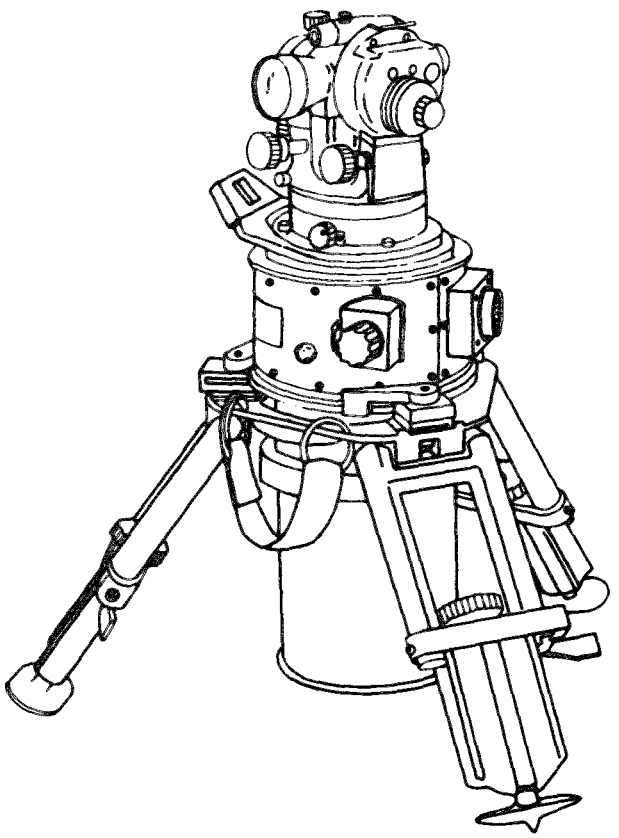
OPERATOR'S MANUAL



EQUIPMENT DESCRIPTION

OPERATING INSTRUCTIONS

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

MAINTENANCE INSTRUCTIONS

TROUBLESHOOTING PROCEDURES

MAINTENANCE PROCEDURES

SURVEY INSTRUMENT: AZIMUTH, GYRO, LIGHTWEIGHT MODEL AG-8, TYPE1 (6675-00-062-8579)

THIS MANUAL TOGETHER WITH TM 5-6675-250-20, SUPERSEDES TM 5-6675-250-12, 16 JUNE 1975 INCLUDING ALL CHANGES.

HEADQUARTERS DEPARTMENT OF THE ARMY

30 JUNE 1986

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 20 January 1988

Operator's Manual

for

SURVEY INSTRUMENT: AZIMUTH,
GYRO, LIGHTWEIGHT
MODEL AG-8, TYPE 1
(6675-00-062-8579)

TM 5-6675-250-10, 30 June 1986, 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
B-3 and B-4	B-3 and B-4
B-5 and B-6	B-5 and B-6
B-7 and B-8	B-7 and B-8
C-1 and C-2	C-1 and C-2
D-1 and D-2	D-1 and D-2

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

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L.DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator's requirements for Survey Instrument, Azimuth, Gyro, Lightweight (AG-8, Type 1)

WARNING

Take particular heed to specific Cautions and Warnings through out this manual.

DANGEROUS CHEMICALS

are used in this equipment.

DEATH

or severe burns may result if personnel fail to

observe safety precautions.

- **Corrosive battery electrolyte, potassium hydroxide. Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.**

TECHNICAL MANUAL

NO. 5-6675-250-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D,C., 30 June 1986

Operator's Manual

SURVEY INSTRUMENT: AZIMUTH, GYRO, LIGHTWEIGHT MODEL AG-8, TYPE 1 (6675-00-062-8579)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

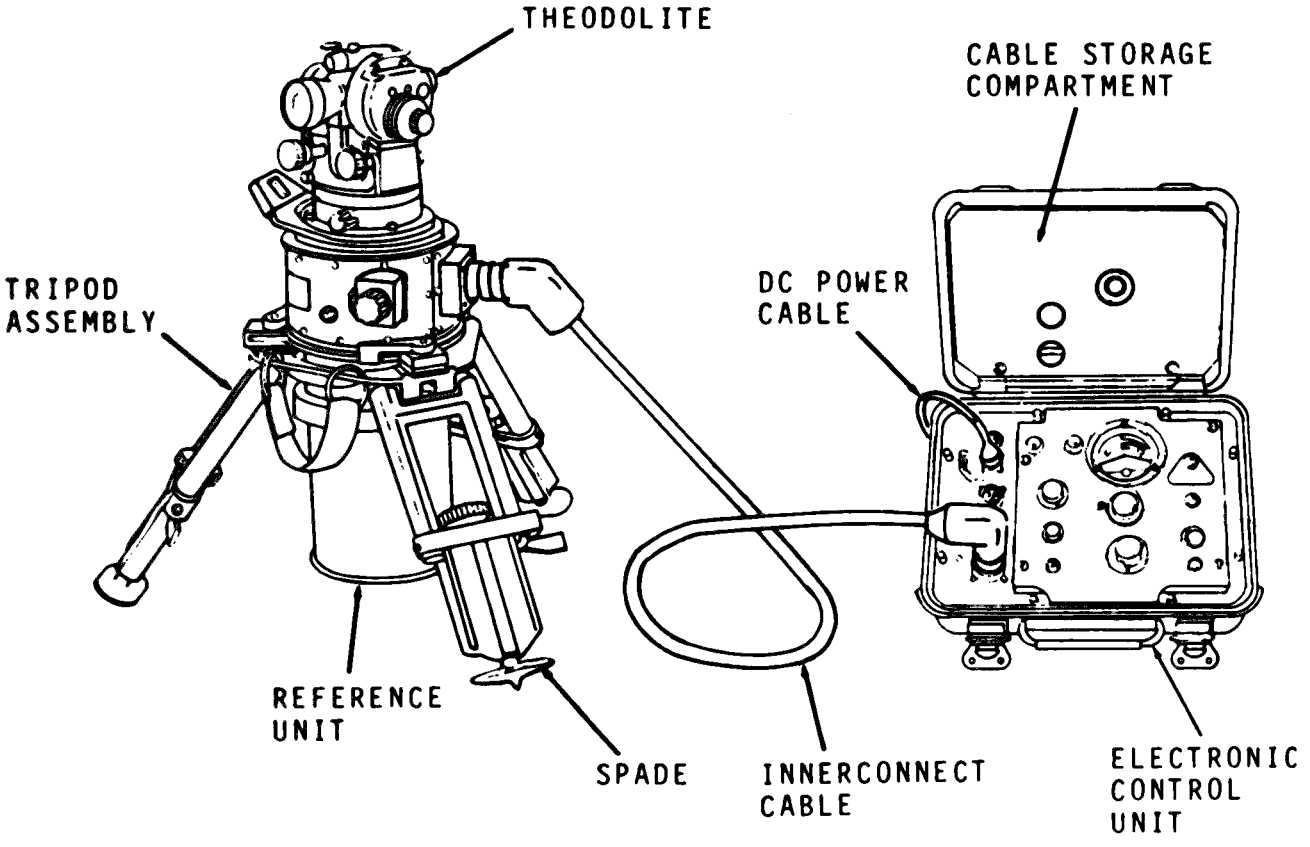
You can help improve this manual. If you find any mistake or if you know of away to improve the procedures,please let us know. Mail your letter, DA Form 2028(Recommended Changes to Publications and BlankFoms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St.Louis, M0 63120-1798. A reply will be furnished directly to you.

TABLE OF CONTENTS

TABLE OF CONTENTS (Con't.)

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION



1-1. SCOPE

a.	Type of Manual	Operator Manual (Containing Preventative Maintenance and Troubleshooting Procedures)
b.	Model Number and Equipment Name.....	Survey Instrument: Azimuth, Gyro, Lightweight Lear Siegler, Inc. Model AG-8, Type 1-NSN 6675-00-062-8579
c.	Purpose of Equipment	A North-seeking Gyroscope Capable of Determining True North With High Accuracy Without theAssistance of Celestial or Landmark Sightings

1-2. MAINTENANCE FORMS, RECORDS AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. HAND RECEIPT MANUALS

This manual has a companion document with a TM number followed by "-HR" (which stands for Hand Receipt). The TM 5-6675-250-10-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, Bll, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR310-2: Commander U.S. Army AG Publications Center, ATTN: AGLD-OD, 2800 Eastern Boulevard, Baltimore, MD 21220.

1-4. REPORTING OF EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your instrument needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Instructions for preparing EIRs are provided in DA PAM 738-750, The Army Maintenance Management System. EIRs should be mailed directly to Commander, U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Boulevard, St. Louis MO. 63120-1798. A reply will be furnished directly to you.

1-5. LIST OF ABBREVIATIONS

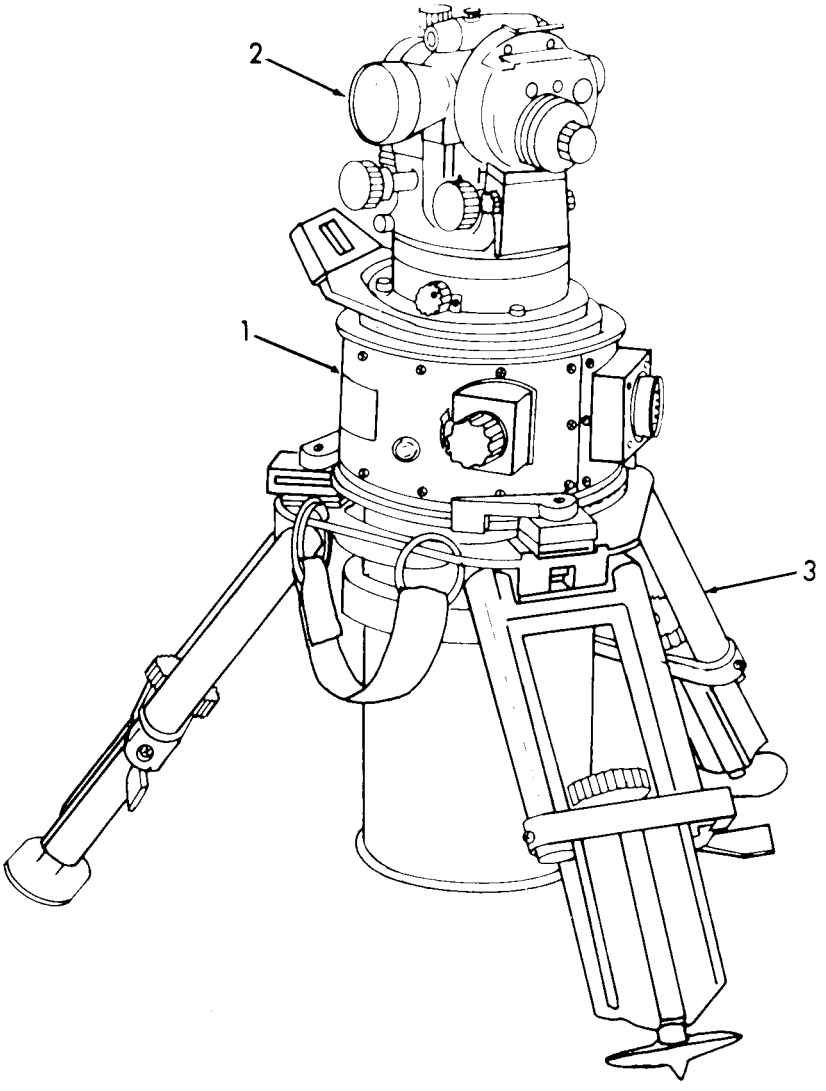
AC ..... alternating current
amp ..... ampere
BRT ..... BRIGHT
C ..... Celsius
CCW ..... counterclockwise
cm ..... Centimeters
CW ..... clockwise
DC ..... direct current
ECU ..... Electronic Control Unit
F ..... Fahrenheit
GC ..... Gyro Compass
GRU ..... Gyroscopic Reference Unit
hex ..... hexagon
hvywt ..... heavyweight
Hz ..... Hertz
ILLUM ..... Illuminate
in ..... inch(es)
Kg ..... Kilogram
kHz ..... Kilohertz
kmph ..... Kilometers per hour
MHz ..... Megahertz
mil ..... thousandths of an inch
mph ..... miles per hour
PWR ..... Power
SIAGL ..... Survey Instrument: Azimuth, Gyro, Lightweight
SYNC ..... Synchronous
THEO ..... Theodolite
V ..... Vertical, Volt
Vac ..... Volt(s) alternating current
Vdc ..... Volt(s) direct current
V/M ..... Volt/Meter

Section II. EQUIPMENT DESCRIPTION

1-6. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

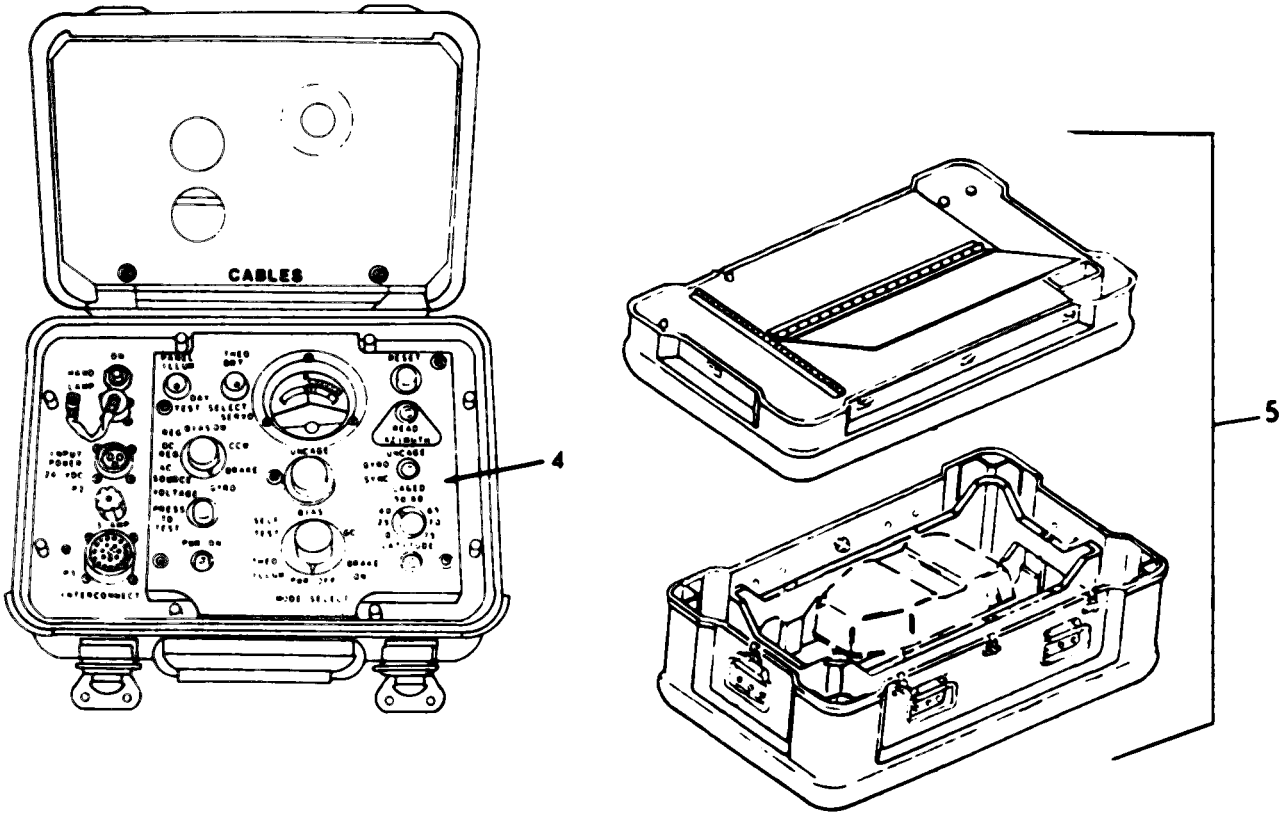
- Man portable
- Highly accurate
- All weather operational
- Built-in-self-test circuits
- Capable of determining and indicating true north within 15 minutes after power is applied.

1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



GYROSCOPIC REFERENCE UNIT (GRU) (1)	Pendulous north seeking gyro, which automatically references the readout theodolite to true north.
THEODOLITE (2)	Surveying instrument used to measure vertical and horizontal angles.
TRIPOD ASSEMBLY (3)	Supports and provides leveling for the GRU.

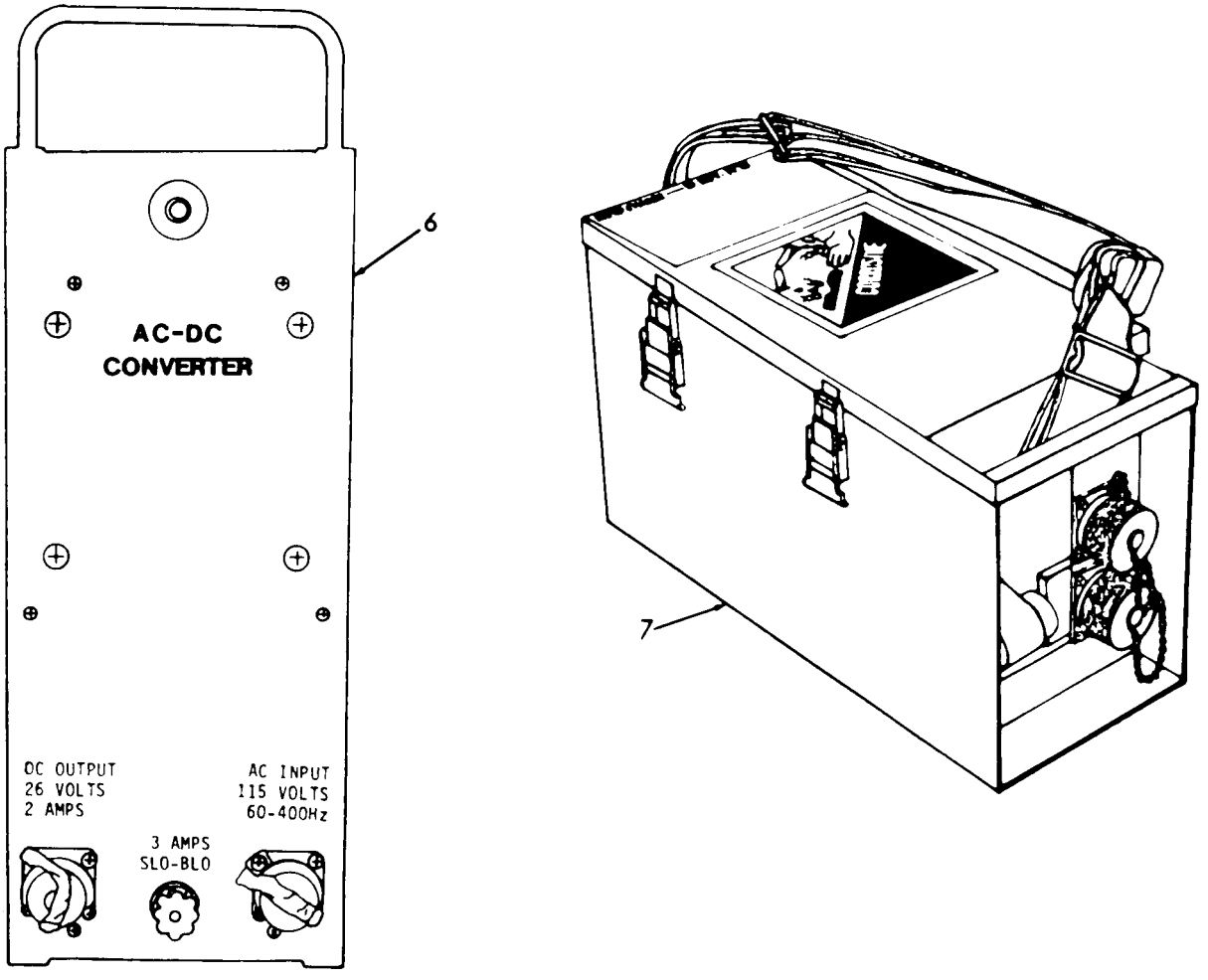
1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued



ELECTRONICS CONTROL UNIT (ECU) (4) . . . Contains operating controls, indicators, and control electronics.

TRANSPORT CASE (5) . . . . . Provides means for shipping, storage of the Survey Instrument, Azimuth, Gyro, Lightweight (SIAGL) and spare parts.

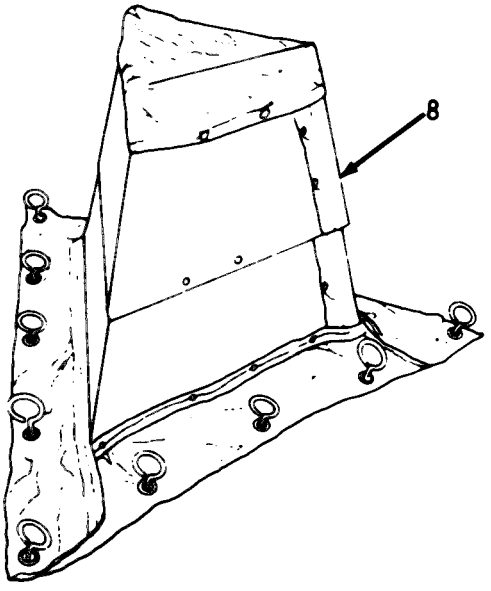
1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued

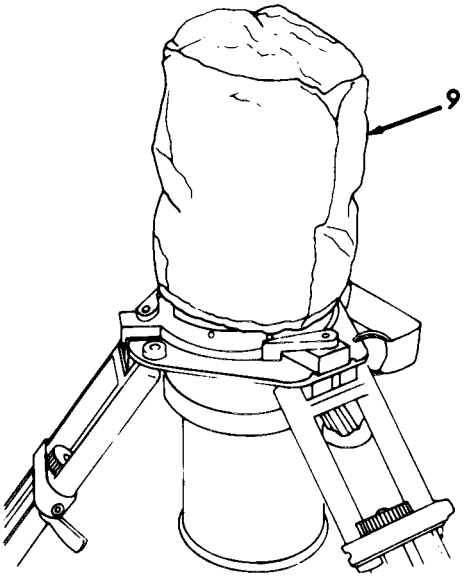


AC-DC CONVERTER (6) . . . . . Used to convert 115 ± 10 Vac, 60 or 400 Hz power to the 24 Vdc power required to operate the equipment.

BATTERY (7) . . . . . Used as source of power for the SIAGL.

1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued

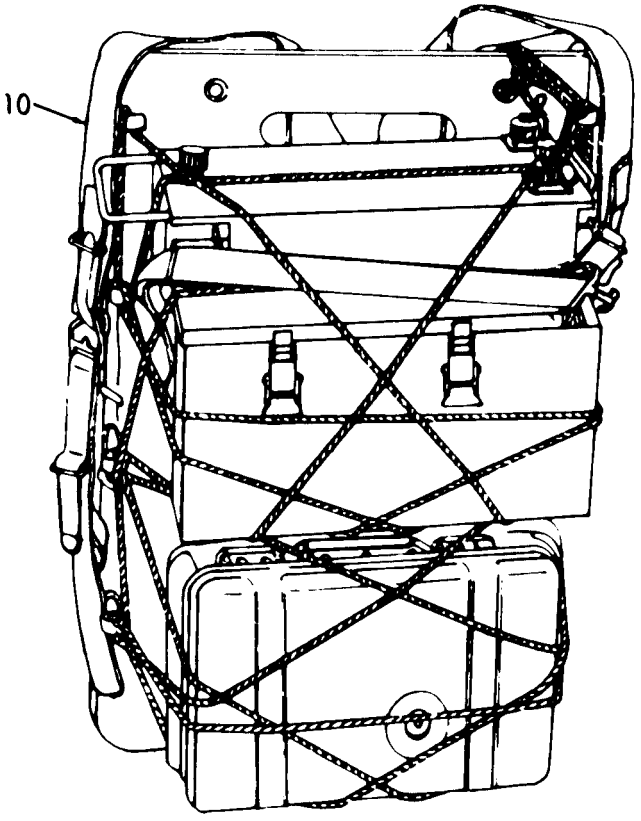


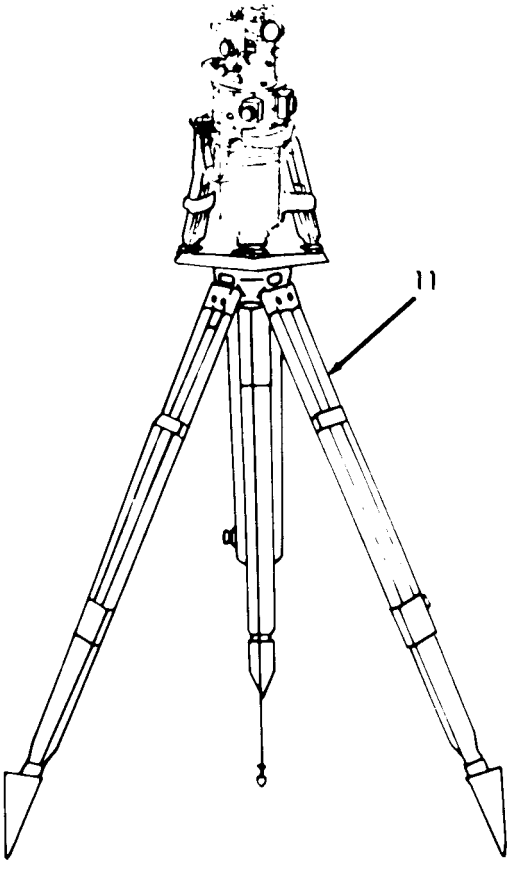


WIND SHELTER (8) ..... Used to protect the equipment and maintain performance during operations in winds exceeding 20 mph (32 kmph).

RAIN AND DUST COVER (9) ..... Provides protection for the theodolite when operating in adverse weather conditions.

1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued





PACKBOARD (10) . . . . . Provides means for backpacking the ECU, converter, and other associated components of theSIAGL set.

AUXILIARY TRIPOD ASSEMBLY (11) . . . . . Used to elevate the instrument when operations from a standing position are desired.

1-8. EQUIPMENT DATA

Dimensions and Weights:

TRANSPORT CASE (packed)

Length	36.9 inches	(93.7 cm)
Width	21.8 inches	(55.4 cm)
Height	18.4 inches	(46.7 cm)
Weight	125 pounds	(56.7 Kg)

TRANSIT CASE (packed-weight including Transport case)

Length	19.7 inches	(50.0 cm)
Width	11.5 inches	(29.2 cm)
Height	9.5 inches	(24.1 cm)
Weight	28.5 pounds	(12.9 Kg)

ELECTRONIC CONTROL UNIT WITH COVER (packed-weight, including transport case)

Length	12.1 inches	(30.7 cm)
Width	10.3 inches	(26.2 cm)
Height	6.1 inches	(15.5 cm)
Weight	13.5 pounds	(6.1 Kg)

WIND SHELTER (packed)

Length	29 inches	(73.7 cm)
Width	5 inches	(12.7 cm)
Height	15.5 inches	(39.4 cm)
Weight	18 pounds	(8.1 Kg)

AUXILIARY TRIPOD (packed)

Length	38 inches	(96.5 cm)
Weight	15 pounds	(6.8 Kg)

BATTERY, storage, BB-442/U

Length	12.5 inches	(31.8 cm)
Width	5.8 inches	(14.7 cm)
Height	7.4 inches	(18.8 cm)
Weight	30.0 pounds	(13.6 Kg)

PACKBOARD

Width	15 inches	(38.1 cm)
Height	24 inches	(61.0 cm)
Weight	6 pounds	(2.70 Kg)

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-9. TECHNICAL PRINCIPLES OF OPERATION

a. Gyroscopic Reference Unit (GRU)

(1) Uncaged indicator (1). Illuminates during operations when the pendulum is uncaged.

(2) Caging knob (2). Used to uncage the pendulum in the bias mode and after the gyro motor attains synchronous speed in the gyro compass (GC) mode. Also used for caging the pendulum after bias and after GC has been completed. Illumination of the GYRO SYNC indicator on the ECU is necessary prior to activating the CAGE-UNCAGE knob when in GC mode.

(3) Vertical lock (3). Permits operator to lock telescope at any desired vertical position. When vertical lock is released (turned counterclockwise), the telescope is free to be moved to any vertical position.

(4) Elevation control (4). Permits operator to control vertical positioning of the telescope. The control is used to center target image vertically in the reticle pattern of the telescope.

(5) Horizontal lock (5). Permits operator to lock theodolite at any desired horizontal position. The lock is released when it is necessary to rotate the theodolite; light finger torque is applied to lock the theodolite at the desired position.

(6) Azimuth control (6). Permits the operator to adjust the horizontal position of the theodolite. The control is used to center the target image horizontally in the reticle pattern of the telescope.

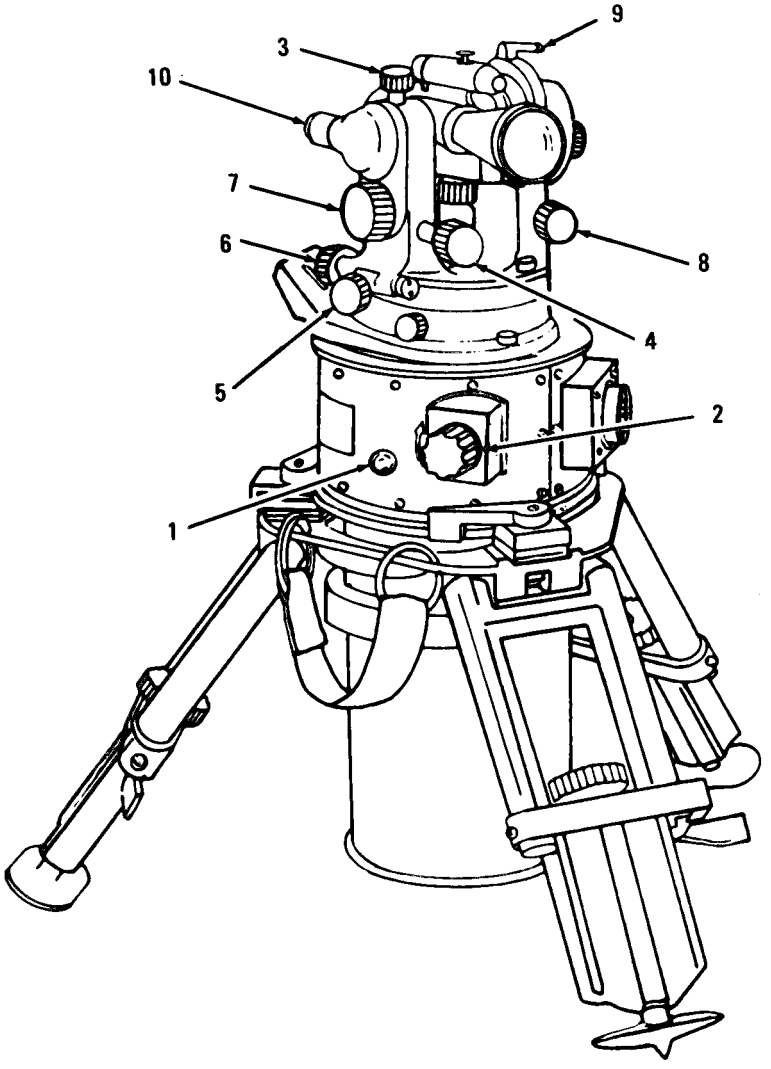
(7) Micrometer control (7). Permits the operator to adjust the full range of the vernier scale to obtain an accurate horizontal and vertical scale reading.

(8) Altitude level control (8). Adjusts the position of the altitude level and V circle (vertical) optical scale.

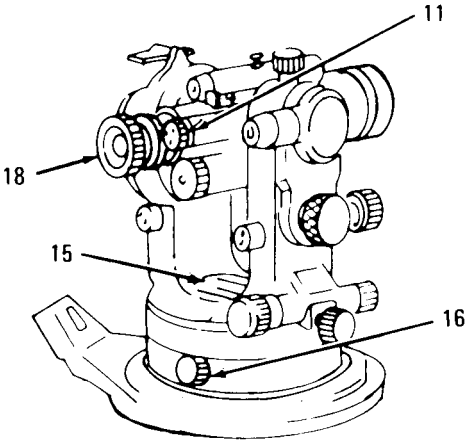
(9) Altitude level mirror (9). Manually adjustable to permit the operator to see the altitude level without changing from a telescope and azimuth scale reading position.

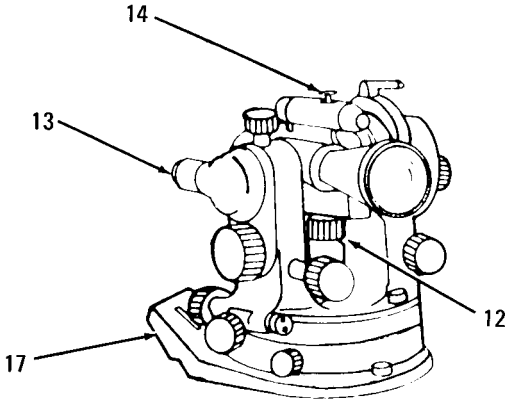
(10) Theodolite scale lamp eyepiece (10). Used to view the optical scales. The eyepiece can be swiveled to allow the optical scales to be viewed from any position.

1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued



1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued





1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued

(11) Telescope focus control (11). Permits the operator to adjust the focal length of the telescope to see a target.

(12) Reticle illumination control (12). Adjusts the intensity of the lighting of the reticle pattern during night operations.

(13) Microscope focus control (13). Permits the operator to adjust the focus of the microscope to present a clear, sharp image of the optical scales.

(14) Magnetic compass plunger (14). Locks the compass needle in a fixed position to protect it from vibration and shock when not in use. Pressing the plunger releases the locking mechanism and permits the spring-mounted needle to move freely.

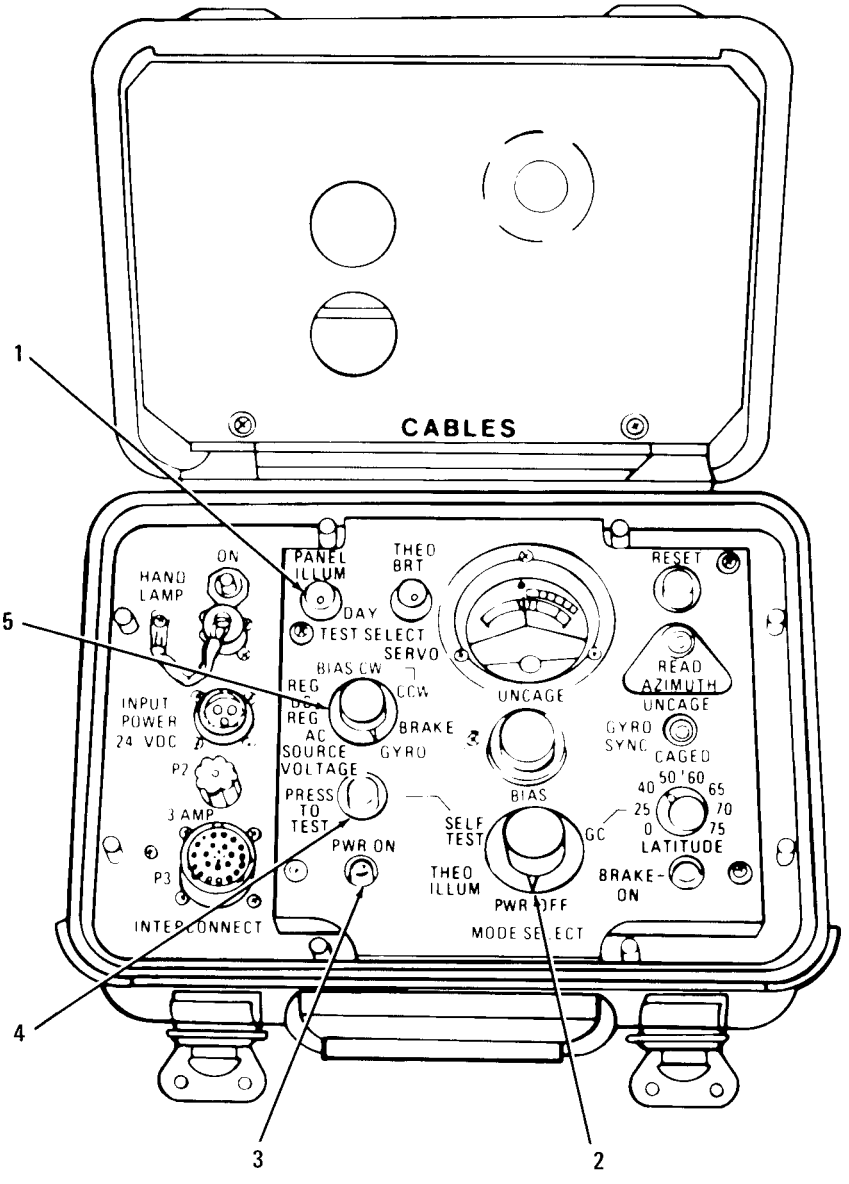
(15) Plate level (15). Indicates the level of the theodolite and the GRU.

