029 -31	Roll down stack 1
030	X	030 -35	Multiply S_2 X A_T
031	X	031 -35	
032	X≷Y	032 -41	
033	+	033 -24	Divide by R_T
034	STO 1	034 35 01	Store constant
035	1	035 01	Input
036	CHS	036 -22	Change sign
037	STO 1	037 35 46	Print indicator, 1
038	CL X	038 -51	Clear X
039	f SPACE	039 16-11	Space printer
040	RTN	040 24	Return to 000
041	LBL f b	041 21 16 12	SLOPE AREA routine
042	STO 8	042 35 08	Slope factor
043	RCL I	043 36 46	
044	f X<0?	044 16-45	Conditional area test
045	GTO 7	045 22 07	Go to slope calculation
046	RTN	046 24	Return to 000 (Test Failed)

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
047		047 21 07	Slope area calculation
048	R↓	048 -31	Adjust memory stack
049	1	049 01	Input
050	PRINT X	050 -14	Print display
051	f SPACE	051 16 11	Space printer
052	X≷Y	052 -41	
053	÷	053 -24	
054	f TAN^{-1}	054 16 43	Arc tangent
055	COS	055 42	Slope cosine (run)
056	STO 7	056 35 07	Slope storage
057	RTN	057 24	Return to 000
058	LBL C	058 21 13	Actuate + Routine
059	1	059 01	Input
060	STO 6	060 35 06	Storage indicator
061	f SPACE	061 16-11	Space printer
062	RTN	062 24	Return to 000
063	LBL f C	063 21 16 13	Actuate - Routine
064	1	064 01	Input
065	CHS	065 -22	Change sign
066	STO 6	066 35 06	Store indicator
067	f SPACE	067 16-11	Space printer
068	RTN	068 24	Return to 000
069	LBL D	069 21 14	Initiate routine

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
070	0	00	Input 0
071	STO 0	35 00	Zero register 0
072	STO 2	35 02	Zero register 2
073	STO 3	35 03	Zero register 3
074	STO 4	35 04	Zero register 4
075	STO 5	35 05	Zero register 5
076	STO 6	35 06	Zero register 6
077	STO 7	35 07	Zero register 7
078	STO 8	35 08	Zero register 8
079	STO 9	35 09	Zero register 9
080	f SPACE	16-11	Space printer
081	RTN	24	Return to 000
082	LBL f d	21 16 14	INCHES/ACRES routine
083	1	01	Input
084	STO 9	35 09	Zero register nine
085	RCL 1	36 46	
086	f x>0?	16-44	Test for length or area
087	GTO 5	22 05	To calculate inches
088	RCL 1	36 01	
089	4	04	
090	3	03	
091	5	05	Constant
092	6	06	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cent		
093	0	093 00	
094	÷	094 -24	Divide
095	f SPACE	095 16-11	Space printer
096	STO 2	096 35 02	
097	RTN	097 24	Return to 000
098	LBL E	098 21 15	PRINT routine
099	STO 0	099 35 00	
100	RCL 1	100 36 46	
101	f X=0?	101 16-43	Test for points
102	STO 0	102 22 00	If Yes
103	RCL 8	103 36 08	If No
104	f X≠0?	104 16-42	Test for slope
105	GTO 4	105 22 04	If Yes, routine 4
106	RCL 9	106 36 09	If No
107	f X>0?	107 16-44	Test for inches/acres
108	GTO 2	108 22 02	If Yes, routine 2
109	GTO 1	109 22 01	If No, routine 1
110	RTN	110 24	Return to 000
111	LBL 1	111 21 01	Print areas or length routine
112	RCL 0	112 36 00	
113	PRINT X	113 -14	Print display
114	RCL 6	114 36 06	
115	f X≠0?	115 16-42	Test for actuate

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont			
116	GTO 8	116	22 08	If Yes, routine 8
117	f SPACE	117	16-11	If No
118	R↓	118	-31	Adjust memory stack
119	RTN	119	24	Return to 000
120	LBL 8	120	21 08	PRINT actuate routine
121	X	121	-35	Input X
122	RCL 3	122	36 03	
123	+	123	-55	Add
124	STO 3	124	35 03	
125	PRINT X	125	-14	Print total
126	f SPACE	126	16-11	Space printer
127	RTN	127	24	Return to 000
128	LBL 2	128	21 02	Print inches/acres routine
129	RCL 0	129	36 00	
130	PRINT X	130	-14	Print display
131	RCL 1	131	3601	
132	÷	132	-24	
133	RCL 2	133	36 02	
134	X	134	-35	
135	PRINT X	135	-14	Print inches/acres
136	STO 5	136	35 05	
137	RCL 6	137	36 06	
138	f X≠0?	138	16-42	Test for actuate

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont			
139	GTO 9	139	22 09	If yes, routine 9
140	f SPACE	140	16-11	If no
141	R↓	141	-31	Adjust memory to X
142	RTN	142	24	Return to 000
143	LBL 9	143	21 09	Print inches/acres Actuate routine
144	RCL 0	144	36 00	
145	RCL 6	145	36 06	
146	X	146	-35	
147	RCL 3	147	36 03	
148	+	148	-55	Add
149	STO 3	149	35 03	
150	PRINT X	150	-14	Print display
151	RCL 5	151	36 05	
152	RCL 6	152	36 06	
153	X	153	-35	Input
154	RCL 4	154	36 04	
155	+	155	-55	Add
156	STO 4	156	35 04	
157	PRINT X	157	-14	Print
158	f SPACE	158	16-11	Space printer
159	f SPACE	159	16-11	Space printer
160	RTN	160	24	Return to 000
161	LBL 0	161	21 00	Print points routine

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
162	RCL 0	36 00	
163	RCL A	36 11	
164	PRINT X	-14	
165	X	-35	Input
166	PRINT X	-14	
167	f SPACE	16-11	
168	RTN	24	Return to 000
169	LBL 4	21 04	Print slope routine
170	RCL 0	36 00	
171	PRINT X	-14	Print
172	RCL 7	36 07	
173	÷	-24	Divide
174	PRINT X	-14	Print
175	STO 5	35 05	
176	f SPACE	16-11	Space printer
177	RCL 6	36 06	
178	f X≠0?	16-42	Test for ACCU
179	GTO 9	22 09	If Yes, routine 9
180	R↓	-31	If No, move stack
181	RTN	24	Return to 000
182	LBL 5	21 05	Inches routine
183	RCL 1	36 01	
184	RCL A	36 11	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
185	÷	185 -24	Divide
186	STO 2	186 35 02	
187	f SPACE	187 16-11	Space printer
188	RTN	188 24	Return to 000
189	LBL f e	189 21 16 15	Memory load routine
190	STO 4	190 35 04	
191	R↓	191 -31	Move memory stack
192	STO 3	192 3503	
193	R↓	193 -31	Move memory stack
194	STO 2	194 3502	
195	R↓	195 -31	Advance memory stack
196	STO 1	196 35 01	
197	1	197 01	
198	STO I	198 35 46	
199	f SPACE	199 16-11	Space printer
200	R/S	200 51	Run/Stop, end of program
	Program II - Volumes by Contour		
001	LBL A	001 21 11	Load data routine
002	STO E	002 35 15	
003	f R↑	003 16-31	Roll up stack
004	STO A	004 35 11	Horizontal scale entry
005	f R↑	005 16-31	Roll up stack
006	STO B	006 35 12	Vertical scale entry

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program II - Volumes by Contour - Cont		
007	R↓	007	-31	Roll down stack
008	1	008	01	
009	2	009	02	
010	.	010	-62	Actual area of test rule
011	5	011	05	
012	5	012	05	
013	STO C	013	35 13	Test area
014	f R↑	014	16-31	Roll up stack
015	STO D	015	35 14	
016	f R↑	016	16-31	Roll up stack
017	CL X	017	-51	Clear display
018	f SPACE	018	16-11	
019	RTN	019	24	Return to 000
020	LBL B	020	21 12	Fill routine
021	1	021	01	
022	LBL 4	022	21 04	Cut/Fill indication
023	STO I	023	35 46	Entry
024	f SPACE	024	16-11	
025	RTN	025	24	Return to 000
026	LBL C	026	21 13	First section routine
027	STO 9	027	35 09	
028	f SPACE	028	16-11	
029	RCL 5	029	36 05	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
030	RCL 6	030 36 06	
031	f P≷S	031 16-51	
032	STO 6	032 35 06	
033	R↓	033 -31	Roll down stack
034	STO 5	034 36 05	
035	f P≷S	035 16-51	
036	0	036 00	
037	STO 0	037 3500	
038	RTN	038 24	Return to 000
039	LBL D	039 21 14	Initiate routine
040	RCL A	040 36 11	Indicator
041	RCL B	041 36 12	
042	X	042 -35	Multiply
043	RCL C	043 36 13	
044	X	044 -35	Multiply
045	RCL D	045 36 14	
046	÷	046 -24	Divide
047	STO 1	047 3501	O Stored
048	0	048 00	
049	STO 5	049 35 05	Store O's
050	STO 6	050 35 06	Store 0's
051	STO 7	051 35 07	Store 0's
052	STO 8	052 35 08	Store O's

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program II - Volumes by Contour - Cont			
053	STO 9	053	35 09	Store 0's
054	f P≷S	054	16-51	
055	STO 0	055	35 00	Store 0's
056	STO 1	056	35 01	Store 0's
057	STO 2	057	35 02	
058	STO 3	058	35 03	
059	STO 4	059	35 04	
060	STO 5	060	35 05	
061	STO 6	061	35 06	
062	f P≷S	062	16-51	
063	f SPACE	063	16-11	
064	f CLF 0	064	16 22 00	Clear flag 0
065	RTN	065	24	Return to 000
066	LBL E	066	21 15	Print routine
067	RCL 6	067	36 06	
068	f P≷S	068	16-51	Current area next to last area
069	STO 2	069	35 02	
070	f P≷S	070	16-51	
071	X≷Y	071	-41	
072	STO 6	072	35 06	Store new area in current area
073	RCL 7	073	36 07	
074	f P≷S	074	16-51	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program II - Volumes by Contour - Cont		
075	STO 3	075	35 03	Store current intermediate volume in last intermediate volume
076	f P≷S	076	16-51	
077	RCL 9	077	3609	
078	PRINT X	078	-14	Print next elevation
079	RCL 6	079	36 06	
080	PRINT X	080	-14	Print new area
081	f P≷S	081	16-51	
082	RCL 2	082	36 02	
083	+	083	-55	Add
084	f P≷S	084	16-51	
085	RCL 0	085	36 00	Section/Volume calculation
086	X	086	-35	Multiply
087	5	087	05	
088	4	088	04	Constant
089	÷	089	-24	Divide
090	RCL 9	090	36 09	
091	RCL 5	091	3605	
092	−	092	-45	Subtract
093	X	093	-35	Multiply
094	STO 7	094	35 07	
095	PRINT X	095	-14	Print intermediate volume
096	RCL 8	096	36 08	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
097	f P≷S	097 16-51	
098	STO 4	098 3504	
099	f P≷S	099 16-51	
100	+	100 -55	Add
101	STO 8	101 35-08	Store total volume
102	PRINT X	102 -14	Print total volume
103	RCL 9	103 36 09	
104	f P≷S	104 16-51	
105	RCL 5	105 36 05	
106	f P≷S	106 16-51	
107	−	107 -45	Subtract
108	f X≠0?	108 16-42	Twin peak test
109	GTO 0	109 22 00	If yes
110	RCL 6	110 3606	If no
111	f P≷S	111 16-51	
112	RCL 6	112 36 06	
113	f P≷S	113 16-51	
114	+	114 -55	Add
115	STO 6	115 35 06	
116	LBL 0	116 21 00	Twin peak routine
117	RCL 9	117 3609	
118	f F?0	118 16 23 00	Test flag 0
119	GTO 2	119 22 02	If yes

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
120	RCL E	36 15	If no
121	÷	-24	Divide
122	f FRAC	16 44	
123	f X=0?	16-43	Test for 000
124	GTO 1	22 01	If yes
125	RCL I	36 46	If odd elevations
126	1	01	
127	−	-45	Subtract
128	2	02	
129	÷	-24	Divide
130	CHS	-22	Change sign
131	RCL 9	36 09	
132	RCL E	36 15	
133	÷	-24	Divide
134	+	-55	Add
135	f INT	1634	Truncate to integer
136	RCL E	36 15	
137	X	-35	
138	GTO 2	22 02	To twin peak routine
139	LBL 1	21 01	Even elevation routine
140	RCL 9	36 09	
141	LBL 2	21 02	Twin peak routine
142	RCL I	36 46	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
143	RCL E	143 36 15	
144	X	144 -35	Multiply
145	+	145 -55	Add
146	f F?0	146 16 23 00	Test flag 0
147	GTO 8	147 22 08	If yes
148	f P≷S	148 16-51	If no
149	RCL 0	149 36 00	
150	f P≷S	150 16-51	
151	+	151 -55	Add
152	LBL 8	152 21 08	In twin peak routine
153	RCL 9	153 36 90	
154	RCL 5	154 36 05	
155	f P≷S	155 16-51	
156	STO 1	156 35 01	
157	f P≷S	157 16-51	
158	R↓	158 -31	Roll down stack
159	STO 5	159 3505	
160	R↓	160 -31	
161	STO 9	161 35 09	
162	1	162 01	
163	STO 0	163 35 00	
164	RCL 8	164 36 08	
165	f P≷S	165 16-51	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program II - Volumes by Contour - Cont		
166	RCL 0	166	36 00	
167	f X=0?	167	16-42	Test for twin peak
168	f STF 0	168	16 21 00	Set flag to 0
169	f P≷S	169	16-51	
170	RCL 8	170	36 08	
171	f SPACE	171	16-11	Space printer
172	RTN	172	24	Return to 000
173	LBL f a	173	21 16 11	New interval routine
174	STO E	174	35 15	
175	f SPACE	175	16-11	Space printer
176	RCL 5	176	3605	
177	STO 9	177	35 09	Store last elevation
178	f P≷S	178	16-51	In current elevation
179	RCL 1	179	36 01	
180	f P≷S	180	16-51	
181	STO 5	181	35 05	
182	GTO 0	182	22 00	To first section routine
183	LBL f b	183	21 16 12	Cut routine
184	1	184	01	
185	CHS	185	-22	Change sign
186	GTO 4	186	22 04	
187	LBL f c	187	21 16 13	Next section routine
188	STO 9	188	35 09	

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program II - Volumes by Contour - Cont		
189	f SPACE	189	16-11	Space printer
190	RTN	190	24	Return to 000
191	LBL f d	191	21 16 14	Reload stack routine
192	GSB 5	192	23 05	To subroutine 5, data load
193	f R↓	193	16-31	
194	RCL E	194	36 15	
195	RCL I	195	36 46	Set up for next elevation
196	X	196	-35	Multiply
197	+	197	-55	Add
198	STO 9	198	35 09	
199	RCL 8	199	36 08	
200	f SPACE	200	16-11	
201	RTN	201	24	Return to 000
202	LBL f e	202	21 16 15	Erase routine
203	RCL 5	203	36 05	
204	STO 9	204	35 09	
205	f P≷S	205	16-51	Backs up data
206	RCL 1	206	36 01	Group 1 section
207	RCL 2	207	36 02	
208	RCL 3	208	36 03	
209	RCL 4	209	36 04	
210	f P≷S	210	16-51	
211	f STACK	211	16-14	Print stack

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, Ill, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program II - Volumes by Contour - Cont			
212	LBL 5	212	21 05	Loader routine
213	STO 8	213	35 08	
214	R↓	214	-31	Roll down stack
215	STO 7	215	35 07	Loads stack into memory
216	R↓	216	-31	Roll down stack
217	STO 6	217	35 06	
218	R↓	218	-31	Roll down stack
219	STO 5	219	35 05	
220	R↓	220	-31	Roll down stack
221	RTN	221	24	Return to 000
222	R/S	222	51	Run/Stop, end of program
	Program III - Multiple Scale or Alinement Factors			
001	LBL E	001	21 15	Print X routine
002	PRINT X	002	-14	
003	RTN	003	24	Return to 000
004	LBL A	004	21 11	Loads register 2
005	RCL 2	005	36 02	
006	STO 1	006	35 01	Loads register 2 into 1
007	RTN	007	24	Return to 000
008	LBL B	008	21 12	Loads register 3
009	RCL 3	009	36 03	
010	STO 1	010	35 01	Loads register 3 into 1
011	RTN	011	24	Return to 000

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont		
012	LBL C	21 13	Loads register 4
013	RCL 4	36 04	
014	STO 1	35 01	Loads register 4 into 1
015	RTN	24	Return to 000
016	LBL D	21 14	Loads register 5
017	RCL 5	36 05	
018	STO 1	35 01	Loads register 5 into 1
019	RTN	24	Return to 000
020	LBL f a	21 16 11	Loads register 6
021	RCL 6	36 06	
022	STO 1	35 01	Loads register 6 into 1
023	RTN	24	Return to 000
024	LBL f b	21 16 12	Loads register 7
025	RCL 7	36 07	
026	STO 1	35 01	Loads register 7 into 1
027	RTN	24	Return to 000
028	LBL f c	21 16 13	Loads register 8
029	RCL 8	36 08	
030	STO 1	35 01	Loads register 8 into 1
031	RTN	24	Return to 000
032	LBL f d	21 16 14	Loads register 9
033	RCL 9	36 09	
034	STO 1	35 01	Loads register 9 into 1

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont			
035	RTN	035	24	Return to 000
036	R/S	036	51	Run/Stop, end of program
	Program IV - Linear Measuring Probe Program for Aerial Photos			
001	LBL A	001	21 11	Enter 1 routine
002	1	002	01	
003	STO 1	003	35 01	Enter 1 into memory
004	RTN	004	24	Return to 000
005	LBL B	005	21 12	Constant/Ratio routine
006	ENTER↑	006	-21	
007	RCL 1	007	36 01	
008	X	008	-35	Multiply
009	1/X	009	52	Reciprocal of X
010	RCL 8	010	36 08	
011	X	011	-35	Multiply
012	PRINT X	012	-14	Print X
013	STO 3	013	35 03	
014	7	014	07	
015	2	015	02	Constant
016	4	016	04	
017	X	017	-35	
018	PRINT X	018	-14	
019	f SPACE	019	16-11	Space printer
020	RTN	020	24	Return to 000

Table 9-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAM I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont			
021	LBL C	021	21 13	C_L routine
022	RCL 3	022	36 03	
023	STO 1	023	35 01	Enter C_L in memory
024	RTN	024	24	Return to 000
025	LBL E	025	21 15	Print routine
026	PRINT X	026	-14	
027	RTN	027	24	Return to 000
028	R/S	028	51	Run/Stop, end of program

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES

Step	Keyboard Entry	Purpose
001	*LBLO	Clear registers subroutine.
002	CL REG	
003	P≷S	
004	CL REG	
005	RTN	
006	*LBLa	Function test subroutine.
007	RND	
008	RCLI	
009	X≠Y?	
010	R/S	
011	*LBL2	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
012	DSZI	DSZI and RCLI subroutine.
013	*LBL5	
014	RCLI	
015	RTN	RCL and STOP if called.
016	*LBLc	
017	RCL(i)	
018	RCLI	Verify registers and sum in
019	X≠Y?	R_0 subroutine.
020	R/S	
021	STO O	
022	DSZI	
023	GTOc	
024	3	
025	EEX	
026	2	
027	RCLO	
028	X≠Y?	Test R_0.
029	R/S	
030	RTN	
031	*LBLe	Decrement x subroutine.
032	1	
033	-	
034	RTN	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
	NOTE	
	These first 34 instruction steps are standard for any program run. They are used to set registers and flags for the following program.	
035	*LBLA	Start and pause after first subroutine execution.
036	5	
037	7	
038	GSBO	
039	P SE	
040	GSBe	Decrement x.
041	ENT↑	
042	R↑	Stack (X, Y, Z, T) test.
043	X≷Y	
044	R↑	
045	R↑	
046	X≷Y	
047	R↑	
048	X≠0?	
049	X≠Y?	
050	RTN	
051	GSBe	Decrement x.
052	X>Y?	
053	RTN	
054	GSBe	X-to-Y comparisons.

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
055	X=Y?	
056	RTN	
057	GSBe	
058	X<Y?	
059	GTO1	
060	RTN	
061	*LBL1	Decrement x.
062	GSBe	
063	STO I	I-register test.
064	RCLI	
065	X≥Y	
066	X≠Y?	X-to-O comparisons.
067	RTN	
068	GSB2	
069	X≠0?	
070	GT03	
071	RTN	
072	*LBL3	
073	GSB2	
074	X=0?	
075	RTN	
076	GSB2	
077	X<0?	
078	RTN	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
079	GSB2	
080	X>0?	
081	GT04	
082	RTN	
083	*LBL4	Check set status on flags.
084	DSZI	
085	F?2	
086	GT05	
087	DSZI	
088	F?1	
089	GT05	
090	DSZI	
091	F?3	
092	GT06	
093	GT05	
094	*LBL6	
095	DSZI	
096	F?0	
097	GT07	
098	GT05	
099	*LBL7	Check complement of set status on flags.
100	STF2	
101	STF1	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
102	CFO	
103	DSZI	
104	F?3	
105	GT05	
106	DSZI	
107	F?0	
108	GT05	
109	DSZI	
110	F?2	
111	GT08	
112	GT05	
113	*LBL8	
114	DSZI	
115	F?1	
116	GT09	
117	GT05	
118	*LBL9	Check F2 for test clearing.
119	DSZI	
120	F?2	
121	GT05	
122	GSB2	Test DEG, SIN, SIN^{-1}.
123	DSP7	
124	DEG	
125	SIN	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
126	SIN^{-1}	
127	GSBa	
128	COS	Test COS, COS^{-1}.
129	COS^{-1}	
130	GSBa	
131	TAN	Test TAN, TAN^{-1}.
132	TAN^{-1}	
133	GSBa	
134	→P	Test →P, →R.
135	→R	
136	GSBa	
137	SIN	
138	→H.MS	Test →H.MS, H.MS→
139	H.MS→	
140	SIN^{-1}	
141	GSBa	
142	LOG	Test LOG, 10^x.
143	10^x	
144	GSBa	
145	LN	Test LN, e^x.
146	e^x	
147	GBSa	
148	$\sqrt{X}$	Test $\sqrt{X}$, X^2.
149	X^2	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
150	GSBa	
151	ENT↑	Test y^x, LASTx, 1/x.
152	Y^x	
153	LAST X	
154	1/x	
155	Y^x	
156	GSBa	
157	ENT↑	Test +, -
158	+	
159	LAST X	
160		
161	GSBa	
162	ENT↑	Test x, ÷
163	x	
164	LAST X	
165	÷	
166	GSBa	
167	$\sqrt{X}$	Test FRAC, INT.
168	FRAC	
169	LAST X	
170	INT	
171	+	
172	X^2	
173	GSBa	Test D→R, R→D.

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
174	D→R	
175	R→D	
176	GSBa	
177	EEX	Test EEX, %.
178	2	
179	X≷Y	
180	%	
181	GSBa	
182	DSP1	Test registers 24 and 0.
183	*LBLb	
184	RCLI	
185	STO(i)	(Sensitivity of lower-order registers to higher-order register changes.)
186	DSZI	
187	GTOb	
188	2	
189	4	
190	X≷I	
191	GSBc	
192	GSBO	
193	*LBLd	
194	DSZI	
195	RCLI	
196	ABS	

Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
197	STO(i)	
198	2	
199	4	
200	X≠Y?	
201	GTOd	
202	STOI	
203	GSBc	
204	9	Generate “PASS” display.
205	EEX	
206	8	-8-888888888-88
207	7	
208	1/x	
209	8	
210	CHS	
211	X	
212	STF 0	
213	CLF 1	Reset status for possible second pass.
214	STF 3	
215	RAD	
216	DSP3	Test display formatting and printing.
217	ENG	
218	PRINT X	
219	SC I	

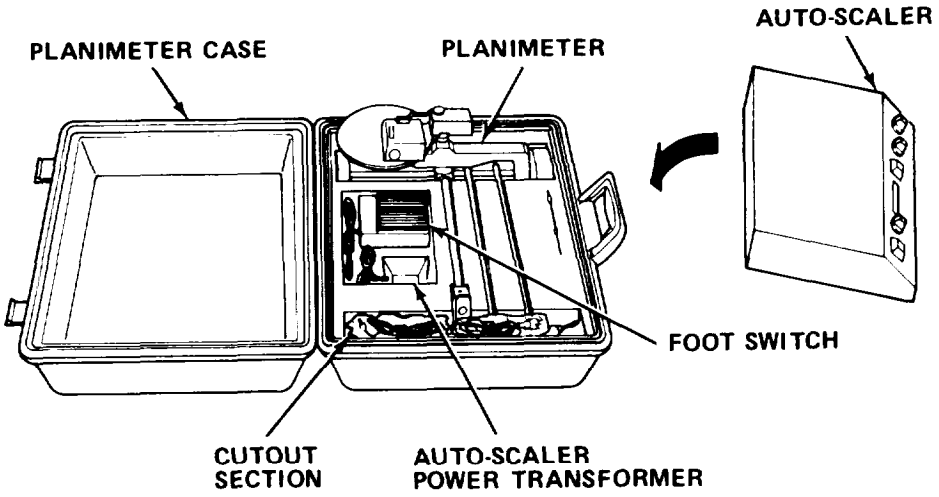
Table 9-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

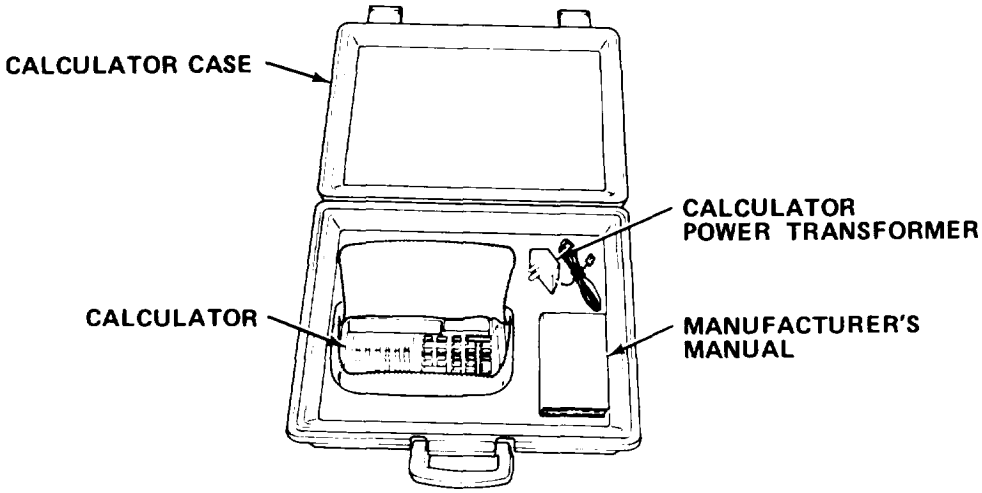
Step	Keyboard Entry	Purpose
220	PRINT X	
221	DSP1	
222	FIX	
223	PRINT X	
224	R/S	End of test.

9-6.3 Preparation for Movement.

a. Disconnect all cables and switches from equipment.

b. Cover components with their respective plastic covers.





c. Place foot switch and auto-scaler power transformer into planimeter case.

d. Place planimeter tracer arm extensions into cutout section of planimeter case.

e. Place planimeter with needle tracing assembly sideways into case.

f. Place remote tracer switch, point counter pen, linear measuring probe, and drafting bridge into cutout section of planimeter case.

g. Place auto-scaler in planimeter case.

h. Place calculator in small case.

i. Place calculator case, calculator power transformer, magnetic card pack, and manufacturer's manual in large calculator case.

j. Close and secure both cases.

9-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III Operator Maintenance

9-8. LUBRICATION INSTRUCTIONS.

NOTE

These lubrication instructions are mandatory.

Apply one drop of watch oil (Item 16, Appendix E) to drive gears of linear measuring probe quarterly.

9-9. TROUBLESHOOTING PROCEDURES.

9-9.1 The table lists the common malfunctions which you may find during the operation or maintenance of the QPS. You should perform the test/inspections and corrective actions in the order listed.

9-9.2 This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 9-5. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. AUTO-SCALER DOES NOT OPERATE.	
Step 1. Check to see if power transformer is plugged into wall outlet and auto-scaler back panel.	
	(a) If power transformer is plugged in, proceed to step 2.
	(b) Plug in power transformer.
Step 2. Check position of circuit breaker in power panel.	
	(a) If circuit breaker is on, refer to organizational maintenance.
	(b) Turn on circuit breaker.
2. CALCULATOR DOES NOT OPERATE.	
Step 1. Check to see if power transformer is plugged into wall outlet and back of calculator.	
	(a) If power transformer is plugged in, proceed to step 2.
	(b) Plug in power transformer.
Step 2. Check position of circuit breaker at power panel.	
	(a) If circuit breaker is turned on, refer to organizational maintenance and proceed to step 3.
	(b) Turn on circuit breaker.
Step 3. Check to see if calculator will energize with good battery pack.	
	(a) If calculator energizes, replace power transformer.
	(b) If calculator does not energize, replace calculator.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. AUTO-SCALER AND CALCULATOR DISPLAY ALL ZEROS .		
	Step 1. With scale diials set to 000, check setting of NORMAL/SCALE switch.	(a) If NORMAL/SCALE switch is on NORMAL, proceed to step 2. (b) Set NORMAL/SCALE switch to NORMAL.
	step 2. Check to see if switches on auto-scaler front panel are set correctly for specific measuring procedure.	(a) If switches are set correctly, proceed to step 3. (b) Set auto-scaler switches for measuring procedure being performed.
	Step 3. Check to see if remote tracer switch is stuck.	(a) If remote tracer switch functions properly, proceed to step 4. (b) Free remote tracer switch.
	Step 4. Check to see if auto-scaler 0FF/E_2/ E_1 switch is set correctly for specific measuring procedure.	(a) If 0FF/E_2/ E_1 switch is set correctly, proceed to step 5. (b) Set 0FF/E_2/ E_1 switch correctly.
	Step 5. Check alinement procedure with linear measuring. probe (paragraph 9-6.2n).	Perform alinement procedure with linear measuring probe (paragraph 9-6.2n).
4. AUTO-SCALER DISPLAYS ALL ZEROS. CALCULATOR DISPLAYS CORRECT COUNT.		
	Check to see if auto-scaler switches are set correctly for specific measuring procedures.	Set switches correctly.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
5. AUTO-SCALER DISPLAYS CORRECT COUNT. CALCULATOR DISPLAYS ALL ZEROS.		
	Step 1. Check to see if ribbon cable in back of calculator is correctly connected.	(a) If ribbon cable is connected properly, proceed to step 2. (b) Insert ribbon cables correctly.
	Step 2. Check to see if [1] , [STO] , [1] , and [ENTER↑] have been keyed into calculator memory.	(a) If correct entries have been keyed in, proceed to step 3. (b) Key into calculator [1] , [STO] , [1] , and [ENTER↑] .
	Step 3. Check to see if auto-scaler MAN/AUTO switch, X MEMORY switch, and INIT button are set correctly for specific measuring procedure.	(a) If switches are set correctly, proceed to step 4. (b) Set switches correctly.
	Step 4. Run calculator diagnostic program on preprogrammed magnetic card.	Replace calculator.
6. AUTO-SCALER IS ERRATIC. CALCULATOR DISPLAYS CORRECT COUNT.		
	Perform checks in malfunction 5.	
7. CALCULATOR DISPLAYS CORRECT COUNT BUT DOES NOT RESPOND TO AUTO-SCALER SWITCHES.		
	Step 1. Check to see if ribbon cable in back of calculator is correctly connected.	(a) If ribbon cable connection is correct, proceed to step 2. (b) Insert ribbon cable correctly.
	Step 2. Run calculator diagnostic program on preprogrammed magnetic card.	Replace calculator.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION
8. CALCULATOR AND AUTO-SCALER DISPLAYS ARE ERRATIC .	
Step 1. Check to see if encoder cable is correctly inserted into auto-scaler back panel.	(a) If encoder cable is correctly inserted, proceed to step 2. (b) Insert encoder cable correctly.
Step 2. Check to see if encoder mounting screws are loose or missing.	(a) If no screws are loose or missing, proceed to step 3. (b) Notify direct/general support maintenance for tightening or replacing of screws.
Step 3. Check to see if planimeter drive gears are slipping or jamming.	(a) If gears are operating correctly, proceed to step 4. (b) Tighten or loosen setscrew on wheel axle to adjust drive gears.
Step 4. Check to see if compression spring is operating.	(a) If compression spring is operating properly, proceed to step 5. (b) Replace compression spring (paragraph 9-10.3).
Step 5. Check to see if encoder measuring wheel is in contact with planimeter disk.	Proceed to step 6.
Step 6. Check for any obstruction under the planimeter disk.	(a) If there is no obstruction present, proceed to step 7. (b) Remove obstruction, press encoder housing in place.
Step 7. Check to see if there are enough paper disks in planimeter.	If necessary, add another disk to planimeter (paragraph 9-10.4).

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
9. AUTO-SCALER DISPLAYS CORRECT COUNT. CALCULATOR DISPLAY IS ERRATIC.	Perform checks in malfunction 8.	
10. POINT COUNTER PEN DOES NOT INCREMENT COUNT CORRECTLY.		
	Step 1. Check to see if point of point counter pen is jammed.	
		(a) If point is free, proceed to step 2.
		(b) Free point.
		(c) Replace cartridge.
		(d) Replace point counter pen.
	Step 2. Check to see if point counter pen will operate with new cartridge.	
		(a) Replace cartridge.
		(b) Replace point counter pen.
	Step 3. Check to see if auto-scaler LED display shows erratic counting while moving point counter pen.	
		Replace point counter pen.
11. BOTH DISPLAYS APPEAR NORMAL. ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT.		
	Step 1. Check to see if planimeter tracer arm has slipped or moved.	
		(a) If planimeter tracer arm is in the proper position, proceed to step 2.
		(b) Set tracer arm to proper length.
	Step 2. Check to see if planimeter wheels are clean.	
		(a) If planimeter wheels are clean, proceed to step 3.
		(b) Clean wheels using a soft brush.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
11. BOTH DISPLAYS APPEAR NORMAL. ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT - Cont	Step 3. Check to see if teflon guide washer beneath the lens tracing assembly is clean and in contact with surface.	(a) If teflon guide washer is clean and positioned correctly, proceed to step 4. (b) Clean teflon guide washer with soft clean cloth. (c) Replace teflon guide washer (paragraph 9-10.2).
	Step 4. Check to see if paper disk on planimeter is clean.	(a) If paper disk is clean, proceed to step 5. (b) Replace paper disk (paragraph 9-10.4).
	Step 5. Check to see if auto-scaler NORMAL/SCALE switch is set to NORMAL.	(a) If switch is correctly set, proceed to step 6. (b) Set NORMAL/SCALE switch to NORMAL.
	Step 6. With 90° triangle, check to see if axis of tracing assembly is at 90° angle to surface being measured.	(a) If axis is at proper angle, proceed to step 7. (b) Adjust axis of tracing assembly until it is at 90° angle with surface being measured.
	Step 7. With 90° triangle, check to see if axis of tracer arm and axis of wheel axle are at 90° angle.	(a) If axis is correct, proceed to step 8. (b) Adjust tracer arm assembly until it is at 90° angle with axis of wheel axle.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION
11. BOTH DISPLAYS APPEAR NORMAL. ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT - Cont	
Step 8. Check to see if encoder measuring wheel is clean.	(a) If encoder measuring wheel is clean, proceed to step 9. (b) Clean encoder measuring wheel with soft brush.
Step 9. Check to see if encoder is alined.	Notify direct/general support maintenance for encoder alinement and replacement.
12. AUTO-SCALER AND CALCULATOR DISPLAYS DO NOT AGREE BY TWO OR MORE COUNTS.	
Check to see if ribbon cable in back of calculator is correctly connected.	Insert ribbon cable correctly.
13. CALCULATOR WILL NOT ACCEPT MAGNETIC CARD.	
Step 1. Check to see if magnetic card is being fed into reader backward or upside down.	(a) If card is being inserted correctly, proceed to step 2. (b) Feed magnetic card correctly.
Step 2. Check to make sure calculator is correctly keyed to accept card.	(a) If calculator has been correctly keyed, proceed to step 3. (b) Set keys correctly.
Step 3. Check to see if head-cleaning card will be accepted into magnetic card reader.	(a) If head-cleaning card will be accepted, proceed to step 4. (b) Run head-cleaning card through magnetic card reader.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

13. CALCULATOR WILL NOT ACCEPT MAGNETIC CARD - Cont

Step 4. Check to see if magnetic card is dirty.

(a) If magnetic card is clean, proceed to step 5.

(b) Clean magnetic card with cloth moistened with alcohol (Table 6-1.

Step 5. Check to see if battery pack contacts are clean and straight.

(a) If contacts are clean and straight, proceed to step 6.

(b) Clean battery pack contacts with cotton swab moistened with alcohol (Table 9-1).

(c) Straighten battery pack contacts by pressing down with finger.

(d) Replace battery pack (paragraph 9-10.1).

Step 6. Run calculator diagnostic program on preprogrammed magnetic card.

Replace calculator.

14. CALCULATOR PRINTER WILL NOT ADVANCE.

Step 1. Check to see if paper roll is jammed.

(a) If paper roll is free, proceed to step 2.

(b) Free paper roll.

Step 2. Check to see if battery pack is defective.

(a) If battery pack is good, proceed to step 3.

(b) Replace battery pack (paragraph 9-10.1).

Step 3. Check to see if calculator display is active.

(a) If display is active, proceed to step 4.

(b) Replace calculator.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

14. CALCULATOR PRINTER WILL NOT ADVANCE - Cont

Step 4. Check to see if calculator PRGM/RUN switch is set to RUN.

(a) If PRGM/RUN is set properly, proceed to step 5.

(b) Set switch to RUN.

Step 5. Run calculator diagnostic program on preprogrammed magnetic card.

Replace calculator.

15. CALCULATOR PRINTER ADVANCES, BUT NOTHING PRINTS WHEN PRINT X IS ACTIVATED.

Step 1. Check to see if paper roll is jammed.

(a) If paper roll is free, proceed to step 2.

(b) Free paper roll.

Step 2. Perform checks in malfunction 14.

16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT.

Step 1. Check to see if power source has 10 v dc to 15 V dc output.

(a) If output is correct, proceed to step 2.

(b) Change power source.

Step 2. Check to see if voltage on regulator on main logic PC board is 8 V dc.

(a) If voltage is correct, proceed to step 3.

(b) Notify direct/general support maintenance for replacement of main logic PC board.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION
16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT - Cont	
Step 3. Check to see if there is power at power source but not on main logic PC board.	(a) If power is present, proceed to step 4. (b) Notify direct/general support maintenance for replacement of main logic PC board and front display PC board.
Step 4. Check to see if auto-scaler LED display shows numbers but does not count.	(a) If display operates properly, proceed to step 5. (b) Notify direct/general support maintenance for replacement of main logic PC board and front display PC board.
Step 5. Check to see if auto-scaler LED display shows count only increasing or only decreasing.	(a) If count is correct, proceed to step 6. (b) Notify direct/general support maintenance for replacement of main logic PC board and front display PC board.
Step 6. Check to see if auto-scaler LED display shows erratic counts or skips counts.	(a) If count is correct, proceed to step 7. (b) Notify direct/general support maintenance for replacement of main logic PC board and front display PC board.
Step 7. Check to see if auto-scaler LED display does not show even or odd digits.	(a) If display is correct, proceed to step 8. (b) Notify direct/general support maintenance for replacement of main logic PC board.

Table 9-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT - Cont
Step 8. Check to see if auto-scaler LED display shows inaccurate counts.
(a) If display is correct, proceed to step 9.
(b) Notify direct/general support maintenance for replacement of main logic PC board.
Step 9. Check to see if calculator LED shows incorrect readings.
(a) If calculator LED display is correct, proceed to step 10.
(b) Notify direct/general support maintenance for replacement of main logic PC board.
Step 10. Check to see if calculator LED display will clear.
(a) If display clears, proceed to step 11.
(b) Notify direct/general support maintenance for replacement of main logic PC board.
Step 11. Check to see if auto-scaler NORMAL/SCALE switch and scale dials are operating correctly.
(a) Notify direct/general support maintenance for replacement of scaler PC board.
(b) Replace auto-scaler.
NOTE
If above procedures do not correct malfunction, notify direct/general support maintenance for replacement of all auto-scaler PC boards in the following order:
(1) Replace main logic PC board.
(2) Replace front display PC board.
(3) Replace scaler PC board.
(4) Replace rear input PC board.

9-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the quantity processing system. Personnel required are listed only if the task requires more than one.

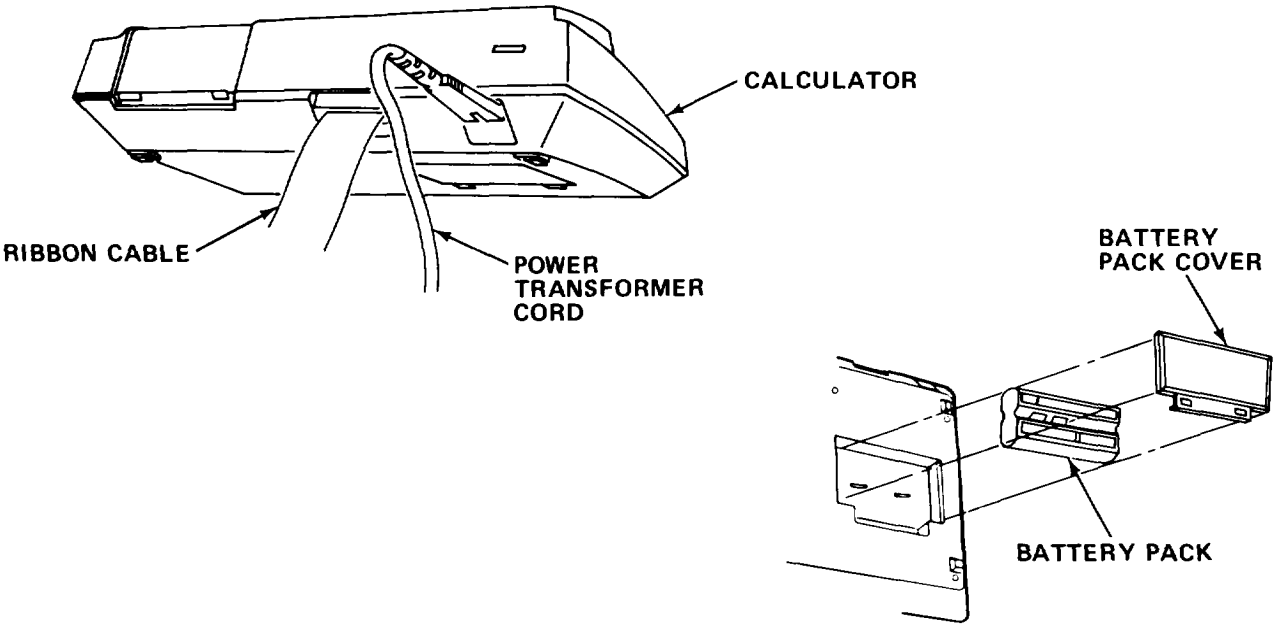
b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

9-10.1 Replace Battery Pack.

MOS: 81Q, Terrain Analyst

SUPPLIES: Battery Pack



a. Turn calculator OFF/ON switch to OFF. Disconnect power transformer from wall outlet.

b. Remove ribbon cable.

c. Turn calculator over. Slide battery cover latches open.

d. Remove defective battery pack.

e. Install new battery pack so contacts face calculator and line up with connectors.

f. Replace cover. Slide cover latches over to secure.

CAUTION

Arrows on ribbon cable and calculator must aline. Damage to calculator can result if cable is plugged in backward.

g. Turn calculator over. Replace ribbon cable.

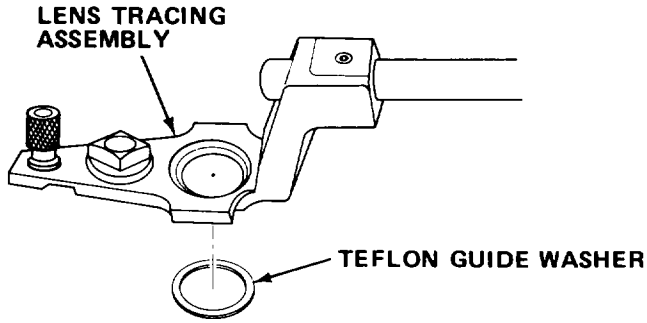
h. Reconnect power transformer to wall outlet. Turn calculator on.

9-10.2 Replace Teflon Guide Washer.

MOS: 81Q, Terrain Analyst

TOOLS: 3/16 in. Flat Tip Screwdriver
Steel Knife
3/32 in. Hex Head Key Wrench

SUPPLIES: Teflon Guide Washer
Rubber Adhesive (Item 2, Appendix E)
Alcohol (Item 4, Appendix E)
Cheesecloth (Item 7, Appendix E)



CAUTION

Hold tracer arm with one hand before removing lens tracing assembly. Tracer arm will fall and damage planimeter.

a. Remove lens tracing assembly from planimeter tracer arm by loosening setscrew on top. Slide lens tracing assembly off tracer arm.

b. Turn lens tracing assembly over. Pry up teflon guide washer.

c. Scrape off glue and pieces of washer from base of lens tracing assembly.

d. Apply small amount of rubber adhesive to bottom of new teflon guide washer.

e. Press new teflon guide washer into place. Remove excess adhesive with alcohol and soft cloth.

f. Check to be sure teflon washer guide is level and is flat on surface.

g. Slide lens tracing assembly on tracer arm. Secure by tightening setscrew on top.

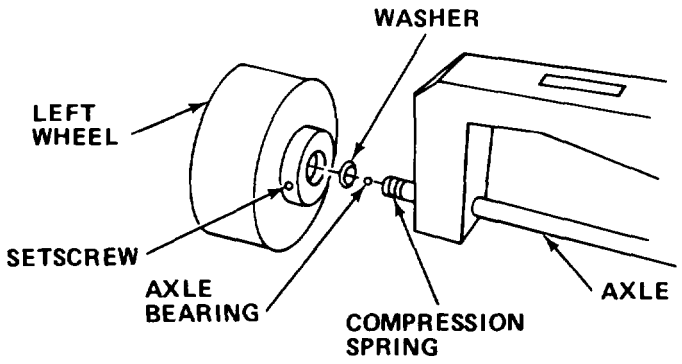
9-10.3 Replace Compression Spring.

MOS: 81Q, Terrain Analyst

TOOLS: 5/64 in. Hex Head Key Wrench

SUPPLIES: Compression Spring

a. Remove wires from antenna and tracer arm assembly.



b. Facing the back of the planimeter, loosen three setscrews holding left wheel on axle.

c. Slide left wheel and washer off end of axle.

d. Slide axle bearing off.

e. Pull defective compression spring from end of axle.

f. Install new compression spring on end of axle.

g. Reinstall axle bearing.

h. Reinstall washer and left wheel on end of axle.

i. Evenly tighten setscrews.

