TM 5-6675-250-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

SURVEY INSTRUMENT:

AZIMUTH, GYRO, LIGHTWEIGHT

(LEAR SIEGLER, INC.

MODELS AG-8 AND AG-8A)

NSN 6675-00-062-8579

HEADQUARTERS, DEPARTMENT OF THE ARMY

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CHANGE

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Direct Support and General Support Maintenance Manual

SURVEY INSTRUMENT: AZIMUTH GYRO, LIGHTWEIGHT (LEAR SIEGLER, INC., MODEL AG-8) NSN 6675-00-062-8579

TM 5-5420-2C2-20, 19 December 1975, is changed as follows:

1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page, or adjacent to the title.
3. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration identification number.

Remove Pages	*Insert Pages*
1-7 through 1-11	*1-7 through 1-11*
2-7, 2-8	*2-7, 2-8*
2-11 through 2-20	*2-11 through 2-20*
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3-1 through 3-6	*3-1 through 3-6*
4-1 through 4-12	*4-1 through 4-12*
4-15, 4-16	*4-15, 4-16*
5-3	*5-3*
Figure 1-6	*Figure 1-6*
Figure 1-7 (sheet 1 through 5)	*Figure 1-7 (sheet 1 through 5)*

4. File this change sheet in front of the publication for reference purposes.

TM 5-6675-250-34
C1

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TECHNICAL MANUAL
No. 5-6675-250-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C. *19 December 1975*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

SURVEY INSTRUMENT: AZIMUTH, GYRO, LIGHTWEIGHT

(LEAR SIEGLER, INC. MODELS AG-8 AND AG-8A) NSN 6675-00-062-8579

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is for your use in maintaining the Surveying Instrument: Azimuth, Gyro, Lightweight (SIAGL) Model AG-8 Type 1 and Model AG-8A Type 2. Subsequent sections include description, testing, troubleshooting, repair, and procedures necessary to maintain the equipment in a serviceable condition. Information in this manual is to be used in conjunction with, information in the Operator and Organizational Maintenance Manual, TM 5-6675-250-12.

1-2. Maintenance Forms and Records

Maintenance forms, records, and reports that you are required to use are DA Form 314, 2400, 2401, 2404 and 2406 (see TM 38-750).

1-3. Reporting of Errors

You can help to improve this manual by calling attention to errors and by recommending improvements. Your letter, DA Form 2028 (Recommended Changes to Publications), and DA Form 2028-2 (Recommended Changes to Equipment Technical Manuals), may be used. Copies of DA Form 2028-2 are attached in the back of the manual for your use. Please mail your recommended changes directly to Commander, U. S. Army Troop Support Command, ATTN: DRSTS-MPP, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

1-4. Equipment Serviceability Criteria (ESC)

This equipment is not covered by an ESC.

1-5. Destruction of Army Material to Prevent Enemy Use

Using an axe, pick, mattox, sledge or another heavy implement, damage all vital elements such as the theodolite, electronic control unit, gyroscopic reference unit and battery.

1-6. Administrative Storage

Administrative storage procedures which are to be used by maintenance personnel are described in TM 740-90-1.

1-7. Calibration

Periodic calibration of this equipment is not required.

Section II. DESCRIPTION AND DATA

1-8. Description

a. General. The SIAGL is man portable north-seeking gyroscope capable of determining true north with extreme accuracy without the assistance of celestial or landmark sightings. The SIAGL consists of a gyroscopic reference unit (GRU) with an integral theodolite and tripod assembly, an electronic control unit (ECU), a transit case which houses the GRU and auxiliary equipment. The complete SIAG1 is contained in a transport case. The maintenance paragraphs of this manual contain detailed descriptions of its components.

b. Gyroscopic Reference Unit (GRU). The GRU (fig. 1-1) contains the pendulous gyro, gyro motor, suspension system, follow-up mechanism, and components necessary to accomplish the azimuth determination operation. A theodolite for reading and preorienting the instrument is mounted on top of the GRU. An adjustable tripod assembly is provided for supporting the unit.

(1) Internal components of the unit are contained in a cylindrical housing and are discussed in detail in the theory of operation (para. 1-9). Controls on the housing are limited to a caging knob; an uncaged indicator light is located adjacent to the knob .

(2) The theodolite contains a magnetic compass for preorientation of the unit to approximately true north, a telescope for sighting and focusing, and a microscope for reading a 0.02-mil graduated scale. The theodolite is secured to the GRU housing by three screws and is electrically connected through a cable.

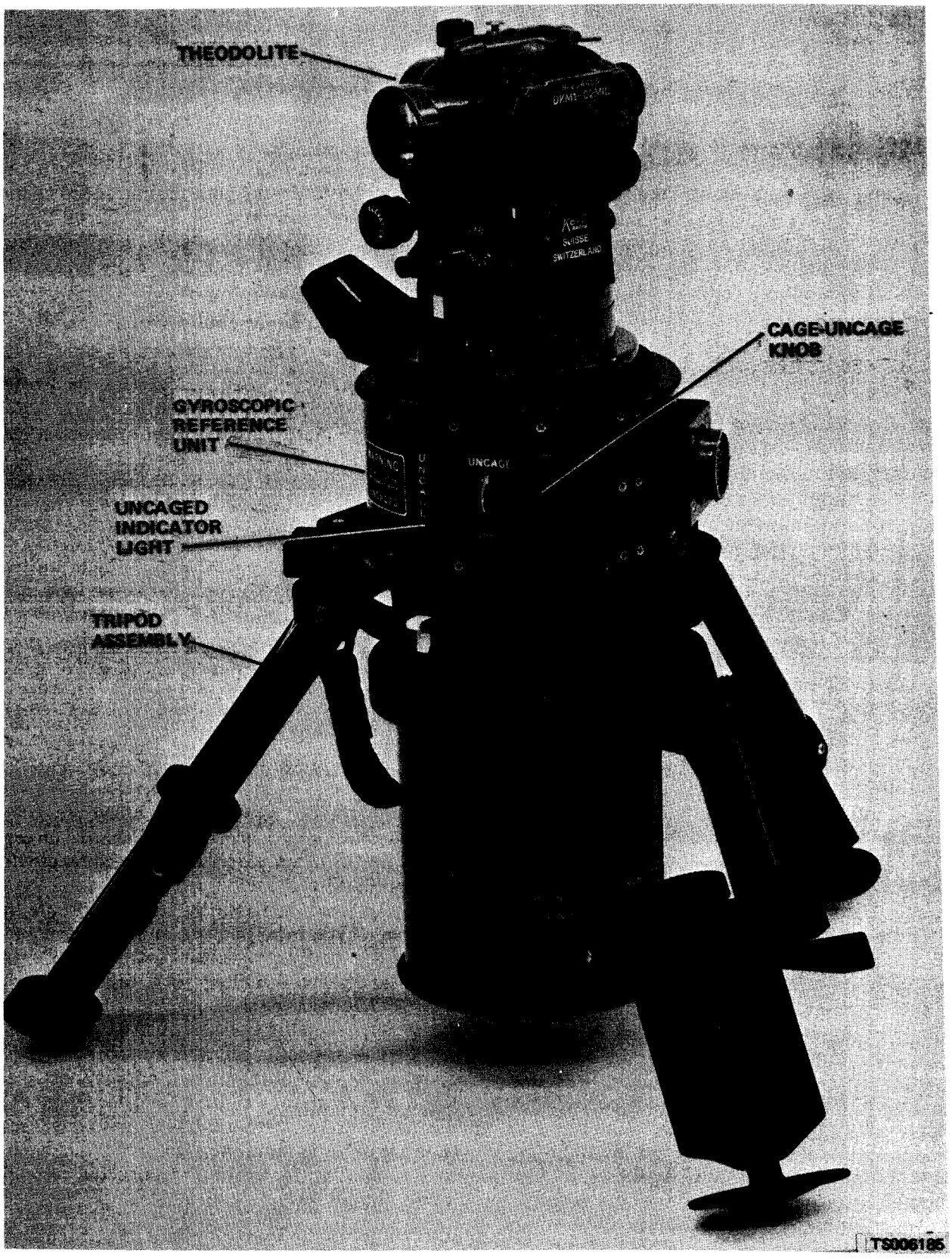


Figure 1-1. Gyroscopic reference unit (GRU).

c. Electronic Control Unit (ECU). The ECU (figure 1-2) consists of a panel assembly mounted in a carrying case. Controls and indicators extend through an edge-lighted panel assembly. The panel is marked to identif y controls, indicators, and switch positions. Receptacles are provided for connecting the equipment for operation. A fuse protects the equipment from excessive current. Test provisions are provided by a meter and switches. The electronic circuitry of the ECU is contained on a printed circuit board secured to the underside of the panel assembly. Removal of the panel from the case provides access to the electronics and all internal components of the unit.

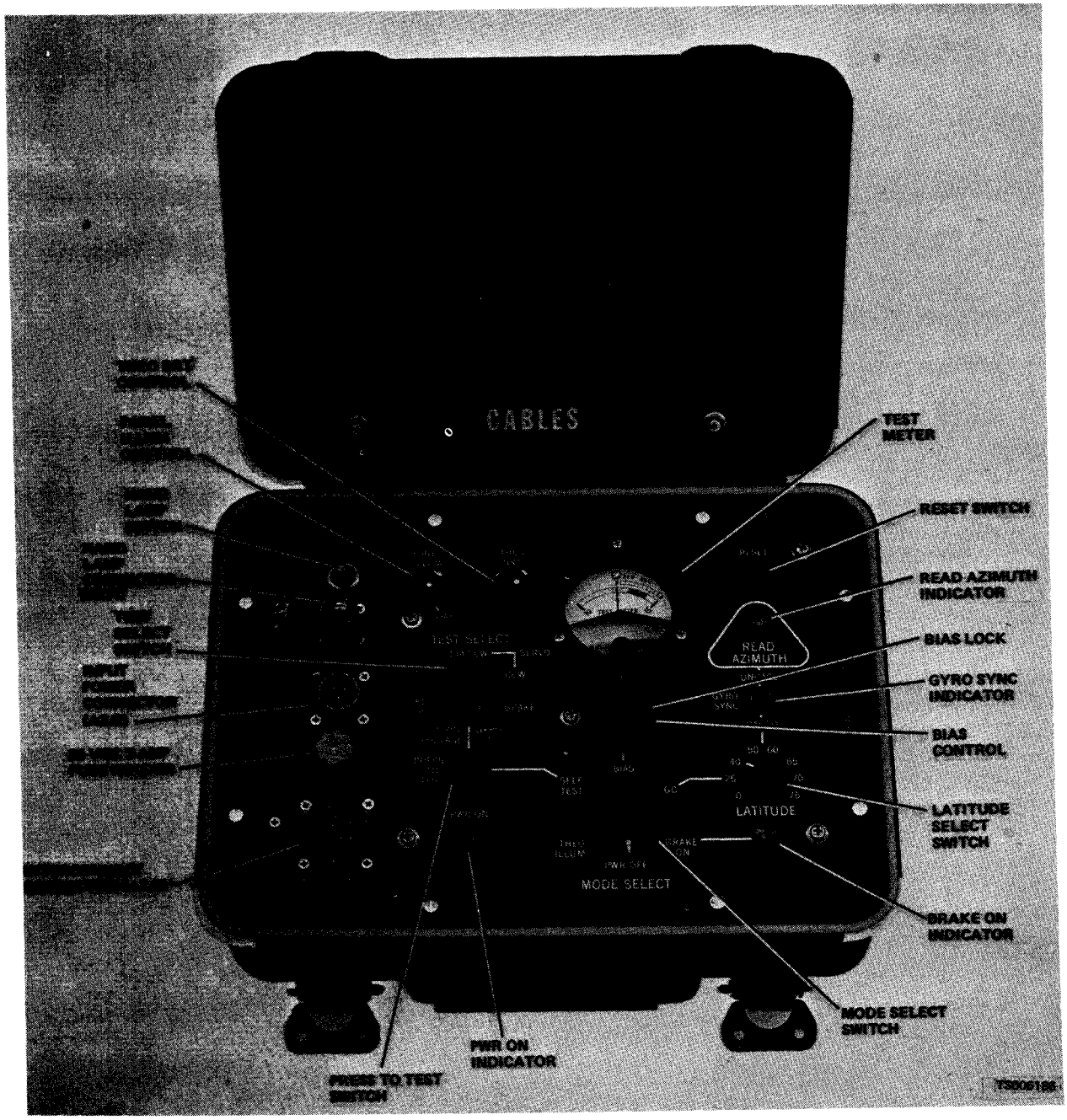


Figure 1-2. Electronic control unit (ECU)

d. AC-DC Converter. The ac-dc converter (figure 1-3) enables the instrument to be operated from a 115 Vat, 60 or 400 Hz power source. When connected to an ac power source, the converter supplies the dc voltage necessary to operate the instrument. Input and output receptacles on the converter are covered by protective caps when the equipment is not in use. The converter circuit is portected by s fuse and consists of a transformer, capacitor, resistor, two diodes, and EMI filter.

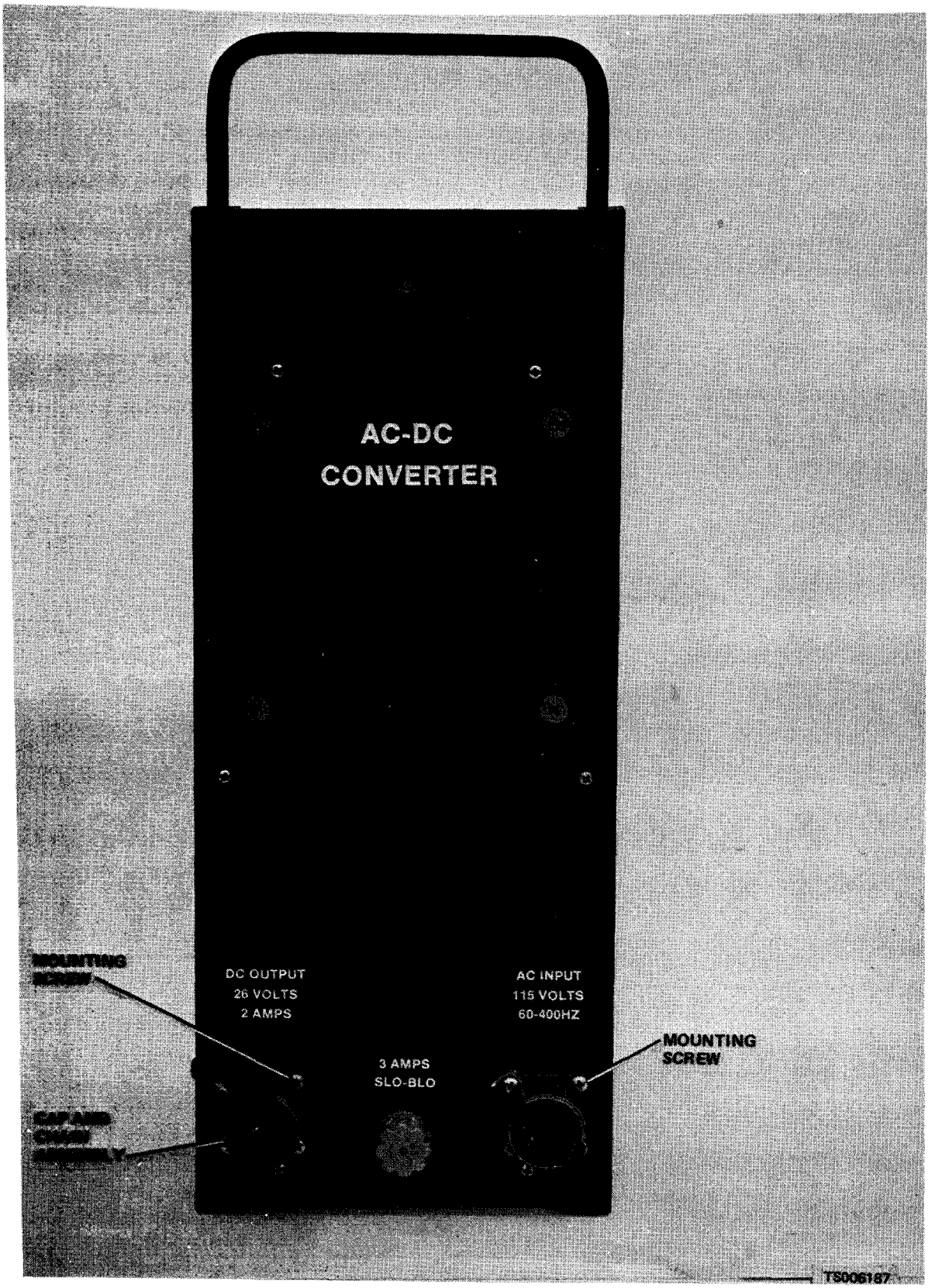


Figure 1-3. AC-DC converter.

e. Test Support Equipment. Test support equipment includes an interconnect breakout box and a printed circuit card cable extender. The interconnect breakout box contains test jacks and switches for checking subcircuits of the instrument and is connected between the GRU and ECU during testing and troubleshooting operations. The cable extender is provided to connect the printed circuit card to the ECU when the printed circuit card is removed. The printed circuit card is removed to aid checks of the system components during troubleshooting.

1-9. Theory of Operation

a. The operation of SIAGL is based on the principle that a pendulous gyro suspended with its spin axis horizontal tends to align this axis with the horizontal component of the earth's spin velocity (fig. 1-4). The gyro is suspended on a flexible, low torque metal band to permit minute pendulous and rotational torques to affect the motion of the pendulous gyro. With the pendulous gyro in position (a) with the angular momentum vector (H) pointed east, the pendulous gyro attempts to maintain its orientation in space because of its inertia as it is carried from (a) to (b) because of the earth's rotation. This requires that the spin axis tilt, resulting in the departure of the pendulum from the local vertical, as shown in (b). The acceleration of gravity, however, exerts a downward force on the center of mass of the pendulum and forces it to remain in the local vertical. A torque, therefore, is present about a horizontal axis normal to the gyro spin axis. This torque produces precession about the vertical axis turning the eastern end of the spin axis counterclockwise until position (c) is reached and the spin axis is aligned. While thus aligned the earth's rotation will cause further precession because the rotation is about the spin axis of the gyro. However, the gyro in processing towards north builds up momentum which carries it through the meridian to position (d). At position (e) the same sequence occurs as at (a) but because the spin axis is now pointing west, precession drives the spin axis back toward north.

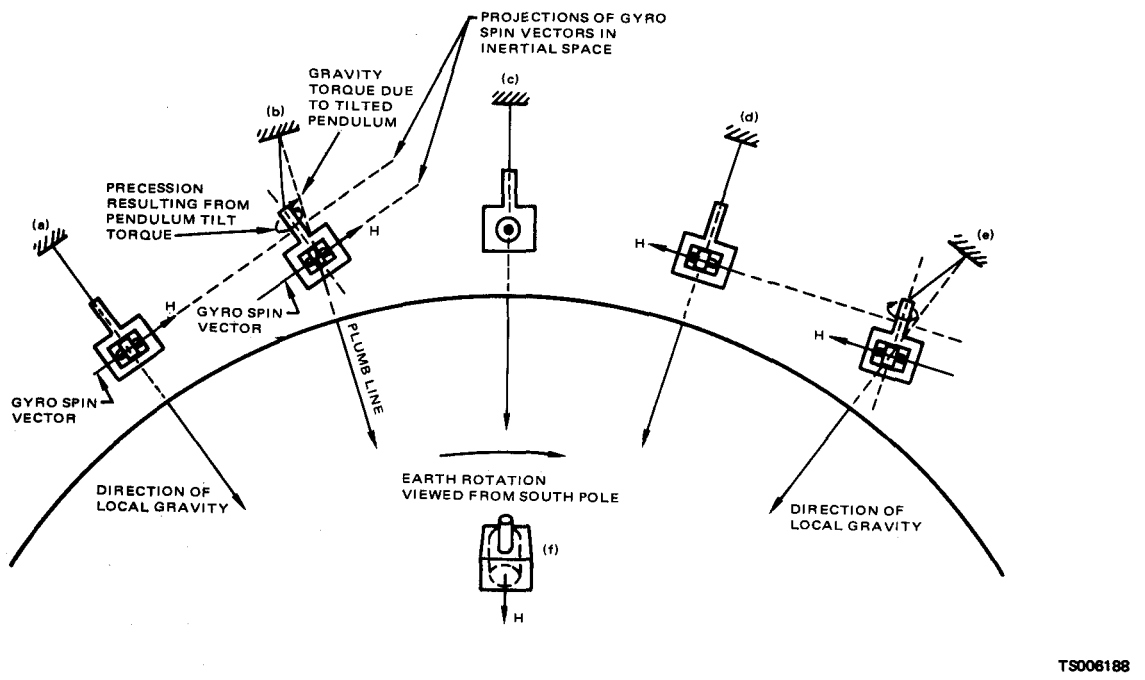


Figure 1-4. Principle of operation.

b. The meridian-seeking action described in the preceding paragraph is accomplished with the SIAGL through the GRU (figure 1-5). The unit consists of a theodolite, upper housing and follow-up mechanism, a cylindrical pendulum containing the gyro wheel, and a supporting tripod.

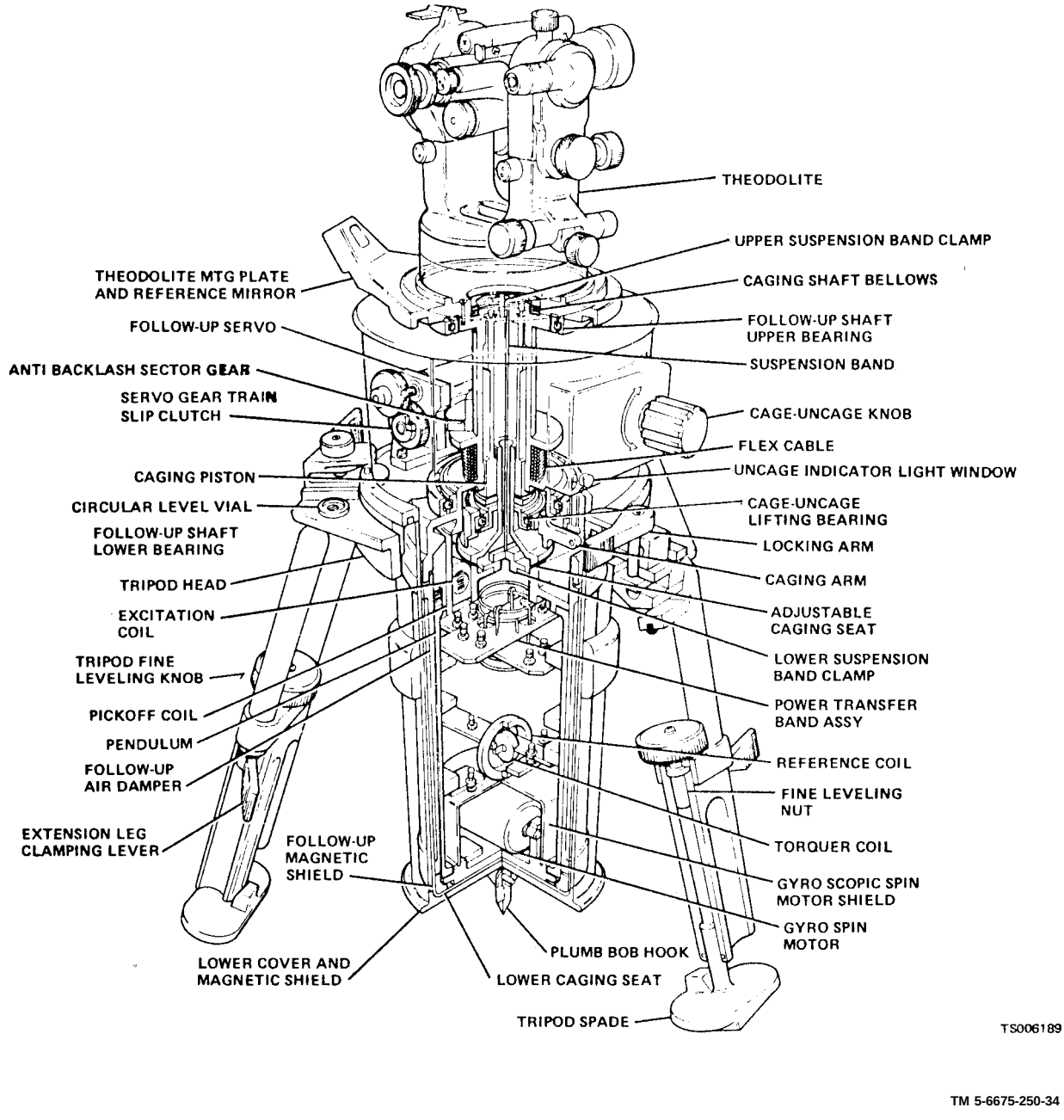


Figure 1-5. Gyroscopic reference unit - cutaway

(1) The housing contains the follow-up shaft, the servo gear train and the pendulum mechanism. The follow-up shaft is mounted to the housing through a pair of preloaded ball bearings. The shaft engages a single lead worm at the gear train output through an anti-backlash worm wheel. This arrangement provides a locked condition of the GRU output when the servo motor is de-energized after gyrocompass is complete. The servo gear train is mounted to the housing structure. It consists of a servo motor which drives a two speed gear head which in turn drives the output worm through several spur gears. To assure the needed locked-up condition of the follow-up shaft, the worm gear is mounted with a preloaded pair of ball bearings. The two speed gear head is provided to give the follow-up shaft ample angular velocity to track the pendulum from 40° off of the meridian, yet have enough resolution to position the shaft as the pendulum is damped to the meridian. Force for caging the pendulum is obtained through a lever which has one end attached to the housing. The upper pendulum caging seat is attached to the center of the lever and the movable end of the lever is connected to a crank. The crank is mounted on a shaft which is rotated through a worm gear. The gear is then driven by the

CAGE-UNCAGE knob on the outside of the housing.

(2) The pendulum is a tubular structure with the top end capped with a mounting plate for the suspension band clamp and the lower end is fitted with the gyro wheel assembly. Surrounding the full length of the pendulum is a tubular structure called the air damper, that is attached to the lower end of the follow-up shaft. The purpose of the air damper is to suppress lateral pendulum motion through pneumatic damping. In the uncaged condition, the pendulum is suspended by a thin metal band which extends from the top of the follow-up shaft to the top of the pendulum. Caging of the lower end of the pendulum is furnished by a tapered seat on the pendulum that rests on a similar seat on the air damper. The pendulum and air damper is isolated from magnetic fields by a mu-metal shield which is attached to the lower side of the housing.

c. Control of the aximuth determination procedure is provided through the ECU. Power supplied to the input receptacle is distributed to the printed circuit board and chassis-mounted components through the MODE SELECT switch. Unregulated input voltage is regulated in ac and dc supply circuits in the system. Corresponding to the position of the switches on the control unit, operating power is applied to the GRU through the interconnect cable. Feedback signals from the GRU reflecting gyroscopic action are applied to the printed circuit board. Subcircuits on the printed circuit board include a gyro sync sensor, digital timing, and reference voltage circuits. In operation of the SIAGL, derived signals from the printed circuit board activate GYRO SYNC and READ AXIMUTH indicators on the control unit panel. A self-test mode of operation enables both the control unit and the reference unit to be tested prior to the azimuth determination procedure. A PRESS TO TEST switch and TEST METER are used in conjunction with the TEST SELECT switch to obtain indications of circuit operation. Through the PRESS TO TEST switch, the output of circuits under test are connected from the calibration circuit to the TEST METER. Satisfactory operation of the circuits corresponding to the TEST SELECT switch positions (fig. 1-2) are indicated on the TEST METER and as specified in test procedures. Lighting provisions of the unit are activated with the initial application of power.

1-10. Electrical System (Fig. 1-6 and 1-7).

a. General. The electrical system is contained in the ECU and GRU. Cable assemblies are provided to interconnect the two units and to connect the control unit to a power source. Unregulated dc power is connected at the INPUT POWER receptacle 2A2J2 of the ECU to provide operating power to the SIAGL. The INTERCONNECT receptacle 2A2J3 is connected, through a two-branch wiring harness, to controls and indicators on the front panel, chassis-mounted transformer 2A2T2, and to the card strip connectors 2A2J5 and 2A2J6. Additional harnesses connect submodules, controls, and indicators to the card strip connectors 2A2J5 and 2A2J6. In the GRU, one wiring harness interconnects receptacle 1A1J1 to components in the follow-up and upper housing assemblies. The harness also connects the 26 Vac reference voltage for the excitation coils and the varied voltage for the torquer reference coil through separate power bands. From receptacle 1A1J1 the signal voltages to the servo motor and gear train assembly are connected by a sleeved cable through connector 1A1J2.

Figure 1-6. Functional block diagram.
(Located in back of manual)

b. Detailed Description. All ac and dc operating voltages used in the system are derived from the nominal 24 Vdc input. Through a fuse in the power input circuit, input voltage is applied to the MODE SELECT switch. The following paragraphs describe the operation of the equipment for each of the five activated positions of the MODE SELECT switch.

Figure 1-7. Electronic control unit schema tic diagram (Sheet 1 of 5).
(Located in back of manual).

Figure 1-7. Electronic control unit schematic diagram (Sheet 2 of 5).
(Located in back of manual).

Figure 1-7. Electronic control unit schematic diagram (Sheet 3 of 5).
(Located in back of manual).

Figure 1-7. Electronic control unit schematic diagram (Sheet 4 of 5).
(Located in back of manual).

Figure 1-7. Electronic control unit schematic diagram (Sheet 5 of 5).
(Located in back of manual).

(1) *THEO ILLUM.* With the MODE SELECT switch 2A2S3 positioned to THEO ILLUM, unregulated B+ voltage is applied to THEO BRT rheostat 2A2R1 through 2A2S3B-2. The voltage is tapped from 2A2R1 to receptacle 2A2J3, through the interconnect cable W1 to 1A1P1 on the GRU. A wiring harness connects 1A1J1 through 1A1J3 to the theodolite lamp. Voltage to the HAND LAMP switch 2A2S6 and receptacle 2A2J1 is applied through 2A2S3C-2.

(2) *SELF TEST.* With the MODE SELECT switch 2A2S3 at position 3, SELF TEST, power is applied to all circuits of the system. Activation of the circuits corresponds to the positioning of the TEST SELECT switch 2A2S1. Each circuit monitored in SELF TEST has its own calibration network to ensure proper meter deflection when the equipment is operating correctly. With the exception of the GYRO and SOURCE VOLTAGE positions, satisfactory operation of circuits corresponding to the following switch positions is indicated by the TEST METER pointer in the green band of the meter scale.

(a) SOURCE VOLTAGE. With the TEST SELECT switch 2A2S1 positioned to SOURCE VOLTAGE, B+ voltage is applied to the PRESS TO TEST switch 2A2S2 through 2A2S1C-1. Pressing the PRESS TO TEST switch routes the signal to the TEST METER. The voltage is read out on the voltage scale of the TEST METER.

(b) REG AC. With the TEST SELECT swith 2A2S1 positioned to REG AC, regulated 26 Vac from the ac supply is applied to the PRESS TO TEST switch 2A2S2 through 2A2S1C-2. Pressing the PRESS TO TEST switch routes the signal to the TEST METER.

(c) REG DC. With the TEST SELECT switch 2A2S1 positioned to REG DC, regulated 5, 9, and 18 Vdc is applied through a summing junction and 2A2S1C-3 to the PRESS TO TEST switch. Pressing the PRESS TO TEST switch routes the signal to the TEST METER.

(d) BIAS. In the BIAS mode 2A2S1 in position 4, relays 2A1K1 and 2A1K2 are energized. A simulated signal derived from transformer 2A2T1 through 2A1P6-E to 2A2S1A4 and back through 2A1P6-MM and the closed contacts of 2A1K1A to amplifier 2A1A1. The output of 2A1A1 is then routed via the closed contacts of 2A1K2A through the demodulator. The output of the demodulator then routed to the GRU torquercoil via 2A1P5-E, W1 and 1A1Ja. Current drawn from the torquer coil is monitored to provide an indication of the circuit condition on the TEST METER.

(e) SERVO CW. With the TEST SELECT switch 2A2S1 positioned in the SERVO CW mode, the high-speed gear is energized through 2A2S1D-5. The servo motor control circuit is activated through a derived signal from transformer 2A2T1 and energized relay 2A1K1. With the servo motor operating at high speed and rotating the follow-up assembly clockwise, a feedback signal from the tachometer in the GRU is applied to the demodulator through de-energized relay 2A1K2. From the demodulator, the signal is routed to the torquer coil. Current through the torquer coil is monitored by the TEST METER when the PRESS TO TEST switch is pressed.