(16) Horizontal circle setting control (16). Used to set the horizontal circle during theodolite calibration.

(17) Mounting plate and reference mirror (17). Used for aligning the theodolite horizontal circle with the follow-up by providing a fixed reference point.

(18) Reticle focus control (18). Permits the operator to adjust the reticle pattern to a sharp focus. The reticle focus control is used in conjunction with the reticle lamp illumination control during night use.

1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued



1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued

b. Electronic Control Unit (ECU)

(1) Panel illumination control (1). Enables the operator to illuminate the panel during night use. During day operations the control is rotated fully counterclockwise. To illuminate the panel for night operations, the control is rotated clockwise.

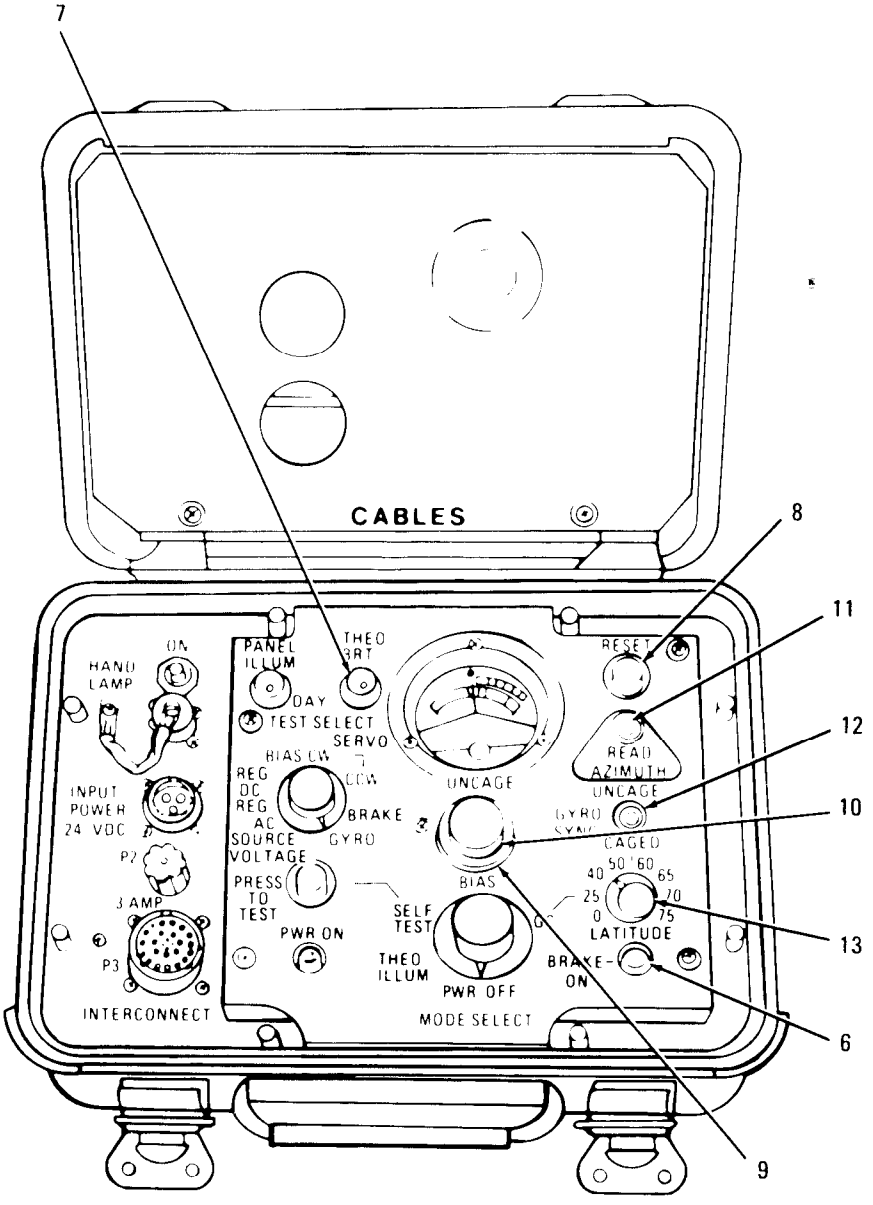
(2) Mode select switch (2). The MODE SELECT switch is maintained in the PWR OFF position when the equipment is not in operation. Placing the switch in THEO ILLUM position lights the telescope reticle, the scales, and the autocollimation eyepiece. Placing the switch in the SELF TEST position enables the operator to perform assurance tests of the equipment before and during operation. The determination and setting of bias conditions is accomplished with the use of the MODE SELECT switch in the BIAS position. Placing the switch in GC (gyro compassing) applies power to the gyro motor and indicates the alignment operation of the instrument. Through the BRAKE ON position, the gyro motor is stopped when it is desired to repeat alignments or shut down the instrument. With the MODE SELECT switch in the THEO ILLUM position, all system power is off except to the theodolite. In this mode the theodolite may be used for determining azimuths from the original north determination, but the azimuth should be verified by re-reading to the target after caging and braking of the gyro wheel. In this mode the theodolite can also be used for any normal theodolite procedure.

(3) Power on indicator (3). The system's power is on when the PWR ON indicator is lit. Failure of the indicator to light when the ECU is connected to the power source, and when the MODE SELECT switch is moved from the PWR OFF or THEO ILLUM positions, indicates a malfunction in the system.

(4) Press to test switch (4). Press to obtain a TEST METER indication for each test position setting of the TEST SELECT switch. Operation of the PRESS TO TEST switch is needed only during the self-test procedure to obtain an indication on the TEST METER.

(5) Test select switch (5). Used in conjunction with the TEST METER to check subsystems of the equipment and stages of operation. During self-test operations, the selector switch is placed to each of its positions. At each position the PRESS TO TEST switch is pressed and operability of the associated circuit is indicated on the TEST METER (pointer in green area for all but SOURCE VOLTAGE, which is displayed on the upper meter scale and GYRO, which should center in yellow area).

1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued



1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued

(6) Brake on indicator (6). Illuminates when the MODE SELCT switch is placed to BRAKE ON, indicating the braking sequence. At the completion of the sequence, a 90-second dynamic braking of the gyro motor, the BRAKE ON indicator light will be extinguished.

(7) Thoedolite brightness control (7). Rotating the control clockwise increases the intensity of the light.

(8) Reset switch (8). Enables the operator to reinitiate the gyrocompass interval. Pressing the RESET switch extinguishes the READ AZIMUTH indicator and reinitiates gyrocompass action for a minimum of 45 seconds.

(9) Bias control (9). Following self-test operations, the instrument is adjusted for bias through the BIAS control. Rotating the BIAS control clockwise will move the pointer to the right, and counterclockwise rotation will move the pointer to the left. Careful attention should be given to positioning the pointer in the center of the scale to ensure the highest degree of accuracy.

(10) Bias lock (10). Mechanically holds the BIAS CONTROL in the set position to prevent an accidental movement.

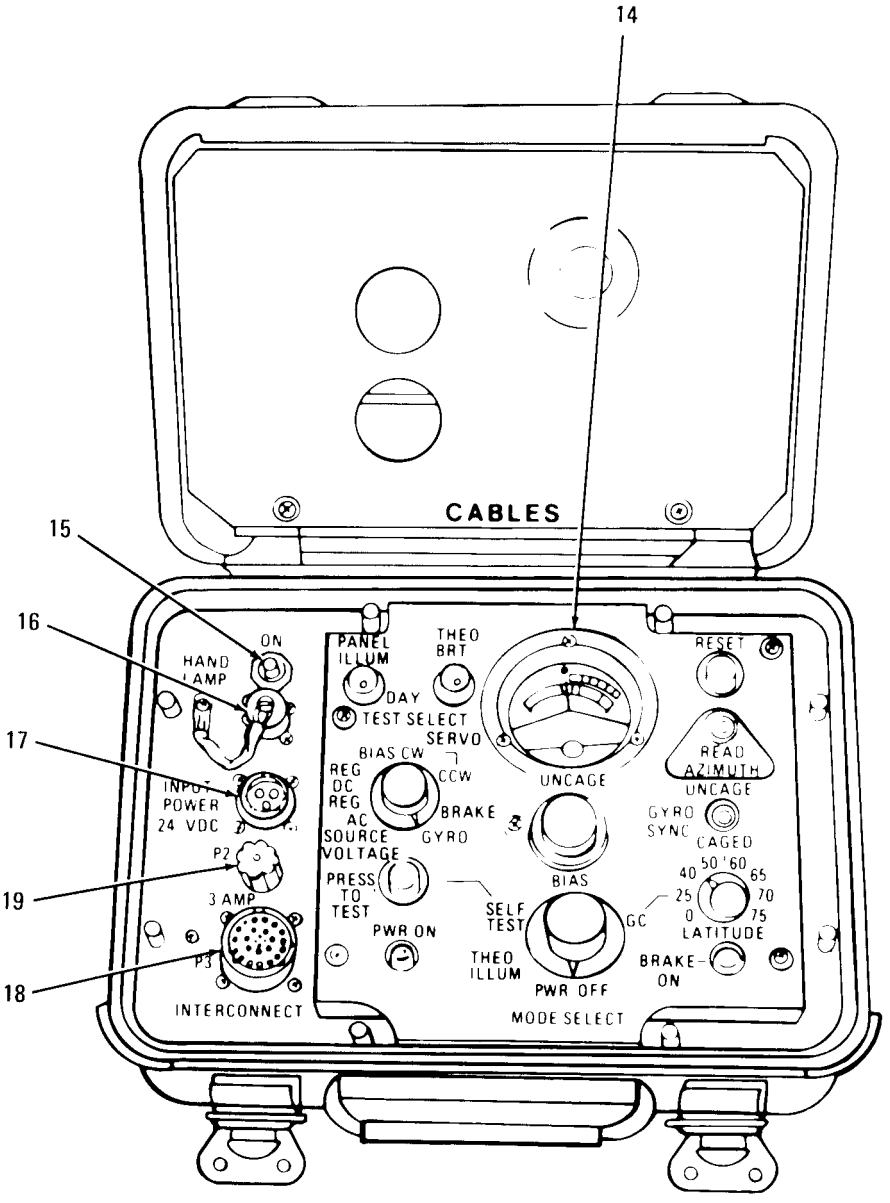
(11) Read azimuth indicator (11). Illuminates when true north has been obtained; light is applied automatically to the theodolite scale for azimuth reading.

(12) Gyro sync indicator (12). Illumination indicates that the gyro motor has attained synchronous speed. When the GYRO SYNC indicator illuminates the CAGE-U NCAGE knob, the GRU is to be rotated to UNCAGE (clockwise rotation).

(13) Latitude select switch (13). Provided to maintain instrument operating time at different latitudes of operation. The switch is adjustable with a screwdriver and contains eight positions. The switch positions and corresponding latitudes of operation areas follows:

Switch Position	Latitude of Operation
0	0-15 degrees
25	15-30 degrees
40	30-45 degrees
50	45-55 degrees
60	55-63 degrees
65	63-67 degrees
70	67-73 degrees
75	73-75 degrees

1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued



1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued

(14) Test meter (14). Provides a visual indication of operational status of the instrument in both testing and operating modes. Satisfactory operation of the circuits associated with TEST SELECT switch position is indicated by the meter pointer. The meter and the TEST SELECT switch are used in conjunction with the PRESS TO TEST switch, which must be actuated to obtain meter indications during self-test operation. When the TEST SELECT switch is in the SOURCE VOLTAGE position, the input voltage may be read on the voltage scale on the right side of the meter scale. When the TEST SELECT switch is in the GYRO position, the meter pointer should center in the yellow area. When the TEST SELECT switch is in any other position, the meter pointer should be in the green area.

(15) Hand-lamp switch (15). Provided to turn the hand-lamp on or off.

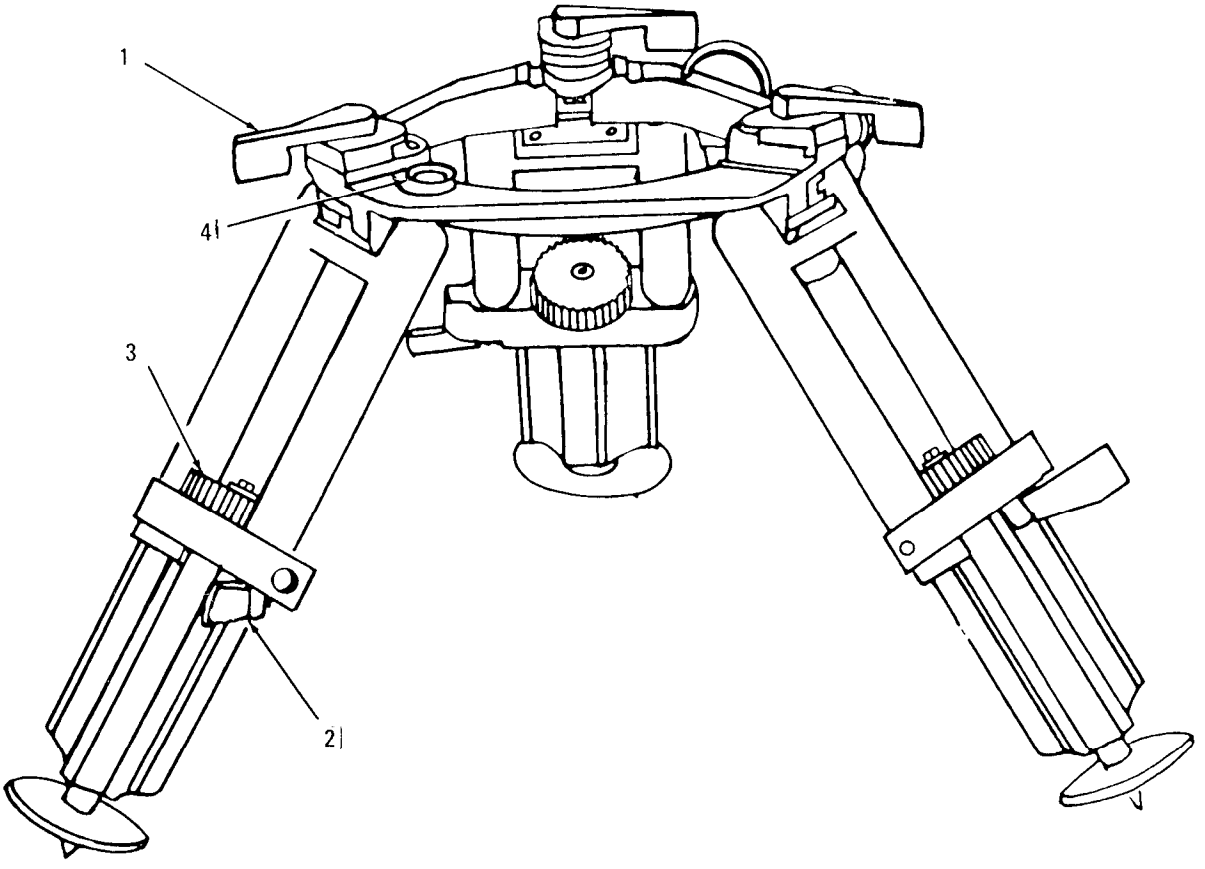
(16) Hand-lamp connector (A2J1) (16). Connects the hand-lamp to the ECU.

(17) Input power connector (A2J2) (17). Connects the ECU to the electrical power source.

(18) Interconnect connector (A2J3) (18). Connects the GRU to the electronic control unit.

(19) Fuse holder (19). A receptacle for the 24 Vdc, 3 amp fuse, which protects the electric parts from damage in the event of a power overload.

1-9. TECHNICAL PRINCIPLES OF OPERATION - Continued



c. Tripod.

(1) Hold-down clamps (1). The three hold-down clamps on the tripod assembly are provided to secure the GRU to the tripod assembly. A lever on each clamp is provided to release the GRU when it is necessary to rotate or laterally move the GRU for preorientation or plumbing.

(2) Tripod leg clamps (2). Leg clamps are provided on each leg of the tripod for controlling the elevation of the assembly. Loosening the leg clamps permits the center section of the legs to be extended or retracted for coarse adjustment.

(3) Fine-level adjustment knob (3). Provisions for leveling the tripod assembly are provided by fine-level adjustment knobs on each leg.

(4) Tripod circular level (4). A level vial is provided on the base plate of the tripod to indicate the coarse level of the assembly.

CHAPTER 2
OPERATING INSTRUCTIONS

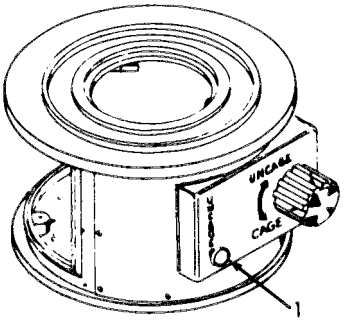
INDEX

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. OPERATOR'S CONTROLS AND INDICATORS

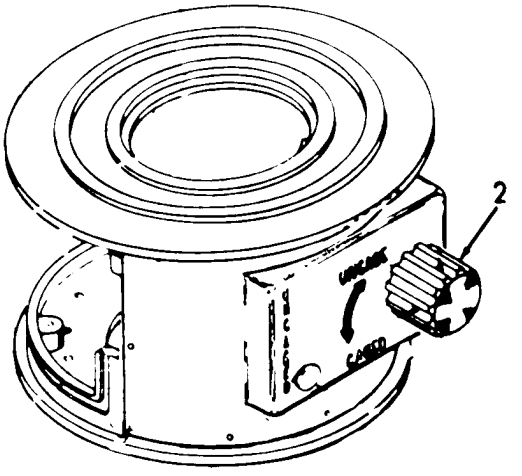
a. Gyroscopic Reference Unit (GRU)

(1) Uncaged indicator (1). The UNCAGED indicator is located on the upper housing of the GRU and is illuminated during operations when the pendulum is uncaged.

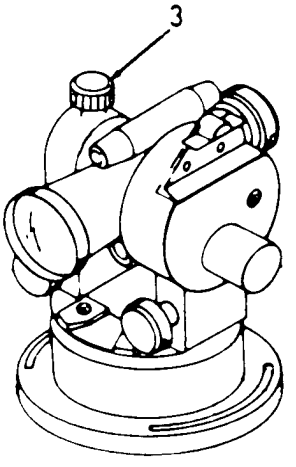


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

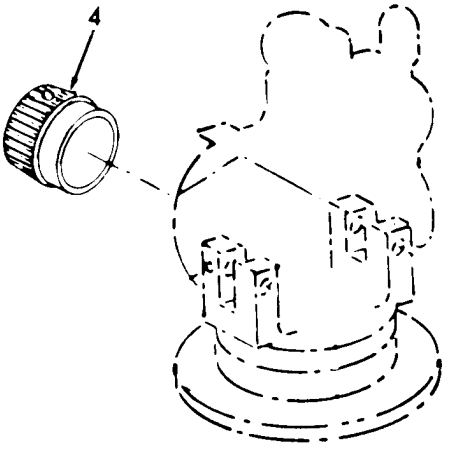
(2) Caging knob (2). The CAGE-UNCAGE knob on the upper housing of the GRU is used to uncage the pendulum in the bias mode and after the gyro motor attains synchronous speed in the GC (gyrocompass) mode. Also, the caging knob is used for caging the pendulum after bias and after the GC has been completed. Illumination of the GYRO SYNC indicator on the ECU is necessary prior to activating the CAGE-UNCAGE knob when in the GC mode.



(3) Vertical lock (3). The vertical lock on the theodolite permits the operator to lock the telescope at any desired vertical position. When the vertical lock is released (turned counterclockwise) the telescope is free to be moved to any vertical position.



(4) Elevation control (4). The elevation control permits the operator to control the vertical positioning of the telescope. The control is used to center the target image vertically in the reticle pattern of the telescope.

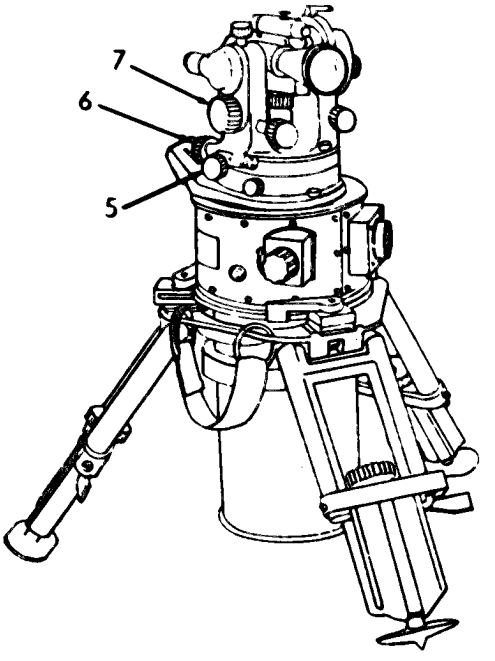


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

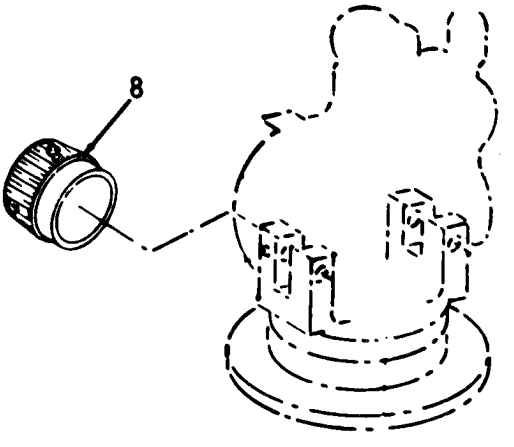
(5) Horizontal lock (5). The horizontal lock on the theodolite permits the operator to lock the theodolite at any desired horizontal position. The lock is released when it is necessary to rotate the theodolite; light finger torque is applied to lock the theodolite at the desired position.

(6) Azimuth control (6). The azimuth control permits the operator to adjust the horizontal position of the theodolite. The control is used to center the target image horizontally in the reticle pattern of the telescope.

(7) Micrometer control (7). The micrometer control on the theodolite permits the operator to adjust the full range of the vernier scale to obtain an accurate horizontal and vertical scale reading.

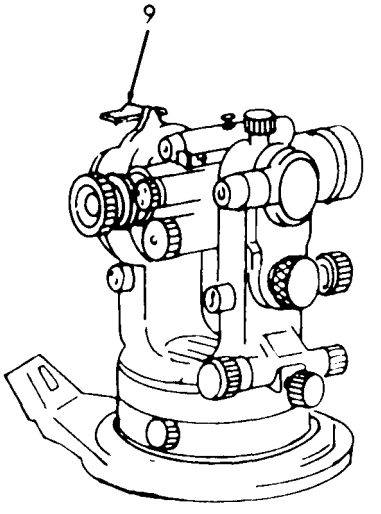


(8) Altitude level control (8). The altitude level control adjusts the position of the altitude level and V circle (vertical) optical scale. When the level displays a level condition, the vertical portion of the scale is automatically referenced to horizontal level for elevation angle readings.

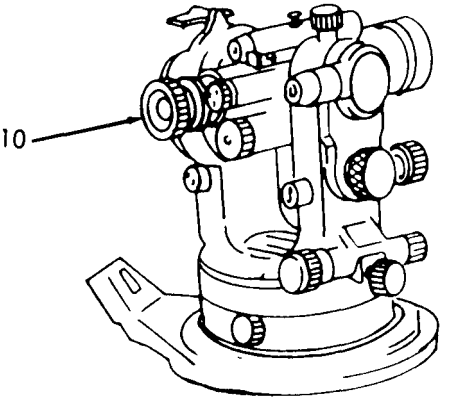


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

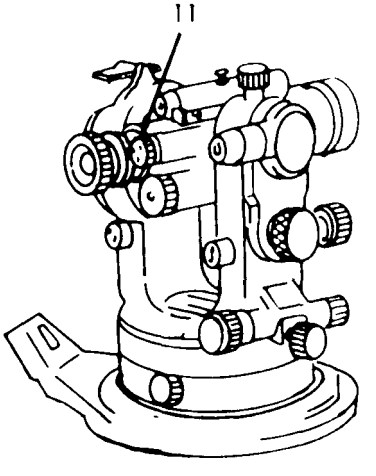
(9) Altitude level mirror (9). The altitude level mirror is manually adjustable to permit the operator to see the altitude level without changing from a telescope and azimuth scale reading position.



(10) Reticle focus control (10). The reticle focus control on the telescope eyepiece permits the operator to adjust the reticle pattern to a sharp focus. The reticle focus control is used in conjunction with the reticle lamp illumination control during night use.

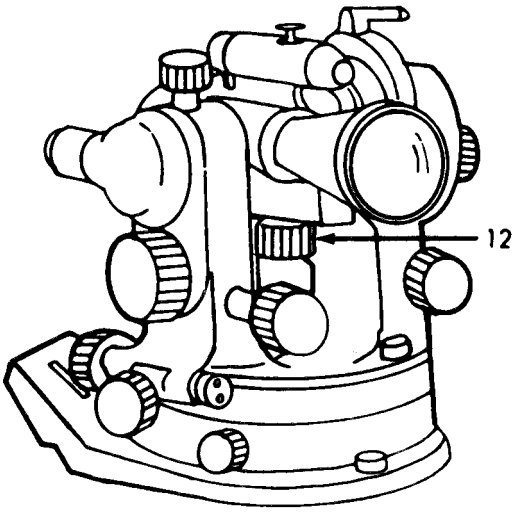


(11) Telescope focus control (11). The telescope focus control permits the operator to adjust the focal length of the telescope to see a target.

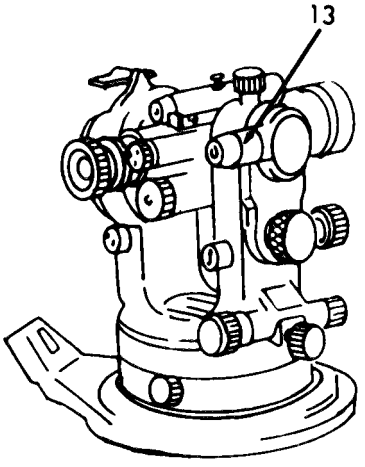


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

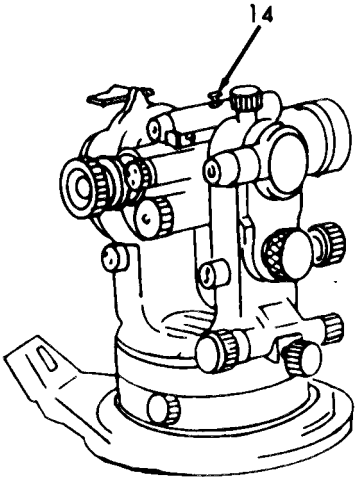
(12) Reticle illumination control (12). The reticle illumination control adjusts the intensity of the lighting of the reticle pattern during night operations. The light intensity is adjusted in conjunction with the reticle focus control to obtain a clear, sharp image of the reticle pattern.



(13) Microscope focus control (13). The microscope focus control permits the operator to adjust the focus of the microscope to present a clear, sharp image of the optical scales.

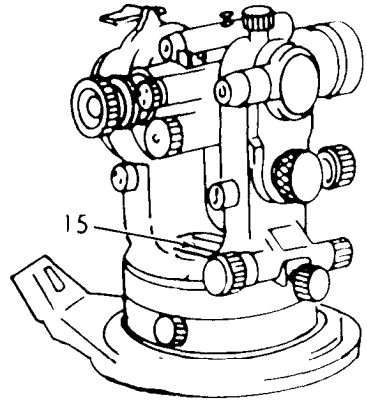


(14) Magnetic compass plunger (14). The plunger on the magnetic compass locks the compass needle in a fixed position to protect it from vibration and shock when not in use. Pressing the plunger releases the locking mechanism and permits the spring-mounted needle to move freely. The magnetic north direction is indicated when the two points of the needle are in coincidence.



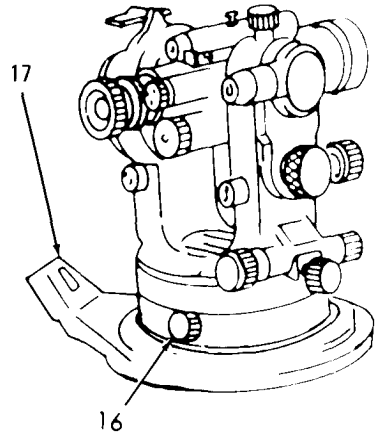
2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

(15) Plate level (15). The plate level is provided to indicate the level of the theodolite and the GRU.

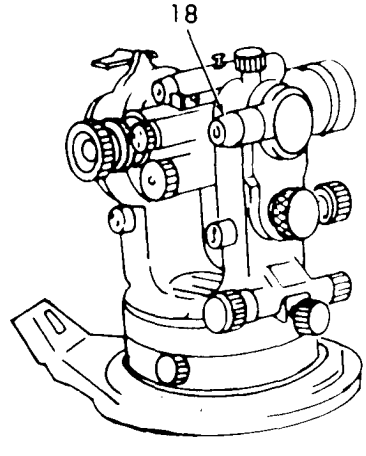


(16) Horizontal circle setting control (16). The horizontal circle setting control is used to set the horizontal circle during theodolite calibration.

(17) Mounting plate and reference mirror (17). The theodolite calibration mounting plate and reference mirror are used for aligning the theodolite horizontal circle with the follow-up by providing a fixed reference point. Alignment of the horizontal circle is accomplished with power on and prior to the beginning of the azimuth determination operation.



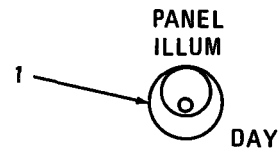
(18) Theodolite scale lamp eyepiece (18). The theodoiite scale lamp eyepiece is used to view the optical scales. The eyepiece can be swiveled to allow the optical scales to be viewed from any position.

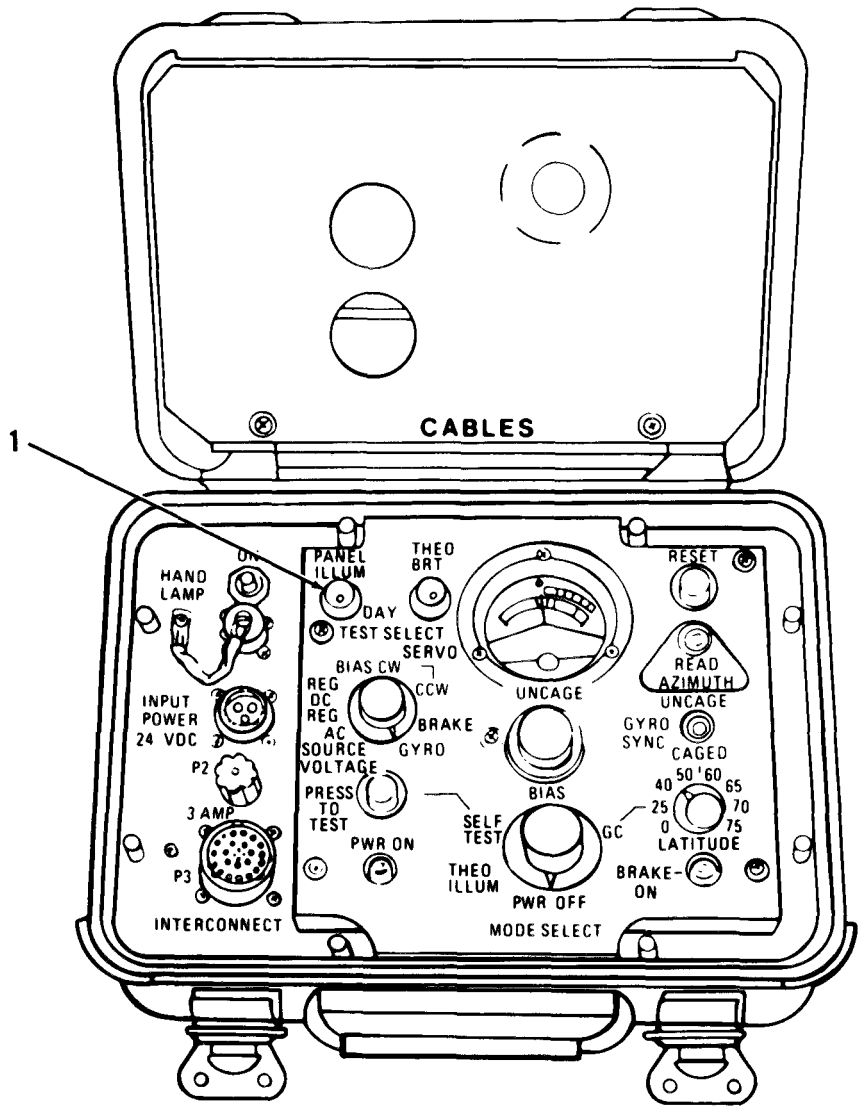


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

b. Electronic Control Unit (ECU)

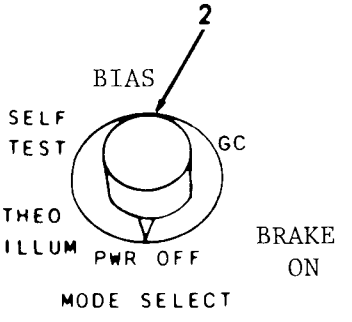
(1) Panel illumination control (1). The PANEL ILLUM control enables the operator to illuminate the panel during night use. During day operations the control is rotated fully counterclockwise. To illuminate the panel for night operations, the control is rotated clockwise.



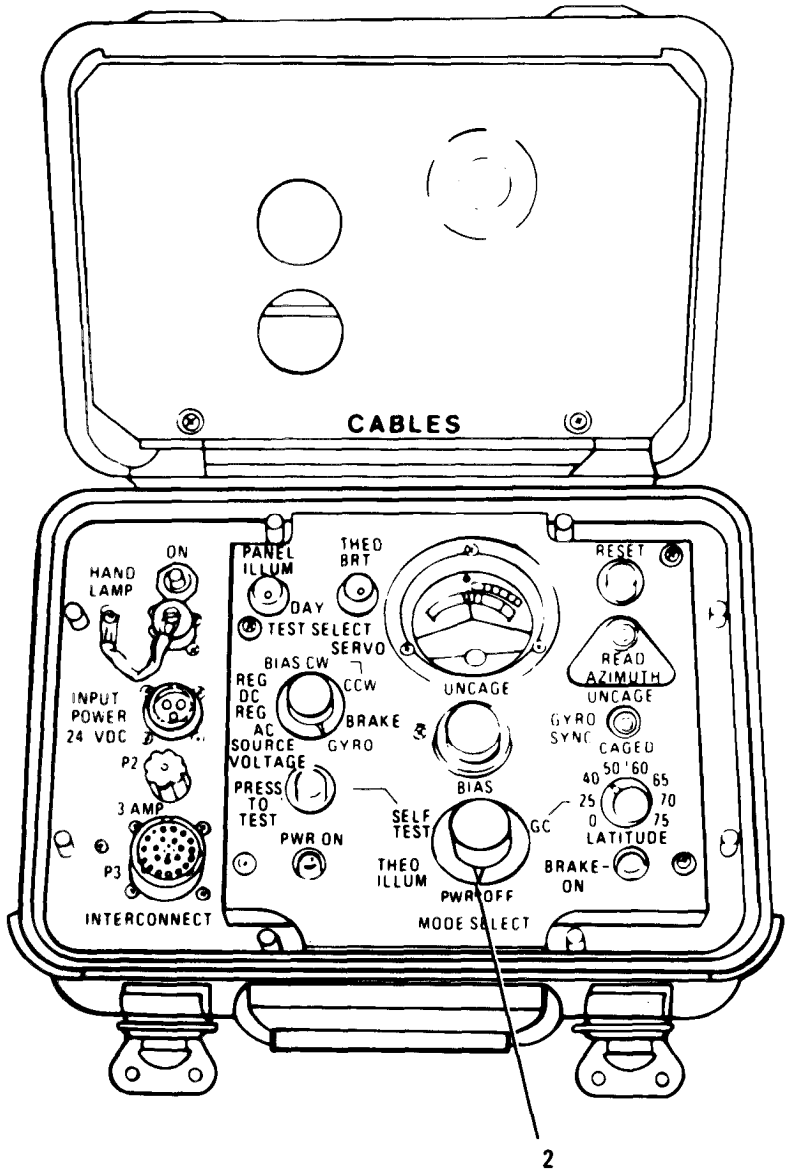


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

(2) Mode select switch (2). The MODE SELECT switch is maintained in the PWR OFF position when the equipment is not in operation. Placing the switch in THEO ILLUM position lights the telescope reticle, the scales and the autocollimation eyepiece. Placing the switch in the SELF TEST position enables the operator to perform assurance tests of the equipment before and during operation. The determination and setting of bias conditions is accomplished with the use of the MODE SELECT switch in the BIAS position. Placing the switch to GC (gyro compassing) applies power to the gyro motor and initiates the alignment operation of the instrument. Through the BRAKE ON position, the gyro motor is stopped when it is desired to repeat alignments or shut down the instrument. With the MODE SELECT switch in the THEO ILLUM position, all system power is off except to the theodolite. In this mode the theodolite may be used for determining azimuths from the original north determination, but the azimuth should be verified by re-reading to the target after caging and braking of the gyro wheel. In this mode the theodolite can also be used for any normal theodolite procedure.