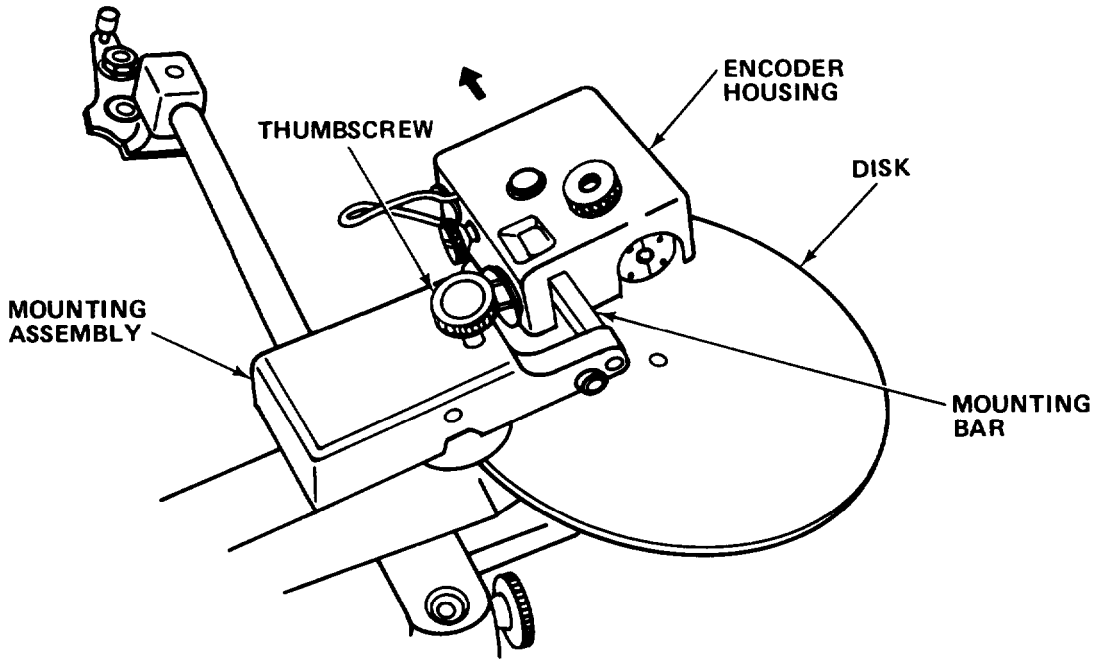
j. Reinstall wires on tracer arm assembly and antenna.

9-10.4 Replace Paper Disk.

MOS: 81Q, Terrain Analyst

TOOLS: Knife

SUPPLIES: Paper Disk
Rubber Adhesive (Item 2, Appendix E)
Alcohol (Item 4, Appendix E)
Brush



a. Loosen thumbscrew on side of encoder housing. Slide encoder housing off mounting bar.

b. Turn thumbscrew to move mounting assembly away from paper disk.

c. Pry up old paper disks with knife and remove.

d. Remove any remaining adhesive with alcohol and a brush.

e. Spread three or four drops of rubber adhesive along edge of paper disk.

f. Reinstall new disk on planimeter surface. Press down firmly.

g. Trim excess paper from edges with knife. Remove any excess adhesive from edges.

h. Slide encoder housing onto mounting bar. Tighten thumbscrew.

Section IV ORGANIZATIONAL MAINTENANCE

9-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication at the organizational level.

9-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT. These items are not required at this level of maintenance.

9-13. SERVICE UPON RECEIPT.

9-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

9-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

9-15. ORGANIZATIONAL TROUBLESHOOTING. There are no organizational trouble-shooting procedures assigned for this equipment.

9-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

9-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

9-18. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT.

9-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

9-18.2 Special Tools: Test. Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

9-18.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering direct/general support maintenance for this equipment.

9-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING.

There are no direct/general support troubleshooting procedures assigned for this equipment.

9-20. DIRECT/GENERAL SUPPORT MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance functions for the quantity processing system. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

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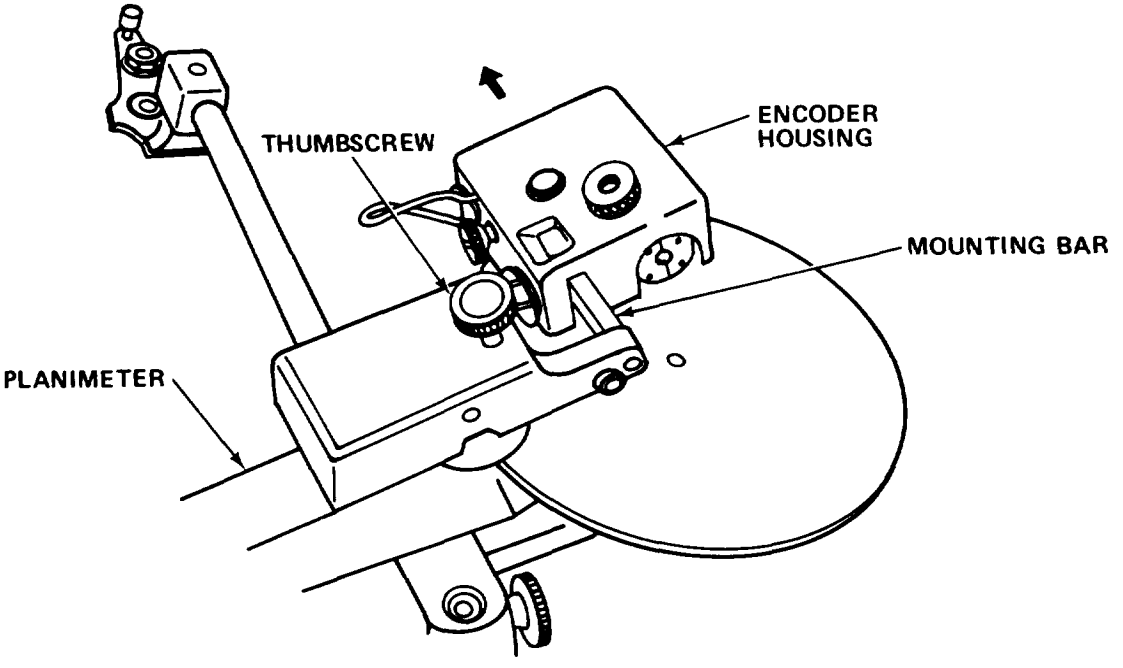
9-20.1 Replace Planimeter Encoder.

MOS: 35E, Special Electronic Devices Repairer

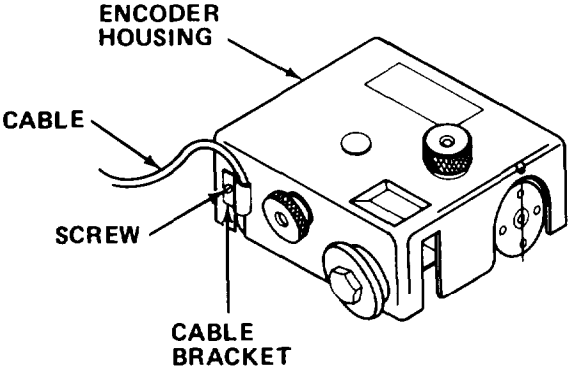
TOOLS: 5/64 in. Hex Head Key Wrench
No. 2 Jeweler's Screwdriver
3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver
Scribe

SUPPLIES: Encoder

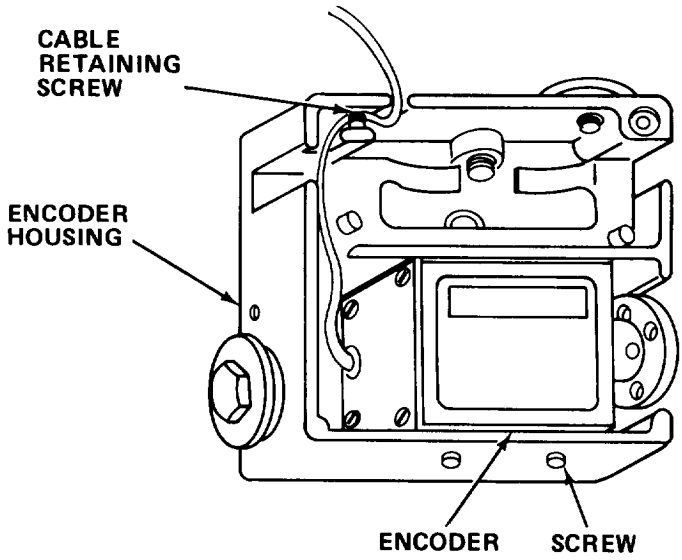


a. Loosen thumbscrew holding encoder housing on planimeter.

b. Grasp encoder housing and slide off mounting bar.



c. Remove screw holding cable bracket to encoder housing. Remove cable bracket and cable.



d. Remove cable retaining screw.

e. Mark exact position of encoder on inside walls of encoder housing with scribe.

f. Remove two hex head screws on side of housing.

g. Remove defective encoder from housing.

h. Install new encoder in housing.

i. Make sure the new encoder is parallel with the bottom of the housing and placed exactly between the marks made on the housing.

j. Reinstall two hex head screws on side of encoder housing.

k. Insert cable in housing. Reinstall cable retaining screw.

l. Reinstall cable bracket. Secure with screw.

m. Slide encoder housing onto mounting bar of planimeter.

n. Tighten thumbscrew holding encoder housing on planimeter.

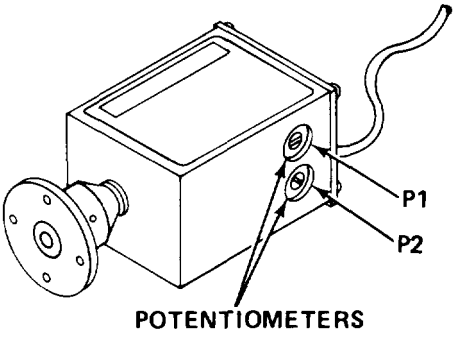
9-20.2 Aline Planimeter Encoder.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
1/8 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver
No. 2 Jeweler's Screwdriver
5/64 in. Hex Head Key Wrench
Encoder Calibrator

SUPPLIES: Spar Varnish (Item 26, Appendix E)
Technical Acetone (Item 1, Appendix E)
Dip-Clip (14 pin)

a. Remove planimeter encoder from housing (paragraph 9-20.1).



b. With technical acetone, remove resin covering from adjustment potentiometers, P1 and P2.

c. Remove four screws and washers from top of auto-scaler. Lift off top.

d. Plug encoder into E_1 encoder socket on back of auto-scaler.

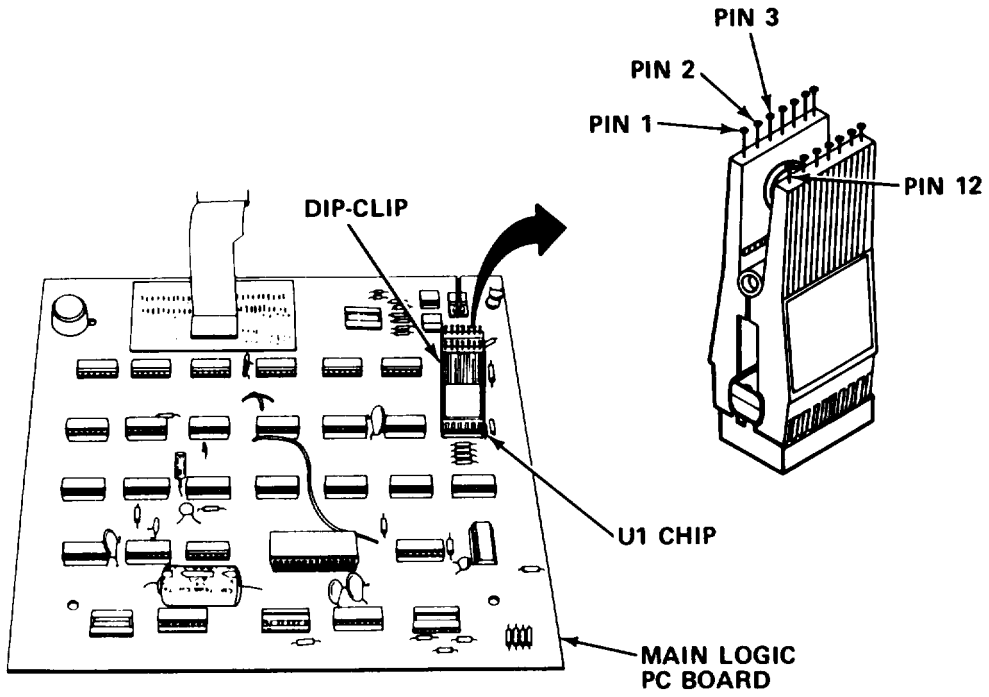
e. Set encoder switch to E_1.

CAUTION

Plug transformer power cable into auto-scaler before connecting it to wall outlet. Failure to do so could result in damage to auto-scaler.

f. Plug transformer power cable into POWER supply jack on back panel of auto-scaler.

g. Plug transformer power cable into wall outlet.



CAUTION

Make sure power is off before attaching dip-clip to U1 chip. Failure to do so could result in damage to auto-scaler.

h. Attach dip-clip to U1 chip on main logic PC board.

i. Attach positive lead from encoder calibrator to pin 3 on U1 chip. Attach negative lead to pin 12.

j. Turn B/ACCU/A/OFF switch to A.

k. Take voltage reading on encoder calibrator. Divide voltage reading by two to obtain encoder alinement voltage.

NOTE

- At pin 3 and pin 12, voltage should be 12 V dc.
- The encoder wheel must be turning to aline.

l. Turn B/ACCU/A/OFF switch to OFF.

m. Disconnect positive lead from pin 3 and attach to pin 1. Leave negative lead on pin 12.

n. Turn B/ACCU/A/OFF switch to A.

o. While encoder wheel is turning, adjust P1 by turning screw slowly to obtain encoder alinement voltage (6 ±0.3 V dc).

p. Turn B/ACCU/A/OFF switch to OFF.

q. Disconnect positive lead from pin 1 and attach to pin 2. Leave negative lead on pin 12.

r. Turn B/ACCU/A/OFF switch to A.

s. While encoder wheel is turning, adjust P2 by turning screw slowly to obtain encoder alinement voltage (6 ±0.3 V dc).

t. Turn B/ACCU/A/OFF switch to OFF.

u. After encoder alinement is obtained, coat adjustment pots, P1 and P2 with spar varnish.

v. Disconnect and remove probes from dip-clip.

w. Reinstall encoder in housing (paragraph 9-20.1).

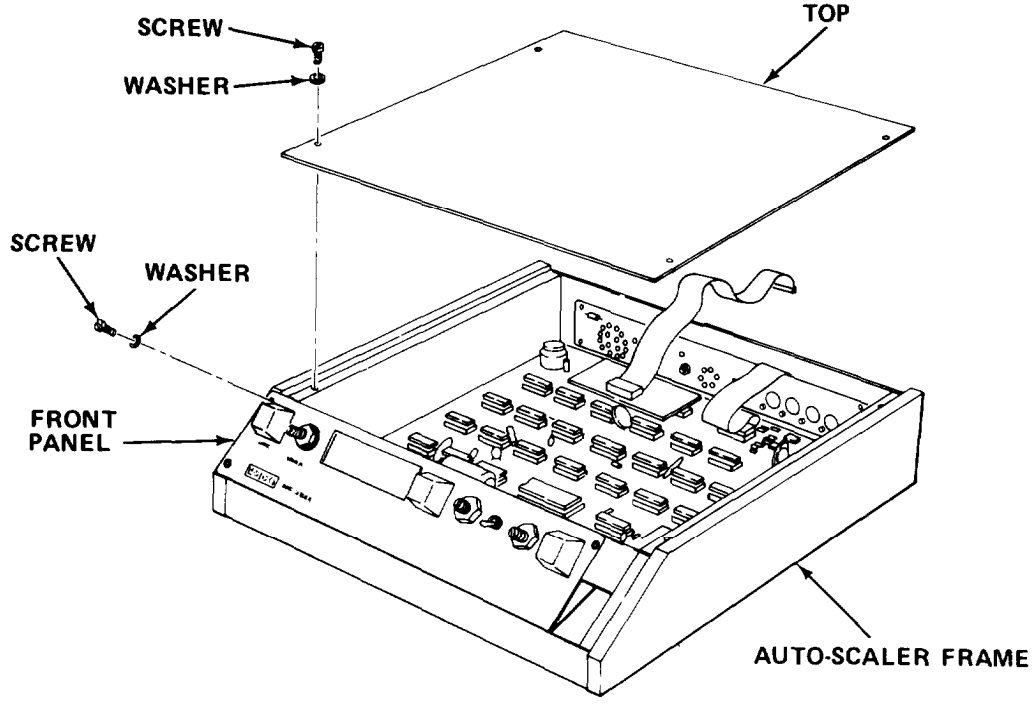
x. Reinstall top on auto-scaler. Secure with four washers and screws.

9-20.3 Replace Main Logic PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Main Logic PC Board

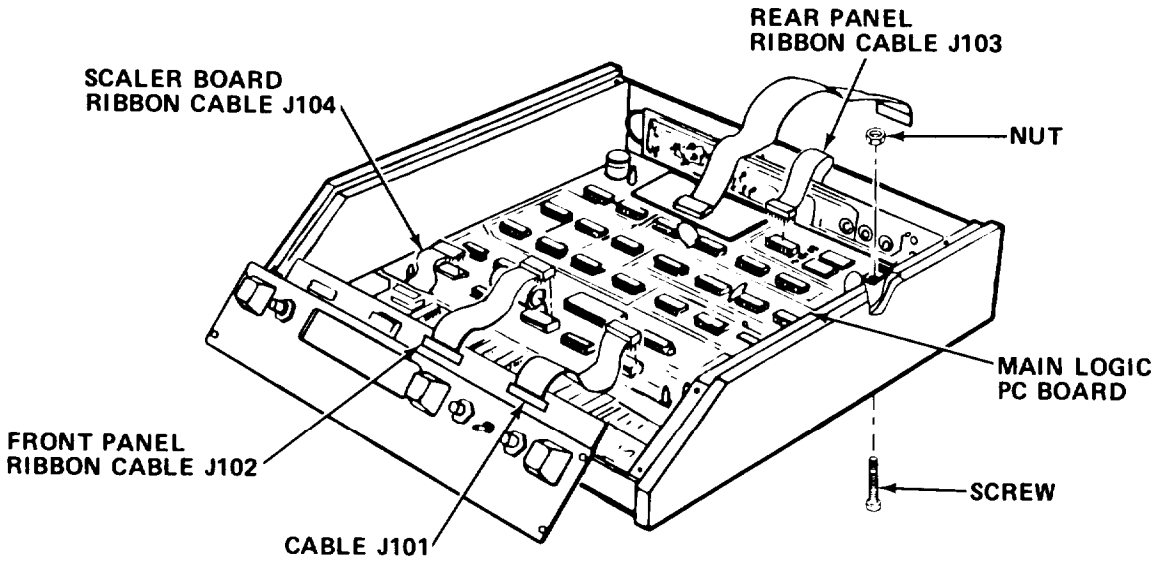


a. Remove four screws and washers from top of auto-scaler. Lift off top.

CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.



c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board.

d. Disconnect scaler board ribbon cable J104 and rear panel ribbon cable J103 from main logic PC board.

e. Remove screw and nut from upper right corner of main logic PC board.

f. Pinch plastic retainers to free main logic PC board from auto-scaler base.

g. Remove defective main logic PC board. Remove plastic retainers from board.

h. Install plastic retainers in auto-scaler base.

i. Press new main logic PC board onto plastic retainers in auto-scaler base.

j. Reinstall screw and nut on upper right corner of main logic PC board.

k. Reconnect rear panel ribbon cable J103 and scaler board ribbon cable J104 to main logic PC board.

l. Reconnect front panel ribbon cables J101 and J102 to main logic PC board.

m. Reinstall front panel on auto-scaler frame. Secure with four screws.

n. Reinstall top on auto-scaler. Secure with four washers and screws.

9-20.4 Replace Front Display PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
1/2 in. Box End Wrench
No. 2 Cross Tip Screwdriver

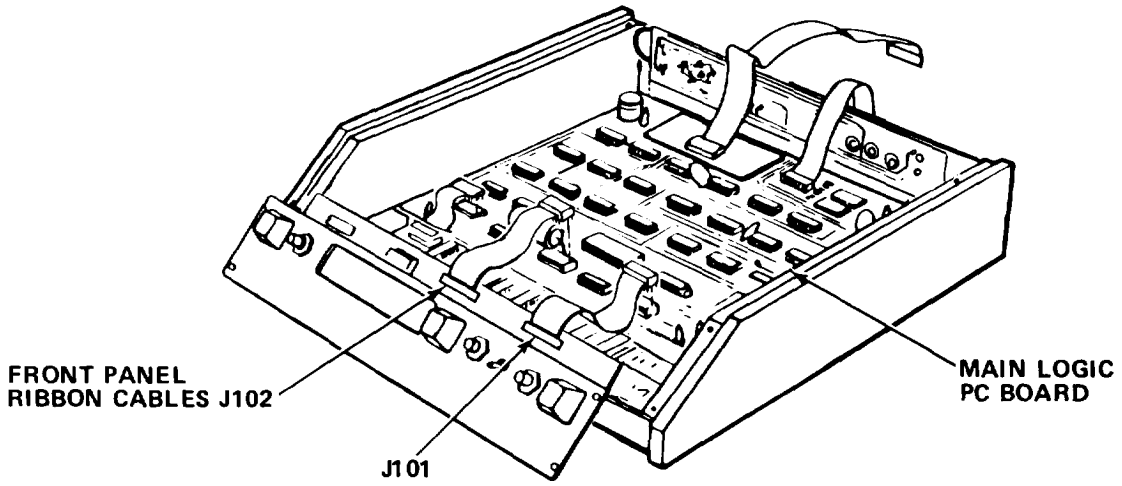
SUPPLIES: Front Display PC Board

a. Remove four screws and washers from top of auto-scaler. Lift off top.

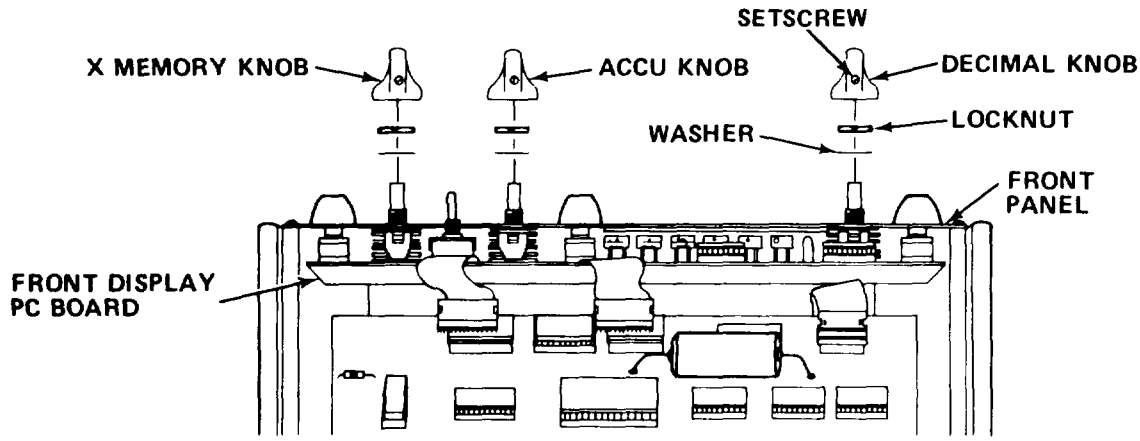
CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.



c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board.



d. Loosen setscrews holding DECIMAL, ACCU, and X MEMORY switch knobs to front panel. Remove knobs.

e. Remove three locknuts and washers from front panel. Lift off front panel. Remove defective front display PC board.

f. Place front panel on new front display PC board. Reinstall three washers and locknuts to front panel.

g. Reinstall DECIMAL, ACCU, and X MEMORY knobs on front panel. Tighten setscrews to secure.

h. Reconnect front panel ribbon cables J101 and J102 to main logic PC board.

i. Reinstall front panel on auto-scaler frame. Secure with four screws.

j. Reinstall top on auto-scaler. Secure with four washers and screws.

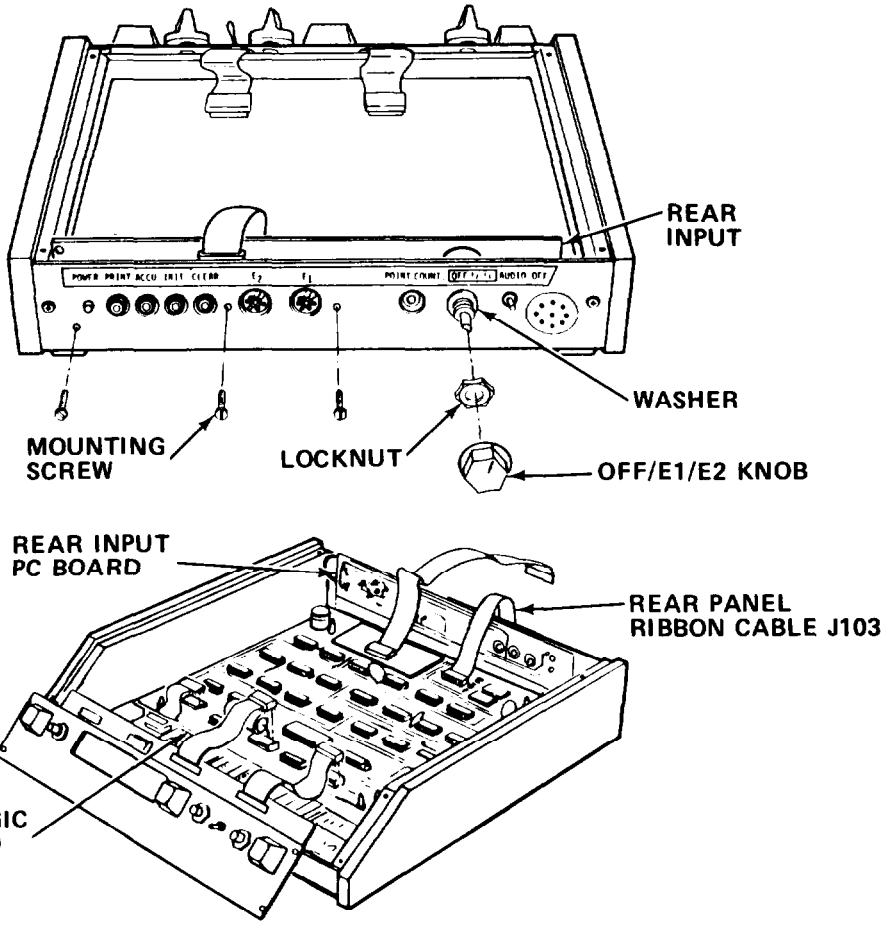
9-20.5 Replace Rear Input PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver

SUPPLIES: Rear Input PC Board

a. Remove four screws and washers from top of auto-scaler. Lift off top.



b. Disconnect rear panel ribbon cable J103 from main logic PC board.

c. Loosen OFF/E2/E1 knob locknut. Remove OFF/E_2/E_1 knob, locknut, and washer from back panel.

d. Remove three rear input PC board mounting screws and nuts from back panel. Remove defective rear input PC board.

e. Secure new rear input PC board on back panel with three nuts and screws.

f. Reinstall OFF/E_2/E_1 washer, locknut, and knob on back panel. Tighten locknut.

g. Reconnect rear panel ribbon cable J103 to main logic PC board.

h. Reinstall top on auto-scaler. Secure with four washers and screws.

9-20.6 Replace Scaler PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2. Cross Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Scaler PC Board

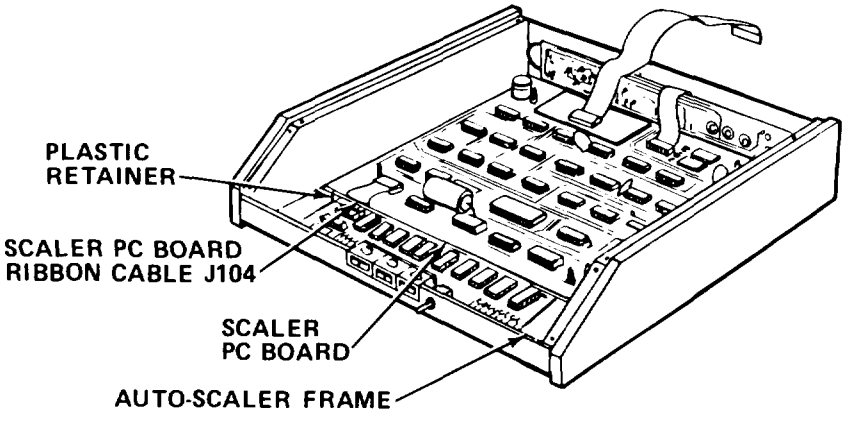
a. Remove four screws and washers from top of auto-scaler. Lift off top.

CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.

c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board. Set front panel to one side.



d. Disconnect scaler board ribbon cable J104 from scaler PC board.

e. Pinch plastic retainers, and gently pry scaler PC board free from auto-scaler frame. Lift out scaler PC board.

f. Install new scaler PC board by snapping onto plastic retainers.

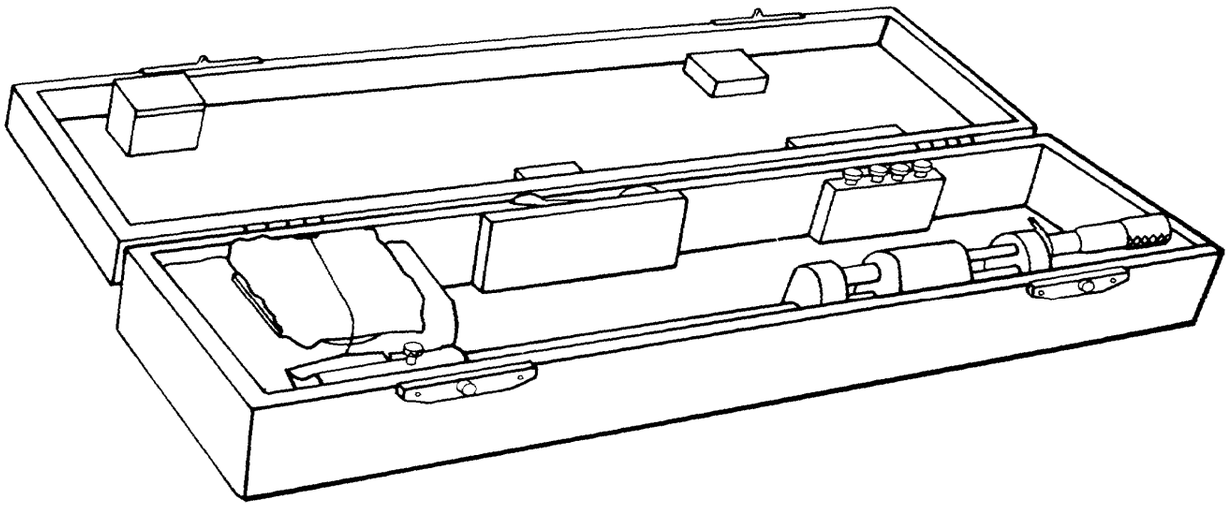
g. Reconnect scaler board ribbon cable J104 to scaler PC board.

h. Place front panel on auto-scaler frame.

i. Reconnect front panel ribbon cables J101 and J102 to main logic PC board.

j. Secure front panel to auto-scaler frame with four screws.

k. Reinstall top on auto-scaler. Secure with four washers and screws.



CHAPTER 10

STEREOMETER PARALLAX BAR

Section I INTRODUCTION

10-1. GENERAL INFORMATION.

10-1.1 Scope.

a. Model Number and Equipment Name. Stereometer parallax bar.

b. Purpose of Equipment. To determine height differences when viewing stereoscopic photographs.

10-1.2 Glossary.

Absolute Altitude	Altitude of aircraft above surface of earth.
Fiducial Mark	Marks on edge of photograph to indicate optical center of photograph.
Differential Parallax	Small linear displacement between same photographic images on different photographs resulting from height of surface.
Principal Point on Photograph	Center of one photograph that can be transferred to adjacent stereophotograph.
Stereo-Pair Photographs	Photographs taken at different positions showing same features.

10-2. EQUIPMENT DESCRIPTION.

10-2.1 Equipment Characteristics, Capabilities, and Features.

a. Self-contained with transport case.

b. Simple computation of values.

c. No power requirements.

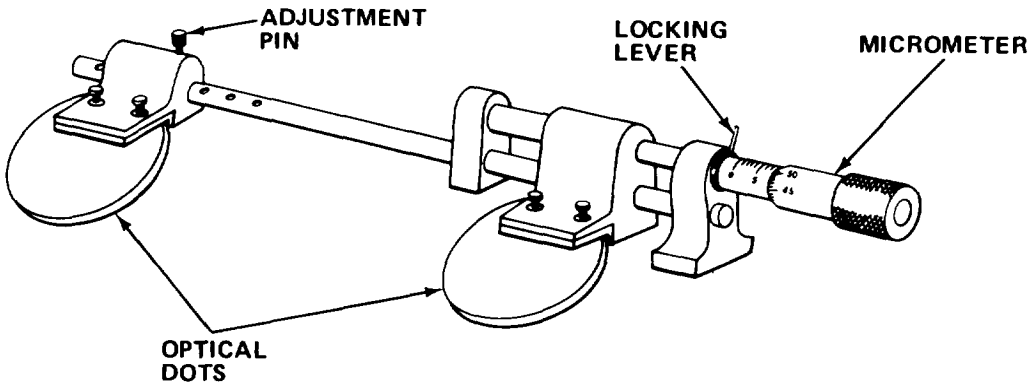
10-2.2 Equipment Data.

Operating Range	8-1/2 to 4-1/2 in. (21.6 to 11.4 cm)
Micrometer Adjustment Range	1 in. (25.4 mm)
Total Adjustment Range	2 in. (5.1 cm)

10-3. TECHNICAL PRINCIPLES OF OPERATION. Techinal principles of operation are combined with description and use of operator's controls and indicators.

Section II OPERATING INSTRUCTIONS

10-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Adjustment Pin	Positions left optical dot at one of five positions on arm.
Locking Lever	Locks micrometer.
Micrometer	Rotation of knurled knob precisely moves right optical dot. Amount of movement is read on micrometer in hundredths of millimeters.
Optical Dots	Clear optical glass with center dot.

10-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

10-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Flat Tip Screwdriver	1 ea
Lens Paper (Item 12, Appendix E)	ar
Lens Cleaner (Item 6, Appendix E)	ar

Table 10-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

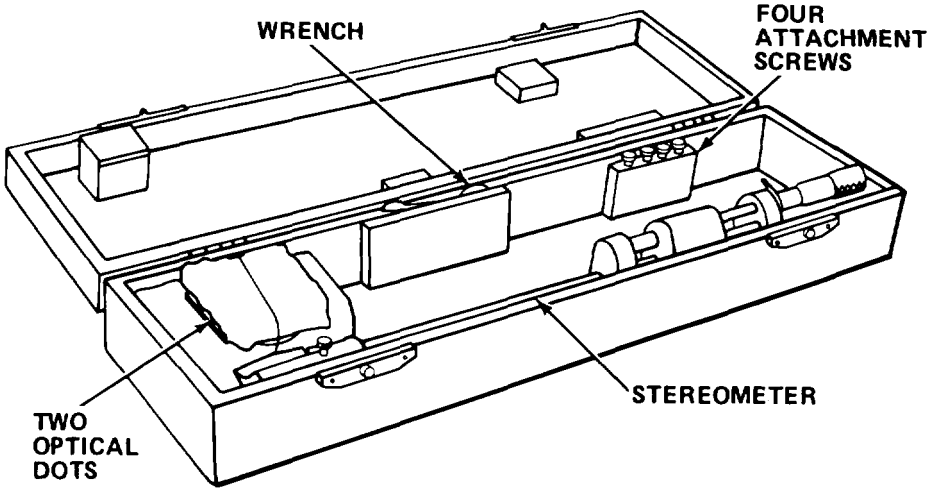
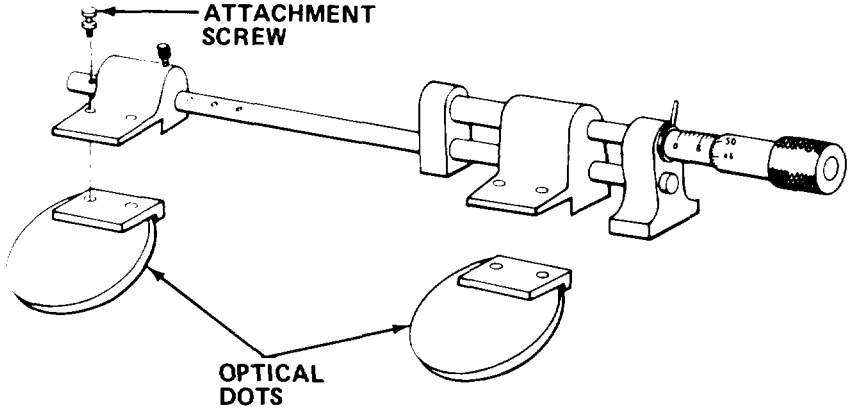
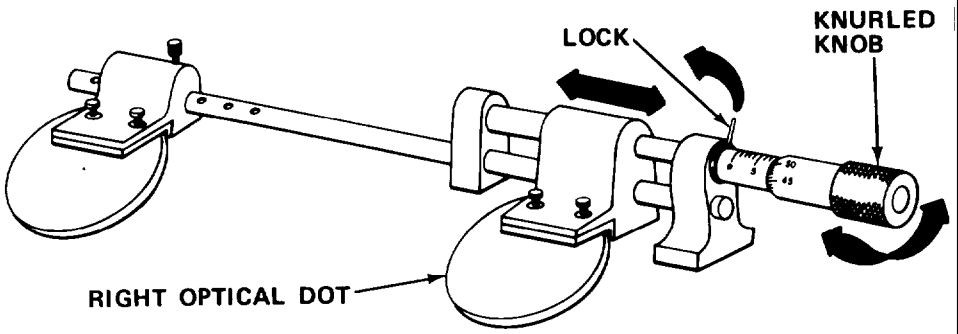
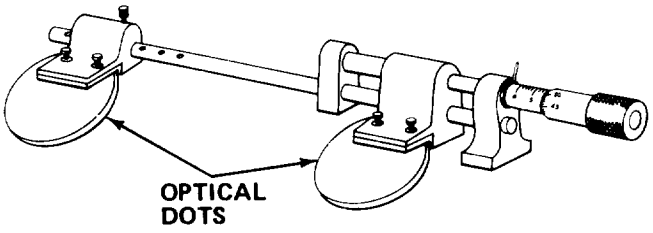
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		STEREOMETER PARALLAX BAR	
1	B	Inspect Parallax Bar.	
		1. Place transport case on work surface and open. 	
		2. Inspect for completeness: two optical dots, wrench, four attachment screws and stereometer. 	Two optical dots missing or broken.
		3. Attach optical dots to stereometer with four attachment screws.	

Table 10-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

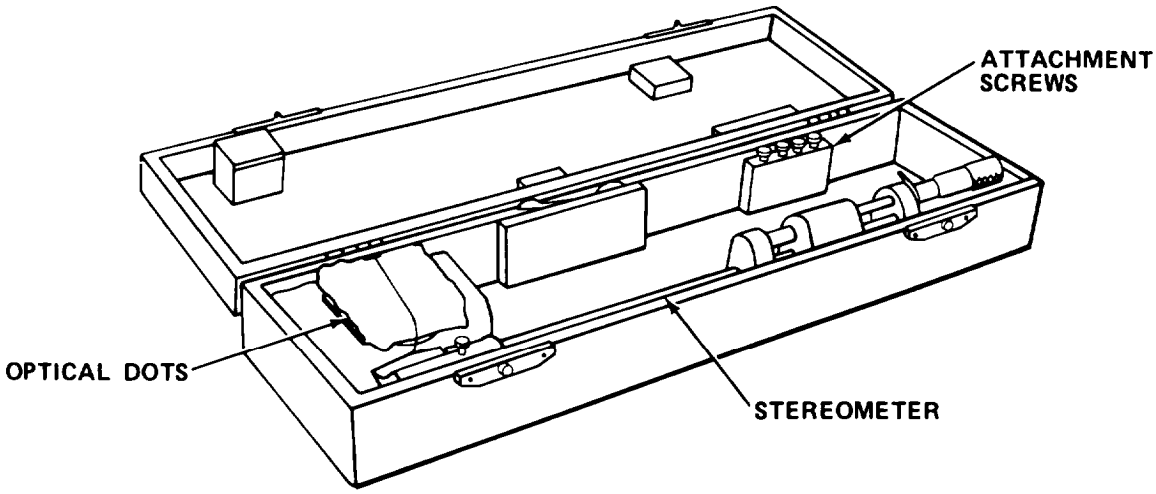
B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		STEREOMETER PARALLAX BAR - Cont	
1	B	Inspect Parallax Bar - Cont	
		4. Inspect optical dots for chips, fingerprints, or cracks.	
			
		5. Unlock micrometer barrel by releasing lock. Rotate knurled knob and observe free movement of mount for right optical dot against spring tension.	
2	B	Clean Parallax Bar.	
		1. Moisten clean lens paper with lens cleaner.	
			
		2. Wipe optical dot surfaces with moistened lens paper using circular motion, starting from center and moving toward edge.	
		3. Wipe optical dot glass surfaces with fresh, dry lens paper using a circular motion, starting from center and moving toward edge.	
		4. Wipe exposed metal surfaces with clean lens paper to remove dust or dirt.	

10-6. OPERATION UNDER USUAL CONDITIONS.

10-6.1 Assembly and Preparation For Use.

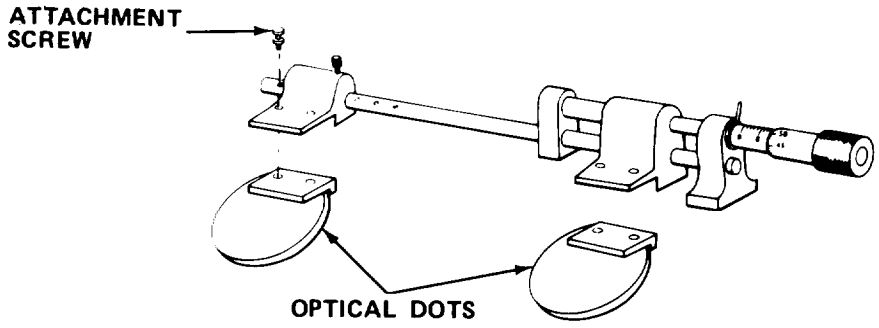
a. Place transport case on work surface.



b. Remove optical dots.

c. Remove attachment screws.

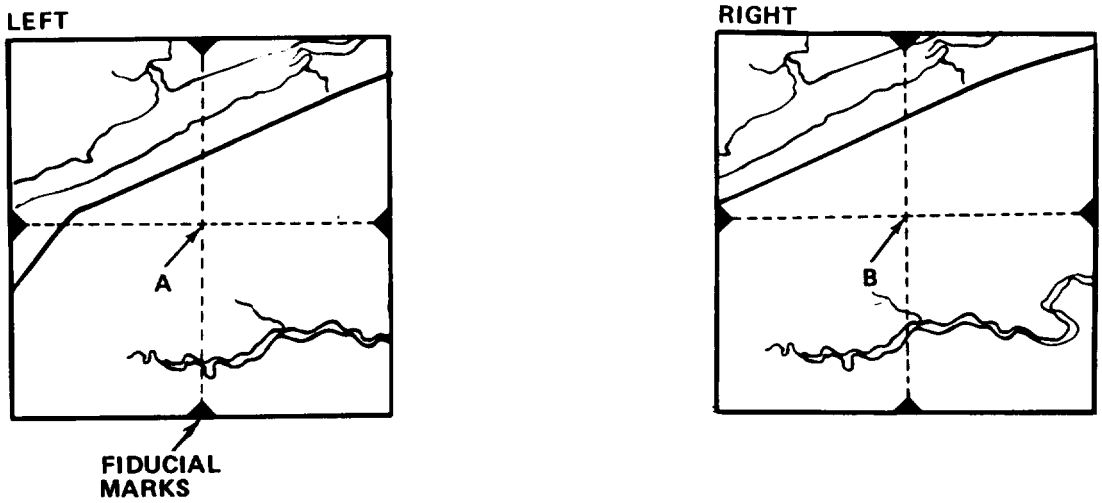
d. Remove stereometer.



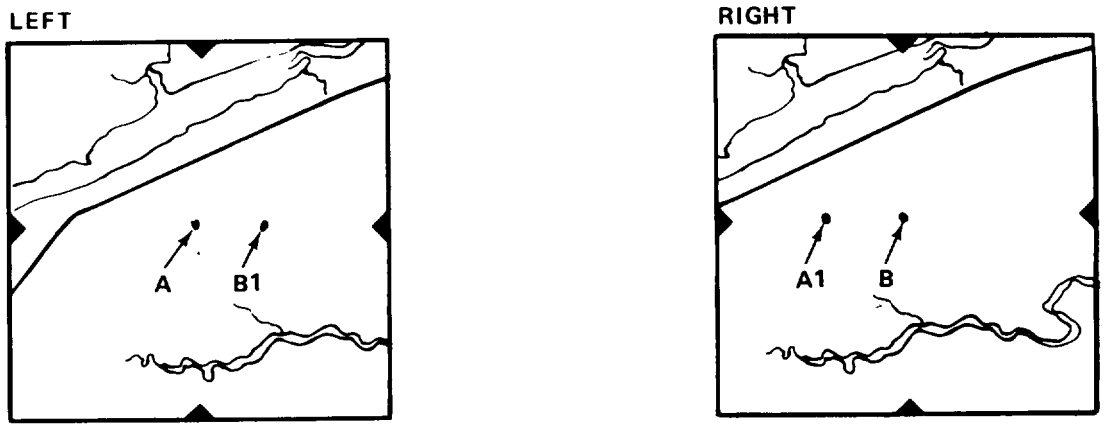
e. Aline optical dots with mounts and secure with attachment screws.

10-6.2 Operating Procedures.

a. Aline stereo-pair photographs on work surface.



(1) Prick center of each photograph with pin at A and B.

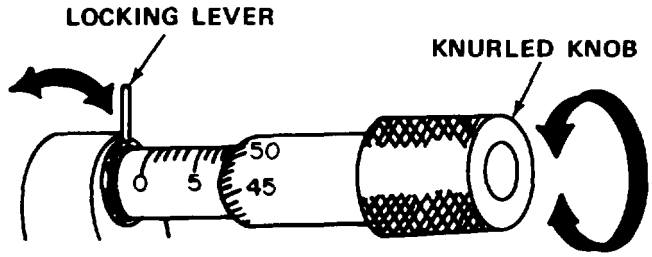


(2) Observe photographic point designated as B, and prick this point on left photograph (point B1).

(3) Observe photographic point designated as A, and prick this point on right photograph (point A1).

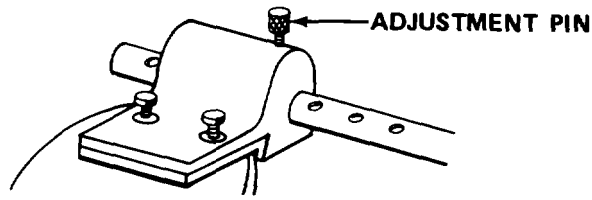
(4) Place stereoscope over photographs, and follow stereoscope instructions to obtain stereoscopic view of photograph.

b. Set stereometer to base of photographs.