(f) SERVO CCW. With the TEST SELECT switch 2A2S1 positioned to SERVO CCW, operation is the same as described in the preceding paragraph except that voltage is distributed through 2A2S1A-6 and 2A2S1D-6 causing the direction of rotation to be reversed. The theodolite rotates in a counterclockwise direction when looking down on the GRU.

(g) BRAKE ON. With the TEST SELECT switch 2A2S1 positioned to BRAKE ON, relay 2A2K1 is energized through 2A2S1D-7. Through relay 2A2K1, dc current is applied to the high side of the gyro motor. Pressing the PRESS TO TEST switch connects the TEST METER to the circuit current limiting resistor to indicate the state of the circuit.

(h) GYRO. With the TEST SELECT switch 2A2S1 positioned to GYRO, the circuit is monitored through the output of the sync sensor. Through 2A2S1B-8 and 2A2S1C-8, a circuit to the TEST METER is completed when the PRESS TO TEST switch is pressed. Satisfactory operation of the circuit and gyro motor is indicated when the TEST METER needle moves to the green area while the MODE SELECT switch is in GC and the SYNC indicator is illuminated.

(3) BIAS. With the MODE SELECT switch 2A2S3 at position 3, BIAS, rotation of the BIAS control knob provides control of biasing through potentiometer 2A2R4. The biasing operation is performed with the pendulum in the GRU uncaged. Feedback signals from the GRU reflect error torques which are balanced by the adjustment of potentiometer 2A2R4. Relay 2A1K2 is energized during biasing operation to permit electronic damping of the pendulum. Centering the meter pointer in the center of the scale is necessary to obtain a high degree of accuracy in the subsequent gyro-compassing opeation. Following the biasing operation, it is necessary to cage the pendulum to permit the MODE SELECT switch to be moved to the next position.

(4) GC. Placing the MODE SELECT switch to GC begins the gyro-compassing operation. Through 2A2S3A-5, 400 Hz power form the 26 Vac bus is distributed to the primary of 2A2T2, the time totalizing meter, and relay 2AK4A-1. Through 2A2S3B-5, B± voltage is applied to 2A1K4B-4, the control winding of the gyro motor, and to the high side of the speed changer. 400 Hz power is applied to the gyro motor through the primary of transformer 2A2T2 and the closed contact 2A2K1A. The gyro sync sensor circuit monitors voltage at the secondary of 2A2T2 and determines when the synchronous speed is reached, the GYRO SYNC indicator illuminates and relay 2A1K4 becomes energized. Energizing 2A1K4 converts the 400 Hz signal to regulated 26 Vat, and energizes the uncaging solenoid. Through 2A1K4A, 400 Hz is applied to the high side of the motor/tach windings.

(a) When the GYRO SYNC indicator illuminates the pendulum is to be uncaged. Uncaging the pendulum energizes relay 2A1K3 to complete the servo loop and initiate a timing operation. Initial pendulum energy is dissipated during a 30-second damping period following uncaging (fig. 1-8). After the 30-second damping period, the servo gear train is shifted to high speed to permit the follow-up assembly to follow the pendulum from large offsets from north. The duration of the tracking operation corresponds to the setting of the LATITUDE switch and is approximately equal to one quarter of the pendulous period. After the variable timed tracking, the servo gear train is shifted to slow speed. The meridian-seeking action of the pendulum is reflected in its relation to the follow-up assembly. When the pendulum and the follow-up assembly are aligned, the servo motor drive signal is removed. When the servo motor drive signal is off for a 45- second period, indicating stable alignments, the READ AZIMUTH indicator illuminates, the servo loop is interrupted, and the theodolite lamps illuminate. Through the 45-second delay circuit, gyro-cornpassing is continued when the RESET switch is pressed. The counting operation of the delay circuit is restarted and another 45 seconds (minimum) is required to obtain a READ AZIMUTH indication. The reset operation verifies the validity of the initial indication. With the READ AZIMUTH indicator illuminated, azimuth is determined through theodolite readings.

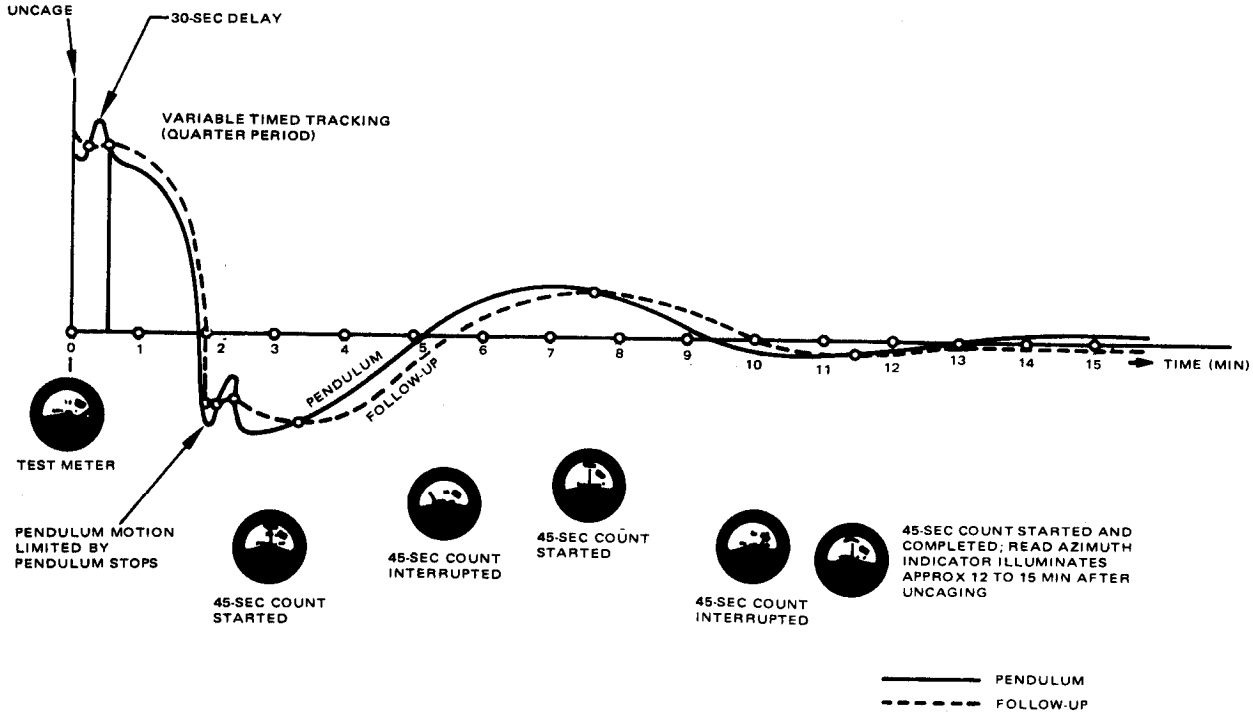


Figure 1-8. Pendulum and follow-up relationship.

(5) BRAKE ON. Placing the MODE SELECT switch to BRAKE ON energizes relay 2A2K1 and the 90-second delay circuit through S3B-6. Energizing relay 2A2K1 applied B+ voltage through a current-limiting resitor to brake the motor. Control of a dynamic 90-second braking period is provided through the delay circuit. Through relay 2A2K1, B + voltage is applied to the BRAKE ON indicator to keep the indicator illuminated during the braking period. At the end of the 90 second braking period, relay 2A2K1 is de. energized, the mode sequencing solenoid L1, is deenergized, and the BRAKE ON indicator goes out.

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. Tools and Equipment

Tools and equipment issued with or authorized for the SIAGL are listed in the Operator and Organizational Maintenance Manual, TM 5-6675-250-12.

2-2. Special Tools and Equipment

Tool and test equipment requirements are listed in the Operator and Organizational Maintenance Manual, TM 5-6675-250-12.

2-3. Maintenance Repair Parts

Repair parts and equipment are listed in TM 5-6675-250-34P, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Manual).

Section II. TROUBLESHOOTING

2-4. 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 will help you to determine probable causes and corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or 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.

Table 2-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
ELECTRONIC CONTROL UNIT (ECU)
1. POWER ON INDICATOR FAILS TO LIGHT WHEN POWER IS APPLIED.
Step 1. Check for a bad POWER-ON indicator lamp (fig. 2-1).
a. Unscrew the plastic lens from the indicator lamp assembly.
b. Visually inspect lamp for a burned out filament.
If a filament is bad, replace with a new lamp. Place the new lamp in the socket of the lamp assembly. Screw the plastic lens in place over the lamp and tighten tbe plastic lens finger tight.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

POWER ON INDICATOR FAILS TO LIGHT WHEN POWER IS APPLIED.

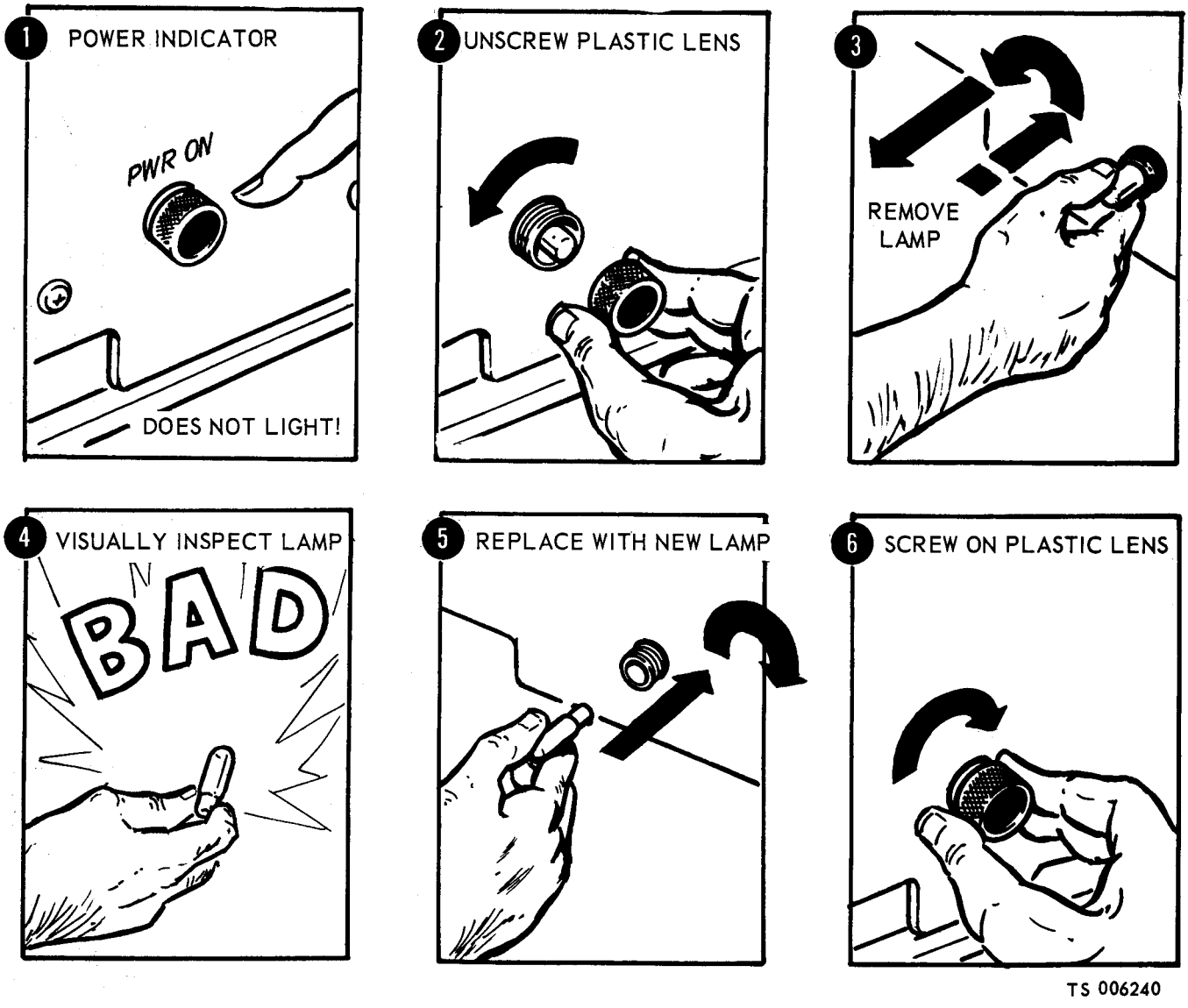


Figure 2-1. Checking for a bad power on indicator lamp.

Step 2. Check for a bad power source (fig. 2-2).

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

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CHECK FOR BAD POWER SOURCE

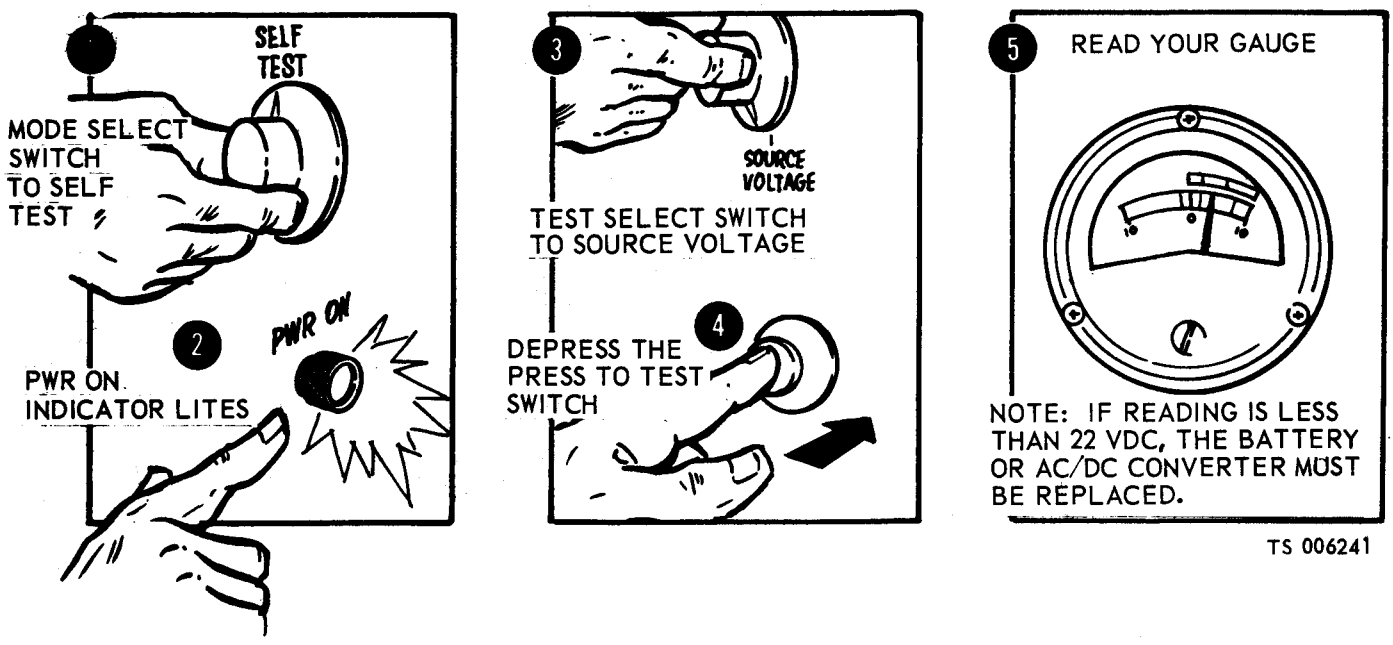


Figure 2-2. Check for a bad-power source.

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 leas than 22 VDC, the battery on AC-DC converter must be replaced.

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

(1) Unscrew the cap on the fuse holder (fig. 2-3) and remove the fuse.

IF AC/DC CONVERTER IS BEING USED.

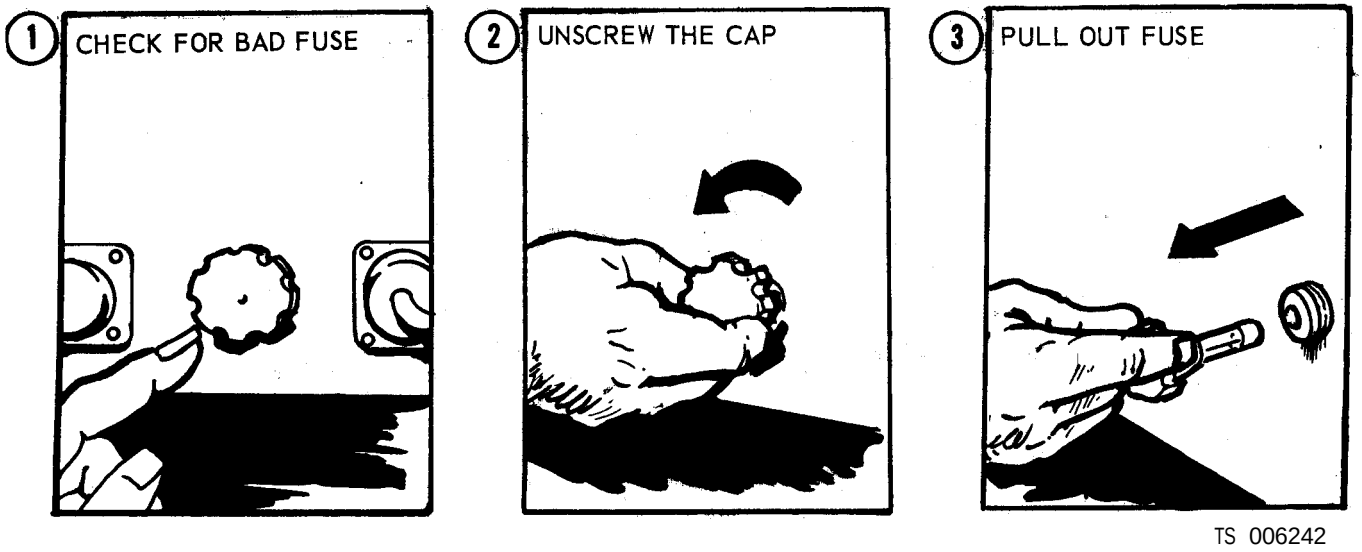


Figure 2-3. Removing AC-DC converter fuse.

(2) Test fuse for continuity with an ohmmeter.

Table 2-1. Troubleshooting--Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

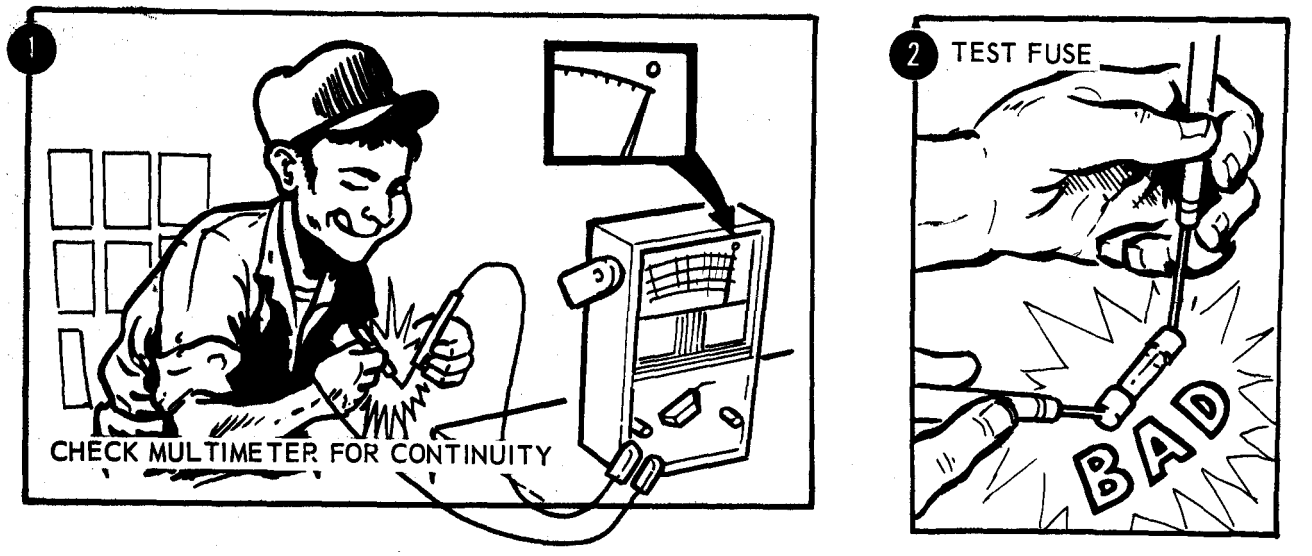


Figure 2-4. Testing fuse for continuity.

If fuse is bad, replace it.

(a) Place a new fuse in cap of the fuse holder.

Insert fuse in AC-DC-converter, press down and turn the cap clockwise,

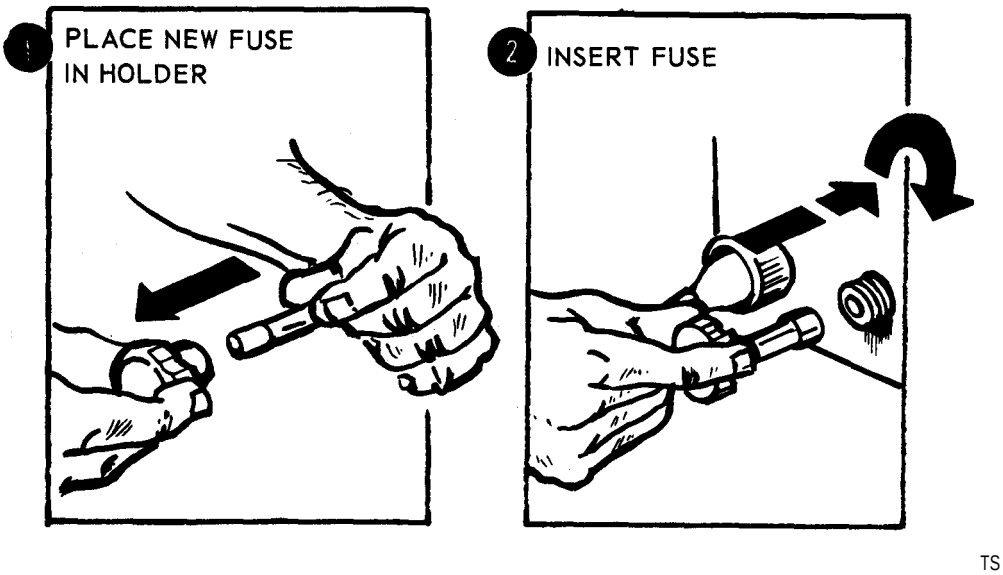


Figure 2-5. Installing new fuse in AC-DC converter.

(b) If the AC-DC converter doee not function properly after replacing a bad fuse, replace the AC-DC converter by disconnecting and connecting the power cables (fig. 2-6).

Table 2-1. Troubleshooting– Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

IF AC/DC CONVERTER IS BAD REPLACE IT.

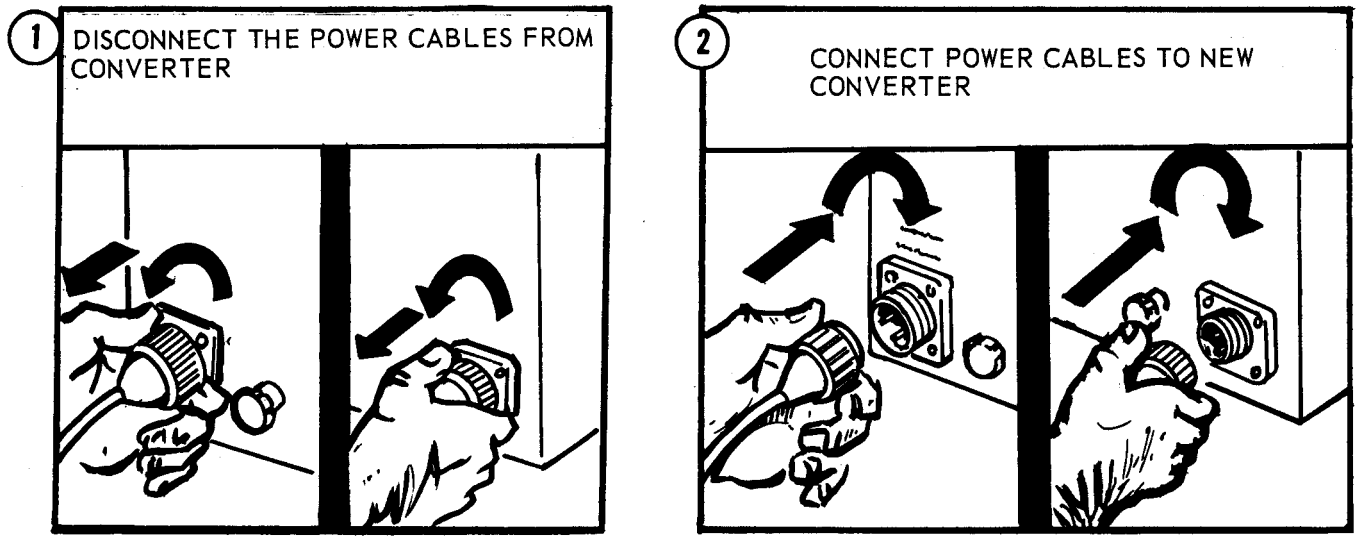


Figure 2-6. Removing AC-DC power cables.

Step 3. Check for a bad fuse in the ECU panel.

a. Unscrew the cap on the fuse holder (fig. 2-7) and remove the fuse.

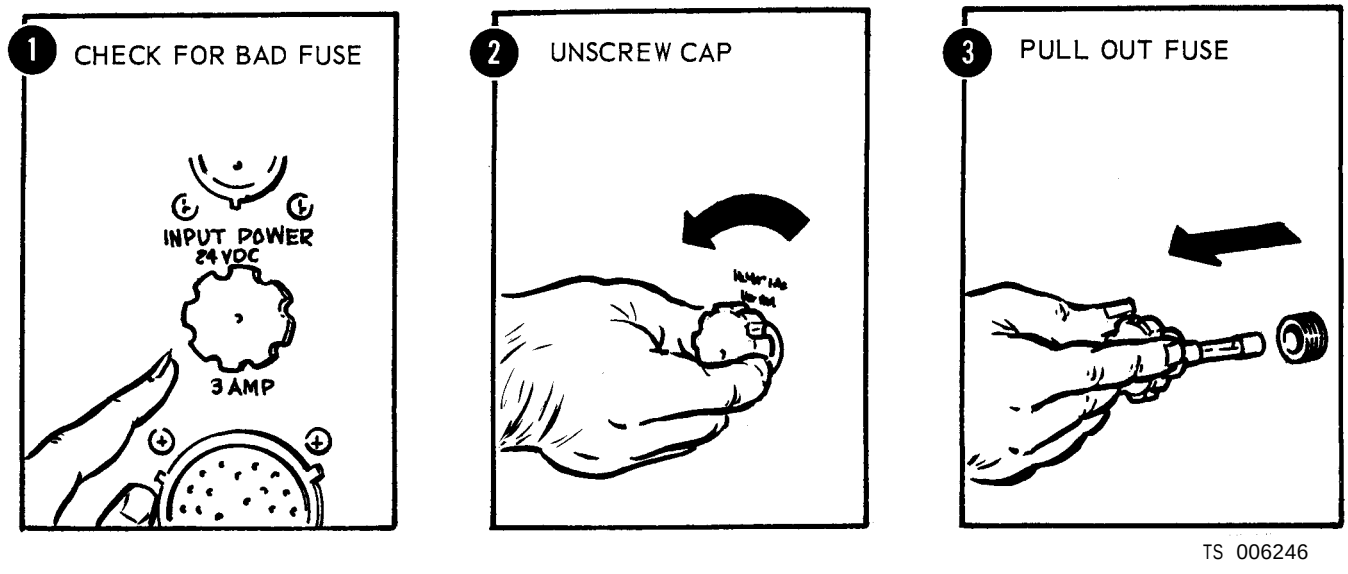


Figure 2-7. Removing ECU panel fuse.

b. Test the line for continuity with an ohmmeter, (fig. 2-8).

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

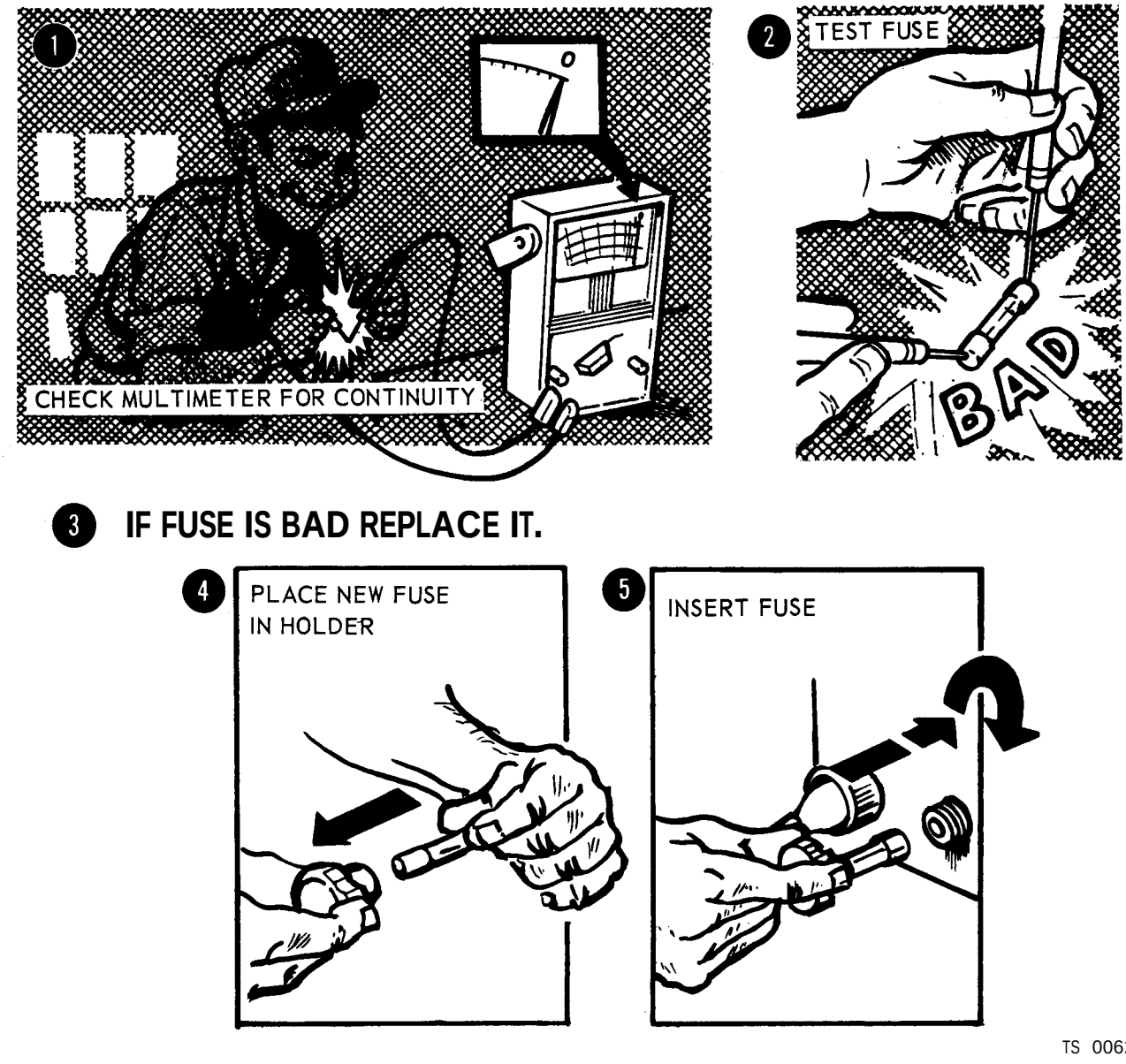


Figure 2-8. Testing fuse for continuity.

If fuse is bad, replace it.

Place the new fuse in the cap of the fuse holder (fig. 2-9). Insert fuse in ECU panel, press down and turn the cap clockwise.

Table 2-1. Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

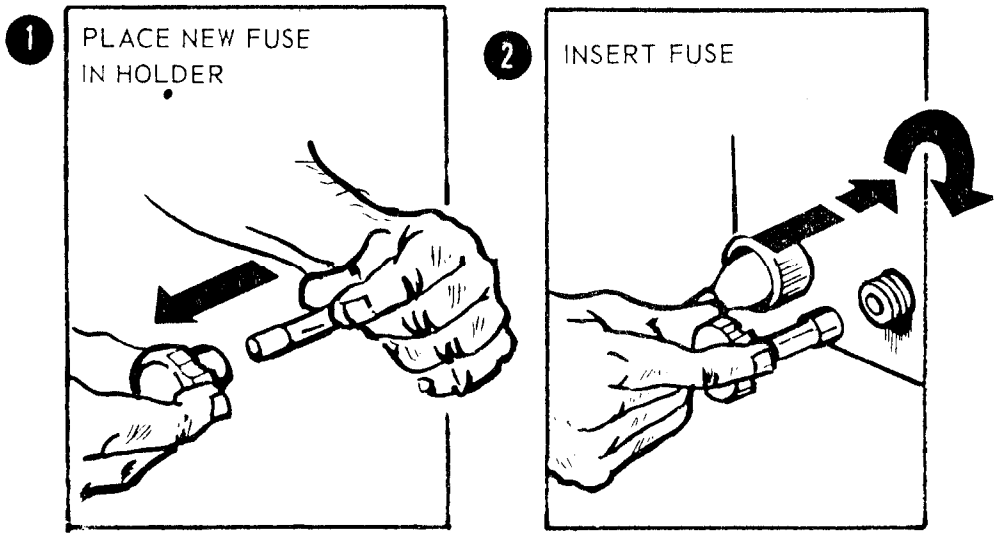


Figure 2-9. Installing new fuse in ECU panel.