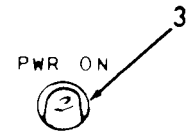


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

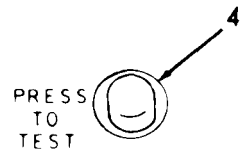


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

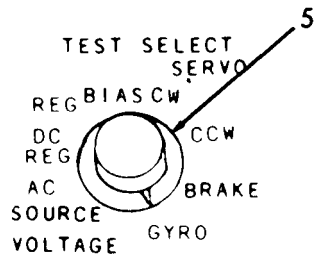
(3) Power on indicator (3). The application of power to the system is indicated by the illumination of the PWR ON indicator. Failure of the indicator to light when the ECU is connected to a power source, and when the MODE SELECT switch is moved from the PWR OFF or THEO ILLUM positions, indicates a malfunction in the system.



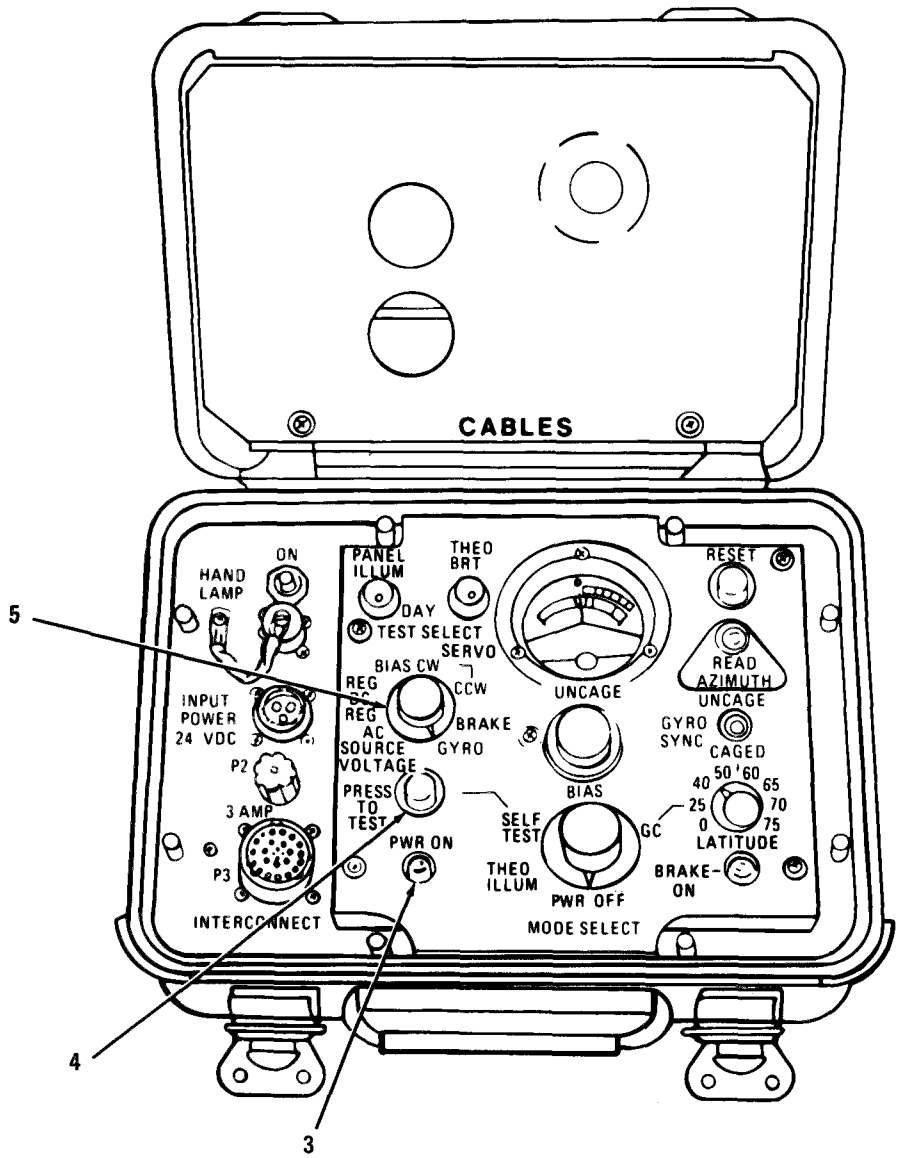
(4) Press to test switch (4). The PRESS TO TEST switch is pressed to obtain a TEST METER indication for each test position setting of the TEST SELECT switch. Operation of the PRESS TO TEST switch is needed only during the self-test procedure to obtain an indication on the TEST METER.



(5) Test select switch (5). The TEST SELECT switch is used in conjunction with the TEST METER to check subsystems of the equipment and stages of operation. During self-test operations, the selector switch is placed to each of its positions. At each position the PRESS TO TEST switch is pressed and operability of the associated circuit is indicated on the TEST METER (pointer in green area for all but SOURCE VOLTAGE, which is displayed on the upper meter scale and GYRO, which should center in yellow area).

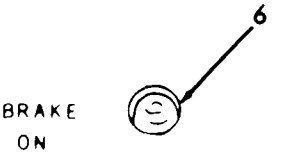


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

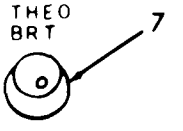


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

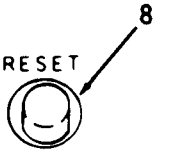
(6) Brake on indicator (6). The BRAKE ON indicator is illuminated when the MODE SELECT switch is placed to BRAKE ON, initiating the braking sequence. At the completion of the sequence, a 90-second dynamic braking of the gyro motor, the BRAKE ON indicator light will be extinguished.



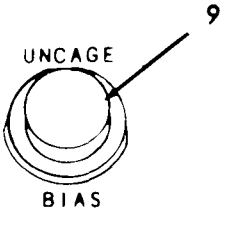
(7) Theodolite brightness control (7). Control of the theodolite lamp brightness is provided through the THEO BRT control. Rotating the control clockwise increases the intensity of the light.



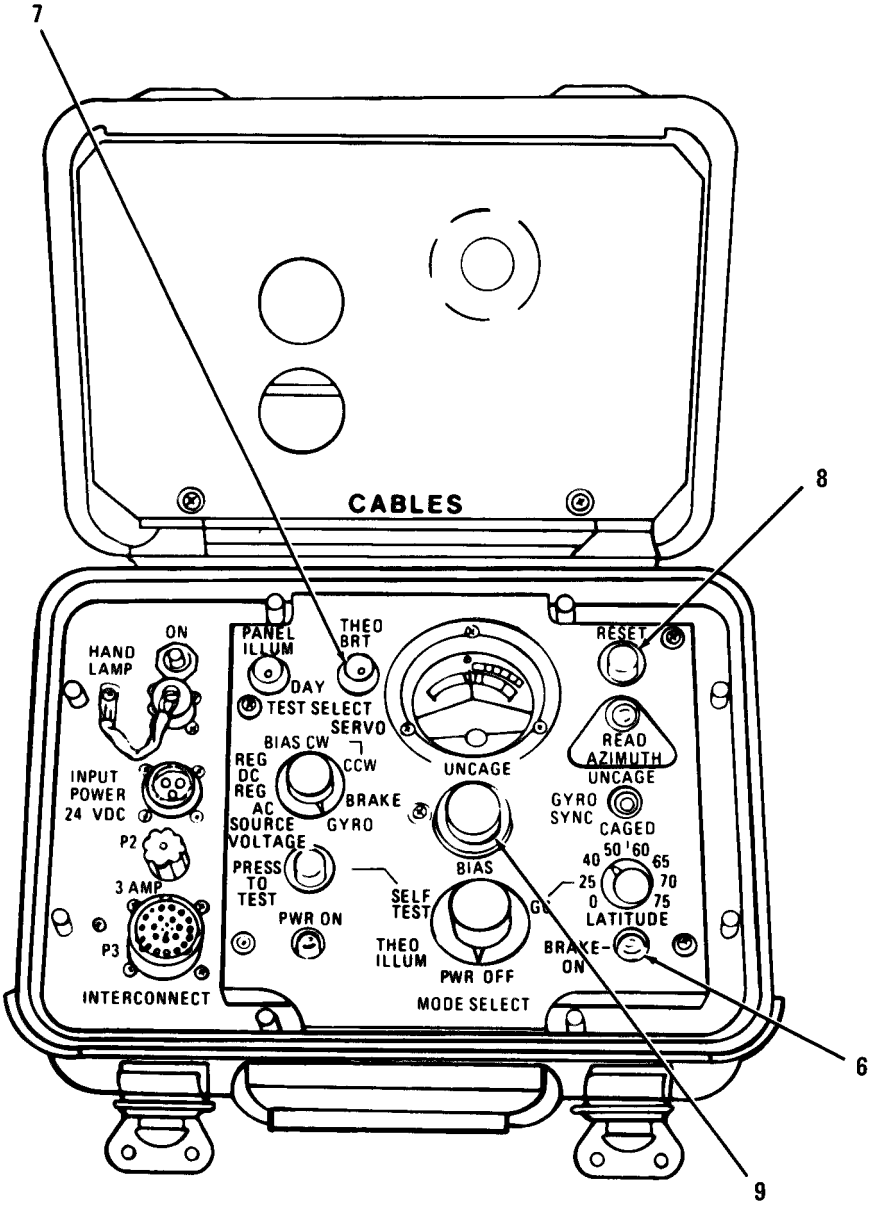
(8) Reset switch (8). The RESET switch enables the operator to reinitiate the gyrocompass interval. Pressing the RESET switch extinguishes the READ AZIMUTH indicator and reinitiates gyrocompass action for a minimum of 45 seconds.



(9) Bias control (9). Following self-test operations, the instrument is adjusted for bias through the BIAS control. Rotating the BIAS control clockwise will move the pointer to the right, and counterclockwise rotation will move the pointer to the left. Careful attention shoud be given to positioning the pointer in the center of the scale to ensure the highest degree of accuracy.

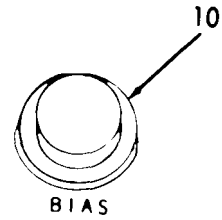


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued



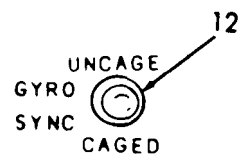
2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

(10) Bias lock (10). The BIAS LOCK mechanically holds the BIAS CONTROL in the set position to prevent an accidental movement.

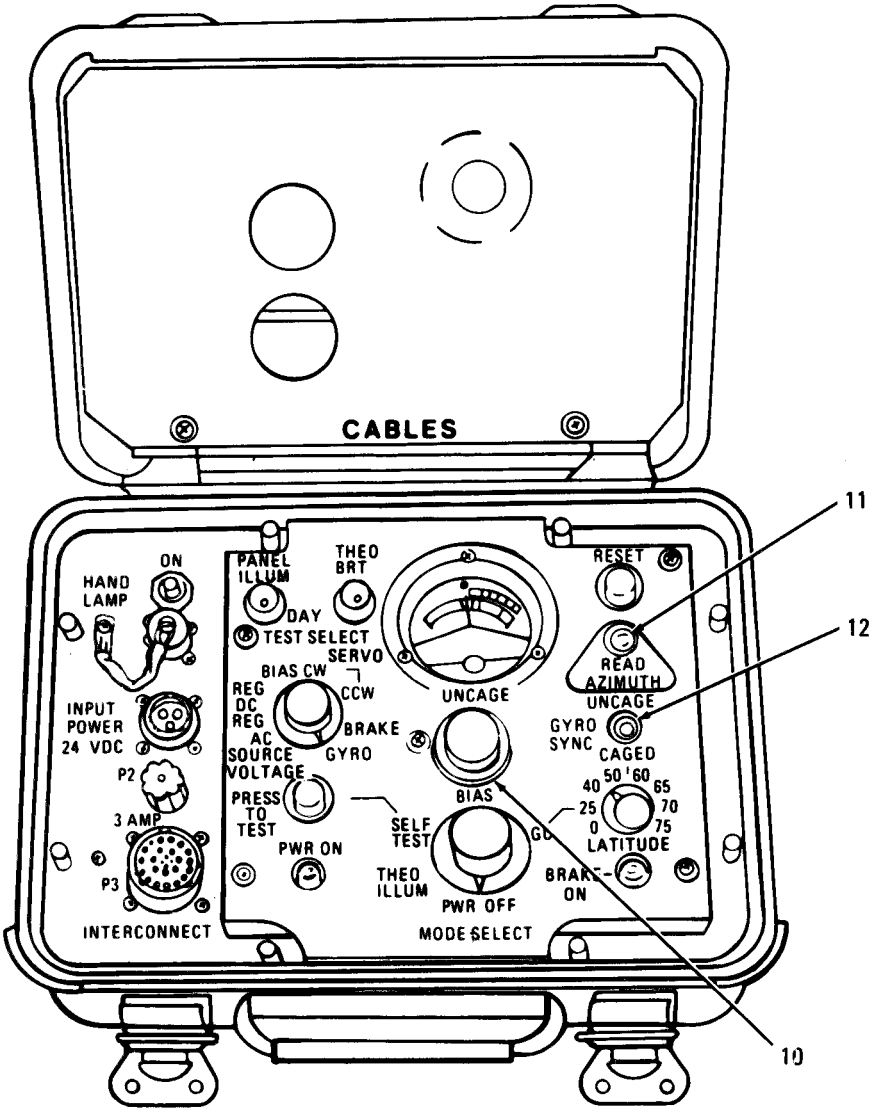


(11) Read azimuth indicator (11). The READ AZIMUTH indicator is illuminated when true north has been obtained; light is applied automatically to the theodolite scale for azimuth reading.

(12) Gyro sync indicator (12). Illumination of the GYRO SYNC indicator indicates that the gyro motor has attained synchronous speed. When the GYRO SYNC indicator illuminates the CAGE-UNCAGE knob on the GRU, the GRU is to be rotated to UNCAGE (clockwise rotation). Under normal operating conditions, in temperatures above 15°F (-9.4°C), the GYRO SYNC indicator illuminates two minutes after the instrument is energized.

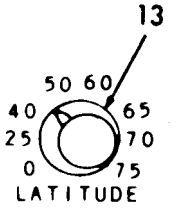


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued



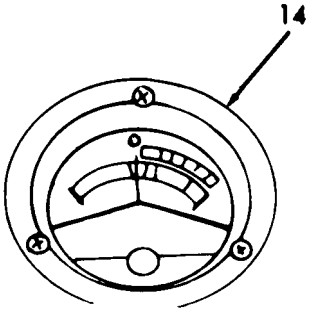
2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

(13) Latitude select switch (13). The LATITUDE select switch is provided to maintain instrument operating time at different latitudes of operation. The switch is adjustable with a screwdriver and contains eight positions. The switch positions and corresponding latitudes of operation are as follows:

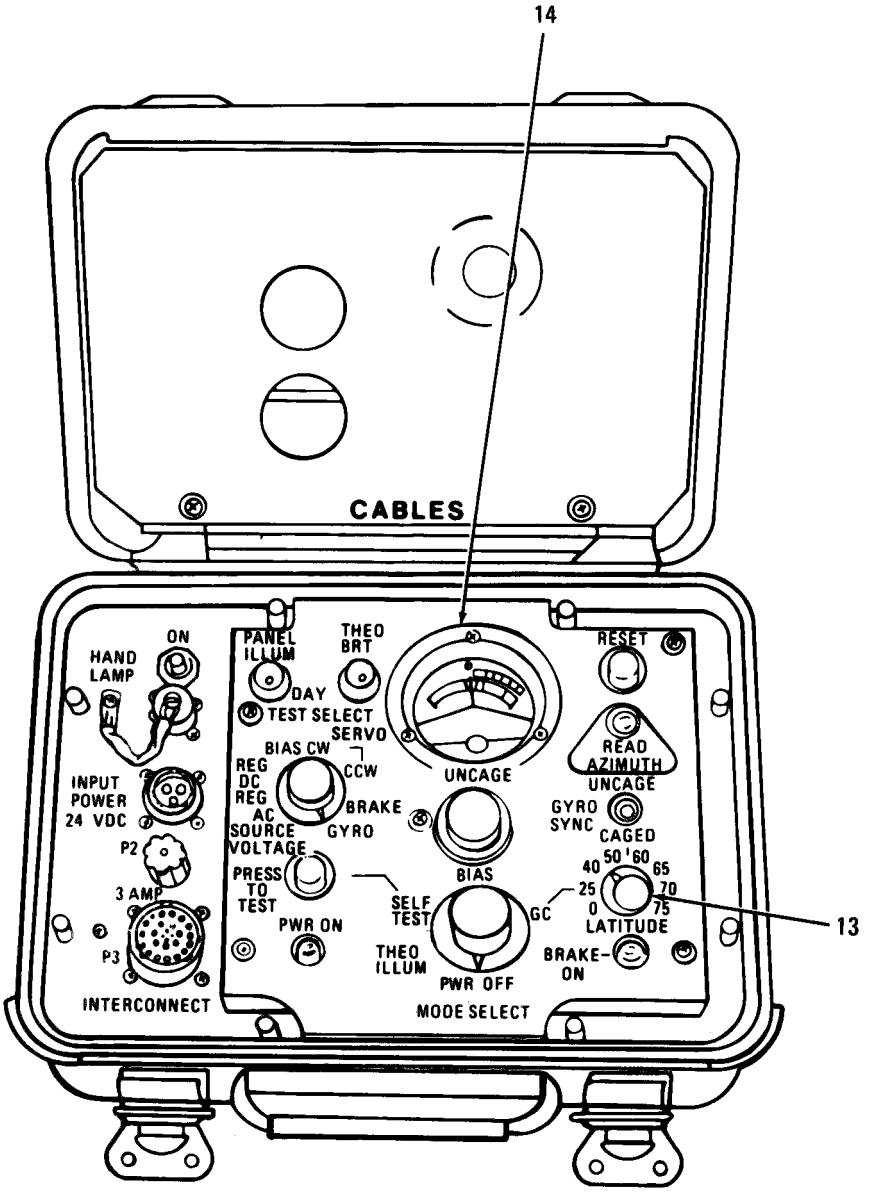


Switch Position	Latitude of Operation
0	0-15 degrees
25	15-30 degrees
40	30-45 degrees
50	45-55 degrees
60	55-63 degrees
65	63-67 degrees
70	67-73 degrees
75	73-75 degrees

(14) Test meter (14). The TEST METER provides a visual indication of operational status of the instrument in both testing and operating modes. Satisfactory operation of the circuits associated with TEST SELECT switch position is indicated by the meter pointer. The meter and the TEST SELECT switch are used in conjunction with the PRESS TO TEST switch, which must be actuated to obtain meter indications during self-test operation. When the TEST SELECT switch is in the SOURCE VOLTAGE position, the input voltage may be read on the voltage scale on the right side of the meter scale. When the TEST SELECT switch is in the GYRO position, the meter pointer should center in the yellow area. When the TEST SELECT switch is in any other position, the meter pointer should be in the green area.

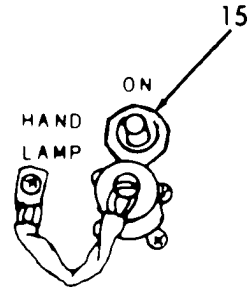


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

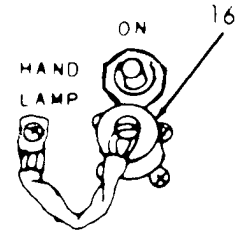


2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

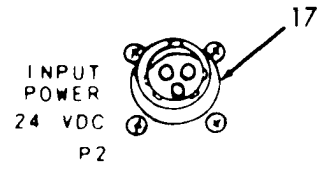
(15) Hand-lamp switch (15). The HAND-LAMP switch is provided to turn the hand-lamp on or off.



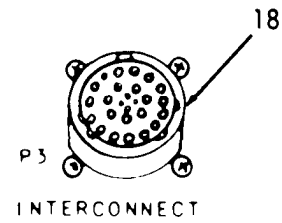
(16) Hand-lamp connector (A2J1) (16). Connects the hand-lamp to the ECU.



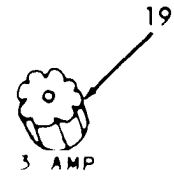
(17) Input power connector (A2J2) (17). Connects the ECU to the electrical power source.



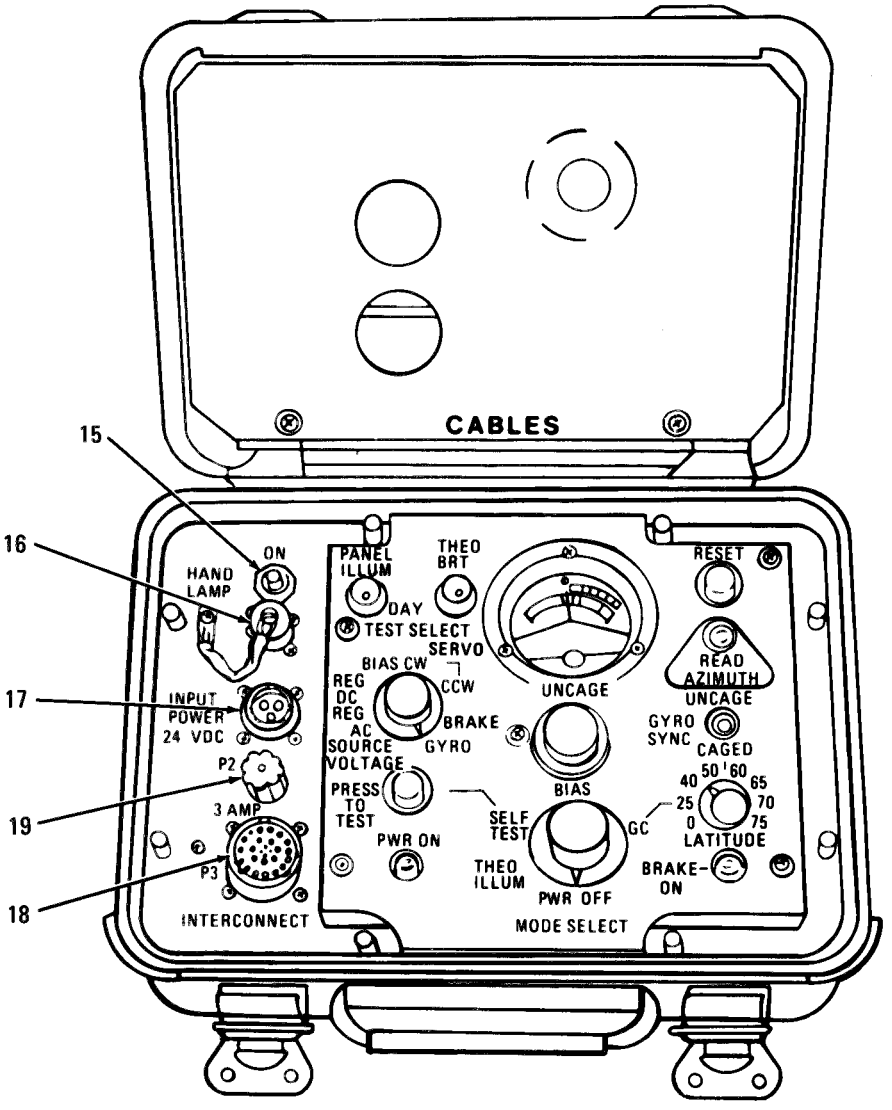
(18) Interconnect connector (A2J3) (18). Connects the GRU to the electronic control unit.



(19) Fuse holder (19). A receptacle for the 24 Vdc, 3 amp fuse which is used to protect the electric parts from damage in the event of a power overload.



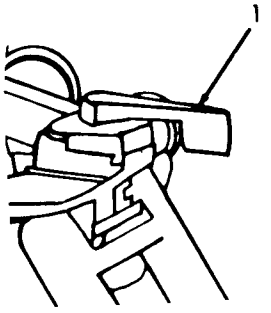
2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued



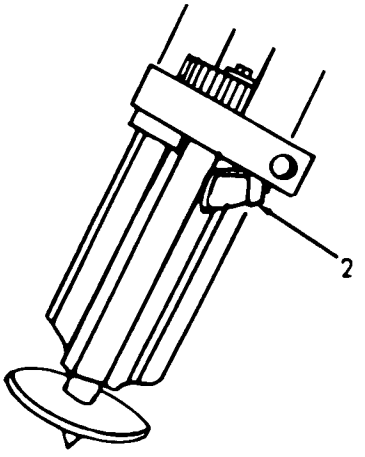
2-1. OPERATOR'S CONTROLS AND INDICATORS - Continued

c. Tripod

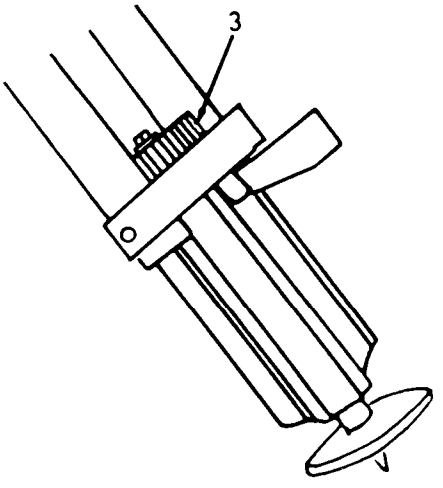
(1) Hold-down clamps (1). The three hold-down clamps on the tripod assembly are provided to secure the GRU to the tripod assembly. A lever on each clamp is provided to release the GRU when it is necessary to rotate or laterally move the GRU for preorientation or plumbing.



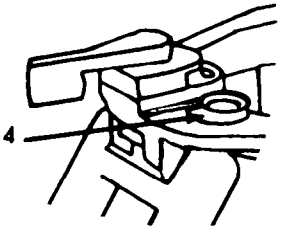
(2) Tripod leg clamps (2). Leg clamps are provided on each leg of the tripod for controlling the elevation of the assembly. Loosening the leg clamps permits the center section of the legs to be extended or retracted for coarse adjustment.



(3) Fine-level adjustment knob (3). Provisions for leveling the tripod assembly are provided by fine-level adjustment knobs on each leg.



(4) Tripod circular level (4). A level vial is provided on the base plate of the tripod to indicate the coarse level of the assembly.



Section II. PREVENTIVE MAINTENANCE

CHECKS AND SERVICES (PMCS)

2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES - GENERAL

a. To ensure that the surveying instrument is ready for use at all times, deficiencies must be discovered and corrected before serious damage or failure results. All deficiencies and shortcomings will be recorded, together with corrective action taken, on DA Form 2404 (Equipment Inspection Maintenance Worksheet) (see form on following page) at the earliest opportunity.

b. Before you operate: Always keep in mind the **CAUTIONS** and **WARNINGS.** This is for your protection. Perform your before (B) 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.

e. Perform operator's preventive maintenance checks and services in accordance with the instructions in the PMCS Table.

2-3. PMCS PROCEDURES

Your Preventive Maintenance Checks and Services table lists the inspections and care of the equipment required to keep it in good operating condition.

a. The **ITEM NO.** column refers to the number used in the illustrations.

b. The **INTERVAL** column tells when to perform a certain check or service:

B = Before operating.

A = After operating.

c. The **ITEM TO BE INSPECTED** column indicates the name of the item.

d. The **PROCEDURE** column describes the checks or services to be performed.

e. The **EQUIPMENT IS NOT READY/AVAILABLE IF:** column describes the conditions under which the equipment may not be used.

2-4. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS TABLES)

NOTE

- **Within designated intervals, these checks are to be performed in the order listed. Report deficiencies IAW DA PAM 738-750.**
- **The item number column shall be used as a source of item numbers for the "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.**

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before operation A - After operation

Item no.	Interval B	Interval A	Item to be inspected	Procedure	Equipment is not ready/available if:
1	•		Transport Case	Exterior Inspect for damage. Inspect latches for proper operation and security. Check pressure relief valve for proper operation. Report damage and defects to Organizational Maintenance. Cleanliness. Inspect both exterior and interior surfaces for cleanliness. Use clean cloths and general purpose cleaners to remove dirt, grease, and foreign material.	Latches are inoperable or broken.

2-4. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS TABLES) - Continued

Item no.	Interval B	Interval A	Item to be inspected	Procedure	Equipment is not ready/available if:
2	•	•	Accessories	Inspect for full complement of accessories contained in: a. Transport case b. Winterization kit c. Adapter assembly d. Spares Report missing, damaged, or unserviceable equipment to Organizational Maintenance personnel and obtain replacements.	Any accessories are damaged or missing.
3	•	•	Cable Assemblies	Inspect cables for damaged insulation and connectors for both bent or broken pins. Report damage to Organizational Maintenance.	Cable is defective.
4	•	•	AC-DC Converter	Inspect exterior for damage. Check that cap and chain assemblies are securely fastened on electrical receptacles.	Converter is damaged or cap and chain assemblies are defective.
5	•	•	Transit Case	Exterior. Inspect for damage. Inspect latches for proper operation and security. Report damage and defects to Organizational Maintenance.	Latches are inoperable or broken.

2-4. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS TABLES) - Continued

Item no.	Interval B	Interval A	Item to be inspected	Procedure	Equipment is not ready/available if:
5	•	•	Transit Case (Continued)	Interiors. Inspect isolators for damage. Report damage to Organizational Maintenance. Cleanliness. Inspect both exterior and interior surfaces for cleanliness. Use clean cloths and general purpose cleaners to remove dirt, grease, and foreign material.	Isolators are damaged or missing.
6	•	•	Gyroscopic Reference Unit.	Check that GRU is securely held in tripod by hold-down clamps, and check that tripod is secure. Inspect GRU subassemblies. Inspect structure, control knobs, and electrical connectors for damage. Report damage to Organizational Maintenance.	Hold-down clamps are missing or inoperative. Control knobs missing or damaged. Electrical connectors are damaged.
7	•	•	Theodolite	Inspect theodolite for damage. Check controls for smoothness of operation. Inspect optics and glass surfaces for damage. Report inoperative or damaged equipment to Organizational Maintenance.	Any controls are inoperable or damaged. Theodolite is damaged.

2-4. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS TABLES) - Continued

Item no.	Interval B	Interval A	Item to be inspected	Procedure	Equipment is not ready/available if:
8	•	•	Electronic Control Unit	Inspect exterior of case for damage. Inspect hand lamp assembly. Inspect cables for broken insulation and damaged connectors. Components discovered to be defective through testing or operation are to be replaced as specified.	Cables or connectors are damaged or defective. Lamp is inoperative.
9	•	•	Wind Shelter	Inspect for ripped seams and torn or frayed edges. Use soap and water to remove dirt, grease, and foreign material from wind shelter.	

Section III. OPERATION UNDER USUAL CONDITIONS

CAUTION

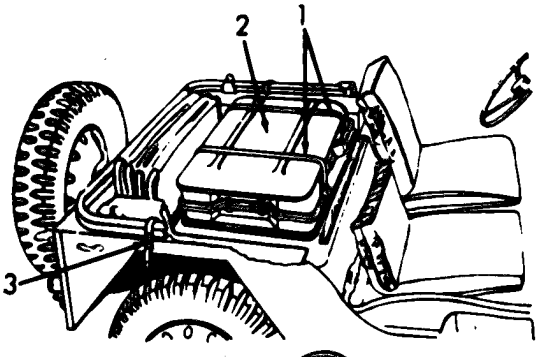
- **Avoid exposure of the equipment to dust, soil, or other abrasive materials.**
- **If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.**
- **Exercise care when unloading the transport cases from vehicles. Do not stand or walk on the cases, and do not stack more than three cases high, as damage to the equipment may result. Use handles provided on the cases for safety and ease of handling.**

2-5. ASSEMBLY AND PREPARATION FOR USE

REMOVING TRANSPORT CASE FROM VEHICLE

a. Unfasten retaining straps (1).

b. Remove transport case (2) from vehicle (3).



UNPACKING EQUIPMENT

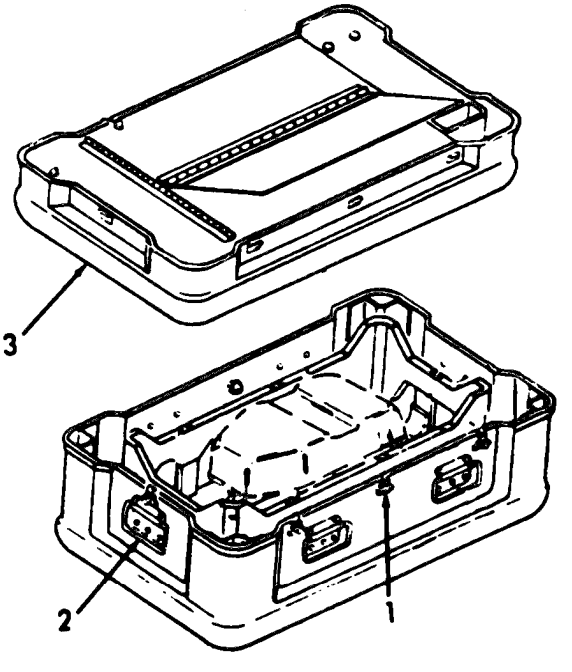
a. Transport Case

(1) Press pressure relief valve (1) to release pressure in case.

(2) Unfasten latches (2) securing upper section.

(3) Remove upper section (3).

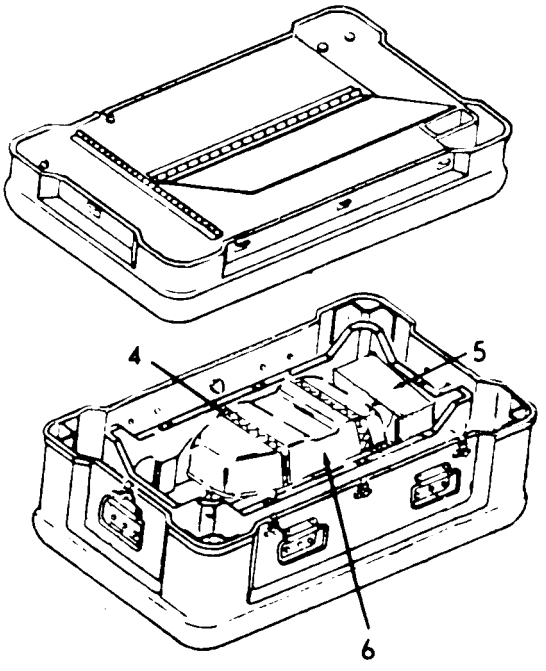
(4) Inspect equipment for damage and for loose or missing parts.



2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

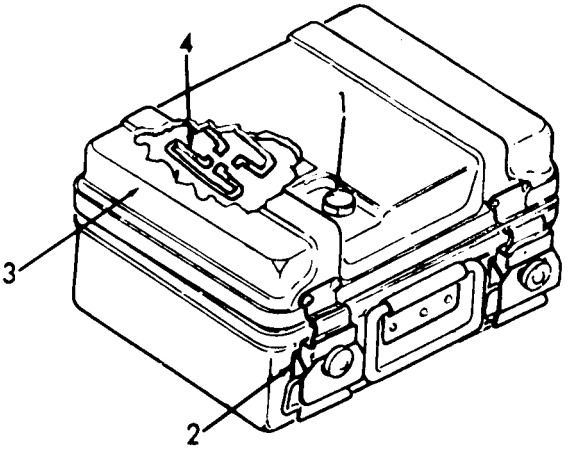
UNPACKING EQUIPMENT - Continued

Auxiliary Equipment and Accessories
Transport Case
a. AC Power cable
b. Battery adapter cable
c. DC Power extension cable
d. DC Power adapter cable
e. Jumper cable
f. Winterization kit
g. Shoulder and waist harness
h. Tripod adapter assembly
i. Spare fuses
j. Spare lamps
k. Spare knobs
l. Tools
m. Operator and Organizational Maintenance Manual
n. AC-DC Converter



(5) Unfasten strap latches (4) securing ECU and transit case.

(6) Remove ECU (5) and transit case (6).



(7) Press pressure relief valve (1) on ECU case.

(8) Unfasten latches (2) on ECU case.

(9) Remove cover (3).

(10) Remove cables (4) from case cover.

2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

UNPACKING EQUIPMENT - Continued

NOTE

Remove auxiliary equipment required for operation from the transport case storage compartments.

b. Transit Case

(1) Press pressure relief valve (1).