(1) Position micrometer at midscale.

(2) Position left optical dot over point A.



(3) Lift adjustment pin and position right optical glass mount at adjustment hole closest to point A1.

(4) Position left optical dot over point A. Unlock locking lever on micrometer. Then turn knurled knob on micrometer to left or right until right optical dot is over point A1.

c. Make datum plane reading.

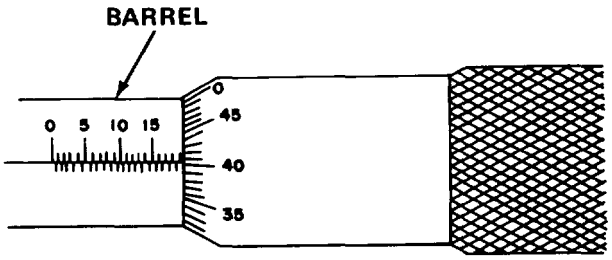
(1) Choose known elevation point that is on both photographs (or point that will be at reference elevation).

(2) Place left optical dot over this point on left photograph.

(3) Place right optical dot over same point on right photograph.

(4) Look through stereoscope and turn micrometer knurled knob until two optical dots are seen as one dot that looks as if it contacts ground on reference point.

d. Read micrometer scale.



(1) Read largest number visible on barrel, i.e., 15.

(2) Count full divisions visible between 15 and 20, i.e., 3.

(3) Add: 15+3=18.

(4) Marks below the line indicate 0.5. Mark between 18 and 19 is visible, so add 0.5, i.e., 18.5

(5) Read hundredth's scale, i.e., 0.41.

(6) Total reading: 18 + 0.5 + 0.41 = 18.91.

e. Make elevation reading.

(1) Place left optical dot over point for which elevation is to be determined.

(2) Place right optical dot over same point in right photograph.

(3) Look through stereoscope and turn micrometer knurled knob until optical dots are fused and apparently contact ground at point.

(4) Read micrometer scale, and record reading to hundredths of millimeters.

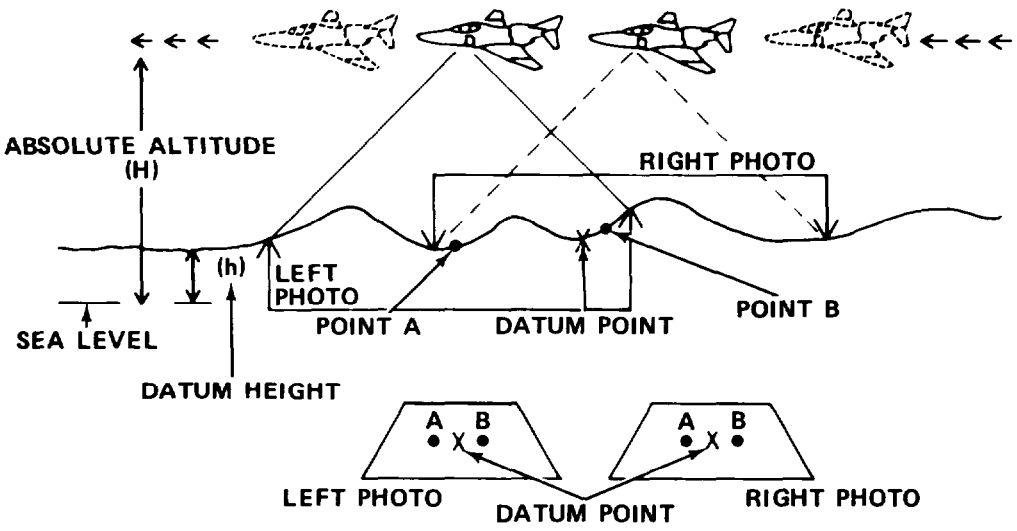
f. Determine differential parallax.

(1) When elevation reading at unknown point is smaller than datum reading, assign minus value (lower elevation).

(2) When elevation reading at unknown point is greater than datum reading, assign plus value (higher elevation).

(3) Determine numerical difference between datum reading and elevation reading. This number is differential parallax ($\triangle p$).

g. Compute elevation. When numerical value and sign of differential parallax have been determined, height above or below datum may be computed:



$$h = \frac{H\,\Delta p}{b + \Delta p}$$

Where:

h = Difference in elevation between datum plane and point in feet.

H = Absolute altitude in feet.

Δp = Differential parallax in millimeters (to nearest 0.01 mm).

b = Distance between principal points of photographs in millimeters.

h. Compute relative elevation. Small changes in elevation from one point to another point may be computed using the following formula:

$$\frac{h}{\Delta p} = \frac{h^1}{\Delta p^1} \qquad \text{or} \qquad h^1 = \frac{h\,\Delta p^1}{\Delta p}$$

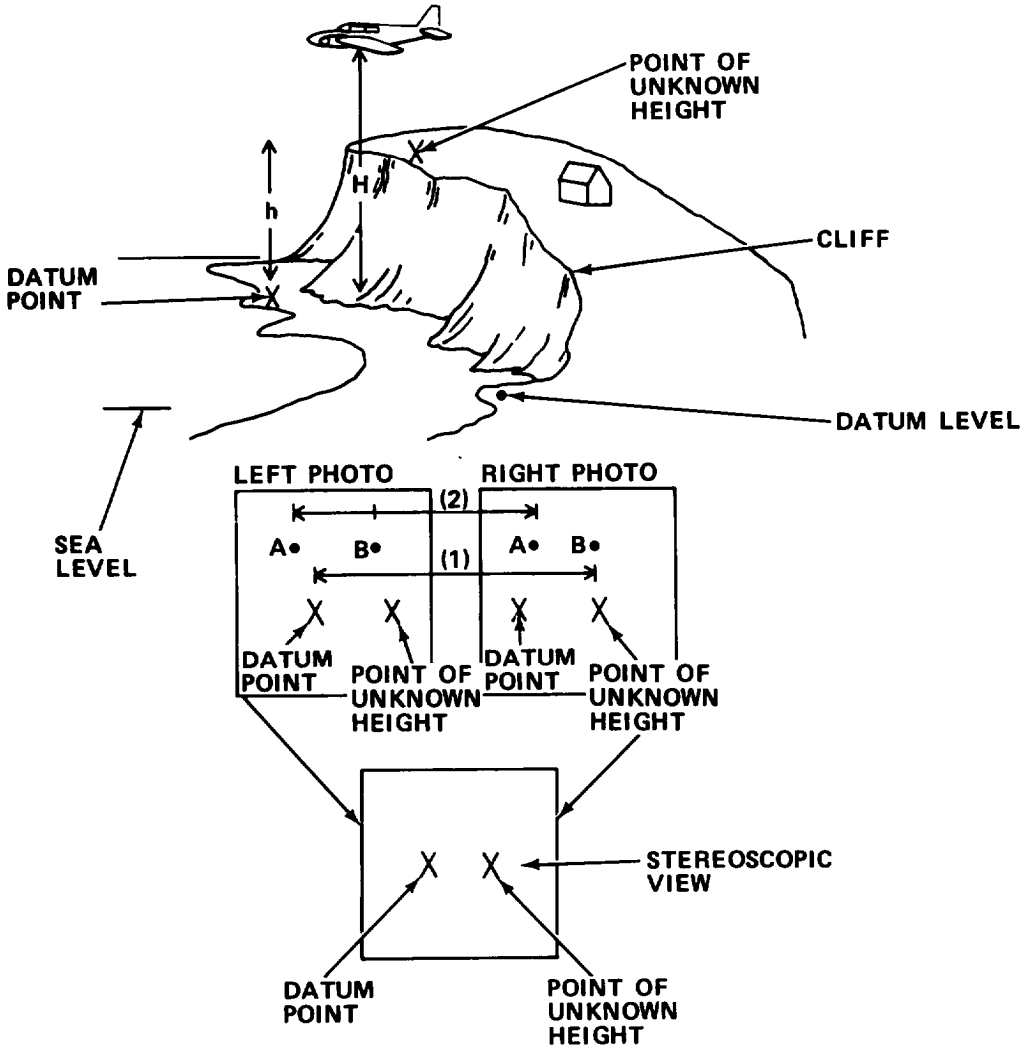
h = Difference in elevation between datum plane and first point in feet.

Δp = Differential parallax used for first determination.

h^1 = Difference in elevation between datum and second point.

Δp^1 = Differential parallax for second point measured in millimeters.

Example (1) :



(1) Check distance between datum and point to be measured. (Must be between 8-1/2 in. and 4-1/2 in.)

(2) Make datum plane reading (paragraph 10-6.2c). Micrometer reads 3.38 mm.

(3) Make elevation reading (paragraph 10-6.2 e). Micrometer reads 3.98 mm.

(4) Subtract readings. Difference is 0.60 mm. Reading is increased so sign is + (plus).

(5) Measure distance (principle point separation). Distance is 76.2 mm.

(6) Height of aircraft was 5000 ft above sea level.

$$H = 5000 \text{ ft}$$

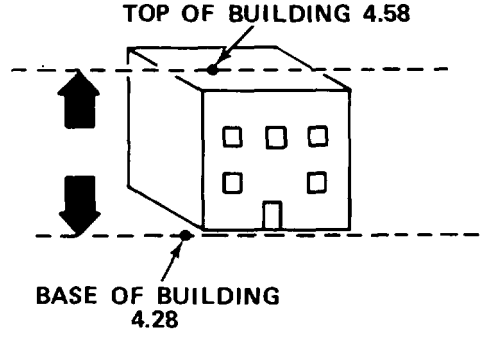
$$\Delta p = +0.60 \text{ mm}$$

$$b = 76.2 \text{ mm}$$

$$h = \frac{H \Delta p}{b + \Delta p}$$

$$h = \frac{5000 \times 0.60}{76.2 + 0.60} = \frac{3000}{76.80} = 39 \text{ ft}$$

Example (2): Using same photographs, determine height of building.



1. Make datum reading at base of building. Reading is 4.28 mm.

2. Make elevation reading at top of building. Reading is 4.58 mm.

Base Height Above Datum

$h = 39$ ft

$\Delta p = 0.60$ mm

$\Delta p^1 = 0.90$ mm

$$h^1 = \frac{h\ \Delta p^1}{\Delta p}$$

$$h^1 = \frac{39 \text{ X } 0.90}{0.60} = 58 \text{ ft Above Datum}$$

Building Top Above Datum

$h = 39$ ft

$\Delta p = 0.60$ mm

$\Delta p^1 = 1.2o$ mm

4.58 mm - 4.28 mm = 0.30 mm

0.90 mm + 0.30 mm = 1.20 mm

$$h^1 = \frac{h\ \Delta p^1}{\Delta p}$$

$$h^1 = \frac{39 \text{ x } 1.20}{0.60} = 78 \text{ ft Above Datum}$$

Height of Building (78 ft - 58 ft) = 20 ft

10-6.3 Preparation For Movement.

a. Place transport case on work surface.

b. Remove two attachment screws on each optical glass.

c. Place screws in transport case.

d. Pad optical glass and place in case.

e. Place stereometer in case.

f. Close lid and check that lid latches.

10-7. OPERATION UNDER UNUSUAL CONDITIONS. The stereometer can be used under any condition that permits use of a stereoscope.

Section III OPERATOR MAINTENANCE

10-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

10-9. TROUBLESHOOTING. There are no operator troubleshooting procedures assigned for this equipment.

10-10. MAINTENANCE PROCEDURES. There are no operator maintenance procedures assigned for this equipment.

Section IV ORGANIZATIONAL MAINTENANCE

10-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

10-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT. These items are not required for this equipment.

10-13. SERVICE UPON RECEIPT.

10-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

10-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

10-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

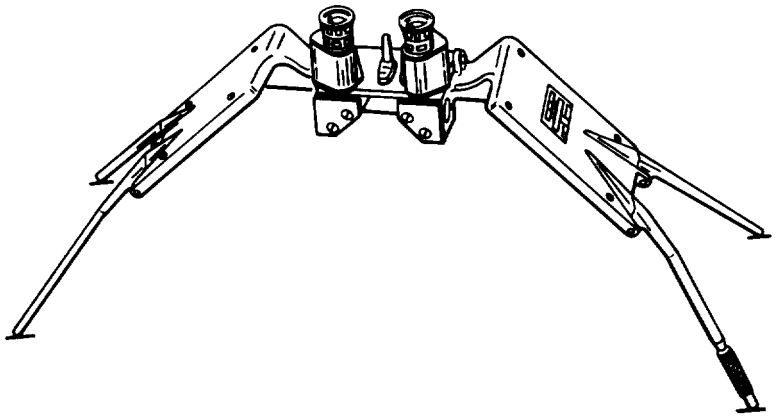
10-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

10-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.

10-16



CHAPTER 11

LENS-PRISM-MIRROR STEREOSCOPE

Section I INTRODUCTION

11-1. GENERAL INFORMATION.

11-1.1 Scope.

a. Model Number and Equipment Name. Lens-Prism-Mirror Stereoscope.

b. Purpose of Equipment. Stereoscopic viewing of stereo-pair photographs and to determine heights (when used with parallax bar).

11-1.2 Glossary.

Diopter.	Measurement of lens power and refraction.
Fiducial Mark.	Marks on edges of aerial photographs used to determine center of photo-graph.
Interpupillary Distance	Distance between center of observer's eyes.
Principal Point of Photograph	Center of photographic image.
Stereo-Pair Photograph	Photographs taken of same object or area from different positions.
Stereoscopic	An apparent three-dimensional image obtained when viewing stereo-pair photographs.

11-2. EQUIPMENT DESCRIPTION.

11-2.1 Equipment Characteristics. Capabilities, and Features.

Removable binocular assembly permits full stereoscopic viewing of 9 in. X 9 in. (22.9 cm x 22.9 cm) aerial photographs.

b. Four-power magnification with binocular assembly.

c. Lightweight.

d. Folds for storage.

e. Adjusts for uneven surface.

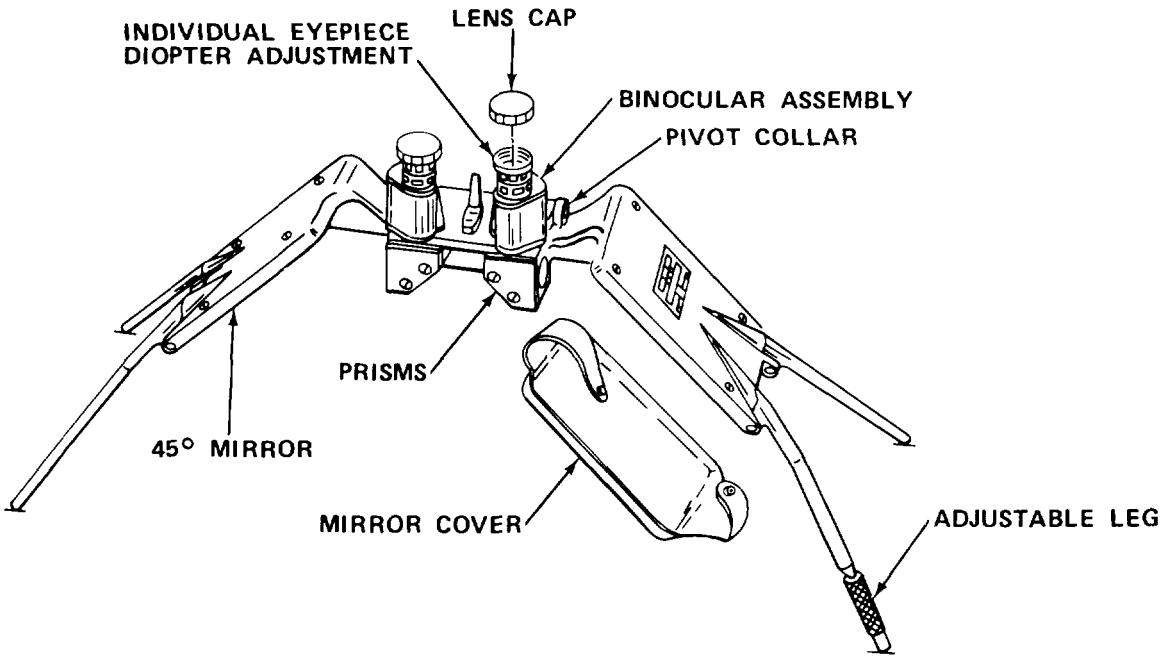
11-2.2 Equipment Data

Stereo Base	10 in. (25.4 cm)
Interpupillary Distance	Fixed
Focal Length	5-1/2 in. (13.97 cm)
Common Field of View	5 in. (12.7 cm)
Weight	2-1/2 lbs (1.14 kg)
Unfolded Dimensions	6 in. X 7 in. X 19 in. (15.24 cm X 17.78 cm X 48.26 cm)
Binocular Magnification	4x
Eyepiece Adjustment	±5 diopters

11-3. TECHNICAL PRINCIPLES OF OPERATION. Principles of operation are combined with operator's controls and indicators for this equipment.

Section II OPERATING INSTRUCTIONS

11-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS



Control or Indicator	Function
Lens Cap	Protects optics.
Individual Eyepiece Diopter Adjustment	Compensates for operator's vision.
Binocular Assembly	Four-power magnification of view field.
Pivot Collar	Holds binocular assembly to frame. Permits operator to view unmagnified image by removing binocular assembly.
Prisms	Direct right and left line of sight to right and left mirrors.
45-Degree Mirrors	Reflect right and left photographs to right and left line of sight.

Control or Indicator	Function
Mirror Covers	Protect mirrors when storing stereoscope and when stereoscope is not in use.
Adjustable Leg	Permits stereoscope to be used on uneven surface.

11-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

11-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Watchmaker's Blower	1 ea
Lens Paper (Item 12, Appendix E)	ar
Optical Lens Cleaner (Item 6, Appendix E)	ar

Table 11-1. OPREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

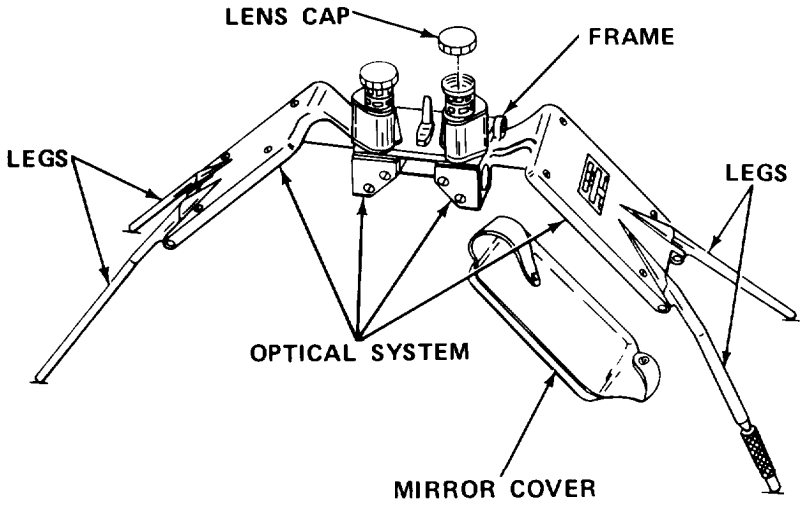
B - Before
D - During
A - After

W - Weakly
M - Monthly
Q- Quarterly

AN - Annually
S - Semiannually
Bl - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		LENS-PRISM-MIRROR STEREOSCOPE	
1	B	Inspect Stereoscope.	



		1. Inspect frame for bending and twisting.	
		2. Inspect mirror covers for tears, broken snaps, and fungi.	
		3. Inspect legs for bends, breaks, and loose hinges.	
		4. Inspect mirrors for cracks, chips, and defective silvering.	Mirrors are broken.
		5. Place white sheet of paper under mirrors and look through optical system to detect chips, cracks, or fungi.	

Table 11-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		LENS-PRXSM-MIRROR STEREOSCOPE - Cont	
2	B	Clean Stereoscope.	

CAUTION

- Do) not touch optical or mirror surfaces with bare fingers to prevent damage to optical surfaces.
- Do not wipe dry optical surfaces with lens paper. Do not reuse lens paper on more than one lens, or glass surfaces will be scratched.

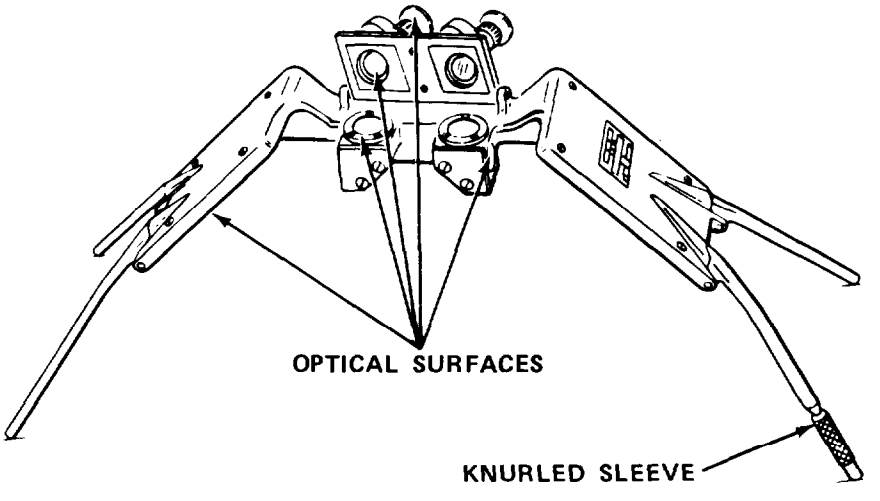


Table 11-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

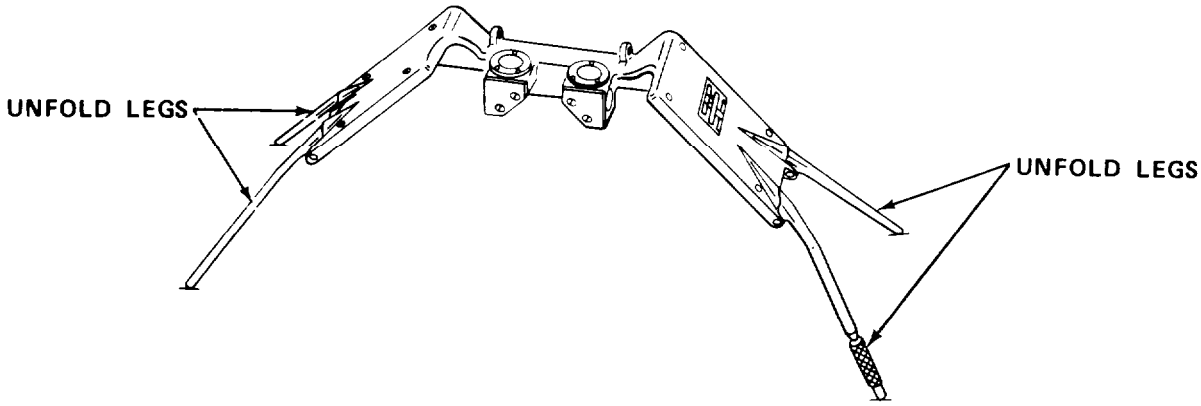
(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		LENS-PRISM-MIRROR STEREOSCOPE - Cont	
2	B	Clean Stereoscope - Cont 1. Blow dirt and dust from optical surface with watchmaker's blower. 2. Moisten lens paper with optical lens cleaner, and wipe one optical surface with circular motion from center toward edges. Discard lens paper. 3. Dry optical surface by wiping with clean lens paper using circular motion from center toward edges. Discard lens paper. 4. Repeat procedure on each remaining optical surface and two mirrors. 5. Turn leg adjustment knurled sleeve to full right, then to full left, to clear threads.	

11-6. OPERATION UNDER USUAL CONDITIONS.

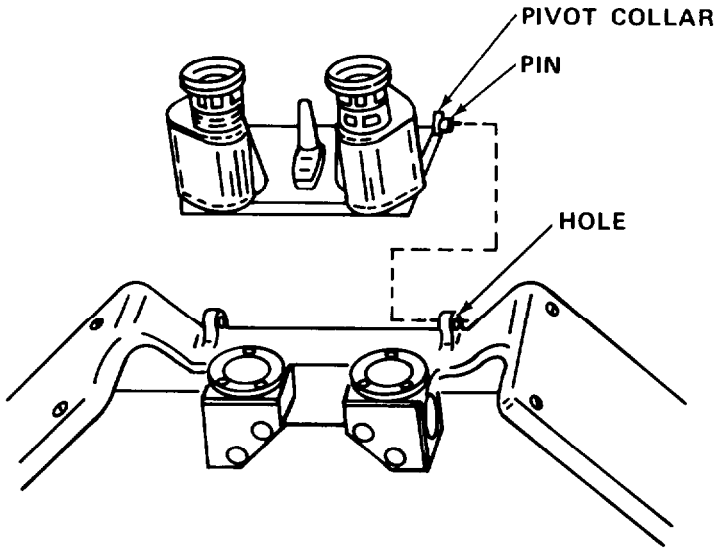
11-6.1 Operating Procedures.

a. Remove stereoscope frame and binocular assembly from case, and place on. work surface.

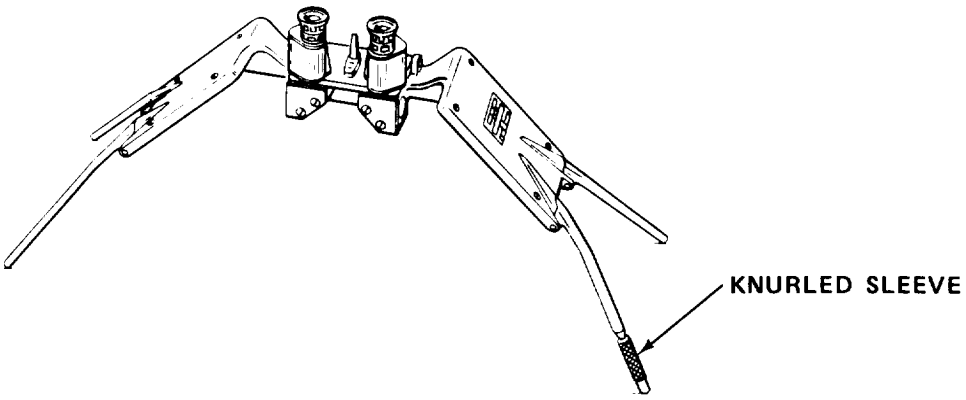


b. Unfold four legs to full extension.

c. Unsnap mirror covers and remove.

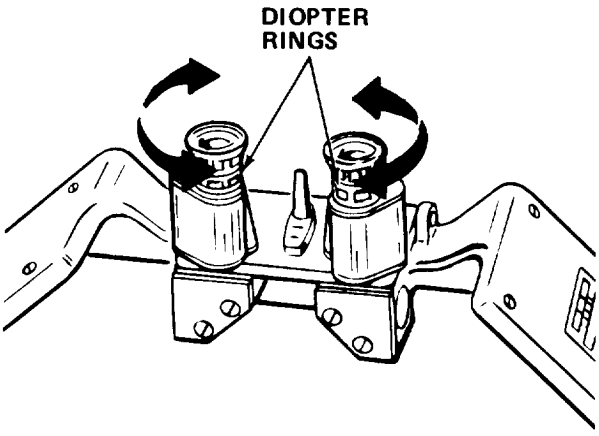


d. Squeeze pivot collars between fingers, and place binocular assembly on frame so that pin will enter holes. Release pivot collars.



e. Adjust leg by turning knurled sleeve until stereoscope is level.

f. Adjust eyepiece to individual operator's eyes by placing stereo-pair photographs under stereoscope with left photograph visible in left eyepiece and right photograph visible in right eyepiece.



g. Close one eye and turn diopter ring until vision is clear. Close other eye and adjust second diopter ring.

h. Aline stereo-pair photographs for stereoscopic viewing.

NOTE

Alinement of fiducial marks and principal points is easier if binocular assembly is tilted back and photographs are viewed through lens-prism system.

i. Check that right and left photographs are not interchanged.

j. Determine that principal point in each photograph is visible in other photographs.

k. Adjust photographs to a common base line.

l. Adjust stereoscope base line parallel to photograph base line with proper separation.

m. Replace mirror covers when finished.

NOTE

If stereoscope is not to be used immediately, replace stereoscope in case.

11-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

11-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

11-9. TROUBLESHOOTING PROCEDURES. There are no operator troubleshooting procedures assigned for this equipment.

11-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the lens-prism-mirror stereoscope. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is-properly functioning.

INDEX

11-10.1 Adjust Mirror.

MOS: 81Q, Terrain Analyst

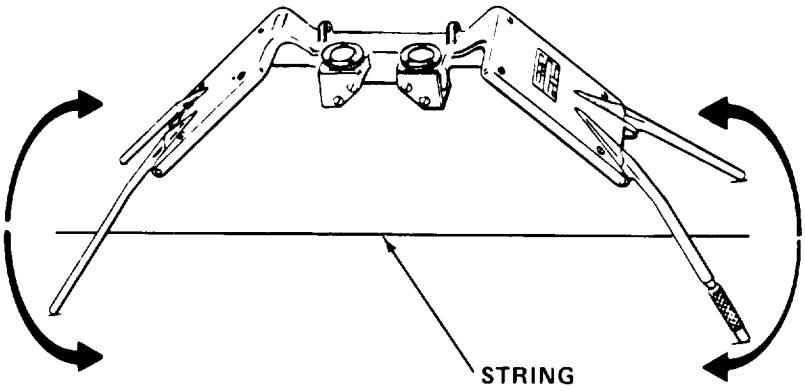
TOOLS: Jeweler's Screwdriver Set

a. Remove binocular assembly by pinching pivot collars with fingers and lifting free.

b. Stretch piece of string under stereoscope so that string may be observed through both prisms.

c. Keep stereoscope centered over string and move legs horizontally to right or left until string appears to be one clear line.

d. Keep eyes close to lenses and look to right, then left. String should remain one clear line. If line is bent or offset, adjust mirrors.



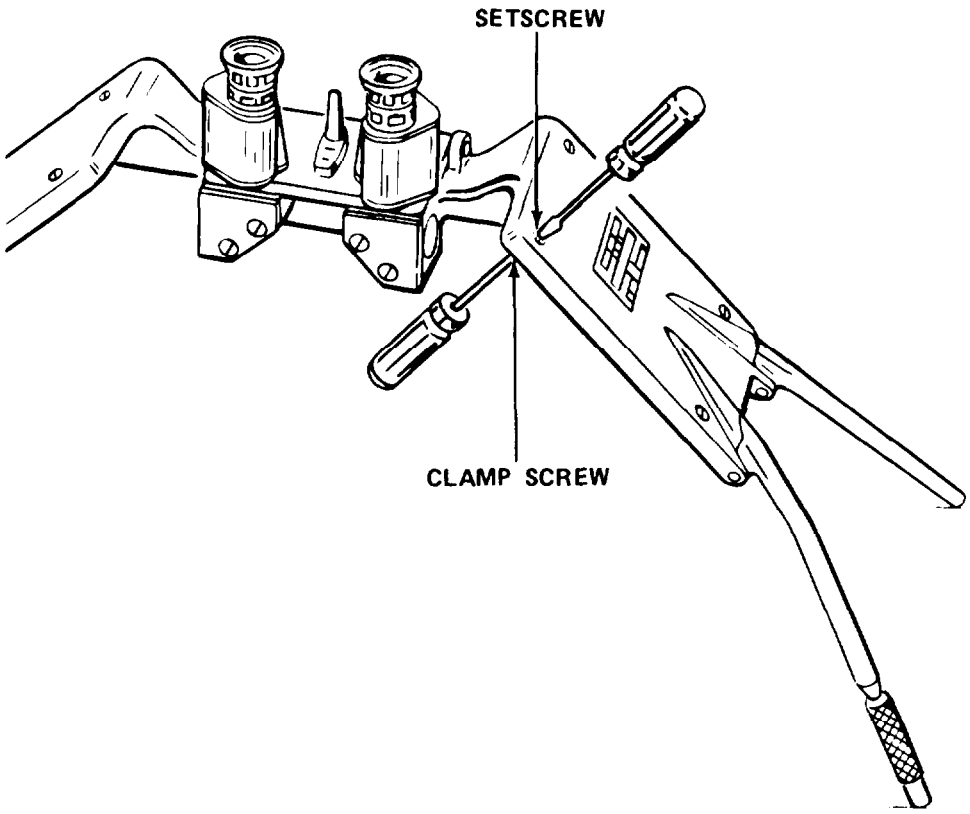
OBSERVED STRAIGHT LINE
(CORRECT ADJUSTMENT)

OBSERVED OFFSET LINE

OBSERVED BENT LINE

CAUTION

To prevent damage to mirrors, do not overtighten screws.



e. Loosen setscrew and tighten clamp screw an equal amount. Observe line. If improvement is noted, continue loosening setscrew and tightening clamp screw until error is removed. If condition is worse, loosen clamp screw and tighten setscrew. If improvement is noted, continue adjustment until error is removed. If no improvement is noted, return setscrew and clamp screw to original positions. When improvement stops, retain last setting.

f. Loosen or tighten setscrew and clamp screw equal amounts until error is removed in other mirror.

9. Tighten screws firmly and recheck adjustment.

Section IV ORGANIZATIONAL MAINTENANCE

11-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

11-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT. These items are not required for this equipment.

11-13. SERVICE UPON RECEIPT.

11-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all-discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

11-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

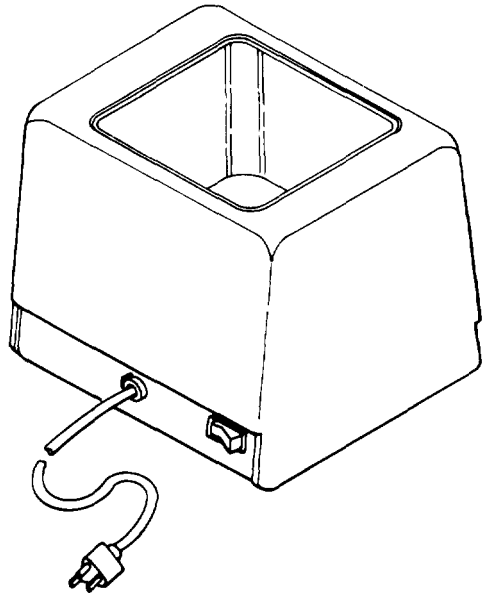
11-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

11-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

11-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.



CHAPTER 12

ULTRASONIC CLEANER

Section I INTRODUCTION

12-1. GENERAL INFORMATION.

12-1.1 Scope.

a. Model Number and Equipment Name. Model 3069USC3 Ultrasonic Cleaner.

b. Purpose of Equipment. To clean drafting/drawing pens.

12-2. EQUIPMENT DESCRIPTION.

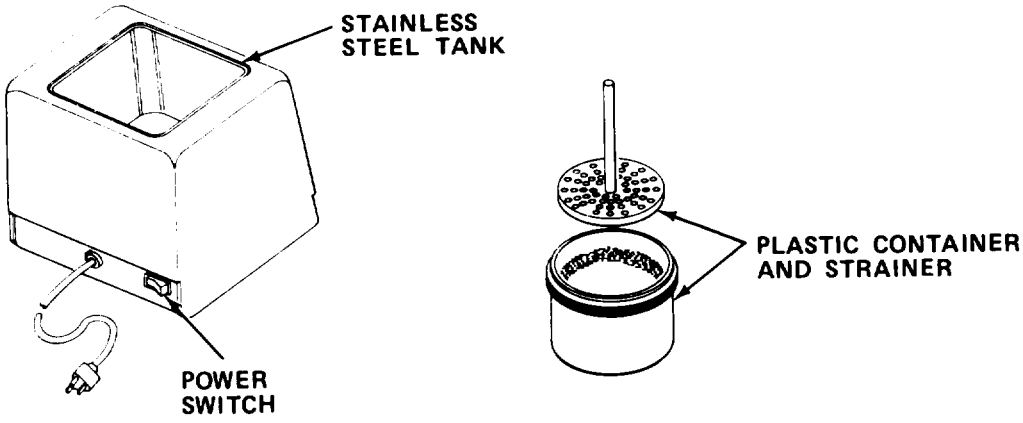
12-2.1 Equipment Characteristics, Capabilities, and Features.

a. Cleans without disassembly.

b. Removes dried ink.

c. Portable.

12-2.2 Location and Description of Major Components.



STAINLESS STEEL TANK. Holds water.

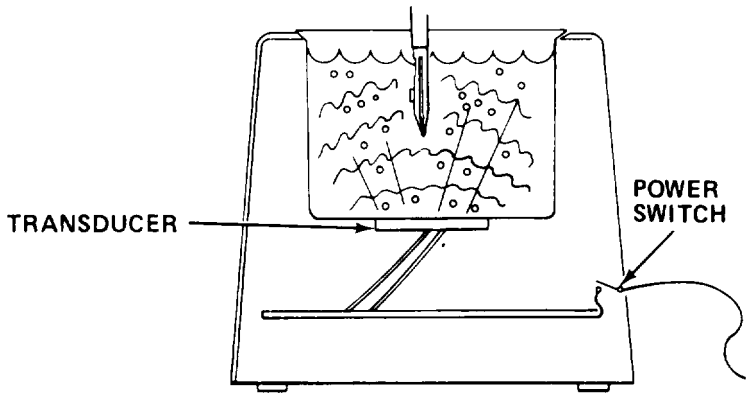
PLASTIC CONTAINER AND STRAINER. Holds small parts in solution for cleaning.

POWER SWITCH. Turns machine on or off.

12-2.3 Equipment Data.

Weight	5.51 lbs (2.5 kg)
Power Requirements	115 V, 60 Hz, 60 W

12-3. TECHNICAL PRINCIPLES OF OPERATION.

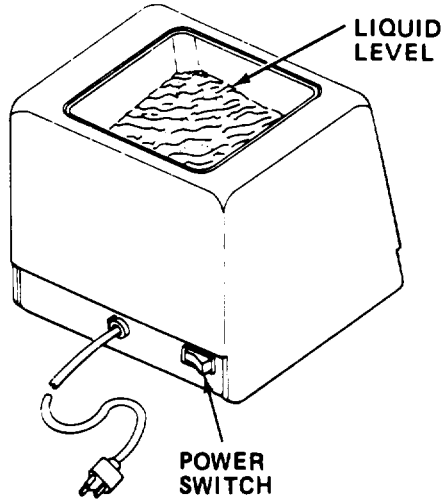


POWER SWITCH. When turned on, provides power to the transducer.

TRANSDUCER. Generates ultrahigh frequency sound waves.

Section II OPERATING INSTRUCTIONS

12-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Liquid Level	Level of liquid in stainless steel tank must be 1/3 full.
Power Switch	Turns power on or off.

12-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

12-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Cheesecloth (Item 7, Appendix E)	ar

Table 12-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ULTRASONIC CLEANER	
1	B	Inspect Cleaner.	

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

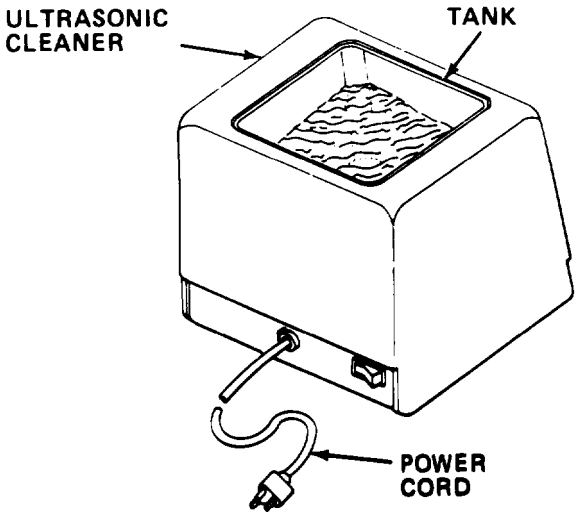


Table 12-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B . Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

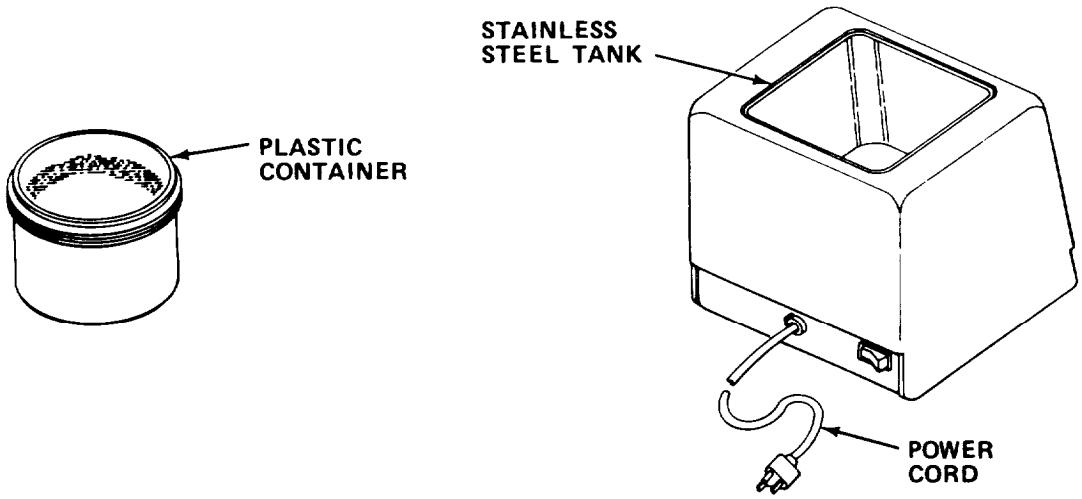
AN - Annuallv
S - Semiannually
Bl - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ULTRASONIC CLEANER - Cont	
1	B	Inspect Cleaner - Cont	
		1. Check power cord for kinks, frays, or burns. If power cord is defective, notify organizational maintenance.	Power cord is damaged.
		2. Check tank for dirt or chemical residue. Clean tank by wiping with cheesecloth moistened with water.	
		3. Check for agitation of water surface.	Water surface is not agitating.

12-6. OPERATION UNDER USUAL CONDITIONS.

12-6.1 Operating Procedure



a. Fill stainless steel tank 1/3 full with fresh, clean water. Fill plastic container with water to within 1/2 in. (12.7 mm) of top.

b. Add .135 oz (4 ml) of cleaning solution to plastic container.

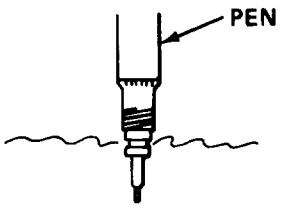
c. Plug in power cord to 120 V, 60 Hz grounded outlet.

d. Turn power on. Be sure water surface in stainless steel tank is agitating.

WARNING

Do not place fingers in stainless steel tank when ultrasonic cleaner is operating. Cleaning solution may be driven through skin or ultrasonic waves may cause injury to body tissue.

e. Prepare cleaning solution by operating ultrasonic cleaner for one minute before cleaning pen tips.



CAUTION

Do not immerse pen beyond cap threads. Damage to pen may result.

f. Dip pen about 3/4 in. (19 mm) in cleaning solution.

g. Lift pen from cleaning solution. Keeping point downward, shake solution from pen onto cheesecloth (Item 7, Appendix E).

h. Wipe pen.

i. Draw pen over scrap paper until ink flows freely and shows uniform color.

j. Turn power off. Unplug power cord.

k. Dispose of cleaning solution when dirty.

CAUTION

Avoid getting water into body of ultrasonic cleaner. Damage to circuit board can result.

l. Carefully rinse stainless steel tank.

m. Wipe stainless steel tank dry with cheesecloth (Item 7, Appendix E).

12-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

12-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

12-9. TROUBLESHOOTING PROCEDURES. There are no operator troubleshooting procedures assigned for this equipment.

12-10. MAINTENANCE PROCEDURES. Operator maintenance is limited to performance of regular preventive maintenance checks and services and replenishment of cleaning solution.

Section IV ORGANIZATIONAL MAINTENANCE

12-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

12-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

12-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

12-12.2 Special Tools: Test. Measurement. and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

12-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

12-13. SERVICE UPON RECEIPT.

12-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

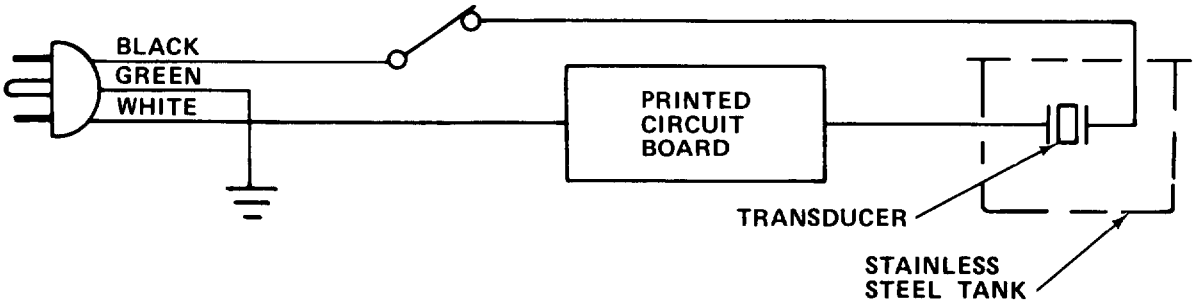
12-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

12-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Trouble-shooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the following schematic or the foldout located at the end of this manual for further fault analysis.



d. If the ultrasonic cleaner does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedure for dead receptacle (Table 1-4).

Table 12-2. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION
1. NO CLEANING ACTION, WATER AGITATES.	
Check cleaning action using fresh cleaning solution.	
	(a) If test was satisfactory, instruct operator to change cleaning solution when dirty.
	(b) If test was not satisfactory, replace circuit board (paragraph 12-16.1).
2. NO WATER AGITATION.	
Step 1. Using multimeter, check for continuity of power cord.	
	(a) If continuity exists, proceed to step 2.
	(b) If continuity does not exist, replace power cord (paragraph 12-16.1).

Table 12-2. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
2. NO WATER AGITATION - Cont	
Step 2. Check continuity of power switch.	
(a) If continuity does not exist, replace power switch (paragraph 12-16.1).	
(b) If continuity does exist, replace circuit board (paragraph 12-16.3).	

12-16. MAINTENANCE PROCEDURES .

a. This section contains instructions covering organizational maintenance functions for the ultrasonic cleaner. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

12-16.1 Replace Power Cord.