Step 4. Check for a bad power cable.

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

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

Replace a damaged power cable.

Connect the new power cable to the ECU and power source.

(1). Replace a damaged power cable.

(2) Connect the power cable to the power source rrnd ECU receptacle.

Step 5. Check for defective MODE SELECT switch.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-10).

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

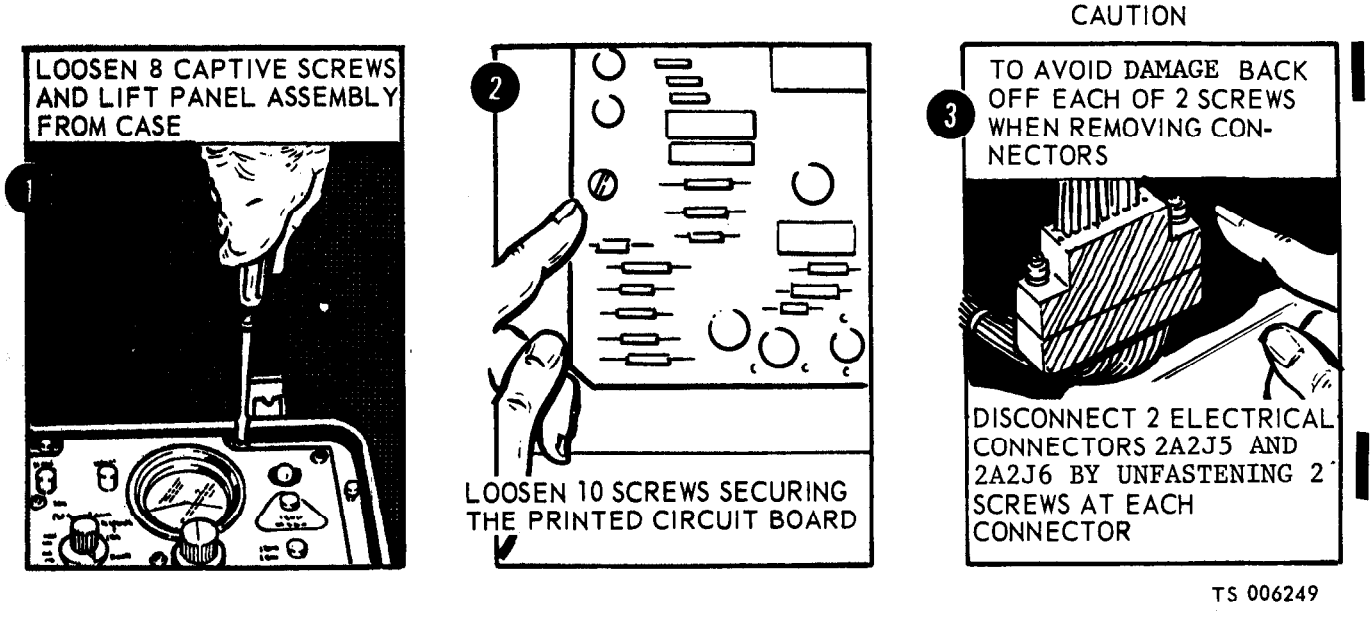


Figure 2-10. Removal of ECU panel assembly.

b. Unfasten ten screws eecuring the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A3J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity between pins A, B, and C of switch 2A2S3 and function pins.

If continuity is not present, replace MODE S-ELECT switch no follows.

(1). Place MODE SELECT switch to GC position (fig. 2-11).

(2). Place TEST SELECT switch to SOURCE VOLTAGE position (fig. 2-11).

(3). Loosen MODE SELECT and TEST SELECT knob setscrews with 5/64 inch and 0.050-inch hex wrench, respectively, and remove knob from switch shaft.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

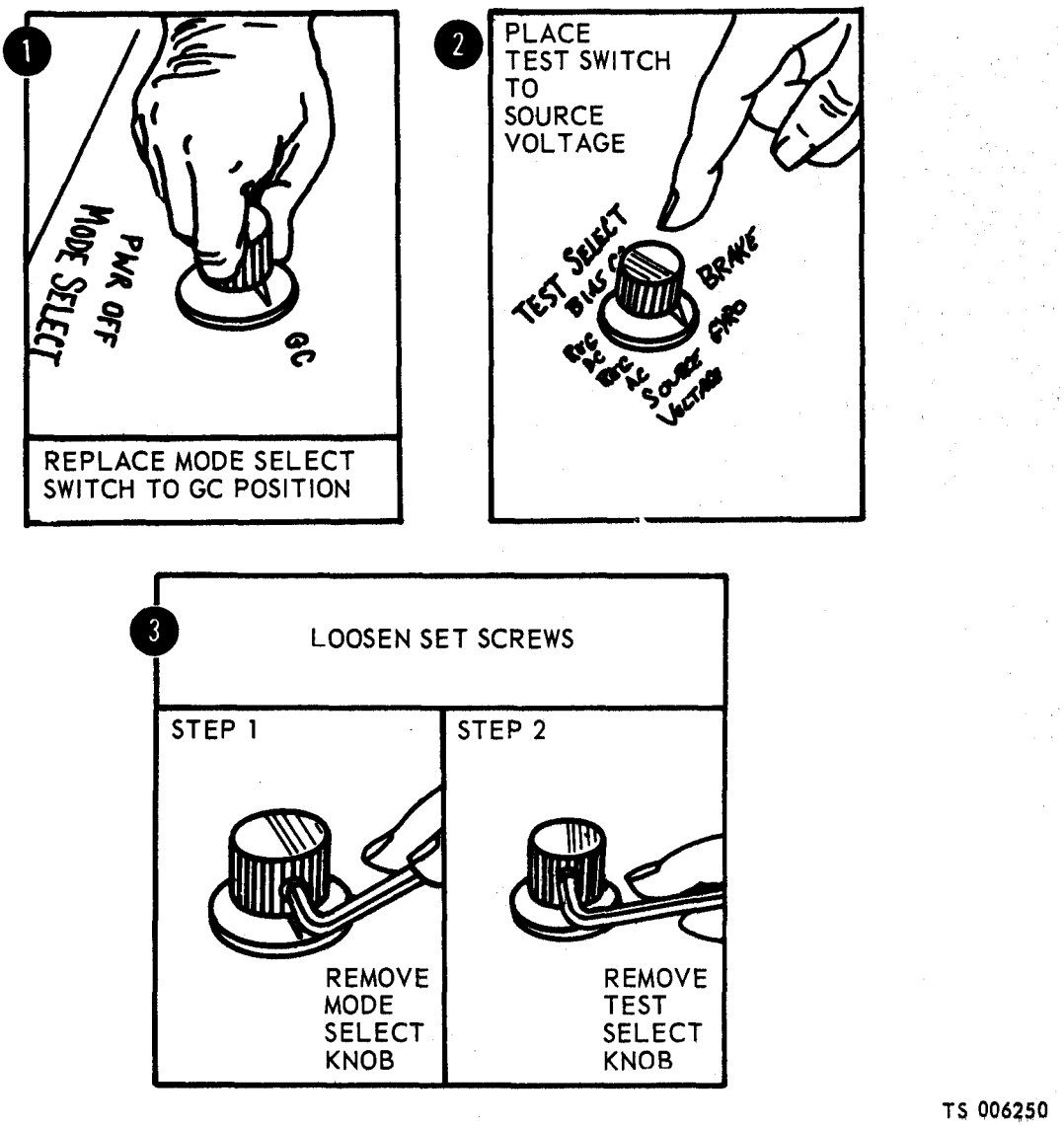


Figure 2-11. Removal of MODE and TEST SELECT switch knobs.

(4). Loosen BIAS knob setscrews with 5/64 inch hex wrench and remove knob from switch shaft.

(5). Unscrew BIAS control locking knob from BIAS control shaft and remove.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

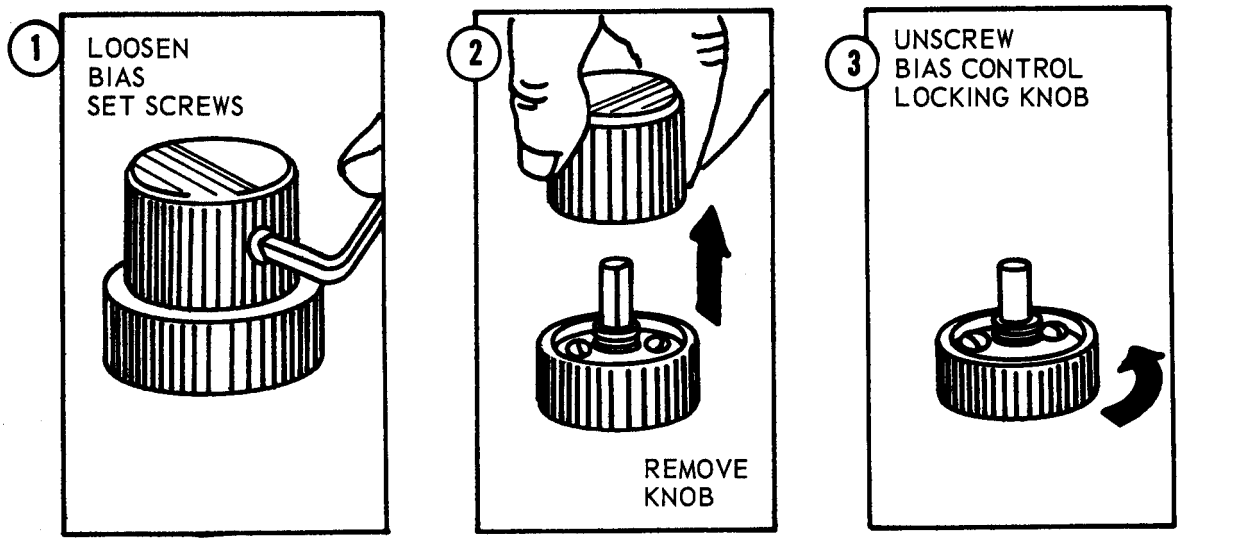


Figure 2-12. Removal of BIAS control knob.

(6). Remove five screws securing edge-lighted panel to control panel.
(7). Using orangewood sticks, lift edge-lighted panel off control panel.

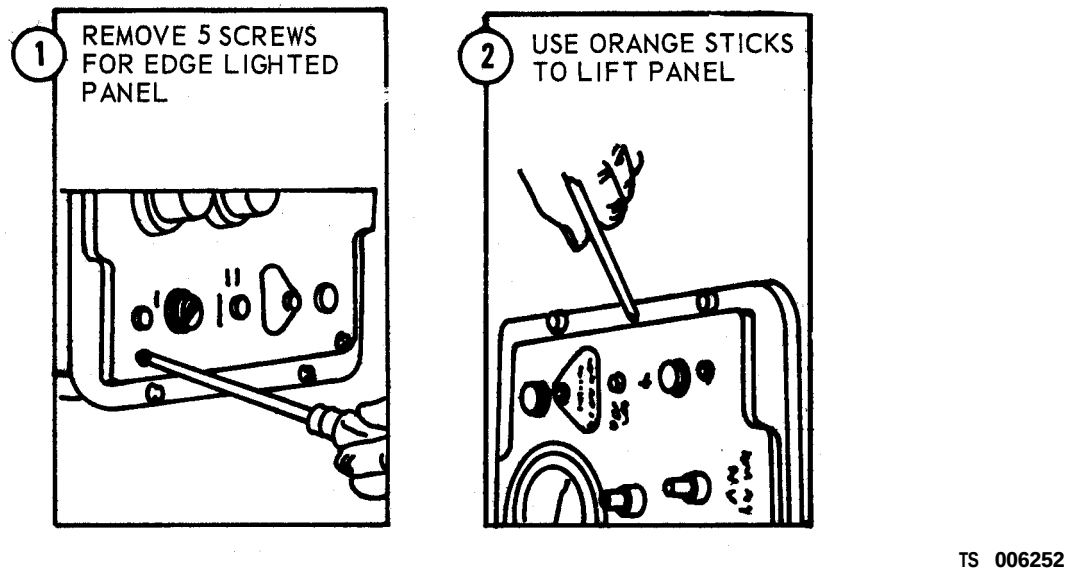


Figure 2-13. Removal of edge-lighted panel.

(8). Unsolder the electrical leads from the defeetive switch and tag for identification.
(9). Remove the attaching parts securing the switch to the panel assembly and remove switch

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

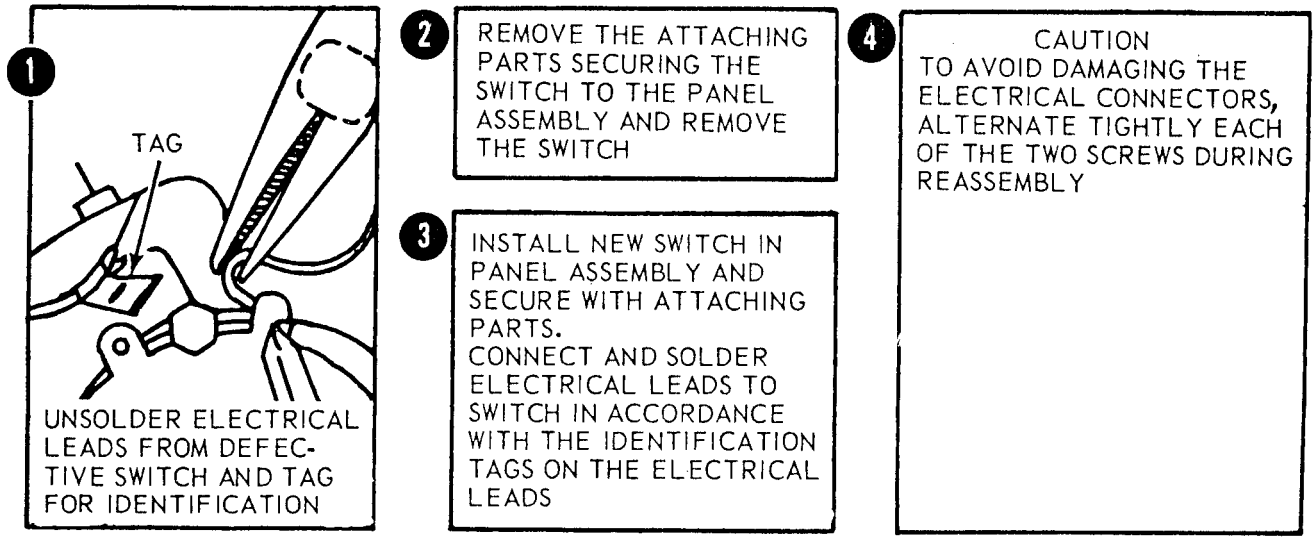


Figure 2-14. Removal of MODE SELECT switch.

(10). Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(11). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(12). Place edge-lighted panel (fig. 2-13) over connector, seat properly and secure with five mounting screws.

(13). Install BIAS control locking and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews (fig. 2-12).

(14). Install TEST SELECT knob on shaft with pointer at source voltage position. Install MODE SELECT knob on shaft with pointer at GC position. Secure each knob by tightening setscrews (fig. 2-11).

(15). Install electronic control panel assembly in case and secure with eight captive screws.

2. MODE SELECT SWITCH CAN BE ROTATED COUNTERCLOCKWISE FROM GC, BRAKE OR PWR OFF POSITIONS

Step 1. Knob rotates on switch shaft. Knob setscrews loose or switch shaft worn. Tighten two setscrews in knob. Replace switch.

a. Loosen the eight captive screws (fig. 2-15) and lift the electronic control panel assembly from the case.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

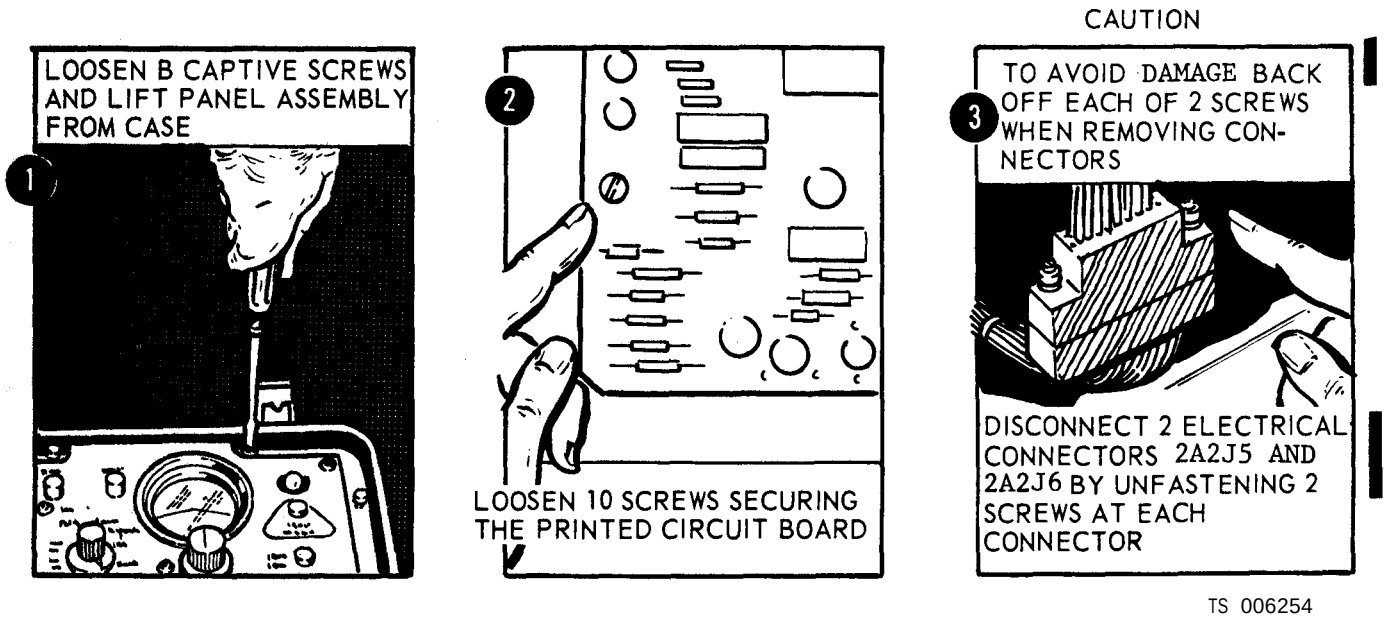


Figure 2-15. Removal and ECU panel assembly.

b. Unfasten ten screws (fig. 2-15) securing the printed circuit board to mounting brackets and loosen board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately backoff each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6), by unfastening two screws at each connector.

d. Place MODE SELECT switch to GC position (fig. 2-16).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

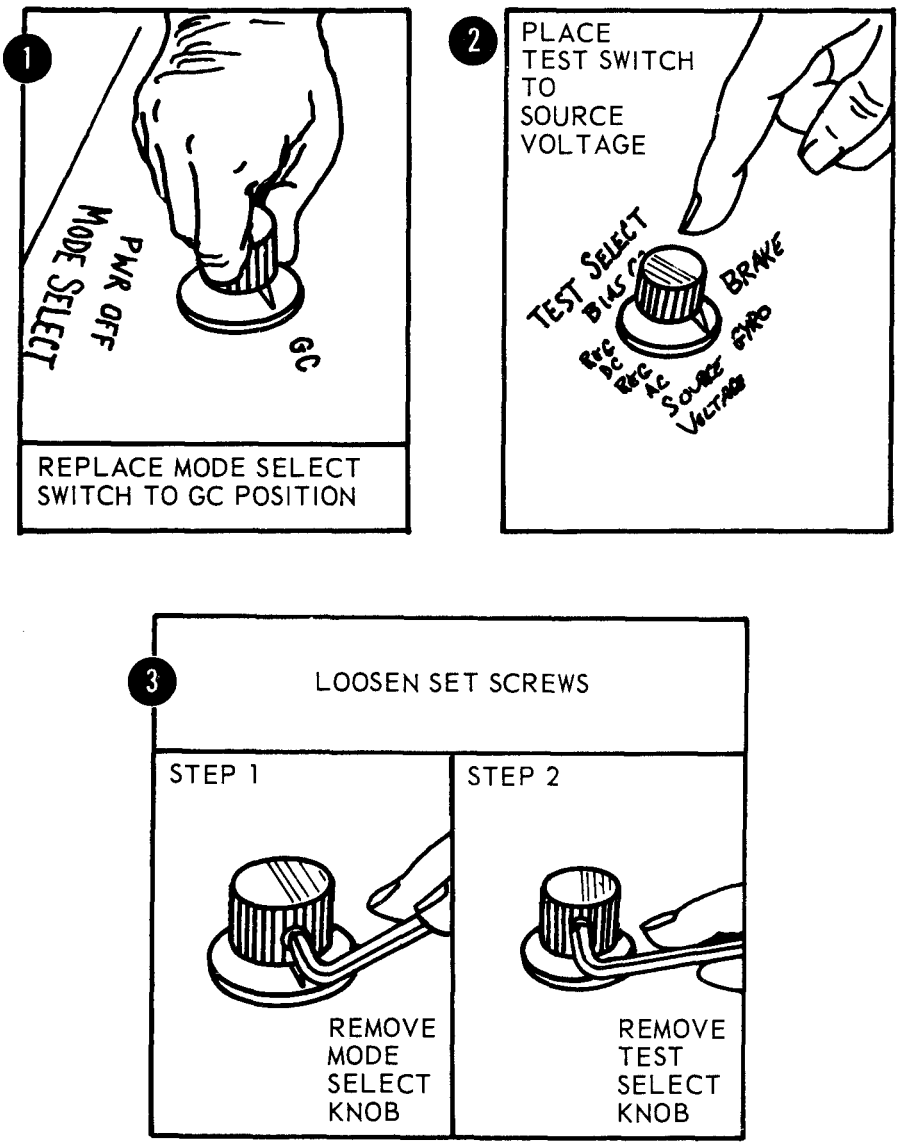


Figure 2-16. Removal of MODE and TEST select switch knobs.

e. Place TEST SELECT switch to SOURCE VOLTAGE position. (fig. 2-16).

f. Loosen MODE SELECT and TEST SELECT knob setscrews (fig. 2-16) with 5/64-inch and 0.050-inch hex wrench, respectively, and remove knob from switch shaft.

g. Loosen BIAS knob setscrews (fig. 2-17) with 5/16 inch hex wrench and remove knob from switch shaft.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

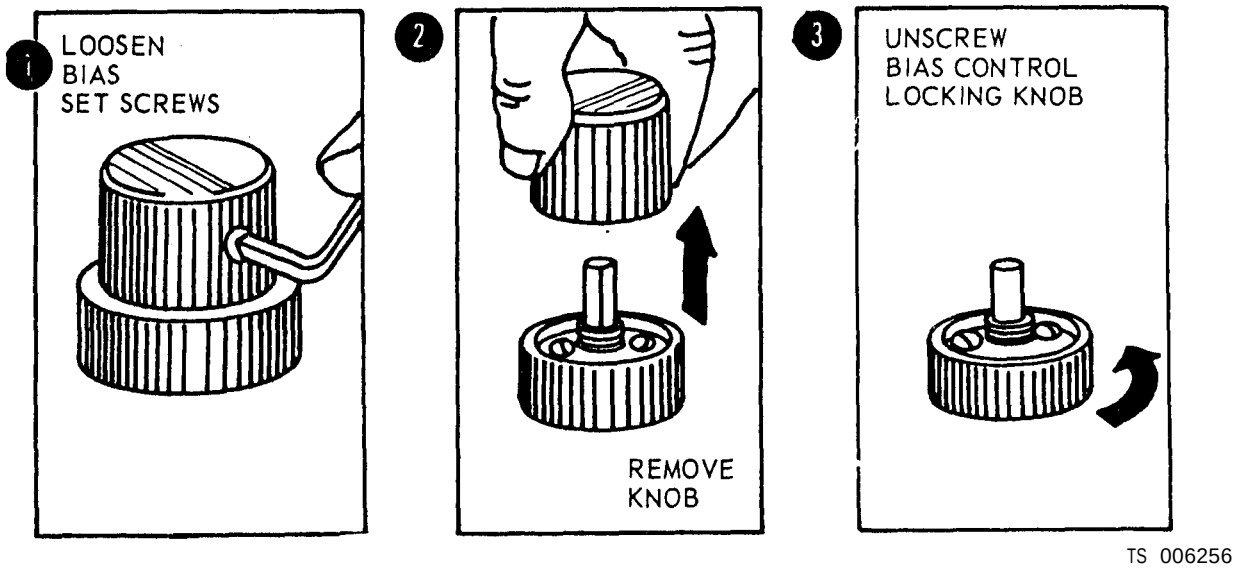


Figure 2-17. Removal of BIAS control knob.

h. Unscrew BIAS control locking knob from BIAS control shaft and remove.
i. Remove five screws (fig. 2-18) securing edge-lighted panel to control panel. Using orangewood sticks, lift edge-lighted panel (fig. 2-18) off control panel.

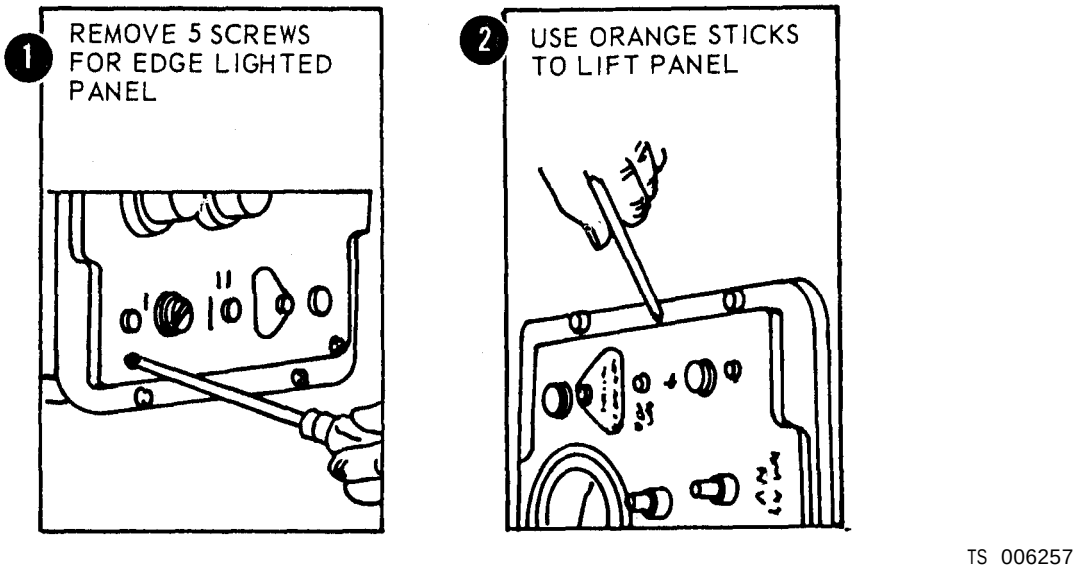


Figure 2-18. Removal of edge-lighted panel.

j. Unsolder the electrical leads from the defective switch and tag for identification.
k. Remove the attaching parts securing the switch to the panel assembly and remove switch.

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

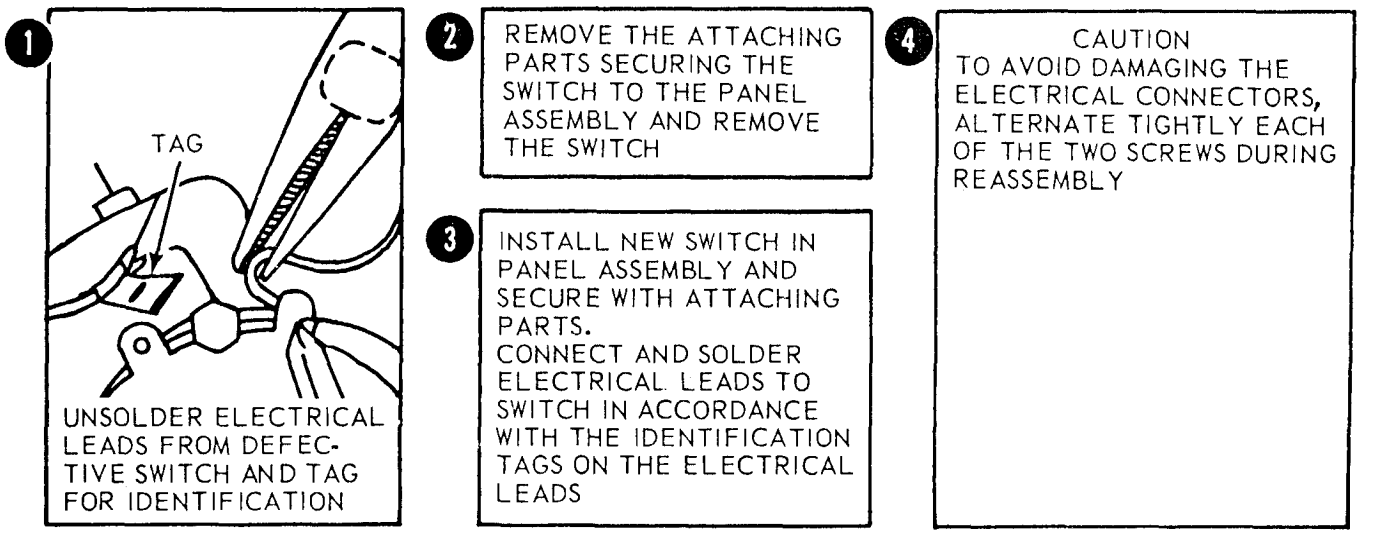


Figure 2-19. Removal of MODE SELECT switch.

l. Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

CAUTION
To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

m. Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

n Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

o. Install BIAS control locking and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

p. Install TEST SELECT knob on shaft with pointer at source voltage position. Install MODE SELECT knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

q. Install electronic control panel assembly in case and secure with light captive screws.

3. THEODOLITE LIGHT CIRCUIT INOPERATIVE WHEN MODE SELECT SWITCH IS IN THEO ILLUM POSITION AND THEO BRT CONTROL IS FULLY CW.

Step 1. Check for defective theodolite lamp.

a. Ensure that the power is off.

b. Rotate the protective cap counterclockwise and remove.

c. Remove the lamp from the socket.

d. Visually inspect lamp for a burned out filament.

(1). Place a good lamp in the socket.

(2). Position the protective cap over the socket and turn clockwise until finger tight

Step 2. Check for a bad interconnect cable.

a. Disconnect the interconnect cable from the receptacle on the ECU and GRU.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

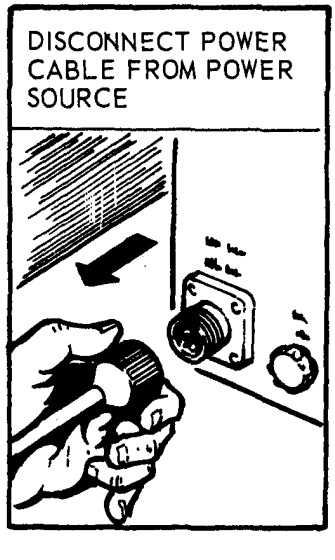


Figure 2-20. Removal of ECU and GRU power cables.

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

(1). Replace a damaged cable.

(2). Connect the interconnect cable to the GRU and ECU receptacle.

Step 3. Check for defective theodolite bright control (2A2R1) or MODE SELECT switch (2A2S3).

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-21).