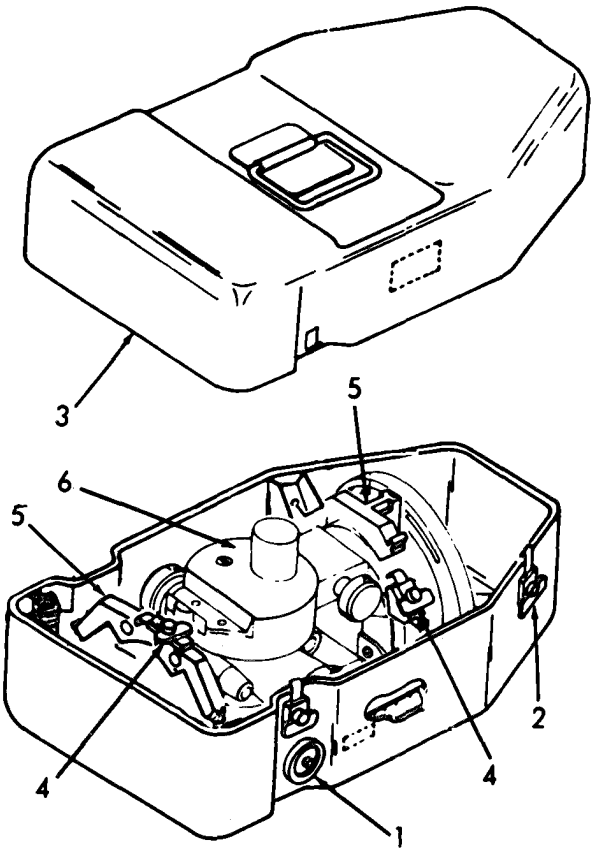
(2) Unfasten latches (2) securing upper and lower sections.

(3) Remove upper section (3).

(4) Unfasten latches (4) and open clamps (5) securing GRU in transit case.

(5) Remove GRU (6) from case.

(6) Inspect equipment for damage and for loose or missing parts.



Auxiliary Equipment and Accessories
Transit Case a. Dusting brush b. Plumb bob assembly c. Eyepiece prism (right angle) d. Eyepiece sun filter e. Spare lamps f. Horizontal circle setting tool g. Fuse h. Rain and dust cover

2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

UNPACKING EQUIPMENT - Continued

CAUTION

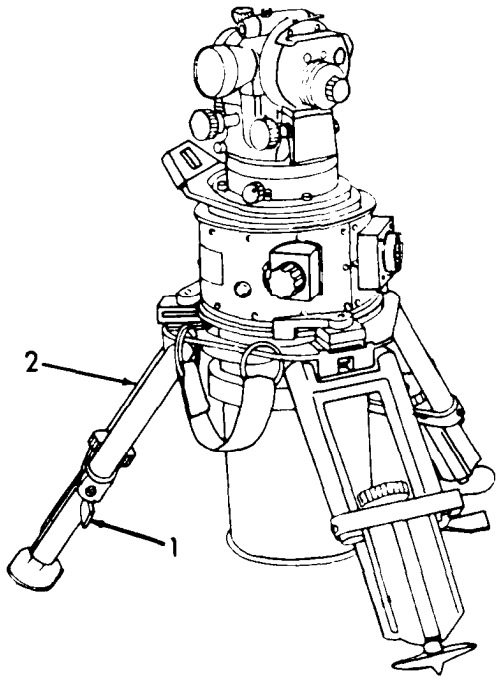
Avoid exposure of the equipment to dust, soil or other abrasive materials.

SETTING-UP GYROSCOPIC REFERENCES UNIT (GRU) AND TRIPOD

a. Loosen leg clamp (1) on each leg of tripod.

b. Extend each leg to about 1/4 inch (.64 cm) from full extension.

c. Tighten clamps (1) to secure adjustable legs (2).



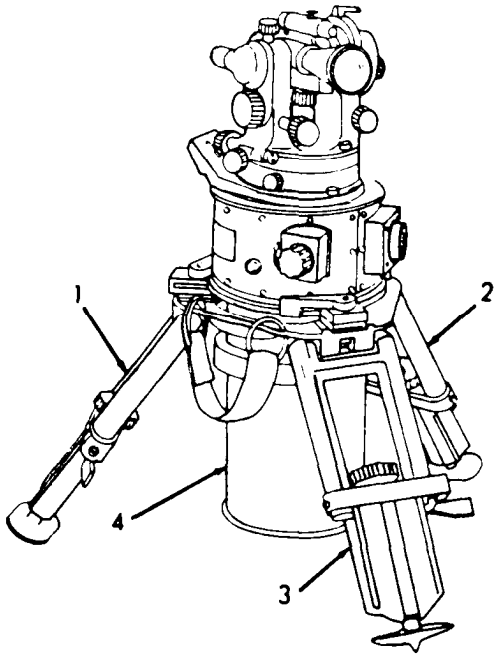
CAUTION

The legs of the tripod assembly are hinge-mounted and can swing beyond a normal standing position. Exercise care to avoid spreading the legs excessively and knocking the GRU against the ground surface.

d. Spread the tripod legs (1,2 and 3) outward to obtain a level condition while standing the unit (4) in a vertical position over a selected location.

NOTE

Perform preventive maintenance checks and services as specified in PMCS chart.



2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

AUXILIARY TRIPOD

CAUTION

Make sure that the auxiliary tripod is leveled when setting up the equipment. Binding of the tripod (6) legs may occur during adjustment if the auxiliary tripod is not leveled.

NOTE

The GRU maybe operated with or without the use of an auxiliary tripod. The auxiliary tripod is used when operation of the equipment from a standing position is required.

a. Spread auxiliary tripod legs (1) outward to obtain a level condition while standing the assembly in a vertical position over a selected position.

b. Remove tripod adapter assembly (2) from transport case storage compartment.

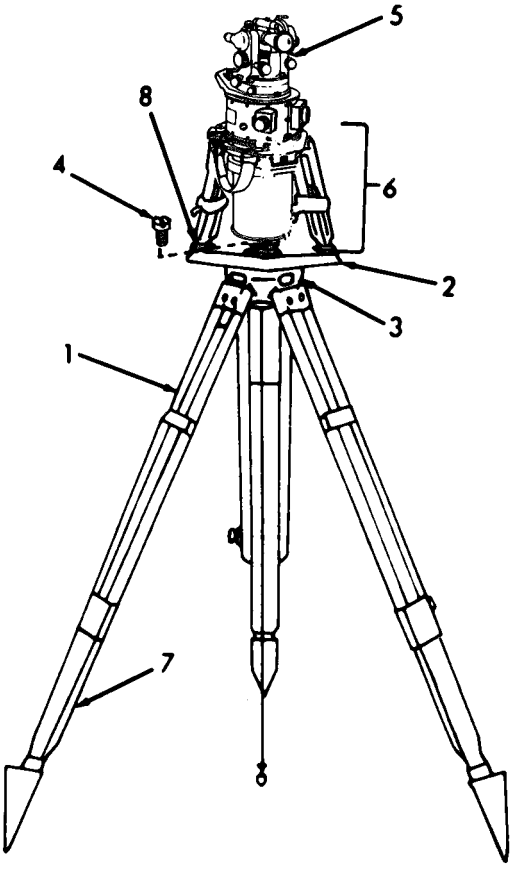
c. Center and position each tripod adapter leg at the apex (3) of the auxiliary tripod plate (2).

d. Secure with bridge screw (4) attached to tripod plate.

e. Place GRU (5) and tripod (6) on tripod adapter assembly (2).

f. Place tripod leg spades (7) in receptacles provided in each leg of the adapter assembly.

g. Secure tripod (6) to adapter assembly (2) with space latches (8).



2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

AUXILIARY TRIPOD - Continued

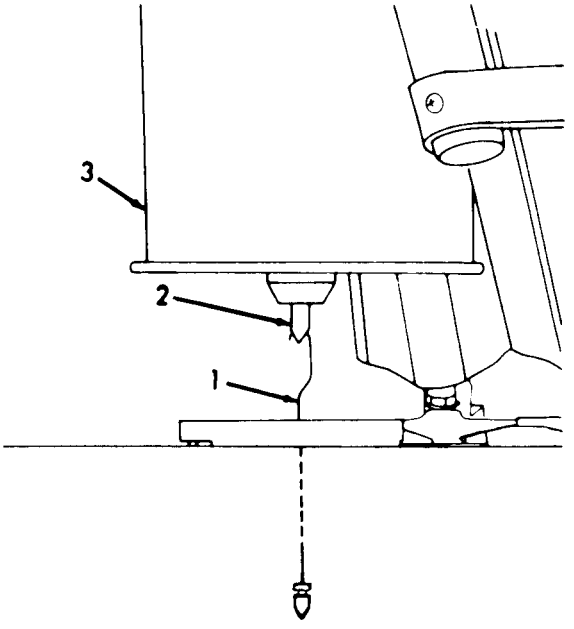
NOTE

If a plumb bob is to be used for centering the instrument over a fixed reference point, use the plumb bob assembly stored in the transit case.

h. Insert extension hook (1) through the bridge screw and attach to the pointer (2) on the underside of GRU housing (3).

i. Attach plumb bob assembly to plumb pointer (2).

j. Adjust cord length to position plumb bob approximately over fixed reference point.



CAUTION

Make sure adapter assembly is firmly attached.

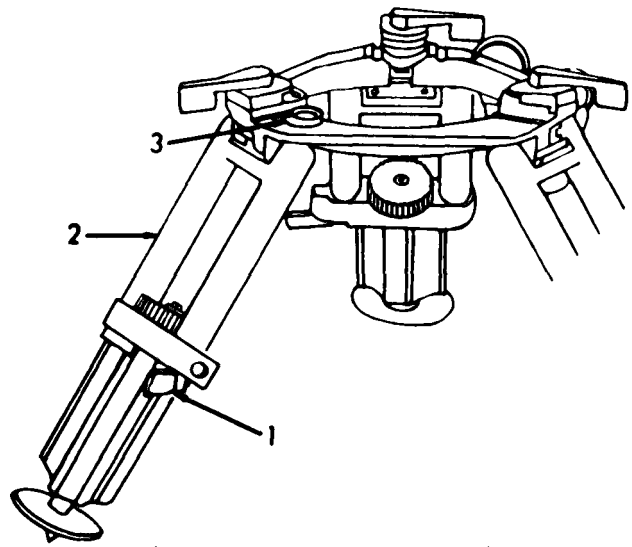
k. Turn auxiliary tripod to position point of plumb bob over the fixed reference point. Check plumb bob extension hook (1) to be sure that it is not touching the sides of the bridge screw.

2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

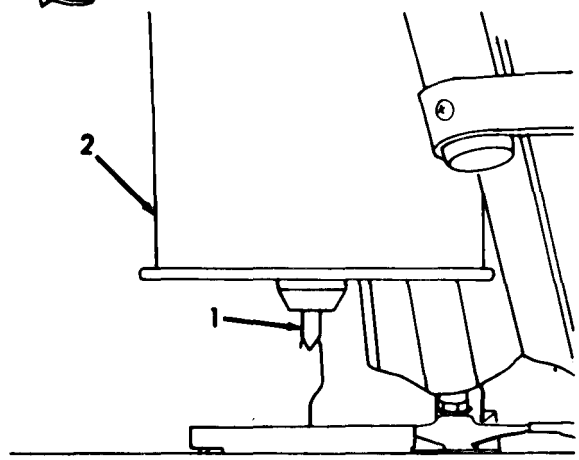
COARSE LEVELING OF UNIT

a. Coarse level the instrument by releasing one of the tripod leg clamps (1).

b. Adjust the leg (2) to obtain a level indication on the tripod circular level (3). Repeat procedure for each of the other two legs.

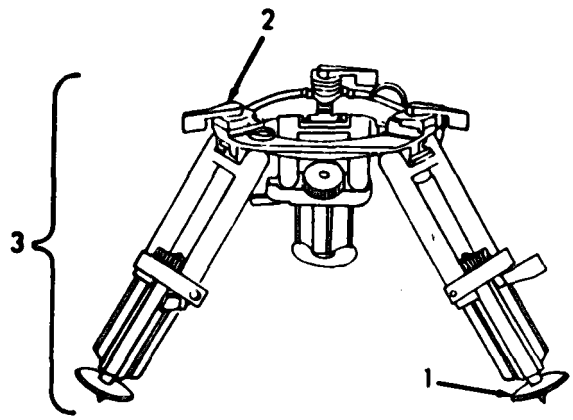


c. If the unit is to be centered over a fixed reference point, extend the plumb pointer (1) located on the bottom of the GRU housing (2)



d. Place the GRU on the ground so that the pointer is close to the fixed point and press leg spades (1) into the ground.

e. Release hold down clamps (2) on tripod (3) and shift GRU in the tripod to position the pointer over the fixed reference point.



2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

COARSE LEVELING OF UNIT – Continued

f. Rotate theodolite alidade (1) to position objective end of telescope over the NORTH mark on GRU. Tighten horizontal lock (2).

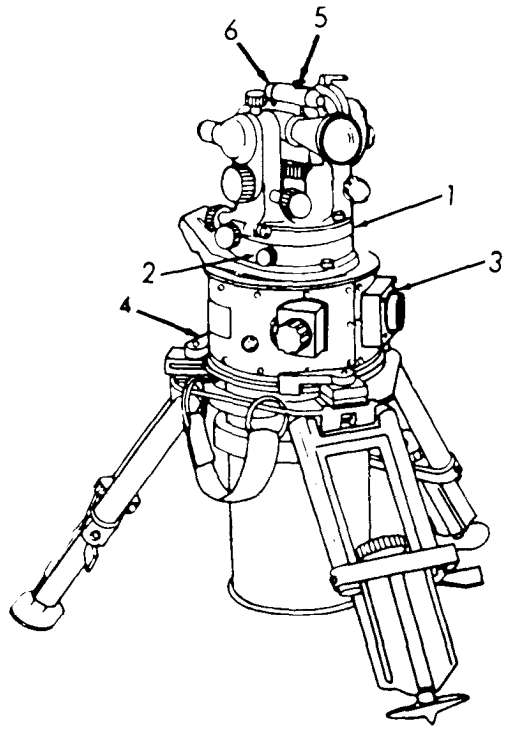
g. Preorient GRU (3) to NORTH by releasing tripod hold-down clamps (4) and rotate GRU in the tripod until the two magnetic compass images coincide.

h. With telescope level, depress plunger (5) on magnetic compass (6).

NOTE

Check to ensure that the plumbing pointer is still over the fixed reference point.

i. Tighten each of the three hold-down clamps (4) on the tripod.



POWER CABLE INSTALLATION

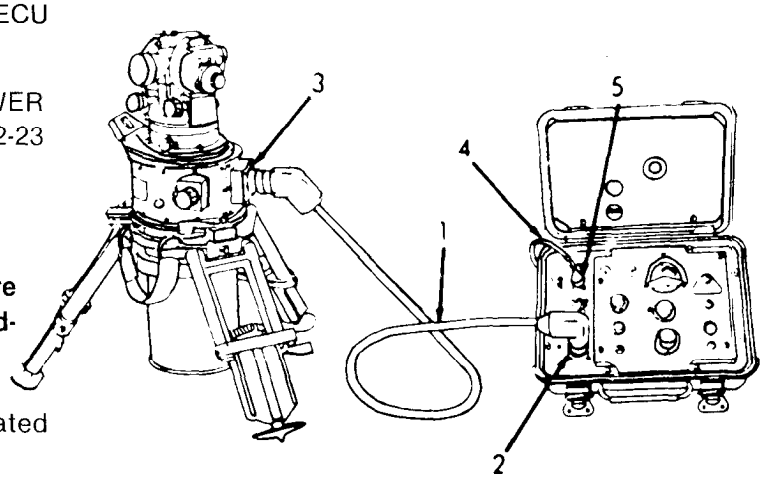
a. Connect interconnect cable (1) to the ECU (2) and GRU (3).

b. Connect DC power cable (4) to the POWER receptacle (5) on ECU (2) and to a 22-23 Vdc power source.

NOTE

Auxiliary cables and an AC-DC converter are stored in the transport case for use as needed.

c. Remove AC-DC converter and associated cables from transport case.



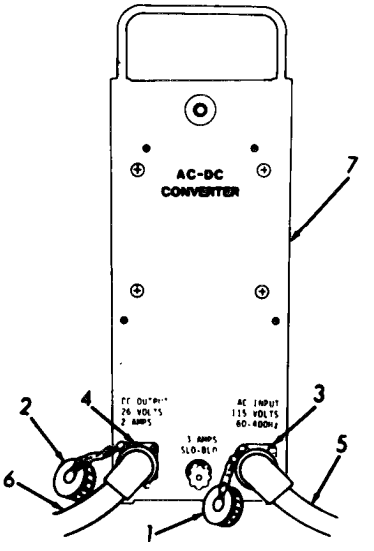
2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

POWER CABLE INSTALLATION – Continued

d. Remove protective caps (1 and 2) from receptacles (3 and 4).

e. Connect the 115 Vac cable (5) between AC power source and input receptacle (3).

f. Connect power cable (6) between output receptacle (4) on the converter (7) and the power receptacle on the ECU.



FINE-LEVELING OF UNIT

a. Rotate theodolite alidade (1) so that the long axis of the plate level (2) is in the same plane as one of the tripod legs (3).

b. Adjust fine-level control (4) to place the bubble in the center of the level vial.

NOTE

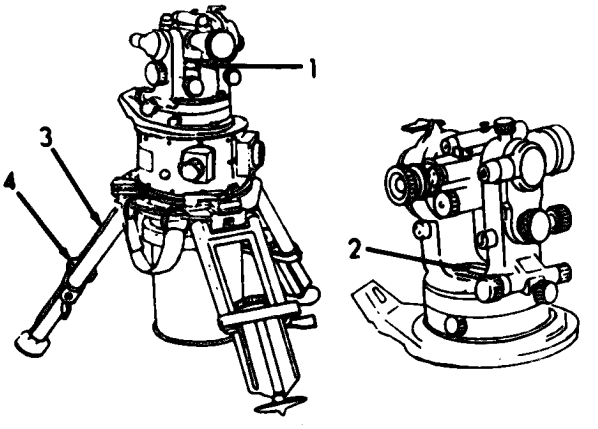
If adjustment can not be made, proceed to steps c and d.

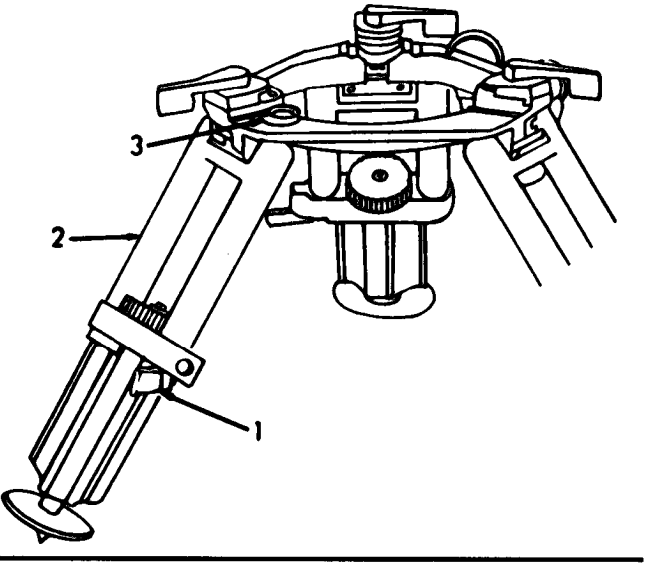
c. Coarse level the instrument by releasing one of the tripod leg clamps (1).

d. Adjust the leg (2) to obtain a level indication on the tripod circular level (3). Repeat procedure for each of the other two legs.

e. Rotate the alidade 90 degrees and adjust both the remaining legs.

f. Continue the process until the alidade can be rotated 360 degrees with no more than ± 1/2 division displacement of the bubble.



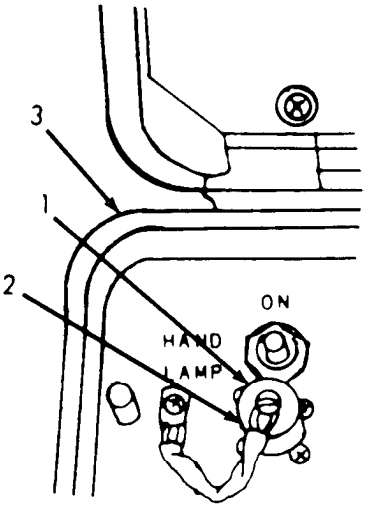


2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

NIGHT OPERATION

WARNING

When operating in the dark, light from the cage-uncage indicator is visible at 45 meters. The indicator should be shielded to avoid detection when security is required.



a. Remove cap and chain (1) from hand lamp connector (2) on ECU case (3).

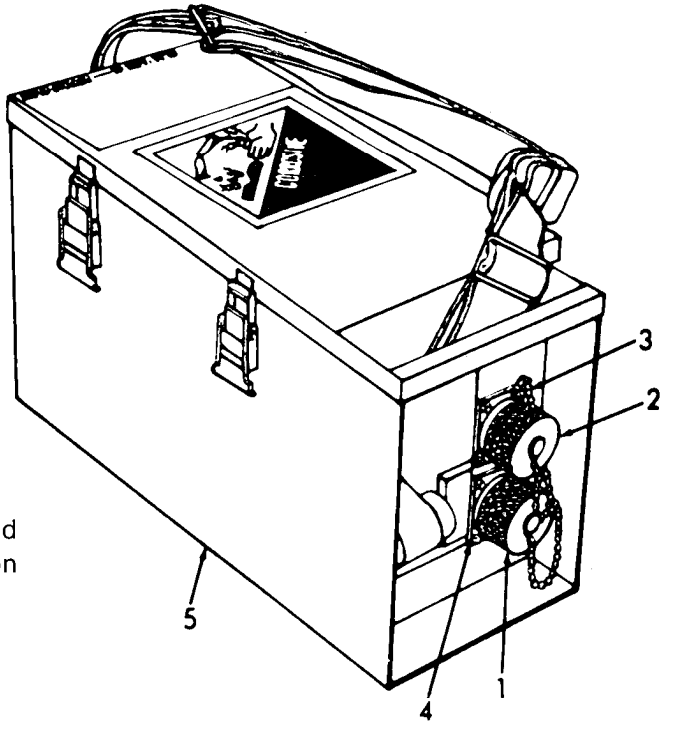
b. Remove hand lamp assembly from ECU lid.

c. Install hand lamp assembly on connector (2).

BATTERY INSTALLATION

WARNING

Corrosive Battery Electrolyte (Potassium Hydroxide). Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.



a. Remove can and chain assemblies (1 and 2) from electrical connectors (3 and 4) on battery (5).

2-5. ASSEMBLY AND PREPARATION FOR USE - Continued

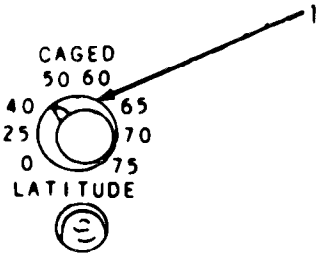
BATTERY INSTALLATION – Continued

b. Connect battery adapter cable to the battery and power cable.

c. Connect power cable to the ECU.

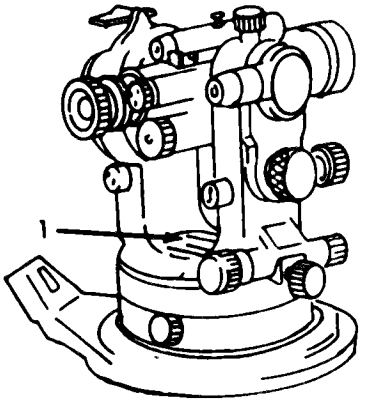
2-6. INITIAL ADJUSTMENTS AND ROUTINE CHECKS

a. Adjust latitude switch (1) to correspond to the closest latitude of operation. Refer to Table below for switch positions and corresponding latitudes of operation.



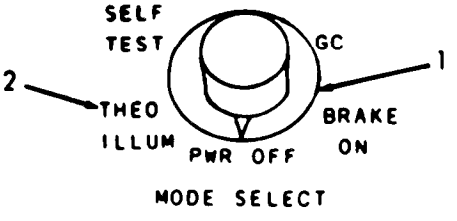
Switch Position	Latitude of Operation
0	0-15 degrees
25	15-30 degrees
40	30-45 degrees
50	45-55 degrees
60	55-63 degrees
65	63-67 degrees
70	67-73 degrees
75	73-75 degrees

b. Adjust switch position to desired latitude of operation using a screwdriver.

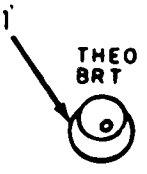


c. Check plate level (1) to verify that the equipment is level, and ensure that the reference unit is correctly preoriented to NORTH.

d. Place MODE SELECT switch (1) to THEO ILLUM (2); verify that theodolite scale lamp is illuminated.

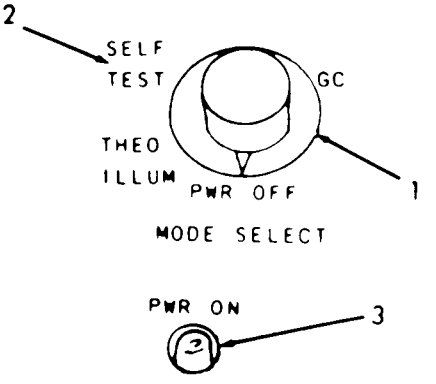


e. Rotate the THEO BRT control (1) to gain desired intensity of theodolite lamps.



2-6. INITIAL ADJUSTMENTS AND ROUTINE CHECKS - Continued

f. Place MODE SELECT switch (1) to SELF-TEST (2); verify that PWR ON indicator (3) is illuminated.



NOTE

When operating at night, the hand-lamp assembly may be used to assist the operator. With the hand-lamp assembly connected to the HAND LAMP receptacle, place the HAND LAMP switch to ON. Adjust the PANEL ILLUM switch to get the desired lighting of the panel. During day operations the PANEL ILLUM switch is maintained in the DAY position.

2-7. OPERATING PROCEDURE

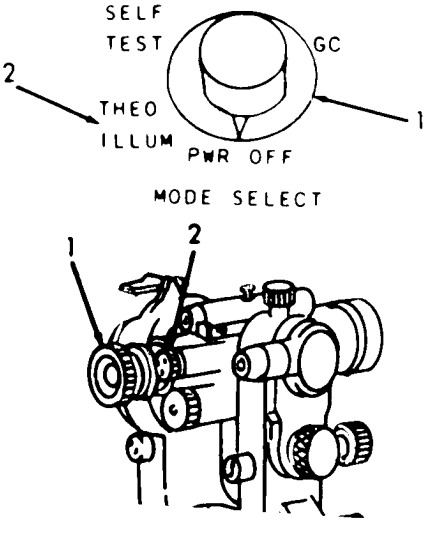
NOTE

Prior to starting an azimuth determination, the alignment of the horizontal circle shall be checked and adjusted if necessary. Instructions for performing the alignment procedure are provided in the following paragraph.

ALIGNMENT OF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR

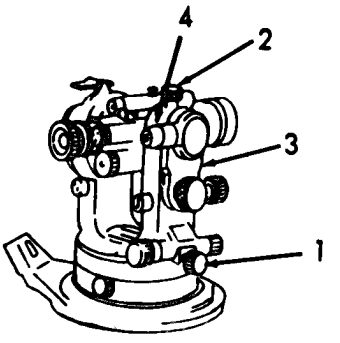
a. Place the MODE SELECT switch (1) to THEO ILLUM (2).

b. Adjust reticle focus (1) to obtain a sharp, clear focus of the reticle seen through the telescope eyepiece (2).



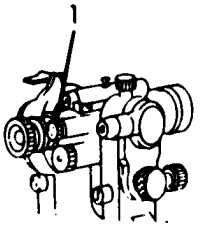
2-7. OPERATING PROCEDURE - Continued

ALLIGNMENT OF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR – Continued

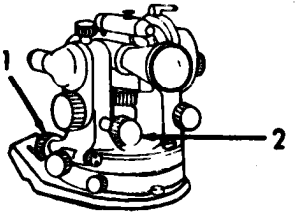


c. Release horizontal (1) and vertical locks (2) on the theodolite (3).

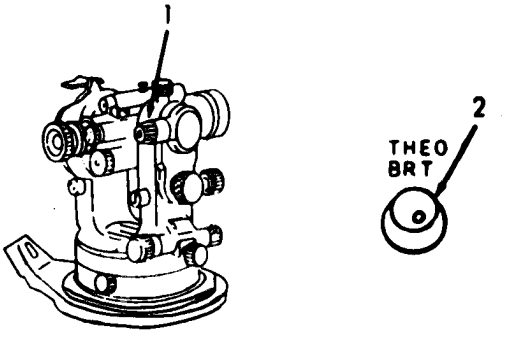
d. Align telescope (4) to the mirror and tighten horizontal (1) and vertical locks (2).



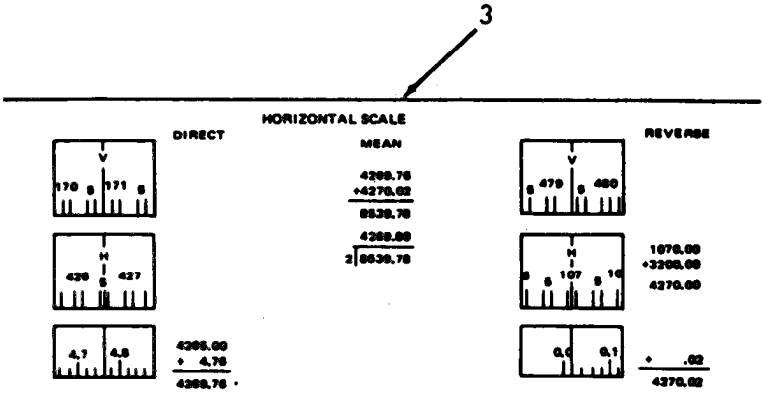
e. Adjust telescope focus (1) until autocollimated image (a bright green cross) appears in clear focus.

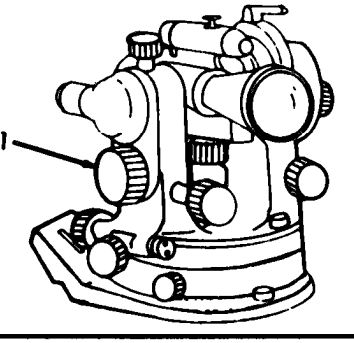


f. Adjust azimuth (1) and elevation controls (2) to center image accurately in reticle pattern.



g. Adjust microscope focus control (1) and THEO BRT control (2) until the horizontal scale image (3) appears in clear focus.





h. Adjust the micrometer control (1) to position the fixed index mark of the horizontal scale to the center of the nearest double line.

2-7. OPERATING PROCEDURE - Continued

ALIGNMENT OF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR - Continued

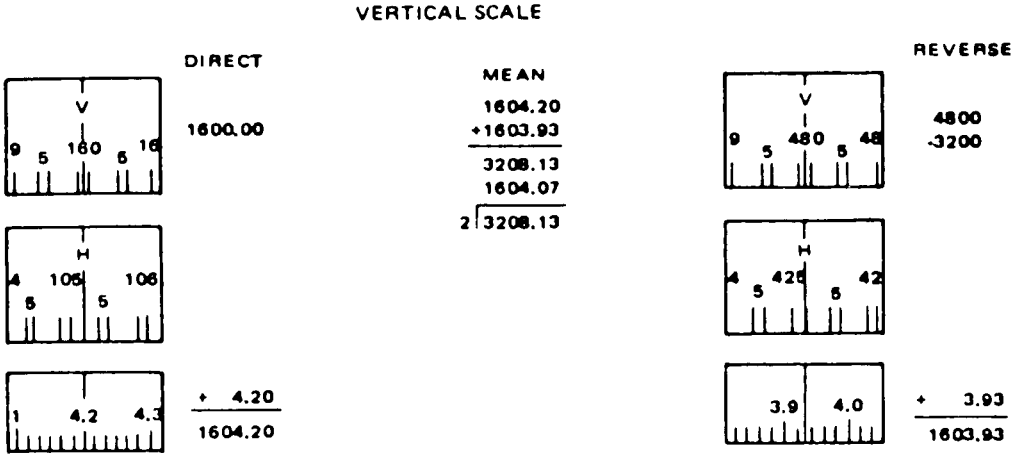
i. If the vernier scale does not appear under the fixed index, adjust the micrometer control to position the fixed index mark of the horizontal scale to the center of the second nearest double line.

j. Record the horizontal scale reading as follows:

(1) If the fixed index is over a three-digit number, record the number as it appears and add a zero as the fourth digit.

(2) If the fixed index is over a number five, record the preceding three-digit number and add a five as the fourth digit.

k. Record the vernier scale reading. Examples of vernier scale readings are shown below.



2-7. OPERATING PROCEDURE - Continued

ALIGNMENTOF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR - Continued

l. Obtain the direct horizontal reading by adding the recorded readings of the horizontal and vernier scales.

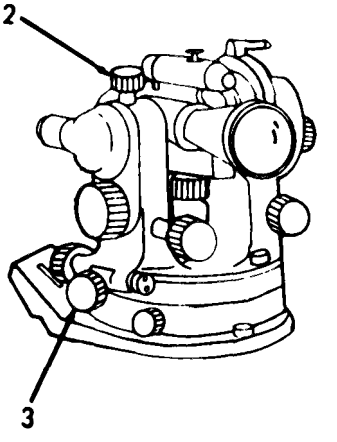
m. To obtain reverse readings:

(1) Release the vertical lock (2) and rapidly rotate the telescope 180 degrees about the horizontal axis; tighten the vertical lock.

(2) Release the horizontal lock (3) and rotate the theodolite alidade 180 degrees (clockwise); tighten the horizontal lock.

(3) Record the reverse horizontal and vernier scale readings in the same manner as used for direct readings.

(4) Add horizontal and vernier scale readings to obtain reverse horizontal reading.



2-7. OPERATING PROCEDURE - Continued

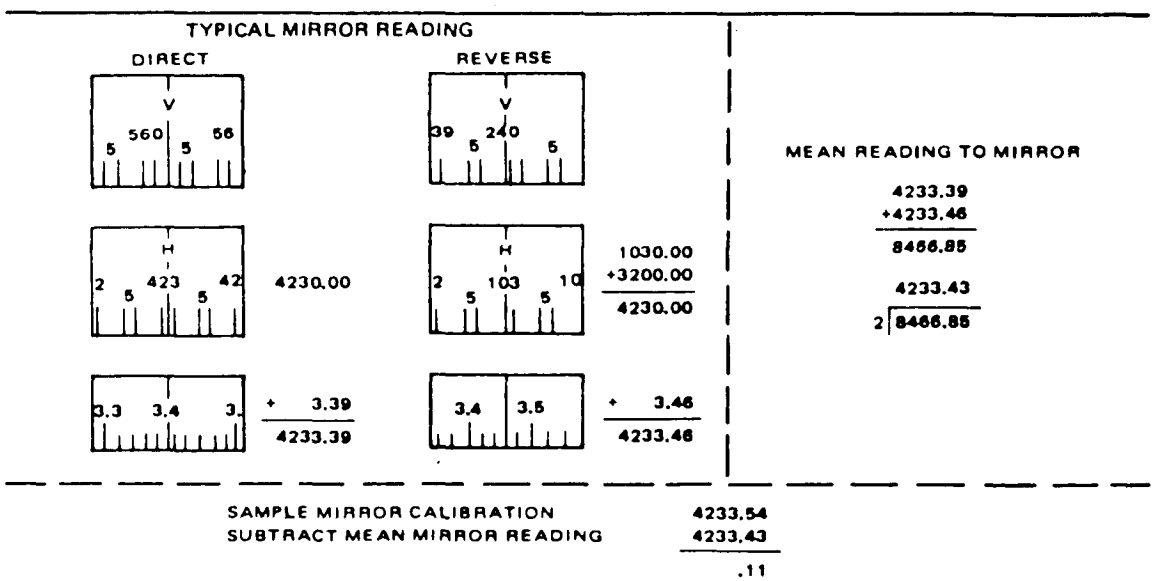
ALIGNMENT OF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR - Continued

n. To obtain mirror reading:

(1) Add 3200.00 to the reverse reading.

(2) Add the direct and reverse readings.

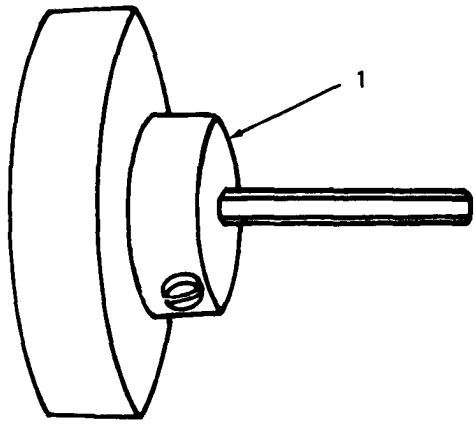
(3) Divide the sum of step (2) by two to obtain the mean mirror reading.