MOS: 41B, Topographic Instrument Repair Specialist

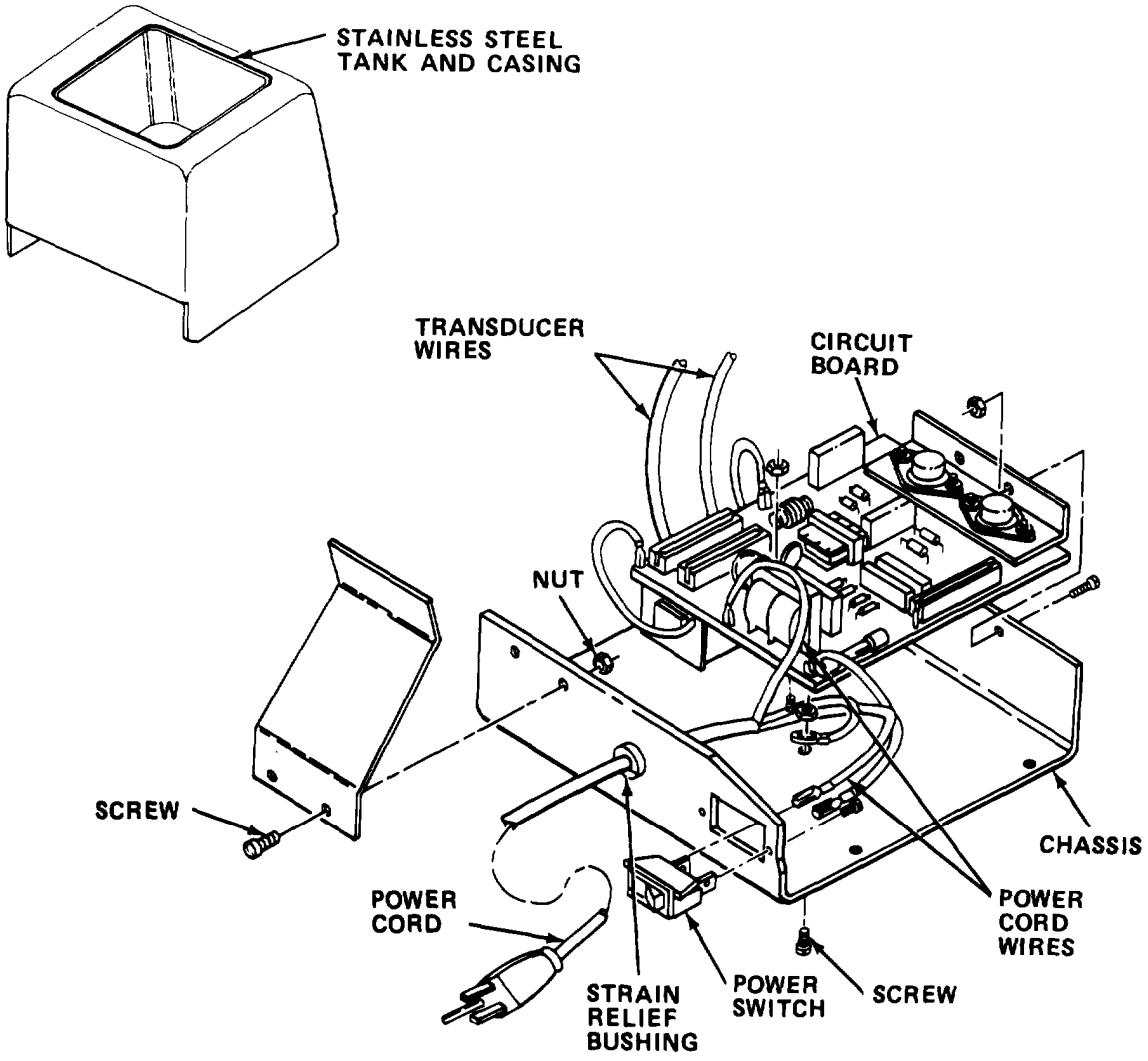
TOOLS: Flat Tip Screwdriver

SUPPLIES: Power Cord
Wire Clips

WARNING

Death or serious injury may occur if power cord is not unplugged before servicing.

a. Turn power off. Unplug power cord.



b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Remove three screws, one nut, and one washer holding circuit board to chassis.

e. Disconnect power cord wires from power switch, chassis ground, and circuit board.

f. Loosen strain relief bushing from chassis and remove defective power cord.

g. Install strain relief bushing on new power cord. Insert terminal ends of cord into chassis.

h. Fit strain relief bushing into chassis.

i. Reconnect power cord wire to circuit board, chassis, and power switch.

j. Reinstall circuit board into chassis and secure with one washer, one nut, and three screws.

k. Reinstall stainless steel tank and casing. Secure with screws and washers.

l. Fill stainless steel tank 1/3 full with water.

m. Plug in power cord and turn power on. Check that water surface agitates.

12-16.2 Replace Power Switch.

MOS: 41B, Topographic Instrument Repair Specialist

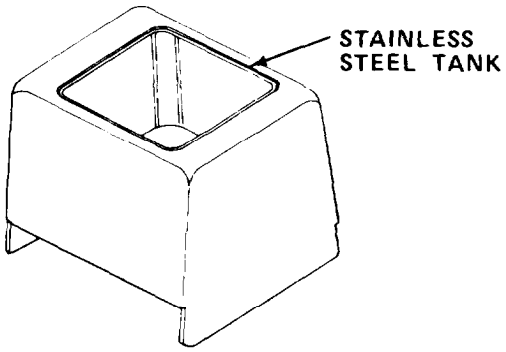
TOOLS: Flat Tip Screwdriver

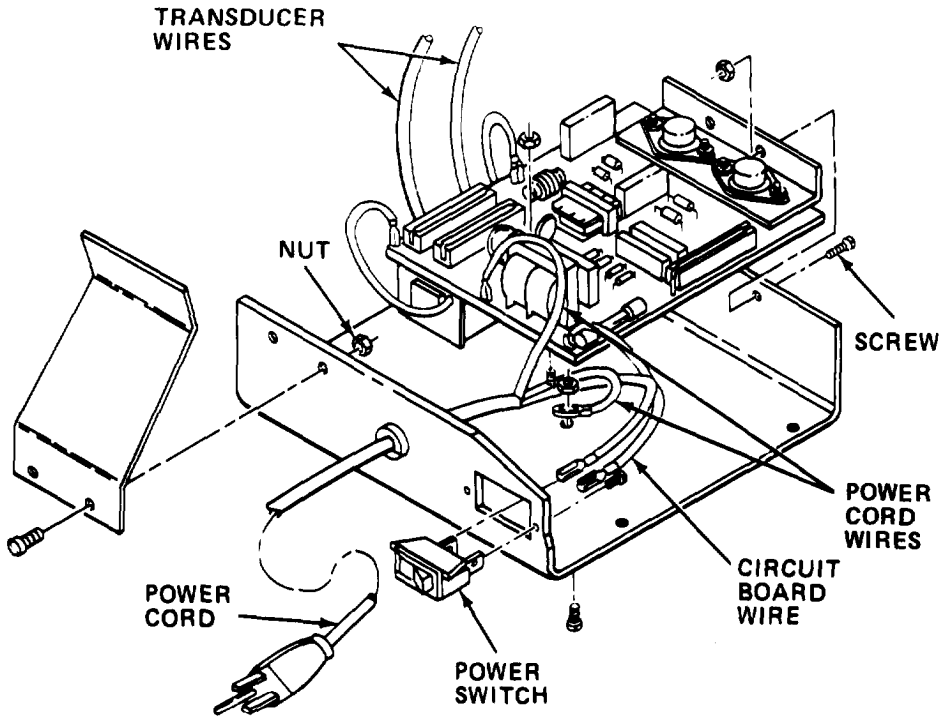
SUPPLIES: Switch

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.





b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Tag and disconnect power cord wire and circuit board wire from power switch.

e. Press sides of defective power switch and remove from chassis.

f. Install new power switch in chassis. Push power switch until tabs lock into hole.

g. Reconnect wires to power switch.

h. Reinstall stainless steel tank and casing. Secure with screws and washers.

i. Fill stainless steel tank 1/3 full with water.

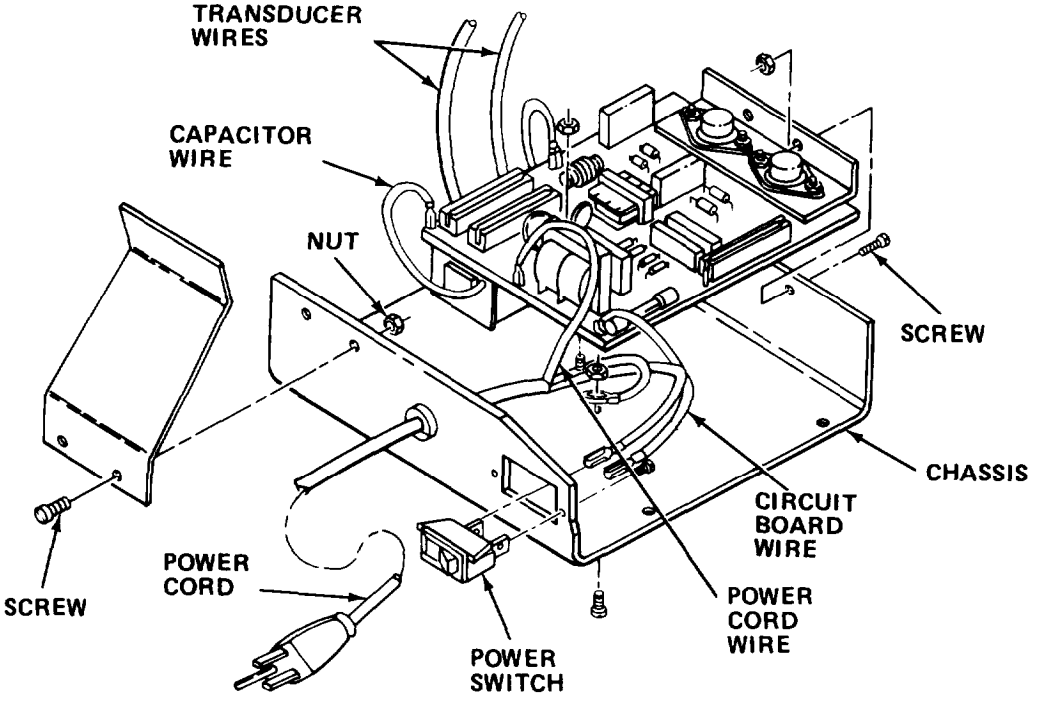
j. Plug in power cord and turn power on. Check that water surface agitates.

12-16.3 Replace Circuit Board.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver

SUPPLIES: Circuit Board



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.

b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Remove three screws, one nut, and one washer holding circuit board to chassis.

e. Tag and disconnect power cord wire and circuit board wire from circuit board.

f. Disconnect capacitor wires from circuit board.

g. Tag and disconnect two transducer wires from circuit board.

h. Remove defective circuit board.

i. Install new circuit board.

j. Reconnect two transducer wires to circuit board.

k. Reconnect capacitor wires to circuit board.

l. Reconnect circuit board wire and power cord wire to circuit board.

m. Reinstall one washer, one nut, and three screws holding circuit board to chassis.

n. Reinstall stainless steel tank and casing. Secure with screws and washers.

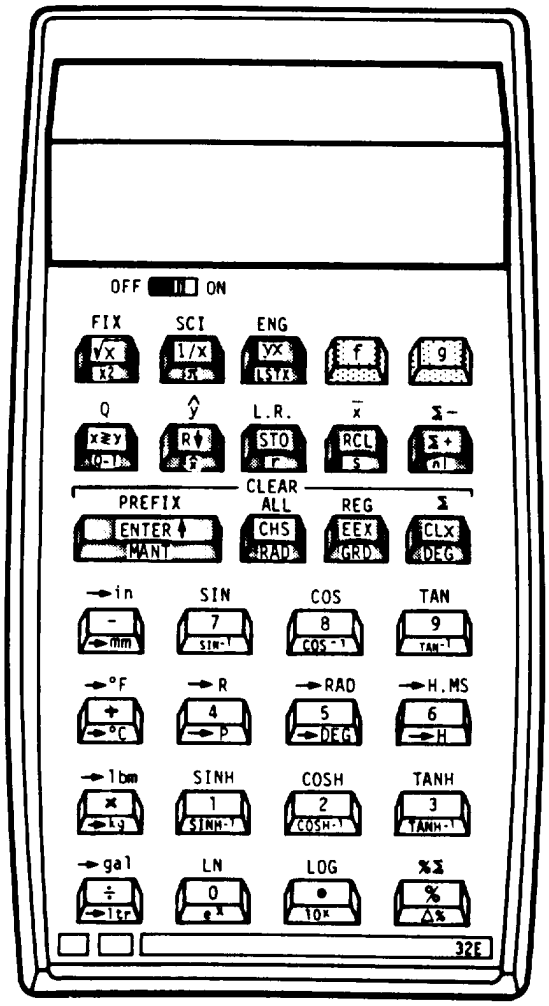
o. Fill stainless steel tank 1/3 full with water.

p. Plug in power cord and turn power on. Check that water surface agitates.

12-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.


OFF ON
FIX
SCI
ENG
Q
L.R.
CLEAR
PREFIX
ALL
REG
ENTER
MANT
CHS
EEX
CLX
SIN
COS
TAN
SINH
COSH
TANH
LN
LOG
32E

CHAPTER 13

POCKET CALCULATOR

Section I INTRODUCTION

13-1. GENERAL INFORMATION.

13-1.1 Scope.

a. Model Number and Equipment Name. Model HP-32E Pocket Calculator.

b. Purpose of Equipment. To perform mathematical calculations.

13-2. EQUIPMENT DESCRIPTION.

13-2.1 Equipment Characteristics, Capabilities, and Features. Performs mathematical calculations with the following capabilities and features.

a. Rechargeable battery pack.

b. AC operation.

c. Trigonometric functions.

d. Ten-digit display.

e. Automatic memory stack.

f. Fifteen storage registers.

g. Scientific notation.

h. Logarithmic functions.

i. Square root.

j. Fixed-point display.

k. Engineering display.

l. Automatic overflow and underflow.

m. Error display.

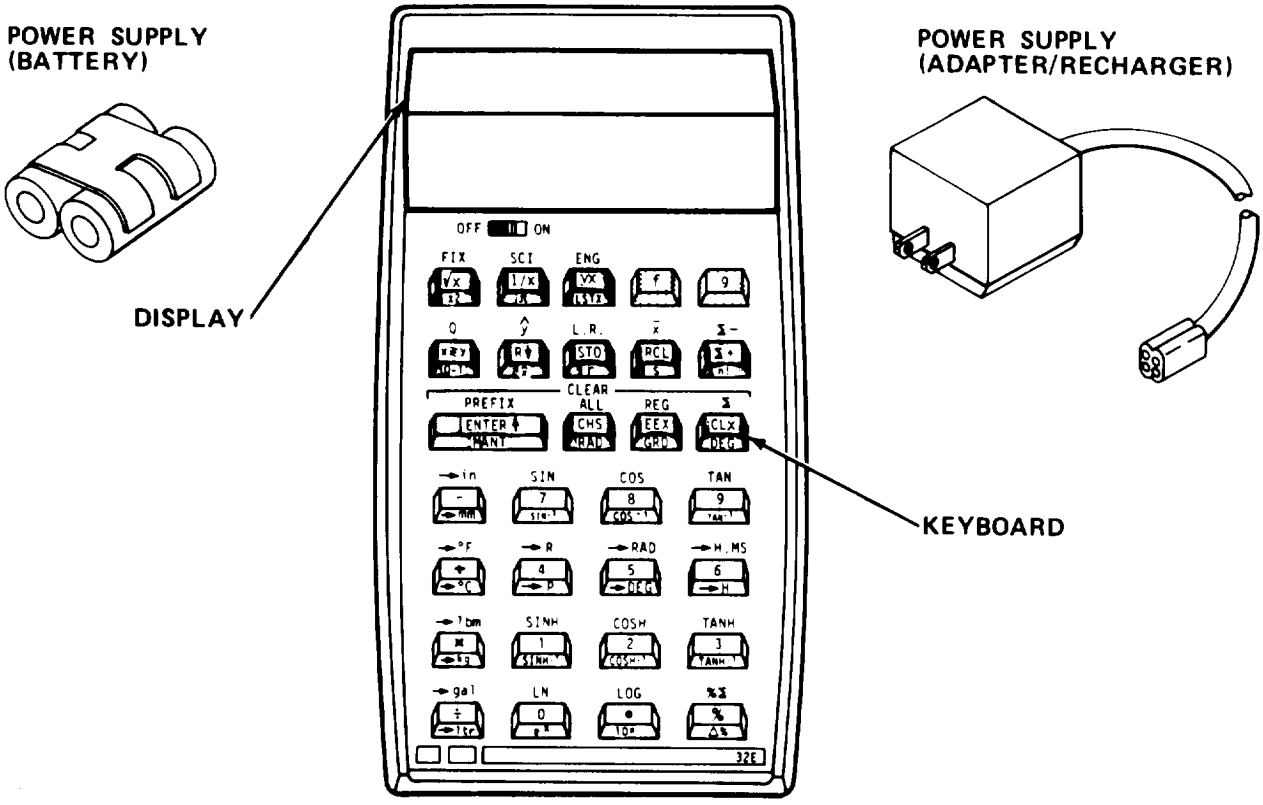
n. Key-selected metric conversions.

o. Self-Check.

13-2.2 Equipment Data.

Power Requirements	120 V, 60 Hz
Battery Pack:	
Recharge Time	9 hrs, maximum (calculator off)
	17 hrs, minimum (calculator on)
Operating Time	3 hrs, maximum

13-3. TECHNICAL PRINCIPLES OF OPERATION. The purpose of the HP-32E Calculator is to assist its user in the performance of complex or simple mathematics equations and consists of the following functional parts:



POWER SUPPLY. Power is provided to the calculator from either the battery pack or ac adapter/recharger. The battery pack consists of two rechargeable nickel cadmium batteries which give the calculator full portability. The adapter/recharger also provides power to the calculator when plugged into a power outlet. When battery pack is in need of recharging, raised decimal is turned on at the far left of the display. When raised decimal is displayed, there are 1 to 25 minutes of operating time left.

KEYBOARD. The keyboard is used to select functions and input numbers into the calculator. All keys, except [f] and [g] keys, perform three functions.

One function is indicated by the symbol on the flat surface of the key, a second by the symbol on the slanted key face, and a third by the symbol written above the key on the calculator case. Function printed on the flat face of the key is selected by pressing the key. Function printed above the key is selected by first pressing prefix key [f] and then the function key. The function printed on the slanted face of the key is selected by first pressing prefix key [g] and then the function key.

DISPLAY. The display is the X-register of the automatic memory stack and provides a visual readout of latest numeric entry, operation result, or error messages.

MEMORY. Memory is divided into two parts; storage registers and automatic memory stack.

a. Storage registers. Storage registers are used to set aside numbers for recall in later calculations. Numbers are stored by first pressing [STO] followed by a number [0] thru [8] or a decimal point and a number [0] thru [5]. The number in displayed X-register is then copied into the selected register. Recalling a number is accomplished by first pressing [RCL] followed by a number [8] or a decimal point and a number [0] thru [5]. The number that is in the selected register will be copied into the displayed X-register without any change to contents of that register. Storage registers R.0 through R.5 are used for accumulation of statistical data. Turning calculator off will clear (place zeros in) all storage registers.

b. Automatic memory stack. The automatic memory stack is used to store intermediate results during calculations. The stack consists of four registers designated X, Y, Z and T. The contents of X-register are constantly shown on the calculator display. Numbers are manually entered into the memory stack by pressing [ENTER↑]. During chain calculations (long equations), intermediate answers are automatically entered in the memory stack. Each new entry into the stack is first entered in the X-register and, with each additional entry, the stack rolls up one and the contents that were in the T-register before roll-up, are lost. The contents of the stack can be viewed by pressing [RCL] key four times. The contents of T-register are not lost because the stack forms a continuous loop, i.e., the contents of-T-register are shifted to the Z-register; Z-register to Y-register; Y-register to X-register; and X-register to T-register. With intermediate answers stored in the stack, operations can be performed with these numbers by pressing the key of the desired operation.

Example: To calculate (3 x 5) + 2, press:

[3] (3 enters X-register.)

[ENTER↑] (3 is copied to Y-register.)

[5] (5 is entered in X-register; 3 stays in Y-register.)

[×] (5 is multiplied by 3; result, 15, is placed in X-register; Y-register becomes 0.)

[2] (15 moves to Y-register; 2 enters X-register.)

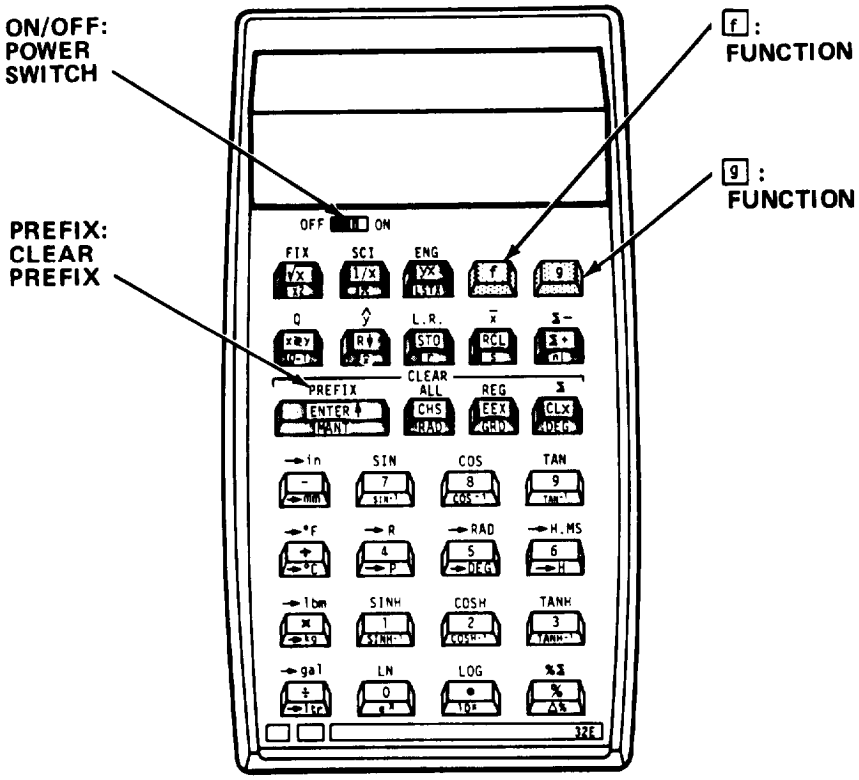
[+] (2 is added to 15; result, 17, is placed in X-register; Y-register becomes 0.)

Section II OPERATING INSTRUCTIONS

13-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

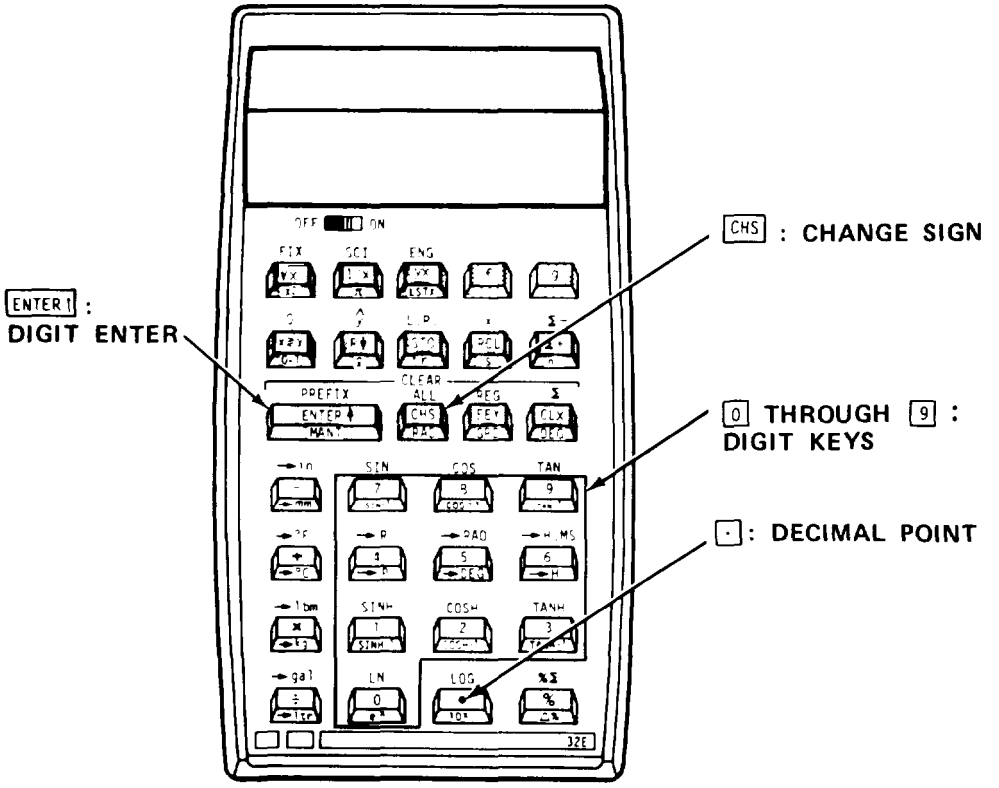
NOTE

Symbols on flat surface and slanted surface of keys are boxed. Symbols over keys are not boxed.



Key	Control or Indicator	Function
OFF ON	Power Switch	Turns power on or off.
f	Function	Pressed before another key, it selects function printed above key.
g	Function	Pressed before another key, it selects function printed on slanted face of key.

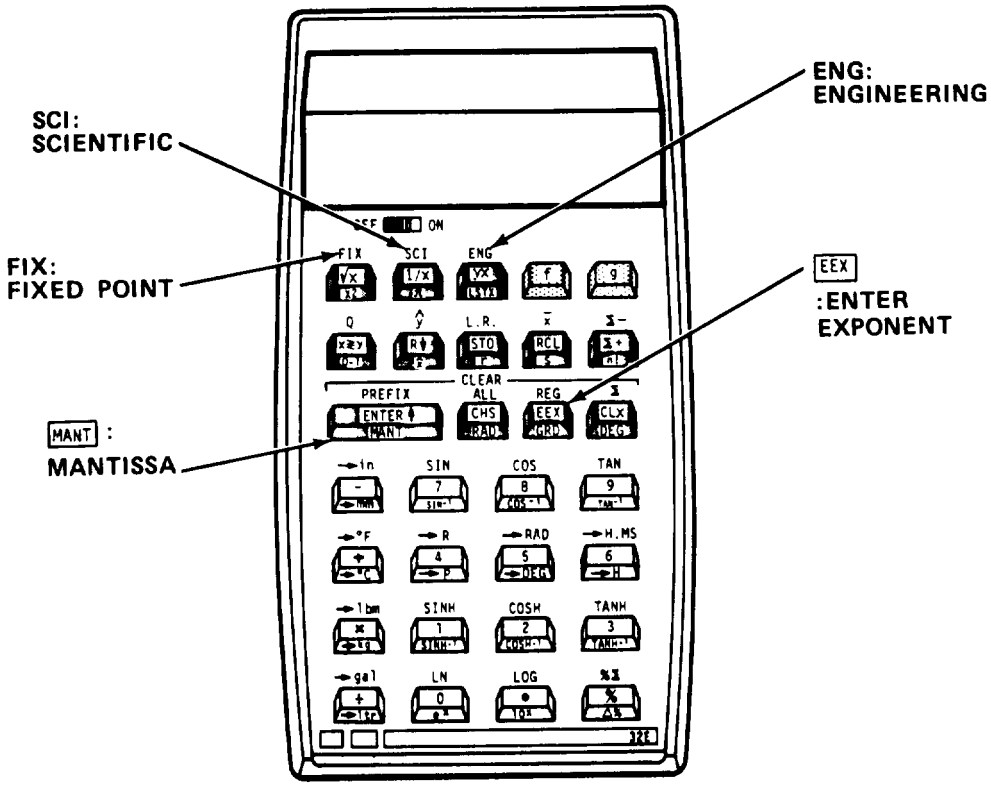
Key	Control or Indicator	Function
PREFIX	Clear Prefix	Cancels the following key strokes or sequence of key strokes when pressed after each one: [f], [g], [STO], [RCL], [STO] [.], [RCL] [.], [STO] [+], [STO] [-], [STO] [x], [STO] [÷], [STO] [+] [.], [STO] [-] [.], [STO] [x] [g], [STO] [÷] [.], FIX, SCI, ENG,



Digit Entry

0 thru 9	Digit Keys	Enters digits.
.	Decimal Point	Enters decimal point.

Key	Control or Indicator	Function
ENTER↑	Digit ENTER	Enters copy of number displayed in X-register into Y-register of automatic memory stack. Pressing key also causes contents of Y-register to be shifted to Z-register and Z-register to the T-register. Contents of T-register are lost.
CHS	Change Sign	Changes sign of mantissa or exponent in display (X-register).

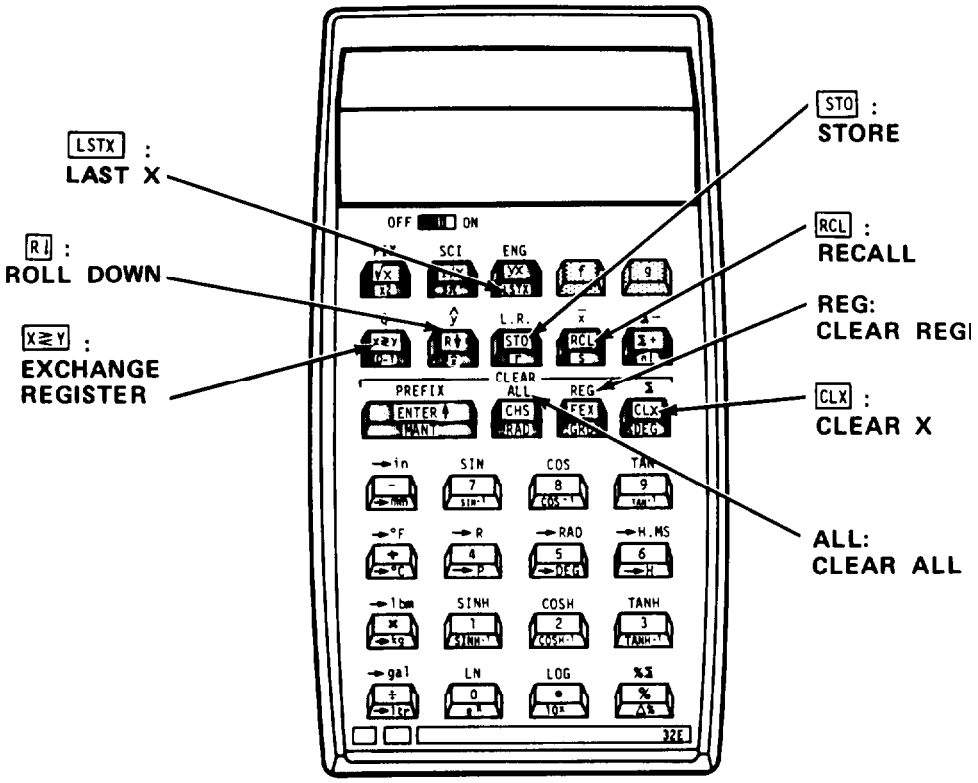


Display Control

EEX	Enter Exponent	After pressing, next numbers keyed in are exponents of 10.

Key	Control or Indicator	Function
FIX	Fixed Point	Followed by digit key, selects fixed point notation display. Digit entry designates number of digits to be displayed to the right of decimal point.
SCI	Scientific	Followed by the number key that specifies the number of decimal places the display will be rounded to.
ENG	Engineering	Followed by digit key, selects engineering notation display. Digit key specifies number of digits to be displayed to right of decimal point.
MANT	Mantissa	Temporarily displays all 10 digits of mantissa of number in X-register.

Key	Control or Indicator	Function

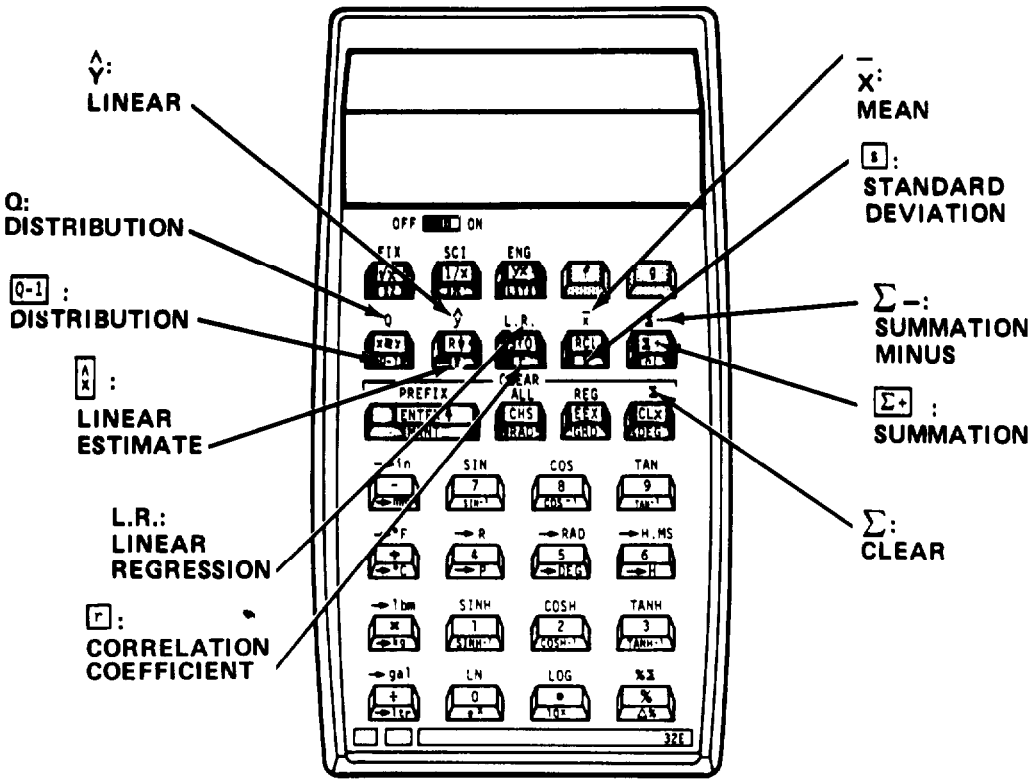


Number Manipulation

X≷Y	Exchange Register	Interchanges contents of X and Y-registers.
R↓	Roll Down	Rolls down contents of automatic memory stack for viewing in X-register without loss of data. When pressed, contents of X-register is shifted to T-register, T-register shifts to Z-register, Z-register shifts to Y-register, and Y-register advances to X-register for viewing.
CLX	CLEAR X	Clears contents of displayed X-register.

Key	Control or Indicator	Function
ALL	CLEAR ALL	Clears contents of memory stack and all storage registers.
STO	Store	Followed by digit key 0 through 8 or by a decimal point and a key 0 through 5 , stores displayed number in that specified location. Also used to perform storage register arithmetic.
RCL	Recall	Followed by digit key 0 thru 8 or by a decimal point and a digit key 0 thru 5, recalls value from specified storage register into the dis- displayed X-register.
REG	CLEAR Register	Clears contents of stor- age registers R0 through R8. Contents of regi- sters R.0 thru R.5 are unaffected.
LSTX	LAST X	Recalls number displayed before previous opera- tion back into displayed X-register.

Key	Control or Indicator	Function

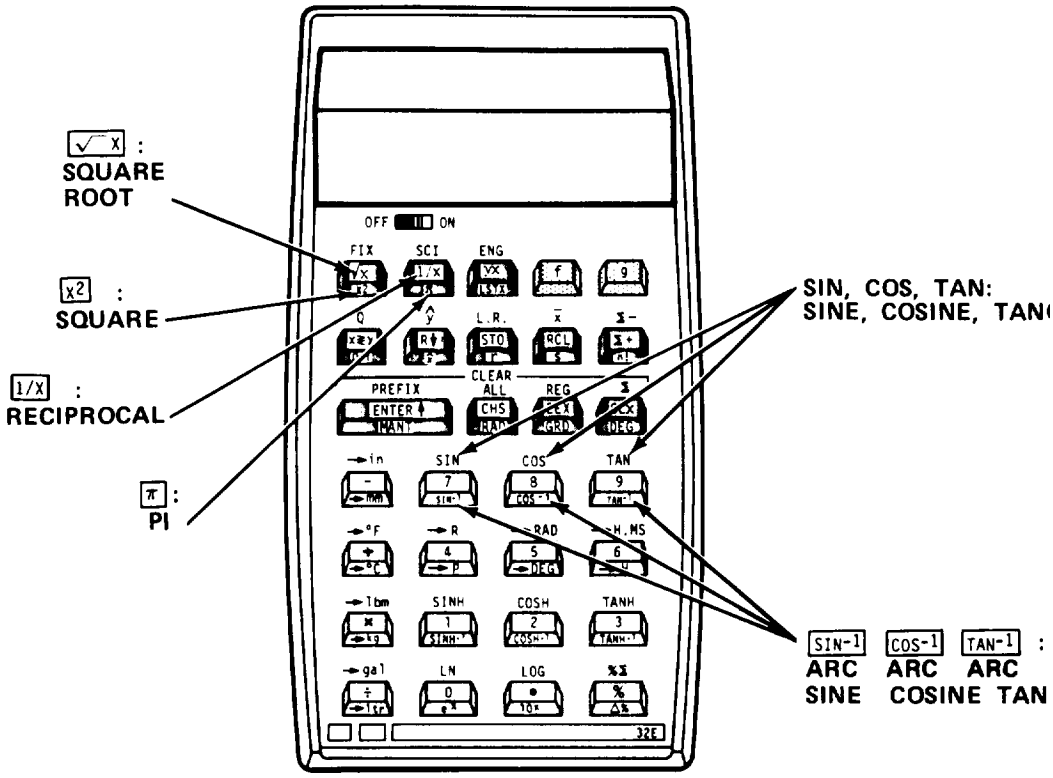


Statistical

Q	Distribution	Computes area under standard normal distribution curve to left of X.
Q-1	Distribution	Computes X, given area under standard normal distribution curve to left of x.
Ŷ	Linear Estimate	Computes estimated value of Y for a given value of x.
x̂	Linear Estimate	Computes estimated value of X for a given value of Y.

Key	Control or Indicator	Function
L.R.	Linear Regression	Computes Y-intercept and slope for linear function approximated by X and Y values accumulated using $\boxed{\Sigma+}$ Value of slope is placed in Y-register.
$\boxed{r}$	Correlation Coefficient	Computes goodness of fit between X and Y values accumulated using $\boxed{\Sigma+}$ and linear function which they approximate.
$\bar{X}$	MEAN	Computes mean (average) of X and Y values accumulated using $\boxed{\Sigma+}$.
$\boxed{s}$	Standard Deviation	Computes standard deviations of X and Y values accumulated using $\boxed{\Sigma+}$.
$\boxed{\Sigma+}$	Summation	Accumulates statistical data in storage registers R.0 thru R.5 using numbers in X- and Y-registers.
$\Sigma-$	Summation Minus	Subtracts from statistical data in storage registers R.0 thru R.5 using numbers in X- and Y-registers.
Σ	CLEAR	Clears statistical storage registers R.0 thru R.5.

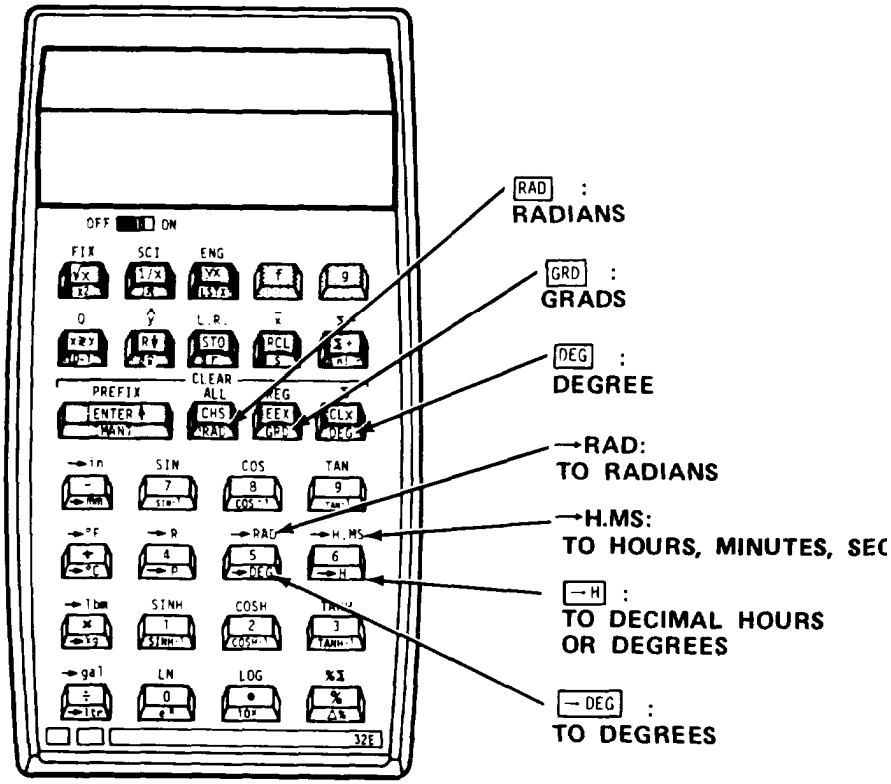
Key	Control or Indicator	Function



Mathematical

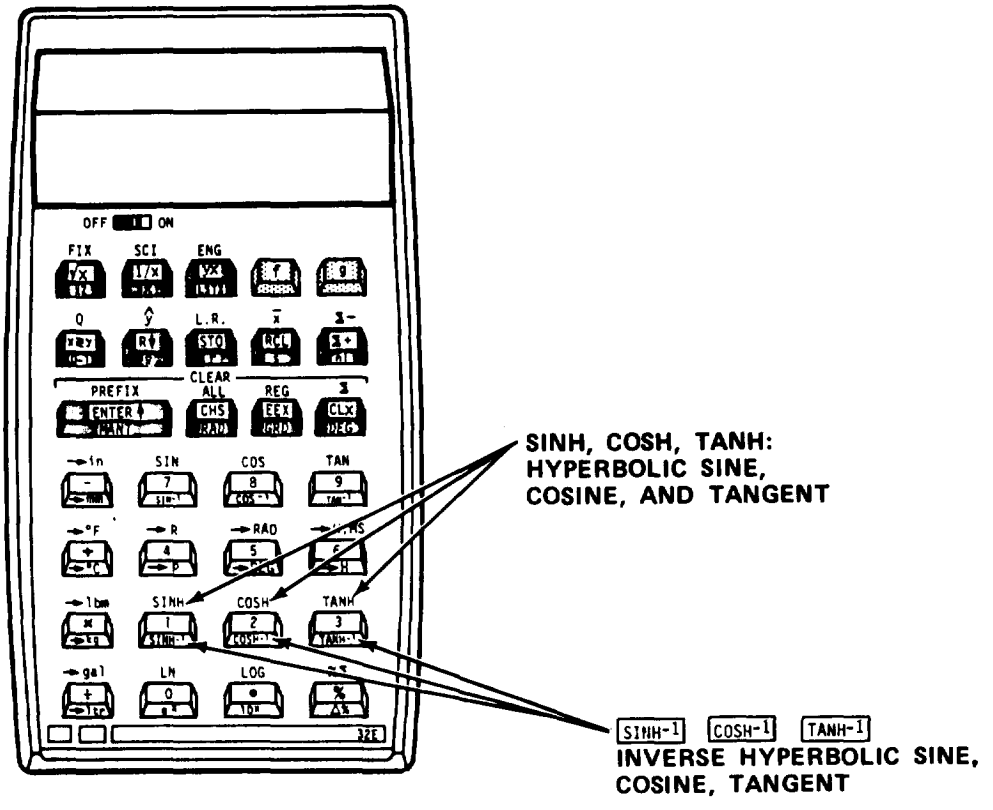
√x	Square Root	Computes square root of number in displayed X-register.
x2	Square	Computes square of number in displayed X-register.
1/X	Reciprocal	Computes reciprocal of number in displayed X-register.
π	pi	Places value of pi (3.141592654) into X-register.
SIN, COS, TAN	Sine, Cosine, Tangent	Computes sine, cosine, or tangent of number in displayed X-register.

Key	Control or Indicator	Function
SIN-1 , COS-1 , TAN-1	Arc Sine, Arc Cosine, Arc Tangent	Computes arc sine, arc cosine, or arc tangent of number in displayed X-register.



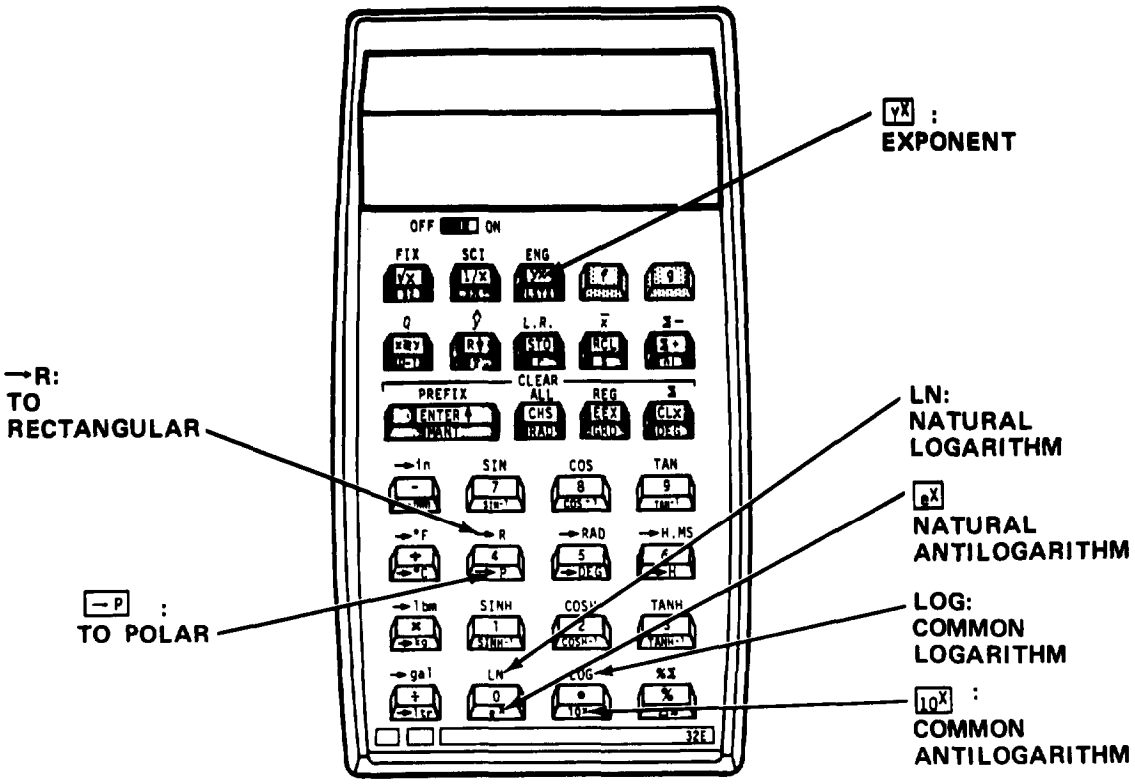
RAD	Radians	Sets radians mode for all trigonometric functions.
GRD	Grads	Sets grads mode for all trigonometric functions.
DEG	Degree	Sets decimal degrees mode for all trigonometric functions.
→RAD	To Radians	Converts decimal degrees to radians.
→DEG	To Degrees	Converts radians to decimal degrees.

Key	Control or Indicator	Function
→H.MS	To Hours. Minutes Seconds	Converts decimal hours or degrees to hours, minutes, seconds or degrees, minutes, seconds.
[−H]	To Decimal Hours or Degrees	Converts hours, minutes, seconds, or degrees, minutes, seconds to decimal hours or degrees.



Key	Control or Indicator	Function
	Hyperbolic	
SINH, COSH, TANH	Hyperbolic Sine, Cosine, and Tangent	Computes hyperbolic sine, hyperbolic cosine, or hyperbolic tangent of number in displayed X-register.
SINH-1 , COSH-1 , TANH-1	Inverse Hyperbolic Sine, Cosine, Tangent	Computes inverse hyperbolic sine, inverse hyperbolic cosine, or inverse hyperbolic tangent of number in displayed X-register.