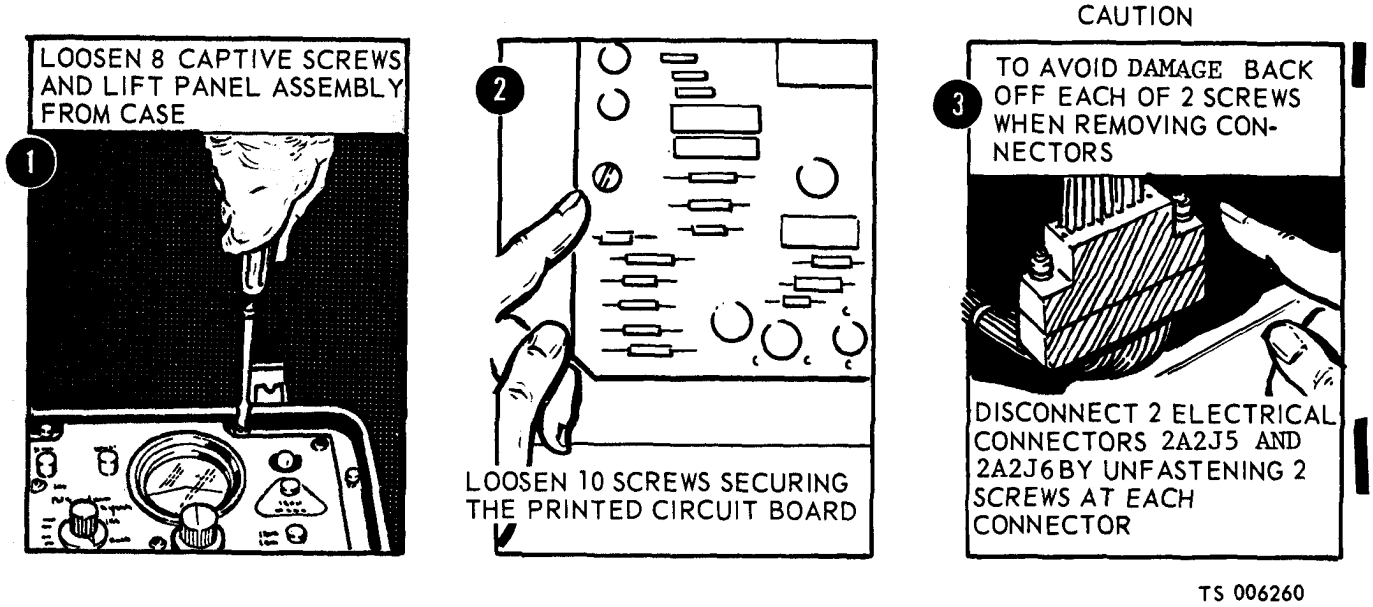


Figure 2-21. Removal of ECU panel assembly.

Table 2-1. Troubleshooting-Continued

MALFUNCITON	TEST OR INSPECTION	CORRECTIVE ACTION

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5, 2A2J6) by unfastening two screws at each connector.

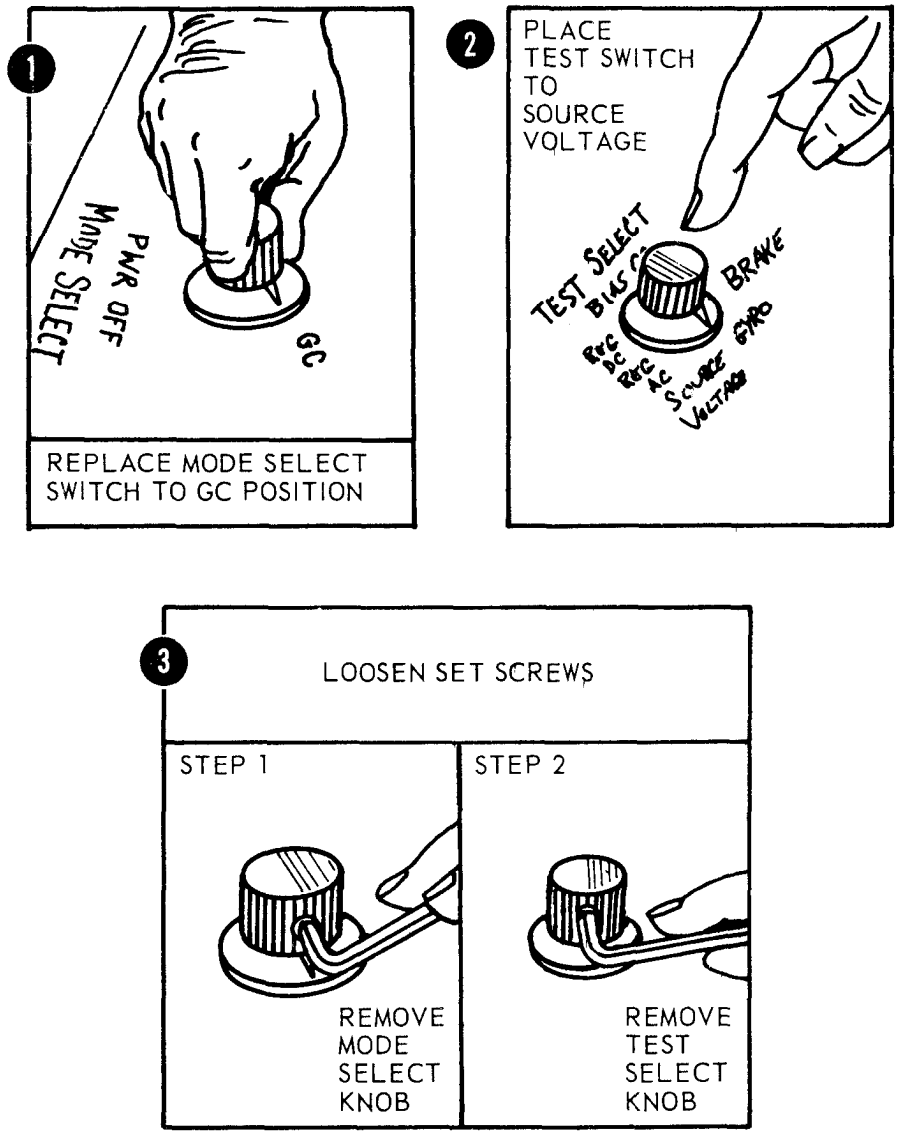
d. Check continuity between the input pins of the mode select switch and the position pins. Check voltage drop between pin 2 of the theodolite bright control and pins 1 and 3 while rotating the control shaft.

If continuity is not present when checking the MODE SELECT switch and voltage drop exist when checking theodolite bright control, replace them.

(1). Place MODE SELECT switch to GC position.

(2). Place TEST SELECT switch to SOURCE VOLTAGE positions.

(3). Loosen MODE SELECT and TEST SELECT knob setscrews with 5/64 and 0.050-inch hex wrench, respectively, and remove knpb from switch shaft.



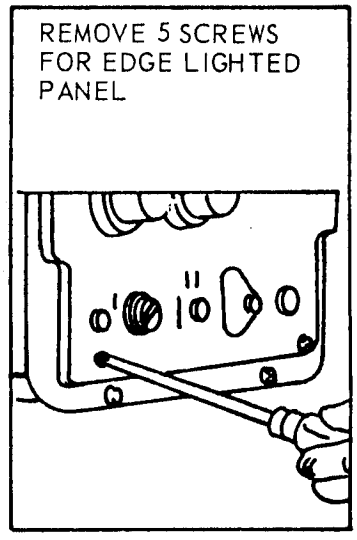
TS 006261

Figure 2-22. Removal of MODE and TEST SELECT switch knobs.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(4). Unscrew BIAS control locking knob from BIAS control shaft and remove.
(5). Remove five screws (fig. 2-22) securing edge-lighted panel to control panel.



TS 006262

Figure 2-23. Removal of edge-lighted panel.

(6). Using orangewood sticks, lift edge-lighted panel (fig. 2-22) off control panel.
(7). Unsolder the electrical leads (fig. 2-23) from the defective switch or control and tag for identification.

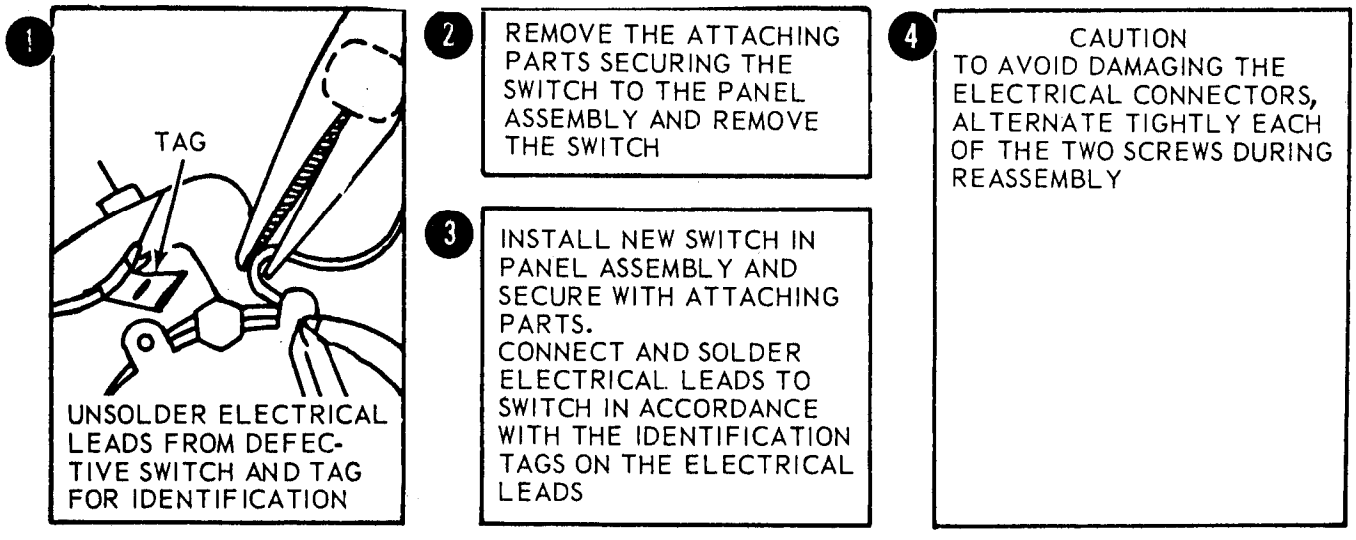


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Figure 2-24. Removal of MODE SELECT switch or theodolite bright control.

(8). Remove the attaching parts securing the switch or control to the panel assembly and remove switch.
(9), Install new switch or control in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical con nectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(12). Install BIAS control locking and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install TEST SELECT knob on shaft with pointer at source voltage position. Install MODE SELECT knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with eight captive screws.

Step 4. Check for defective gyroscopic reference unit. Replace existing GRU with a GRU that is operable by disconnecting and connecting power cables. If tbe system operates correctly with the new GRU, this indicates the original GRU was bad. Report a bad GRU to the next higher level of maintenance.

4. PANEL ILLUMINATION CIRCUIT INOPERATIVE

Step 1. Check for a defective panel illumination control (2A2R2) or defective mode select switch (2A2S1).

a. Loosen the eight captive-screws and lift the electronic control panel assembly from the case (fig. 2-25).

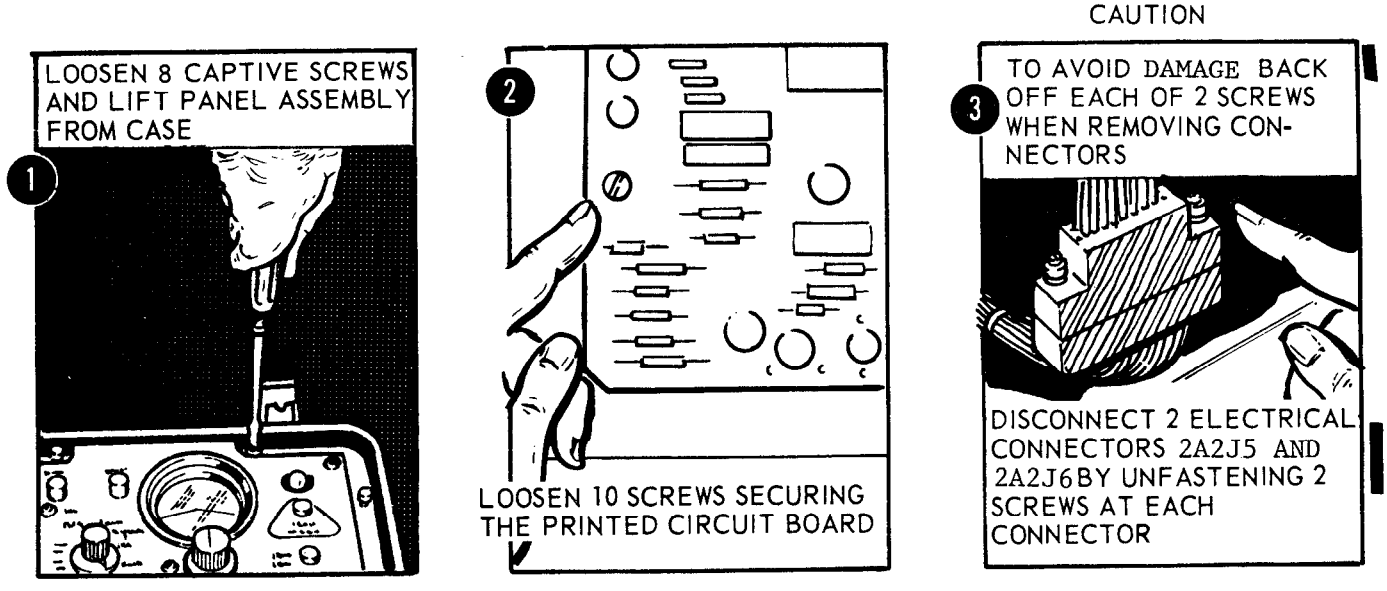

Figure 2-25. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity between the input pins of the mode select switch and position pins. Use an ohm-meter and check continuity between pin 3 and pin 1 and 2 of the panel illumination control.

If continuity is not present, replace a defective mode select switch or panel illumination control.

(1). Place MODE SELECT switch to GC position.

(2). Place TEST SELECT switch to source voltage position.

Table 2-1. Troubleshooting - Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

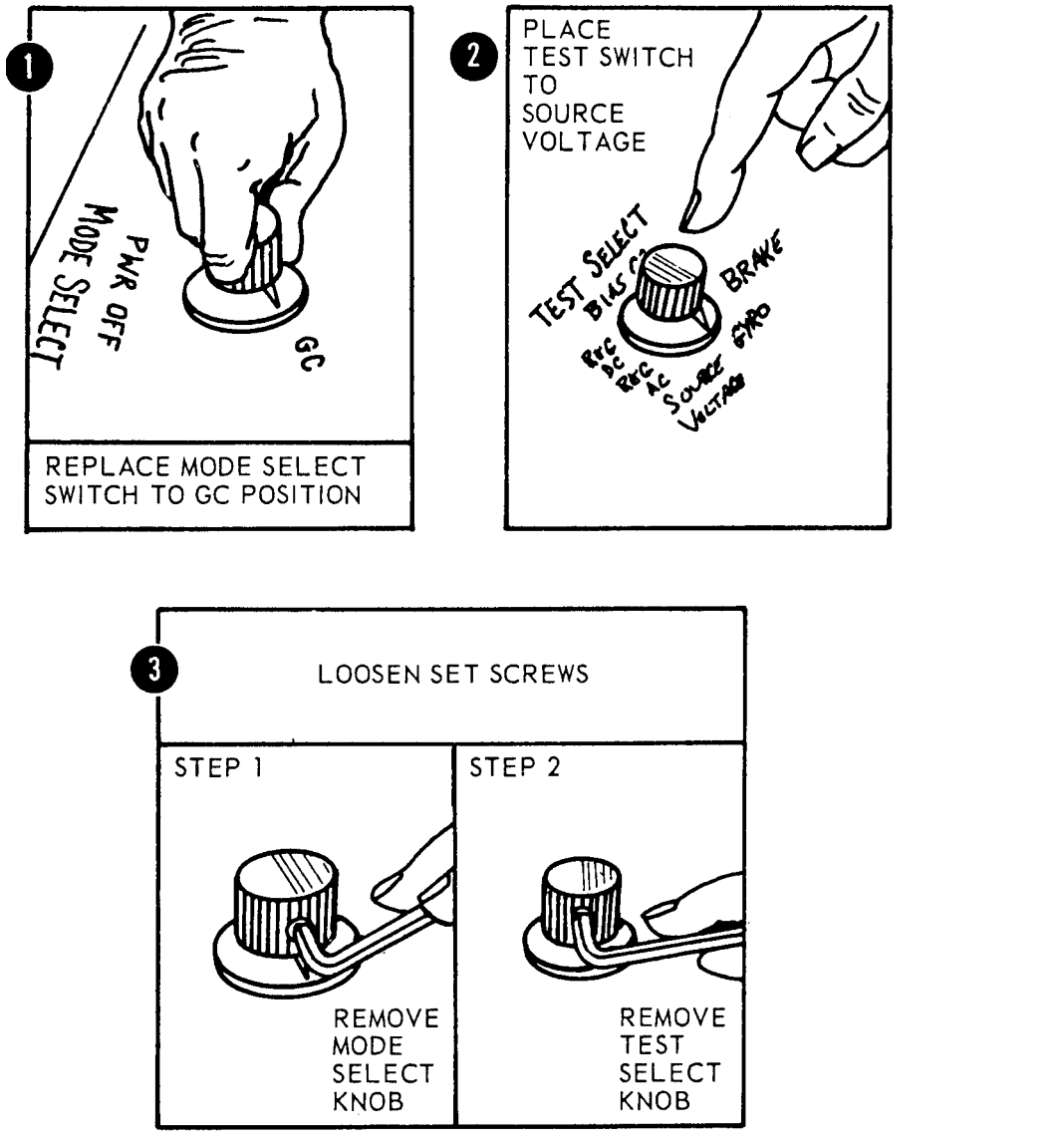

Figure 2-26. Removal of MODE and TEST SELECT switch knobs.

(3) Loosen MODE SELECT and TEST SELECT knob setscrews with 5/64-inch and 0.050-inch, hex wrench, respectively, and remove knob from switch shaft.
(4) Unscrew BIAS control locking knob from BIAS control shaft and remove.

Table 2-1. Troubleshooting—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

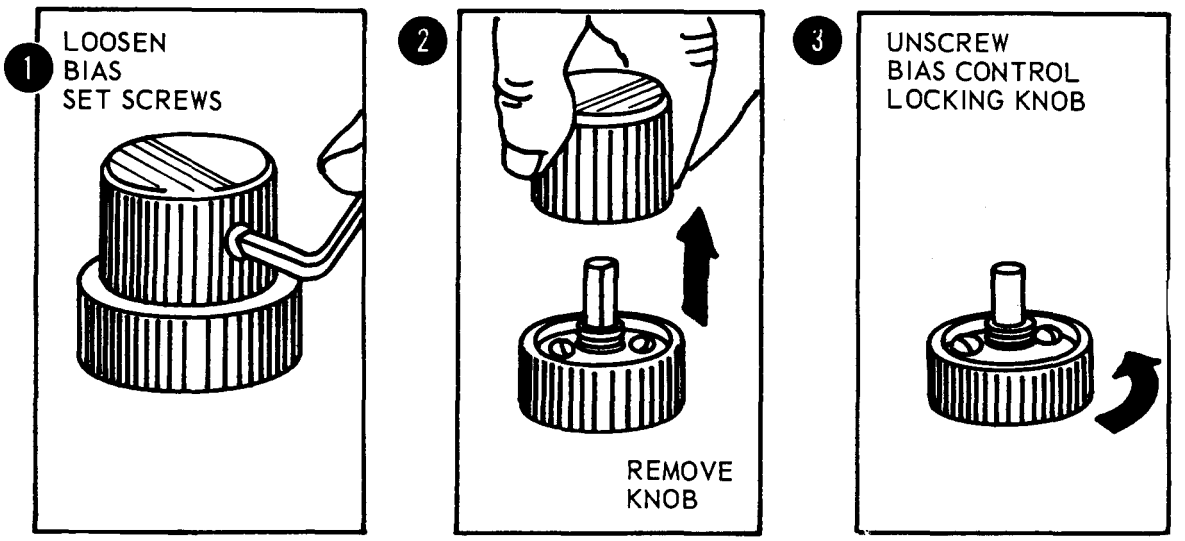

Figure 2-27. Removal of BIAS control knob.

(5). Remove five screws (fig. 2-28) securing edge-lighted panel to control panel.

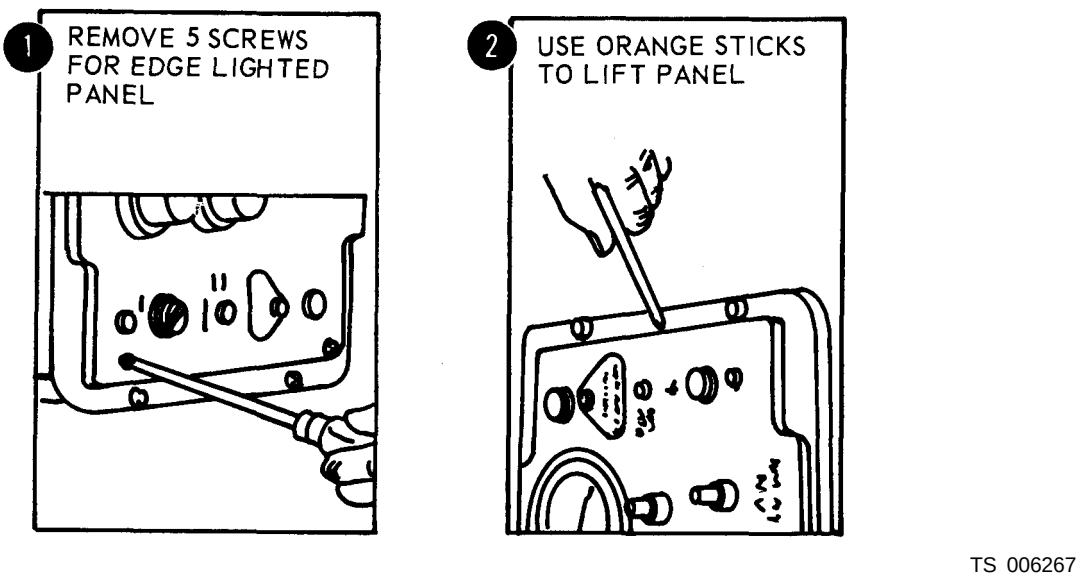

Figure 2-28. Removal of edge-lighted panel.

(6). Using orangewood sticks, lift edge-lighted panel off control panel.

(7). Unsolder the electrical leads from the defective switch or control and tag for identification.

Table 2-1. Troubleshooting— Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

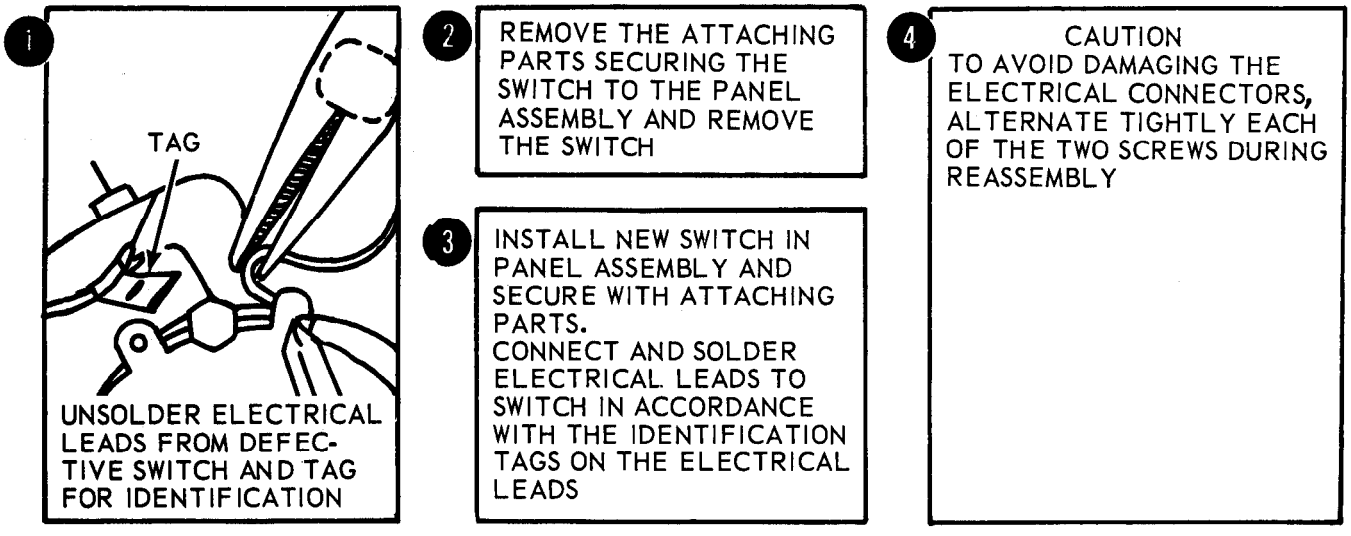

Figure 2-29. Removal of MODE SELECT switch or panel illumination control.

(8). Remove the attaching parts securing switch or control to the panel assembly and remove switch.

(9). Install new switch or control in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identificaiton tags on the electrical leads.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during assembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connset the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(12). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install TEST SELECT knob on shaft with pointer at source voltage position. Install MODE SELECT knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with light captive screws.

Step 2. Check for defective edge-lighted panel.

Replace the edge-lighted panel as follows: (fig. 2-30).

a. Place MODE SELECT switch to GC position.

b. Place TEST SELECT switch to SOURCE VOLTAGE position.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

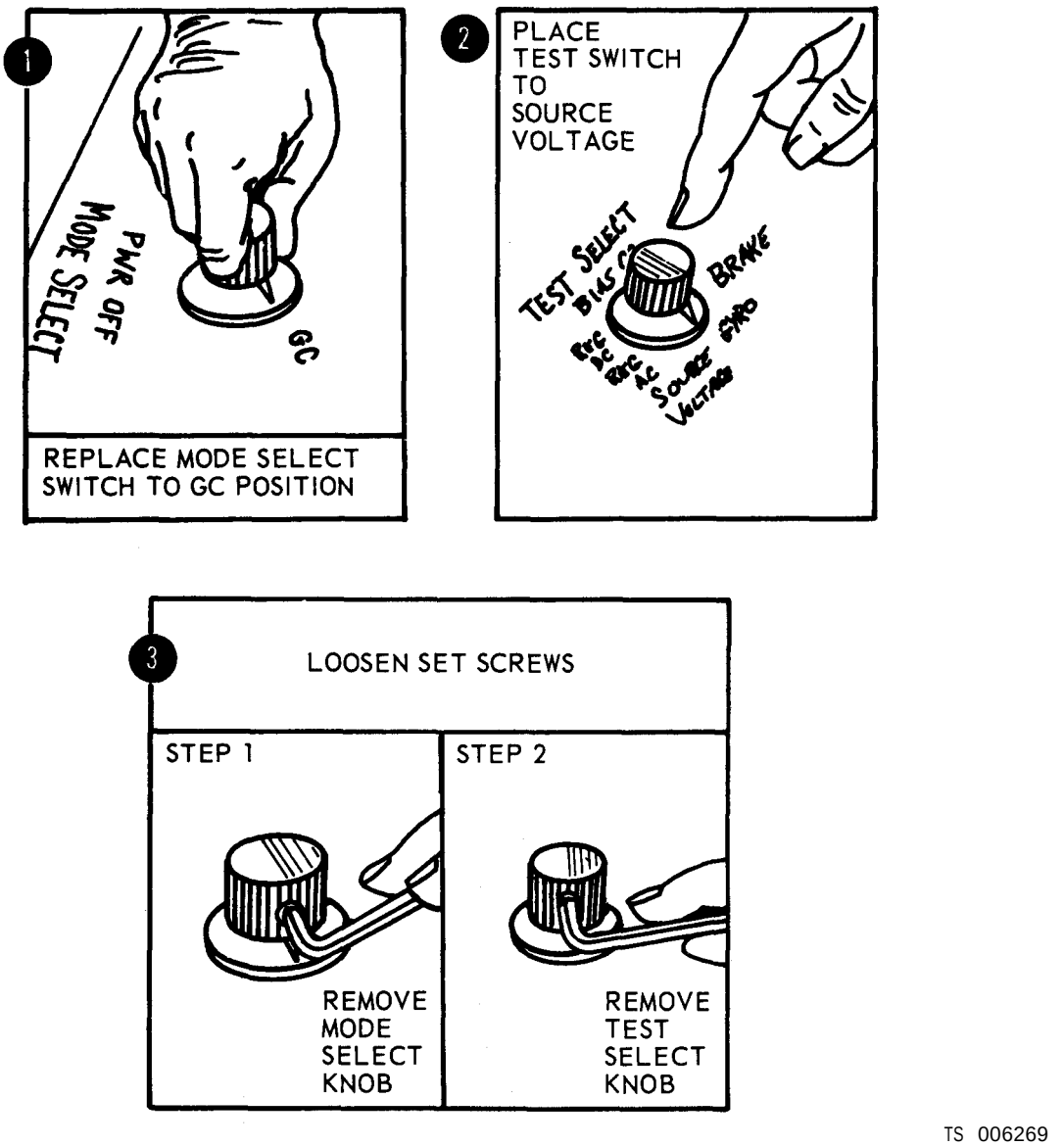

Figure 2-30. Removal of MODE and TEST switch knobs.

c. Loosen MODE SELECT and TEST SELECT knobs setscrews and remove knob from switch shaft.

d. Loosen BIAS knob setscrews (fig. 2-31) and remove knob from switch shaft.

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

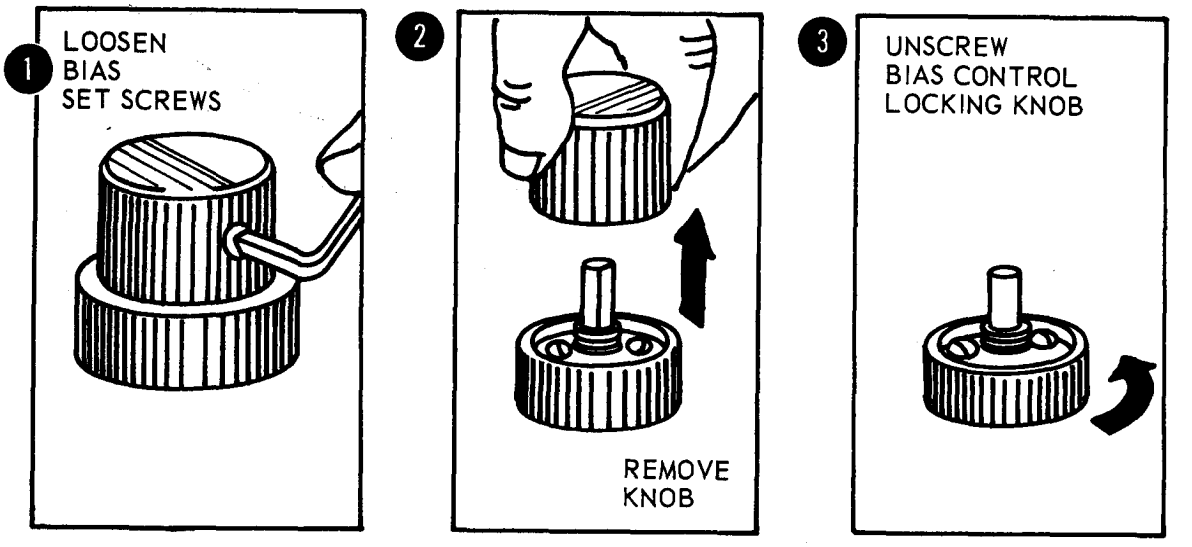

Figure 2-31. Removal of BIAS control knobs.

e. Unscrew BIAS control locking knob from BIAS control shaft remove.
f. Remove five screws (fig. 2-32) securing edge-lighted panel to control panel.

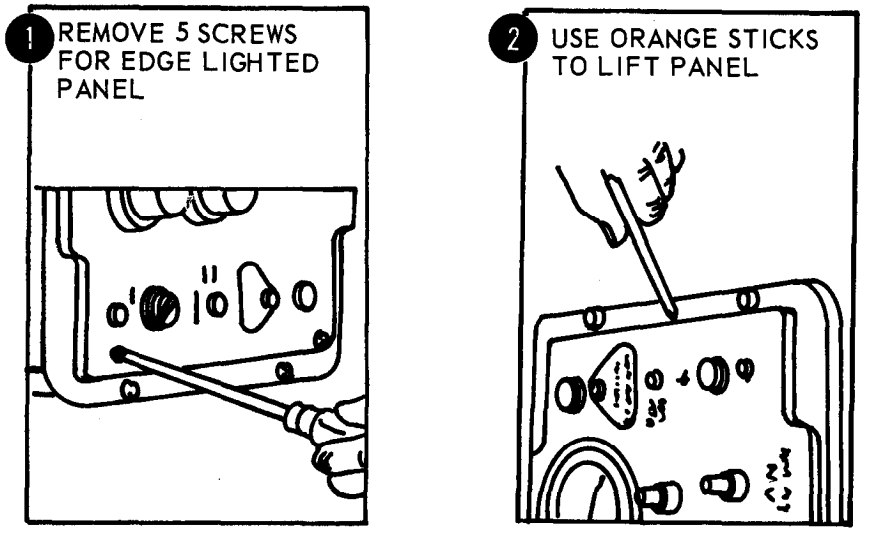

Figure 2-32. Removal of edge-lighted panel.

g. Using orangewood sticks, lift edge-lighted panel off control panel.
h. Install a new edge-lighted panel over connector and seat properly.
i. Install five mounting screws to secure panel in place.