2-7. OPERATING PROCEDURE - Continued

ALIGNMENT OF THEODOLITE HORIZONTAL CIRCLE TO REFERENCE MIRROR – Continued

o. If the mirror reading determined in step n is within 0.04 mil of the value displayed on the mirror azimuth plate, then no adjustment is necessary. If the error is greater than 0.04 mil, the following adjustment procedures are to be followed.

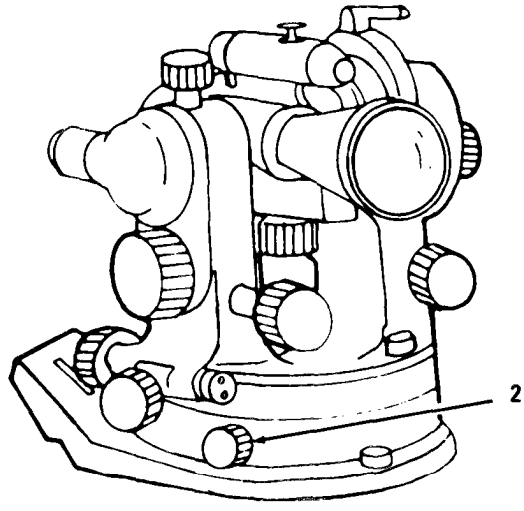


(1) Subtract the last four digits of the reverse reading from the last four digits of the direct reading (disregard the first two digits).

(2) Divide this value by two to determine the collimation error.

(3) Algebraically add the collimation error to the value on the mirror azimuth plate.

(4) With the telescope in the direct position, center the image accurately in the reticle pattern. Adjust azimuth and elevation controls as necessary to center image. Using the horizontal circle adjusting tool (1) and the horizontal circle setting control (2), adjust the micrometer and horizontal circle to the value calculated in step (3).



2-7. OPERATING PROCEDURE - Continued

SELF TEST

a. With the MODE SELECT switch (1) positioned to SELF TEST (2) and with the PWR ON indicator (3) illuminated, place the TEST SELECT switch (4) to SOURCE VOLTAGE (5).

b. Depress the PRESS TO TEST switch (6); verify that the TEST METER pointer (7) is positioned between 22 and 23 Vdc on the upper meter scale (8).

c. Place the TEST SELECT switch (4) to REG AC (9); verify that the TEST METER pointer (7) is positioned in the green band (10) of the meter scale.

d. Repeat step c with the TEST SELECT switch (4) in the REG DC (11) and BIAS (12) positions.

e. Place the TEST SELECT switch (4) to the SERVO CW position (13), verify that the theodolite rotates in a clockwise direction when looking down on the GRU and verify that the TEST METER pointer (7) is positioned in the green band (10) of the meter scale.

f. Place the TEST SELECT switch (4) to the SERVO CCW position (14). Verify that the theodolite rotates in a counterclockwise direction when looking down on the GRU and verify that the TEST METER pointer (7) is positioned in the green band (10) of the meter scale.

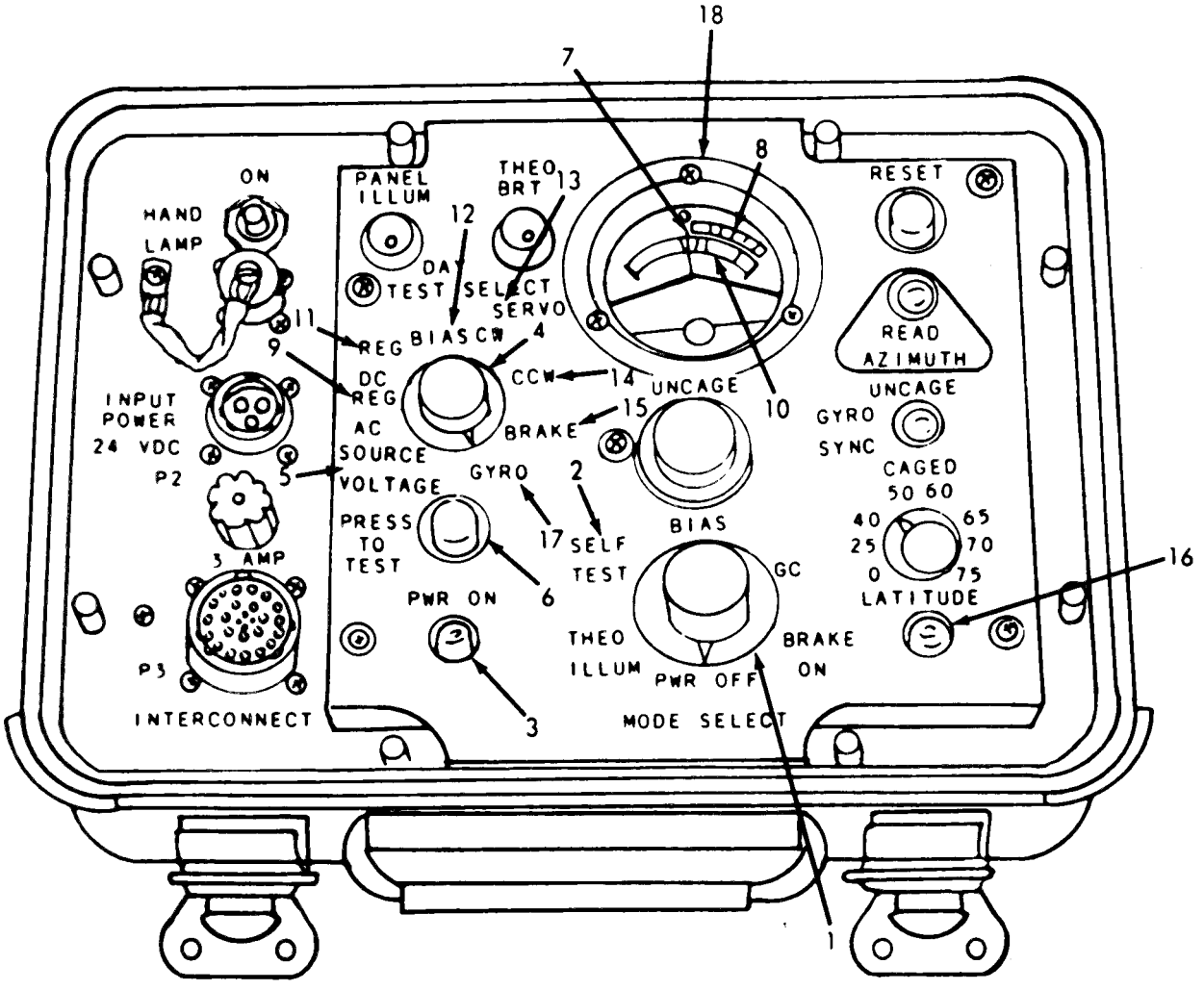
g. Place the TEST SELECT switch (4) in the SERVO CW (13) or SERVO CCW (14) position until the yellow follow-up index mark on the theodolite mounting plate and output is near the center of the servo operating range.

h. Place TEST SELECT switch (4) to BRAKE (15); verify that the BRAKE ON indicator is illuminated.

i. Place TEST SELECT switch (4) to GYRO (17); verify that the TEST METER (18) indicates a zero reading. Release the PRESS TO TEST switch (6).

2-7. OPERATING PROCEDURE - Continued

SELF-TEST – Continued



1. Mode select switch
2. Self test
3. PWR on indicator
4. Test select switch
5. Source voltage
6. Press to test switch
7. Pointer
8. Meter scale
9. Reg AC
10. Green band
11. Reg DC
12. Bias
13. Servo CW position
14. Servo CCW position
15. Brake
16. Brake ON indicator
17. Gyro
18. Test meter

2-7. OPERATING PROCEDURE - Continued

OPERATION

a. Place the MODE SELECT switch (1) to BIAS (2) (audible click).

WARNING

When operating in the dark, light from the cage-uncage indicator is visible at 45 meters. The indicator should be shielded to avoid detection when security is required.

b. Rotate the CAGE-UNCAGE knob (8) on the reference unit (9) clockwise until the UNCAGE indicator (10) lights.

c. Observe TEST METER pointer (3) swing left and right from zero, at a rate of about one reversal every five seconds. When the pointer comes to a stop, verify that it is positioned at zero; if necessary use the BIAS control (4) to obtain the required position. This is done by rotating the outer ring counterclockwise to unlock the inner knob, rotating the inner knob to the pointer, and rotating the outer ring clockwise to relock the inner knob.

d. Rotate the CAGE-UNCAGE knob (8) on the GRU (9) counterclockwise until the UNCAGE indicator (3) is out (audible click).

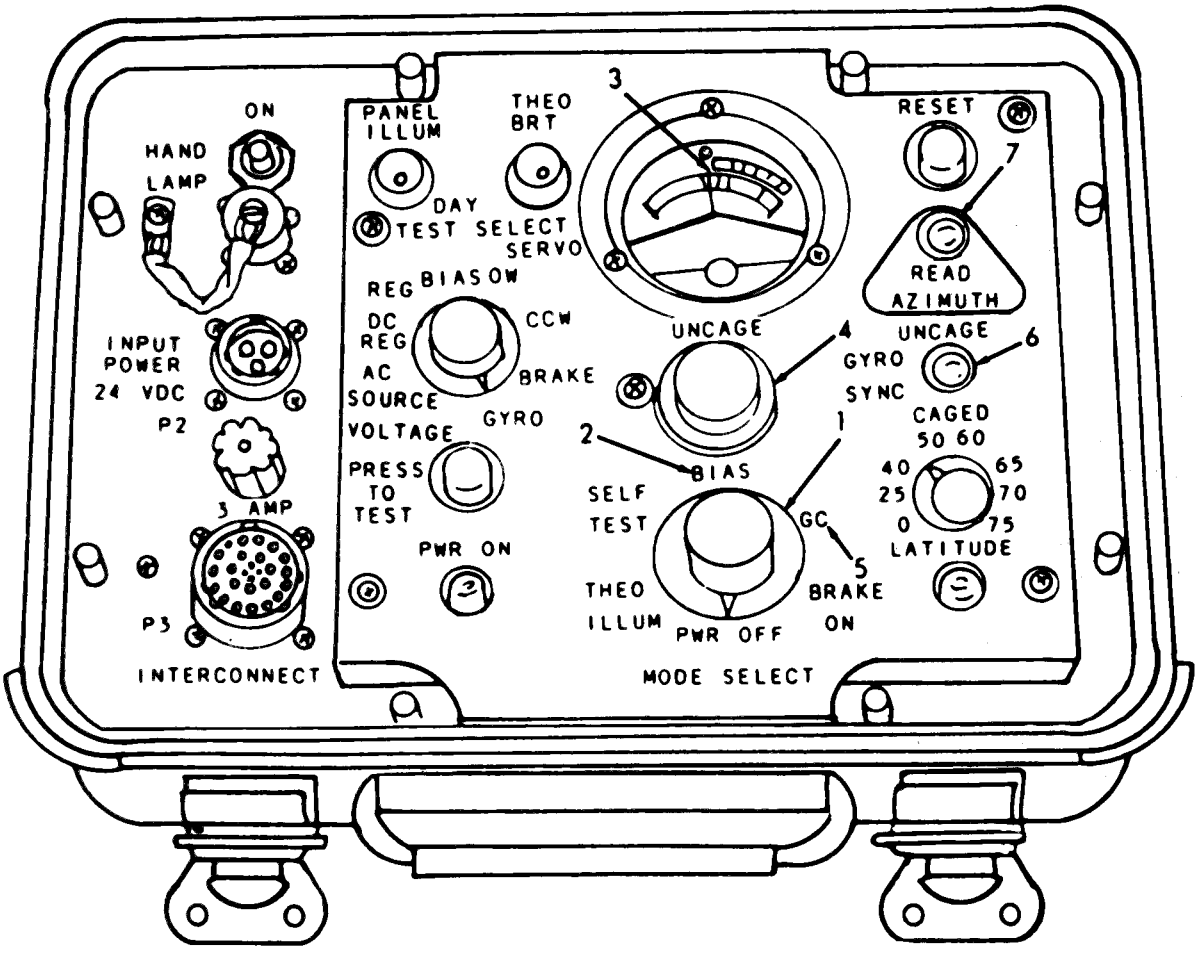
e. Place the MODE SELECT switch (1) to GC (gyro compass) (5); verify that the GYRO SYNC indicator (6) illuminates within two minutes at normal ambient temperature (above + 15°F (+9.4°C)).

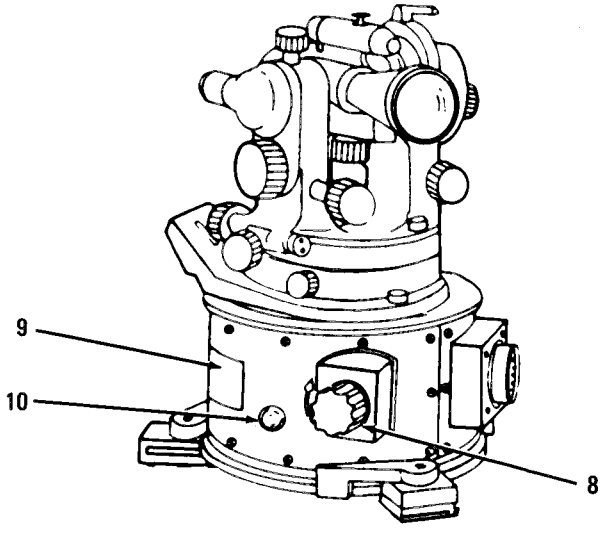
CAUTION

During the first azimuth determination on a new site, the operator should ensure the follow-up index mark does not remain at either end of the servo operation range. Continuous operation of the instrument in this condition could cause excessive magnetic anomalies, which cause the GRU to be preoriented in excess of 40 degrees of true north.

2-7. OPERATING PROCEDURE - Continued

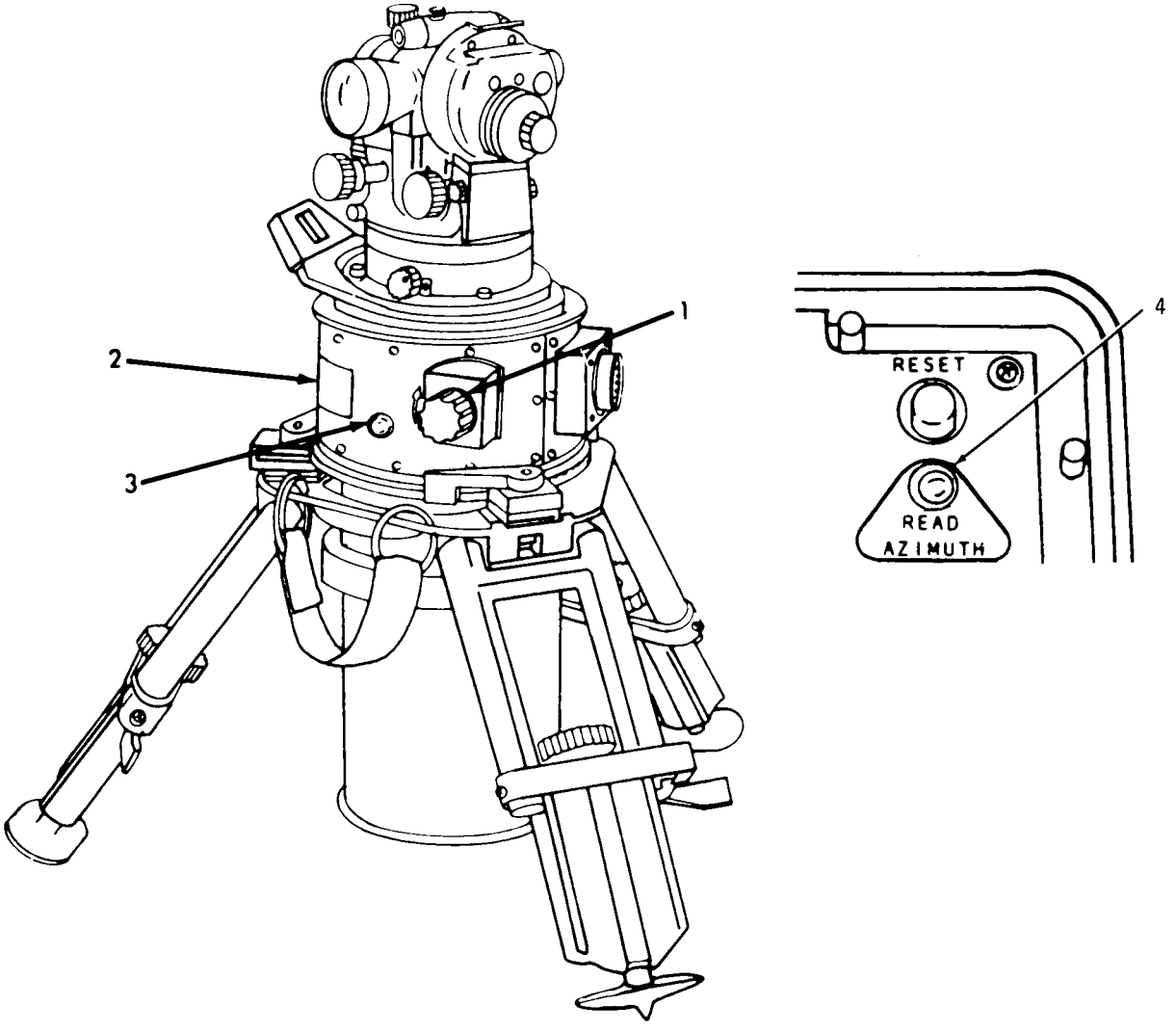
OPERATION – Continued





2-7. OPERATING PROCEDURE - Continued

OPERATION – Continued



f. Rotate the CAGE-UNCAGE knob (1) clockwise until the UNCAGE indicator (3) illuminates.

g. Verify that the READ AZIMUTH indicator (4) illuminates 15 minutes after uncaging the gyro.

2-7. OPERATING PROCEDURE - Continued

OPERATION - Continued

NOTE

Actuation of the RESET switch reinstates the servo mechanism so that it may continue to track and damp the pendulum for a minimum of 45 seconds. Under normal operating conditions, it is not required to use the reset, for it would only delay the azimuth determination with little improvement in azimuth determination accuracy. Three possible examples of when to use the reset are: (1) an abnormally short alignment time, (2) when the GRU or tripod has been disturbed after the READ AZIMUTH indicator illuminates, or (3) after an immediate full-scale deflection either direction on the TEST METER FOLLOWING ILLUMINATION OF the READ AZIMUTH indicator. Considering time available to establish azimuth and azimuth and accuracy required, the operator must exercise judgment prior to performing the reset operation. In order to avoid error accumulation, it is recommended that the RESET not be used later than 20 minutes after biasing.

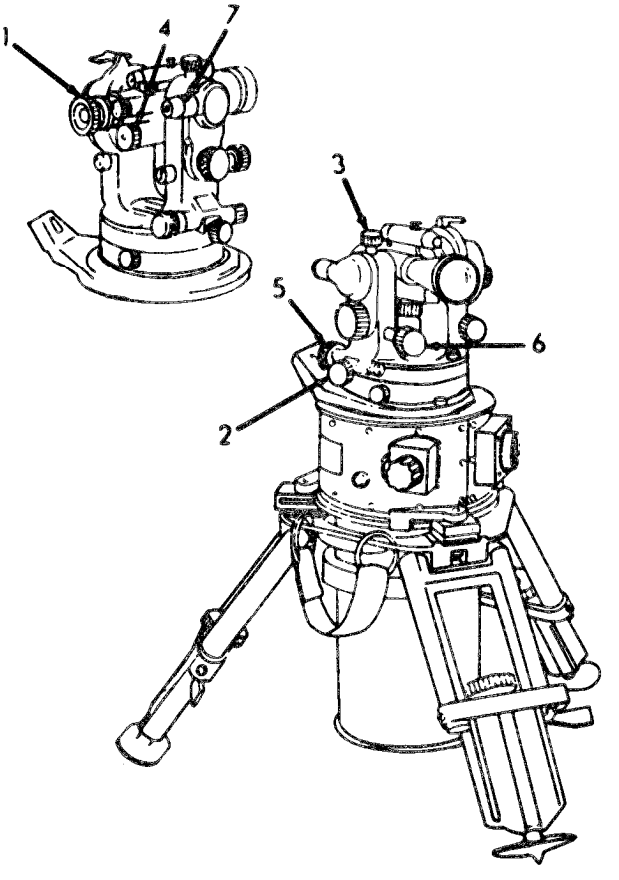
THEODOLITE READING

a. Adjust the RETICLE FOCUS (1) to obtain a sharp, clear image of the reticle pattern.

b. Release the horizontal (2) and vertical locks (3) on the theodolite. Align the reticle on the target. Focus the telescope (4) to obtain a clear, sharp image of the target.

c. Adjust the azimuth (5) and elevation controls (6) to center the target in the reticle pattern.

d. Adjust the MICROSCOPE FOCUS (7) to obtain a clear, sharp image of the scales. Adjust the THEO BRT control on the ECU to illuminate scales.



2-7. OPERATING PROCEDURE - Continued

THEODOLITE READING - Continued

e. Adjust the MICROMETER control (1) to center the fixed INDEX between the nearest double lines on the horizontal scale.

f. Read the horizontal scale as follows:

(1) If the FIXED INDEX mark is under a three digit number, record the number and add a zero as the fourth digit.

(2) If the FIXED INDEX is under a number five, record the three-digit number immediately to the left of the number five and add a five as the fourth digit.

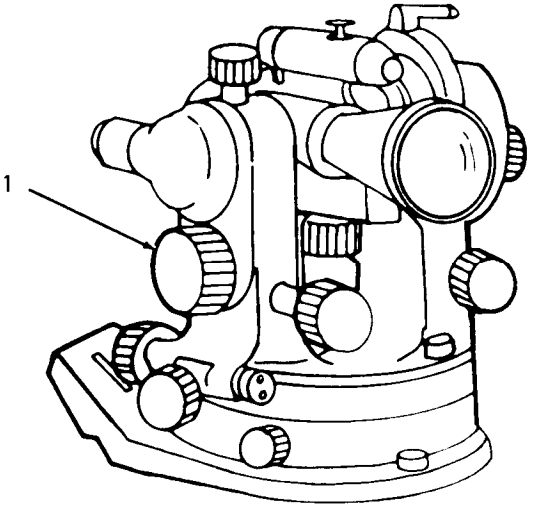
NOTE

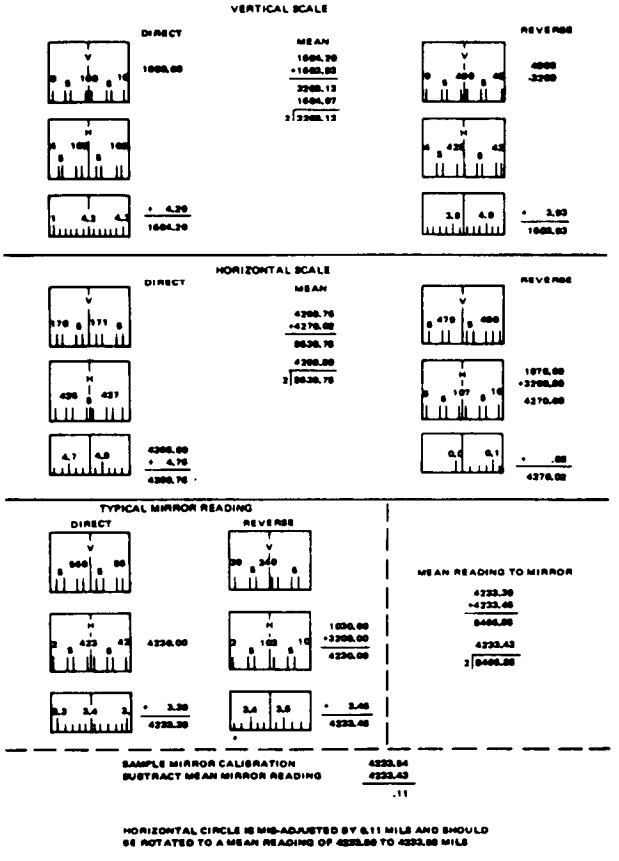
Instructions for obtaining the vertical angle are given as an optional procedure. If the vertical angle is not required, disregard the instruction to read the vertical scale.

g. Read the vertical scale in the same manner as the horizontal scale, except in this case, the bubble of the altitude level must be centered prior to centering FIXED INDEX.

h. Read the VERTICAL scale as it appears on the instrument.

i. Obtain the direct azimuth reading by adding the horizontal scale and the vernier scale reading.





2-7. OPERATING PROCEDURE - Continued

THEODOLITE READING – Continued

j. Obtain the direct vertical reading by adding the vertical scale and the vernier scale readings.

k. To obtain the reverse readings:

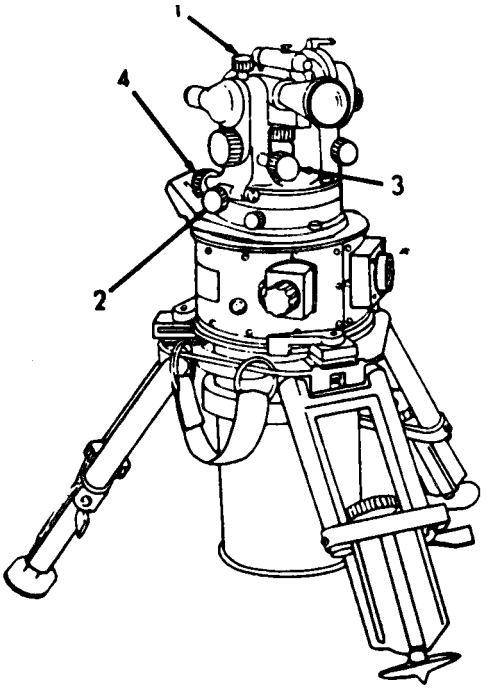
(1) Release the VERTICAL lock (1) and rapidly rotate the telescope.

(2) Release the HORIZONTAL lock (2) and rotate the telescope 3200 mils.

(3) Center the target in the reticle pattern, using the elevation (3) and azimuth controls (4).

(4) Read and record the reverse readings in the same manner as direct readings.

l. Determine the mean readings.

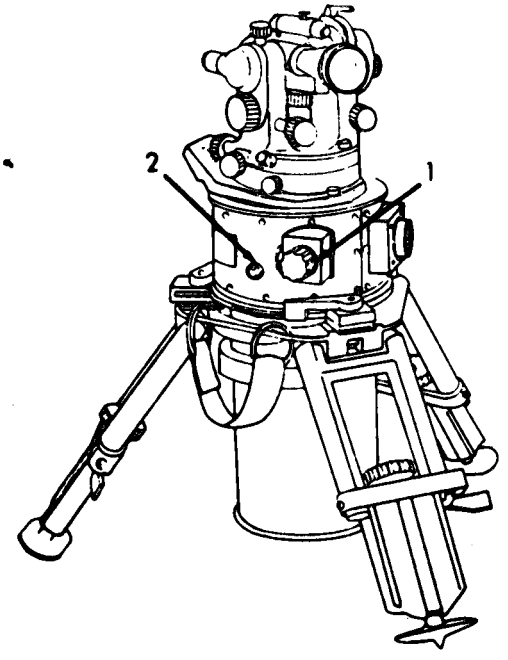


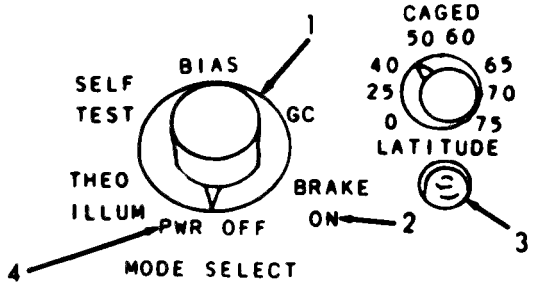
STOPPING

a. Rotate the CAGE-UNCAGE knob (1) counterclockwise until the UNCAGE indicator (2) is out.

b. Place the MODE SELECT switch (1) to BRAKE ON (2). Observe that BRAKE ON indicator (3) illuminates and then goes out at the completion of the braking sequence (90 seconds).

c. Place the MODE SELECT switch (1) to PWR OFF (4).





2-8. OPERATION OF AUXILIARY EQUIPMENT

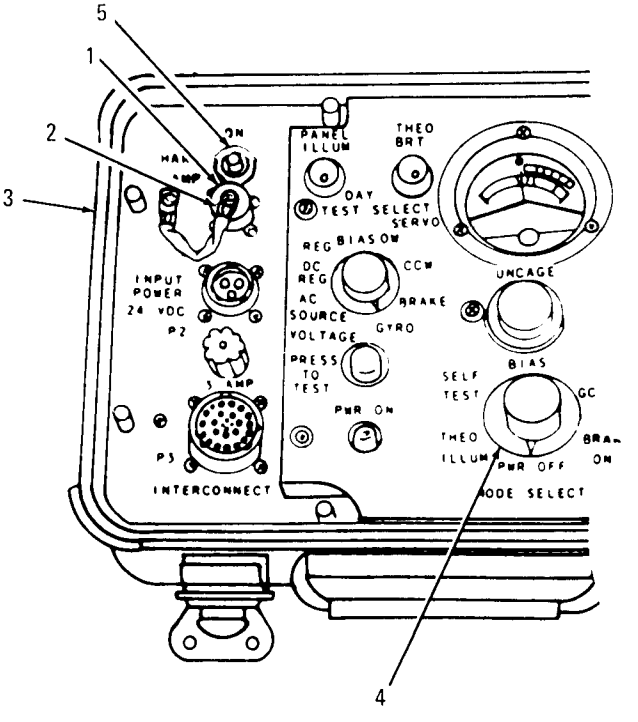
HAND-LAMP ASSEMBLY

WARNING

When operating in the dark, light from the cage-uncage indicator is visible at 45 meters. The indicator should be shielded to avoid detection when security is required.

a. Description. The hand-lamp assembly is provided for use during night operations. The assembly is connected to receptacle on the ECU during use and is turned off and on by an adjacent switch. An eight-foot cord permits the lamp to be extended during operations. The assembly is hand-held and provides illumination of controls and indicators on the ECU and GRU during night operations.

b. Installation. Remove the protective cap (1) fron the hand-lamp receptacle (2). Connect the plug to the HAND-LAMP receptacle on the ECU (3). With power applied to the ECU and with the MODE SELECT switch (4) in an activated position, place the HAND-LAMP switch (5) to ON to turn the hand-lamp assembly on.

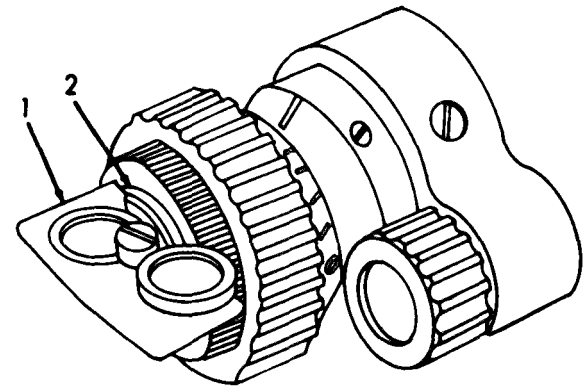


2-8. OPERATION OF AUXILIARY EQUIPMENT - Continued

EYEPIECE PRISM

a. Description. The eyepiece prism contains a 90-degree glass prism with an exterior hinge-mounted filter. The 90-degree eyepiece prism enables the operator to observe a target while at right angles to the normal viewing angle. The hinge-mounted filter is to be positioned over the eyepiece aperture when the target is situated in the line of direct sunlight.

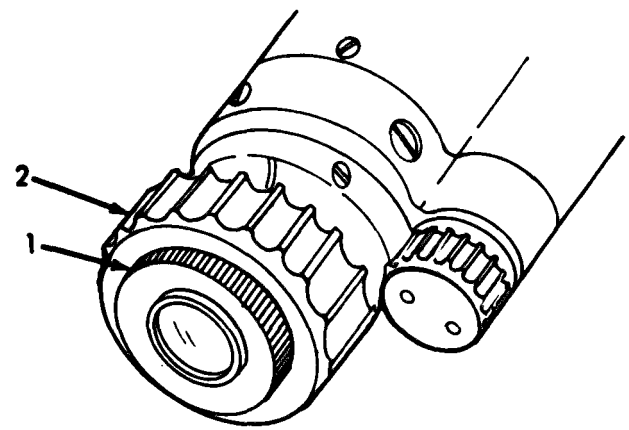
b. Installation. The eyepiece prism (1) is installed by pressing it into the eyepiece aperture (2).



EYEPIECE SUN FILTER

a. Description. The eyepiece sun filter is used to restrict reflected or direct sunlight.

b. Installation. Install sun filter (1) by pressing into eyepiece aperture (2).



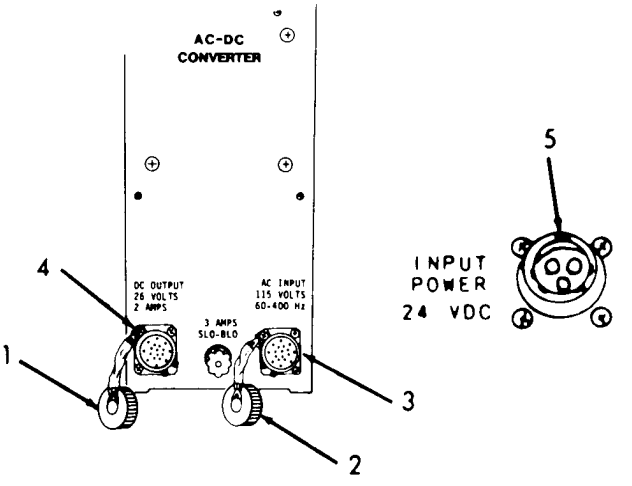
AC-DC CONVERTER

a. Description. The AC-DC converter assembly is provided to permit the surveying instrument to be powered from a 115 Vac, 60 or 400 Hz power source. When connected to the AC power source, the converter supplies the DC voltage necessary to operate the instrument. The converter and interconnecting electrical cables are stored in the transport case. Cap assemblies are provided on the converter to protect the electrical receptacles when the equipment is not in use.

2-8. OPERATION OF AUXILIARY EQUIPMENT - Continued

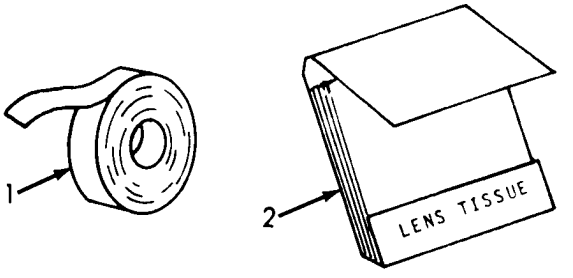
AC-DC CONVERTER - Continued

b. Setting up for Operation. Remove the protective caps (1 and 2) from the receptacles (3 and 4) on the converter. Connect the 115 Vac cable between the AC power source and the input receptacle (3) on the converter. Connect the power cable between the output receptacle (4) on the converter and the power receptacle (5) on the ECU.



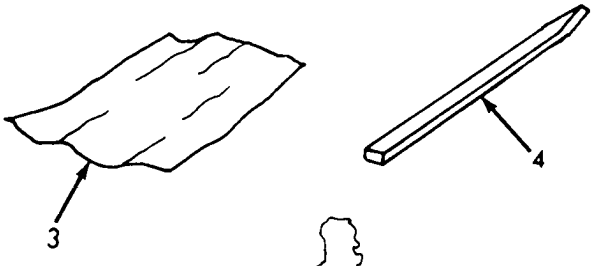
WINTERIZATION KIT

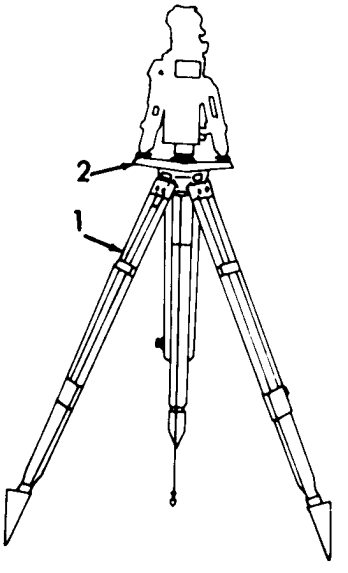
The winterization kit contains plastic tape (1), lens tissue (2), cleaning cloths (3), and orangewood sticks (4). The tissues and orangewood sticks are used to remove moisture and frost from optics and glass surfaces. The plastic tape is used to repair minor cuts in cable insulation. The cleaning cloth is used for general cleaning of the instrument.



AUXILIARY TRIPOD ASSEMBLY

The auxiliary tripod assembly (1) is used to elevate the instrument when operations from a standing position are desired. The adapter assembly (2) permits the GRU and tripod to be installed on the auxiliary tripod assembly. Instructions pertaining to the use of the auxiliary tripod are included in Paragraph 2-3.