Key	Control or Indicator	Function

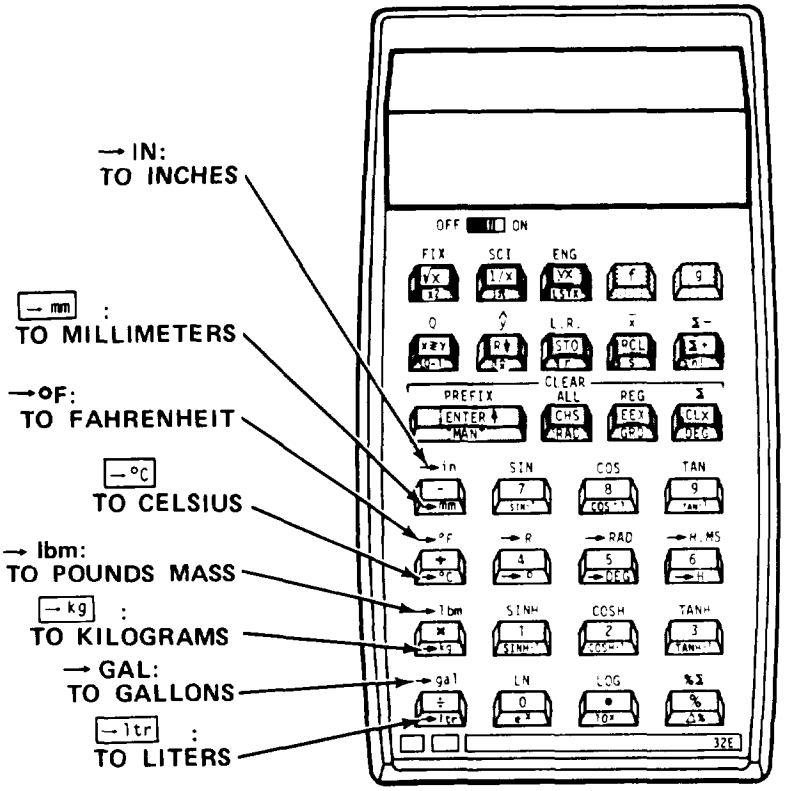


Logarithmic and Exponential

yX	Exponent	Raises number in Y-register to power of number in displayed X-register.
LN	Natural Logarithm	Computes natural logarithm (base e) of number in displayed X-register.
eX	Natural Antilogarithm	Raises e to power of number in displayed X-register.
LOG	Common Logarithm	Computes common logarithm (base 10) of number in displayed X-register.

Key	Control or Indicator	Function
10^x	Common Antilogarithm	Raises 10 to power of number in displayed X-register.
$\rightarrow P$	To Polar	Converts rectangular (X,Y) coordinates in X- and Y - registers into polar (R, θ) coordinates. Angle θ stored in Y-register.
$\rightarrow R$	To Rectangular	Converts polar (R, θ) coordinates in X- and Y-registers into rectangular (X, Y) coordinates.

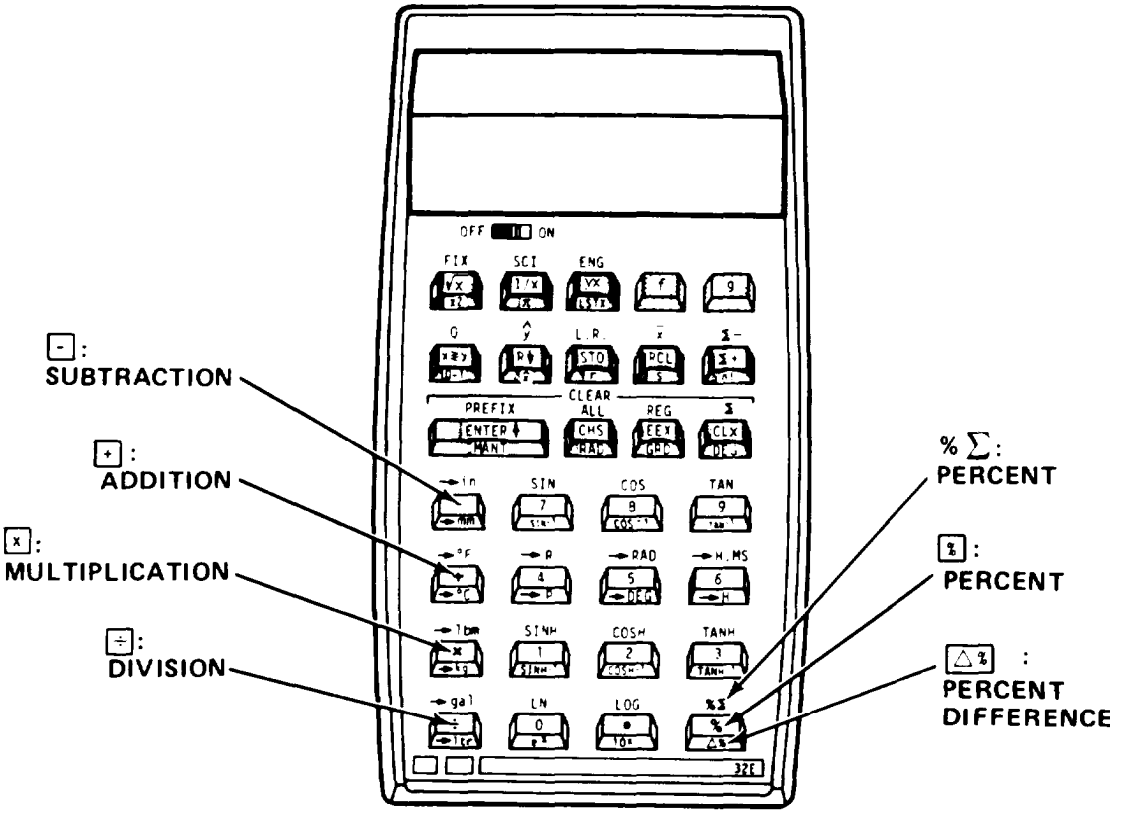
Key	Control or Indicator	Function



Metric Conversions

→in	To Inches	Converts millimeters to inches.
→mm	To Millimeters	Converts inches to millimeters.
→°F	To Fahrenheit	Converts degrees Celsius to degrees Fahrenheit.
→°C	To Celsius	Converts degrees Fahrenheit to degrees Celsius.
→ lbm	To Pounds Mass	Converts kilograms to pounds mass.
→kg	To Kilograms	Converts pounds mass to kilograms.

Key	Control or Indicator	Function
	To Gallons	Converts liters to gallons (U.S.).
	To Liters	Converts gallons (U.S.) to liters.



Percentage

%	Percent	Computes X-percent of Y.
Δ%	Percent Difference	Computes percent difference between number in Y-register and number in X-register.
%Σ	Percent	Computes percent that X is of the number (ΣX) in storage register $R_{.1}$.

Arithmetic Functions

+	Addition	Arithmetic functions
-	Subtraction	
x	Multiplication	
÷	Division	

13-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

13-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows.

Item	Quality
Cheesecloth (Item 7, Appendix E)	ar

Table 13-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before **D - During** **A - After** | **W - Weekly** **M . Monthly** **Q - Quarterly** | **AN - Annually** **S - Semiannually** **BI - Biennially** | **(Number) - Hundreds of Hours**

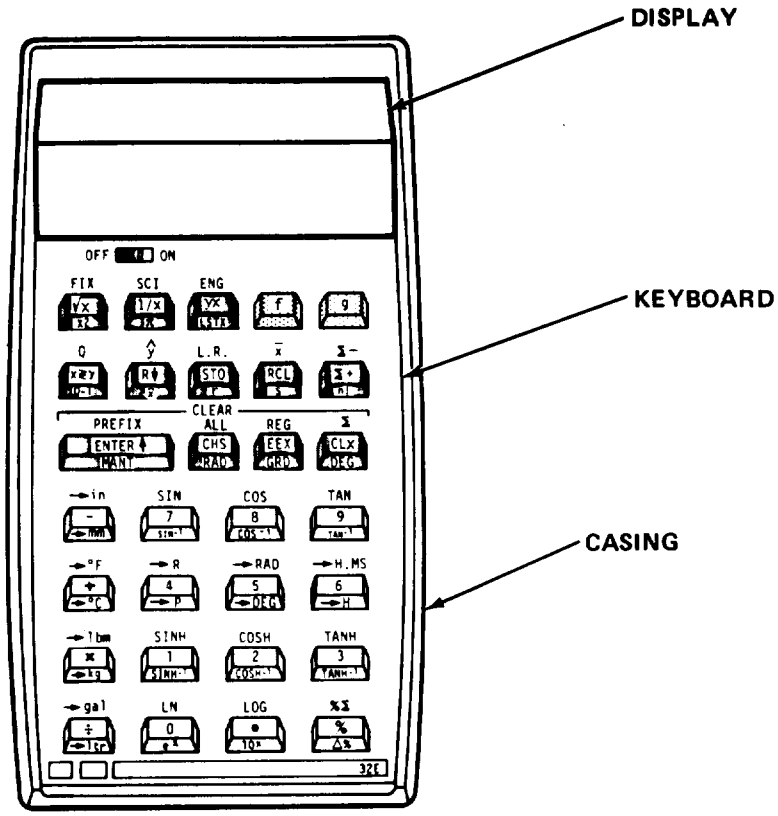
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment Is Not Ready/ Available If:
		POCKET CALCULATOR	
1	B	Inspect. 	
		1. Check keyboard, display, and casing for cracks or breaks. Replace calculator if casing or display is cracked or broken.	Calculator keyboard, display, or casing is damaged.

Table 13-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		POCKET CALCULATOR - Cont	
1	B	Inspect - Cont	
		2. Connect ac adapter/recharger to calculator and plug in. Turn calculator on. Press [STO] and [ENTER↑]. Display should indicate -8, 8, 8, 8, 8, 8, 8, 8, 8, 8.	Display does not show -8, 8, 8, 8, 8, 8, 8, 8, 8, 8.
		3. With battery pack in calculator, check operation to be sure calculator turns on. Remove battery pack and check for clean contacts. Wipe clean. Reinstall battery pack.	Battery pack is defective.
		4. Check power cord for kinks, frays or burns.	Power cord is damaged.

13-6. OPERATION UNDER USUAL CONDITIONS.

13-6.1 Operating Procedure.

a. Selecting a function.

NOTE

Most keys on the keyboard perform three functions. One function is indicated by symbol on top of key, second is above key, and third is on slanted face of key.

(1) To select a function printed on the key, press the key.

(2) To select a function printed above the key, press key [f], then function key.

Example: To use **LOG** in calculation, enter number, [f] then LOG.

(3) To select a function printed on slanted face of key, press [g] then function key.

Example: To use q in calculations, enter number, [g] then [x^2].

b. Keying in numbers.

(1) Press keys corresponding to digits and decimal point in the order that they appear, reading from left to Fight.

(2) If needed, press [CHS] to make number negative.

c. One-number functions.

(1) Key in number on which operation is to be performed.

(2) Select desired function. Press key.

Example: To calculate square root of 5, press [5] and [√x].

Answer is 2.2361.

d. Two-number functions.

(1) Key in first number.

(2) Press [ENTER↑] to separate first number from second number.

(3) Key in second number.

(4) Select desired function. Press key.

Example: To calculate 5 percent of 35, press [3], [5], [ENTER↑], [5], and [%].

Answer is 1.75.

e. Exponent key q .

NOTE

Exponent key is two-number function.

(1) Key in number for Y. Press [CHS] if it is negative.

(2) Press [ENTER↑] to send number to Y register in automatic memory stack.

(3) Key in number for X (exponent for Y).

(4) Press [y^x] key.

Example: To calculate 5^3, press [5], [ENTER↑], [3], and [y^x].

Answer is 125.

f. Chain calculations.

NOTE

Calculator uses reverse polar notation (RPN) logic for chain calculations.

(1) If equation has parenthetical expressions, key in numbers and perform function in first parenthesis. Key in first number, press [ENTER↑] key in second number, and press function key for that operation.

(2) Key in numbers and perform function in second parenthesis. Key in first number, press [ENTER↑] , key in second number, then press function key for that operation.

(3) Press function key for operation indicated between parentheses.

Example: To calculate (3 x 4) x (5 + 6), press

[3] , [ENTER↑] , [4] , and [x]
[5] , [ENTER↑] , [6] , and [+]
[x] ; answer is 132.

g. Operations with powers of 10.

(1) Key in number being multiplied by power of 10. Press [CHS] if number is negative.

(2) Press [EEX] .

(3) Key in exponent (power) of 10. Press [CHS] if exponent is negative.

(4) Press [ENTER↑] and key in exponent.

(5) Press [x] .

Example: To multiply 15.6×10^{12} by 25 press

[5] , [.] , [6] , [EEX] , and [12]
, [25] , and [x] ; answer is 3.9000×10^{14}.

h. Storage (memory) register arithmetic.

NOTE

This procedure performs two-number arithmetic functions on number stored in storage register. The displayed X-register is the second number.

(1) Press [STO] .

(2) Press appropriate function key [+] , [-] , [x] , or [÷] .

(3) Press [0] through [8] or, [.] [0] through [.] [5], indicating on which register function will be performed.

Example: Pressing [STO], [x] and [1] multiplies value of (displayed) X-register by contents of storage (memory) register 1. The answer is placed into storage (memory) register 1.

NOTE

Value of X-register will not be changed.

i. Clearing storage (memory) register.

(1) To clear single storage (memory) register, press [0], [STO], and location of register to be cleared.

Example: To clear register 2, press [0], [STO] and [2].

(2) To clear registers 0 through 8, press [f] and REG. To clear registers 0 through 5, press [f] and [.]. To clear all registers (including the automatic memory stack) press [f] and ALL.

j. Trigonometric functions.

(1) Enter or calculate value of X, number on which trigonometric function is to be performed.

(2) Press [g] key.

(3) Press [DEG], [RAD], or [GRD] to select measurement for answer (degrees, radians, or grads).

(4) Press [f] key.

(5) Press needed function (SIN, COS, TAN) key.

Example: To calculate sine 35, press [3], [5], [g], [DEG], [f], and SIN. Answer is 0.5736.

k. Polar/rectangular coordinate conversion.

(1) Convert from rectangular (X, Y) to polar coordinates.

NOTE

Value for Y is always keyed in first.

(a) Key in value of Y.

(b) Press [ENTER↑].

(c) Key in value of X.

(d) Press [g] then key In [DEG] , [RAD] , or [GRD] to select measurement for answer (degrees, radians, or grads).

(e) Press [g] and [→P] to get R (magnitude). Press [x≷y] to get angle in radians.

Example: To convert rectangular coordinates (4, 3) to polar with angle in radians, press

[3] , [ENTER↑] , and [4]
[g] and [RAD]
[g] and [→P] ; answer is 5.
[x≷y] ; answer is .64.

(2) Convert from polar to rectangular coordinates.

(a) Key in angle in radians.

(b) Press [ENTER↑] .

(c) Key in value of R (magnitude).

(d) Press [g] then key in [DEG] , [RAD] , or [GRD] to select measurement of angle (degrees, radians, or grads).

(e) Press [g], R to get X. Press [x≷y] to get Y.

Example: To convert polar coordinates 5 and .64 to rectangular, press

[.], [6], [4], [ENTER↑] , and [5]
[g] and [RAD]
[g] and [→R] : answer is 4.01.
[x≷y] : answer is 2.986.

1. Statistical functions.

(1) Accumulations.

(a) Pressing [Σ+] key computes sums and products of the values in the X- and Y-registers. Results are automatically accumulated in storage registers R0 through R5. Before starting to calculate accumulations with a new set of x and y values, clear registers by pressing [f] I REG.

Key y value into X-register.

Press [ENTER↑] to raise y value into Y-register.

Key x value into X-register.

Press [Σ+] .

b. If statistical problem involves only one variable (x), clear storage registers R.0 through R.5 and Y-register. Press [f] , Σ, and [ENTER↑] .

Key number into X-register.

Press [Σ+] .

NOTE

Unlike storage register arithmetic, the accumulation operation allows overflows (i.e., number whose magnitudes are greater than $9.99999999 \times 10^{99}$) in storage registers R_0 through R.5 without indicating Error 1 in the display.

c. To use any of the accumulations, recall contents of desired storage register into displayed X-register by pressing [RCL] [.] followed by the number of the register. If this is done immediately after pressing [Σ+] or [Σ-], the accumulation recalled is written over the number of data pair entries (n) in the display. To use both Σx and Σy, press [RCL] [Σ+]. This simultaneously copies Σx from R.1 into displayed X-register and copies Σy from R_3 into Y-register. If this is done immediately after pressing [Σ+], [Σ-], [CLX], or [ENTER↑], the number in the Y-register is first lifted into the Z-register. Otherwise, the numbers in the X- and Y-registers are first lifted into Z- and T- registers, respectively.

Example: To find, Σx, Σx^2, Σy, Σy^2, for the paired values of x and y listed below, press:

y	7	5	9
x	5	3	8

Keystrokes	Display	
[f] CLEAR Σ	0.0000	Clear statistical storage registers. (Display shown assumes no results remain from previous calculations.)
[7] [ENTER↑]	7.0000	
[5] [Σ+]	1.0000	First pair is accumulated: n=1
[5] [ENTER↑]	5.0000	
[3] [Σ+]	2.0000	Second pair is accumulated: n=2
[9] [ENTER↑]	9.0000	
[8] [Σ+]	3.0000	Third pair is accumulated: n=3

Keystrokes	Display	
RCL . 1	16.0000	Sum of x values from register R.1
RCL . 2	98.0000	Sum of squares of x values from register R.2
RCL . 3	21.0000	Sum of y values from register R.3
RCL . 4	155.0000	Sum of squares of y values from register R.4
RCL . 5	122.0000	Sum of products of x and y values from register R.5
RCL . 0	3.0000	Number of entries (n=3) from register R.0

(2) Deleting and correcting data.

(a) If an incorrect value is keyed in and Σ+ has not yet been pressed, press CLX and key in correct value.

(b) To change one of the values, or if after pressing q one of the values was erroneous, correct the accumulations by using Σ- (summation minus) key as follows:

Key incorrect data pair into X- and Y-registers. LSTX can be used to return a single incorrect data value to displayed X-register.

Press f Σ- to delete incorrect data.

Kev in correct values for x and Y. If one value of an (x; y) data pair is incorrect, both values must be deleted and reentered.
Press Σ+.

Example: If last data pair (8, 9) in previous example should have been (8, 6), correct the accumulation as follows, press:

Keystrokes	Display	
9 ENTER↑	9.0000	Incorrect y value is entered again.
8	8.	Correct x value is entered again.
f Σ-	2.0000	Number of entries (n) is now two .

Keystrokes	Display	
6 ENTER↑	6.0000	Correct y value is entered.
8	8.	x value is entered again.
Σ+	3.0000	Number of entries is again three.

(3) Mean. Pressing $\hat{x}$ computes the arithmetic mean (average) of x and y values accumulated in registers R.1 and R.3 respectively.

Pressing f $\hat{x}$ causes the following operations to be performed.

The contents of the stack registers are lifted just as they are when pressing RCL .

The mean of the x values ($\bar{x}$) is calculated using data accumulated in registers R1 (Σx) and R.0 (n). The resulting value for x appears in displayed X-register.

The mean of y values ($\hat{y}$) is calculated using data accumulated in registers (Σy) and R.0. (n).

The resulting value for y is available in Y-register of stack.

Example: Below is a chart of daily high and low temperatures for a winter week. To find average high and low temperatures for week selected, press:

	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
High	6	11	14	12	5	-2	-9
Low	-22	-17	-15	-9	-24	-29	-35

Keystrokes	Display	
f CLEAR Σ	0.0000	Statistical registers cleared. (Display shown assumes no results remain from previous calculations.)
6 ENTER↑ 22	22.	
CHS Σ+	1.0000	Number of data pairs (n) is now 1.
11 ENTER↑ 17	17.	
CHS Σ+	2.0000	Number of data pairs (n) is now 2.
14 ENTER↑ 15	15.	

Keystrokes	Display	
CHS Σ+	3.0000	
1 2 ENTER↑ 9	9.	
CHS Σ+	4.0000	
5 ENTER↑ 2 4	24.	
CHS Σ+	5.0000	
2 CHS ENTER↑	-2.0000	
2 9 CHS Σ+	6.0000	
9 CHS ENTER↑	-9.0000	
3 5 CHS Σ+	7.0000	Number of data pairs (n) is now 7.
f $\bar{x}$	-21.5714	Average low temperature.
x≷y	5.2857	Average high temperature.

(4) Standard deviation.

(a) Pressing s computes the standard deviation (a measure of dispersion around the mean) of accumulated data.

(b) When 9 s is pressed:

The contents of stack registers are lifted just as they are when pressing RCL Σ+ .

The standard deviation of x values (s_x) is calculated using data accumulated in registers R.2 (2), R.1 (Σ), and R.0 (n). The result appears in displayed X-register.

The standard deviation of y values (s_y) is calculated using data accumulated in registers R.4 (y2), R.3 (y), and R.o (n) The result appears in Y-register.

Example: To determine the standard deviation of the following test scores: 79, 94, 68, 86, 82, 78, 83, and 89, press

Keystrokes	Display	
f CLEAR ALL	0.0000	Clear statistical registers and Y-register for new one-variable problem.

Keystrokes	Display	
7 9 Σ+	1.0000	First score is entered. Since this problem involves only one variable, y-value does not have to be entered into Y-register using the ENTER↑ key.
9 4 Σ+	2.0000	Display shows number of scores entered so far.
6 8 Σ+	3.0000	
8 6 Σ+	4.0000	
8 2 Σ+	5.0000	
7 8 Σ+	6.0000	
8 3 Σ+	7.0000	
8 9 Σ+	8.0000	Last score in sample.
g S	7.8365	Standard deviation of test scores.

(5) Linear regression. Linear regression is a statistical method for finding a straight line that best fits a set of data points, thus providing a relationship between two variables.

(a) To use the linear regression function. first key in a series of data points using the Σ+ key. Then press f L.R.

(b) When f L.R. if pressed:

The contents of the stack registers are lifted just as they are when you press RCL Σ+ .

The slope (A) of the least squares line of the data is available in the Y-register of the stack.

The y-intercept (B) of the least squares line of the data appears in the displayed X-register of the stack.

(c) To use value for A or to bring it into displayed X-register, simply shift stack contents with the x≷y key.

Example: An oil company wishes to know the slope and y-intercept of a least squares line for the consumption of motor fuel in the United States against time since 1945. It knows the data given in the table.

Motor Fuel Demand (Millions of Barrels)	696	994	1330	1512	1750	2162	2243	2382	2484
Year	1945	1950	1955	1960	1965	1970	1971	1972	1973

Solution: Key the data into the calculator using the [Σ+] key, then press [f] L.R.

Keystrokes	Display	
[f] CLEAR [Σ+]	0.0000	Clear statistical storage registers. (Display shown assumes no results remain from previous calculations).
[6][9][6] [ENTER↑]	696.0000	
[1][9][4][5] [Σ+]	1.0000	
[9][9][4] [ENTER↑]	994.0000	
[1][9][5][0] [Σ+]	2.0000	
[1][3][3][0] [ENTER↑]	1,330.0000	
[1][9][5][5] [Σ+]	3.0000	
[1][5][1][2] [ENTER↑]	1,512.0000	
[1][9][6][0] [Σ+]	4.0000	
[1][7][5][0] [ENTER↑]	1,750.0000	
[1][9][6][5] [Σ+]	5.0000	
[2][1][6][2] [ENTER↑]	2,162.0000	
[1][9][7][0] [Σ+]	6.0000	
[2][2][4][3] [ENTER↑]	2,243.0000	
[1][9][7][1] [Σ+]	7.0000	
[2][3][8][2] [ENTER↑]	2,382.0000	
[1][9][7][2] [Σ+]	8.0000	
[2][4][8][4] [ENTER↑]	2,484.0000	
[1][9][7][3] [Σ+]	9.0000	All data pairs have been keyed in.

Keystrokes	Display	
[f] L.R.	-118,290.6295	The y-intercept of the line.
[x≷y]	61.1612	Slope of the line.

(6) Linear estimation. With data accumulated in registers R.0 through $R._5$ a predicted value for y (denoted y) can be calculated by keying in a new value for x and pressing [f] $\hat{y}$. A predicted value for x (denoted x) can be calculated by keying in a new value for y and pressing [g] $\hat{x}$.

Example: With data intact from previous example in registers R.0 through $R._5$ to predict demand for motor fuel for the years 1980 and 2000, key in new x values and press [f] $\hat{y}$. To determine the year that the demand for motor fuel is expected to pass 3,500 million barrels, key in 3,500 (new value for y) and press [g] $\hat{x}$.

Keystroke	Display	
[1][9][8][0][f] $\hat{y}$	2,808.6264	Predicted demand in millions of barrels for the year 1980.
[2][0][0][0][f] $\hat{y}$	4,031.8512	Predicted demand in millions of barrels for the year 2000.
[3][5] [g] $\hat{x}$	1,991.3041	The demand is expected to pass 3,500 million barrels during 1992.

(7) Correlation coefficient. Both linear regression and linear estimation presume that the relationship between x and y data values can be approximated, to some degree, by a linear function (a straight line). [r] (correlation coefficient) can be used to determine how closely the data "fits" a straight line. The correlation coefficient can range from r = + 1 to r = -1. At r = + 1, data falls exactly onto a straight line with positive slope. While at r = -1, data falls exactly onto a straight line with negative slope. At r = 0, data cannot be approximated by a straight line.

Example: To calculate the correlation coefficient for previous example press:

Keystrokes	Display	
[g] [r]	0.9931	The data very closely approximates a straight line.

13-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

13-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

13-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during the operation or maintenance of the pocket calculator or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 13-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. CALCULATOR DISPLAY IS BLANK.	
Step 1. Plug in ac adapter/recharger. Turn calculator on.	
(a) If display of zeros comes on, proceed to step 2.	
(b) If display is blank, replace adapter/recharger.	
(c) If problem remains, replace calculator.	
Step 2. Check for raised decimal point at far left corner of display. Indicates low power condition.	
(a) If indicator is on, proceed to step 3.	
(b) If indicator is off, recharge battery pack.	
Step 3. Check to see if contacts are dirty.	
(a)	Clean contacts on inside of calculator and battery pack with cotton swab (Item 6, Appendix E) moistened with alcohol (Item 3, Appendix E).
(b)	Replace battery pack. Open battery pack door. Remove defective battery pack. Install new battery pack. Reinstall battery pack door.

Table 13-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
2. CALCULATIONS OR DISPLAY ERRATIC.	
Step 1. Check for raised decimal point at far left corner of display. Indicates low power condition.	
	(a) Recharge battery pack.
	(b) Replace battery pack.
	(c) Replace calculator.
Step 2. Press [STO] and [ENTER↑] to see if display shows -8,8,8,8,8,8,8,8, not ERROR 9.	
If ERROR 9 is displayed, replace calculator.	
NOTE For error conditions refer to operator's instructions for the HP-32E provided with equipment.	

13-10. MAINTENANCE PROCEDURES. There are no operator maintenance procedures assigned for this equipment.

Section IV ORGANIZATIONAL MAINTENANCE

13-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

13-12. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT. These items are not required at the organizational level of maintenance.

13-13. SERVICE UPON RECEIPT.

13-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

13-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

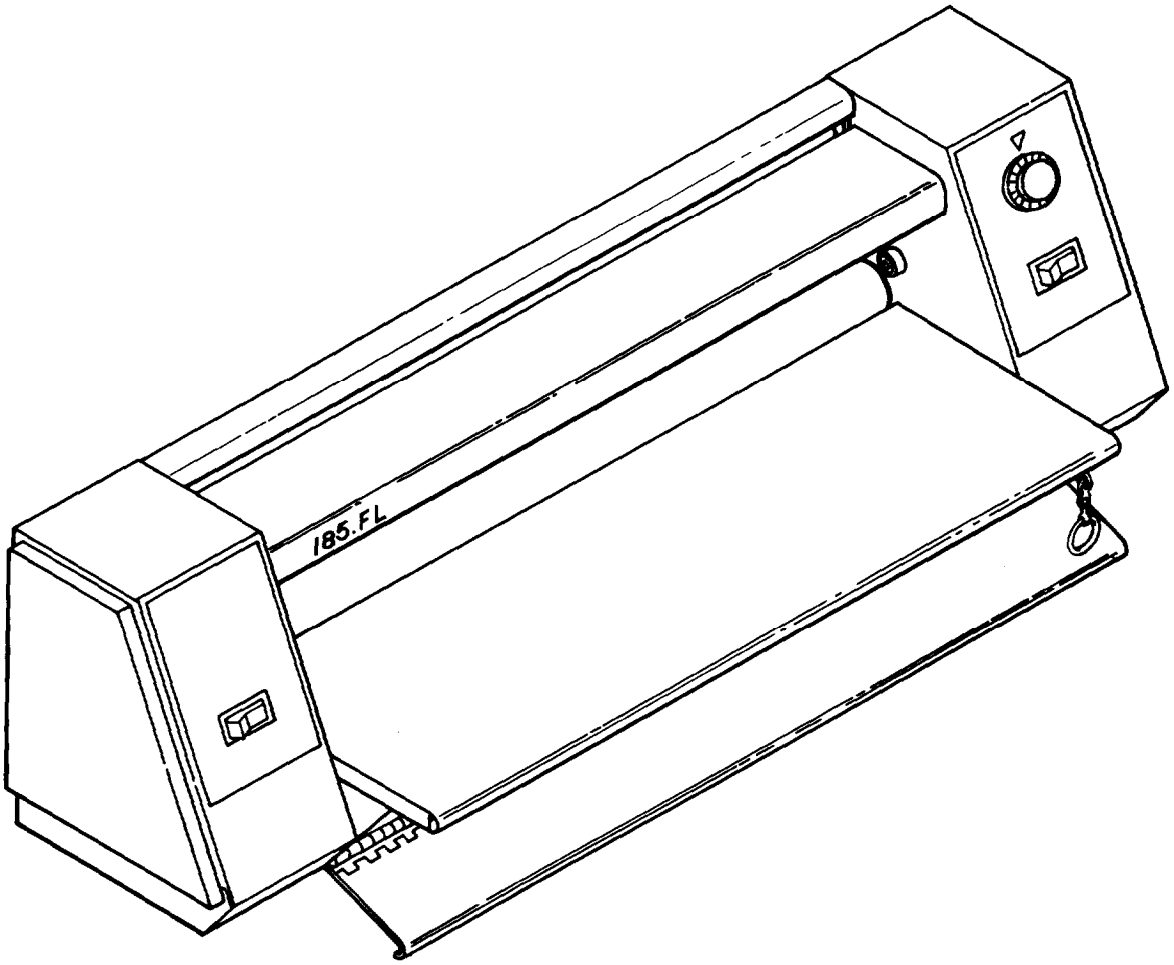
13-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organanizational troubleshooting procedures assigned for this equipment.

13-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

13-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.


185.FL

CHAPTER 14

DIAZO PRINTER

Section I INTRODUCTION

14-1. GENERAL INFORMATION.

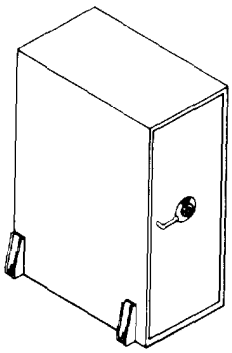
14-1.1 Scope.

a. Model Number and Equipment Name. Model GAF 185.FL Diazo Printer.

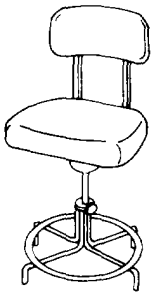
b. Purpose of Equipment. To produce dry Diazo prints from translucent paper, film, or cloth originals.

14-1.2 Reference Information.

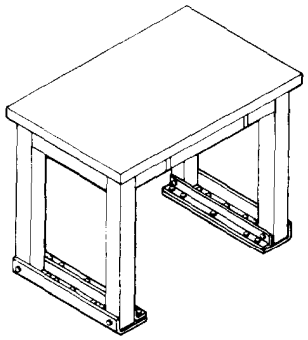
TM 5-3610-256-14 and -24P, Operator, Organizational, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List, Reproduction Set Diazo Process 185.FL-M (3610-01-123-7782), (NSN3610-01-061-0621 FL), contains the information applicable to this equipment.



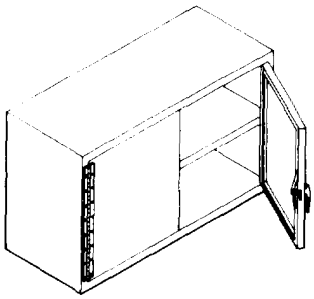
MAP AND PLAN SECURITY CABINET



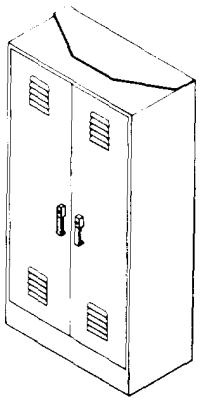
ROTARY DRAFTING CHAIR



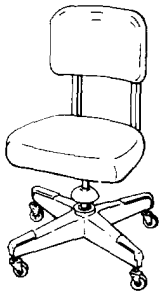
OFFICE TABLE



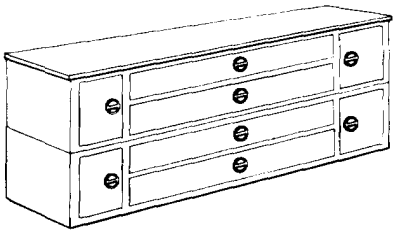
WALL STORAGE CABINET



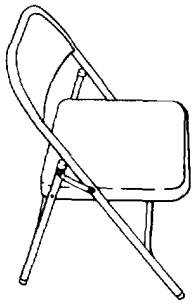
CHEMICAL STORAGE CABINET



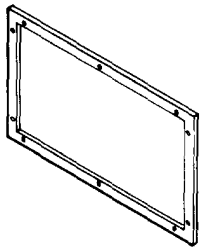
ROTARY DESK CHAIR



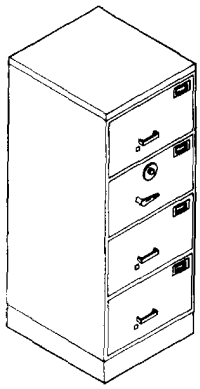
DIAZO SUPPORT CABINET



FOLDING CHAIR



CORK BOARD



SECURITY FILING CABINET

CHAPTER 15

FURNITURE AND CABINETS

Section I INTRODUCTION

15-1. GENERAL INFORMATION.

15-1.1 Scope. This chapter contains the description of all furniture and cabinets contained in this section.

15-2. EQUIPMENT DESCRIPTION.

a. Chemical storage cabinet. Used for storage of miscellaneous chemicals. There are four shelves within the cabinet. It has two doors secured by a handle-type latch with a built-in lock. Dimensions:

Width	36 in. (91.4 cm)
Depth	18 in. (45.7 cm)
Height	72.0 in. (182.8 cm)

b. Security filing cabinet. Used for security storage of classified documents. It has four drawers locked by a latch and combination lock located on the second drawer. Dimensions:

Width	20.75 in. (52.7 cm)
Depth	28 in. (71.1 cm)
Height	52 in. (132.1 cm)

c. Map and plan security cabinet. Used for the security storage of maps, plans and charts of various sizes. These items are hung from racks in the cabinet. The door is secured by a boltwork latch with an integral combination lock. Dimensions:

Width	22 in. (55.9 cm)
Depth	39 in. (99.1 cm)
Height	51.38 in. (130.5 cm)

d. Wall storage cabinet. Used for miscellaneous storage. There are two shelves. The two doors are held shut by a handle-type latch. Dimensions:

Width	30 in. (76.2 cm)
Depth	12 in. (30.5 cm)
Height	18 in. (45.7 cm)

e. Rotary drafting chair. Provides seating for drafting personnel. It has adjustable seat height and back position. Dimensions:

Width	17.12 in. (43.5 cm)
Depth	17.12 in. (43.5 cm)
Height	42 in. (106.7 cm), Max 36 in. (91.4 cm), Min

f. Rotary desk chair. Provides seating for personnel working at desk. It has a 3-3/4 in. (9.5 cm) seat height adjustment, ball bearing casters, tilt movement tension adjustment and adjustable back height. Dimensions:

Width	20 in. (50.8 cm)
Depth	21 in. (53.3 cm)
Height	32 in. (81.3 cm)

g. Folding chair. Provided for general seating. Folds flat for storage. Dimensions:

Width	18 in. (45.7 cm)
Depth	20 in. (50.8 cm)
Height	32 in. (81.3 cm)

h. Diazo support cabinet. Provides storage for support items associated with the Diazo copy machine. This cabinet has four separate sections, each with its own door and latch. Dimensions:

Width	68.12 in. (173.0 cm)
Depth	28.7 in. (72.9 cm)
Height	15.68 in. (39.8 cm)

i. Office table. Provides additional work space. Table has one pull-out drawer. Dimensions:

Width	60 in. (152.4 cm)
Depth	34 in. (86.4 cm)
Height	30.5 in. (77.5 cm)

j. Corkboards. Wall mounted. Dimensions:

Width	30 in. (76.2 cm)
Height	18 in. (45.7 cm)
Width	36 in. (91.4 cm)
Height	24 in. (61.0 cm)

15-3. TECHNICAL PRINCIPLES OF OPERATION. There are no specific principles of operation for this equipment.

Section II OPERATING INSTRUCTIONS

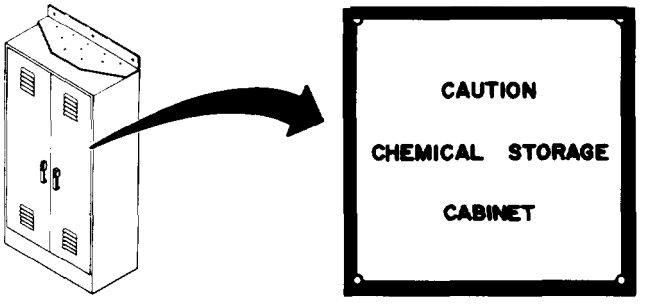
15-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS. This equipment has no operator's controls or indicators.

15-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no operator PMCS procedures assigned for this equipment.

15-6. OPERATION UNDER USUAL CONDITIONS.

15-6.1 Preparation for Movement. Ensure that portable equipment is properly secured with tiedowns provided.

15-6.2 Operating Instructions on Decals and Instruction Plates.



15-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

15-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

15-9. TROUBLESHOOTING PROCEDURES. There are no operator troubleshooting procedures assigned for this equipment.

15-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the furniture and cabinets. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

15-10.1 Inspect Furniture and Cabinets. Inspect furniture and cabinets for structural damage, rust and proper operation of all latches, hinges and adjustment mechanisms.

Section IV ORGANIZATIONAL MAINTENANCE

15-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

15-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE) ; AND SUPPORT EQUIPMENT.

15-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

15-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

15-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

15-13. SERVICE UPON RECEIPT.

15-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

15-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

15-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

15-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance functions for the furniture and cabinets. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

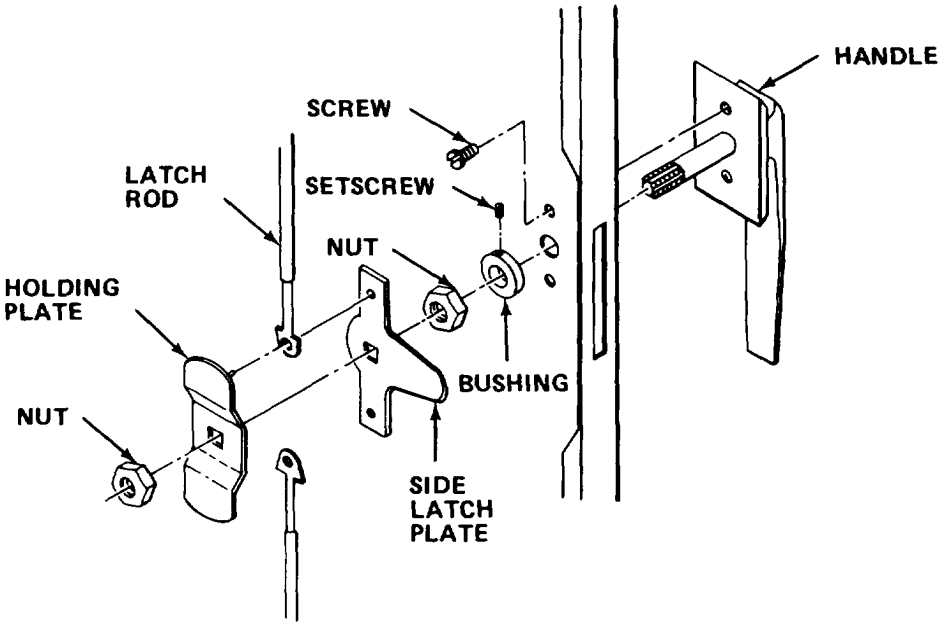
INDEX

15-16.1 Replace Door Latch (Wall Storage Cabinet).

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 9/16 in. Combination Wrench
Flat Tip Screwdriver

SUPPLIES: Handle Type Latch



a. Remove holding plate retaining nut.

b. Remove holding plate and latch rods.

c. Remove side latch plate.

d. Remove handle retaining nut.

e. Loosen setscrew and remove bushing from handle shaft.

f. Remove handle retaining screws and handle.

g. Install new handle and secure with screws.

h. Reinstall bushing on handle shaft and tighten setscrew.

i. Reinstall handle retaining nut.

j. Install side latch plate.

k. Reinstall latch rod holding plates and latch rods.

l. Reinstall holding plate retaining nut.

15-16.2 Replace Door Hinge (Piano Hinge).

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/4 in. Electric Drill
5/32 in. Drill Bit
Pop Rivet Gun

SUPPLIES: Storage Cabinet Hinge
5/32 in. Pop Rivets
8-32 x 1/2 in. Screws (4 required)
8-32 Nuts (4 required)

a. Drill out rivets holding hinge to cabinet and remove hinge.

b. Install new hinge and temporarily secure with four screws and nuts.

c. Close and latch cabinet door and install pop rivets.

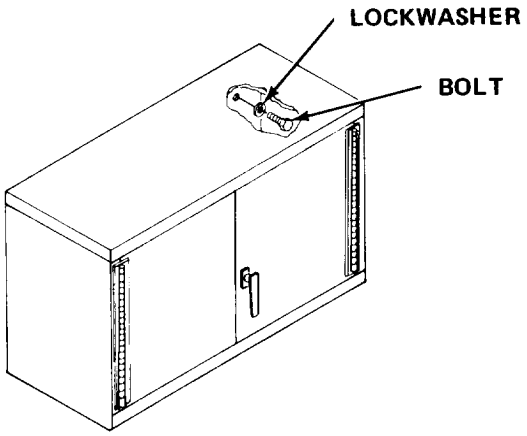
d. Remove temporarily installed screws and nuts, and install POP rivets.

15-16.3 Remove/Install Wall Storage Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/2 in. Drive Ratchet
2 in. Socket Extension, 1/2 in. Drive
1/2 in. Socket, 1/2 in. Drive

SUPPLIES: Wall Storage Cabinet



a. Remove fluorescent light fixture from underneath cabinet if applicable.

b. Remove bolts and lockwashers which secure defective cabinet to wall.

c. Remove defective cabinet.

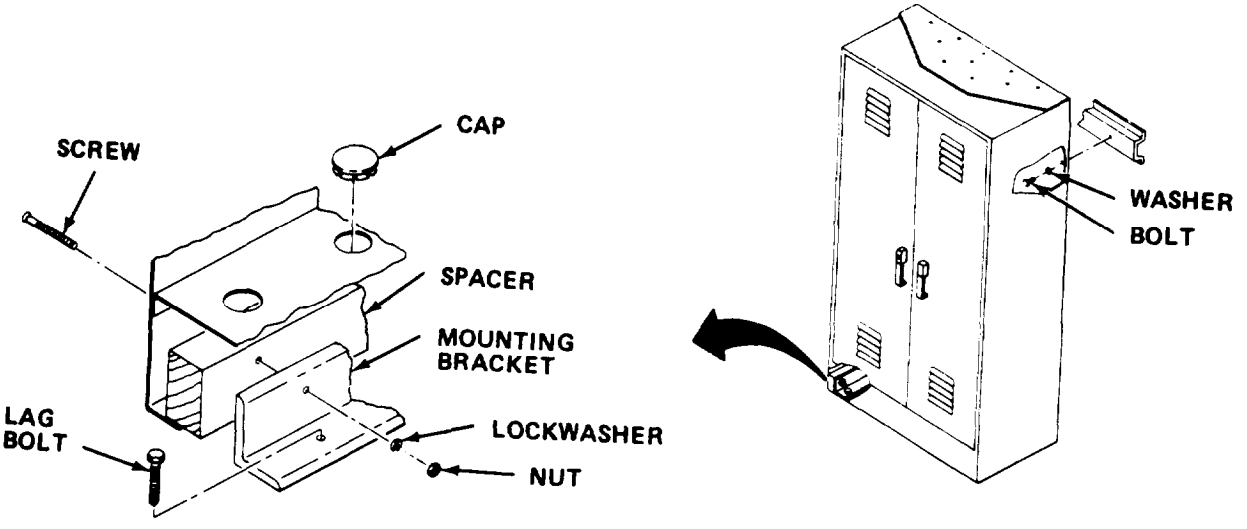
d. Install new cabinet and secure to wall with lockwashers and bolts.

15-16.4 Remove/Install Chemical Storage Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/4 in. Drive Socket Set
6 in. Extension, 1/4 in. Drive
11/32 in. Wrench
Flat Tip Screwdriver
Cross Tip Screwdriver

SUPPLIES: Chemical Storage Cabinet



a. Remove bolts and washers holding cabinet to wall.

b. Remove caps and lag bolts holding mounting bracket to floor and remove cabinet.

c. Remove screws, lockwashers, and nuts and remove mounting brackets and spacers from cabinet. Retain mounting brackets and spacers for use on new cabinet.

d. Position spacers and mounting brackets on new cabinet, and install but do not tighten nuts, lockwashers, and screws.

e. Place new cabinet in position, and install but do not tighten lag bolts.

f. Secure cabinet to wall with washers and bolts.

g. Tighten the bracket retaining bolts and nuts.

h. Tighten the bolts holding the mounting brackets to the floor, and install the caps.

5-16.5 Remove/Install Map and Plan Security Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

PERSONNEL: Two persons are required to perform this procedure.

TOOLS: 1/2 in. Drive Ratchet
1 1/8 in. Socket, 1/2 in. Drive
3 in. Extension

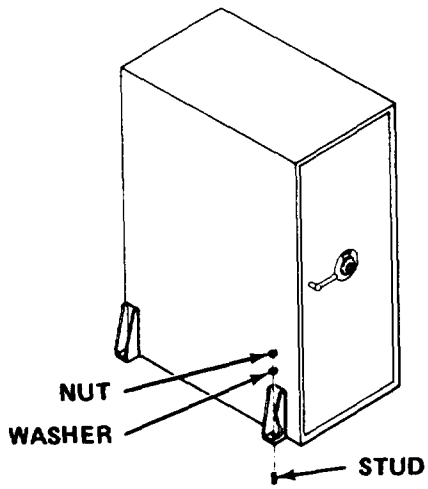
SUPPLIES: Map and Plan Security Cabinet

a. Open cabinet.

b. Remove contents and temporarily store in secure area.

c. Tape lock combination to outside of cabinet.

d. Remove nuts and washers.