5. TEST METER FAILS TO PROVIDE REQUIRED INDICATIONS DURING SELF-TEST OPERATION

Step 1. Check for defective gearbox assembly in SERVO and GYRO test modes by performing the following test. Apply power and check operation as follows:

a. Place TEST SELECT switch to GYRO; verify that the TEST METER indicates a zero reading.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

b. Place the TEST SELECT switch to servo CW position; verify that the theodolite rotates in a clockwise direction when looking down on the GRU and verify that the TEST METER pointer is positioned in the green band of the meter scale.

c. Place the TEST SELECT switch in the CCW position; verify that the theodolite rotates in a counterclockwise direction when looking down on the GRU and verify that the TEST METER pointer is positioned in the green band of the meter scale. If the theodolite fails to rotate in either direction the gearbox assembly is bad.

Replace the gearbox assembly.

(1). Remove tbe main connector housing cover by removing ten screws.

(2). Remove the gearbox assembly access cover by removing ten screws (fig. 2-33).

(3). Remove the three gearbox assembly mounting screws (fig. 2-33) and remove the gearbox assembly.

(4). Disconnect the gearbox assembly electrical cable by rotating the connector mounting screws (fig. 2-33) in the counterclockwise direction. Alternate between the two screws every (2 to 3) turns.

The connector will be damaged if the technique is not followed. Remove the gearbox assembly.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

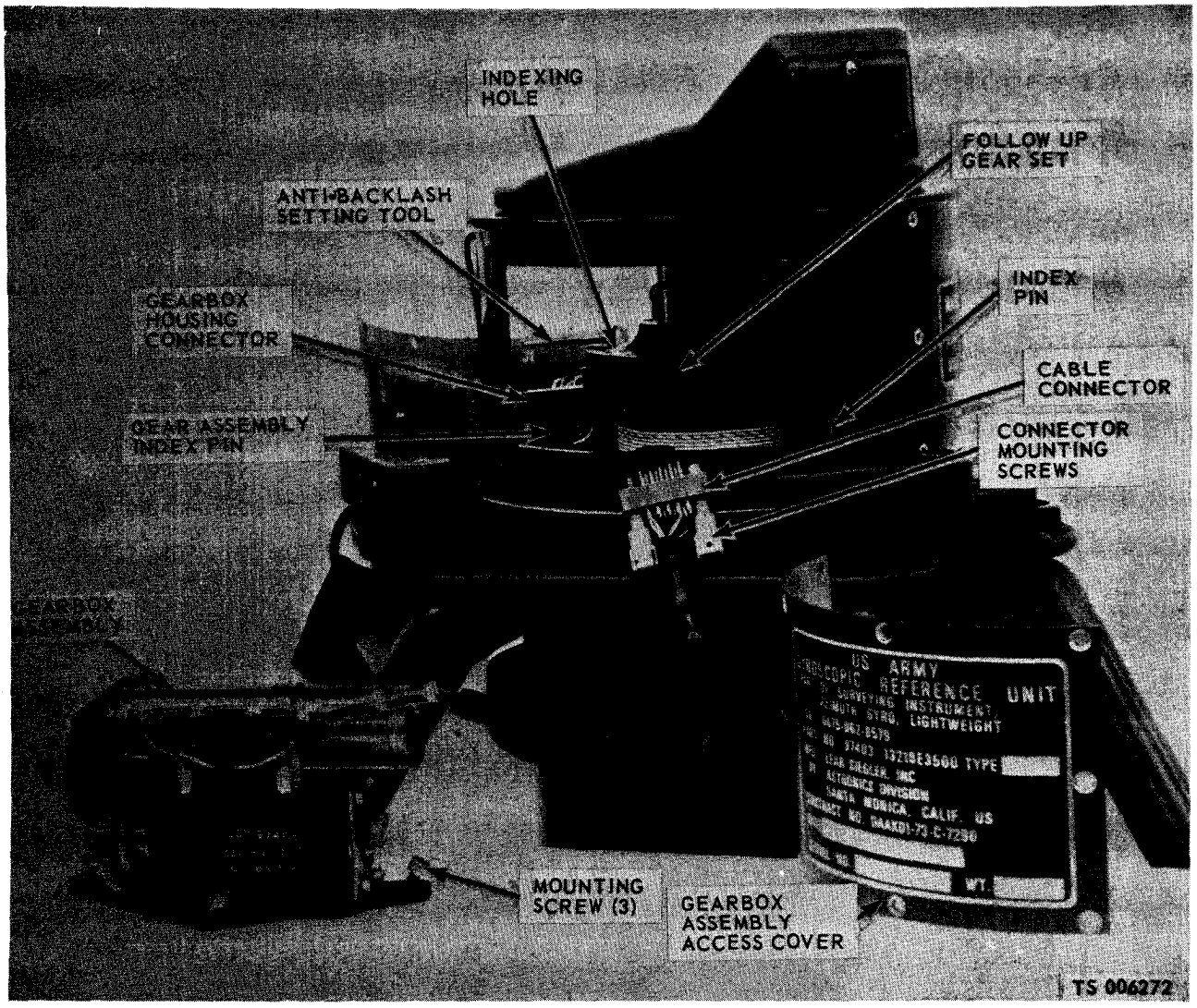

Figure 2-33. Gearbox assembly removal.

(5) Install the anti-backlash setting tool (fig. 2-33) into the index hole of the upper gear half of the follow-up gear set, with the handle of the tool towards the main connector cover.

(6) Place the thumb on one end of the gear set and the index finger on the other and slide the two gear halves together so the ends are flush.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(7). Press the anti-backlash setting tool into the index hole of the lower gear half and relax the thumb and index finger.
(8). Connect the gearbox assembly electrical cable connector to the female receptacle on thegearhox housing connector (fig. 2-33). Rotate the cable connector mounting screws in the clockwise direction, being careful to alternate between the two screws after (2 to 3 turns).
(9). Place the cable between the gearbox assembly mounting pads, so that it will be under the gearbox when the gearbox is in final position.
(10). Rotate the follow-up shaft to the extreme clockwise position by turning the theodolite mounting plate.
(11). Install the gearbox assembly through the access hole and place it so that tbe mounting screw holes are lined up.
(12). Apply sealant primer, MIL-S-22473, Grade T, Form R, to the threads, and allow to air dry. Apply a small amount of thread locking sealant, MIL-S-46163, Grade N, Type II, to the first few threads. Install the gearbox mounting screws, but do not tighten.
(13). Press the gearbox assembly against the index pins on the inner mounting pads and tighten the mounting screws while maintaining the gearbox position.
(14). Remove the anti-backlash setting tool from the indexing hole.
(15). Install the gearbox assembly access cover and main connector housing screws. Secure each cover with ten screws.

Step 2. Check for defective gyroscopic reference unit (GRU).
Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-34).

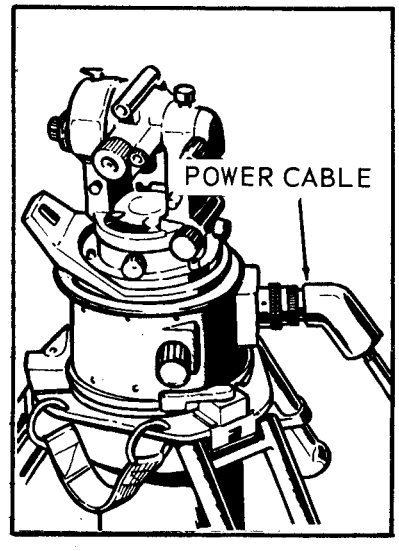

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Figure 2-34. Gyroscopic reference unit power cable.

If the system operates correctly witb the new GRU, this indicates the original GRU was bad. Report a bad GRU to the next higher level of maintenance.

Step 3. Inspect printed circuit board for evidence of damage or failed components.
a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-35)

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

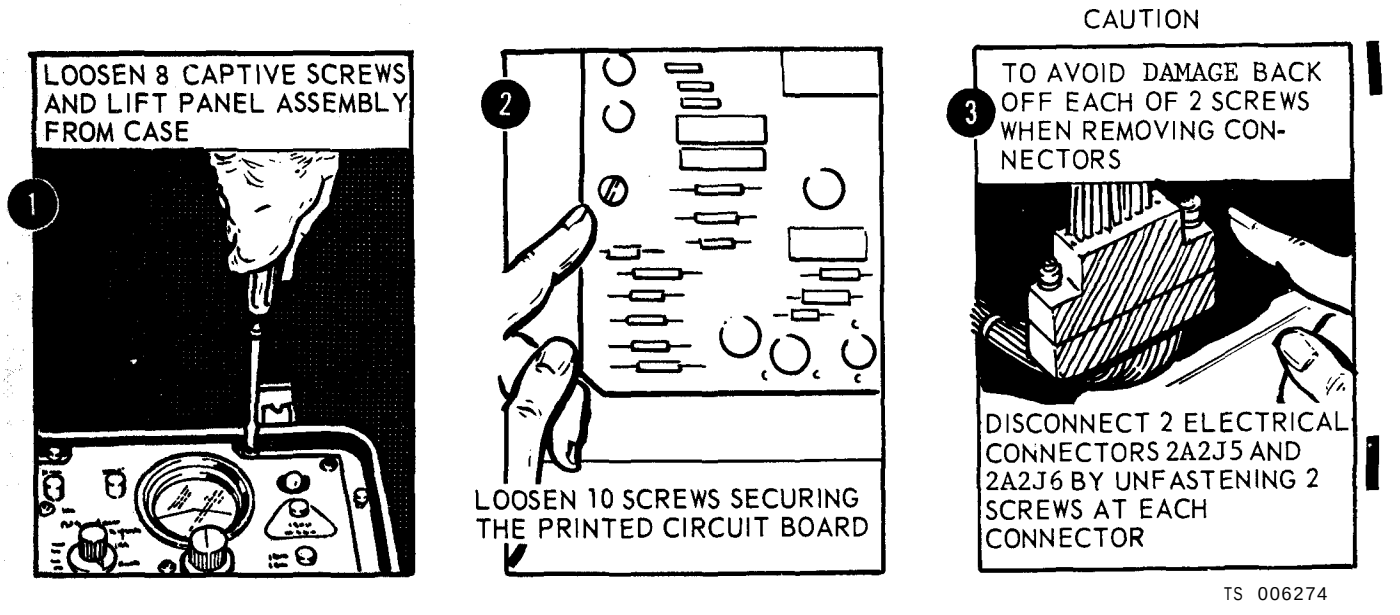

Figure 2-35. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, burns, or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during assembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 4. Check for defective PRESS TO TEST switch (2A1S2, MODE SELECT switch (2A1S3), or TEST SELECT switch (2A1S1).

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-36).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

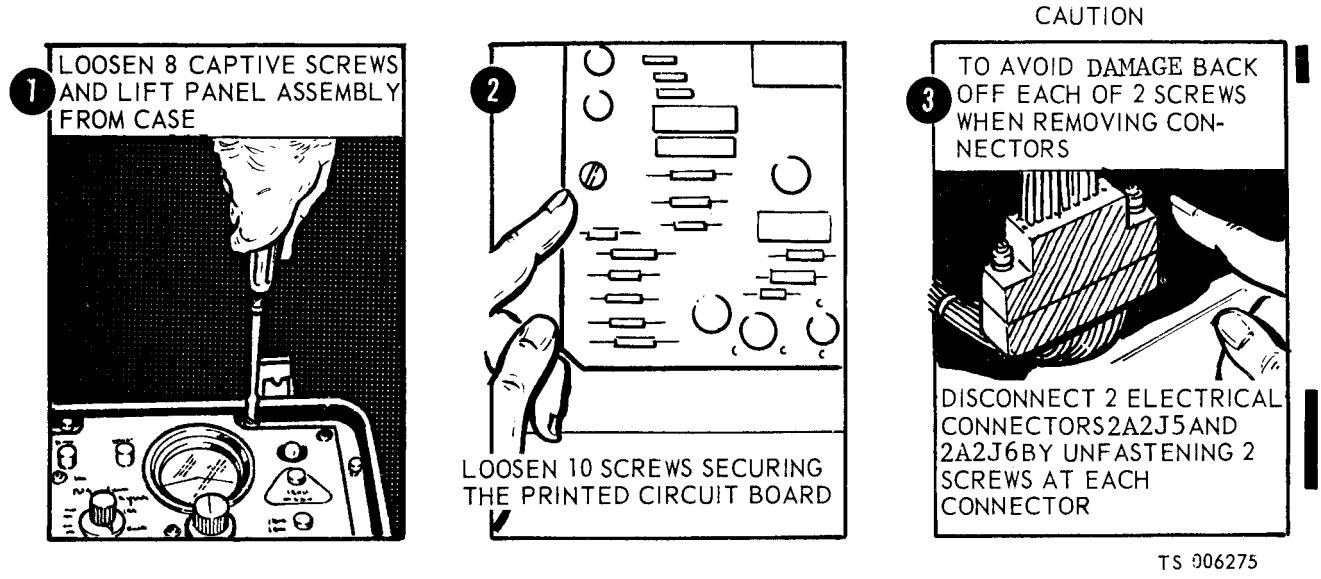

Figure 2-36. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity between pins 2 and 7 and 3 and 6 of PRESS TO TEST switch while the switch is closed.

e. Use an ohmmeter and check continuity between pins A, B, C and the position pins of MODE SELECT switch and TEST SELECT switch.

If continuity is not present, replace a bad switch.

(1). Place MODE SELECT switch (fig. 2-37) to GC position.

(2). Place TEST SELECT switch to source voltage position.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION

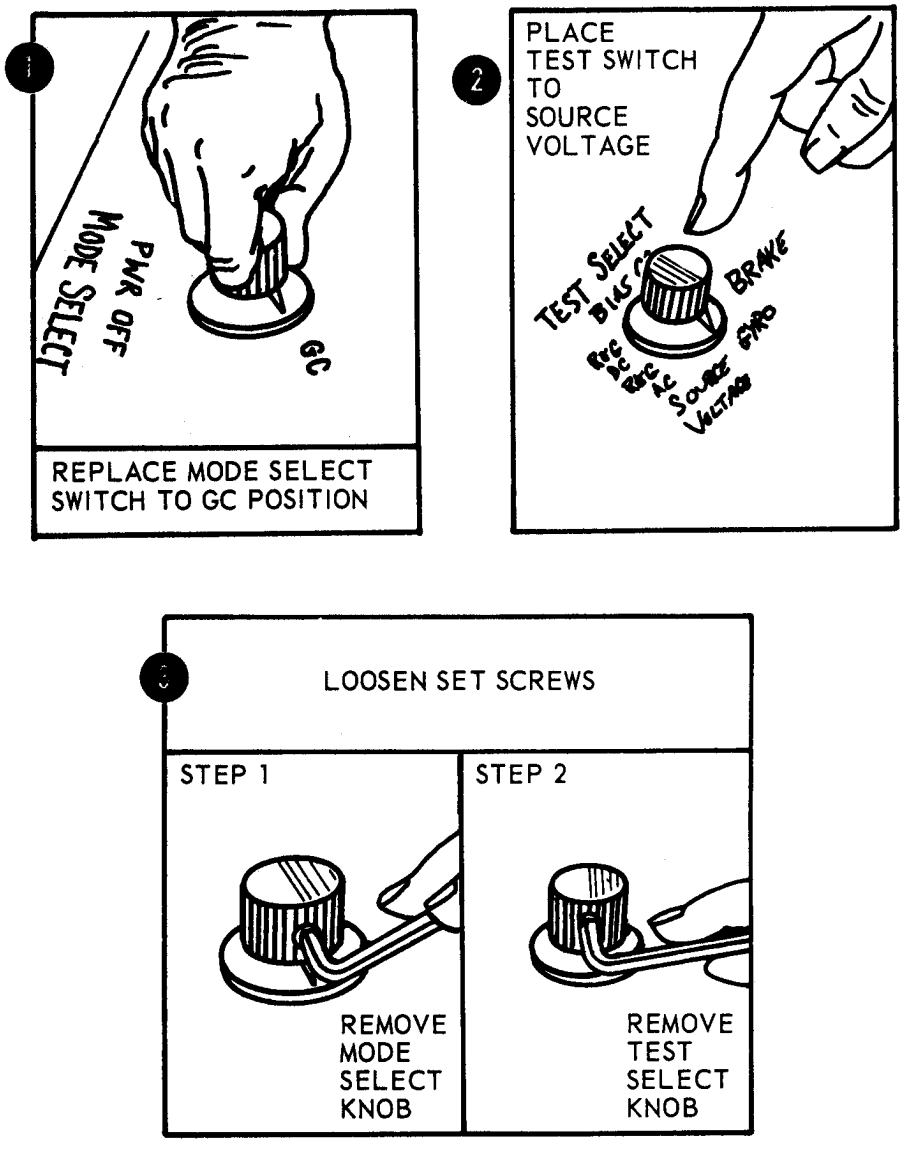

Figure 2-37. Removal of MODE and TEST SELECT switch knobs.

(3). Loosen MODE SELECT, TEST SELECT and BIAS switch knob setscrews with 5/64 inch hex (0.050-inch for TEST SELECT) hex wrench and remove knob from switch shaft.

(4). Unscrew BIAS control locking knob (fig. 2-38) from BIAS control shaft and remove.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

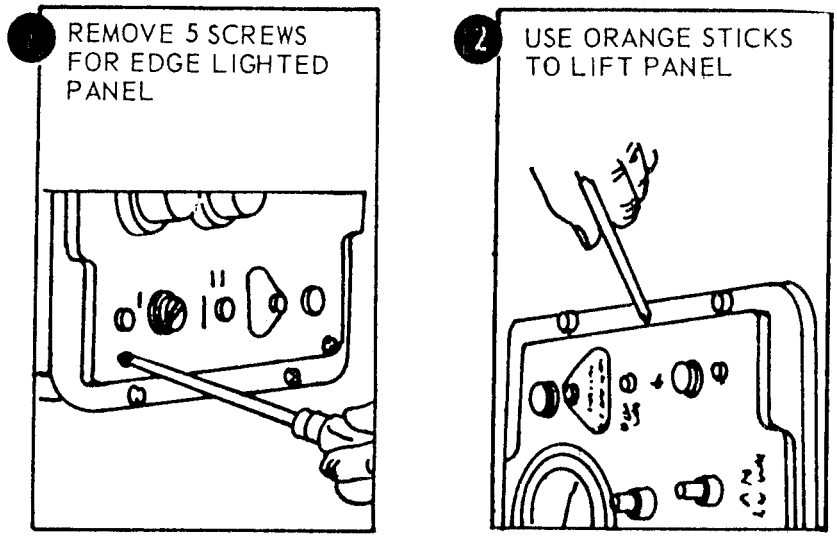

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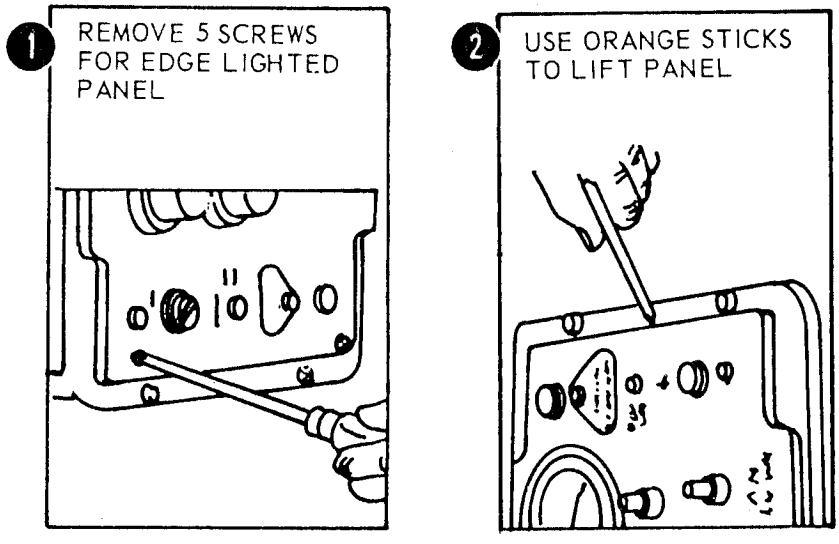
Figure 2-38. Removal of BIAS control knob.

(5) Remove five screws (fig. 2-39) securing edge-lighted panel off control panel.
(6) Using orangewood sticks, lift edge-lighted panel off control panel.



TS 006278

Figure 2-39. Removal of edge-lighted panel.

(7). Remove parts attaching the switch to the electronic control panel assembly and remove.
(8). Unsolder the electrical leads from the defective switch and tag for identification.
(9). Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(12). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install TEST SELECT switch knob on shaft with pointer at source voltage position. Install MODE SELECT switch knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with light captive screws.

Step 5. Check for a defective test meter.

a. Depress PRESS to test SWITCH.

b. If meter fails to provide required indication, meter is bad.

Replace a bad test meter.

(1). Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-40).

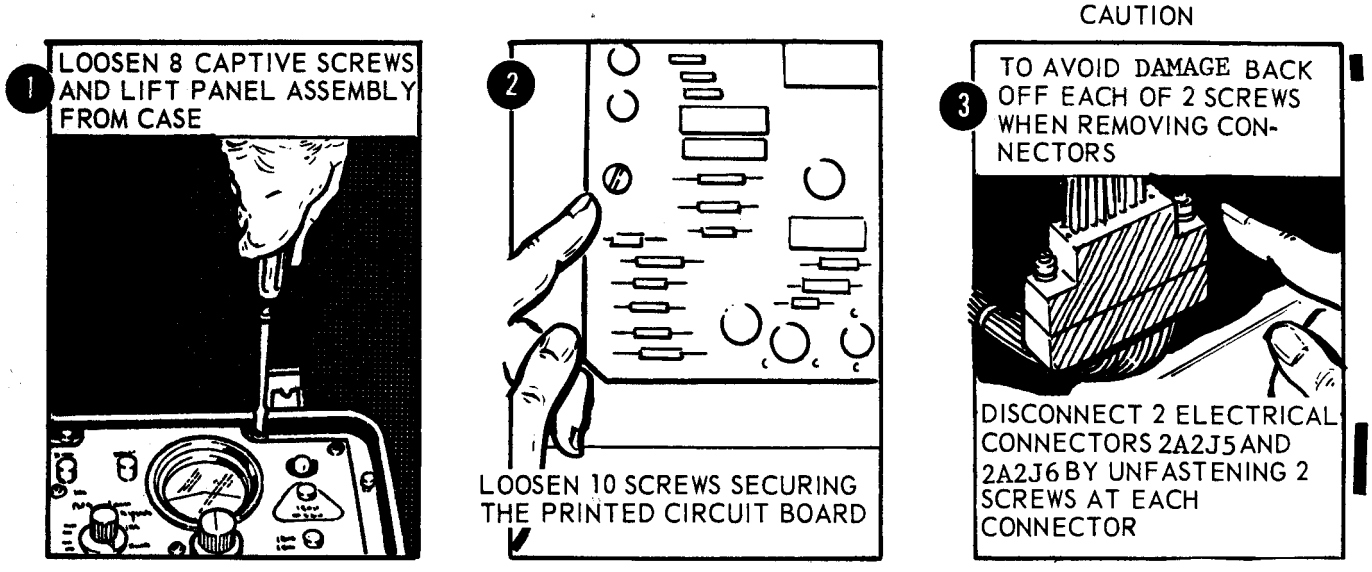


Figure 2-40. Removal of ECU panel assembly.

(2). Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

(3). Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

(4). Unsolder the electrical leads and tag for identification.

(5). Remove three nuts and screws attaching tbe meter and remove from the electronic control panel assembly.

(6). Install a new meter in tbe electronic control panel and secure with three nuts and screws.

(7). Connect and solder the electrical leads to the switch in accordance with the identification tags on the leads.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(8). Install printed circuit board but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(9). Install electronic control panel assembly in case and secure with light captive screws.

6. HAND LAMP CIRCUIT INOPERATIVE

Step 1. Check for defective hand lamp.

a. Unscrew the lamp shield and remove the lamp.

b. Visually inspect the lamp for a burned filament.

Replace a bad lamp. Install a new lamp in hand lamp and install shield.

Step 2. Check for defective HAND LAMP switch (2A2S6).

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-41).

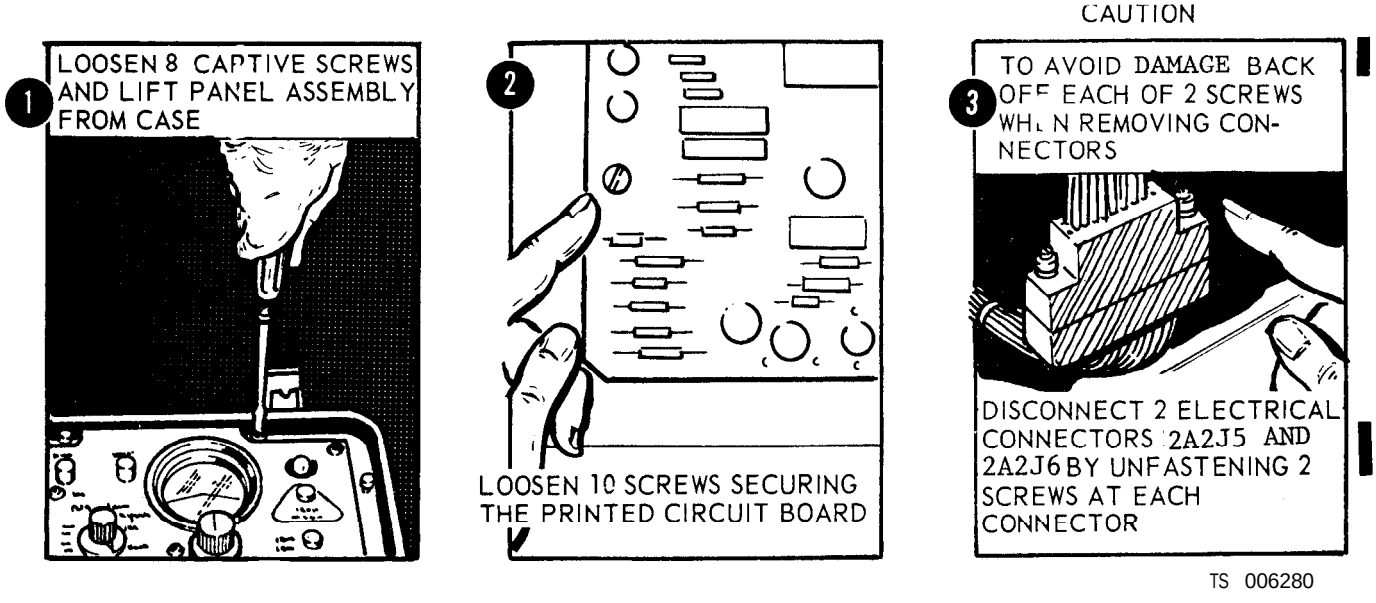


Figure 2-41. Removal of ECU panel assembly

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity between pins 1 and 2 of switch 2A2S6.

If continuity is not present, replace a bad switch.

(1). Place Mode Select switch to GC position (fig. 2-42).

(2). place TEST SELECT switch to SOURCE VOLTAGE position.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

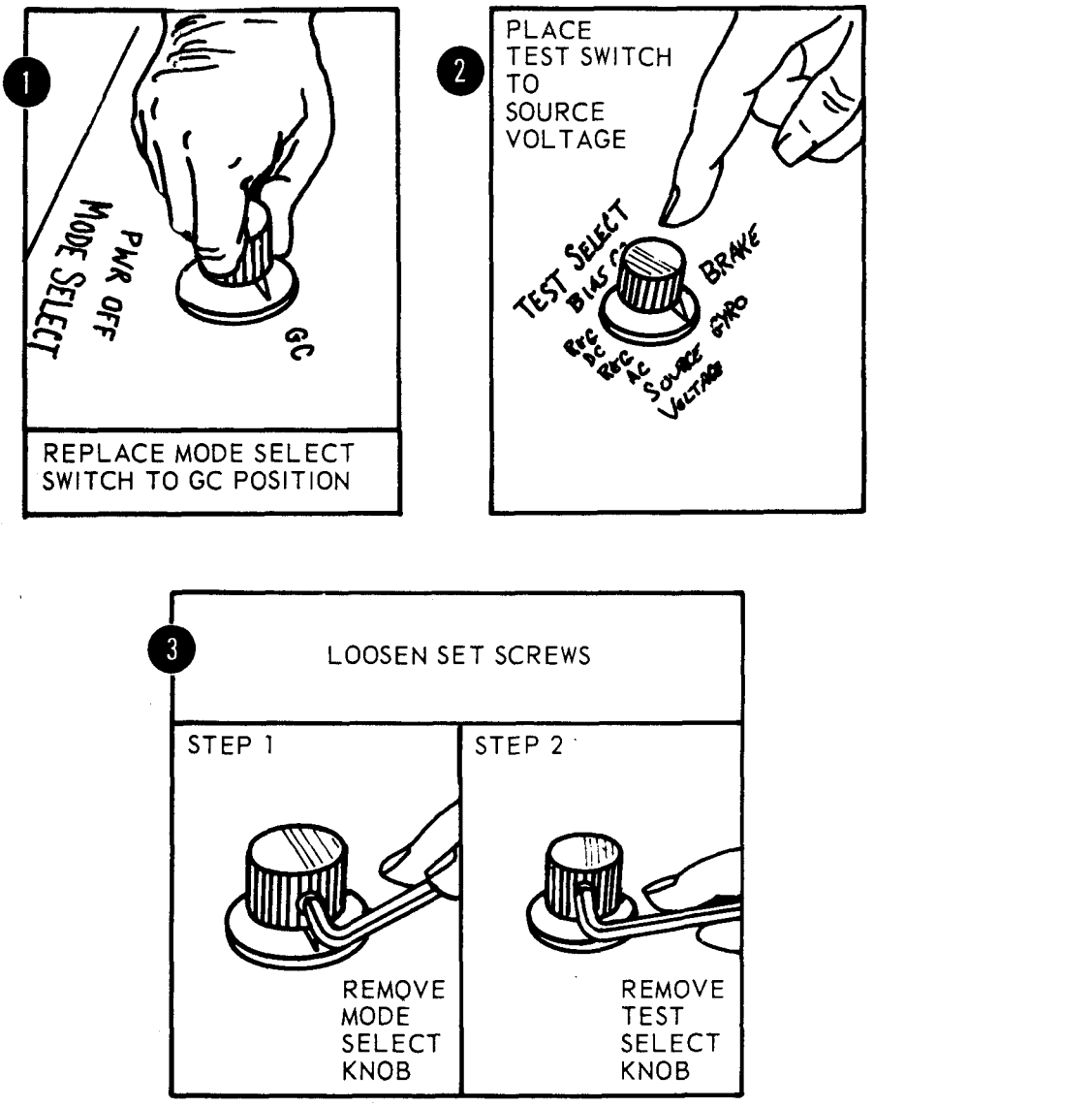


Figure 2-42. Removal of MODE and TEST SELECT switch knobs.

(3) Loosen MODE and TEST SELECT switch knobs setscrews with 5/64-inch and 0.050-inch hex wrench, respectively, and remove knob from shaft.

(4). Loosen BIAS knob setscrews (fig. 2-43) with 5/64 inch hex wrench and remove knob from shaft.

(5). Unscrew BIAS control locking knob form BIAS control shaft and remove.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

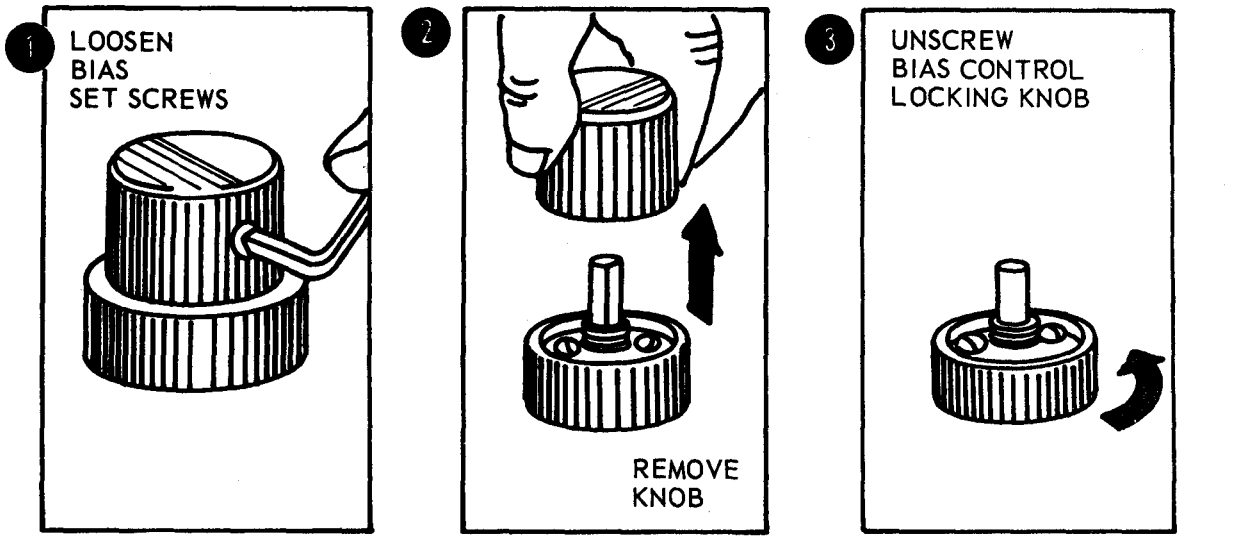


Figure 2-43. Removal of BIAS control knobs.