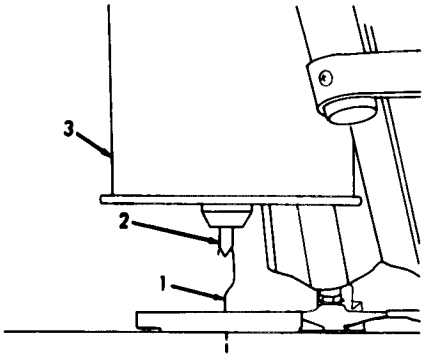




2-8. OPERATION OF AUXILIARY EQUIPMENT - Continued

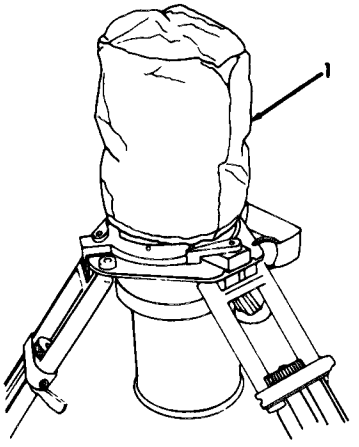
PLUMB BOB ASSEMBLY

The plumb bob assembly is used with the auxiliary tripod assembly to plumb the GRU. To use, the plumb bob extension hook (1) is threaded through the bridge screw and attached to the pointer (2) on the underside of the GRU housing (3).



RAIN AND DUST COVER

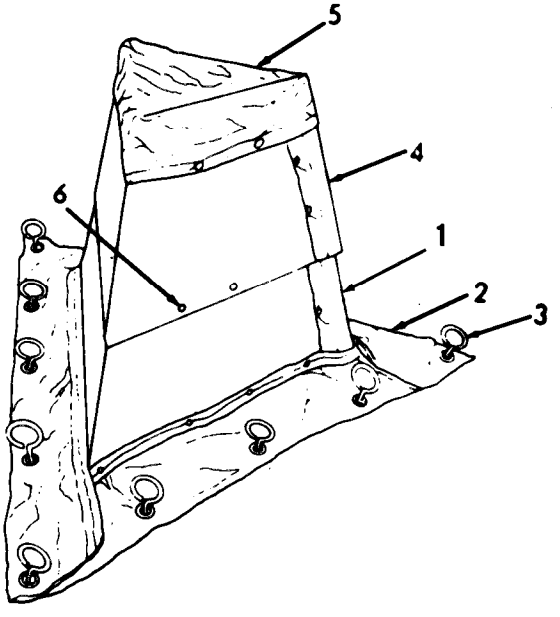
A rain and dust cover is provided to protect the theodolite when operating under adverse weather conditions. Remove the rain and dust cover (1) from the transit case and place over the theodolite when operating where the equipment is exposed to dust or moisture. Remove the cover (1) as needed to take theodolite readings; keep the cover over the theodolite when it does not interfere with operations.



WIND SHELTER

a. The SIAGL is designed to perform accurately in winds up to 20 mph (32 kmph). Wind disturbances can be detected by a difficulty in obtaining a steady BIAS null and extended observation times. In winds in excess of 20 mph (32 kmph), it is recommended that the wind shelter be used to protect the equipment and maintain an accuracy to performance.

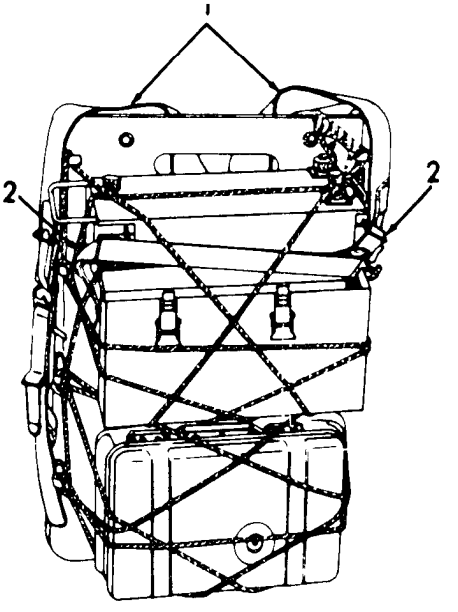
b. To set up the wind shelter, erect lower panel assembly (1) by positioning edge of panel between metal brace and flap, and secure with snap fasteners (6). Place assembly over erected instrument and position to prevent any contact with the instrument during operation. Pin the skirts (2) of the lower panel assembly firmly to the ground with pins (3). Assemble the upper panel assembly (4); stretch cover (5) over upper panel and secure with snap fasteners (6). When the instrument is uncaged in the BIAS or GC mode, press upper panel assembly firmly onto lower panel assembly. Remove the upper panel assembly to read azimuth. When operating in areas of sand or loamy soils, place rock and sod over the lower panel skirts and pins to provide maximum stability of the shelter.



2-8. OPERATION OF AUXILIARY EQUIPMENT — Continued

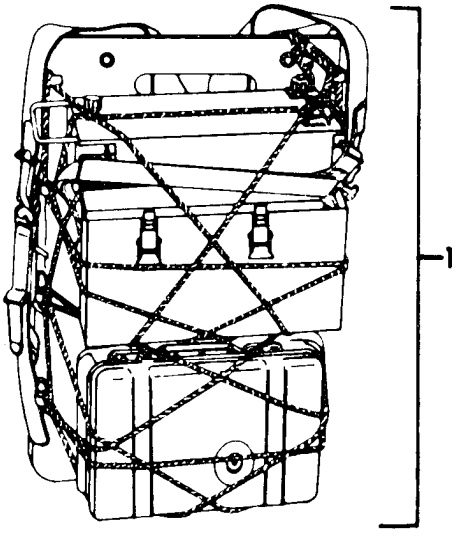
BACKPACK

In areas inaccessible by vehicle the transit case containing the GRU may be carried by use of backpack straps. The equipment is carried on the back of the operator and is held in place by shoulder and waist straps (1 and 2). The shoulder and waist strap harnesses are stored in the transport case. In use, the shoulder straps are attached to the transit case by securing the short strap end to the top center anchor and the long strap end to the bottom side anchor of the transit case. Secure the waist strap to each bottom side strap anchor. Open the waist strap to mount the transit case on back and adjust strap slack for comfort.



PACKBOARD

A standard Army packboard (1) is used for backpacking the ECU, converter, and other associated components of the SIAGL set.



BATTERY

WARNING

CORROSIVE BATTERY ELECTROLYTE POTASSIUM HYDROXIDE

- **Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.**

- **Battery should not be transported by backpack due to possibility of electrolyte leaking.**

2-8. OPERATION OF AUXILIARY EQUIPMENT — Continued

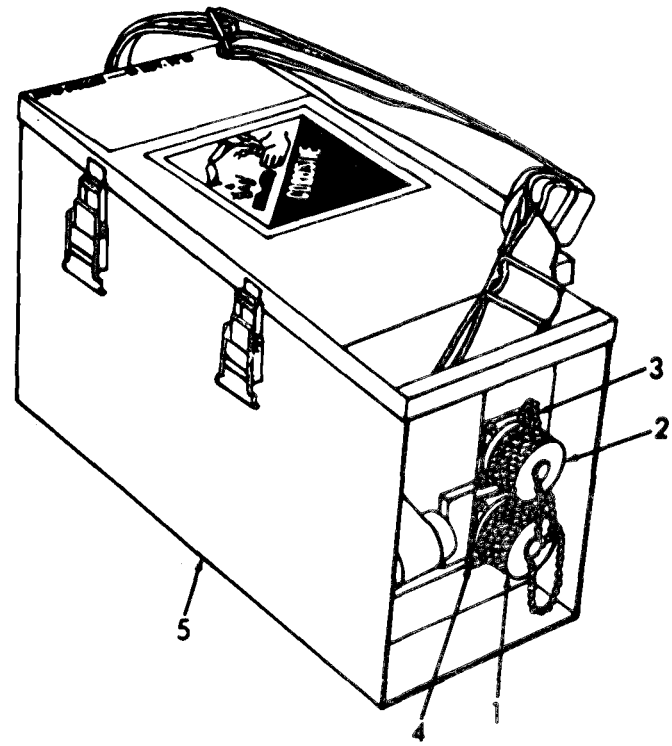
BATTERY – Continued

a. The battery (5) is the most commonly used source of power for the SIAGL.

b. Remove cap and chain assemblies (1 and 2) from electrical connectors (3 and 4) on battery (5).

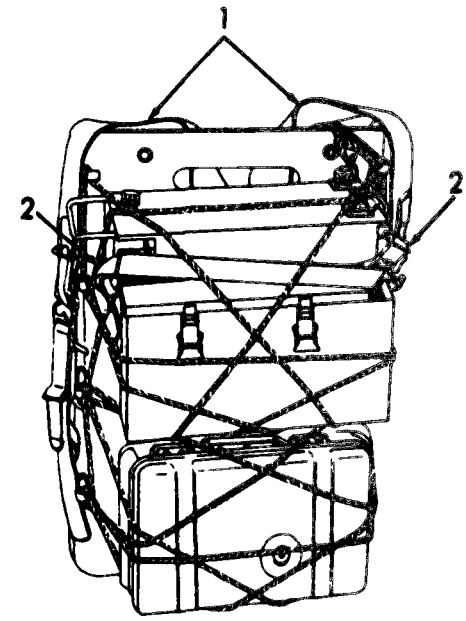
c. Connect battery adapter cable to the battery and power cable.

d. Connect power cable to the ECU.



BACKPACK ACCESSORIES

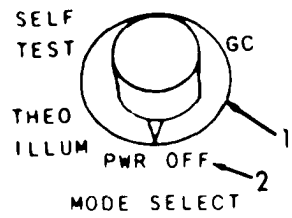
In areas inaccessible by vehicle the transit case containing the GRU may be carried by use of backpack straps. The equipment is carried on the back of the operator and is held in place by shoulder (1) and waist straps (2). The shoulder and waist strap harnesses are stored in the transport case. In use, the shoulder straps are attached to the transit case by securing the short strap end to the top center anchor and the long strap end to the bottom side anchor of the trasit case. Secure the waist strap to each bottom side strap anchor. Open the waist strap to mount the transit case on back and adjust strap slack for comfort.



2-9. PREPARATION FOR MOVEMENT

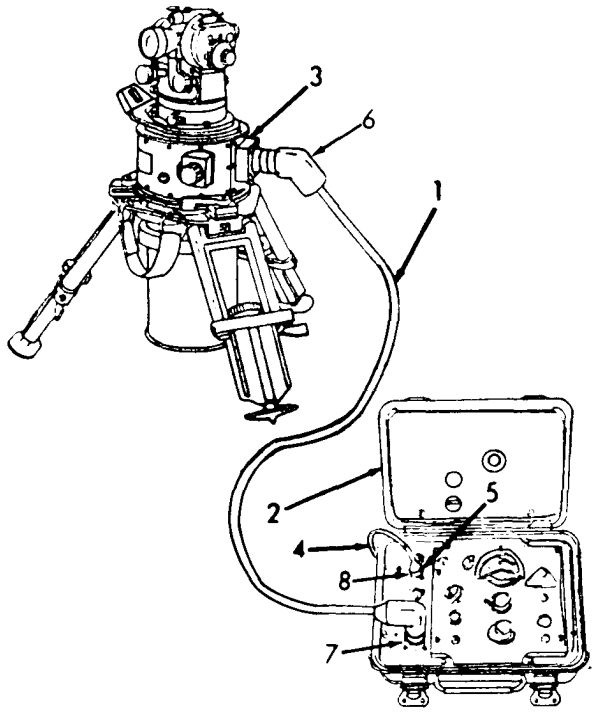
MOVEMENT TO A NEW LOCATION

a. Verify that the MODE SELECT switch (1) is in the PWR OFF position (2).



CAUTION

When placing cables in ECU cover, care must be taken to avoid cable contact with the plunger of the pressure release valve. Disturbing the plunger voids the water-tight characteristics of the case.



b. Disconnect interconnect cable (1) from the ECU (2) and GRU (3).

c. Install protective cap (6) on GRU and protective cap (7) on ECU.

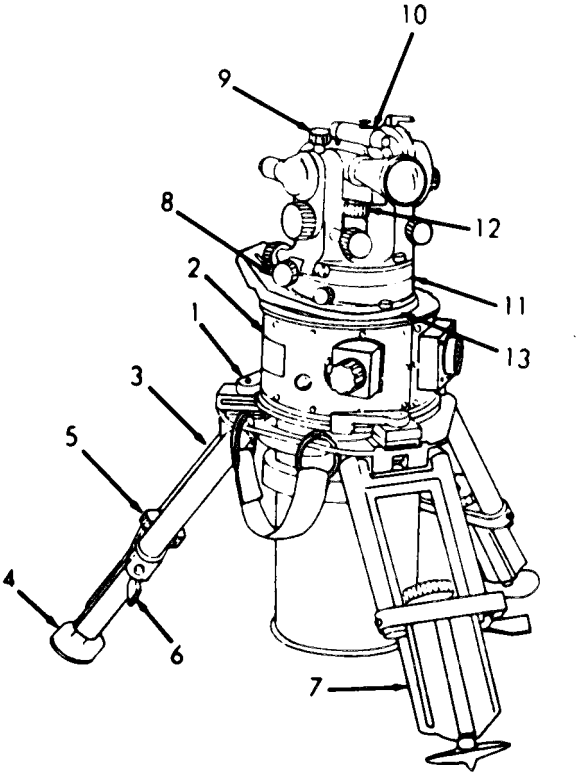
d. Disconnect DC power cable (4) from power receptacle (5) and install protective cap (8) or input power connector.

e. The interconnect and power cables are stored in the cover of the electronic control unit case; cables used in conjunction with the AC-DC converter are stored in the transport case storage compartment.

2-9. PREPARATION FOR MOVEMENT - Continued

MOVEMENT TO A NEW LOCATION - Continued

f. Loosen each of the three tripod hold-down clamps (1) and align the index mark on the theodolite base with the tripod index mark. Center the GRU (2) on the tripod (3) and tighten the hold-down clamps (1). Lift the GRU (2) and tripod (3) to raise the equipment above the site. While holding the equipment, retract the tripod bearing plates (4) with the fine leveling knobs (5), loosen the three leg clamps (6), retract the tripod legs (7), and tighten the leg clamps. Fold the legs in and against the GRU (2).



CAUTION

Leave the theodolite horizontal locks in the released position.

g. Release the theodolite horizontal and vertical locks (8 and 9).

h. Rotate the telescope so that the telescope (10) and alidade storage index marks (11) are lined up.

i. Rotate the alidade (12) so that the alidade and theodolite base storage index marks (13) are lined up.

2-9. PREPARATION FOR MOVEMENT - Continued

MOVEMENT TO A NEW LOCATION - Continued

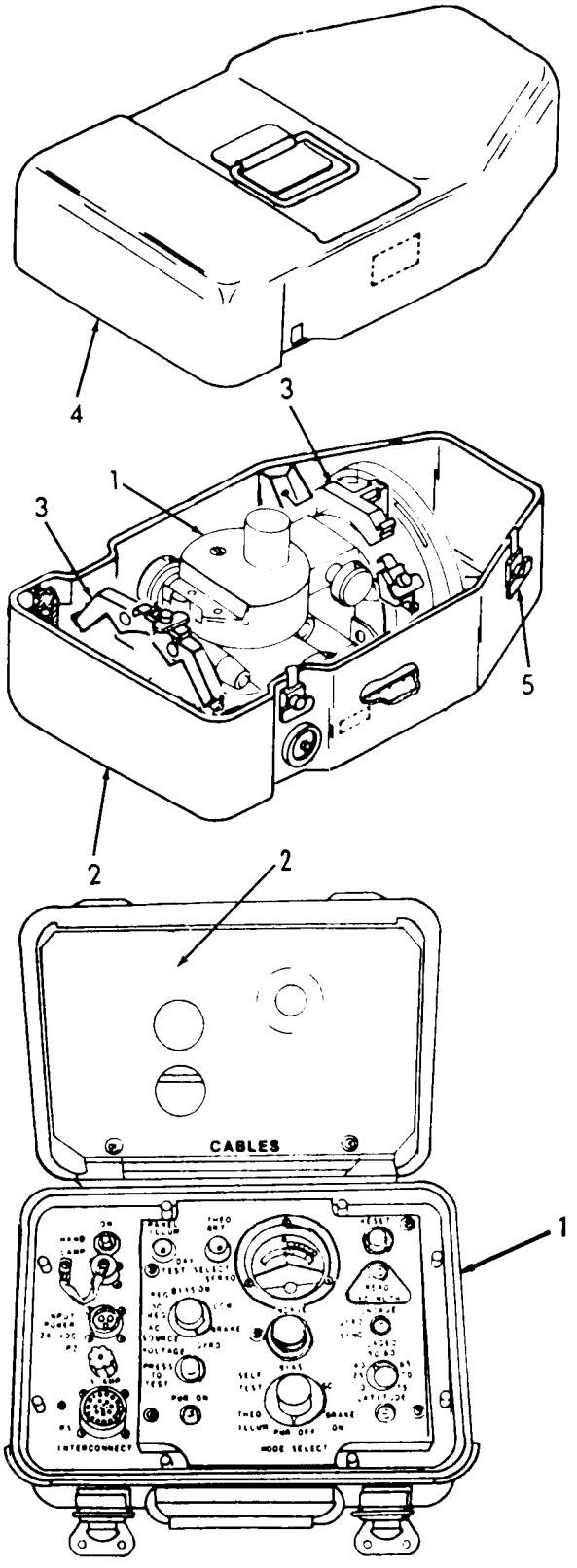
CAUTION

Be sure the white stripes on the alidade index and the theodolite base are lined up when installing the reference unit and tripod in the transit case. Failure to do this will result in damage to the reference mirror.

j. Install the GRU (1) into the transit case (2) with the theodolite end slightly lower than the tripod end.

k. Fold in the GRU securing clamps (3) and place top section (4) of transit case over bottom section. Secure with latches (5).

l. If the hand-lamp assembly was used, remove the hand-lamp from the ECU (1) and store it in the cover (2) of the ECU. Install cover (2) on ECU (1).



2-9. PREPARATION FOR MOVEMENT - Continued

MOVEMENT TO A NEW LOCATION - Continued

m. Secure the ECU (1) in the transport case by fastening the strap latch (2).

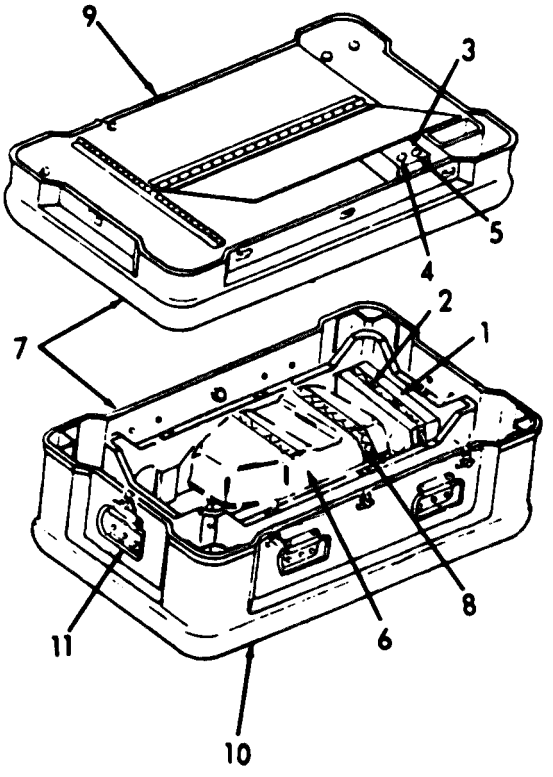
n. If the AC-DC converter (3) was used, disconnect electrical cables, replace protective caps (4 and 5), and store in the transport case.

o. If the auxiliary tripod assembly was used, remove the tripod adapter assembly and store in the transport case.

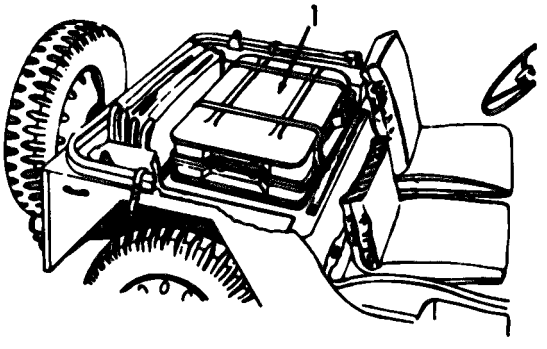
p. Ensure that all accessories and cables are stored in the appropriate compartments of the transit and transport cases.

q. Place the transit case (6) in the transport case (7) and fasten the strap latches (8).

r. Place top section (9) over bottom section (10) and secure with latches (11).



s. If vehicle transportation is to be used, ensure transport case (1) is securely tied down prior to moving.



2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE

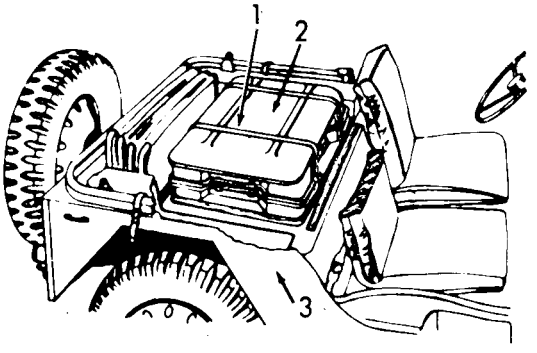
CAUTION

Exercise care when unloading the transport cases from vehicles. Do not stand or walk on the cases and do not stack more than three cases, as damage to the equipment may result. Use handles provided on the cases for safety and ease of handling.

REMOVING TRANSPORT CASE FROM VEHICLE

a. Unfasten retaining straps (1).

b. Remove transport case (2) from vehicle (3).



UNPACKING EQUIPMENT

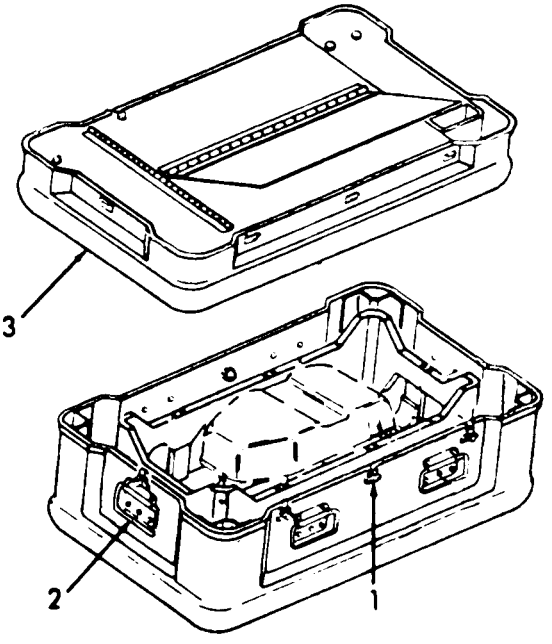
a. Transport Case

(1) Press pressure relief valve (1) to release pressure in case.

(2) Unfasten latches (2) securing upper section.

(3) Remove upper section (3).

(4) Inspect equipment for damage and for loose or missing parts.

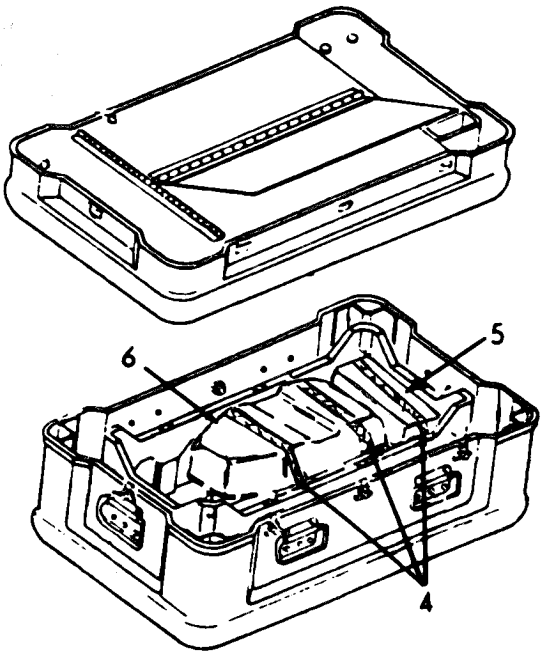


2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

UNPACKING EQUIPMENT - Continued

Auxiliary Equipment and Accessories
Transport Case a. AC Power cable b. Battery adapter cable c. DC Power extension cable d. DC Power adapter cable e. Jumper cable f. Winterization kit g. Shoulder and waist harness h. Tripod adapter assembly i. Spare fuses j. Spare lamps k. Spare knobs l. Tools m. Operator and Organizational Maintenance Manual n. AC-DC Converter



(5) Unfasten strap latches (4) securing ECU and transit case.

(6) Remove ECU (5) and transit case (6).

(7) Press pressure relief valve (1) on ECU case.

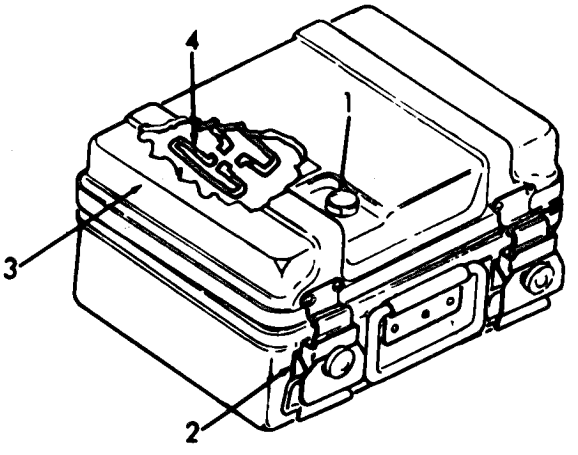
(8) Unfasten latches (2) on ECU case.

(9) Remove cover (3).

(10) Remove cables (4) from case cover.

NOTE

Remove auxiliary equipment required for operation from the transport case storage compartments.



2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

UNPACKING EQUIPMENT - Continued

b. Transit Case

(1) Press pressure relief valve (1).

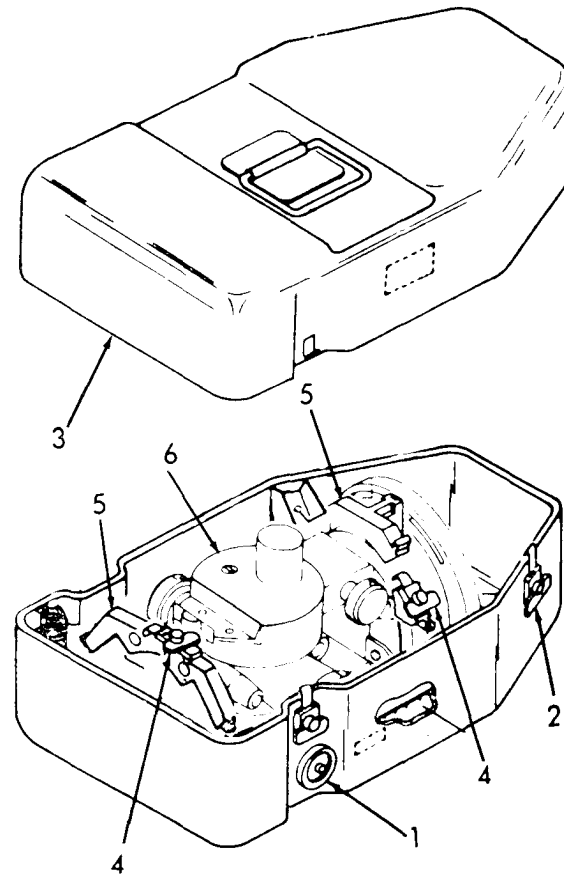
(2) Unfasten latches (2) securing upper and lower sections.

(3) Remove upper section (3).

(4) Unfasten latches (4) and open clamps (5) securing GRU in transit case.

(5) Remove GRU (6) from case.

(6) Inspect equipment for damage and for loose or missing parts.



Auxiliary Equipment and Accessories
Transport Case a. Dusting brush b. Plumb bob assembly c. Eyepiece prism (right angle) d. Eyepiece sun filter e. Spare lamps f. Horizontal circle setting tool g. Fuse h. Rain or dust cover

CAUTION

Avoid exposure of the equipment to dust, soil, or other abrasive materials.

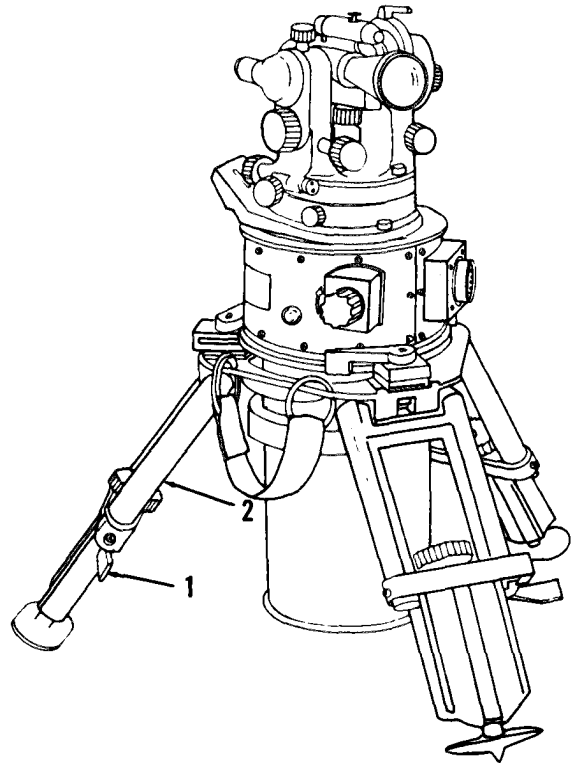
2-9. PREPARATION FOR MOVEMENT - Continued

SETTING GYROSCOPIC REFERENCE UNIT AND TRIPOD

a. Loosen leg clamp (1) on each leg of tripod (2).

b. Extend each leg to about 1/4 inch (.64 cm) from full extension.

c. Tighten clamps (1) to secure adjustable legs.



CAUTION

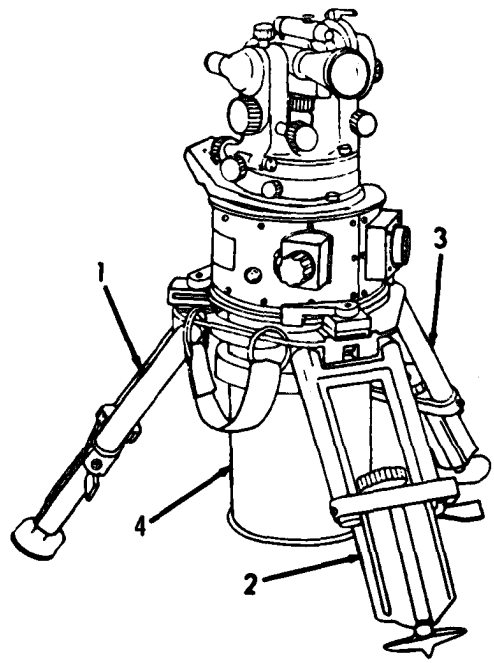
The legs of the tripod assembly are hinge-mounted and can swing beyond a normal standing position. Exercise care to avoid spreading the legs excessively and knocking the GRU against the ground surface.

d. Spread the tripod legs (1, 2 and 3) outward to obtain a level condition while standing the unit (4) in a vertical postition over a selected location.

NOTE

Perform preventive maintenance checks and services as specified in PMCS chart.

AUXILIARY TRIPOD



CAUTION

Make sure that the auxiliary tripod is leveled when setting up the equipment. Binding of the SIAGL tripod legs may occur during adjustment if the auxiliary tripod is not leveled.

2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

AUXILIARY TRIPOD - Continued

NOTE

The GRU may be operated with or without the use of an auxiliary tripod. The auxiliary tripod is used when operation of the equipment from a standing position is required.

a. Spread auxiliary tripod legs (1) outward to obtain a level condition while standing the assembly in a vertical position over a selected postion.

b. Remove tripod adapter assembly (2) from transport case storage compartment.

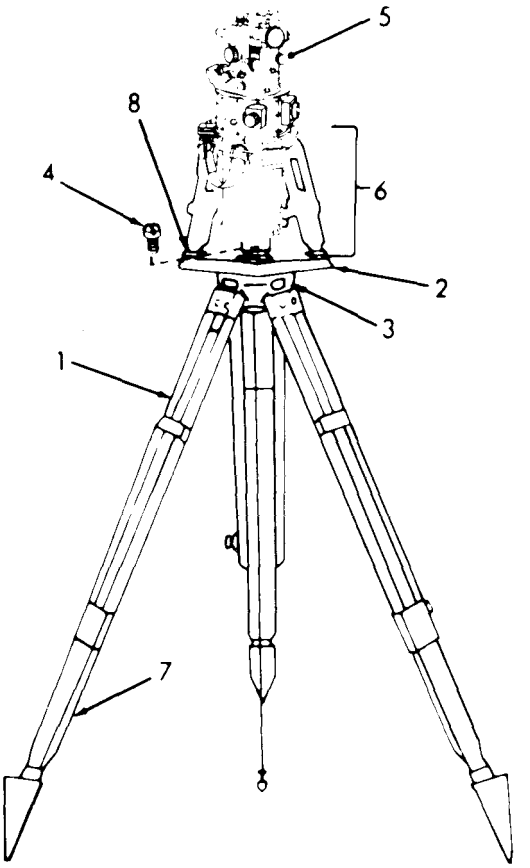
c. Center and position each tripod adapter leg at the apex (3) of the tripod adapter assembly (2).

d. Secure with bridge screw (4) attached to tripod plate.

e. Place GRU (5) and tripod (6) on tripod adapter assembly (2).

f. Place tripod leg spades (7) in receptacles provided in each leg of the adapter assembly.

g. Secure tripod (6) to adapter assembly (2) with spade latches (8).



NOTE

If a plumb bob is to be used for centering the instrument over a fixed reference point, use the plumb bob assembly stored in the transit case.

2-9. PREPARATION FOR MOVEMENT - Continued

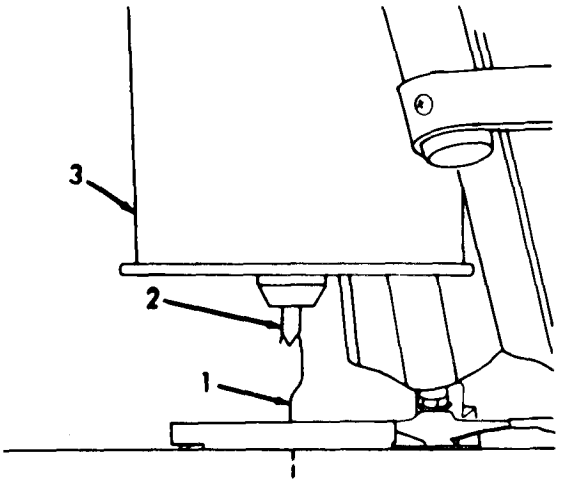
PUTTING SIAGL BACK IN SERVICE - Continued

AUXILIARY TRIPOD – Continued

h. Insert extension hook (1) through the bridge screw and attach to the pointer (2) on the underside of GRU housing (3).

i. Attach plumb bob assembly to the plumb pointer (2).

j. Adjust cord length to postion plumb bob approximately over fixed reference point.



CAUTION

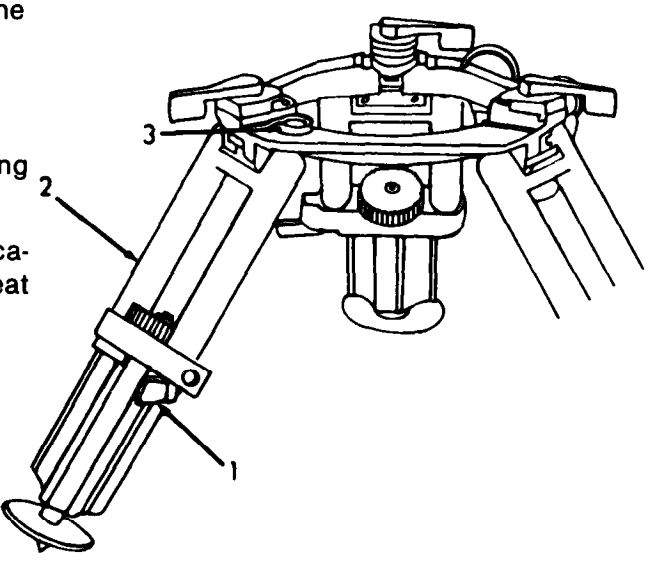
Make sure adapter assembly is firmly attached.

k. Turn auxiliary tripod to position point of plumb bob over the fixed reference point. Check plumb bob extension hook (1) to be sure that it is not touching the sides of the bridge screw.

COARSE LEVELING OF UNIT

a. Coarse level the instrument by releasing one of the tripod leg clamps (1).

b. Adjust the leg (2) to obtain a level indication on the tripod circular level (3). Repeat procedure for each of the other two legs.