WARNING

Serious injury may result if security filing cabinet is removed or replaced in the section without using adequate lifting equipment.

e. Move cabinet to door.

f. Remove cabinet from section.

g. Position new cabinet over studs and reinstall washers and nuts.

h. Have lock combination changed on cabinet before replacing material in cabinet.

15-16.6 Remove/Install Security Filing Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

PERSONNEL: Two persons are required to perform this procedure.

TOOLS: 1/2 in. Drive Ratchet
1 1/8 in. Socket, 1/2 in. Drive
3 in. Extension

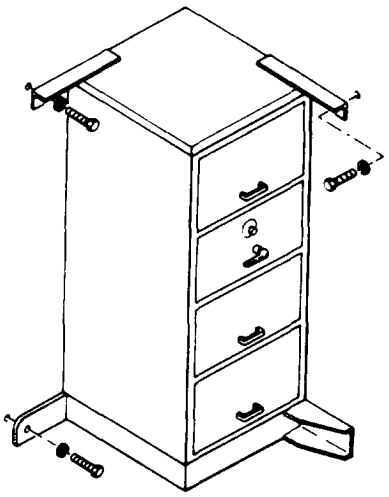
SUPPLIES: Security Filing Cabinet

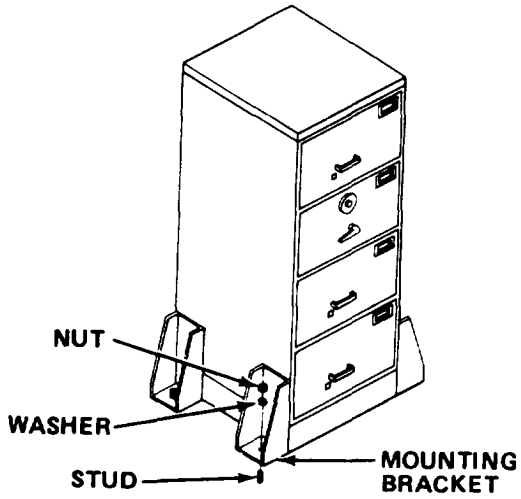
a. Open cabinet.

b. Remove contents and temporarily store in secure area.

c. Tape lock combination to outside of cabinet.

d. Remove attaching hardware.





WARNING

Serious injury may result if security filing cabinet is removed or replaced in the section without using adequate lifting equipment.

e. Move cabinet to door.

f. Remove cabinet from section.

g. Position new cabinet over studs and reinstall attaching hardware.

h. Have combination lock changed to new combination before storing material in security filing cabinet.

15-16.7 Remove/Install Diazo Support Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

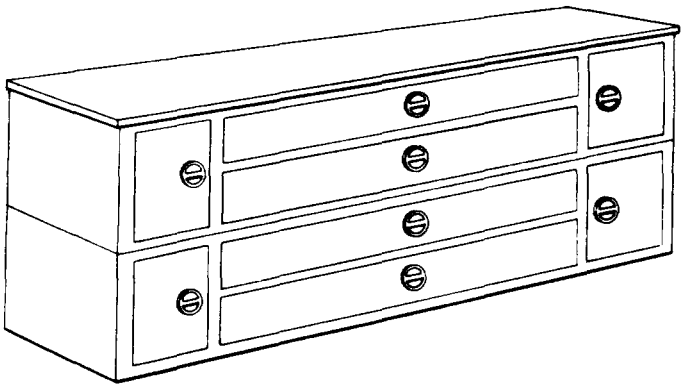
TOOLS: Drill and Bits
9/16 in. Combination Wrench
7/16 in. Combination Wrench
1-1/8 in. Socket, 1/2 in. Drive
1/2 in. Drive Ratchet
3 in. Extension

SUPPLIES: Duct Sealing Tape (Item 29, Appendix E)
Diazo Support Cabinet

a. Remove Diazo supplies from cabinet. Check that al ammonia and absorber containers are securely capped.

b. Unplug Diazo copier. Coil and tape cord.

c. Pull away tubing from cabinet into Diazo and tape to Diazo copier.



d. Remove mounting bolts and washers; then remove Diazo copier.

e. Remove Diazo copier mounting plate from top of cabinet by removing bolts, washers, and nuts.

f. Remove bolts and washers from angle brackets. Then remove cabinet.

g. Install new cabinet. Aline with angle brackets and secure with bolts and washers.

h. Reinstall Diazo mounting plate on top of cabinet and secure with bolts, washers, and nuts.

i. Mount Diazo copier to Diazo mounting plate and secure with bolts and washers. washers.

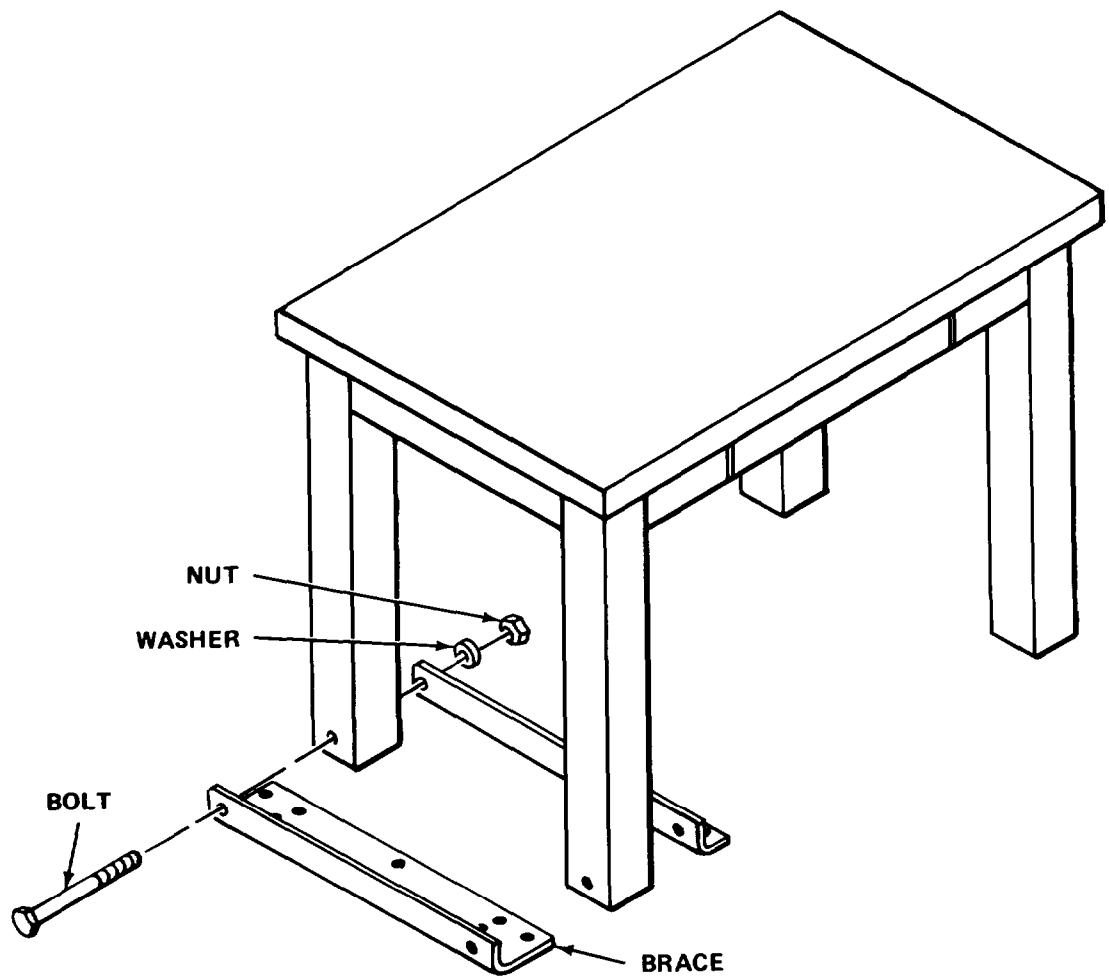
i. Reinstall tubing from Diazo copier to cabinet. Check that there are no kinks or bends in the tubing.

15-16.8 Remove/Install Office Table

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/2 in. Socket, 1/2 in. Drive
1/2 in. Ratchet
3 in. Extension

SUPPLIES: Office Table



a. Remove mounting bolts, washers, and nuts.

b. Remove defective table.

c. Install new table, line up holes with brace.

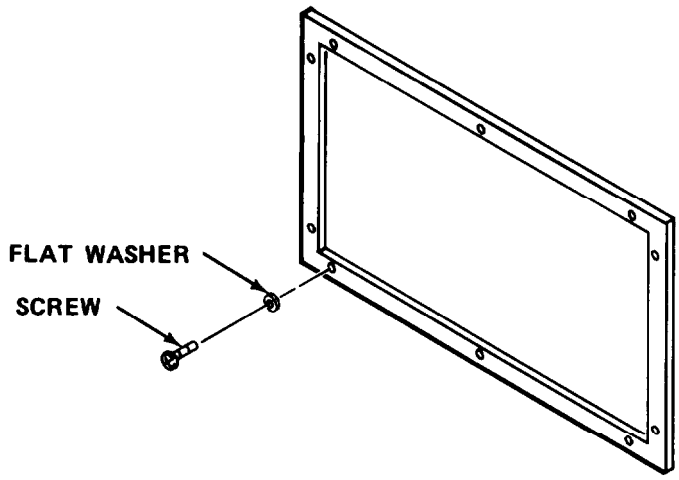
d. Secure with bolts, washers, and nuts.

15-16.9 Remove/Install Corkboard.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: Cross Tip Screwdriver

SUPPLIES: Corkboard



a. Remove attaching hardware securing defective corkboard to wall.

b. Remove defective corkboard.

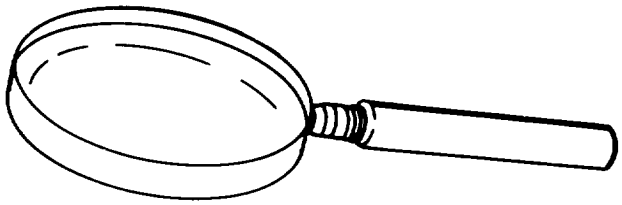
c. Position new corkboard and aline mounting holes.

d. Secure new corkboard to wall with attaching hardware.

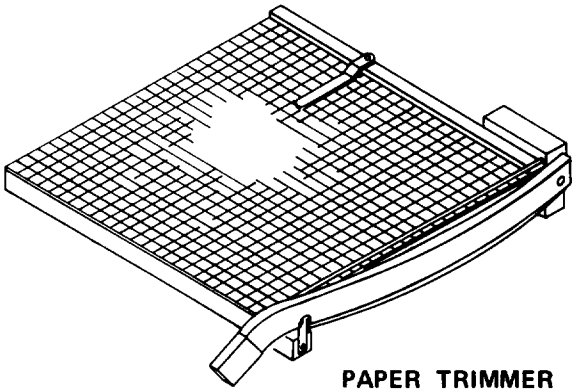
15-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

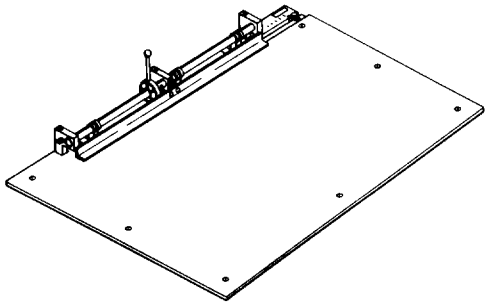
There are no direct/general support maintenance procedures assigned for this equipment.



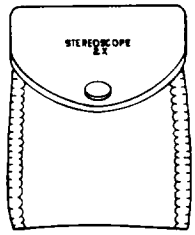
MONOCULAR MAGNIFIER

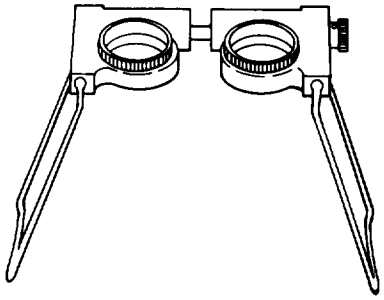


PAPER TRIMMER

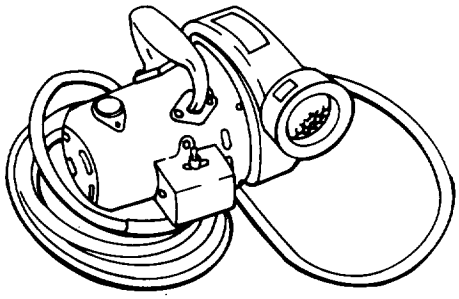


PIN PUNCH REGISTER





POCKET STEREOSCOPE



VACUUM CLEANER

CHAPTER 16

SUPPORT ITEMS

Section I INTRODUCTION

16-1. GENERAL INFORMATION.

16-1.1 Scope This chapter covers the support items contained in this section. The support items consist of the following equipment:

a. Model P/N 12070C Monocular Magnifier.

b. Model FED 99-T-678 Paper Trimmer.

c. Special Model Pin Punch Register.

d. Type 1 Pocket 2X Stereoscope.

e. Model 3400 Vacuum Cleaner.

16-2. EQUIPMENT DESCRIPTION.

16-2.1 Equipment Characteristics, Capabilities, and Features.

a. Monocular magnifier. Hand held magnifier.

b. Paper trimmer. Cuts paper up to 24 in. wide.

c. Pin punch register. Heavy duty hole punch that provides operator with a large flat surface for punching holes-in paper maps and charts of different sizes.

d. Pocket stereoscope. Optically matches and gives operator an apparent single image of two maps or photographs.

e. Vacuum cleaner. High speed, heavy duty, used for general cleaning.

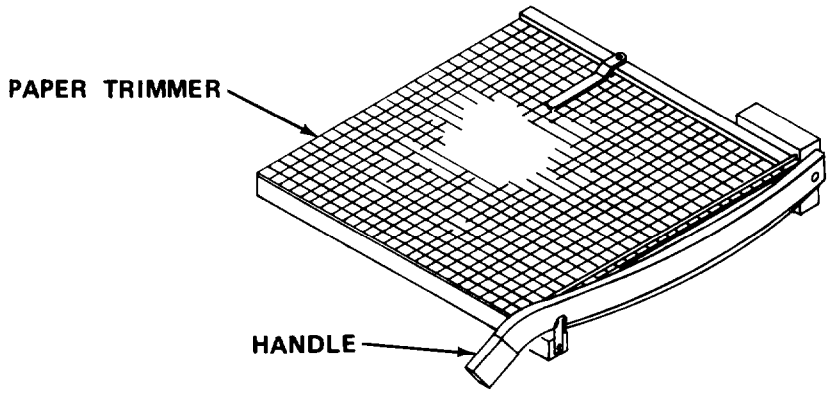
16-2.2 Equipment Data Data. Vacuum cleaner. Packed in storage box containing hose, various vacuum and blowing attachments, liquid spray attachments, and motor repair kit containing motor bearings and brushes.

16-3. TECHNICAL PRINCIPLES OF OPERATION. Principles of operation are combined with description and use of operator's controls and indicators.

Section II OPERATING INSTRUCTIONS

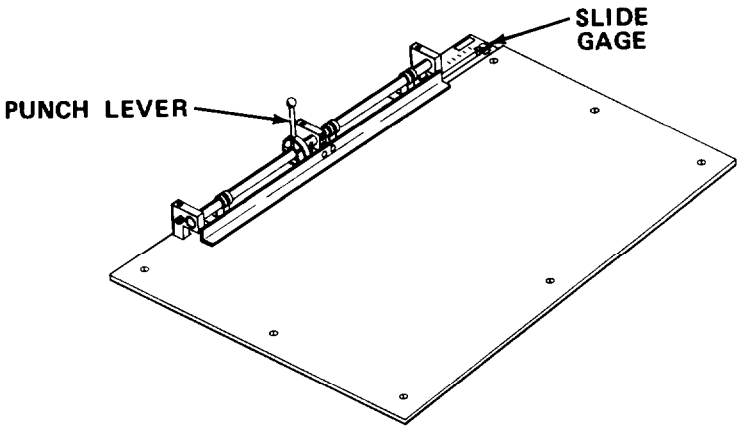
16-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

16-4.1 Paper Trimmer.



Control or Indicator	Function
Handle	Operates cutter

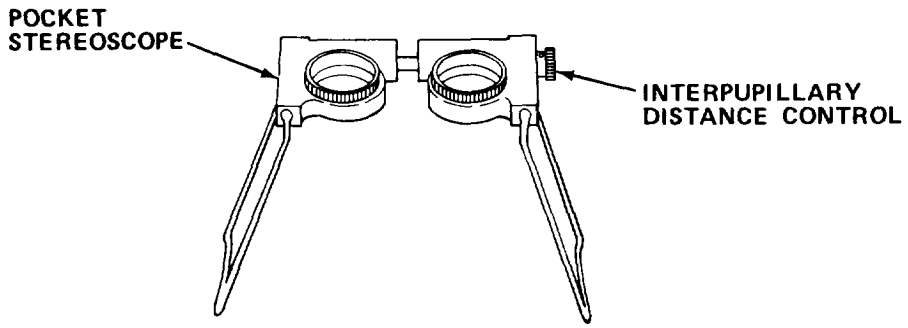
16-4.2 Pin Punch Register.



Control or Indicator	Function
Punch Lever	Operates eccentric which presses down on punch pin and forces it through material.

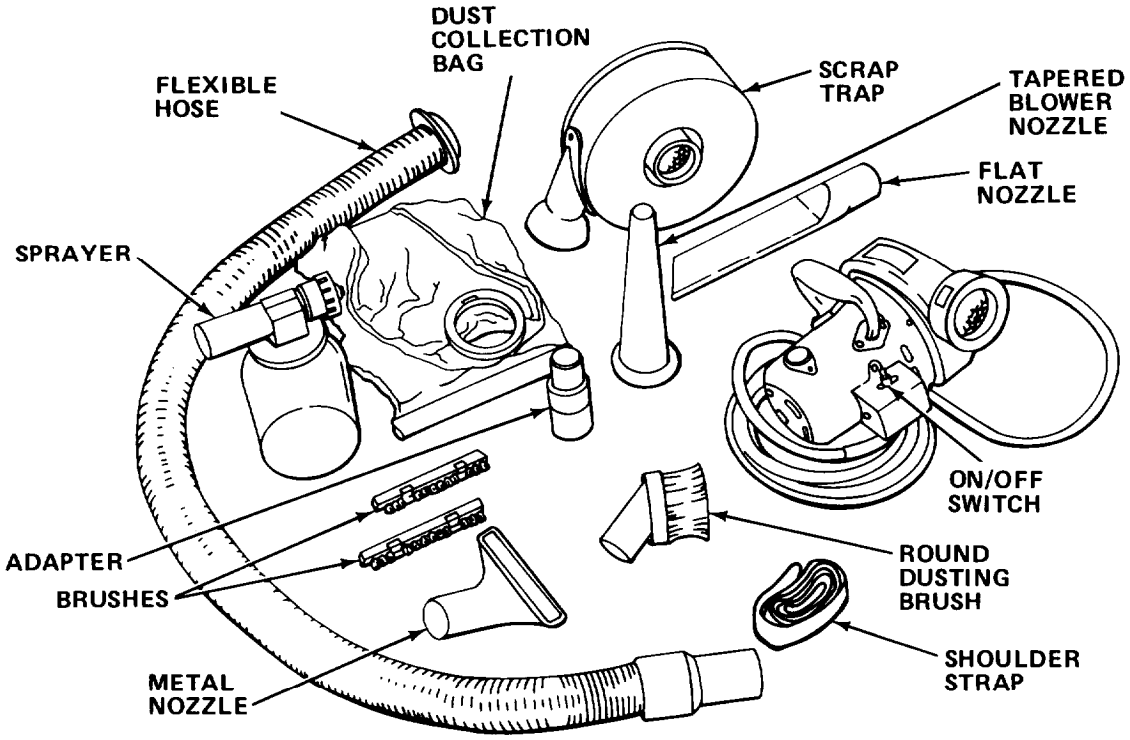
Control or Indicator	Function
Slide Gage	Positions material for proper positioning of punch holes.

16-4.3 Pocket Stereoscope.



Control or Indicator	Function
Interpupillary Distance Control	Adjusts interpupillary diistance of lenses to match that of viewer.

16-4.4 Vacuum Cleaner.



Control or Indicator	Function
Sprayer	Sprays liquids when hooked to blower side of vacuum cleaner.
Flexible Hose	Directs airflow in hard-to-reach areas.
Dust Collection Bag	Collects and holds dust and dirt.
Scrap Trap	Traps large particles before they enter fan.
Flat Nozzle	Used for hard-to-reach areas.

Control or Indicator	Function
Tapered Blower Nozzle	Directs airflow.
On/Off Switch	Turns power on or off.
Shoulder Strap	Attaches to vacuum cleaner for easier carrying.
Round Dusting Brush	Used for dust and dirt.
Metal Nozzle	Used for large, flat surfaces.
Brushes	Used on metal nozzle.
Adapter	Connects various attachments to hose.

16-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform you before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails To Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

16-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Equipment	Items	Quantity
Monocular Magnifier	Lens Paper (Item 12, Appendix E)	ar
Pocket Stereoscope	Lens Paper (Item 12, Appendix E)	ar

Table 16-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without diisturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before **W - Weekly** **AN - Annually** **(Number) - Hundreds of Hours**
D - During **M - Monthly** **S - Semiannually**
A - After **Q - Quarterly** **Bl - Biennially**

ITEM NO.	IN-TER-VA L	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Availabla If:
		SUPPORT ITEMS	
1	B	Monocular Magnifier.	
		1. Inspect lens for cracks or breaks.	Lens is cracked or broken.
		2. Clean lenses with lens paper.	
2	B	Service Monocular Magnifier.	
		Wipe surface of lens with lens paper to remove dust and dirt.	
3	B	Paper Trimmer.	
		Inspect paper trimmer for structural damage and proper operation of blade.	Blade will not operate.

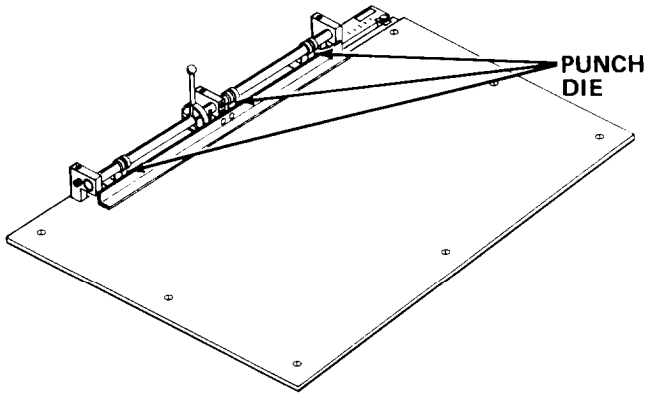
Table 16-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

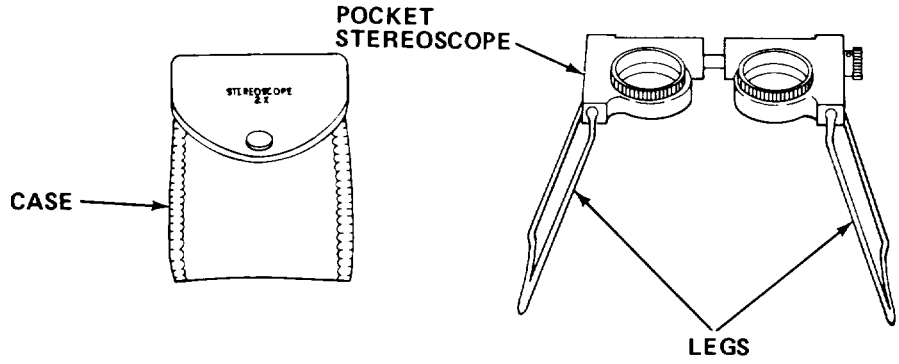
ITEM NO.	INTERVAL.	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SUPPORT ITEMS - Cont	
4	B	Pin Punch Register.  Check punch die for buildup of punched out material and clean as required.	
5	B	Pocket Stereoscope. 1. Inspect lenses for dust, dirt, cracks, or breaks. 2. Clean lenses with lens paper. 3. Inspect housing and legs for cracks or breaks.	
6	Q	Vacuum Cleaner. Inspect vacuum cleaner for damage to housing, frayed or worn power cord, and proper operation of motor.	Cracked or broken housing. Frayed, worn, or damaged power cord or plug. Noisy or improper motor operation.

16-6. OPERATION UNDER USUAL CONDITIONS.

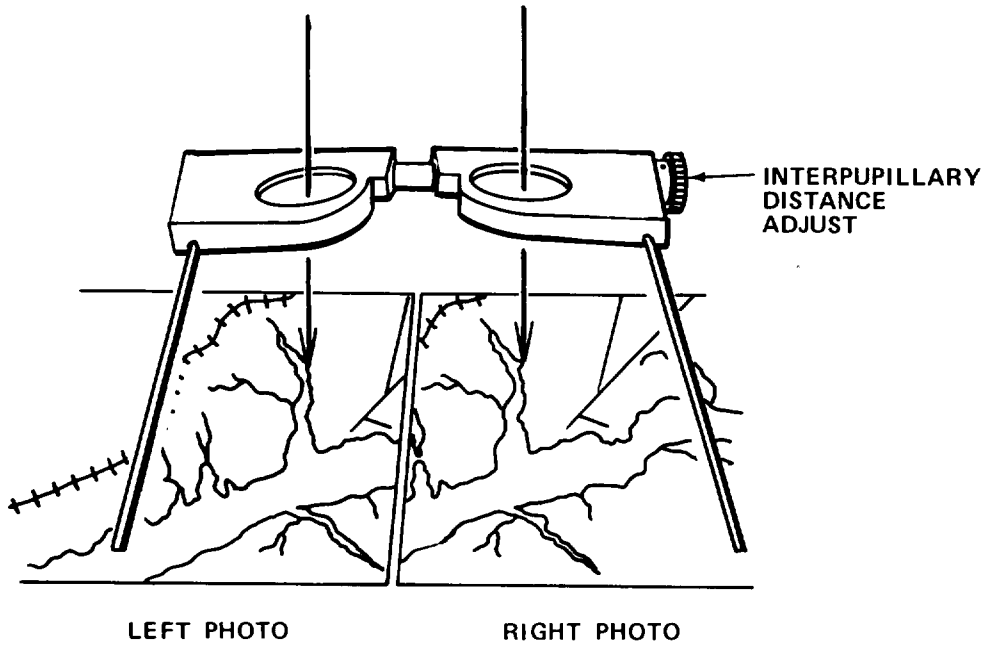
16-6.1 Operating Procedures.

a. Pocket stereoscope.

(1) Position photographs in preparation for viewing in stereo.



(2) Remove pocket stereoscope from case and unfold legs.



(3) Set pocket stereoscope on photographs so that left lens is over left photograph and right lens is over right photograph.

(4) Adjust interpupillary distance between lenses until it matches that of viewer.

(5) Locate detail to be viewed on left photograph and center left lens over it.

(6) Move right photograph until the same detail is centered under right lens. When viewed simultaneously, two details should merge into one. Adjust photographs until this effect is achieved.

b. Vacuum Cleaner.

(1) Using as vacuum.

(a) Attach dust collection bag to air discharge opening.

(b) Remove protective screen lock from air intake opening and scrap trap to that opening.
scrap trap to that opening.

(c) Attach swivel end of hose to scrap trap by turning lock to right until secure.

(d) Attach required tool to other end of hose.

(e) Insert plug into 120 V ac wall outlet and turn on/off switch to ON.

(2) Using as blower.

(a) Attach tapered rubber nozzle to discharge opening.

(b) Attach protective screen lock to air intake opening.

(c) Insert plug into 120 V ac wall outlet and turn on/off switch to ON.

(3) Using as sprayer.

(a) Attach protective screen lock to air intake opening.

(b) Attach swivel end of hose to air discharge opening by turning lock to right until secure.

(c) Attach sprayer to other end of hose.

NOTE

Size of spray pattern is determined by adjusting screw located on top of sprayer.

(d) Insert plug into 120 V ac wall outlet and turn on/off switch to ON.

16-6-2. Operating Instructions on Decals and Instruction Plates.

WARNING

THIS DEVICE IS NOT TO BE USED IN "HAZARDOUS LOCATIONS" AS DEFINED BY UNDERWRITERS LABORATORIES. IT SHOULD BE GROUNDED IN ACCORDANCE WITH PROVISIONS OF THE NATIONAL ELECTRIC CODE, OR ANY APPLICABLE LOCAL CODE, AND MAINTAINED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

WARNING!

ELECTRIC SHOCK COULD OCCUR IF USED ON WET SURFACES. DO NOT EXPOSE TO RAIN. STORE INDOORS.

16-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

16-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

16-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during the opea-tion or maintenance of the vacuum cleaner. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all the possible malfunctions that may occur nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

Table 16-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. VACUUM CLEANER MOTOR DOES NOT OPERATE.
Step 1. Check power cord.
(a) If plugged in, proceed to step 2.
(b) Plug in power cord.
Step 2. Check position of power switch.
(a) If turned on, proceed to step 3.
(b) Turn power switch on.
Step 3. Check circuit breaker position in circuit breaker box.
(a) If turned off or tripped, turn circuit breaker on.
(b) If turned on, refer to organizational maintenance.

16-10. MAINTENANCE PROCEDURES. There are no operator maintenance procedures assigned for this equipment.

Section IV ORGANIZATIONAL MAINTENANCE

16-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

16-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

16-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

16-12.2 Special Tools; Test. Measurement, and Diagnostisc Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

16-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-323-24P covering organizational maintenance for this equipment.

16-13. SERVICE UPON RECEIPT.

16-13.1 Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

16-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

16-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

c. If the vacuum cleaner does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedure for dead receptacle (Table 1-4). If voltage is present at the receptacle, replace vacuum cleaner.

16-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

16-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals and miscellaneous publications referenced in this manual.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028

Recommended Changes to Equipment Technical Publications . . . . . DA Form 2028-2

Equipment Inspection and Maintenance Worksheet . . . . . DA Form 2404

The Army Maintenance Management System (TAMMS). . . . . DA Pam 738-750

Quality Deficiency Report... . . . . .SF 368

A-3. FIELD MANUALS.

Camouflage. FM5-20

First Aid for Soldiers. FM21-11

Nuclear, Biological and Chemical (NBC)
Defense (Reprinted w/Basic Incl C1) FM21-40

Basic Cold Weather Manual FM31-70

Northern Operations FM31-71

Metal Body Repair and Related Operations FM43-2

A-4. TECHNICAL MANUALS.

Administrative Storage of Equipment . . . . . TM 740-90-1

Chemical, Biological and Radiological (CBR)
Decontamination . . . . . TM 3-220

Operator, Organizational, Direct Support and General
Support Maintenance Manual: Air Conditioner, Horizontal,
Compact, 208-Volt, 3-Phase, 18,000 Btu Cooling, 12,000
Btu Heating. . . . . TM 5-4120-367-14

Operator, Organizational, Direct Support and
General Support Maintenance Manual for Chassis,
Semi-Trailer, Container Transporter (ADCOR) . . . . . TM 5-2330-305-14

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Air Conditioner/Heater . . . . . TM 5-4120-367-24P

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Chassis, Semi-Trailer, Container Transporter (ADCOR) . . . . . TM 5-2330-305-24P

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (RPSTL) (Including Depot Maintenance Repair Parts and Special Tools) for Analysis Section . . . . . TM 5-6675-323-24P

Operator's and Organizational Support Maintenance Manual (Including Repair Parts and Special Tools List) for Analytical Photogrammetric Positioning System, APPS AN/UYK-48 . . . . . TM 9-1260-206-12&P

Direct Support and General Support Maintenance Manual (Including Repair Parts and Special Tools) for Analytical Photogrammetric Positioning System, APPS AN/UYK-48 . . . . . TM 9-1260-206-34&P

Organizational, Direct Support and General Support Maintenance Manual for Calculator, Hewlett-Packard Model 9825A (Desk Top Computer, an APPS Component). . . . . TM 11-2660-263-24/1 & /2

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Calculator, Hewlett-Packard Model 9825A (Desk Top Computer, an APPS Component) . . . . . TM 11-2660-263-1079-24P

Painting Instructions for Field Use . . . . . TM 43-0139

Procedure for the Destruction of Equipment to Prevent Enemy Use . . . . . .TM 750-244-3

Use and Care of Hand Tools and Measuring Tools . . . . . TM 9-243

A-5. MISCELLANEOUS PUBLICATIONS.

Lubrication Order: Topographic Support System, Analysis Section, Model ADC-TSS-12 . . . . . LO 5-6675-323-12

Lubrication Order: Topographic Support System, Chassis, Semi-Trailer, Container Transporter (ADCOR). . . . . LO 5-2330-305-12

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I INTRODUCTION

B-1. GENERAL.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating charactersistic to be specified parameters.

e. Aline. To adjust specified variable elemelnts of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services[1], including fault location/-troubleshooting[2], removal/installation, and disassembly/assembly3 procedures, and maintenance actions4 to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00."

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

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[1]Service - Inspect, test, service, adjust, aline, calibrate and/or replace.

[2]Fault locate/troubleshoot - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassemble/assemble - Encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

[4]Welding, grinding, riveting, straightening, facing, remachining and/or resurfacing.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the categorly of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operation conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance categories are as follows:

C . . . . Operator or Crew

O . . . . Organizational Maintenance

F . . . . Direct Support Maintenance

H . . . . General Support Maintenance

L . . . . Specialized Repair Activity [5]

D . . . . Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

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[5]This maintenance category is not included in Section II, column (4) of the Maintenance Allocation Chart. To identify functions to this category of maintenance, enter a work time figure in the “H” column of Section II, column (4), and use an associated reference code in the Remarks column (6). Key the code to Section IV, Remarks, and explain the SRA complete repair application there. The explanatory remark(s) shall reference the specific Repair Parts and Special Tools List (RPSTL) TM which contains additional SRA criteria and the authorized spare/repair parts.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
00	ANALYSIS SECTION	Overhaul					**		
01	VAN BODY	Inspect	0.8						
	(ISO CONTAINER)	Service	0.9	0.5				9,11,14,21	G
		Repair		1.0	1.5	2.0		1,3,6,24	
	FLUORESCENT LIGHT ASSEMBLY	Repair	0.1	0.7				1	
	BLACKOUT/DOME LIGHT ASSEMBLY	Repair	0.2					1	
	EXHAUST FAN ASSEMBLY	Repair		0.5				1	
	AIR CONDITIONER/ HEATER ASSEMBLY	Replace				2.0		1	D
	ELECTRICAL ASSEMBLY	Inspect		0.5					
		Repair		0.9	1.0			1,3	
	TELEPHONE BINDING POST ASSEMBLY	Repair		0.7				1	
	EMERGENCY LIGHT ASSEMBLY	Replace		0.3				1	
	TIEDOWN SOCKET ASSEMBLY	Replace		0.3				6	
	LEVEL INDICATOR ASSEMBLY	Repair		0.6				2,3	
	BLACKOUT CURTAIN ASSEMBLY	Repair		1.0				6	
	PERSONNEL LADDER ASSEMBLY	Repair		0.8				6,24	G
	PERSONNEL/CARGO DOOR ASSEMBLY	Replace			1.5			6	
		Repair			2.0			6	

** Depot will determine work time

Section II. MAINTENANCE ALLOCATION CHART - Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
02	ANALYTICAL PHOTO-GRAMMETRIC POSITIONING SYSTEM (APPS)								E
03	XY GRAPHICS PLOTTER (9872B)	Inspect	0.2						
		Test	0.8						
		Service	0.2					7,8,19	
03A	XY GRAPHICS PLOTTER (9872C)	Inspect	0.2						
		Test	0.8	0.5	0.8			7,8,19	
		Service		0.2				5	
		Adjust			3.8			4,5,16,17 23	G
		Repair			9.8			5,16,17	G
		Replace			0.3			5	
	FRONT CONTROL PANEL ASSEMBLY	Adjust			0.3			5	
		Repair			1.8			5	
	PCA - A3 CARD	Repair							A
		Replace			0.3			5	C
	PCA - A2 CARD	Adjust			0.3			5	
		Repair							A
		Replace			0.3			5	C
	PCA -A1 CARD	Repair							A
		Replace			0.3			5	C
	PCA - A4 CARD	Repair							A
		Replace			0.3			5	C
	PCA - A5 CARD	Repair							A
		Replace			0.3			5	C
	PCA - A6 CARD	Repair							A
		Replace			0.3			5	C

Section II. MAINTENANCE ALLOCATION CHART – Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
03B	HP-IB INTERFACE ASSEMBLY	Test	0.5		0.8			5	
		Repair							A
		Replace			0.8			5	
	PCA A1 CARD	Repair							A
		Replace			0.4			5	C
	PCA A2 CARD	Repair							A
		Replace			0.4			5	C,B
04	PHOTOINTERPRETER DESK	Inspect	0.3					11	
		Service	0.3						
		Adjust	0.2	0.2				4	G
		Replace		0.3				4	
		Repair			0.8				
	ELECTRICAL ASSEMBLY	Inspect	0.2						
		Repair		0.3	0.3			4	G
	LIGHTING ASSEMBLY	Inspect	0.2						
		Repair			0.3			4,5	
05	MICROSCAN LIGHT TABLE	Inspect	0.2						
		Service	0.2						
		Adjust			0.8			5.20,22	
		Repair	0.3	0.8				1,5	
	ELECTRICAL ASSEMBLY	Inspect	0.3						
		Repair			0.8			1,5	
	DIMMER CARD	Adjust			0.5			5,22	
		Replace			0.3			1,22	B
	LIGHT GRID	Replace			0.3			5	
	POWER CORD	Replace		0.2				4	
	FAN MOTOR ASSEMBLY	Replace		0.3				5	G

Section II. MAINTENANCE ALLOCATION CHART - Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
06	SPLIT-STAGE LIGHT TABLE	Inspect	0.2						
		Service	0.3		0.3			4	
		Adjust			1.5			4,20	
		Remove/ Install		1.0				3	
		Repair	0.8	1.0	2.0			4,5,18	G
	ELECTRICAL ASSEMBLY	Inspect	0.2					4	
		Repair			1.8			4,23	G
	LIGHT GRID ASSEMBLY	Adjust			0.3			4,22	
		Replace			0.3			4	
	DIMMER CIRCUIT ASSEMBLY	Replace			0.3			4	
	GRID INTENSITY CONTROL POTENTIO-METER ASSEMBLY	Replace		0.3				4	G
	FAN ASSEMBLY	Replace			0.5			4	
07	ZOOM STEREOSCOPE 95R	Inspect	0.2					8,13	
08	ZOOM TRANSFER SCOPE ZT4-H	Inspect	0.2					8,13	
		Service	0.5						
		Adjust	0.2					15	
	ILLUMINATION SYSTEM	Repair			0.9			4,5	
09	QUANTITY PROCESSING SYSTEM (PLANIMETER)	Inspect	0.2						
		Service	0.3						
		Repair	0.5					8	
	PLANIMETER ASSEMBLY	Inspect	0.2						
		Aline	0.5		0.5			5,23	G
		Repair	0.7		0.8			5,11,15,25	

Section II. MAINTENANCE ALLOCATION CHART - Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
09	QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont								
	LINEAR MEASURING PROBE ENCODER ASSEMBLY	Inspect Service Aline	0.1 0.1 0.3						
	AUTO-SCALER ASSEMBLY	Inspect	0.2						
	MAIN LOGIC PC BOARD	Replace			0.3			5	C
	FRONT DISPLAY PC BOARD	Replace			0.5			4,5	C
	REAR INPUT PC BOARD	Replace			0.5			5	C
	SCALER PC BOARD	Replace			0.5			5	C
10	STEREOMETER PARALLAX BAR	Inspect Service Remove/ Install	0.3 0.3 0.1					11	
11	LENS-PRISM-MIRROR STEREO-SCOPE	Inspect Service Adjust Remove/ Install	0.2 0.3 0.2 0.1					13 12	
12	ULTRASONIC CLEANER	Inspect Repair	0.2	0.7				1	
	CIRCUIT BOARD	Replace		0.6				1	C
13	POCKET CALCULTOR	Inspect Repair	0.3 0.2						
14	DIAZO PRINTER								F

Section II. MAINTENANCE ALLOCATION CHART - Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
15	FURNITURE AND CABINETS	Inspect	0.3						
		Remove/ Install		2.5				1,3,6	
		Repair		0.8				1,24	
16	SUPPORT ITEMS	Inspect	0.3						
		Service	0.3						
		Replace		0.3					

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference Code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	0	Shop Equipment, Automotive Maint & Repair Common # Plus Metric Option	4910-00-754-0654	
2	0	Tool Kit, Carpenters Engineer Squad	5180-00-293-2875	
3	0	Tool Kit, General Mechanic's Automotive Plus Metric Option	5180-00-177-7033	
4	O,F,H	Tool Kit, Electronic Equipment	5180-00-605-0079	
5	F,H	Tool Kit, Electronic Equipment	5180-00-610-8177	
6	O,F,H	Tool Kit, Light Machine Repair	5180-00-596-1540	
7	C	Optical Comparator	6650-00-668-5703	
8	C	Brush, Lens	7920-00-205-0565	
9	C	Brush, Wire	7920-00-291-5815	
10	C	Screwdriver, Cross Tip No. 2	5120-00-234-8913	
11	C	Screwdriver, Flat Tip	5120-00-234-8910	
12	C	Screwdriver Set, Jeweler's	5120-00-288-8739	
13	C	Watchmaker's Blower	5120-00-254-4612	
14	C	Wrench, Adjustable	5120-00-264-3795	
15	C	Wrench Set, Hex Head Key	5120-00-935-4641	
16	O	Gram Gage (0-65 gr)	1355-00-024-9516	
17	O	Dynamometer (100 -500 gr) (60998) 62-6381-00		(60998) 62-6381-00

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS - Cont

(1) Reference Code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
18	C	Screwdriver, Flat Tip 9/64	5120-00-287-2504	
19	C	Metric Scaler		(06175) 81-34-38
20	F	Autocollimator		(02145) 960303
21	O	Spring Scale	6670-00-238-9777	
22	F	Photometer, Digital		(80009) J16TY,OPT2
23	O,F,H	Multimeter		(18480) 3435A
24	O,F,H	Rivet Gun	5120-00-017-2849	
25	C	Knife, TL-29	5110-00-240-5943	

Section IV. REMARKS

Reference Code	Remarks
A	Printed circuit boards will be repaired at the General Support Maintenance level to the maximum extent possible as required by AR750-1.
B	Direct Support Maintenance will provide printed circuit board diagnosis and fault isolation which can be readily accomplished with assigned tools and test, measurement, and diagnostic equipment (TMDE).
C	Replacement of printed circuit boards authorized by the MAC are those identified as damaged, or otherwise defective which— a) Can be readily removed/installed wiht easy-to-use tools. b) Do not require critical adjustment, calibration, or alinement before or after installation.
D	See TM 5-4120-367-14 for maintenance procedures.
E	See TM 9-1260-206-12&P and TM 9-1260-206-34&P for maintenance procedures.
F	See TM 5-3610-256-14&P for maintenance procedures.
G	Maintenance personnel and TSS Section 7 maintenance van (which carries the required tools) are authorized by HHC TOE 05336 H600.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for the Analysis Section to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II: Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III: Basic Issue Items. These are the minimum essential items required to place the Analysis Section in operation, to operate it, and to perform emergency repairs. Bll must be with the Analysis Section during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement Bll based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listings:

a. Column (1): Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

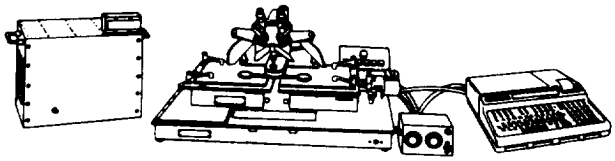
b. Column (2): National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3): Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4): Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation {e.g., ea, in, pr).

e. Column (5): Quanty Required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II COMPONENTS OF END ITEM



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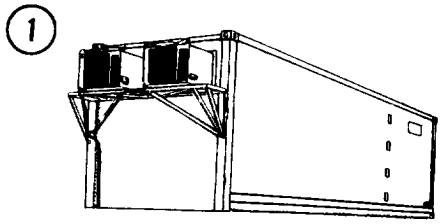

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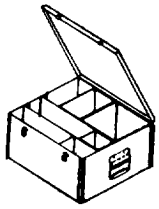

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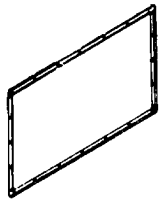

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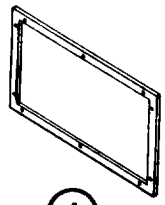


4

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1	4120-00-974-7206	AIR CONDITIONER (81349) MIL-A-52767	ea	2
1A	1260-01-061-7081	ANALYTICAL PHOTOGRAMMETRIC POSITIONING SYSTEM: APPS AN/UYK-48 (52326) 1100-2	ea	1
2	2510-01-033-7967	BODY, VAN TRAILER: (97403) TL/MIL-B-13207	ea	1
3		BOX, Vehicular Accessories for vacuum cleaner (97403) 13225E3490	ea	1
4	7195-00-105-7941	BULLETIN BOARD: (79819) T5-2303	ea	1
5	7195-00-105-7940	BULLETIN BOARD: (79819) T5-2305	ea	1

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for the Analysis Section to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II: Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III: Basic Issue Items. These are the minimum essential items required to place the Analysis Section in operation, to operate it, and to perform emergency repairs. BII must be with the Analysis Section during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listings:

a. Column (7): Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

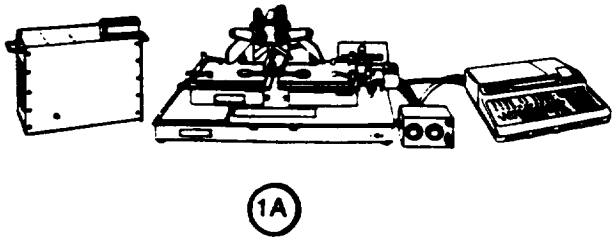
b. Column (2): National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

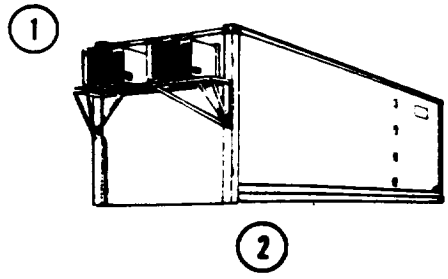
c. Column (3): Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

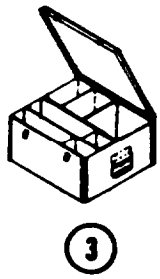
d. Co/umn (4): Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

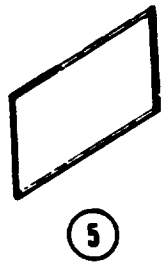
e. Column (5): Quantity Required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