(6). Remove five screws (fig. 2-44) securing edge-lighted panel to control panel.

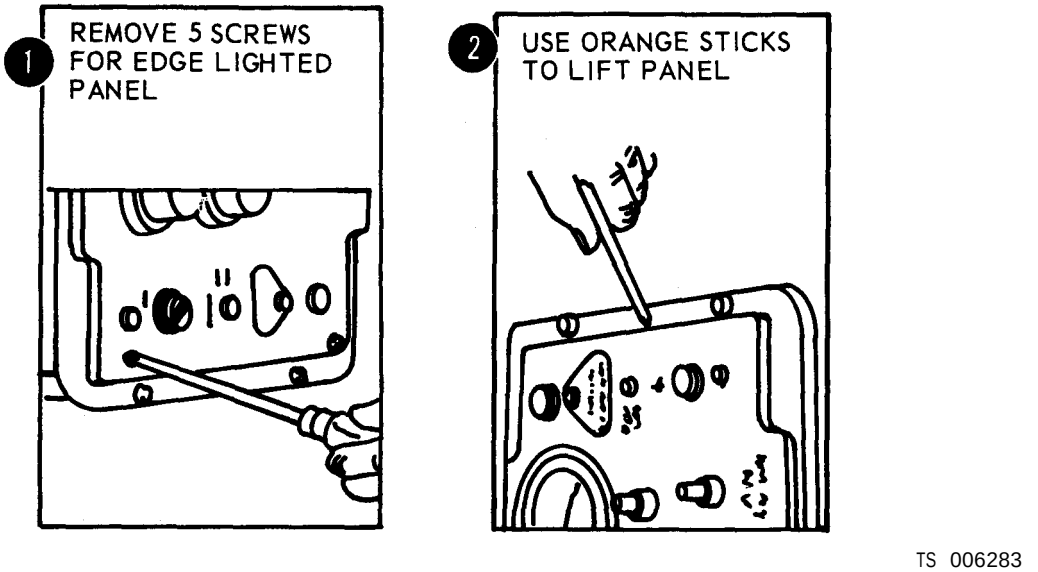


Figure 2-44. Removal of edge-lighted panel.

(7). Using orangewood sticks, lift edge-lighted panel off control panel.

(8). Unsolder the electrical leads from the defective switch and tag for identification.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

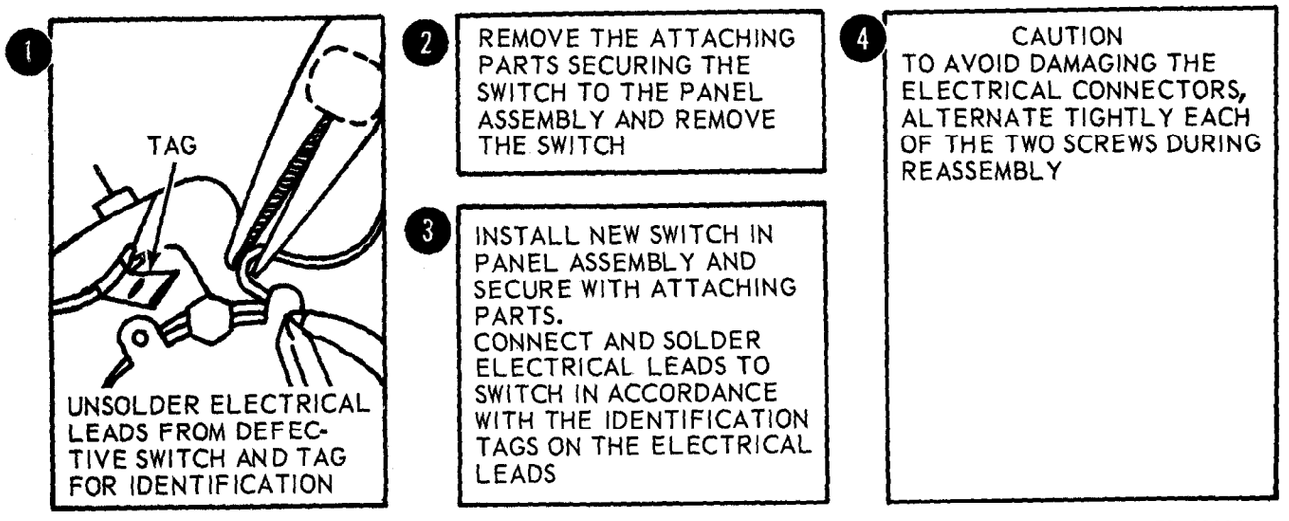


Figure 2-45. Removal of HAND LAMP switch.

(9). Remove parts securing switch to the electrical control panel and remove.

(10). Install a new switch in the electronic control panel and secure with attaching parts.

(11). Connect and solder the electrical leads to the switch in accordance with the identification tags on the leads.

CAUTION

To avoid damaging the electrical connector, alternate tightening each of the two screws during reassembly.

(12). Install printed circuit board but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit to mounting brackets.

(13). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(14). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(15). Install TEST SELECT knob on shaft with pointer at SOURCE VOLTAGE position. Install MODE SELECT knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(16). Install electronic control panel assembly in case and secure with eight captive screws.

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

Step 1. Check for a defective GRU.

Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cable (fig. 2-46).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

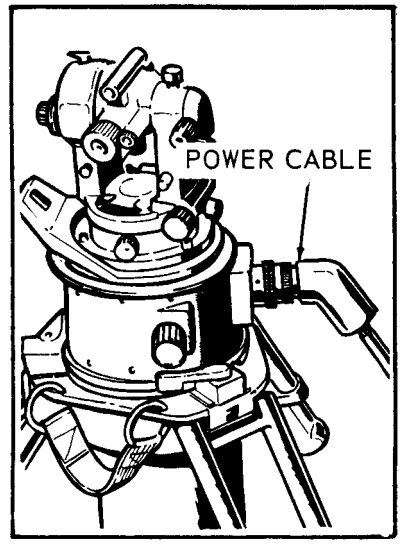


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Figure 2-46. Gyroscopic reference unit power cable.

If the system operates correctly with the new GRU, this indicates the original GRU was bad. Report a bad GRU to the next higher level of maintenance.

Step 2. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-47).

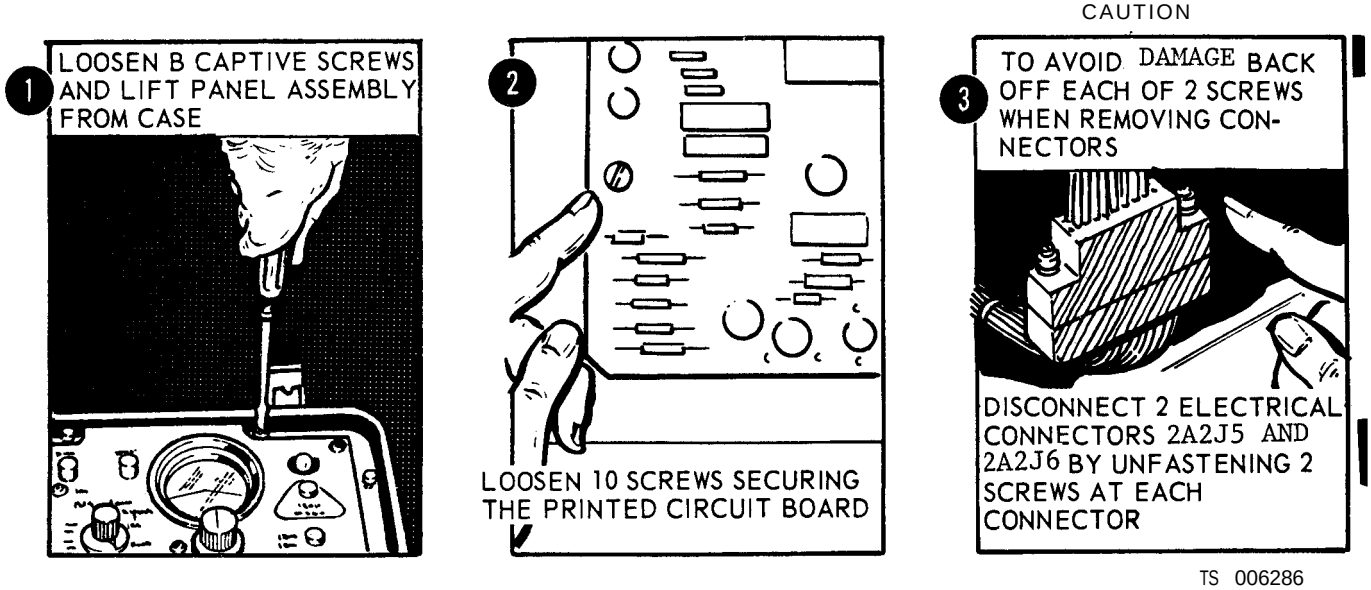

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Figure 2-47. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

Table 2-1. Troubleshooting–Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

c. Disconnect two electrical connectors (2A1P5 and 2A1P6) by unfastening two screws at each connector.
d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, burns, or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging, the electrical connectors, alternate tightening each of thetwoscrews during reassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(2). Install electronic control panel assembly incaseand secure with eight captive screws.

Step 3. Check for defective MODE SELECT (2A2S3) switch or BIAS control (2A2R4) on ECU.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-48).

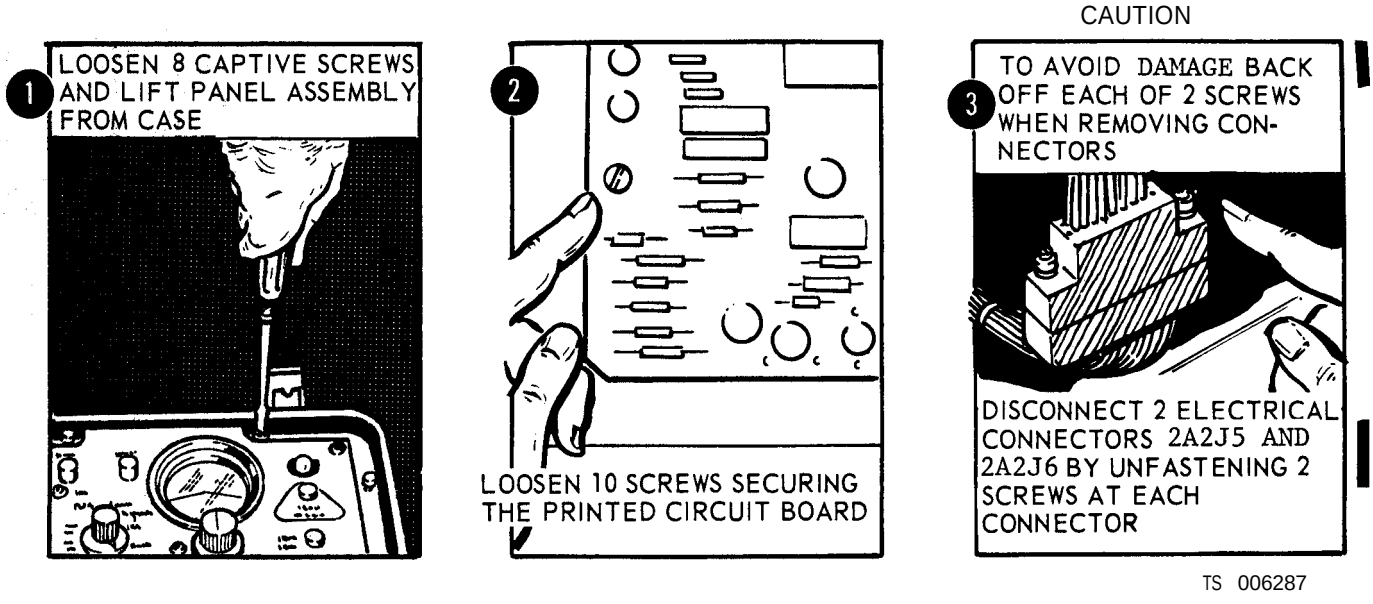

Figure 2-48. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.
d. Use an ohmmeter and check continuity of MODE SELECT switch (2A2S3) between input pins (A, B, and C) and output and output pins (1 thru 6).
e. Use an ohmmeter and check continuity between pins 1, 2, and 3 of BIAS control (2A2R4) variable resistor.

If continuity is not present, replace a bad switch.

(1). Place MODE SELECT switch (fig. 2-49) to GC position.
(2). Place TEST SELECT switch to source voltage position.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

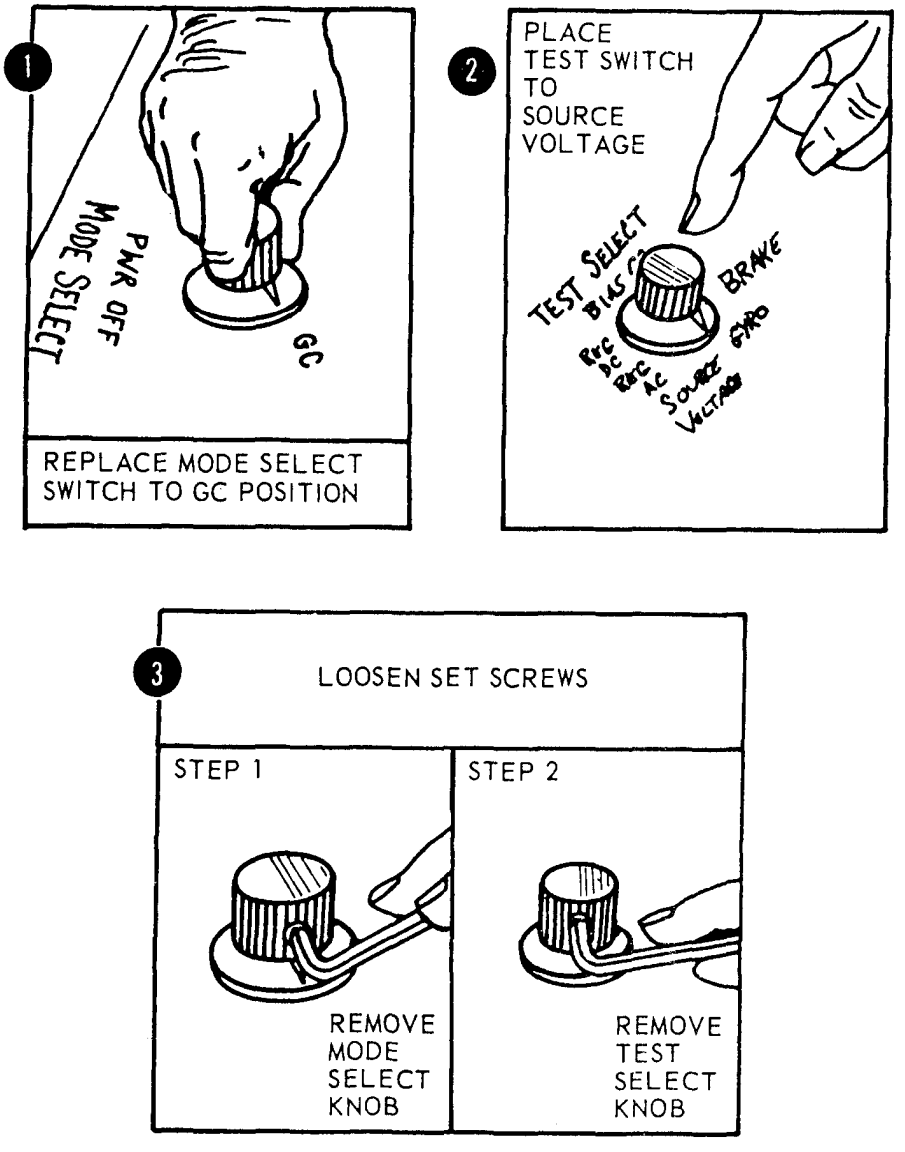

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Figure 2-49. Removal of MODE and TEST SELECT switch knobs.

(3) Loosen MODE SELECT, TEST SELECT and BIAS switch knob setscrews with 5/64-inch (0.050-inch for TEST SELECT) hex wrench and remove knob from switch shaft.

(4) unscrew BIAS control locking knob (fig. 2-50 from BIAS control shaft and remove.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

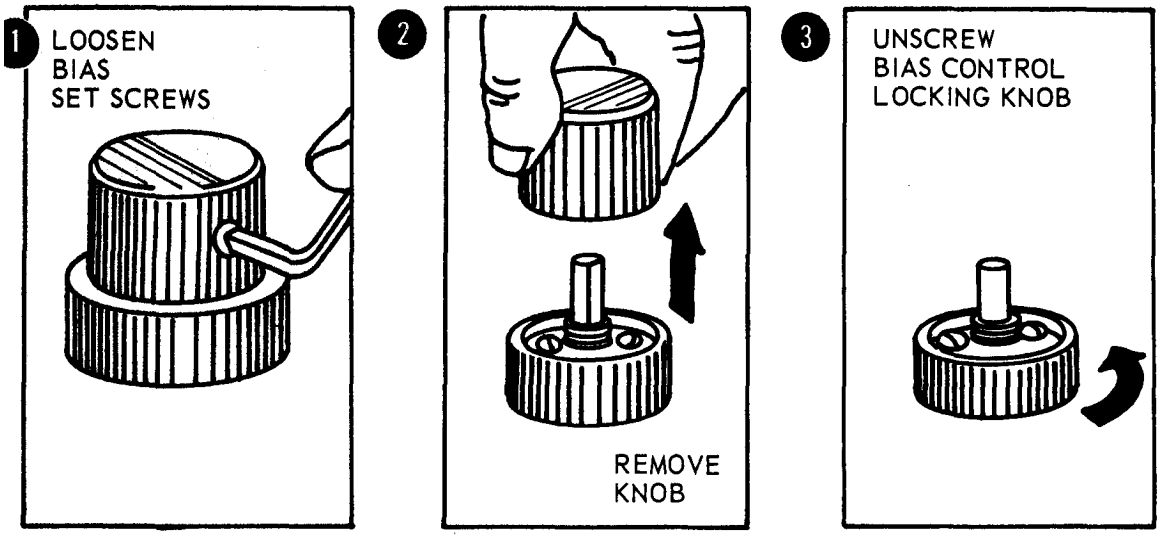


Figure 2-50. Removal of BIAS control knobs.

(5). Remove five screws (fig. 2-51) securing edge-lighted panel to control panel.

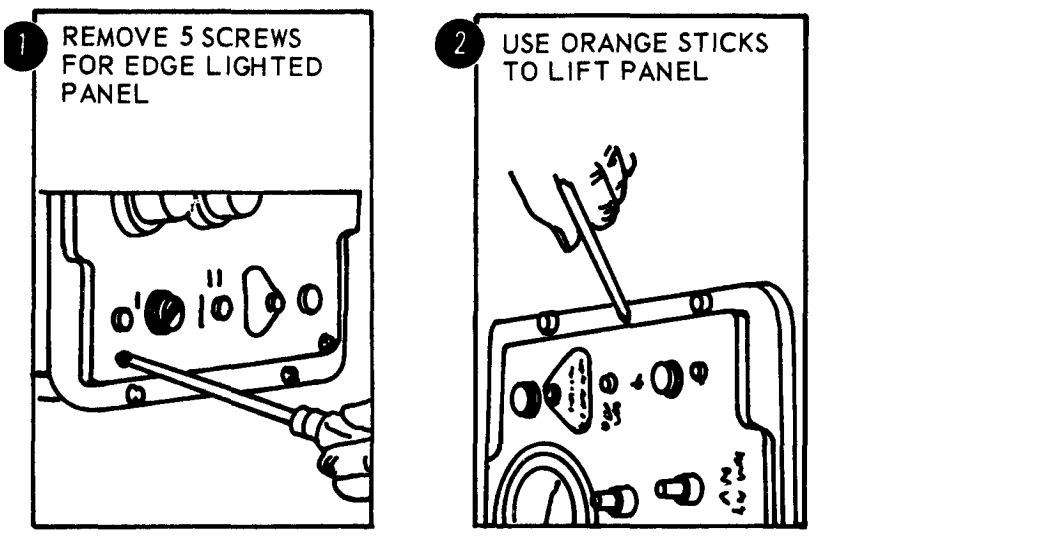


Figure 2-51. Removal of edge-lighted panel.

(6). Using orangewood sticks, lift edge-lighted panel off control panel.
(7). Remove parts attaching the switch to the electronic control panel assembly and remove.
(8). Unsolder the electrical leads from the defective switch and tag for identification.
(9). Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(12). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install test select switch knob on shaft with pointer at source voltage position. Install MODE SELECT knob on shaft-with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with eight captive screws.

Step 4. Check for improper adjustment of upper band clamp. Adjustment of the upper bank clamp is necessary when the BIAS control reaches its limit in positioning the test meter needle to zero (0) during biasing operation.

Adjust the upper band clamp as follows:

a. Set the instrument up as for operation, being sure the GRU is level.

CAUTION

Ensure that the GRU is securely held when removing theodolite. Retain the GRU housing in the tripod assembly or a holding fixture when removing the theodolite.

b. Remove three socket head screws (fig. 2-52) that secure the theodolite to the GRU housing.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

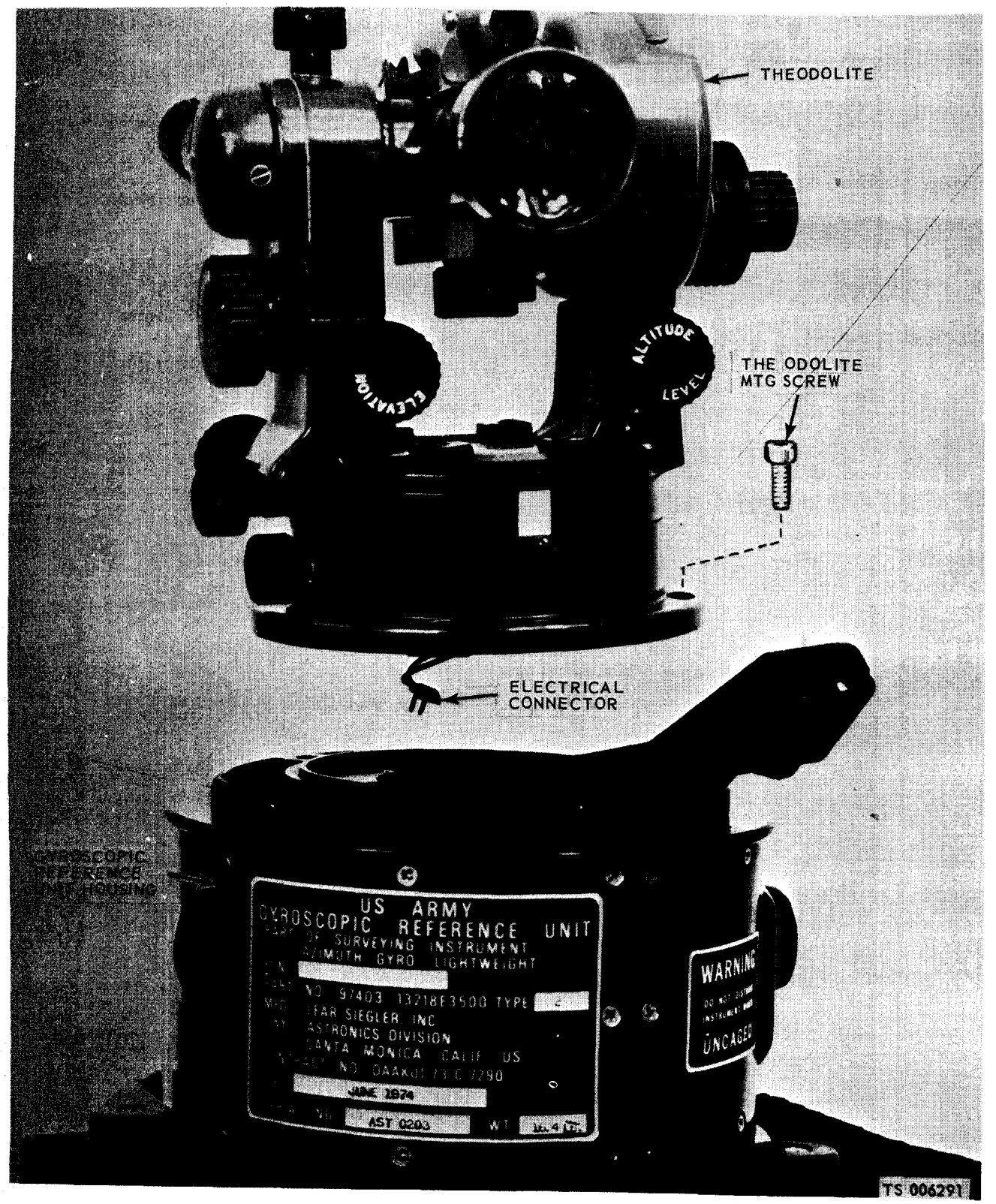


Figure 2-52. Theodolite removal.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
c. Raise the theodolite sufficiently to disconnect the electrical connector (fig. 2-52) from terminal (1A1J3) between thetbeodolite and GRU housing. *d.* Complete removal of the theodolite by raising clear of the GRU housing. CAUTION Store the thedolite on a soft clean surface so as not to damage the theodolite mounting pads. *e.* Install the upper band clamp adjusting tool (fig. 2-53), using two No. 4-40 by 3/8 inch attachment screws.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

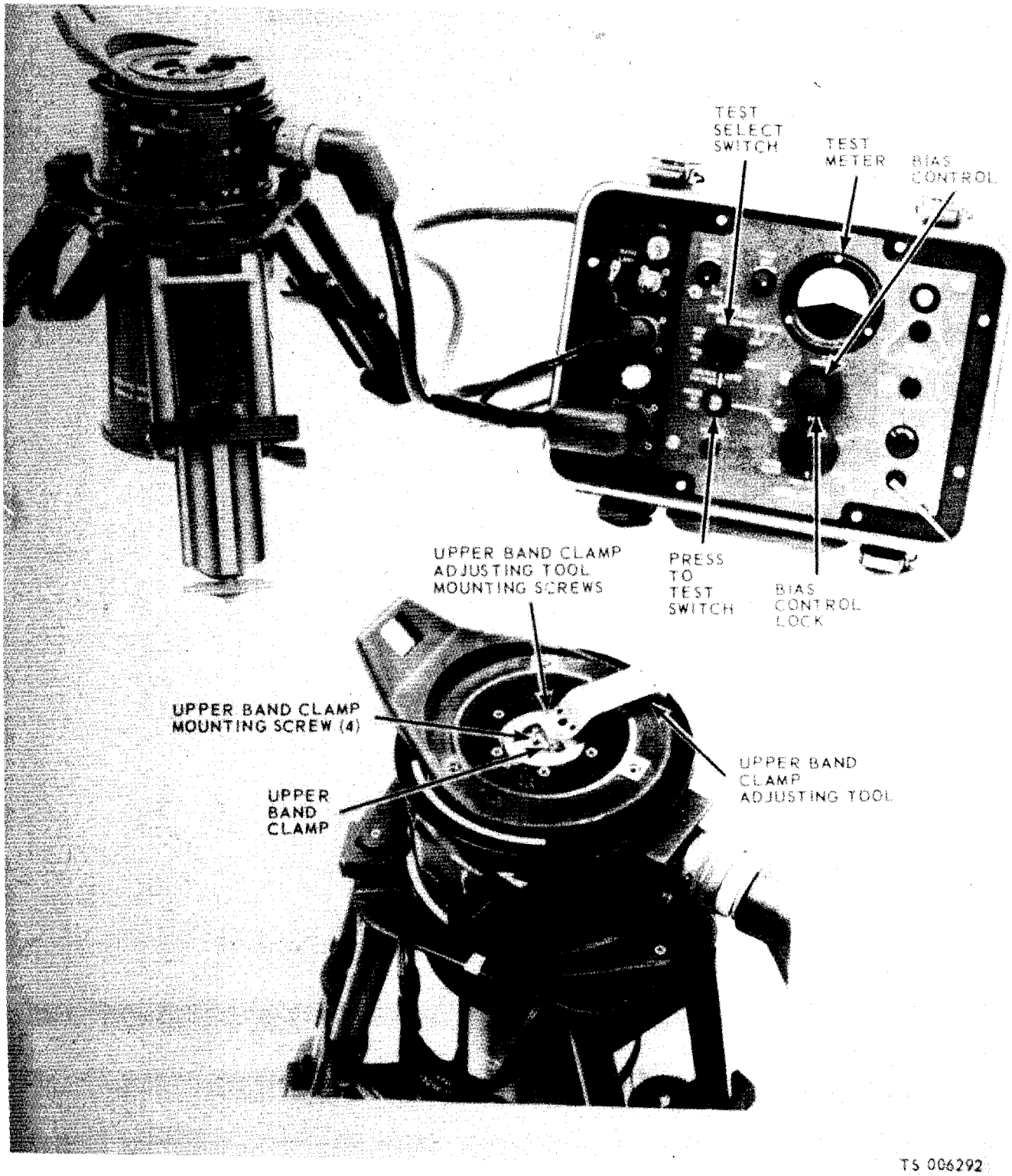


Figure 2-53. Upper band clamp adjusting tool.

Table 2-1. Troubleshooting–Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

f. Loosen the BIAS control lock (fig. 2-53) and rotate the BIAS control (fig. 2-53) to the extreme clockwise position, then rotate the BIAS control (5) turns counterclockwise. Thie sets the BIAS control at mid range and the pendulum biasing current to zero (0).

g. Loosen the four upper band clamp mounting screws enough so that the clamp can be rotated with the adjustment tool.

h. Place the TEST SELECT switch (fig. 2-53) to the BIAS position.

i. Energize the system in the BIAS mode and uncage the pendulum.

j. Depress the PRESS TO TEST switch (fig. 2-53) and observe that the TEST METER (fig. 2. 53) pointer comes to rest after swinging left and right several times.

k. While depressing the PRESS TO TEST switch (fig. 2-53), move the meter pointer to zero by rotating the upper hand clamp. Moving the meter pointer to zero from the left side of the meter requires clockwise rotation of the upper band clamp, and moving the pointer towards zero (0) from the right side of the meter requires rotating the upper band clamp counterclockwise. Moving the upper band clamp is best accomplished by tapping the end of the setting tool with a screwdriver handle or similar object.

l. When tbe meter pointer is on zero (0), release the PRESS TO TEST switch.

m. With the PRESS TO TEST switch released, the gain to the meter is increased and further adjustment will probably be necessary.

n. Continue to tap the setting tool to rotate the upper band clamp in small increments and the meter pointer shows on scale. There is no reason to adjust for a perfect zero (0) adjustment; on scale is adequate.

o. Tighten the four upper band clamp mounting screws and remove the upper band clamp adjusting tool.

p. With the BIAS control (fig. 2-53), set the test meter pointer to zero (0), then cage and uncage several times while observing the BIAS stability. Tbe test meter pointer shall not drift more than half way through the yellow hand.

q. Place the theodolite over the GRU housing and connect the electrical connector to terminal (1A1J3).

CAUTION

Ensure that electrical wire slack is placed adjacent to the inner circular surface of this mounting plate prior to lowering the theodolite.

r. Lower the theodolite to position on the mounting plate. Position the white strip on the theodolite base so that it is adjacent to the yellow stripe on the theodolite mounting plate.

s. Secure the theodolite by installing three sockethead screws. Using a torque wrench progressively tighten the screws in 10-inch pound increments to 30-inch pound torque.