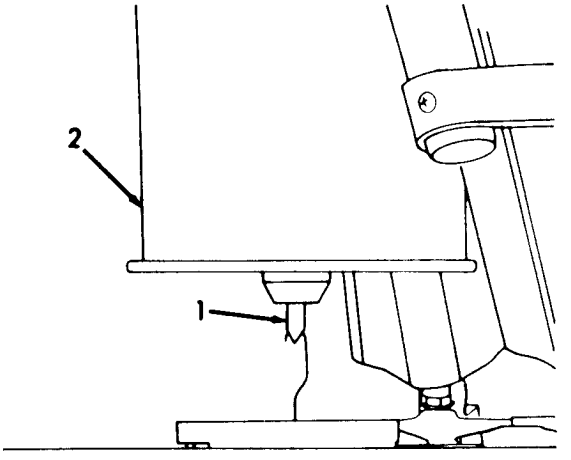


2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE – Continued

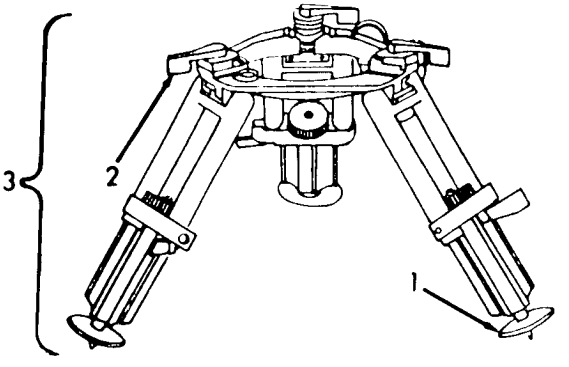
COARSE LEVELING OF UNIT – Continued

c. If the unit is to be centered over a fixed reference point, extend the plumb pointer (1) located on the bottom of the GRU housing (2).



d. Place the GRU on the ground so that the pointer is close to the fixed point and press leg spades (1) into the ground.

e. Release hold-down clamps (2) on tripod (3) and shift GRU in the tripod to position the pointer over the fixed reference point.



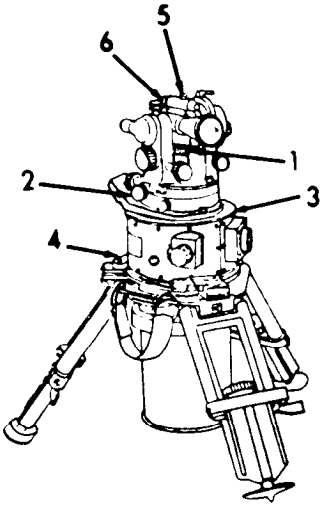
f. Rotate theodolite alidade (1) to position objective end of telescope over the NORTH mark on GRU. Tighten horizontal lock (2).

g. Preorient GRU (3) to NORTH by releasing tripod hold-down clamps (4) and rotate GRU in the tripod until the two magnetic compass images are in coincidence.

h. With telescope level, depress plunger (5) on magnetic compass (6).

NOTE

Check to ensure that the plumbing pointer is still over the fixed reference point.



2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

COARSE LEVELING OF UNIT - Continued

i. Tighten each of the three hold-down clamps on the tripod.

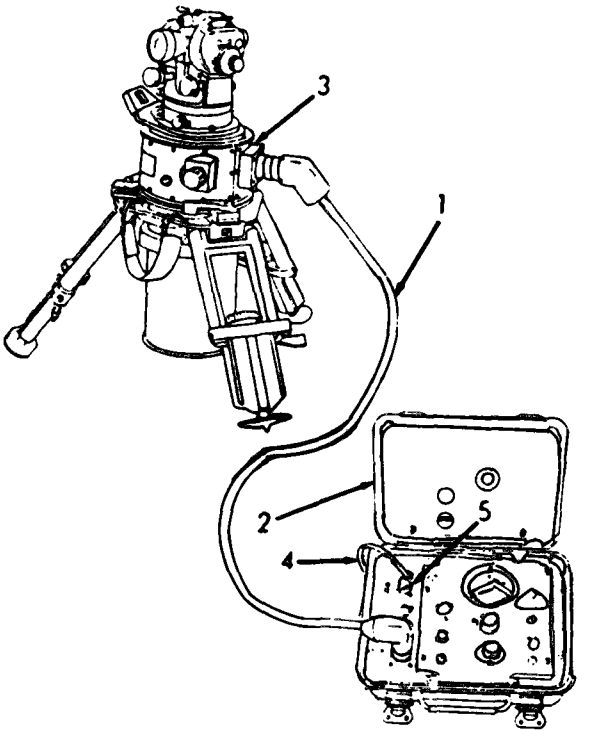
POWER CABLE INSTALLATION

a. Connect interconnect cable (1) to the ECU (2) and GRU (3).

b. Connect DC power cable (4) to the POWER receptacle (5) on ECU (2) and to a 22-23 Vdc power source.

NOTE

Auxiliary cables and an AC-DC converter are stored in the transport case for use as needed.

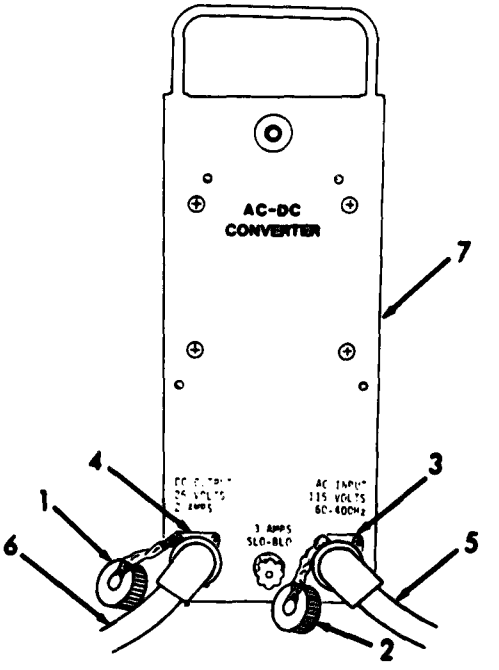


c. Remove AC-DC converter and associated cables from transport case.

d. Remove protective caps (1 and 2) from receptacles (3 and 4).

e. Connect the 115 Vac cable (5) between AC power source and input receptacle (3).

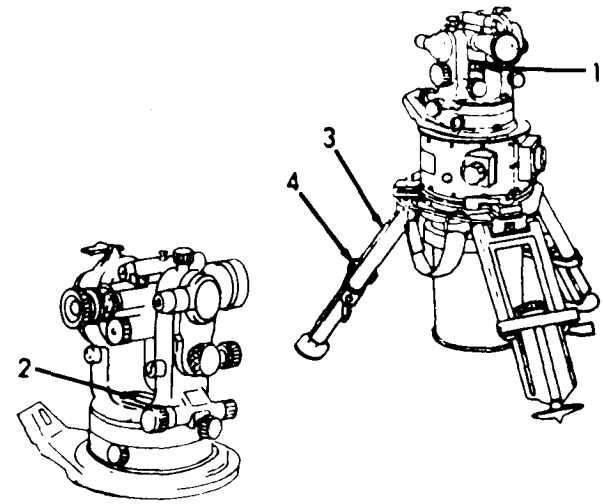
f. Connect power cable (6) between output receptacle (4) on the converter (7) and the power receptacle on the ECU.



2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

FINE-LEVELING OF UNIT

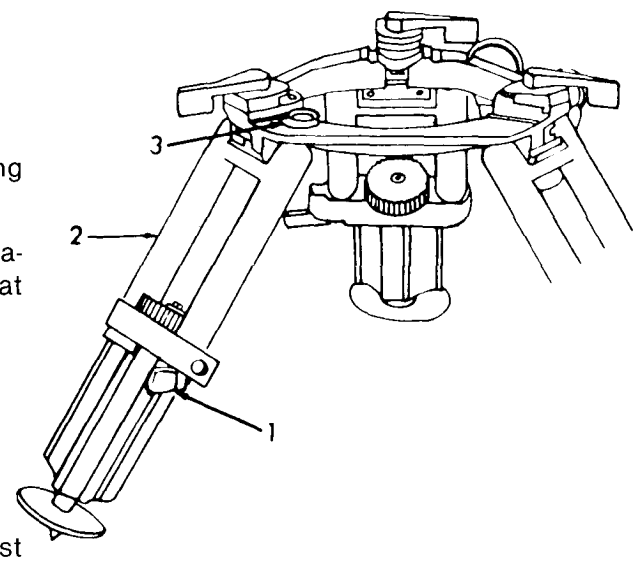


a. Rotate theodolite alidade (1) so that the long axis of the plate level (2) is in the same plane as one of the tripod legs (3).

b. Adjust fine-level control (4) to place the bubble in the center of the level vial.

NOTE

If adjustment can not be made proceed to steps c and d.



c. Coarse level the instrument by releasing one of the tripod leg clamps (1).

d. Adjust the leg (2) to obtain a level indication on the tripod circular level (3). Repeat procedure for each of the other two legs.

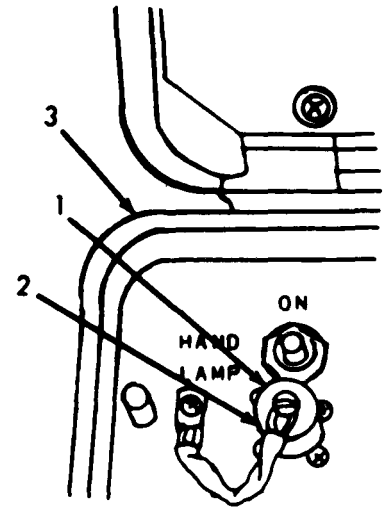
e. Rotate the alidade 90 degrees and adjust both the remaining legs.

f. Continue the process until the alidade can be rotated 360 degrees with no more than ± 1/2 division displacement of the bubble.

2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE – Continued

NIGHT OPERATION



WARNING

When operating in the dark, light from the cage-uncage indicator is visible at 45 meters. The indicator should be shielded to avoid detection

NOTE

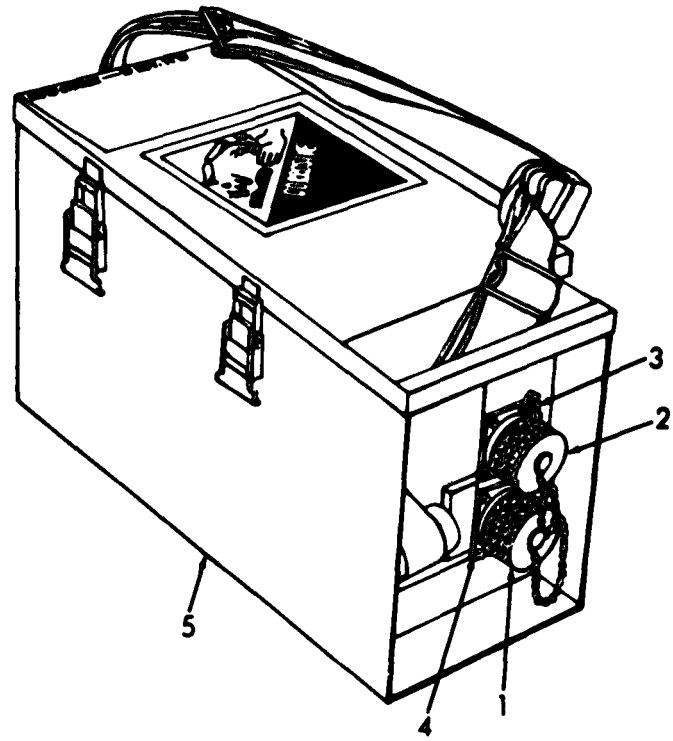
A hand-lamp assembly may be used during night operations. A hand-lamp switch and receptacle are provided on ECU to accommodate the assembly.

a. Remove cap and chain (1) from hand lamp connector (2) on ECU case (3).

b. Remove hand lamp assembly from ECU lid.

c. Install hand lamp assembly on connector (2).

BATTERY INSTALLATION



WARNING

Corrosive Battery Electrolyte (Potassium Hydroxide). Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.

a. Remove cap and chain assemblies (1 and 2) from electrical connectors (3 and 4) on battery (5).

2-9. PREPARATION FOR MOVEMENT - Continued

PUTTING SIAGL BACK IN SERVICE - Continued

BATTERY INSTALLATION - Continued

b. Connect battery adapter cable to the battery and power cable.

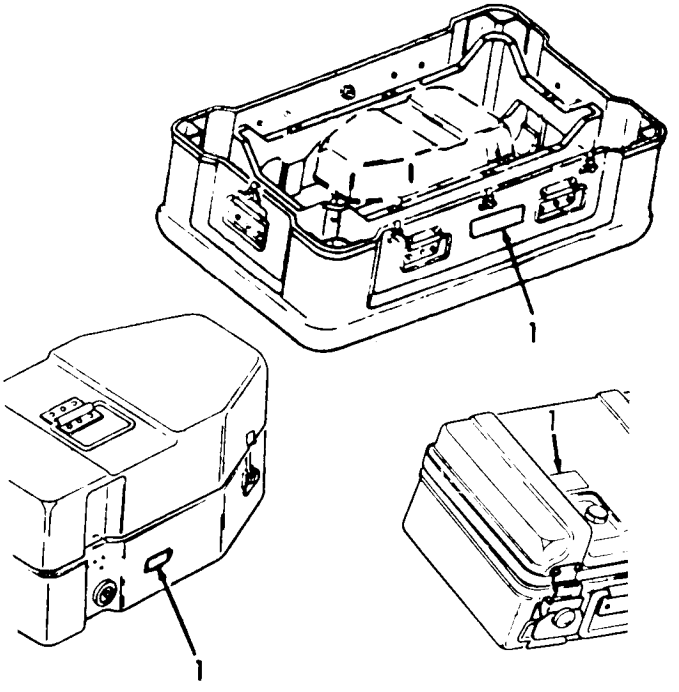
c. Connect power cable to the ECU.

2-10. OPERATING INSTRUCTIONS ON DECALS AND INSPECTION PLATES

a. Transport Case Relief Valve Instruction Plate (1).

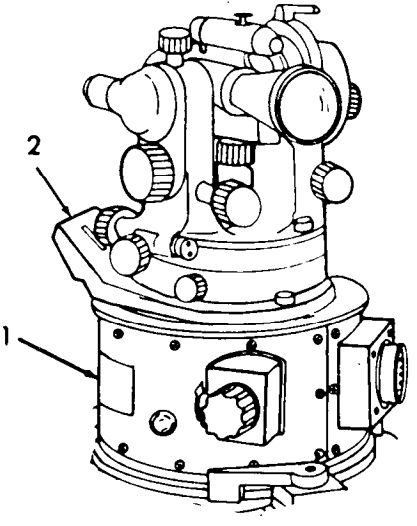
b. Transit Case Relief Valve Instruction Plate (1).

c. ECU Relief Valve Instruction Plate (1).



d. GRU Warning Plate (1), instructing personnel not to disturb the instrument when uncaged, is mounted on GRU upper housing.

e. Mirror Azimuth Plate (2) indicates the required circle setting of the theodolite when autocollimated on mirror.



Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-11. GENERAL

The SIAGL is required to operate in all climatic conditions; however, due to known design limitations of theodolites, the following procedures must be used to permit successful operation.

a. Avoid subjecting the instrument to extreme sudden changes in temperature.

b. Allow the instrument to stabilize at the operating temperature.

c. Select operating sites that can shield or protect the instrument from the full effects of extreme environment. Make use of any available tents or other shelters.

d. At the completion of a mission return the instrument to the sheltered site to prevent its needless exposure to harsh environments.

e. Remove moisture and fogging of the optics by placing the instrument in a warm, dry place (locally fabricated “hot box”) and using a desiccant.

f. Adhere to “local regions” standard operation, maintenance, and storage procedures.

g. Ensure that the equipment is clean and dry prior to replacing.

2-12. OPERATING IN EXTREME COLD - BELOW 0°F. (-17.78°C)

With proper precautions, servicing, and theodolite lubrication, the SIAGL can be used in extreme cold. Its use is limited only by the endurance of operating personnel and conditions affecting visibility. The instrument should be kept out-of-doors or in unheated buildings for short periods of non-use. For temperature below 0°F(-17.78°C), allow 20 minutes for warmup. Warmup can be accomplished by following the normal operating procedures but ignoring the first READ AZIMUTH indication. Operate the theodolite controls slowly and evenly to avoid stressing mechanical parts. Do not attempt to straighten or unnecessarily bend the cables. At temperatures below -40°F(-40°C), turn the GRU both clockwise and counterclockwise about the intended azimuth reading before initiating a gyro compass observation.

2-13. OPERATION IN EXTREME HEAT

The SIAGL is designed to operate in extreme heat up to 125°F (51.6°C); however, to avoid degradation of accuracy due to internal theodolite distortion, the instrument should be protected from direct sunlight by an umbrella or other suitable shelter.

2-14. OPERATION IN DUSTY OR SANDY AREAS

Special care must be given to the theodolite when the SIAGL is being used in dusty or sandy areas, since both dust and sand are highly abrasive. Keep the rain and dust cover over the theodolite at all times, except when making actual sightings. The theodolite should be brushed frequently and carefully wiped clean. Be extremely careful not to scratch lens and prism surfaces when cleaning.

2-15. OPERATION UNDER RAINY OR HUMID CONDITIONS

Exercise care to avoid getting the cable connectors wet or muddy when setting up the equipment. Keep the rain and dust cover over the theodolite at all times, except when making actual sightings. Use lens cleaning tissues to remove moisture from the glass surfaces of the level vials and the theodolite lenses. A slight lowering of temperature in a humid area will cause condensation of moisture and fogging of optics. Internal fogging can usually be removed by placing the instrument in a warm, dry place. Corrosion due to high humidity can be partially eliminated by using warm, dry storage areas and desiccant. Clean and dry the equipment with a soft cloth after use.

2-16. OPERATING IN SALT WATER AREAS

When operating in salt water areas, wipe the instrument often with a soft, clean cloth. Keep the rain and dust cover over the theodolite at all times, except when making actual sightings. Do not allow the theodolite to be exposed to direct salt water spray. Cleaning intervals should be shortened considerably for theodolites subjected to salt air exposure.

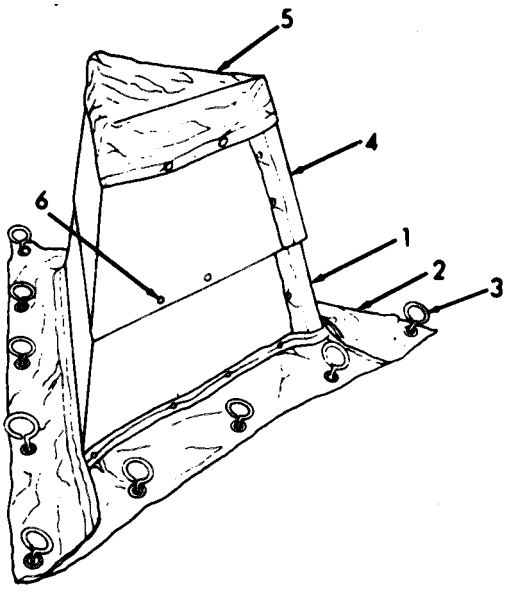
2-17. OPERATION IN AREAS OF LARGE MAGNETIC ANOMALIES

Anomalies in the earth's magnetic field have no effect on the ability of the SIAGL to determine true north. However, they do affect the magnetic compass used to preorient the GRU unit to north. The servo system is free to travel +40°; only anomalies of more than 40° affect the operation of the instrument and require special operating procedures. It is not necessary to know the amount of anomaly at the operating sight. The action taken by the operator during the first gyrocompass is to observe the position of the follow-up index mark on the servo operating band, which is displayed on top of the reference unit at the base of the theodolite. If the index mark moves to the end of the servo operating band, the pendulum is to be caged; rotate the GRU in the tripod 60° in the direction that the index mark was moving. Re-level and re-bias the instrument and proceed with the gyrocompass operation.

2-18. OPERATION IN HIGH WIND

a. The SIAGL is designed to perform accurately in winds up to 20 mph (32 kmph). Wind disturbances can be detected by a difficulty in obtaining a steady BIAS null and extended observation times. In winds in excess of 20 mph (32 kmph) it is recommended that the wind shelter be used to protect the equipment and maintain an accuracy to performance.

b. To set up the wind shelter, erect lower panel assembly (1) by positioning edge of panel between metal brace and flap, and secure with snap fasteners (6). Place assembly over erected instrument and position to prevent any contact with the instrument during operation. Pin the skirts (2) of the lower panel assembly firmly to the ground with pins (3). Assemble the upper panel assembly (4); stretch cover (5) over upper panel and secure with snap fasteners (6). When the instrument is uncaged in the BIAS or GC mode, press upper panel assembly firmly onto lower panel assembly. Remove the upper panel assembly to read azimuth. When operating in areas of sand or loamy soils, place rock and sod over lower panel skirts and pins to provide maximum stability of the shelter.



2-19. ELECTROMAGNETIC INTERFERENCE (EMI)

The SIAGL is susceptible to certain levels of electromagnetic radiation. In areas where frequencies of 30 K H z - 200 KHz are present, the READ Azimuth light will extinguish at levels from 0.10 volts/meter. At frequencies from 30 MHz to 40 MHz the Gyro will cage at levels of 5.6 V/M to 7.5 V/M.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

Lubrication of the SIAGL is not required at the operator/crew-level of maintenance.

Section II. TROUBLESHOOTING PROCEDURES

3-1. GENERAL

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the SIAGL. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which may help you to determine probable causes and corrective actions to take.

b. The troubleshooting table lists the common malfunctions which you may find during the operation or maintenance of the survey instrument. You should perform the tests/inspections and corrective actions in the order listed.

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

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

3-2. TROUBLESHOOTING

The table lists malfunctions that may occur during operation of the equipment, probable causes of the malfunction, and action to be taken to correct the malfunction. Where more than one probable cause exists, follow the sequence shown in the table when performing corrective action. Ensure that equipment is correctly hooked up and properly operated prior to performing troubleshooting procedures. Report equipment to the next higher level of maintenance when malfunctions cannot be remedied through the procedures in the following table.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
ELECTRONIC CONTROL UNIT
1. POWER ON INDICATOR FAILS TO LIGHT WHEN POWER IS APPLIED AND PANEL ILLUMINATION CONTROL IS FULLY CLOCKWISE. Step 1. Check for a bad power source. a. With a MODE SELECT switch positioned to SELF TEST and with PWR ON indicator illuminated, place the TEST SELECT switch to source voltage. b. Depress the PRESS TO TEST switch; verify that the test meter pointer is positioned between 22 and 33 VDC on the upper meter scale. If the reading is less than 22 VDC, replace the battery or AC-DC converter. c. If AC-DC converter is being used, check for a defective converter fuse. d. Unscrew the cap on the fuse holder and remove the fuse. e. Test fuse for continuity with an ohmmeter. Replace defective fuse. f. Place the new fuse in cap of the fuse holder. Insert fuse in AC-DC converter, press down, and turn the cap clockwise to secure the fuse holder.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

Step 2. Check for bad fuse.

a. Unscrew the cap on the fuse holder and remove the fuse.

b. Test fuse for continuity with an ohmmeter. Replace defective fuse.

c. Place the new fuse in the cap of the fuse holder. Insert fuse in ECU panel, press, and turn the cap clockwise to secure the fuse holder.

Step 3. Check for a bad POWER-ON indicator lamp.

a. Unscrew the plastic lens from the indicator lamp assembly.

b. Visually inspect lamp for a burned out filament. If filament is bad, replace with a new lamp.

c. Place the new lamp in the socket of the lamp assembly. Screw the plastic lens in place over the lamp and tighten the plastic lens finger tight.

Step 4. Check for a defective power cable.

a. Disconnect the power cable from the receptacle on the ECU and power source.

b. Inspect power cable for damaged connectors and broken or frayed wires and insulation. Replace damaged power cable.

c. Connect the power cable to the power source and ECU receptacle.

Step 5. Check for a defective ECU.

a. Replace existing ECU with an ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report a defective ECU to the next higher level of maintenance.

2. TEST METER FAILS TO INDICATE PROPERLY (BETWEEN 22 AND 33 VDC)

Step 1. Check for a bad power source.

a. With the MODE SELECT switch position to SELF TEST and with PWR ON indicator illuminated, place the TEST SELECT switch to source voltage.

b. Depress the PRESS TO TEST switch: verify that the TEST METER pointer is positioned between 22 and 33 VDC on the upper meter scale. If the reading is less than 22 VDC, replace the battery or AC-DC converter.

c. If AC-DC converter is being used, check for a defective converter fuse.

d. Unscrew the cap on the fuse holder and remove the fuse.

e. Test fuse for continuity with an ohmmeter. Replace defective fuse.

f. Place the new fuse in cap of the fuse holder. Insert fuse in AC-DC converter, press down, and turn the cap clockwise to secure the fuse holder.

Step 2. Check for defective ECU.

a. Replace existing ECU with an ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report defective ECU to the next higher level of maintenance.

3. TEST METER FAILS TO INDICATE NULL WHEN BIAS CONTROLS ARE OPERATED.

Step 1. Ensure that GRU is level.

a. Rotate the theodolite alidade to position the objective end of the telescope over the NORTH mark on the GRU. Tighten the horizontal lock. Preorient the GRU to north by releasing the tripod hold-down clamps, and rotate the GRU in the tripod until the two magnetic compass needle images coincide. With the telescope level, depress the plunger on the magnetic compass. Check to ensure that the plumbing pointer is still over the fixed reference point. Tighten each of the three hold-down clamps on the tripod.

b. To obtain fine-leveling, rotate the theodolite alidade so that the long axis of the plate level is in the same plane as one of the tripod legs. Adjust the fine-level control to place the bubble in the center of the level vial. Rotate the alidade 90 degrees and adjust both of the remaining legs. Continue the process until the alidade can be rotated 360 degrees, with no more than ±1/2 division displacement of the bubble.

Step 2. Check for defective ECU.

a. With MODE SELECT switch in SELF TEST and TEST SELECT switch in BIAS, depress PRESS to TEST switch for green area reading on test meter.

b. Replace defective ECU with an ECU that is operable by disconnecting and connecting power cable.

c. Report a defective ECU to next higher level of maintenance.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
ELECTRONIC CONTROL UNIT (Continued)	
Step 3. Check for defective GRU.	
	a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.
	b. Replace a defective GRU with a new one by disconnecting and connecting power cables.
	c. Report defective GRU to the next higher level of maintenance.
4. GYRO SYNC INDICATOR FAILS TO LIGHT WITHIN TWO MINUTES AFTER MODE SELECT SWITCH IS PLACED TO GC.	
Step 1. Check for defective GYRO SYNC indicator lamp.	
	a. Unscrew the plastic lens from the indicator lamp assembly.
	b. Visually inspect lamp for a burned out filament. If filament is defective, replace with a new lamp.
	c. Place the new lamp in the socket of the lamp assembly. Screw the plastic lens in place over the lamp and tighten the plastic lens finger tight.
Step 2. Check for defective ECU.	
	a. Place TEST SELECT switch in GYRO position; depress PRESS TO TEST switch for a voltage indication.
	b. Replace defective ECU with an ECU that is operable by disconnecting and connecting power cables.
	c. Report a defective ECU to next higher level of maintenance.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

Step 3. Check for a defective power cable.

a. Disconnect the power cable from the receptacle on the ECU and power source.

b. Inspect power cable for damaged connectors and broken or frayed wires and insulation. Replace damaged power cable.

c. Connect the power cable to the power source and ECU receptacle.

Step 4. Check for defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report defective GRU to next higher level of maintenance.

5. READ AZIMUTH INDICATOR FAILS TO LIGHT 15 MINUTES AFTER UNCAGING.

Step 1. Check to see if GRU is preoriented within ±40 degrees of true north.

a. Rotate the theodolite alidade to position the objective end of the telescope over the NORTH mark on the GRU; tighten the horizontal lock.

b. Preorient the GRU to north by releasing the tripod hold-down clamps, and rotating the GRU in the tripod until the two magnetic compass needle images coincide.

c. With the telescope level, depress the plunger on the magnetic compass.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

d. Check to ensure that the plumbing pointer is still over the fixed reference point.

e. Tighten each of the three hold-down clamps on the tripod.

Step 2. Check to see if LATITUDE select switch is at the proper position.

a. If switch position is not correct, place to position corresponding to applicable latitude of operation as shown below.

0	0-15 degrees
25	15-30 degrees
40	30-45 degrees
50	45-55 degrees
60	55-63 degrees
65	63-67 degrees
70	67-73 degrees
75	73-75 degrees

Step 3. Check for defective READ AZIMUTH indicator lamp,

a. Unscrew the plastic lens from the indicator lamp assembly.

b. Visually inspect lamp for a burned out filament. If filament is defective replace with a new lamp.

c. Place the new lamp in the socket of the lamp assembly. Screw the plastic lens in place over the lamp and tighten the plastic lens finger tight.

Step 4. Check for a defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report defective GRU to the next higher level of maintenance.

Step 5. Check for a defective ECU.

a. Replace existing ECU with an ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report defective ECU to the next higher level of maintenance.

6. BRAKE ON INDICATOR FAILS TO LIGHT WHEN MODE SELECT SWITCH IS PLACED TO BRAKE ON.

Step 1. Check for a defective BRAKE ON indicator lamp.

a. Unscrew the plastic lens from the indicator lamp assembly.

b. Visually inspect lamp for a burned out filament. If filament is defective replace with a new lamp.

c. Place the new lamp in the socket of the lamp assembly. Screw the plastic lens in place over the lamp and tighten the plastic lens finger tight.

Step 2. Check for a defective ECU.

a. Replace existing ECU with an ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ELECTRONIC CONTROL UNIT (Continued)

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report a defective ECU to the next higher level of maintenance.

Step 3. Check for a defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

GYROSCOPIC REFERENCE UNIT (GRU)

1. UNCAGED INDICATOR FAILS TO LIGHT WHEN CAGE-UNCAGED KNOB IS ROTATED TO UNCAGED.

Step 1. Check for a defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

GYROSCOPIC REFERENCE UNIT (GRU) (Continued)

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

Step 2. Check for a defective ECU.

a. Replace existing ECU with a ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report a defective ECU to the next higher level of maintenance.

2. UNCAGED INDICATOR FAILS TO GO OUT WHEN CAGED-UNCAGED KNOB IS ROTATED TO CAGE.

Step 1. Check for a defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

Step 2. Check for a defective ECU.

a. Replace existing ECU with a ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

GYROSCOPIC REFERENCE UNIT (GRU) (Continued)

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report a defective ECU to the next higher level of maintenance.

3. THEODOLITE RETICLE AND OPTICAL LAMPS FAIL TO LIGHT WHEN MODE SELECT SWITCH IS PLACED TO THEO ILLUM AND THEO BRT CONTROL IS ROTATED CLOCKWISE.

Step 1. Check for defective lamp(s).

a. Ensure that the power is off.

b. Rotate the applicable protective cap counter-clockwise and remove.

c. Remove the lamp from the socket.

d. Visually inspect lamp for a burned out filament. If filament is defective, replace with a new lamp.

e. Place the good lamp in the socket.

f. Position the protective cap over the socket and turn clockwise until finger-tight.

Step 2. Check for a defective power cable.

a. Disconnect the power cable from the receptacle on the ECU and power source.

b. Inspect power cable for damaged connectors and broken or frayed wires and insulation. Replace damaged power cable.

c. Connect the power cable to the power source and ECU receptacle.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

GYROSCOPIC REFERENCE UNIT (GRU) (Continued)

Step 3. Check for a defective ECU.

a. Replace existing ECU with a ECU that is operable. If the system operates correctly with the new ECU, this indicates the original ECU was defective.

b. Replace a defective ECU with a new one by disconnecting and connecting power cables.

c. Report a defective ECU to the next higher level of maintenance.

Step 4. Check for a defective GRU.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

4. THEODOLITE RETICLE FOCUS UNOBTAINABLE.

Step 1. Check for defective theodolite.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

3-2. TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

GYROSCOPIC REFERENCE UNIT (GRU) (Continued)

5. THEODOLITE AZIMUTH AND ELEVATION CONTROLS INOPERATIVE.

Check for defective theodolite.

a. Replace existing GRU with a GRU that is operable. If the system operates correctly with the new GRU, this indicates the original GRU was defective.

b. Replace a defective GRU with a new one by disconnecting and connecting power cables.

c. Report a defective GRU to the next higher level of maintenance.

6. HAND-LAMP ASSEMBLY FAILS TO LIGHT WHEN HAND-LAMP SWITCH ON ECU PANEL IS TURNED TO THE ON POSITION.

Check hand-lamp assembly for defective lamp.

a. Unscrew the lamp shield.

b. Remove the lamp from the lamp base.

c. Visually inspect the lamp for a burned filament. If the filament is bad, replace the lamp.

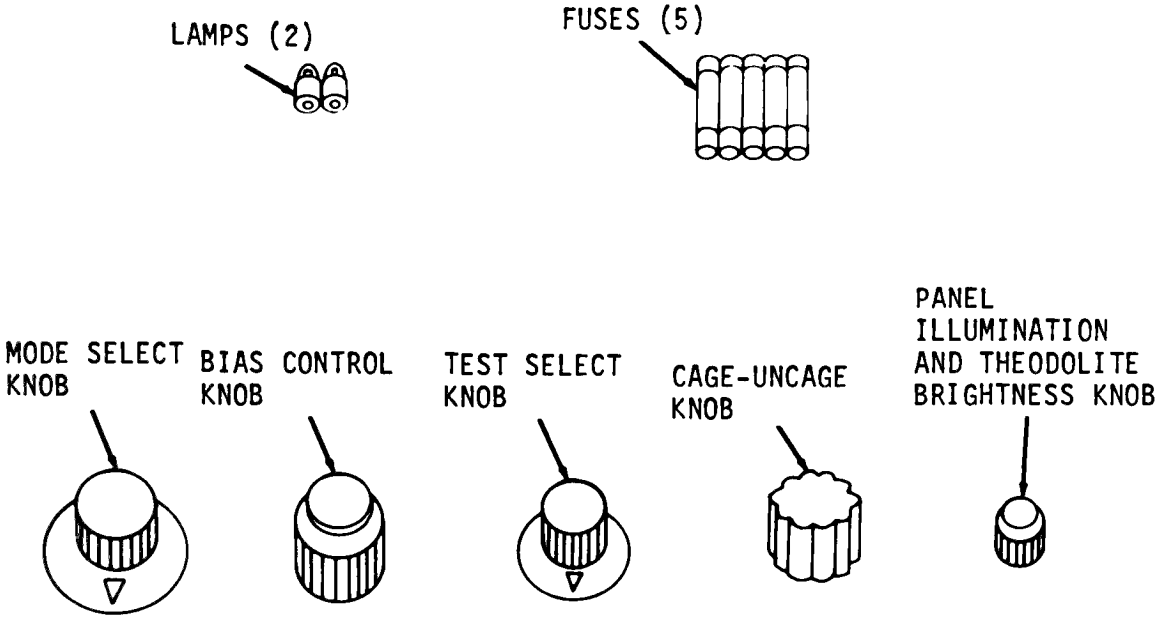
d. Install a good lamp in the lamp base.

e. Screw the lamp shield into the assembly.

Section III. MAINTENANCE PROCEDURES

3-3. GENERAL

Operator/crew maintenance functions consist of lamp and fuse replacement in the ECU, lamp replacement in the hand-lamp assembly, fuse replacement in the AC-DC converter, and tripod adapter adjustment. Spare fuses and lamps are contained in the upper portion of the transport case marked spare parts and in the transit case spares compartment.