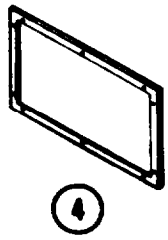
Section II COMPONENTS OF END ITEM









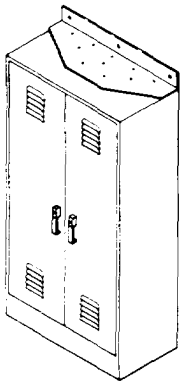


(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1	4120-00-974-7206	AIR CONDITIONER (81349) MIL-A-52767	ea	2
1A	1260-01-061-7081	ANALYTICAL PHOTOGRAMMETRIC POSITIONING SYSTEM: APPS AN/UYK-48 (52326) 1100-2	ea	1
2	6675-01-220-2613	VAN ASSEMBLY, MODIFIED (97403) 13225E3027	ea	1
3		BOX, Vehicular Accessories for vacuum cleaner (97403) 13225E3490	ea	1
4	7195-00-105-7941	BULLETIN BOARD: (79819) T5-2303	ea	1
5	7195-00-105-7940	BULLETIN BOARD: (79819) T5-2305	ea	1

*U.S. GOVERNMENT PRINTING OFFICE: 1992 - 654-028/60138

PIN # 058666-002

Section II COMPONENTS OF END ITEM - Cont



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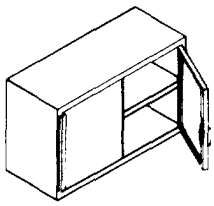

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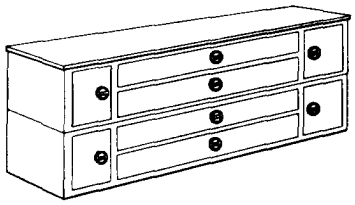

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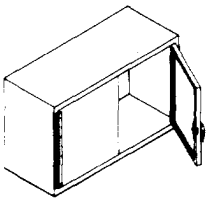

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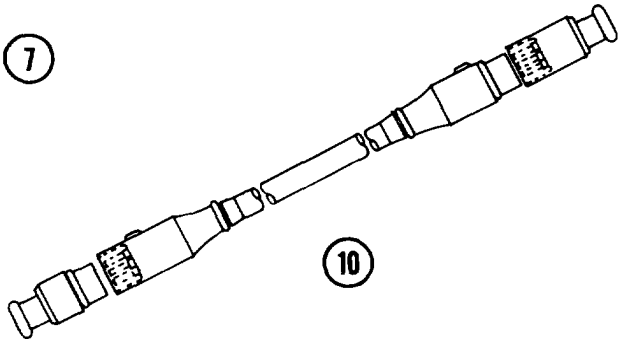
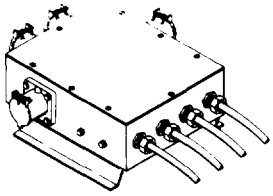


10

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
6		CABINET, STORAGE, CHEMICAL: (97403) 13225E3792	ea	1
7	7125-00-286-5259	CABINET, STORAGE, WALL: (81349) MIL-C-40060/1, Type 1	ea	7
8		CABINET, STORAGE, DIAZO: (97403) 13225E3397	ea	1
		CABINET, STORAGE, DIAZO: (97403) 13225E3857		
9		CABINET, STORAGE, TECH MANUAL: (97403) 13225E4648	ea	1
10	6150-00-134-0847	CABLE ASSEMBLY, POWER ELECTRICAL: (75477) 11601643, table II, fig 5, except 50.5 ft lg.	ea	3

Section II COMPONENTS OF END ITEM - Cont



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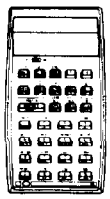

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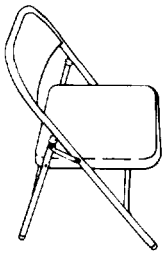

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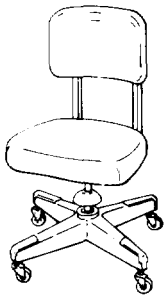

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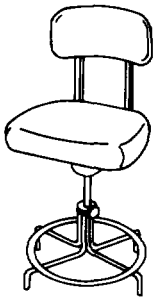
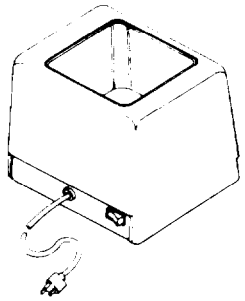


15

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
11	6150-01-081-9264	CABLE TERMINAL BOX ASSEMBLY, ELECTRICAL, SPECIAL PURPOSE: (51745) TL/TA 13222E6250	ea	1
12	7420-01-139-7441	CALCULATING MACHINE: (51174) HP-32E	ea	1
13	7105-00-269-8463	CHAIR, FOLDING: steel (81348) AA-C-291F, type 1, style A, class 1	ea	1
14	7110-00-273-8791	CHAIR, ROTARY: (81348) AA-C-293, type 11, class 2	ea	3
15	7110-00-281-4472	CHAIR, ROTARY: (81348) AA-C-295, class 2, size 2	ea	2

Section II COMPONENTS OF END ITEM - Cont



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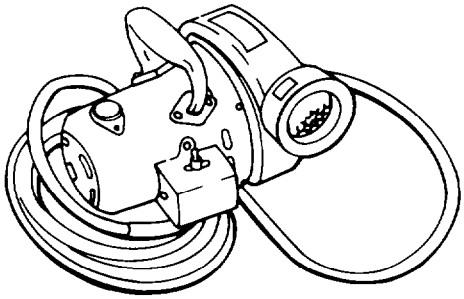

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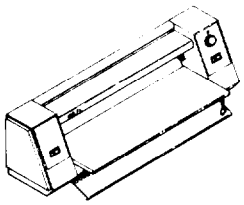

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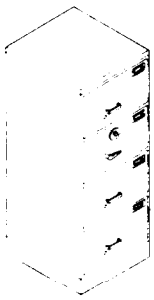

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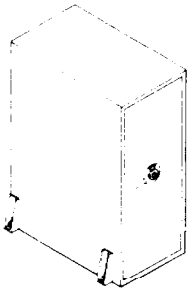

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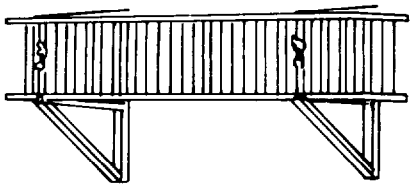
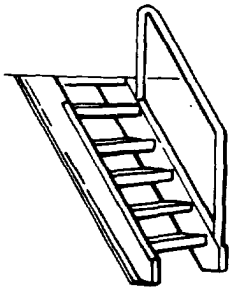


21

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
16	4940-01-118-1890	CLEANER, ULTRASONIC: (79819) 3069 USC3	ea	1
17	7910-00-205-3400	CLEANER, VACUUM, ELECTRIC: (51745) MVV 3400	ea	1
18	3610-01-123-7782	COPYING MACHINE, DIAZO PROCESS: (03641) 185FL	ea	1
19	7110-00-920-9320	FILING CABINET, SECURITY: (81348) AA-F-358, class 6, size 3	ea	2
20	7110-00-068-7736	FILING CABINET, SECURITY, MAP AND PLAN: (41729) 7110-00-068-7736HC	ea	1
21	5440-01-152-7757	LADDER, EXTENSION - FOLDING: (39428) 8028T16	ea	1

Section II COMPONENTS OF END ITEM - Cont



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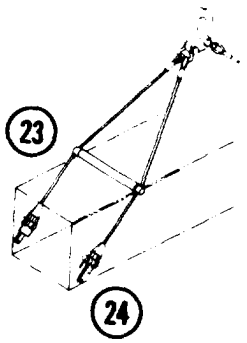

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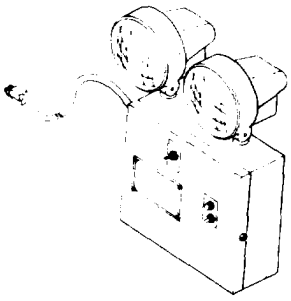

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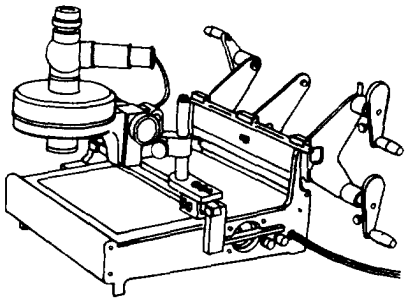
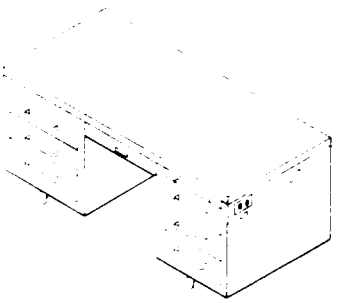


26

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
22	2540-01-133-9726	LADDER, VEHICLE BOARDING: (51745) 13225E3074	ea	2
23		LIFTING AND TIEDOWN DEVICE, TRANSPORTABLE SHELTER: Left hand (52555) 1390-4	ea	2
24		LIFTING AND TIEDOWN DEVICE, TRANSPORTABLE SHELTER: Right hand (52555) 1390-3	ea	2
25		LIGHT, EMERGENCY: (97403) 13225E3396	ea	1
26	6675-01-180-3869	MICROSCAN: (02145) 910563	ea	1

Section II COMPONENTS OF END ITEM - Cont



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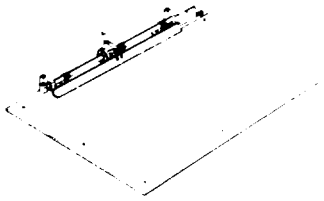

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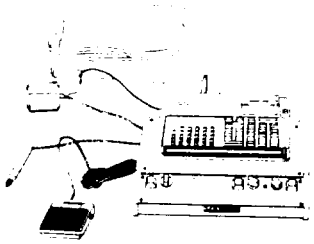

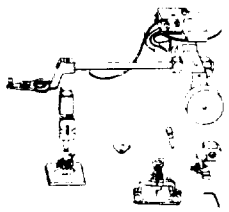

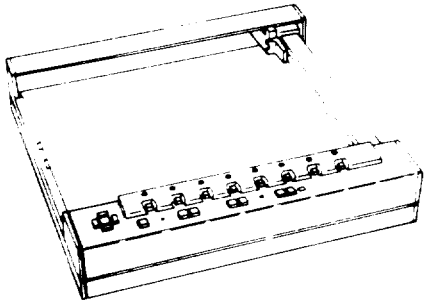

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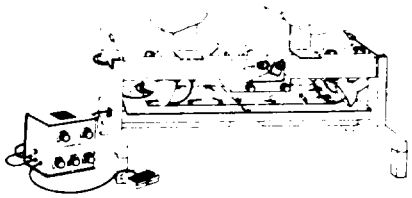

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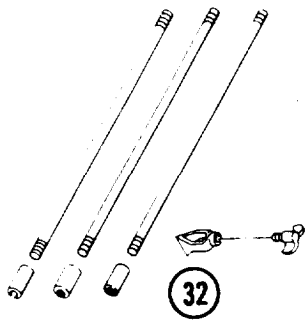
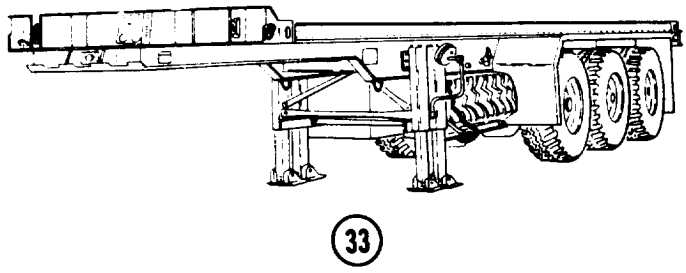
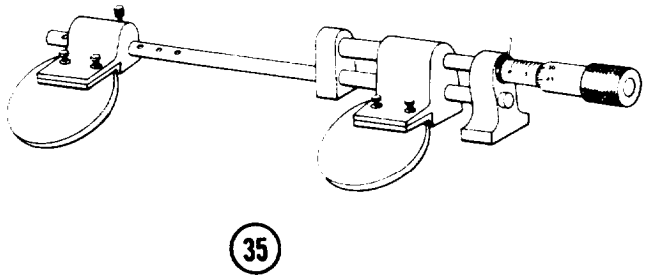
29

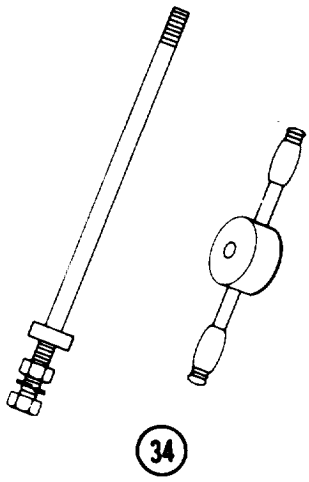
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
27	6740-00-797-7361	PHOTOINTERPRETER/ANALYST STATION: (02145) 910564	ea	2
28	6675-01-175-5914	PIN REGISTER BOARD, CARTOGRAPHIC: (25042) 0510247	ea	**1**
29	6675-01-155-6592	PLANIMETER, QUANTITY PROCESSING SYSTEM: (36970) L2501, w/HP-97	ea	1
30	7025-01-121-4099	PLOTTER, GRAPHICS: (28480) 9872C	ea	1
31	6675-01-139-4526	PLOTTER, TRANSFER, HORIZONTAL INPUT STAGE (ZOOM) : (4L762) 53-05-30-04 or 53-05-30-04, modified by ADCOR Dwg 13225E3648	ea	**1**

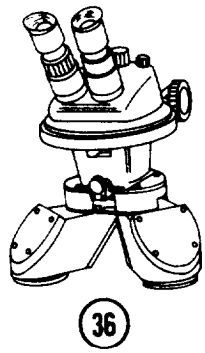
Section II COMPONENTS OF END ITEM - Cont





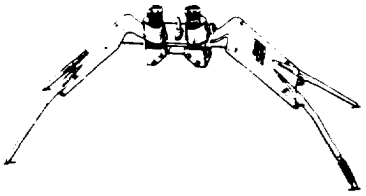






(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
32	5975-00-878-3791	ROD, GROUND: (82370) A104	ea	1
33	2330-01-076-4797	SEMITRAILER, FLATBED: (97403) TL/MIL-B-13207, par 3.11, Fig 12, tables Ill and IV	ea	1
34	5120-01-013-1676	SLIDE HAMMER, GROUND ROD EMPLACEMENT: (45225) P74-144	ea	1
35	6675-01-173-8161	STEREOMETER, PARALLAX BAR (00048) 122GE	ea	2
36	6675-01-180-3868	STEREOSCOPE, LENS PRISM AERIAL PHOTOGRAPH INTERPRETATION: (06175) 53-70-96-02	ea	3

Section II COMPONENTS OF END ITEM - Cont



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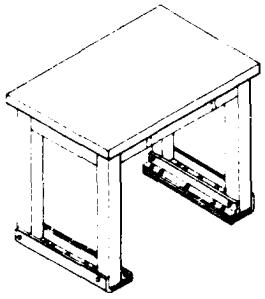

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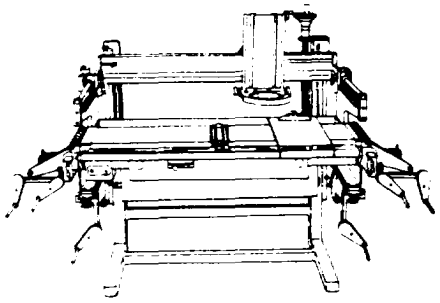

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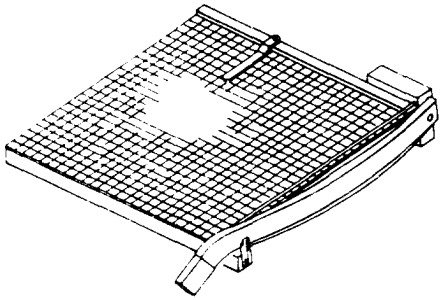

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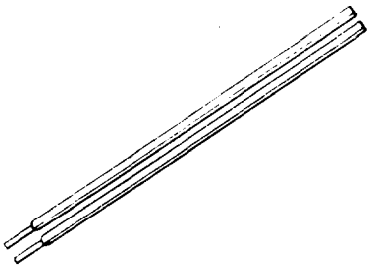
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
37	6675-00-641-3558	STEREOSCOPE, LENS-PRISM-MIRROR, AERIAL PHOTOGRAPH INTERPRETATION: (81349) MIL-S-20660	ea	2
38	7110-01-135-1988	TABLE, OFFICE: (90783) JSL 760	ea	1
39	6740-00-165-7267	TABLE, ILLUMINATED, SPLIT STAGE: (02145) MIM335100 w/Bausch and Lomb mtg bracket	ea	1
40	7520-00-224-7621	TRIMMER, PAPER, DROP KNIFE: (81348) GG-T-678-Type-I, Class 5	ea	1

Section III BASIC ISSUE ITEMS



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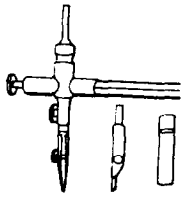

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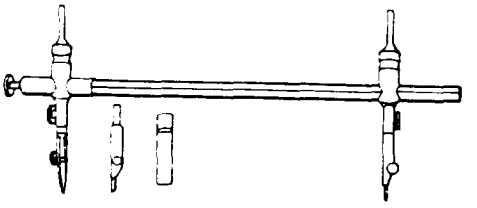
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1	6675-01-114-7226	BAR, EXTENSION, BEAM, COMPASS: (33363) 55-1818	ea	2
2	6675-01-071-8913	BEAM, ATTACHMENT, DRAFTING COMPASS: (79819) 3175BN	ea	2
	5120-00-254-4612	BLOWER, WATCHMAKERS (64959) R895D	ea	1
	7920-00-291-5812	BRUSH, DUSTING, DRAFTSMAN'S: (79819) Q6-38NB-010	ea	4
	7920-00-205-0565	BRUSH, DUSTING, LENS AND PHOTOGRAPHIC NEGATIVE: (17866) R698	ea	2
	7920-00-291-5815	BRUSH, WIRE, SCRATCH: (39428) 7187T2	ea	1
		CASE, STORAGE AND TRANSPORT: u/w Plotter (30562) M91-229	ea	1
		CASE, STORAGE AND TRANSPORT: u/w Photo Interpreter/Analyst (30562) M91-230	ea	2

Section III BASIC ISSUE ITEMS - Cont

3



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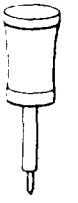

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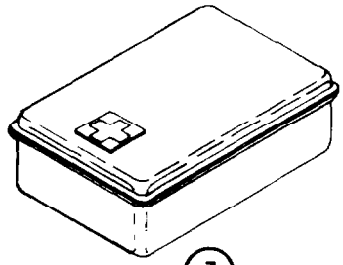
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
		CASE, STORAGE AND TRANSPORT: u/w Stereoscope (30562) M91-231	ea	3
3	6675-00-459-8935	COMPASS, DRAFTING BEAM: (79819) 3175	ea	2
4	6675-00-904-1947	COMPASS, DRAFTING BEAM: (33363) 55-1806	ea	2
5	6675-01-071-8912	COMPASS, DRAFTING LEAD ATTACHMENT: (79819) 3175LA	ea	2
	6675-00-250-2508	CURVE, DRAFTING, IRREGULAR: (7981 9) 8255-A	ea	4
	6675-00-250-2509	CURVE, DRAFTING, IRREGULAR: (17866) 2217-107	ea	4
	6675-00-641-3512	DIVIDERS, DRAFTING, PLAIN: (33363) 55-2910	ea	4
	6675-00-240-2049	DIVIDERS, DRAFTING, PROPORTIONAL: (81349) MIL-D-3467, type I	ea	2
	6675-00-599-8880	DIVIDERS, EQUAL SPACING: 6.0 in. (39428) 1955D11, 6 in.	ea	2
	6675-00-599-8879	DIVIDERS, EQUAL SPACING: 12.0 in. (39428) 1995D12, 12 in.	ea	2
		DUST COVER: (28480) 9222-0564	ea	1

Section III BASIC ISSUE ITEMS - Cont

6



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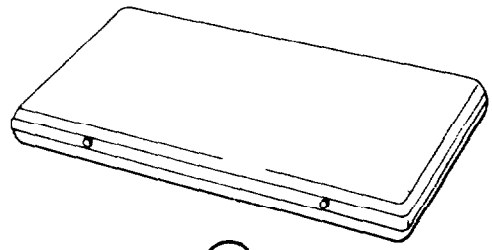

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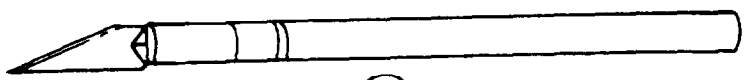
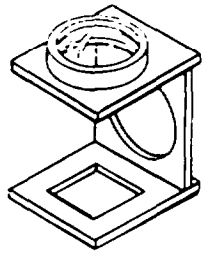


8

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
6	4210-00-555-8837	EXTINGUISHER, FIRE, MONOBROMO-TRIFLUOROMETHANE: (81349) MIL-E-52031	ea	2
7	6545-00-922-1200	FIRST AID KIT, GENERAL PURPOSE: (89875) SC C-6545-IL	ea	1
	4240-00-959-3586	GOGGLES, INDUSTRIAL: (18037) GGD	ea	1
	5120-00-935-4641	KEY SET, SOCKET HEAD SCREW: (81348) GGG-K-275 CL1TY1	se	1
	7510-00-927-8685	KIT, PEN CLEANING: (33363) 61-3115	kt	3
8	5110-00-595-8400	KNIFE, CRAFTSMAN'S: (99941) 3001	ea	4
	5110-00-240-5943	KNIFE, TL-29 (81348) TL-29	ea	1
	7520-01-008-7640	LEAD REPOINTER, PENCIL: (79819) 992WB	ea	4
9	6675-00-551-0785	LETTERING SET: (33363) 61-2901	ea	1

Section III BASIC ISSUE ITEMS - Cont



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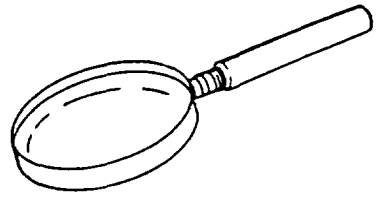

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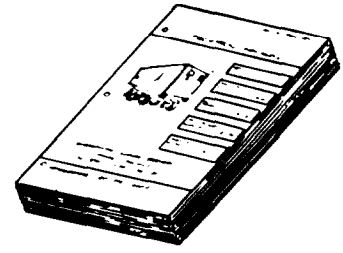

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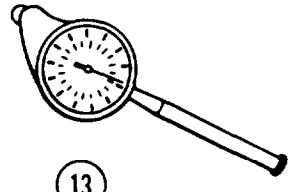
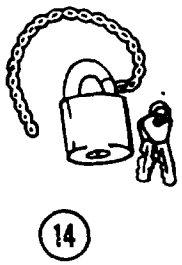


13

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
	6675-00-190-5854	LINE GUIDE, LETTERING, NON-ADJUSTABLE: (17866) 203066	ea	6
10	6650-00-255-8268	MAGNIFIER: linen tester (7981 9) Q8-9518	ea	4
11	6850-00-403-0812	MAGNIFIER: round shape (39428) 149104	ea	2
12		MANUALS, TECHNICAL: LO 5-6675-323-12, Lubrication Order TSS Analysis Section TM 5-6675-323-14, Organizational, DS and GS Maintenance Manual, Analysis Section, Vol 1 and 2 TM 5-6675-323-24P, Repair Parts and Special Tools List, Analysis Section	ea	1
13	8675-00-222-2542	MEASURER, MAP: (33363) 62-0300	ea	2

Section III BASIC ISSUE ITEMS - Cont



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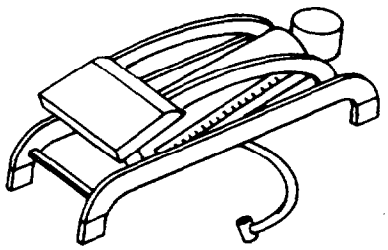

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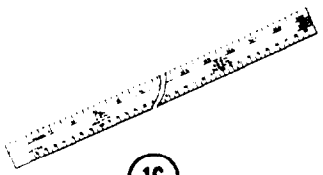
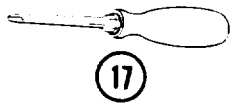
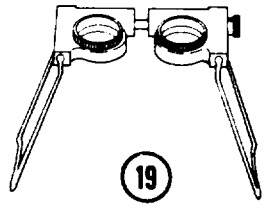


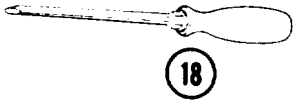
16

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
		Metric Sealer (06175) 81-34-38	ea	1
	6650-00-668-5703	Optical Comparator (06175) 81-34-35	ea	1
14	5340-00-682-1505	PADLOCK SET: (33363) MS 21313-52	se	1
	7510-01-030-7427	PEN POINT ASSORTMENT AND PENHOLDER: (79819) 3095-JDCS9	se	2
		PROTRACTOR, SEMICIRCULAR: (73539) M276, 12 in.	ea	4
15		PUMP, INFLATING, MANUAL: (53800) 6 A 49454	ea	1
16		RULE, STEEL, MACHINIST'S: (57163) CME 600	ea	1
	6675-00-641-5727	SCALE, DRAFTING: (33363) 56-3280	ea	4
	6675-00-283-0035	SCALE, PLOTTING: 12.00 in (17866) GG-S-161/8c, type VIII, shape 2, composition A, grade 1, size B, scale graduation 1, numbering A, style A	ea	4

Section III BASIC ISSUE ITEMS - Cont

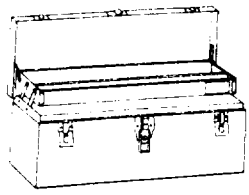






(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
	6675-00-283-0037	SCALE, PLOTTING: 12.00 in. (23366) 28/MR, 12 in.	ea	4
	6675-00-283-0027	SCALE, PLOTTING: 10.00 in. (23366) 28/YD, 10 in.	ea	4
17	5120-00-234-8913	SCREWDRIVER, CROSS TIP: size 2 (81348) GGG-S-121	ea	1
18	5120-00-234-8910	SCREWDRIVER, FLAT TIP: (78525) 1006	ea	1
	5120-00-287-2504	SCREWDRIVER, FLAT TIP 9/64" (81348) GGG-S-121, TY1 CL	ea	1
	5120-00-288-8739	SCREWDRIVER SET, JEWELERS (81348) GGG-S-1808	ea	1
	7510-00-224-7242	SHIELD, ERASING: (79819) 03-605	dz	1
19	6675-00-641-3561	STEREOSCOPE, LENS, AERIAL PHOTOGRAPH INTERPRETATION: Pocket (7D560) 51034, Abrams Model SV-1	ea	4
		STRAIGHTEDGE: (33363) 56-4150	ea	1
		STRAP ASSEMBLY, BUCKLE-END: 6.0 in. (82820) 1844-104	ea	2
		STRAP ASSEMBLY, BUCKLE-END: 8.0 in. (82820) 1844-101	ea	2
		STRAP ASSEMBLY, BUCKLE-END: 9.0 in. (82820) 1844-103	ea	1

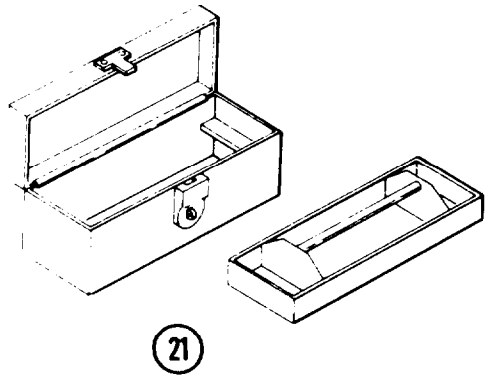
Section III BASIC ISSUE ITEMS - Cont

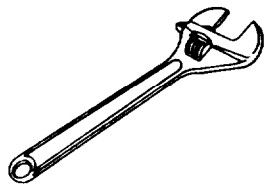


20

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
		STRAP ASSEMBLY, TIP-END: 36.0 in. (82820) 1845-106	ea	2
		STRAP ASSEMBLY, TIP-END: 40.0 in. (82820) 1845-101	ea	4
		STRAP ASSEMBLY, TIP-END: 58.0 in. (82820) 1845-105	ea	1
		STRAP ASSEMBLY, WEBBING: 30.00 in. (98313) 13225E3695-8	ea	3
		STRAP ASSEMBLY, WEBBING: 55.00 in. (98313) 13225E3695-6	ea	8
		STRAP ASSEMBLY, WEBBING: 72.00 in. (98313) 13225E3695-1	ea	9
		STRAP ASSEMBLY, WEBBING: 94.00 in. [98313) 13225E3695-10	ea	1
		STRAP ASSEMBLY, WEBBING: 29.00 in (98313) 13225E3695-13	ea	2
		STRAP ASSEMBLY, WEBBING: 162.00 in. (96603) 90201 -D-1 8-12	ea	4
	6675-00-253-5501	TEMPLATE, DRAFTING: (79819) 831040	ea	4
20	5140-00-331-5496	TOOL BOX, PORTABLE: 1 fixed hinged tray (75206) CS 19	ea	4

Section III BASIC ISSUE ITEMS - Cont





(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
21	5140-00-315-2747	TOOL BOX, PORTABLE: 1 removable tray (75206) CS 16	ea	1
	6675-00-190-5863	TRIANGLE, DRAFTING: 245 degs (33363) 57-0292, 10 in. lg	ea	4
	6675-00-190-5867	TRIANGLE, DRAFTING: 130 deg, 160 deg (33363) 57-0220, 10 in. lg	ea	4
	6675-00-183-6487	T-SQUARE: (81562) 8068E, 42 in.	ea	2
22	5120-00-224-7271	VISE, PIN: (18037) PVDE	ea	6
23	5120-00-264-3795	WRENCH, ADJUSTABLE: (80244) GGG-W-631 TY1 CL1	ea	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I INTRODUCTION

D-1 . SCOPE.

This appendix lists additional items you are authorized for the support of the Analysis Section.

D-2. GENERAL.

This list identifies items that do not have to accompany the Analysis Section and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description FSCM and Part Number	(3) U/M	(4) Qty Auth
	TOE AUTHORIZED ITEMS		
6675-00-641-3610	Drafting Equipment Set, Batt: Charts, Sketches, and Overlays	ea	1
8675-00-202-8542	Interpretation Kit, Photographic	ea	1
5805-00-543-0012	Telephone Set: TA-312/PT	ea	1

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I INTRODUCTION

E-1 . SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the Analysis Section. This listing is for information purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

E-2. EXPLANATION OF COLUMNS

a. Co/urnn (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, Item 5, Appendix E.").

b. Co/urnn (2) - *Level.* This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew

O - Organizational Maintenance

F - Direct Support Maintenance

H - General Support Maintenance

c. Column (3) - /Vationa/ Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Co/umn (4) - *Description.* Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by two-character alphabetical abbreviations (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C	6810-00-223-2739	Acetone, Technical	cn
	C	8040-00-174-2610	Adhesive (81348) MMM-A-185	cn
2	O	8040-00-174-2610	Adhesive, Rubber	cn
3	F	8040-00-152-0063	Adhesive, Waterproof	cn
4	C	6810-00-205-6786	Alcohol, Denatured	qt
	C	7520-00-935-7136	Ball Point Pen: (79819) VER-HR-84, black	dz
	C	7520-00-281-5911	Basket, Wastepaper: (8D190) H10-34	ea
5	F	6850-00-587-2370	Bearing Cleaner	cn
	C	7510-00-616-7471	Binder and Filler, Loose Leaf: (81348) UU-B-356, grade C, 5 x 3 in. sh.	ea
	C	5110-00-359-6478	Blade, Craftsman Knife: Beveled (99941)11	pk
	C	5110-00-542-2043	Blade, Craftsman Knife: Curved (99941) 10	pk
	C	5110-00-542-2044	Blade, Craftsman Knife: Square (99941) 17	pk
	C	5110-00-765-4144	Blade, Craftsman Knife: Stencil (99941) 16	pk
	C	8125-01-088-3553	Bottle, Adhesive Dispenser: (79819) 500, plastic	ea
	C	7510-00-223-6706	Chalk, Marking: white (85419) 1402, white	gr
	C	7510-00-223-6702	Chalk, Marking: blue (81348) SS-C-266, grade A, composition 3	gr

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	7510-00-223-6705	Chalk, Marking: red (81348) SS-C-266, grade A composition 3	gr
	C	7510-00-223-6707	Chalk, Marking: yellow (79819) T2-1401	gr
	C	8330-00-965-1722	Chamois Leather, Sheepskin: (39428) 7358T11	ea
6	C	6850-00-592-3283	Cleaner, Lens	bx
	C	6850-01-007-8073	Cleaning Concentrate (79819) 3069 CON	bt
	C	7510-00-161-4291	Clip, Paper (79819) P2-72620	bx
7	C	8305-00-222-2423	Cloth, Cheesecloth	yd
	C	8220-00-299-8625	Cotton, Nonsterile (81348) JJJ-C-561, grade B	Pg
8	C	6515-00-303-8250	Cotton Swabs	bg
9	C	7930-00-530-8067	Detergent, General Purpose	gl
	C	3610-01-193-4752	Developer, Supply Kit (03641) 892-185	ea
	C	7520-00-285-1772	Dispenser, pressure Sensitive Adhesive Tape: (79619) C-22	ea
	C	7530-00-268-3994	Envelope, Wallet (87263) 1355E	bx
	C	7510-01499-3953	Eraser (79819) 292-F	bt
	C	7510-01-034-1278	Eraser, Film (79819) 9600 (PT20)	bx
	C	7510-01-035-1317	Eraser Kit (79819) 290-K	kt

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	7510-00-634-5034	Eraser, Rubber (79819) T9-7099B	dz
	C	6750-0’ -124-3184	Film, Diazo Type, Sensitized: Black image (61106) 104A5	ro
	C	6750-0’ -124-3183	Film, Diazo Type, Sensitized; Blue image (61106) 202BL	ro
	C	6750-01-124-3184	Film, Diazo Type, Sensitized: Brown image (61106) 402BR	ro
	C	6750-01-124-3180	Film, Diazo Type, Sensitized: Green image (61106) 602GN	ro
	C	6750-01-124-3182	Film, Diazo type, Sensitized: Red image (61 106) 302RD	ro
	C	6750-01-124-3179	Film, Diazo Type, Sensitized: Violet image (24299) 702VT	ro
10	F	5610-00-618-0258	Floor patch	gl
11	O	9150-00-190-0904	Grease, GAA	lb
	O	7510-01-028-2877	Ink, Drawing: for drafting film (79819) 3072-F1	bt
	C	7510-01-070-8947	Ink, Drawing: for paper (79819) 3084-F1	bt
	C	7510-01-039-5075	Ink, Drawing: Carmine (79819) 3080-F1, Carmine	bt
	C	7510-01-035-8133	Ink, Drawing: Blue (79819) 3080-F1, Blue	bt
	C	7510-01-035-8131	Ink, Drawing: Brown (79819) 3080-F1, Brown	bt

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	7510-01-035-8132	Ink, Drawing: Green (79819) 3080-F1, Green	bt
	C	7510-01-036-3726	Ink, Drawing: Orange (79819) 3080-F1, Orange	bt
	C	7510-01-080-1481	Ink, Drawing: Red (79819) 3080-F1, Red	bt
	C	7510-01-086-3725	Ink, Drawing: Violet (79819) 3080-F1, Violet	bt
	C	7510-01-035-8130	Ink, Drawing: Yellow (79819) 3080-F1, Yellow	bt
	C		Lamp, Fluorescent: (90917) 33026	ea
	C	7510-00-281-2143	Lead, Pencil, Graphite: HB (79819) 2200-HB	bx
	C	7510-00-285-5865	Lead, Pencil, Graphite: F (79819) 2200-F	pg
	C	7510-00-285-5866	Lead, Pencil, Graphite: H (79819) 2200-H	pg
	C	7510-00-285-5863	Lead, Pencil, Graphite: 2H (79819) 2200-2H	pg
	C	7510-00-272-9820	Lead, Pencil, Graphite: General purpose type (79819) 2200-3H	pk
	C	7510-00-285-5864	Lead, Pencil, Graphite: General purpose type (79819) 2200-4H	pk
	C	7510-00-285-5862	Lead, Pencil, Graphite: General writing type (81239) F370-GHB	pk
	C	7510-00-285-5847	Lead, Pencil, Graphite: General writing type (81239) F350-2H	pk

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
12	C	6640-00-597-6745	Lens Paper	bk
13	F	9150-00-261-8326	Heat Sink Compound	tu
14	F	9150-00-273-2389	Oil, Lubricating, General Purpose	cn
15	C	9150-00-186-6681	Oil, Lubricating, 30 wt	qt
16	C	9150-00-252-6382	Oil, Watch	bt
	C	7530-00-285-3083	Pad, Writing Paper (8D190)M9-21-112	pk
17	O	8010-01-131-6254	Paint, Black	kt
17A	O	8010-01-160-6745	Paint, Brown	kt
17B	O	8010-01-162-5578	Paint, Green	kt
18	O	8010-00-298-3859	Paint, Light Green, INT.	gl
19	O	5350-00-619-9166	Paper, Abrasive	pk
	O	6750-00-201-0892	Paper, Copying, Diazo Process: Black image (03641) 100S	ro
	C	6750-00-663-0771	Paper, Copying, Diazo Process: Blue image (03641) 200 SE	ro
	C	7530-00-871-8310	Paper, Drawing (33363) 15-2155, 24x 30 in.	pk
	C		Paper, Graph (33363) 48-5094,50 yd. lg; 22 in. w.	ro
	C		Paper, Graph (33363) 48-6002, 12 in. w, 50 yd. lg.	ro
	C	7530-01-006-4496	Paper, Tracing (33363) 10-9155, 24x 30 in.	pk
		7510-00-286-6985	Paperweight (33363) 58-0810	ea

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	7510-00-233-2027	Pencil: colored; thin lead (79819) 1344, blue	dz
	C	7510-00-264-4610	Pencil: colored; thin lead (7981 9) 1800-16, green	dz
	C	7510-00-233-2021	Pencil: colored, thin lead, red (7981 9) 1800-39, red	dz
	C	7510-00-264-4608	Pencil: colored, thin lead, yellow (79819) 1800-5, yellow	dz
	C	7510-00-240-1526	Pencil: glazed, thick lead, black (79819) 1555, black	dz
	C	751 0-00-436-5210	Pencil: glazed, thick lead, blue (79819) 1555, blue	dz
	C	7510-00-275-7212	Pencil: glazed, thick lead, green (79819) 1555, green	dz
	C	7510-00-174-3205	Pencil: glazed, thick lead, red (79819) 1555, red	dz
	C	7520-00-161-5664	Pencil Mechanical: automatic (81 239) P400	ea
	C	7520-01-083-6734	Pencil Mechanical: non automatic (75364) 5611	ea
	C	6675-01-107-9678	Pen Points: rapidometric, pink (79819) 92J, 0.13 mm	ea
	C	6675-01-098-1219	Pen Points: rapidometric, lavender (79819) 92J, 0.18 mm	ea
	C	6675-01-098-1220	Pen Points: rapidometric, beige (79819) 92J, 0.25 mm	ea
	C	6675-01-107-9679	Pen Points: rapidometric, gray (79819) 92J, 0.35 mm	ea
	C	6675-01-098-122	Pen Points: rapidometric, red (7981 9) 92J, 0.50 mm	ea

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	6675-01-099-3440	Pen Points: rapidometric light blue (79819) 92J, 0.70 mm	ea
	C	6675-01-098-0308	Pen Points: rapidometric, orange (79819) 92J, 1.00 mm	ea
	C	6675-01-098-1222	Pen Points: rapidometric, cordovan brown (79819) 92J, 1.40 mm	ea
	C	6675-01-097-4516	Pen Points: rapidometric, cerise red (79819) 92J, 2.00 mm	ea
	C	6685-01-112-1920	Pen, Recorder: blue, 0.3 mm (28480) 5060-6785	pk
	C	6685-01-113-0856	Pen, Recorder: green, 0.3 mm (28480) 5060-6786	pk
	C	6685-01-112-1919	Pen, Recorder: red, 0.3 mm (28480) 5060-6784	pk
	C		Pen, Recorder: 6 pens/pkg 0.3 mm, Violet, Turquoise, Brown, Burnt Orange, Gold, Lime Green (28480) 5060-6894	pk
	C		Pen, Recorder: black, 0.7 mm (28480) 5060-6890	pk
	C		Pen, Recorder: blue, 0.7 mm (28480) 5060-6891	pk
	C		Pen, Recorder: green, 0.7 mm (28480) 5060-6892	pk
	C		Pen, Recorder: red, 0.7 mm (28480) 5060-6893	pk
	C		Pen, Recorder: 6 pens/pkg 0.7 mm, brown, gold, lime green, burnt orange, turquoise, violet (28480) 5060-6895	pk

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	6625-01-107-0338	Pen, Plotter: black, 0.3 mm (28480) 5060-6787	pk
	C	7510-00-174-7343	Pin, Straight (8D190) P3-780C	bx
	C		Plastic Sheet (33363) 44-1037	pk
	C		Plastic Sheet (33363) 44-1507	pk
20	F	8030-00-463-7053	Potting Compound	pt
	O	8010-01-193-0520	Primer	kt
	C	7510-00-543-6792	Refill, Ball Point Pen (79819) VER-4	dz
21	F	8010-01-030-7254	Resin, Epoxy	kt
	C	7510-00-255-4560	Rubber Band Assortment (8D190) N1-8366-54	bx
22	C		Screen, Nylon (39428) 1017A31	ro
23	O	8040-00-851-0211	Sealant, Silicone	tu
24	O	3439-00-273-3722	Solder, Rosin Core	sl
25	O	6850-00-274-5421	Solvent, P-D-680	cn
26	F	8010-00-664-5411	Spar Varnish	pt
27	C	6850-00-880-1013	Spray, Silicone	cn
28	O		Sprayfoam Sealant (39428) 7627T1	cn
	C	7520-00-281-5895	Stapler, Paper Fastening, Office: (8D190) X8-27, gray	ea
	C	7510-00-272-9662	Staples, Paper Fastening, Office Type (8D190) 8-SF4-5M	bx
	C	5345-00-184-1374	Stone, Sharpening (58692) 42862	ea

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
29	O	5640-00-103-2254	Tape, Cloth, Duct Sealing, 2 in.	ro
30	F	5970-00-926-7218	Tape, Electrical, Insulating	ro
31	C	7045-01-060-6452	Tape, Electronic Data	ea
	C		Tape, Paper (28480) 82045A	bx
	C	7510-00-550-7126	Tape, Pressure Sensitive Adhesive (99741) P45	ro
	C	7510-00-234-7960	Tape, Pressure Sensitive Adhesive (76381) 600	ro
	C	7510-00-551-9824	Tape, Pressure Sensitive Adhesive (76381) 810	ro
	C	7510-00-198-5831	Tape, Pressure Sensitive Adhesive (76381) 230	ro
	C	7510-00-272-6887	Thumbtack (79819) V6-53	hd
	C	7920-00-823-9772	Towel, Paper (95135) DW61-1 000-22	bx
	C	4020-00-242-4074	Twine, Fibrous (79819) S9-9	lb