8. GYRO SYNC INDICATOR FAILS TO LIGHT WITHIN TWO MINUTES AFTER MODE SELECT SWITCH IS PLACED TO GC.

Step 1. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-54).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

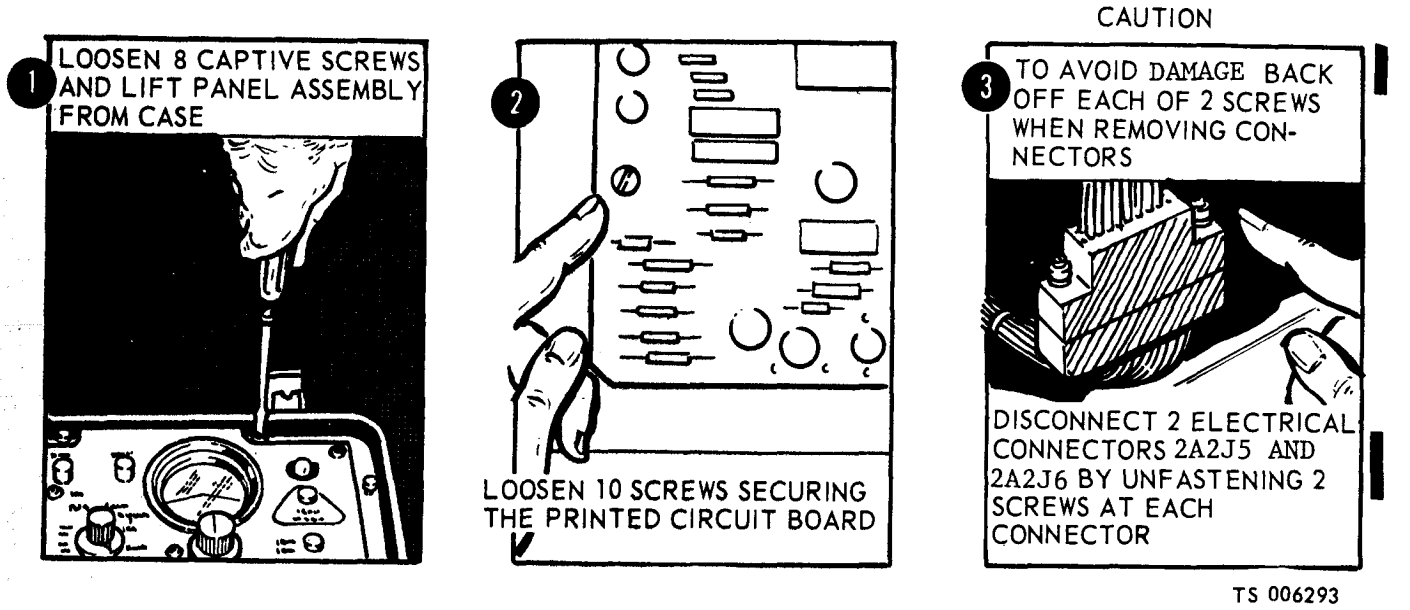


Figure 2-54. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, bums, or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damage to the electrical connectors, alternately tighten each of tbe two attaching screws.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

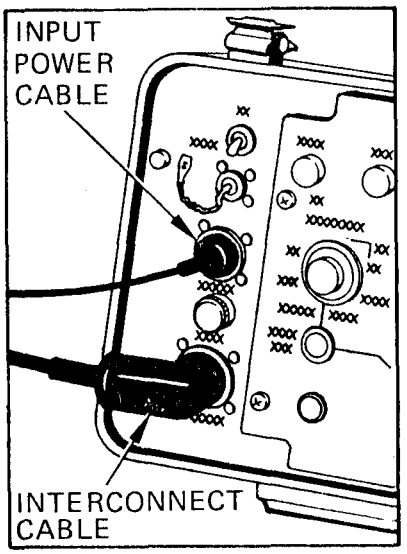
(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 2. Check for a defective ECU.

Replace existing ECU with a ECU that is operable, by disconnecting and connecting power cables (fig. 2-55).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION



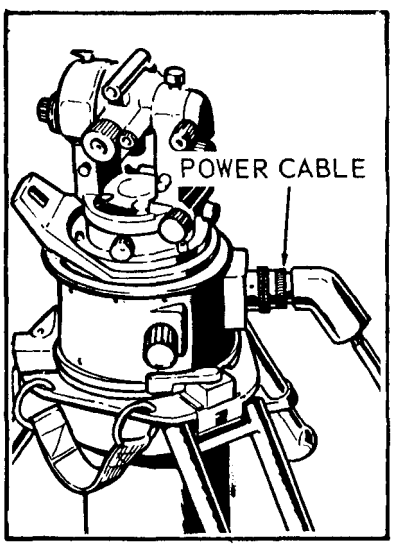
TS 006294

Figure 2-55. Disconnecting power cables.

If the system operates correctly with the new ECU, report the bad ECU to the next higher level of maintenance.

Step 3 Check for a defective GRU.

Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-56).



TS 006295

Figure 2-56. Gyroscopic reference unit power cable removal.

If the system operates correctly with the new GRU, report the bad GRU to the next higher level of maintenance.

Step 4 deleted

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

a. If continuity is not present, the relay is defective. Replace the GRU and report the bad GRU to the next higher level of maintenance.

b. Replace the GRU by disconnecting and connecting power cables.

9. READ AZIMUTH INDICATOR FAILS TO LIGHT APPROXIMATELY 15 MINUTES AFTER GYRO IS UNCAGED.

Step 1. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-57).

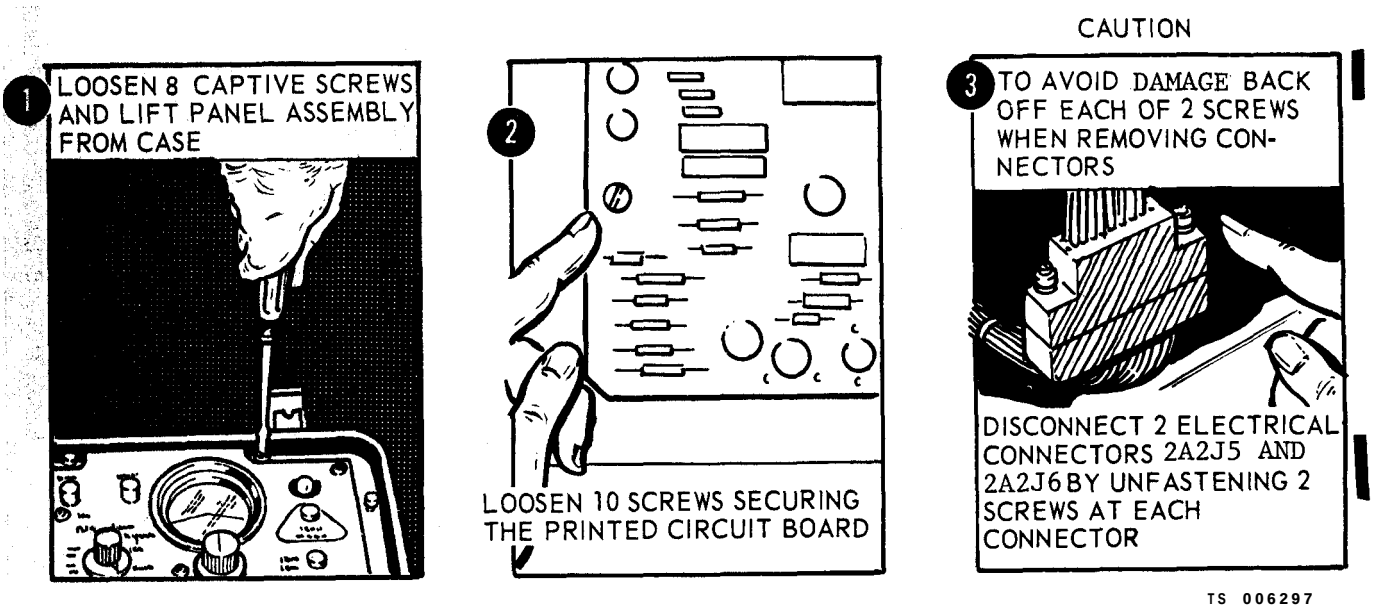


Figure 2-57. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits. Corrosion, burns or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

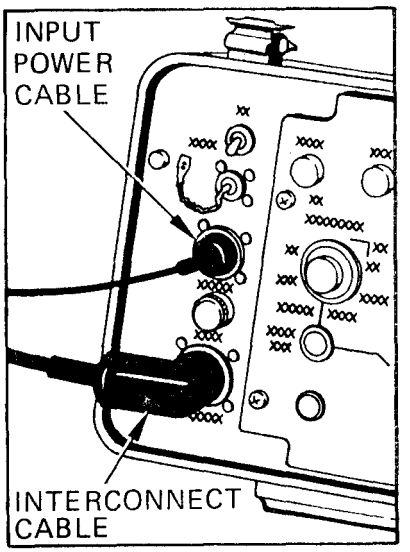
(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 2. Check for defective ECU.

Replace existing ECU with an ECU that is operable, by disconnecting and connecting power cables (Figure 2-58).

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION



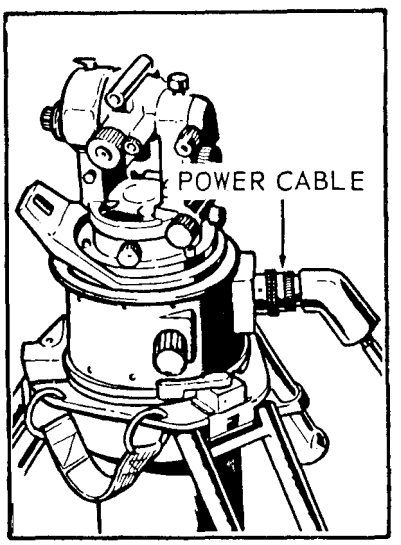
TS 006296

Figure 2-58. Removal of electronic control unit assembly.

If the system operates correctly with the new ECU, report the bad ECU to the next higher level of maintenance.

Step 3. Check for a defective GRU.

Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-59).



TS 006298

Figure 2-59. Gyroscopic reference unit power cable removal.

If the system operates correctly with the new GRU, report the bad GRU to the next higher level of maintenance.

10. RESET CIRCUIT INOPERATIVE WHEN RESET SWITCH IS PRESSED

Step 2. Check for defective RESET switch (2A2S5).

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-24).

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

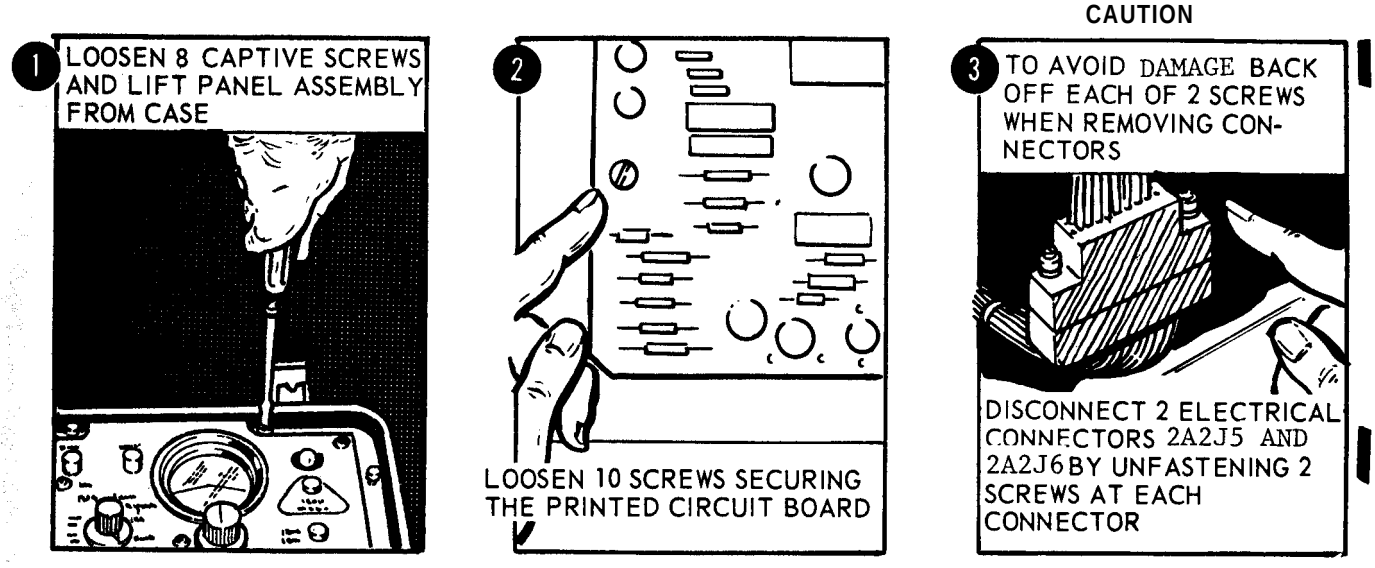


Figure 2-60. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to the mounting bracket and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Depress and hold RESET switch and using an. ohmmeter, check continuity between pins 1 and 2 of switch (2A2S5).

If continuity is not present, replace RESET switch (2A2S5).

(1). Remove parts attaching the switch to the electronic control panel assembly.

(2). Unsolder the electrical leads from the bad switch and tag the electrical leads for identification.

(3). Install a good switch in the electronic control panel assembly and secure with attaching parts.

(4). Connect and solder the electrical leads in accordance with the identification tags.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(5). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(6). Install electronic control panel assembly in case and secure with eight captive screws.

Step 2. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (Figure 2-60).

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, bums or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

Table 2-1. Troubleshooting–Contined

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(2). Install electronic control panel assembly in case and secure with eight captive screws.

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

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

a. Unscrew the plastic lens from the indicator lamp assembly (fig. 2-61).

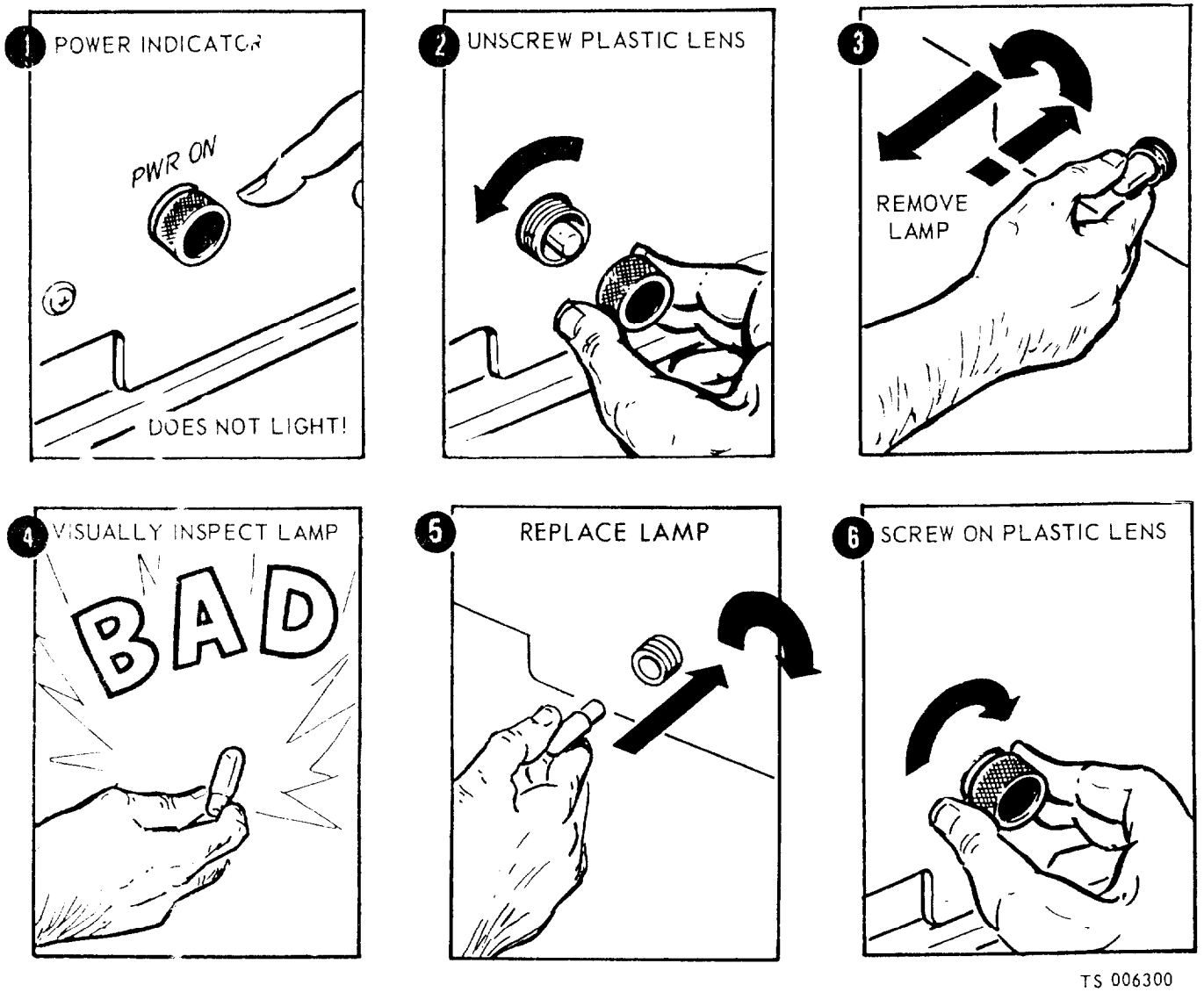


Figure 2-61. Removal of BRAKE ON indicator lamp.

b. Remove the lamp from the socket and visually inspect lamp for a burned out filament. Replace a lamp.

Screw the plastic lens in place over the lamp and tighten the plastic lens finger tight.

Step 2. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-62).

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

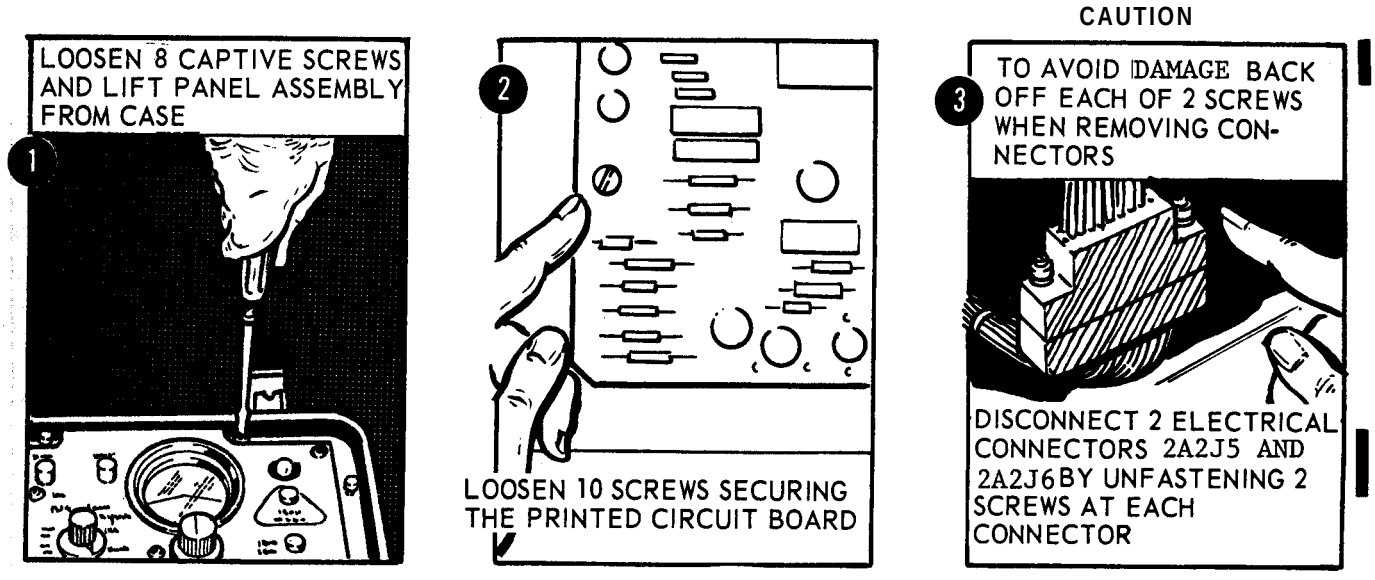


Figure 2-62. Removal of printed circuit board.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuit, corrosion, burns or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 3. Check for defective MODE SELECT switch (2A2S3).

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-63).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

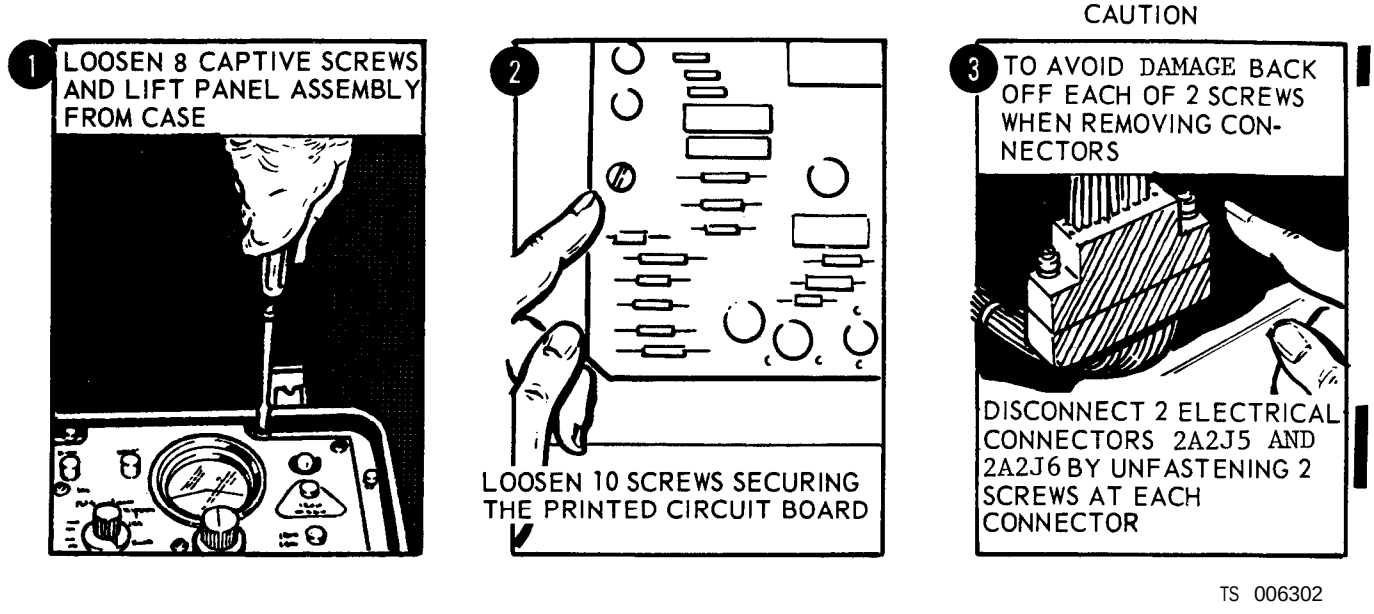


Figure 2-63. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing tbe connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity of MODE SELECT switch (2A2S3) in BRAKE ON position between pins A and A6, B and B6, and C and C6.

If continuity is not present, replace a bad MODE SELECT switch.

(1) Place MODE SELECT switch to GC position (fig. 2-64).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

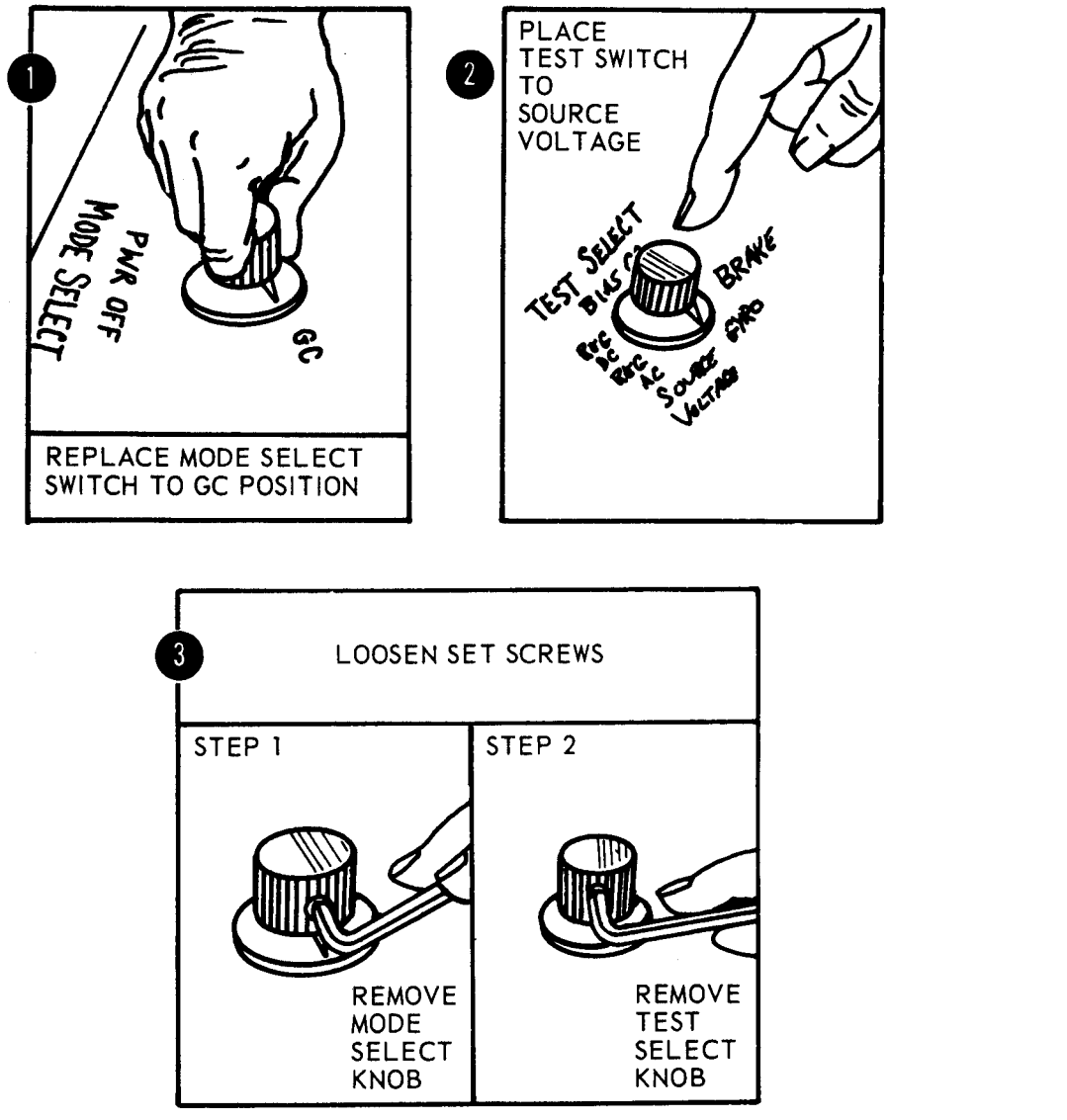


Figure 2-64. Removal of MODE and TEST SELECT switch knobs.

(2). Place TEST SELECT switch to source voltage position.
(3). Loosen MODE SELECT, TEST SELECT and BIAS switch-knob setscrews with 5/64 inch (0.050-inch for TEST SELECT) hex wrench and remove knob from switch shaft.
(4). Unscrew BIAS control locking knob from BIAS control shaft and remove.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

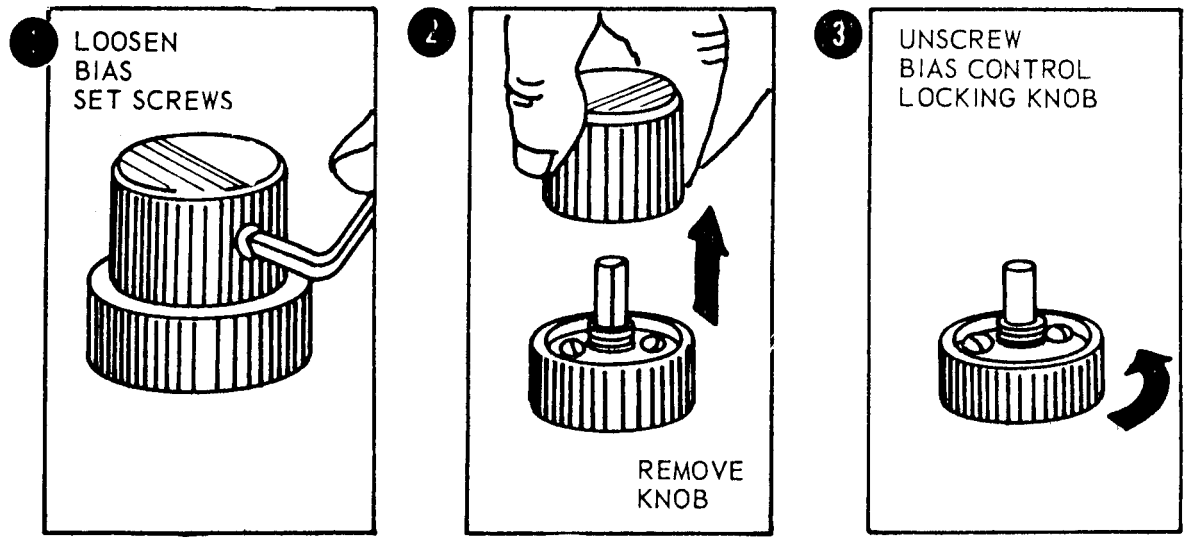


Figure 2-65. Removal of BIAS control knobs.

(5). Remove five screws (fig. 2-66) securing the edge-lighted panel to control panel.

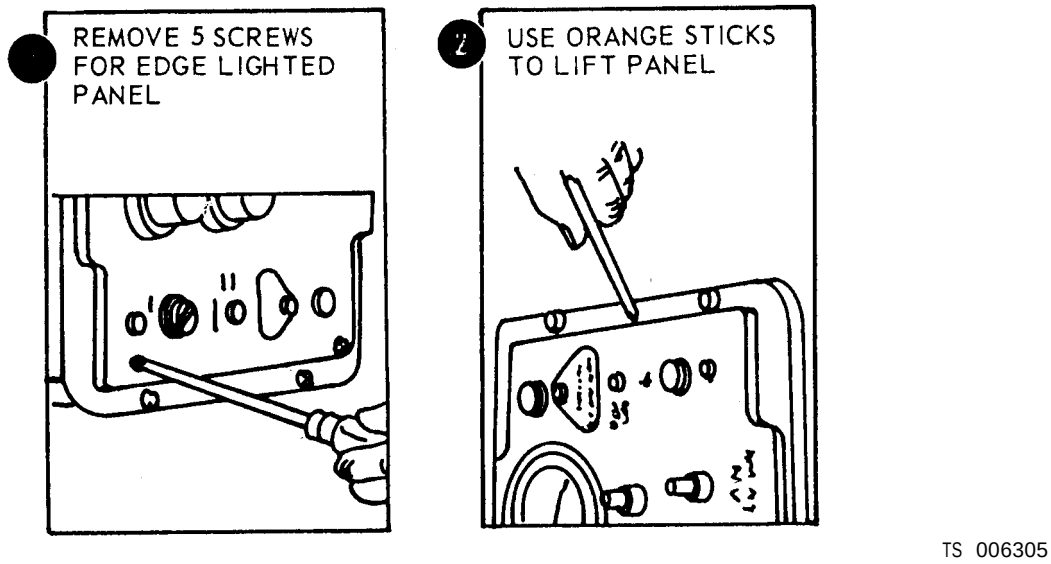


Figure 2-66. Removal of edge-lighted panel.

(6). Using orangewood sticks, lift edge-lighted panel off control panel.
(7). Remove parts attaching the switch to the electronic control panel assembly and remove.
(8). Unsolder the electrical leads from the defective switch and tag for identification.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

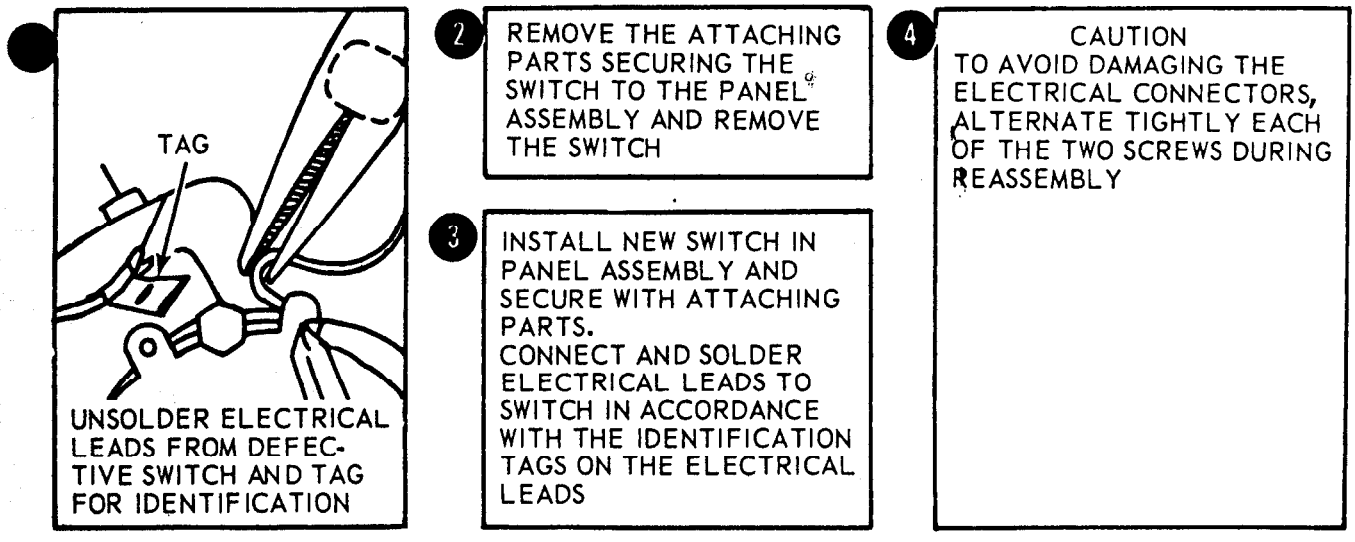


Figure 2-67. Removal of MODE SELECT switch.