3-4. ELECTRONIC CONTROL UNIT INDICATOR LAMPS

This task covers:

a. Removal b. Installation

INITIAL SETUP

Material/Parts

Lamp, MS18209-387

Personnel Required

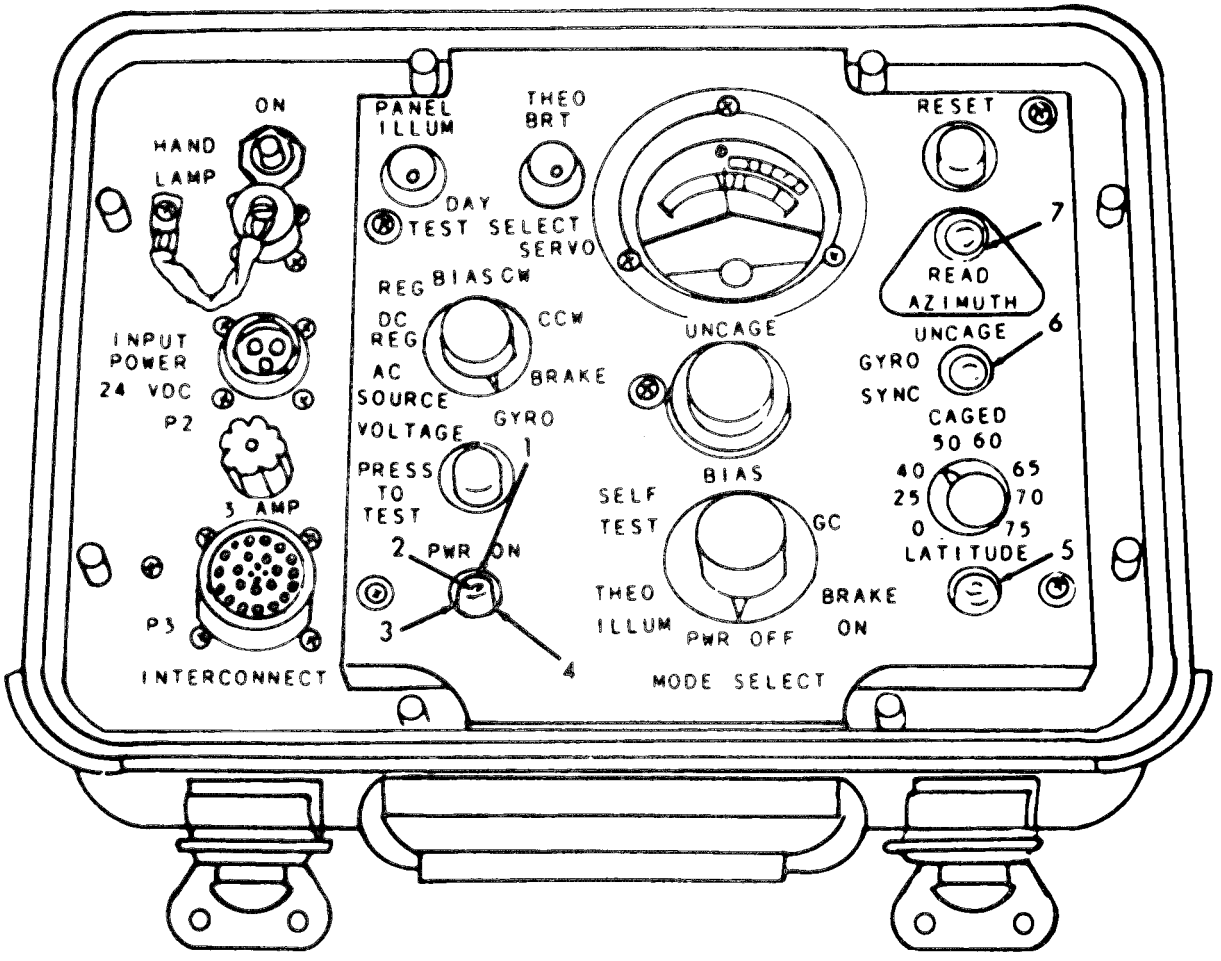
MOS 82C Surveying
Instrument Operator

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Lens	Unscrew plastic lens (1) from defective indicator lamp assembly.	
2. Lamp	a. Remove lamp (2) from socket (3) of lamp assembly (4).	Discard defective lamp.
	b. Remove lens and lamp from other three lamp assemblies (5, 6, and 7) in the same manner.	
INSTALLATION		
3. Lamp	a. Install new lamp (2) in socket (3) of lamp assembly (4).	
	b. Install plastic lens (1) over the lamp.	Tighten lens finger-tight only.
	c. Install all lamps in the same manner.	

3-4. ELECTRONIC CONTROL UNIT INDICATOR LAMPS – Continued

LOCATION / ITEM	ACTION	REMARKS

INSTALLATION – Continued



1. Lens
2. Lamp
3. Socket
4. Lamp assembly
5. Lamp assembly
6. Lamp assembly
7. Lamp assembly

3-5. ELECTRONIC CONTROL UNIT FUSE

This task covers:

a. Removal b. Testing c. Installation

INITIAL SETUP

Test Equipment

Ohmmeter

Material/Parts

Fuse

Personnel Required

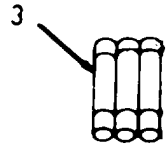
MOS 82C Surveying
Instrument Operator

LOCATION / ITEM	ACTION	REMARKS
REMOVAL		
1. Fuse	a. Unscrew cap (1) from fuse holder (2).	
	b. Remove fuse (3) from cap (1).	
TESTING		
2. Fuse	Test fuse for continuity using an ohmmeter.	Discard defective fuse.
INSTALLATION		
3. Fuse	a. Install fuse (3) in cap (1).	
	b. Place cap (1) over fuse holder (2).	
	c. Press and turn cap clockwise to secure.	

3-5. ELECTRONIC CONTROL UNIT FUSE - Continued

LOCATION / ITEM	ACTION	REMARKS

INSTALLATION - Continued



1. Cap
2. Fuseholder
3. Fuse

3-6. TRIPOD ADAPTER ADJUSTMENT

This task covers:

Adjustment

INITIAL SETUP

Material/Parts

Screwdriver, Flat Tip
GGGS121 (81348)
NSN 5120-00-236-2127

Personnel Required

MOS 82C Surveying
Instrument Operator

LOCATION / ITEM	ACTION	REMARKS

ADJUSTMENT

NOTE

The tripod adapter assembly is used to install the surveying instrument on the auxiliary tripod.

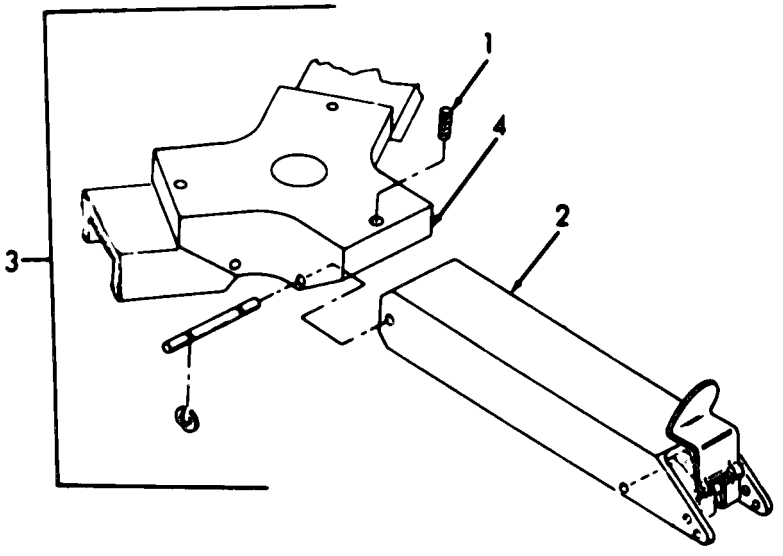
a. Adjust setscrew (1) on each leg (2) of adapter (3) so that legs touch the outer part of the tripod head (4).

b. Adjust setscrew (1) until a gap of 0.02 to 0.04 inches (0.050 to 0.100 cm) is maintained near the center of the adapter (3).

3-6. TRIPOD ADAPTER ADJUSTMENT - Continued

LOCATION / ITEM	ACTION	REMARKS

ADJUSTMENT – Continued



1. Setscrew
2. Leg
3. Adapter
4. Tripod head

3-7. AC-DC CONVERTER FUSE

This task covers:

a. Removal b. Testing c. Installation

INITIAL SETUP

Test Equipment

Ohmmeter

Material/Parts

Fuse

Personnel Required

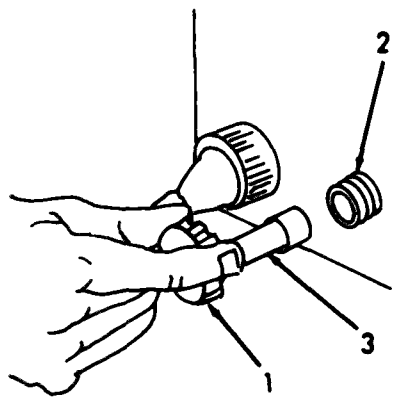
MOS 82C Surveying
Instrument Operator

LOCATION / ITEM	ACTION	REMARKS
REMOVAL		
1. Fuse	a. Unscrew cap (1) from fuse holder (2).	
	b. Remove fuse (3) from cap (1).	
TESTING		
2. Fuse	Test fuse for continuity using an ohmmeter.	Discard defective fuse.
INSTALLATION		
3. Fuse	a. Install fuse (3) in cap (1).	
	b. Place cap (1) over fuse holder (2).	
	c. Press and turn cap clockwise to secure.	

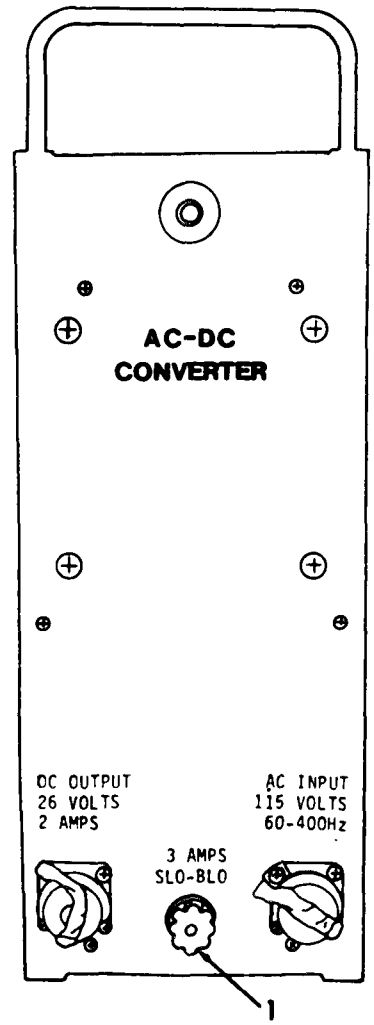
3-7. AC-DC CONVERTER FUSE - Continued

LOCATION / ITEM	ACTION	REMARKS

INSTALLATION – Continued



1. Cap
2. Fuseholder
3. Fuse



3-8. HAND-LAMP ASSEMBLY LAMP

This task covers:

a. Removal b. Repair c. Installation

INITIAL SETUP

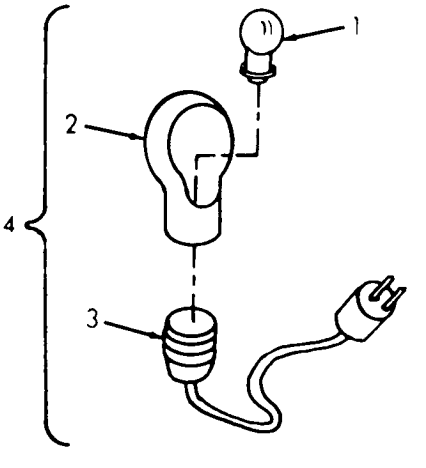
Material/Parts

Lamp, MS18209-387

Personnel Required

MOS 82C Surveying
Instrument Operator

LOCATION / ITEM	ACTION	REMARKS
REMOVAL		
1. Shield	Unscrew and remove lamp shield (2).	
2. Lamp	Remove lamp (1) from lamp base (3).	
REPAIR		
	Replace defective lamp with one of the same wattage.	
INSTALLATION		
3. Lamp	a. Install lamp (1) in base. b. Install lamp shield (2) on lamp base. c. Tighten securely.	



1. Lamp
2. Shield
3. Base

APPENDIX A
REFERENCES

A-1. SCOPE

This appendix lists forms, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS

Equipment Inspection and Maintenance Worksheet . . . . . .DA Form 2404
Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028
Recommended Changes to DA Publications . . . . DA Form 2028-2
Equipment Improvement Recommendations . . . . SF Form 368

A-3. TECHNICAL MANUALS

The Army Maintenance Management System . . . . DA PAM 738-750
Hand Receipt, Organizational Maintenance Manual Survey Instrument:
Azimuth, Gyro, Lightweight (SIAGL) Model AG-8, Type 1; NSN 6675-00-062-8579 . . . . . TM5-6675-250-10HR
Organizational Maintenance Manual Survey Instrument: Azimuth, Gyro,
Lightweight (SIAGL) Model AG-8 Type 1, NSN 6675-00-062-8579 . . . . . .TM5-6675-250-20
Organizational Maintenance Repair Parts and Special Tools List Survey
Instrument; Azimuth, Gyro, Lightweight (Lear SIEGLER, Inc. Model AG-8)
NSN 6675-00-062-8579 . . . . TM5-6675-250-20P

A-4. MISCELLANEOUS PUBLICATIONS

Identification and Distribution of D.A. Publications and Issue of Agency and
Command Administrative Publications . . . . AR 310-2

APPENDIX B
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS

Section I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the surveying instrument to help you inventory items required for safe and efficient operation.

6-2. GENERAL

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section Il. Components of End Item. This listing is for informational purposes only and is not authority to requisition replacements. These items are part of the end item but are removed and separately packaged for transportation or shipment. 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 Ill. Basic Issue Items (BII). These are the minimum essential items required to place the surveying instrument in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, Bll must be with surveying instrument 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.

B-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1) - Illustration Number (lllus 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.

B-3. EXPLANATION OF COLUMNS - Continued

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 parenthesis) followed by the part number.

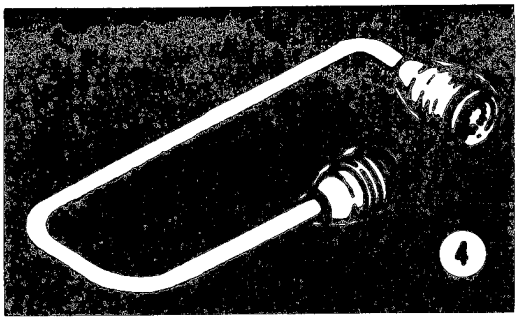
Usable on Codes are identified as follows:

Code	USED ON
BWL	Model AG-8

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).

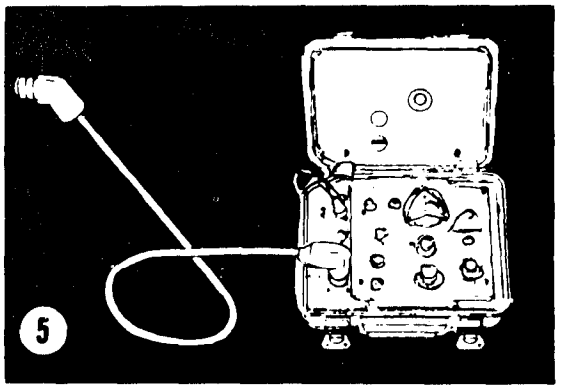
e. Column (5) - Quantity Required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

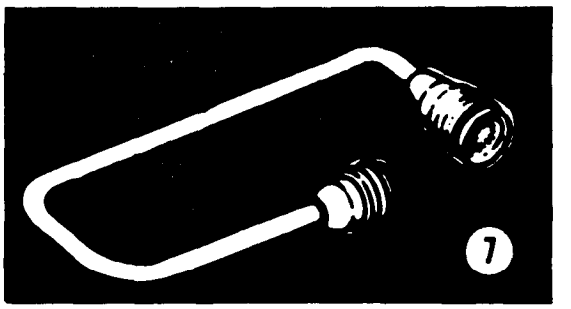
Section II. COMPONENTS OF END ITEM

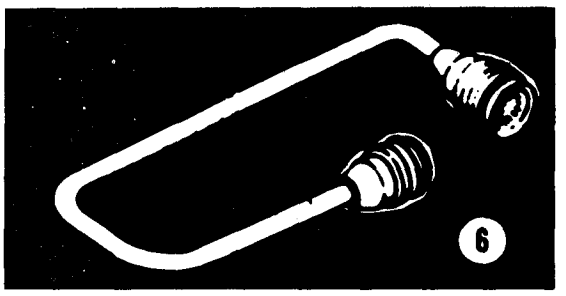


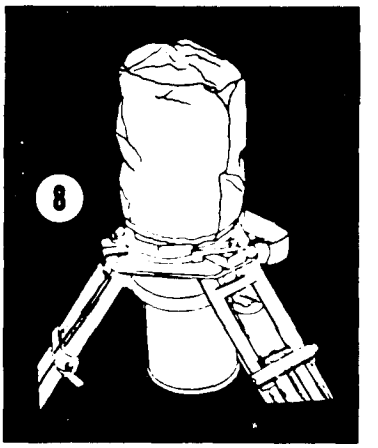
(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
1,2 and 3	Deleted				
4	6150-01-041-4340	Cable Assembly, DC Power Adapter, W5 (97403) 13218E3411	BWL	EA	1

Section II. COMPONENTS OF END ITEM - (Continued)



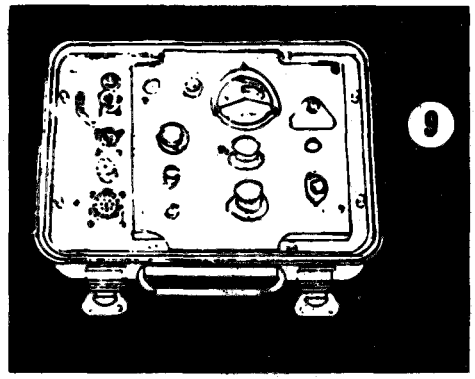


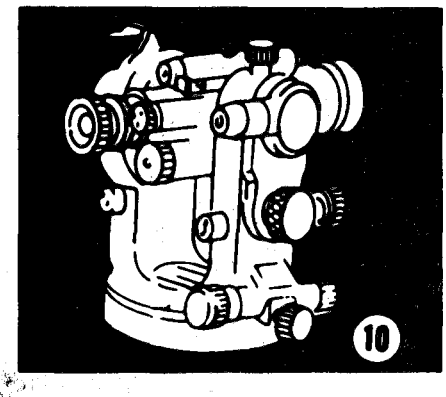


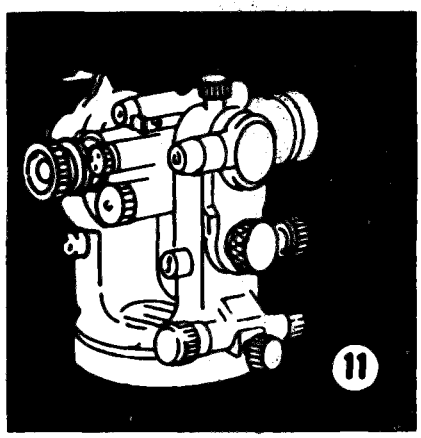


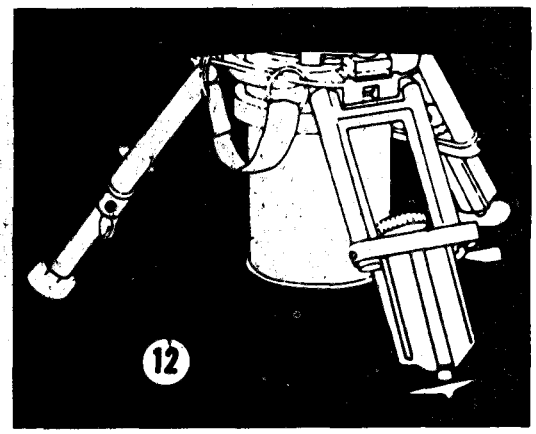
(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
5	6150-01-041-8377	Cable Assembly, DC Power Extension, W3 (97403)13218E3409	BWL	EA	1
6	6150-01-043-9698	Cable Assembly, Inter-connect (97403) 13218E3407	BWL	EA	1
7	6150-01-046-0117	Cable Assembly, Jumper, W6 (97403) 13218E3412	BWL	EA	1
8	6675-01-006-1561	Cover, Rain and Dust, Theodolite (97403) 13218E3549	BWL	EA	1

Section II. COMPONENTS OF END ITEM - (Continued)



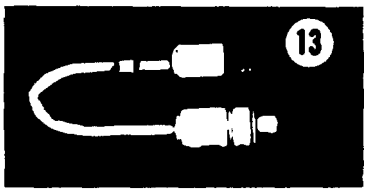


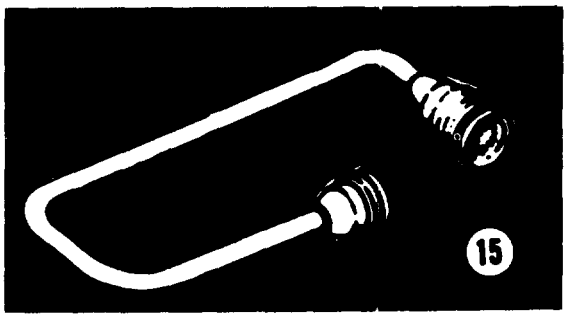


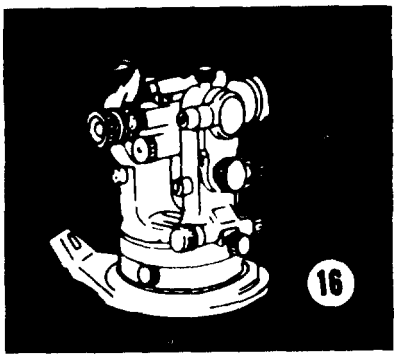


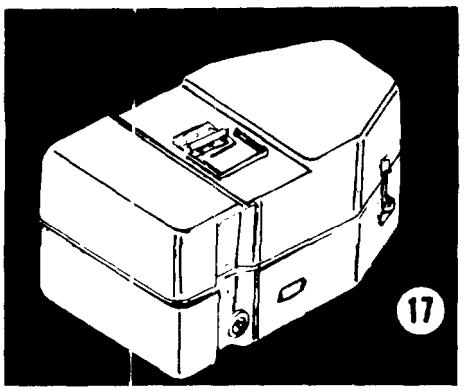
(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
9	6675-00-621-0771	Electronic Control Unit (97403) 13218E3200	BWL	EA	1
10	6675-01-010-0107	Eyepiece, Filter, Theodolite (97403) 13218E3502-2	BWL	EA	1
11	6675-01-010-0006	Eyepiece, Prism, Theodolite (97403) 13218E3502-3	BWL	EA	1
12	6675-00-623-7299	Gyroscopic Reference Unit (97403) 13218E3500	BWL	EA	1

Section II. COMPONENTS OF END ITEM - (Continued)



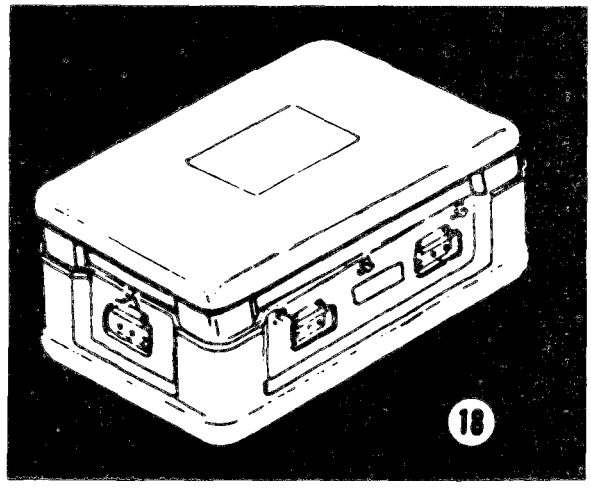


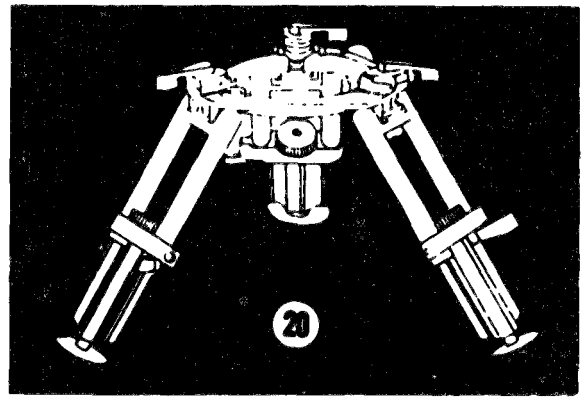


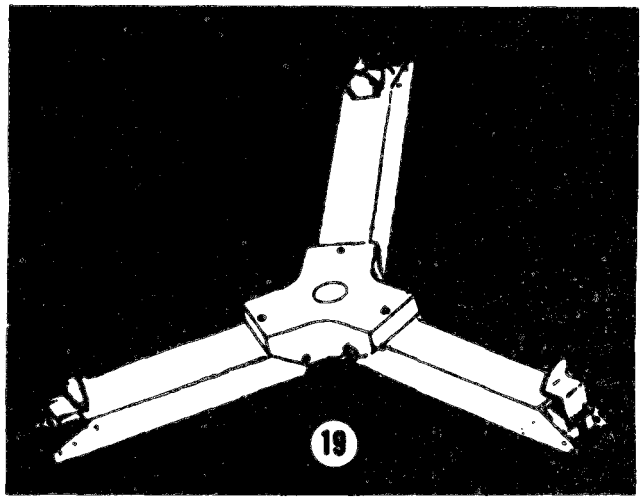


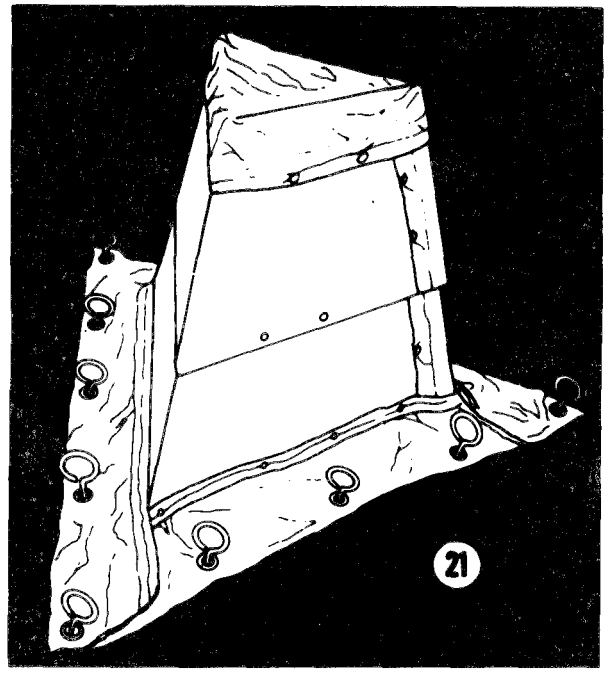
(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
13	5935-01-006-1558	Handlamp Assembly (97403) 13218E3427	BWL	EA	1
14	Deleted				
15	6150-01-042-4635	Lead Electrical, DC Power (97403) 13218E3408	BWL	EA	1
16	6675-00-623-7301	Theodolite, DKM1-02 MIL (01122) 112-002-4135	BWL	EA	1
17	6675-01-047-9640	Transit Case (97403) 13218E3100	BWL	EA	

Section II. COMPONENTS OF END ITEM – (Continued)



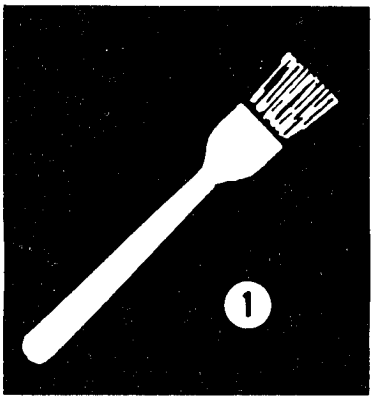


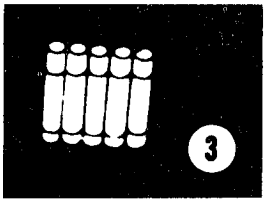


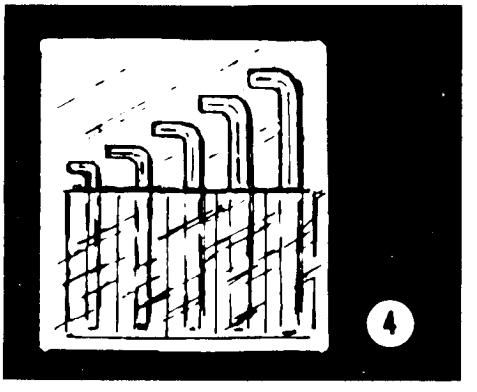


(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
18	6675-01-040-1380	Transport Case (97403) 13218E3002	BWL	EA	1
19	6675-01-006-3619	Tripod Adapter Assembly (97403) 13218E3580	BWL	EA	1
20	6675-00-623-7373	Tripod Assembly (97403) 13218E3550	BWL	EA	1
21	6675-01-014-6299	Wind Shelter (97403) 13218E7300	BWL	EA	1

Section III. BASIC ISSUE ITEMS

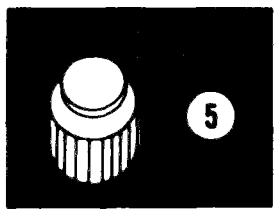


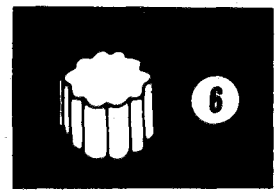


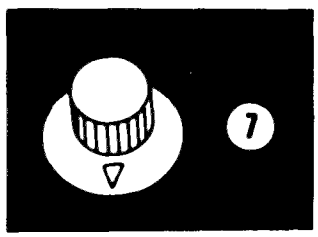


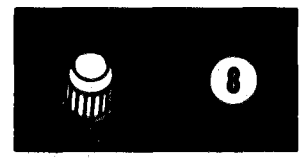
(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
1	7920-01-015-6491	Brush, Lens (97403) 13218E3123	BWL	EA	1
2	Deleted				
3	5920-00-221-8377	Fuse, Cartridge, 3 Amp, 250 volts (81349) F03A25OVA	BWL	EA	5
4	5120-01-017-9535	Key Set, Hexhead, Screw (81348) GGGK275 Type I Class A	BWL	EA	1

Section III. BASIC ISSUE ITEMS - (Continued)



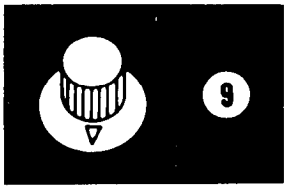


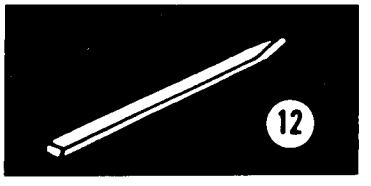




(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
5	5355-00-619-4668	Knob, Bias Control (96906) MS91528-2N2B	BWL	EA	1
6	5355-01-007-8821	Knob, Caging (97403) 13218E3544	BWL	EA	1
7	5355-00-619-3835	Knob, Mode Select (96906) MS91528-202B	BWL	EA	1
8	5355-00-877-8515	Knob, Panel Illumination and Theodolite (96906) MS91528-OC1B	BWL	EA	2

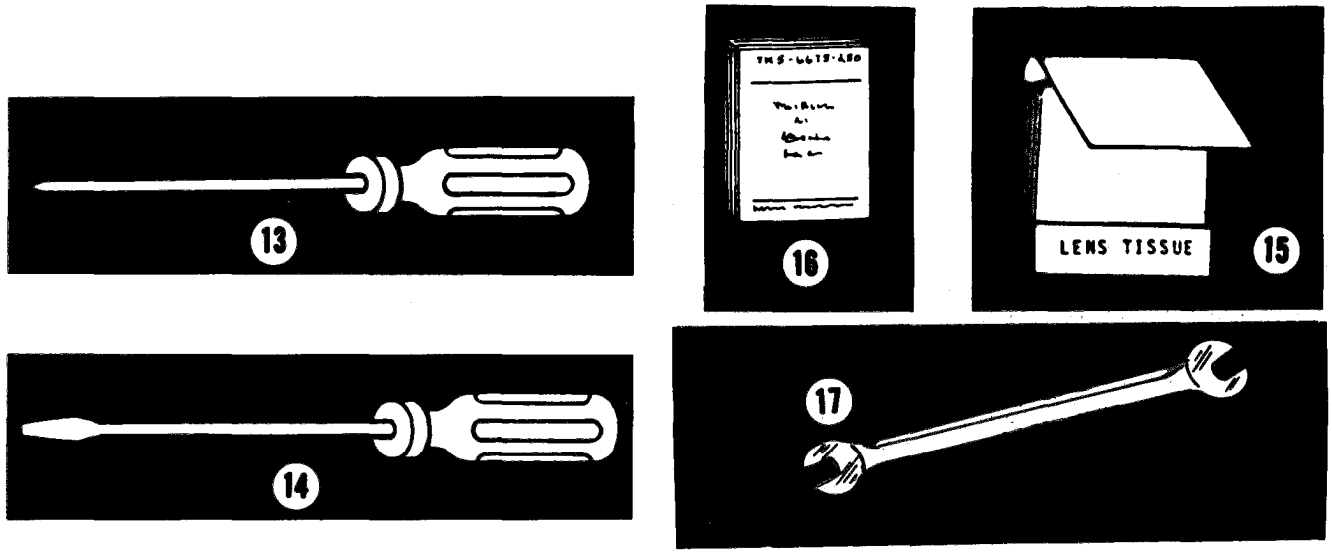
Section III. BASIC ISSUE ITEMS - (Continued)





(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
9	5355-00-989-4269	Knob, Test, Select (96906) MS91528-102B	BWL	EA	1
10	6210-00-179-2531	Lamp, Indicator, Uncaged (97403) 13218E3671	BWL	EA	2
11	6240-00-763-7744	Lamp, Theodolite (96906) MS18209-387	BWL	EA	1
12	5120-01-018-5908	Orangewood Sticks (97403) 13218E3063	BWL	PK	1

Section III. BASIC ISSUE ITEMS - (Continued)



(1) Illus Number	(2) National Stock Number	(3) Description, FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
13	5120-00-965-0626	Screwdriver, Crosstip, 3 in. Blade Point Size No. 1 (81348) GGGS121 Type II Class 1	BWL	EA	1
14	5120-00-236-2127	Screwdriver, Flat, 3 in. Blade Tip (81348) GGGS121 Type I Class I Design 3 IN	BWL	EA	1
15	6640-00-597-6745	Tissue, Lens, hvywt, 4x6 50 Sheets Per Book (81348) NNNP40 Type I Class I	BWL	PK	1
16		TM 5-6675-250-10 Operator's Manual, Survey, Instrument, Azimuth, Gyro, Lightweight (SIAGL)	BWL	EA	1
17	5120-00-228-9505	Wrench, Combination 7/16" (81348) GGG-W-636	BWL	EA	1

APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists additional items you are authorized for the support of the surveying instrument.

C-2. GENERAL

This list identifies items that do not have to accompany the surveying instrument and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

C-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. “Usable On" codes are identified as follows:

CODE	USED ON
BWL	Model AG-8

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	FSCM and Part Number	(2) Description	Usable On Code	(3) U/M	(4) Qty Auth
6140-00-789-2118	BB-422/U 80063	Battery	BWL	EA	1
8465-00-262-5281		Packboard	BWL	EA	1
6675-00-691-3572	MIL-T-14091 81349	Tripod	BWL	EA	1
		Assembled from the following:			
8465-00-543-3682	13218E3017 97403	Harness Shoulder	BWL	AR	
8465-00-360-0233	13218E3021 97403	Harness Waist Strap	BWL	AR	
8465-00-270-0415	MIL-A-1812 81349	Packboard	BWL	AR	
8465-00-255-8220	MIL-P-10941 81349	Packboard Back	BWL	AR	
6675-00-621-0790	(97403)13218E3900	AC-DC Converter	BWL	EA	1
6150-01-040-8135	(97403)13218E3410	Cable Assembly,AC Power W4	BWL	EA	1
6150-01-046-4634	(97403)13218E3413	Lead Electrical,Batter Adapter, W7	BWL	EA	1

APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the surveyinq instrument. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

D-2. EXPLANATION OF COLUMNS

a. Column (1)- Item number.This number is assignedtothe entry in the listing and is referenced in the narrative instructions to identify the material (e.g., Use cleaning compound, Item 5, App. D).

b. Column (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) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parenthesis, 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 a two character alphabetical abbreviation (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 SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C		Cleaner, general purpose	EA
2	C		Cloth, Soft	EA
3	C	792-00-292-9204	Cloth, Cleaning	PK

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By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator's Maintenance requirements for Survey Instrument, Azimuth, Gyro, Lightweight (AG-8, Type I).

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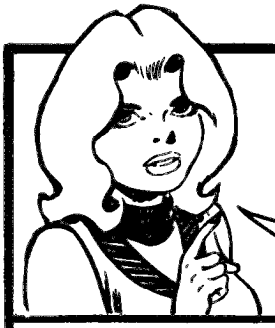
RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6675-250-10	30 June 1986	Azimuth, Gyro, Lightweight Model AG-8, Type 1 (6675-00-062-8579)

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 Cylenders. The engine on my set only has 4 Cylenders. Clange the manual to show 4 Cylenders.

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.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket bit 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

DA FORM 1 JUL 79 2028-2

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DRSTS-M Overprint 1, 1 Nov 80

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG PERFORATED LINE

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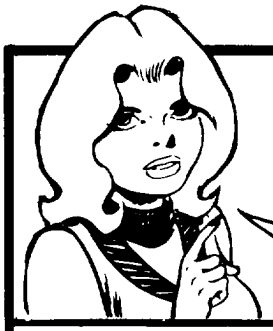

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The Metric System and Equivalents

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 milliters = .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

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