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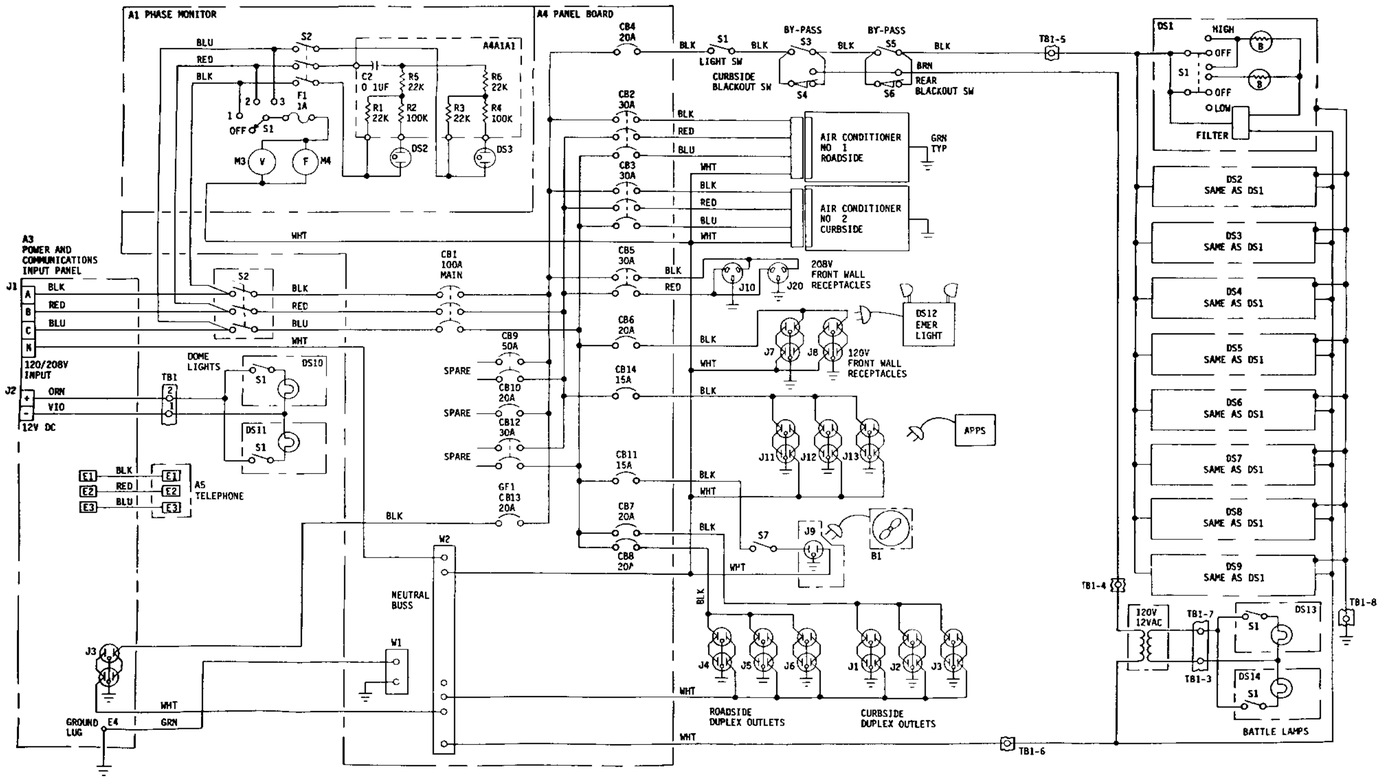
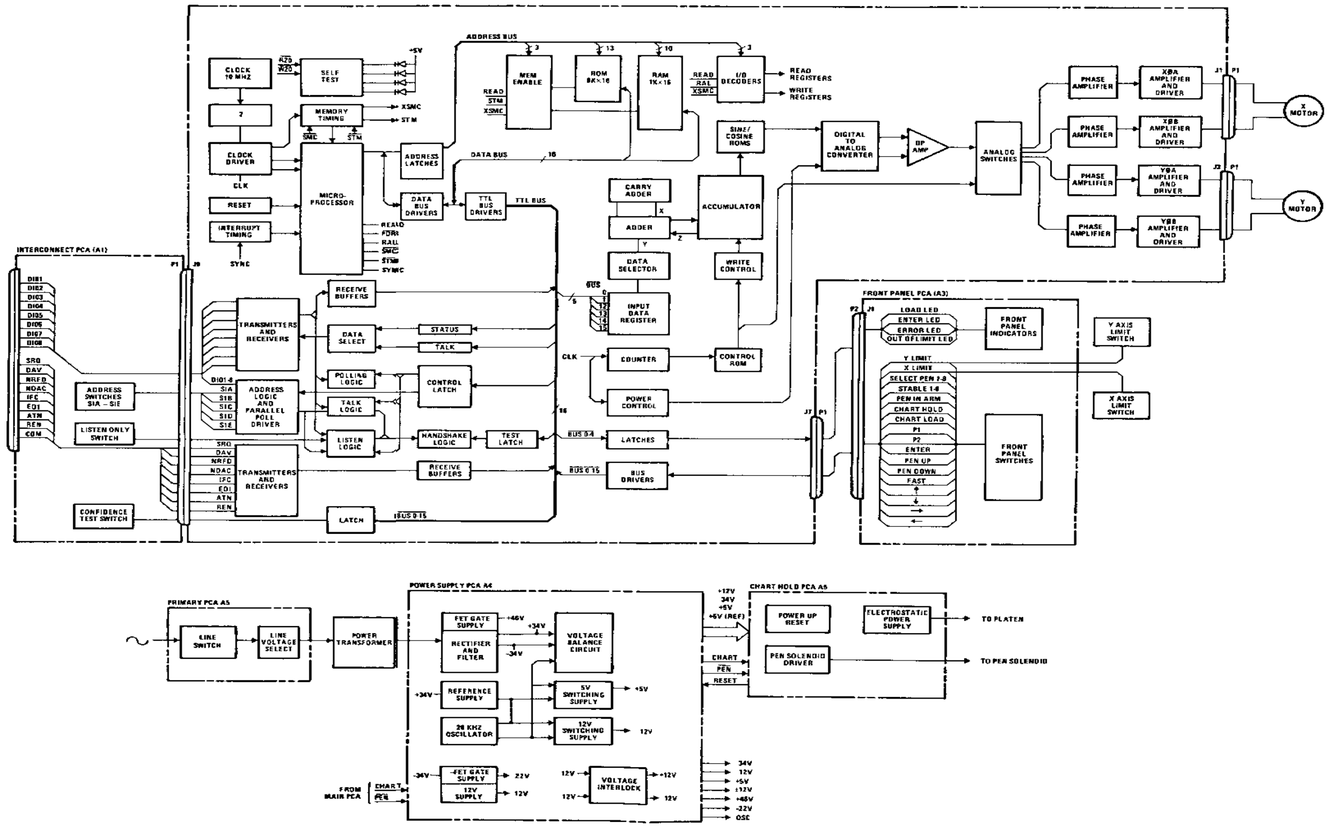
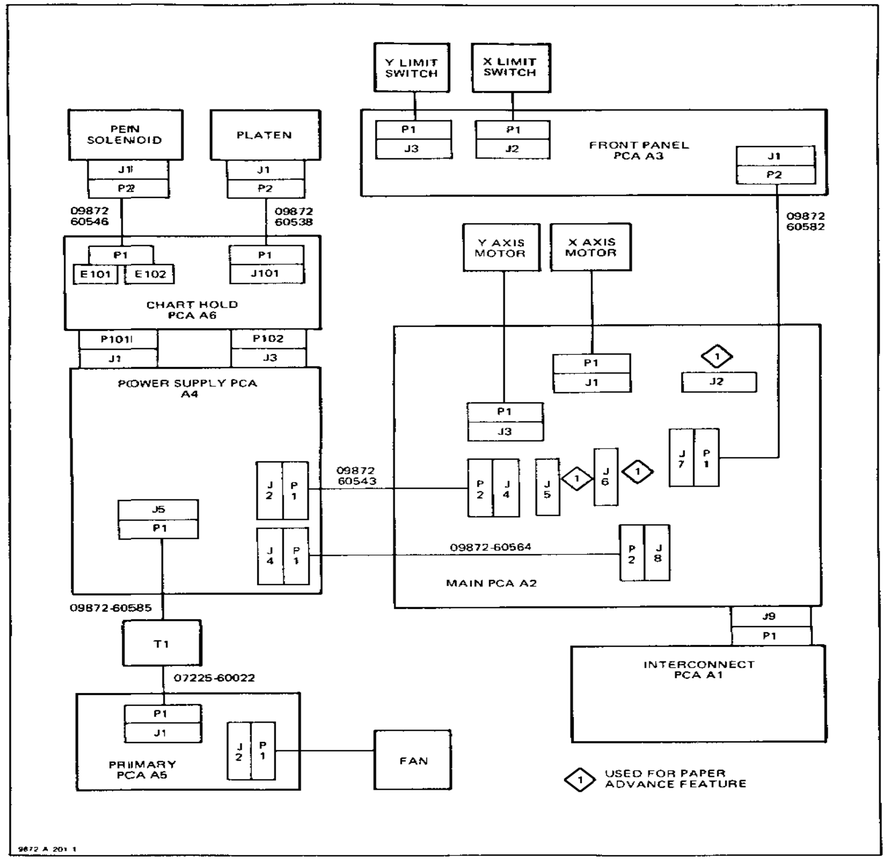


FO 1. Electrical Schematic Analysis Section

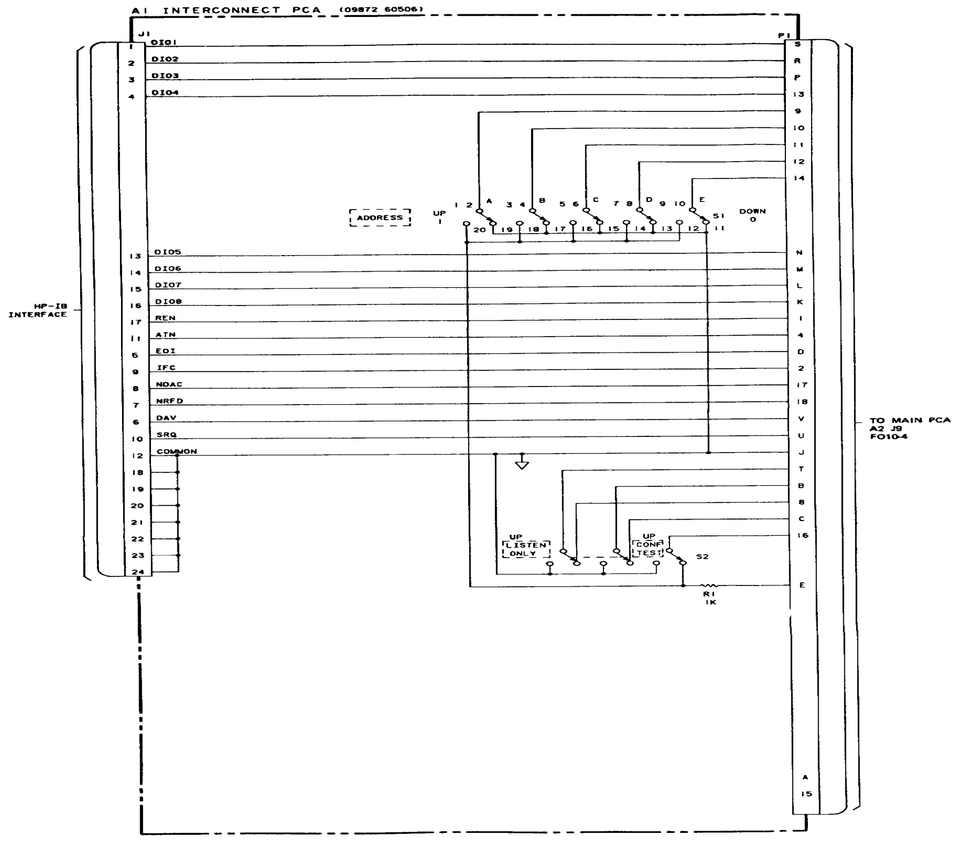


FO-2. **HP Model 9872C Functional Block Diagram**

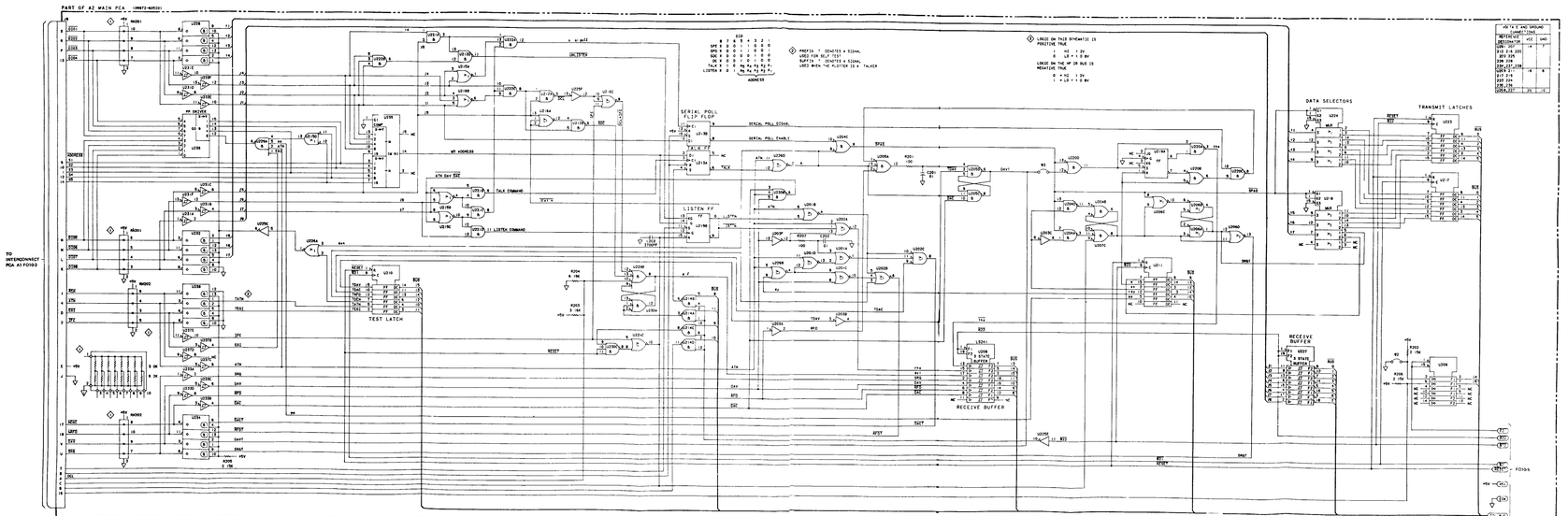
FP-3/(FP-4 blank)



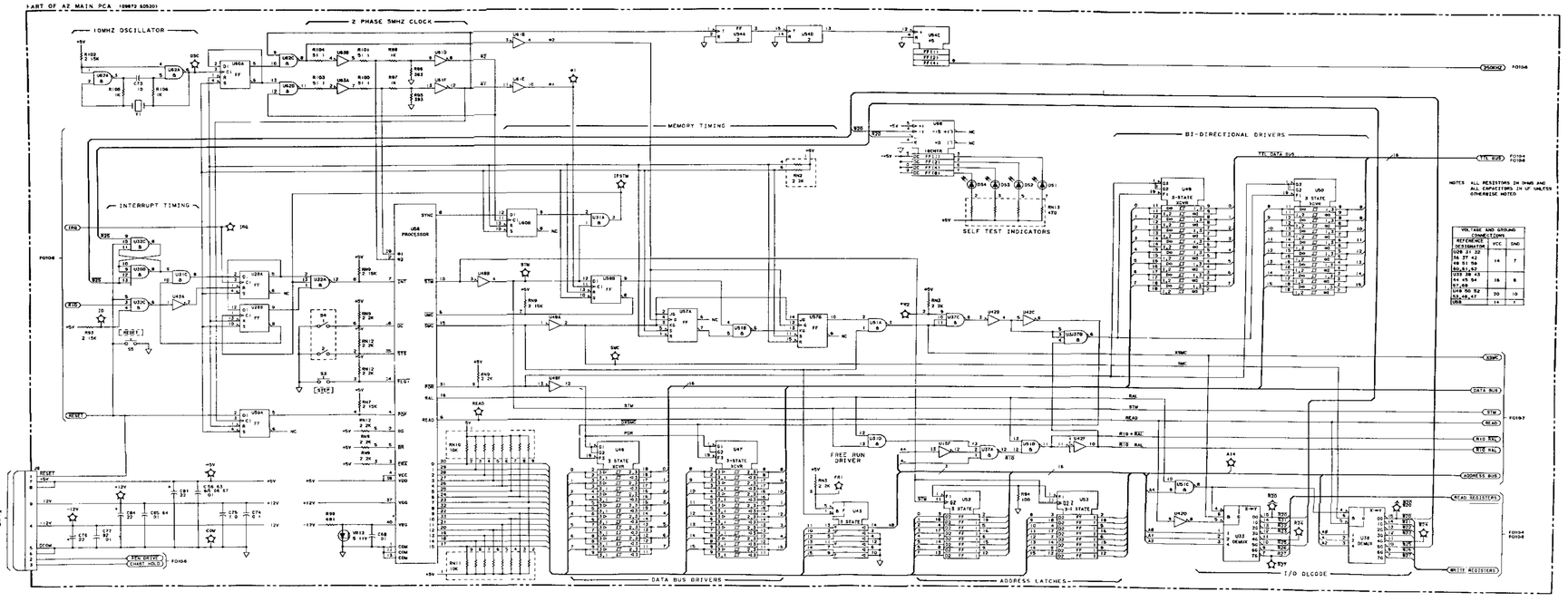
FO-3. **Interconnecting Cable Diagram**



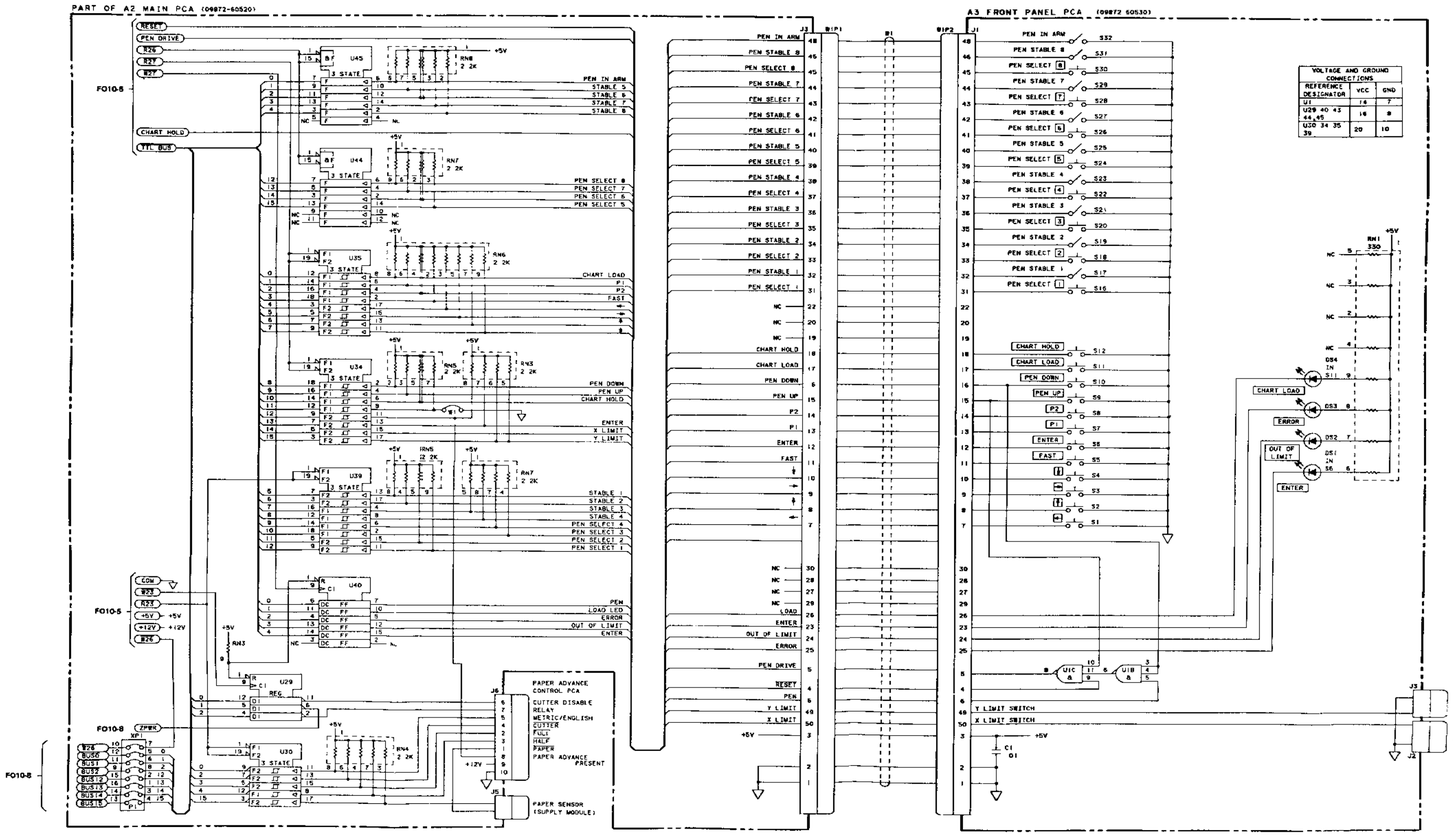
FO-4. **Interconnect PCA A1 Schematic Diagram and Parts Location**



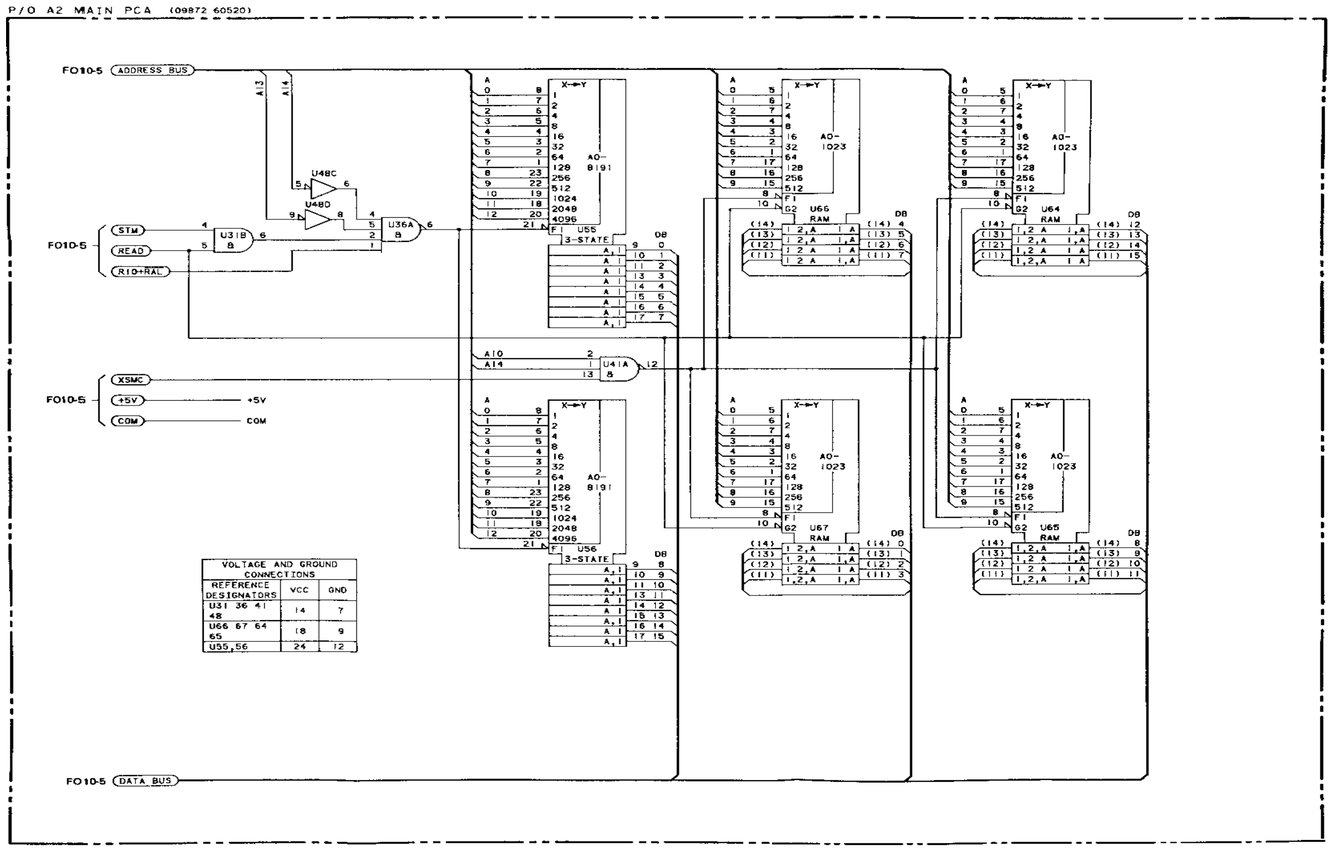
FO-5. Main PCA A2 HP IB Circuit Schematic Diagram



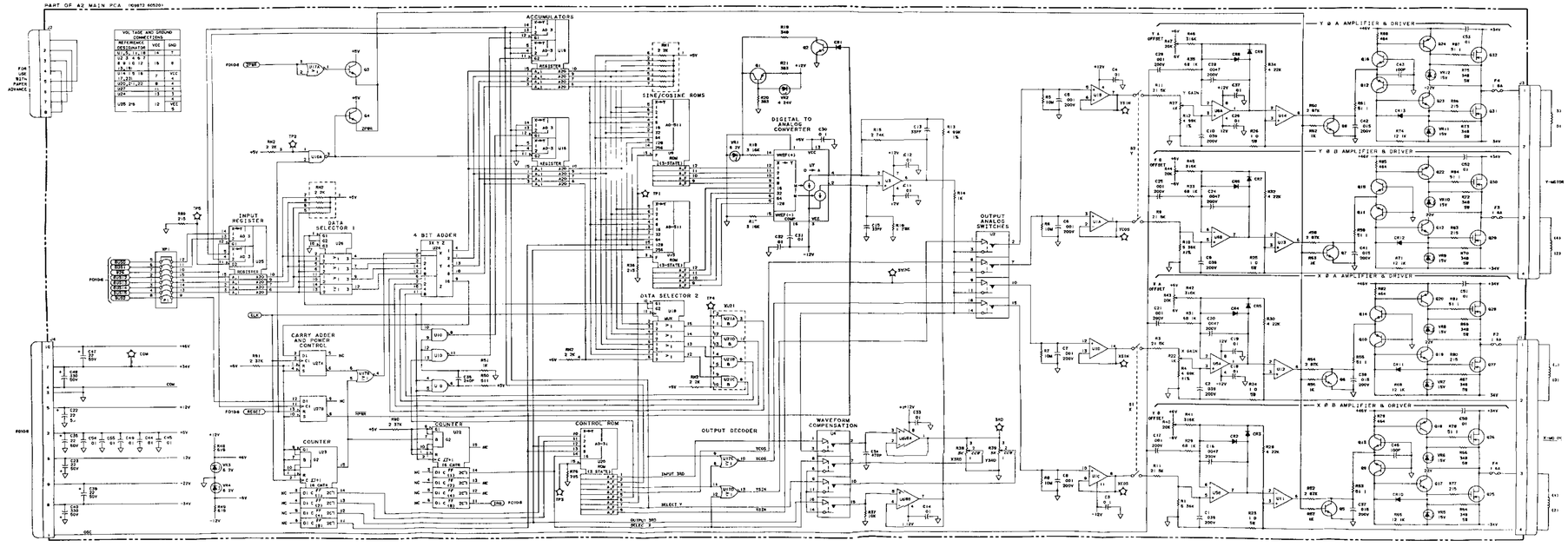
FO-6. **Main PCA A2 Processor Circuit Schematic Diagram**



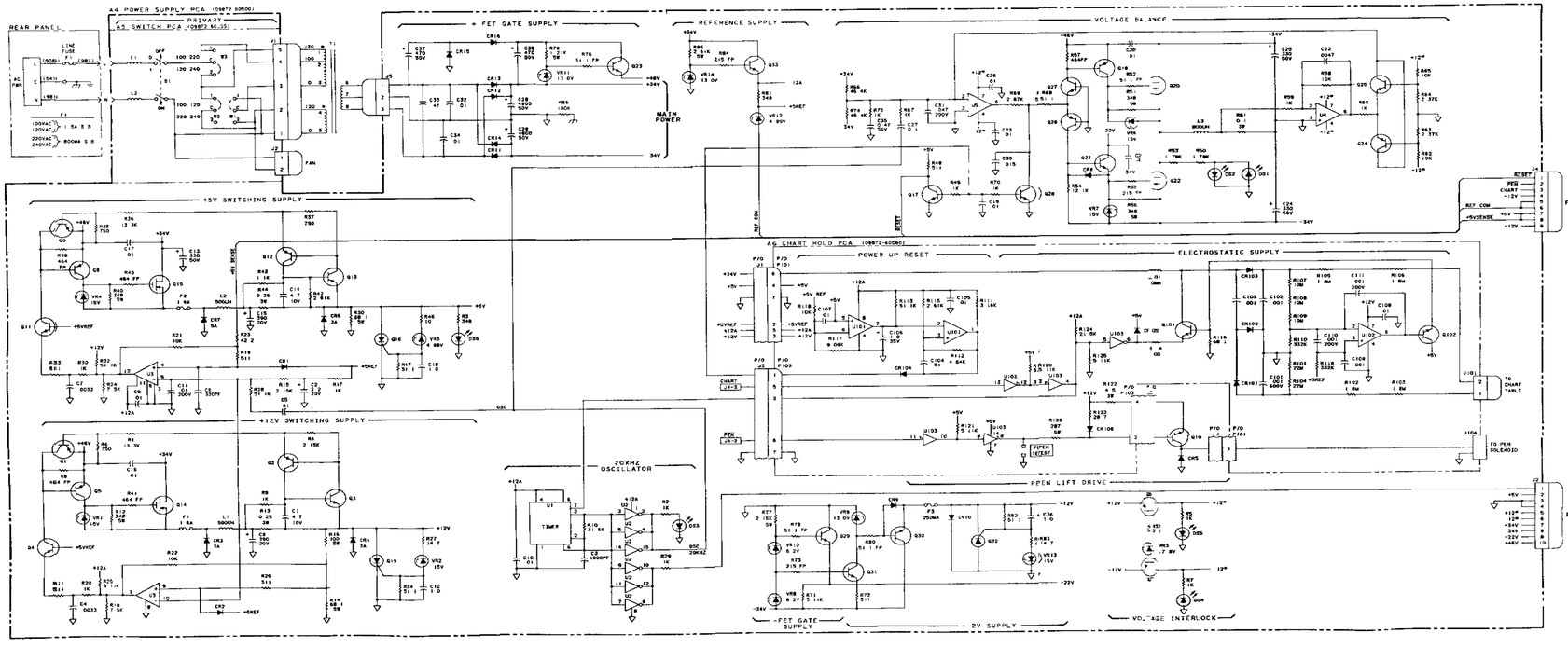
FO-7. Main PCA A2 Internal I/O and Front Panel Schematic



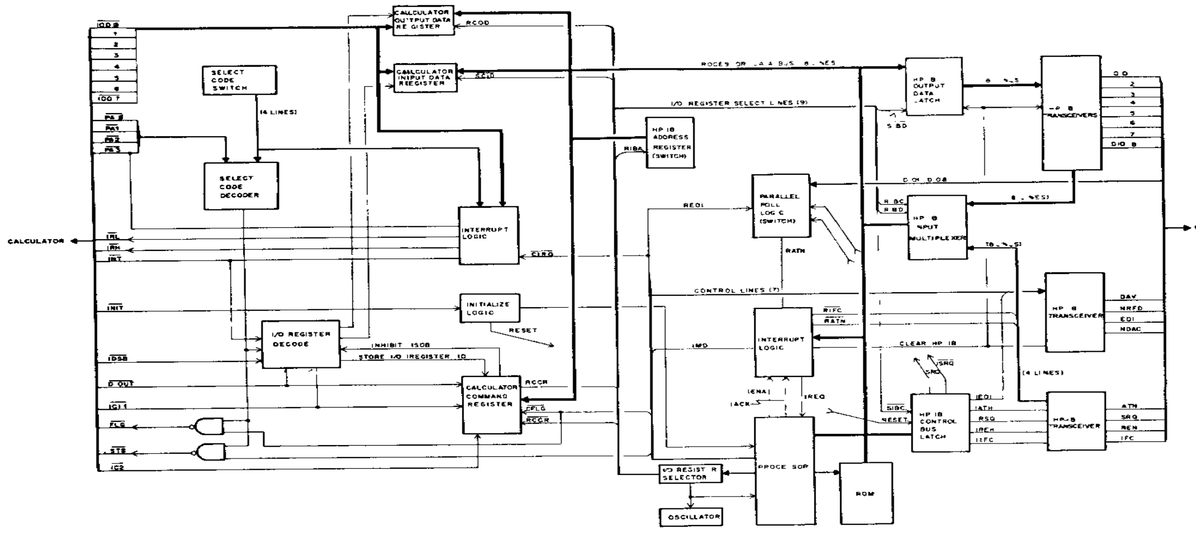
FO-8. **Main PCA A2 Memory Circuit Schematic Diagram**



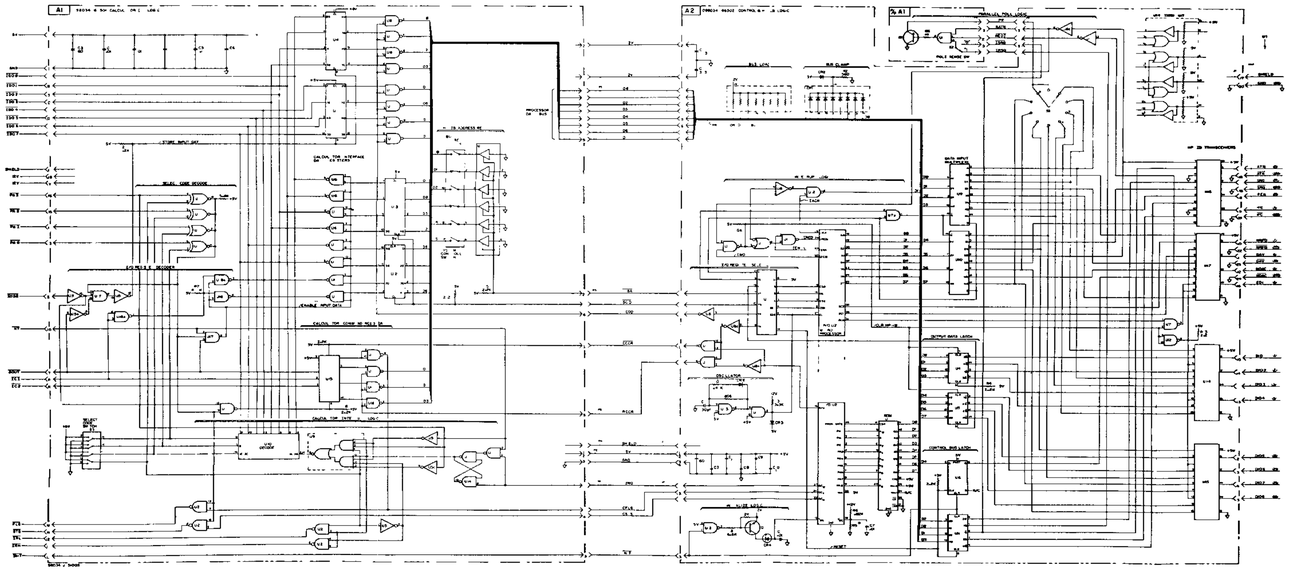
FO-9. **Motor Driver Circuit Schematic Diagram**

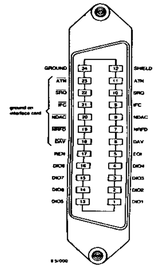


FO-10. **Power Supply Assembly Schematic Diagram**



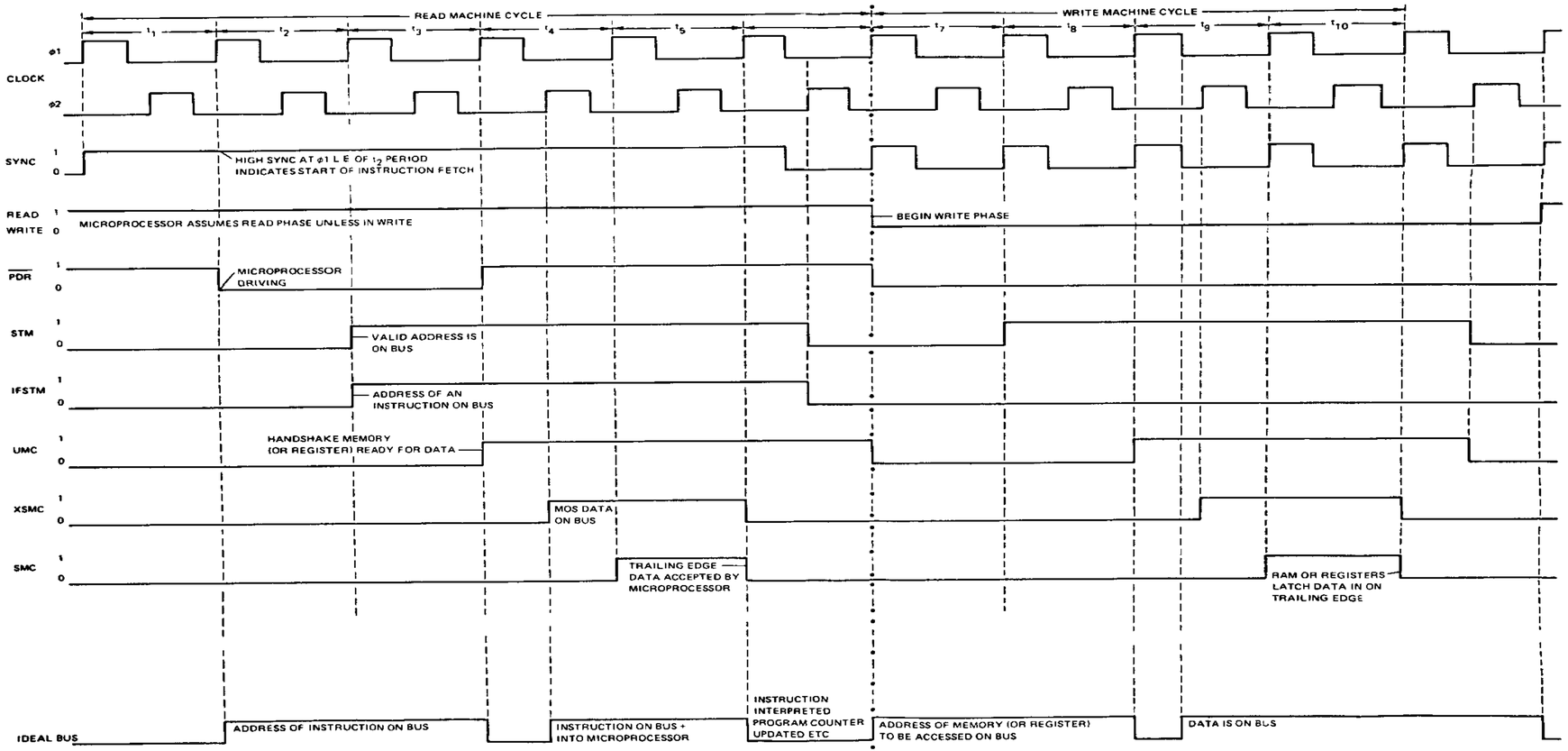
FO-11. **HP-IB Detailed Block Diagram**



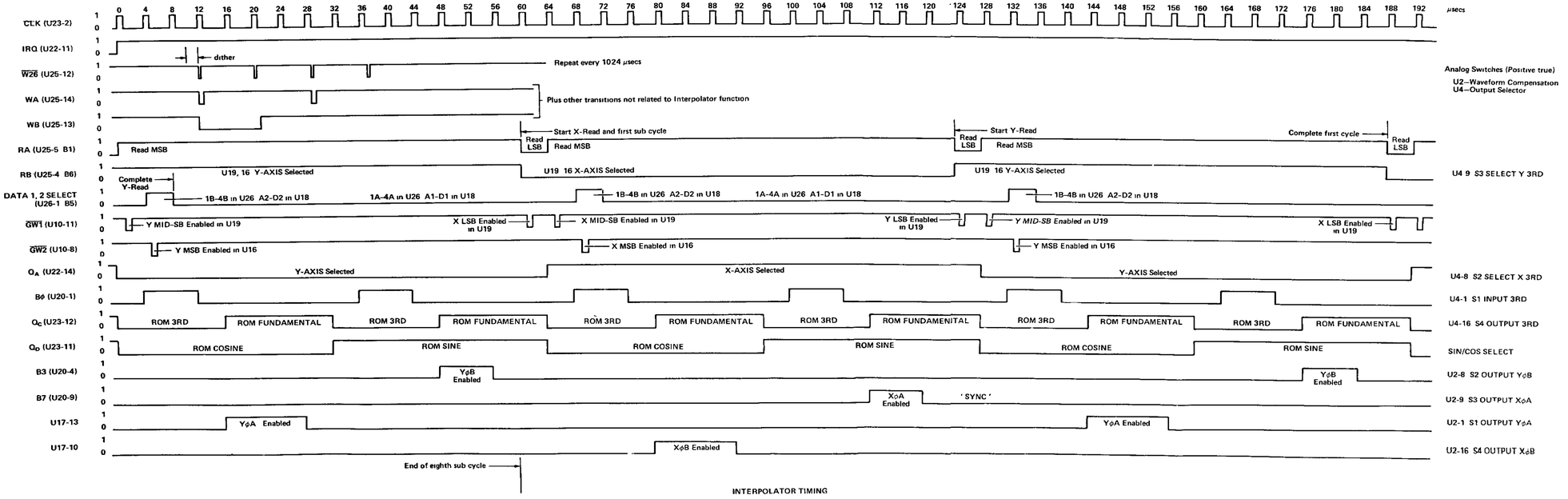


HP-IB Cable Pinouts

FO-12. **HP-IB Interface Cable**



FO-13. **Read Write Timing**



INTERPOLATOR TIMING

FO-14. **Interpolator Timing**

STEP	DESCRIPTION	SWITCH SETTING	DETAILS
1	LED TEST	S3 S4 ON S5 — PRESS	1 SET S4 TO ON 2 PRESS S5 RESET THE SELF TEST LEDS FLASH FOR INITIALLY CHECKS FOR DEFECTIVE LEDS
2	AUTOMATIC TEST	S3 S4 S5 — PRESS	PRESS S3 CONTINUE AN AUTOMATIC TEST OF THE PLOTTER ELECTRONICS IS PERFORMED THE TEST RUNS TO COMPLETION OR A FAILURE SELF TEST LED S WILL INDICATE A FAILURE S NUMBER IS DISPLAYED OR FLASHES UNTIL THE TEST IS PASSED REFER TO THE SELF TEST LED INDICATIONS TO ISOLATE A FAILURE REFER TO STEP 3 IF ALL TESTS ARE PASSED
a	ROM LSB A2U56	S3 S4 S5 — PRESS TO CONTINUE — PRESS SELF TEST LED INDICATION: 8 4 2 1 ● = LED ON	ROM A2U56 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
b	ROM MSB A2U55	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	ROM A2U55 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
c	RAM A2U67	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	RAM A2U67 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
d	RAM A2U66	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	RAM A2U66 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
e	RAM A2U65	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	RAM A2U65 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
f	RAM A2U64	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	RAM A2U64 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
g	INTERRUPT TEST	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	FAILURE OF INTERRUPT REQUEST LOGIC PRESS S3 TO CONTINUE THE SELF TEST
h	INTERRUPT TEST	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	FAILURE OF INTERRUPT SUBROUTINE OR STACK POINTER PRESS S3 TO CONTINUE THE SELF TEST

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STEP	DESCRIPTION	SWITCH SETTING	DETAILS
2	INTERRUPT TEST	S3 S4 ON S5 — PRESS TO CONTINUE — PRESS 8 4 2 1	FAILURE OF INTERRUPT SUBROUTINE OR RETURN TO NORMAL PRESS S3 TO CONTINUE THE SELF TEST
j	HP IB TEST	S3 S4 S5 — PRESS TO CONTINUE 8 4 2 1	FAILURE OF HP IB CIRCUITS END OF AUTOMATIC TEST
3	FRONT PANEL INTERACTIVE TEST	S3 S4 S5 — PRESS 8 4 2 1	1 REMOVE ALL PENS FROM THE PLOTTER 2 SET A2S1 (S MOTOR MUTE) TO OFF AND MOVE THE PLOTTER ARM TO THE LEFT END (NEAREST PEN STALL #1) OF THE PLATEN 3 SET A2S1 TO ON 4 PRESS PEN SELECT PUSHBUTTON #8 ALL FRONT PANEL LED S WILL LIGHT TESTS LED S SELF TEST LED S INDICATE 11 ; 5 PRESS CONTINUE (S3) FRONT PANEL ERROR LED REMAINS ON ALL OTHERS OFF 6 CLOSE EACH FRONT PANEL SWITCH IN THE ORDER INDICATED 1 CHART LOAD — 17 SELECT PEN 3 2 P1 — 18 SELECT PEN 4 3 P2 — 19 SELECT PEN 5 4 FAST — 20 SELECT PEN 6 5 + LEFT — 21 SELECT PEN 7 6 + RIGHT — 22 SELECT PEN 8 7 + UP — 23 PEN IN ARM (LOWER RIGHT) 8 + DOWN — 24 PEN IN STALL 8 9 PEN DOWN — 25 PEN IN STALL 7 10 PEN UP — 26 PEN IN STALL 6 11 CHART HOLD — 27 PEN IN STALL 5 12 ENTER — 28 PEN IN STALL 4 13 X LIMIT (FAR RIGHT) — 29 PEN IN STALL 3 14 Y LIMIT (LOWER RIGHT) — 30 PEN IN STALL 2 15 SELECT PEN 1 — 31 PEN IN STALL 1 16 SELECT PEN 2 AS EACH SWITCH IS CLOSED THE ERROR LED WILL TURN OFF AND THE OUT OF LIMIT LED WILL TURN ON MOMENTARILY WHEN THE ERROR LED TURNS ON AGAIN PRESS THE NEXT SWITCH AFTER ALL 31 SWITCHES ARE TESTED THE SELF TEST LED S WILL FLASH SEQUENTIALLY A SWITCH FAILURE IS INDICATED IF THE OUT OF LIMIT LED DOES NOT TURN ON
4	MOTOR DRIVER TESTS	S3 S4 S5 — PRESS	THE FOLLOWING STEPS TEST MOTOR DRIVER PERFORMANCE AND ARE ALSO USED TO PERFORM ALIGNMENTS 1 PRESS CONTINUE (S3)
a	X 3RD HARMONIC		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #1 FOR APPROXIMATELY THREE SECONDS RELEASE THE PLOTTER ARM WILL BEGIN A PEN UP DIAGONAL MOVE REFER TO SECTION III FOR ADJUSTMENT PROCEDURES SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
b	X GAIN		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #2 UNTIL THE PLOTTER ARM STOPS RELEASE SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
c	X OFFSET		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #3 UNTIL THE PLOTTER ARM STOPS RELEASE SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE

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STEP	DESCRIPTION	SWITCH SETTING	DETAILS
4d	Y 3RD HARMONIC		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #4 UNTIL THE PLOTTER ARM STOPS RELEASE SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
e	Y GAIN		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #5 UNTIL THE PLOTTER ARM STOPS RELEASE SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
f	Y OFFSET		1 PRESS AND HOLD PEN SELECT PUSHBUTTON #6 UNTIL THE PLOTTER ARM STOPS RELEASE SELF TEST LED S ARE OFF A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
5	END OF TEST	S3 S4 S5 — PRESS	1 SET SELF TEST SWITCH (S4) TO OFF AND PRESS RESET (S5) THE PLOTTER WILL INITIALIZE AND BE READY FOR NORMAL OPERATION

9872 C 183-1

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GLOSSARY

ABBREVIATION/TERM	DEFINITION
Absolute Altitude	Altitude of aircraft above surface of earth.
Collimation.	To make light rays parallel by adjustment of optical/mechanical system.
Constant	Factor used to convert electronic measurement counts of rolling disk planimeter or linear probe to desired physical unit, such as feet, inches, yards, etc.
Contour.	Closed loop on contour map, plan, drawing, etc. Also called isorhythm.
Contour Interval	Difference in elevation of two consecutive contour lines. Sometimes referred to as section interval.
Contour Method	Estimates volume of fill or cut via its contours.
Cut.	Excavation or depression-like formation.
Daylighted	Point or edge where cut becomes fill or vice-versa.
Default Conditions	Automatic parameters and conditions for program statements set by factory.
Differential Parallax	Small linear displacement between same photographic images on different photographs resulting from height of surface.
Diopter.	Measurement of lens power and refraction.
Fiducial Mark	Marks on edge of photograph to indicate optical center of photograph.
Fill	Embankment or hilly formation.
Interpupillary Distance	Distance between center of observer's eyes.

GLOSSARY - Cont

ABBREVIATION/TERM	DEFINITION
Micro (μ)	Resolution factor (or planimeter unit) for linear measuring probe or for rolling disk planimeter at specified tracer arm length. Represents smallest area or length measuring instrument can measure. Measuring instrument emits single pulse count for each unit.
MOS	Metal-Oxide Semiconductor.
Pad	One contour.
Planimeter	Instrument that provides data used to estimate area of geometric shape by tracing its boundary line.
Principle Point of Photograph	Center of photographic image.
Program Flag	(Calculator) Memory device, set either true or false, to install decision capabilities into a program.
Program Statement	Programming command recognized by plotter's internal circuits.
QPS	Quantity Processing System.
RAM	Reader Addressable Memory. Can be changed by operator.
R_L (or R_2)	Calibration reading of linear measuring probe representing total number of pulse counts emitted by probe per unit of length (inches or centimeters).
ROM	Read Only Memory. Cannot be changed by operator.
R_T (or R_1)	Calibration reading of rolling disk planimeter representing total number of pulse counts derived by measuring area described by a test rule.
Scale Ratio	Ratio between given distance on map or drawing to corresponding distance on ground.
Slope	Natural or artificial incline or slant of ground.

GLOSSARY - Cont

ABBREVIATION/TERM	DEFINITION
Statement Parameters	Functional limits of each plotter programming statement. Normally a set of tolerances.
Stereo-Pair Photograph	Photographs taken of same object or area from two different positions.
Stereoscope	Optical device to apparently superimpose two separate photographs.
Stereoscopic	An apparent three-dimensional image obtained when viewing stereo-pair photographs.
Subroutine	Distinct routine/program, part of larger routine/program, that will perform its own distinct manipulation of data when called up.
Toe	Lowest point, in terms of elevation, of embankment.
TTL	Transistor-Transistor Logic. IC chip contains linked transistors to accomplish logic functions.
X-Axis	Horizontal or left-right direction.
Y-Axis	90° from X-axis, in same plane, or front-back direction.
Z-Axis	Vertical direction or up/down.

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General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United States Army
The Adjutant General

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PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6675-323-14-2	3 Sep 85	Topographic Support System, Analysis Section

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 Cylenders. The engine on my set only has 4 Cylenders. Change the manual to show 4 Cylenders.
B1		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE John Doe
JOHN DOE

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C