(9). Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector seat properly and secure with five mounting screws.

(12). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install TEST SELECT switch knob on shaft with pointer at source voltage position. Install MODE SELECT switch knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with eight captive screws.

Step 4. Deleted.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

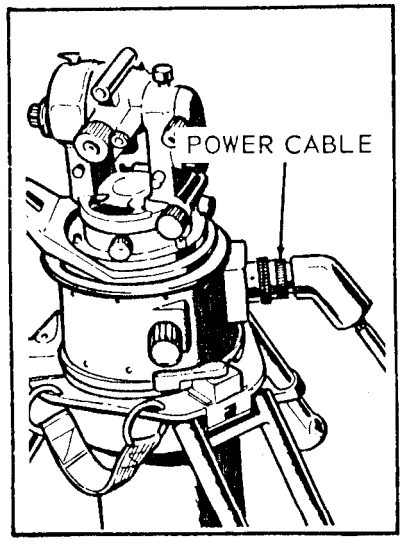


Figure 2-68. Gyroscopic reference unit power cable removal.

Step 5. Check for defective ECU.

Replace existing ECU with an ECU that is operable, by disconnecting and connecting power cables (fig. 2-69).

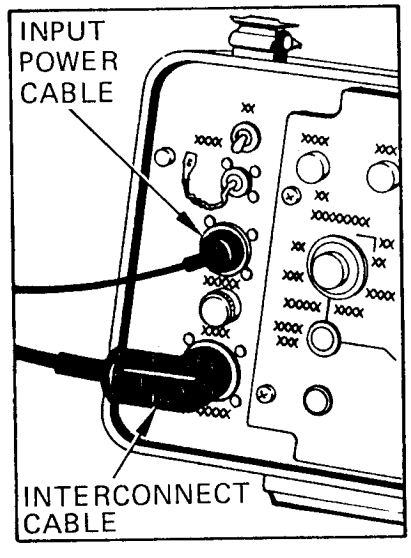


Figure 2-69. Disconnecting power cables.

If the system operates correctly with the new ECU, report the bad ECU to the next higher level of maintenance.

12. BRAKE ON INDICATOR FAILS TO EXTINGUISH FOLLOWING 90-SECOND BRAKING PERIOD

Step 1. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 2-70)

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

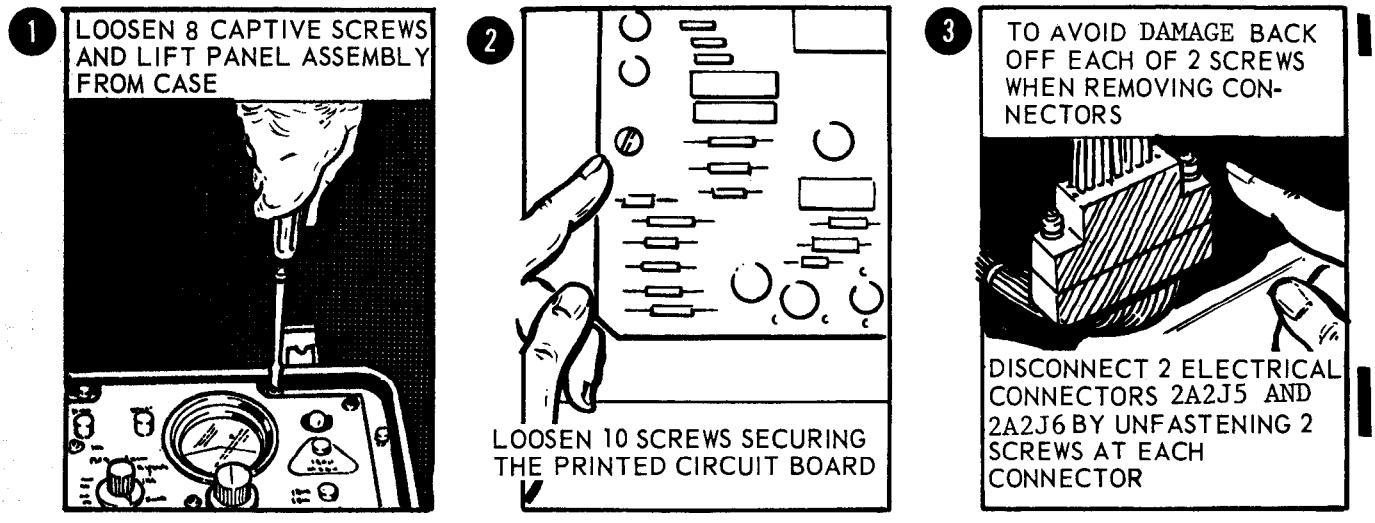


Figure 2-70. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connector.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two ecrews at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, burns or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during unassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 2. Deleted.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Figure 2-71. Deleted.

GYROSCOPIC REFERENCE UNIT (GRU)

13. THEODOLITE MOUNTING PLATE FAILS TO ROTATE OR ROTATES IMPROPERLY WITH MODE SELECT IN SELF-TEST POSITION AND TEST SELECT SWITCH IN THE SERVO POSITION.

Step 1. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive screws and lift the electronic control panel assembly from the case (figure 2-72).

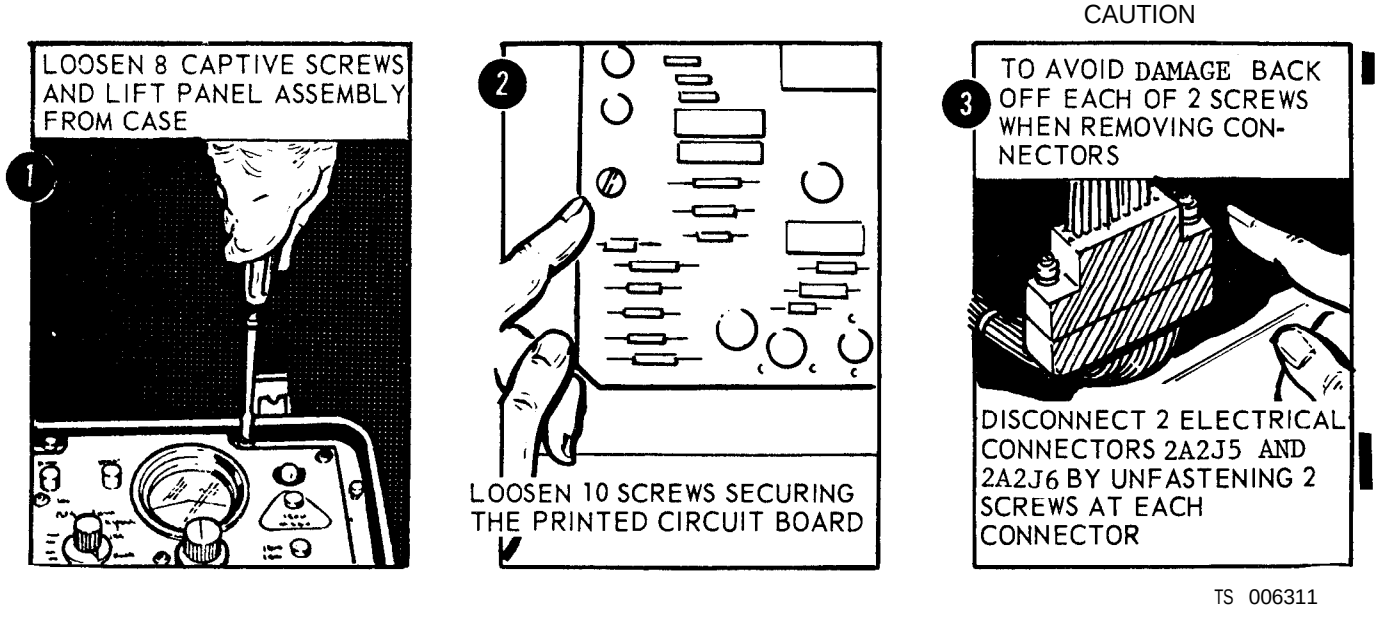


Figure 2-72. Removal of printed circuit board

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A1P5 and 2A1P6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, burns or other evidence of defects.

Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 2. Check for defective TEST SELECT switch (2A1S1) or MODE SELECT switch (2A1S3).

a. Loosen the eight captive screws and lift the electronics control panel assembly from the case (figure 2-73).

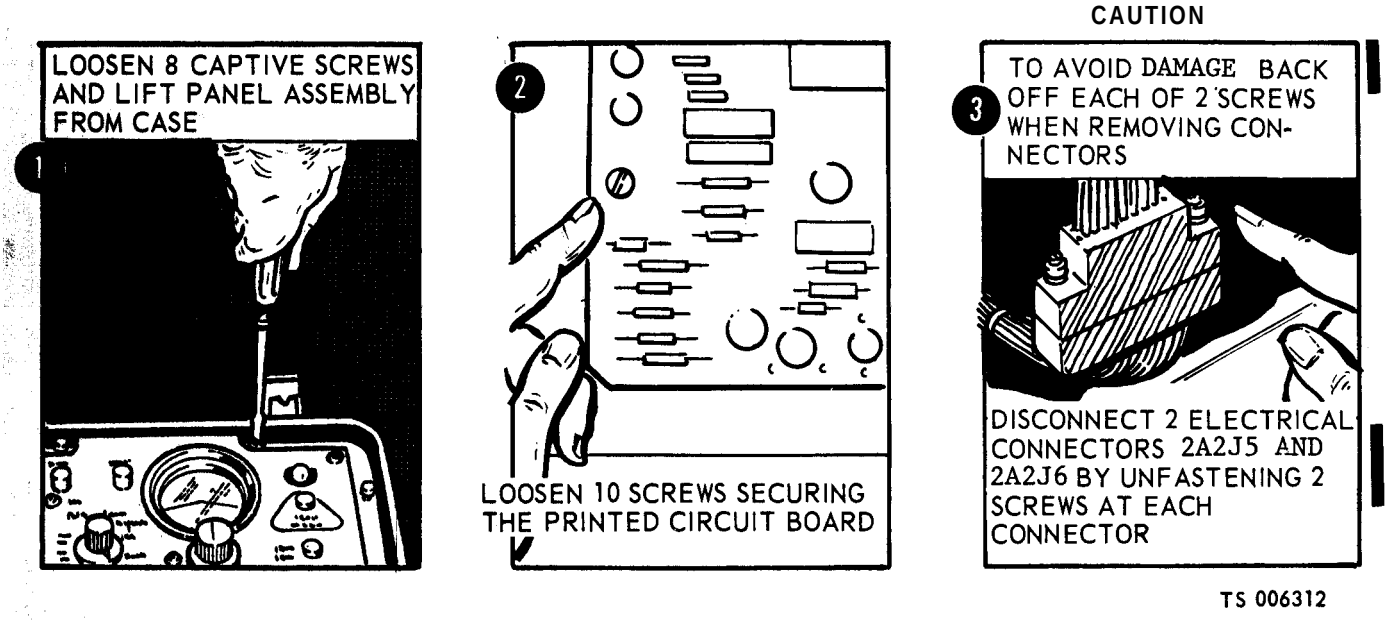


Figure 2-73. Removal of ECU panel assembly.

b. Unfasten ten screws securing the printed circuit board to mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector.

d. Use an ohmmeter and check continuity of TEST SELECT switch (2A2S1) between input pins (A, B, and C) and output pins (1 thru 8).

Replace a bad switch.

(1). Place MODE SELECT switch to GC position (fig. 2-74).

(2). Place TEST SELECT switch to source voltage position.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

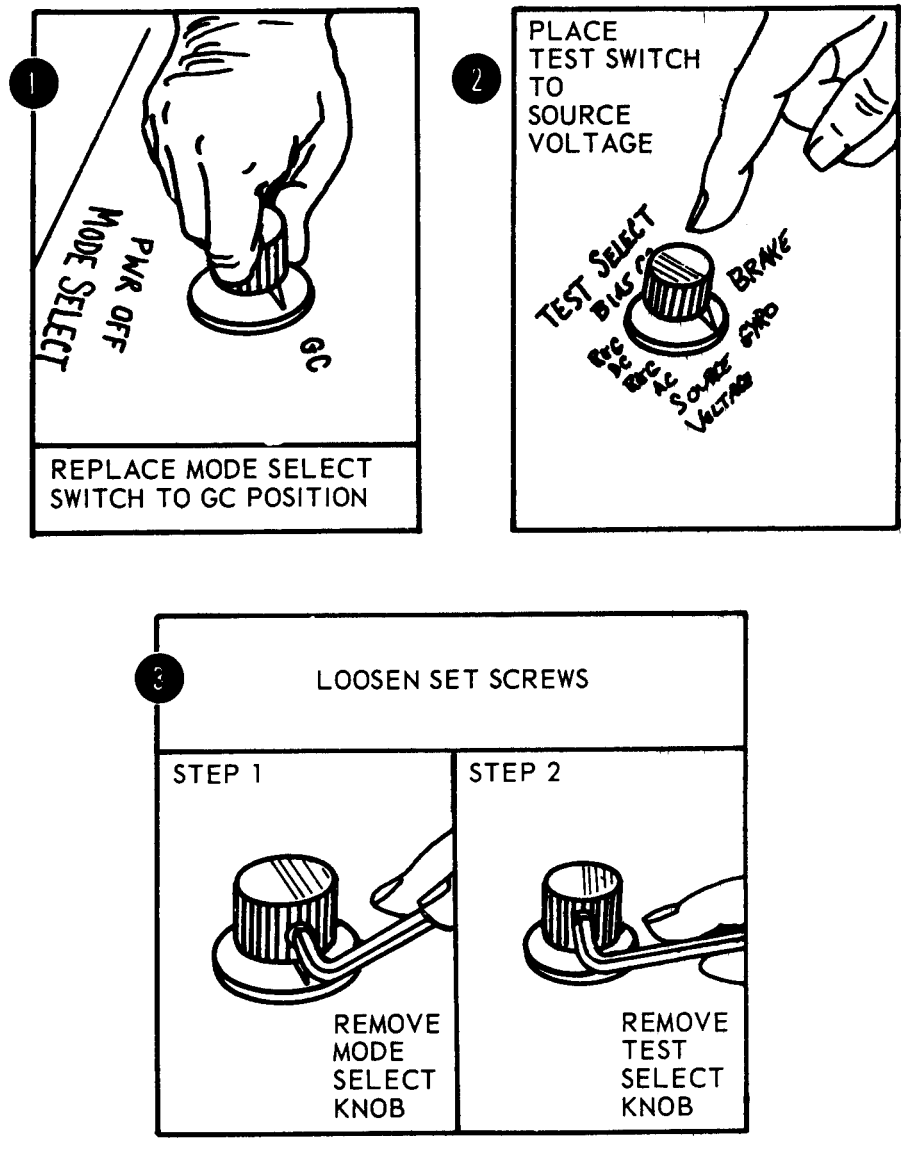


Figure 2-74. Removal of MODE and TEST SELECT switch knobs.

(3). Loosen MODE SELECT, TEST SELECT and BIAS switch knob setscrews with 5/64 inch (0.050-inch for TEST SELECT) hex wrench and remove knob from switch shaft.

(4). Unscrew BIAS control locking knob from BIAS control shaft and remove (fig. 2-75).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

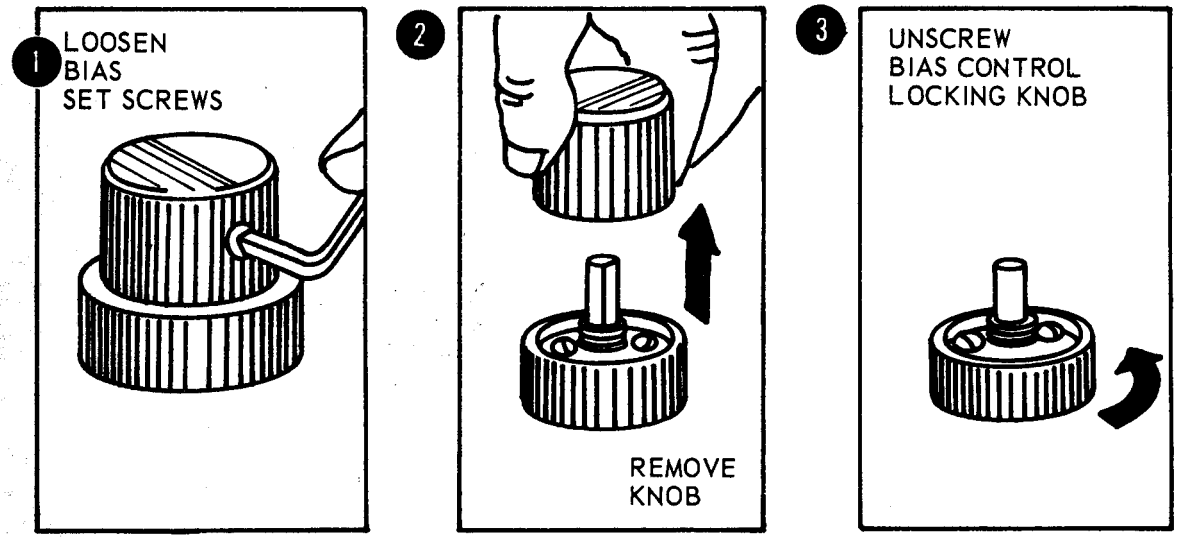


Figure 2-75. Removal of BIAS control knobs.

(5). Remove five screws (fig. 2-76) securing edge-lighted panel to control panel.

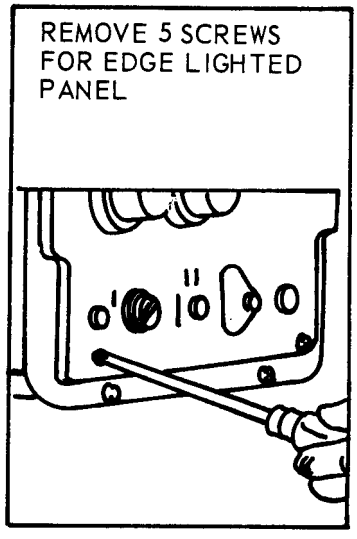


Figure 2-76. Removal of edge-lighted panel.

(6). Using orangewood sticks, lift edge-lighted panel off control panel.

(7). Remove parts attaching the switch to the electronic control panel assembly and remove.

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

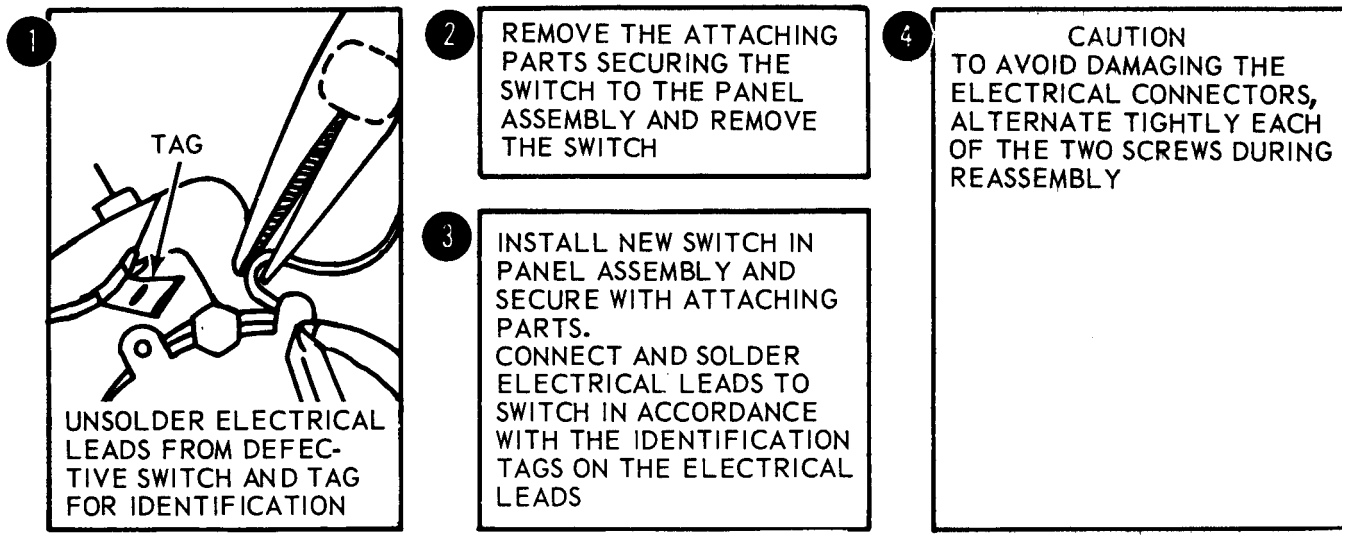


Figure 2-77. Removal of MODE and TEST SELECT switch.

(8). Unsolder the electrical leads from the defective switch and tag for identification.

(9). Install new switch in panel assembly and secure with attaching parts. Connect and solder electrical leads to switch in accordance with the identification tags on the electrical leads.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

(10). Install printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.

(11). Place edge-lighted panel over connector, seat properly and secure with five mounting screws.

(12). Install BIAS control locking knob and BIAS knob on switch shaft. Secure BIAS knob by tightening setscrews.

(13). Install TEST SELECT switch knob on shaft with pointer at source voltage position. Install MODE SELECT switch knob on shaft with pointer at GC position. Secure each knob by tightening setscrews.

(14). Install electronic control panel assembly in case and secure with eight captive screws.

14. CAGING INOPERATIVE

Step 1. Check to see if caging link is out of adjustment.

a. Remove eight screws attaching the outer shield to the upper housing assembly and remove.

b. To keep foreign particles from entering. the inner parts of the instrument, place masking tape between the housing and the inner shield, except in the area of the caging link.

c. Set the instrument on the work surfaces, resting on the inner shield and in the upright position. Be careful not to damage the shield as the shield material is very soft and sensitive to shock.

d. Loosen the caging link jam nut (fig. 2-78). Install the cage-uncage knob temporarily, so that the caging mechanism may be actuated.

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

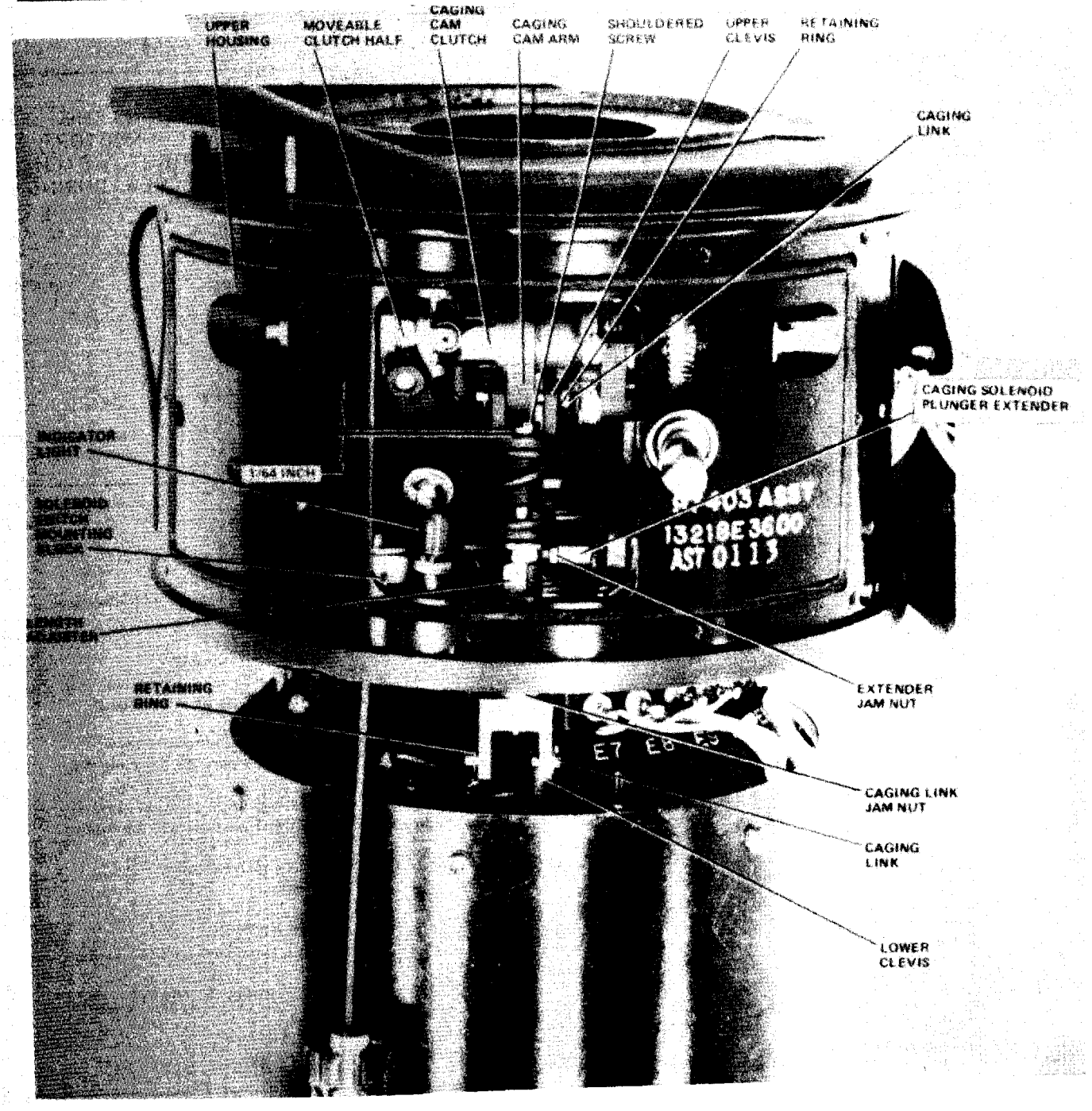


Figure 2-78. Caging Mechanism adjustment.

e. Connect the GRU to the ECU and apply power in the BIAS mode.

f. Rotate the cage-uncage knob until the caging arm passes over center of the caging link. At the point where the arm crosses over center, observe that a small gap (approximately 1/64 inch) is present between the head of the shoulder screw and the upper clevis.

g. If the gap described in step (f) is not correct, rotate the length adjuster counterclockwise to increase the gap and clockwise to decrease the gap.

h. Continue rotating the cage-uncage knob until the caging arm guide pin (fig 2-80) moves about 1/32 inch in the guide clot. The uncaged indicator should light at that point. If the indictor does not light at the proper point, the caging control switches need adjusting.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

The pendulum is now uncaged, being supported by a thin metal band. Leave the instrument in the upright position and handle it gently while in this state.

Adjust the caging solenoid and caging switch as follows:

(1). Loosen the extender jam nut (fig. 2-78).

(2). Manually advance the solenoid plunger out of the solenoid until it stops.

(3). Adjust the plunger extender so that the movable clutch half enters the caging cam clutch teeth and bottoms out, without the clutch actuator arm moving in relation to the clutch actuator, i.e., the clutch actuator arm and the clutch actuator shall not deflect at the pivot point.

(4). Tighten the extender jam nut. Position the solenoid control switch mounting block so that the switch is actuated 0.10 to 0.020 inch (.250 to .500 cm) from full extension of the solenoid plunger.

(5) . Tighten the switch mounting block screws.

(6). Connect the GRU to the ECU, using the interconnect breakout box (fig. 2-79).

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

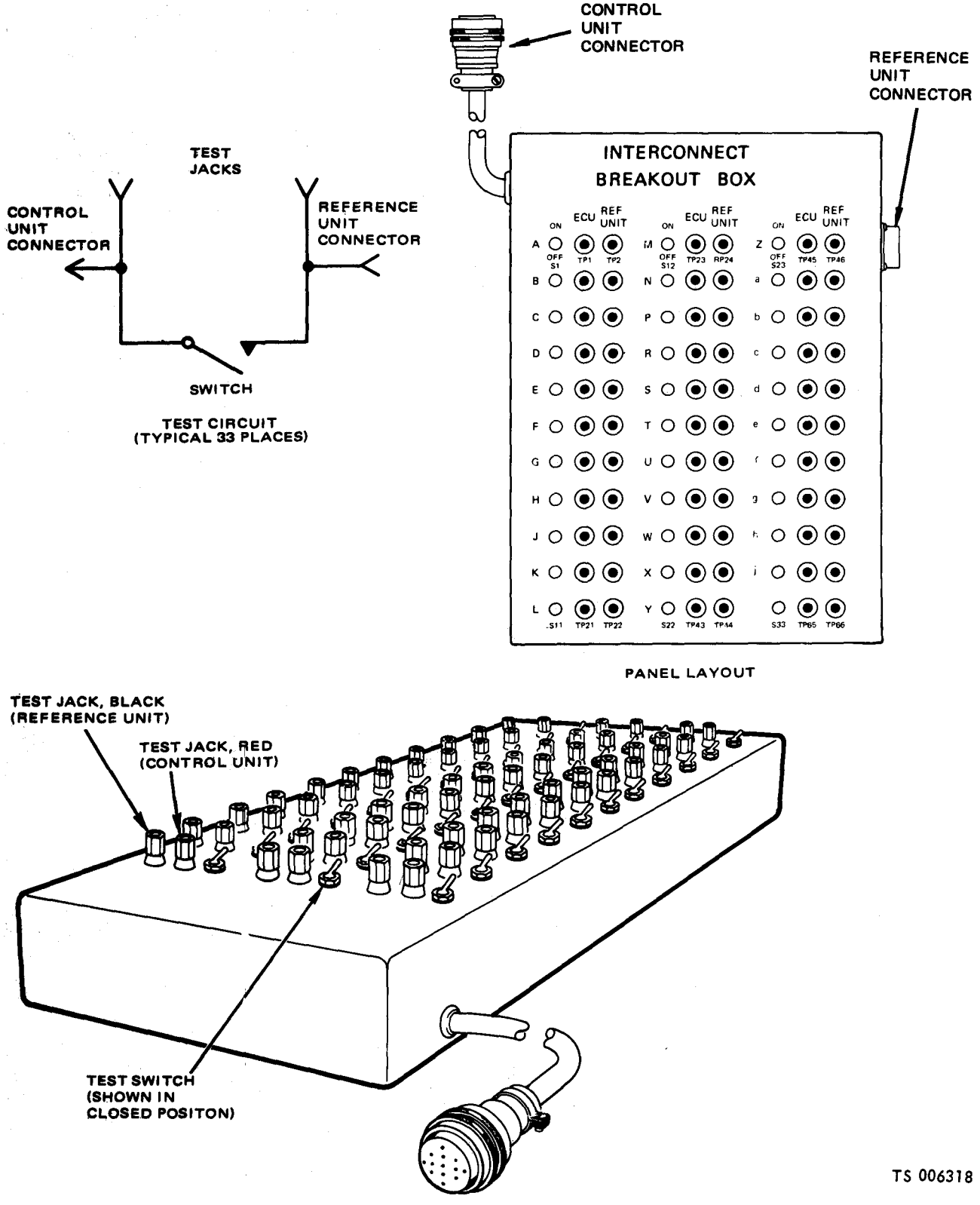


Figure 2-79. Interconnect breakout box.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(7). Connect a TS-352/U multimeter or equivalent in the 2-5 amp range, across jacks N of breakout box and open switch N.

(8). Energize the system in the BIAS mode and observe the multimeter. If the solenoid switch is adjusted properly, the current should be 0.05 amp. If the solenoid draws 1.5 amps, the switch must be moved closer to the solenoid. Should the solenoid chatter and draw high current, then the switch must be moved away from the solenoid.

(9) Switch from BIAS to SELF-TEST several times to insure proper operation.

Adjust the caging cam switch as follows (fig. 2-80).

(10). With the caging link adjusted, set up the system for operation and energize the caging mechanism by placing the MODE SELECT SWITCH in the BIAS mode. Manually hold the clutch in the engaged position so that it is not released while adjusting the caging arm switch.

(11). Loosen the caging cam switch mounting screws. Adjust the caging cam switch so that the actuator solder follows the depression on the cam and is actuated when the caging arm guide pin is 1/32 inch from the top of its guide slot (fig. 2-80).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

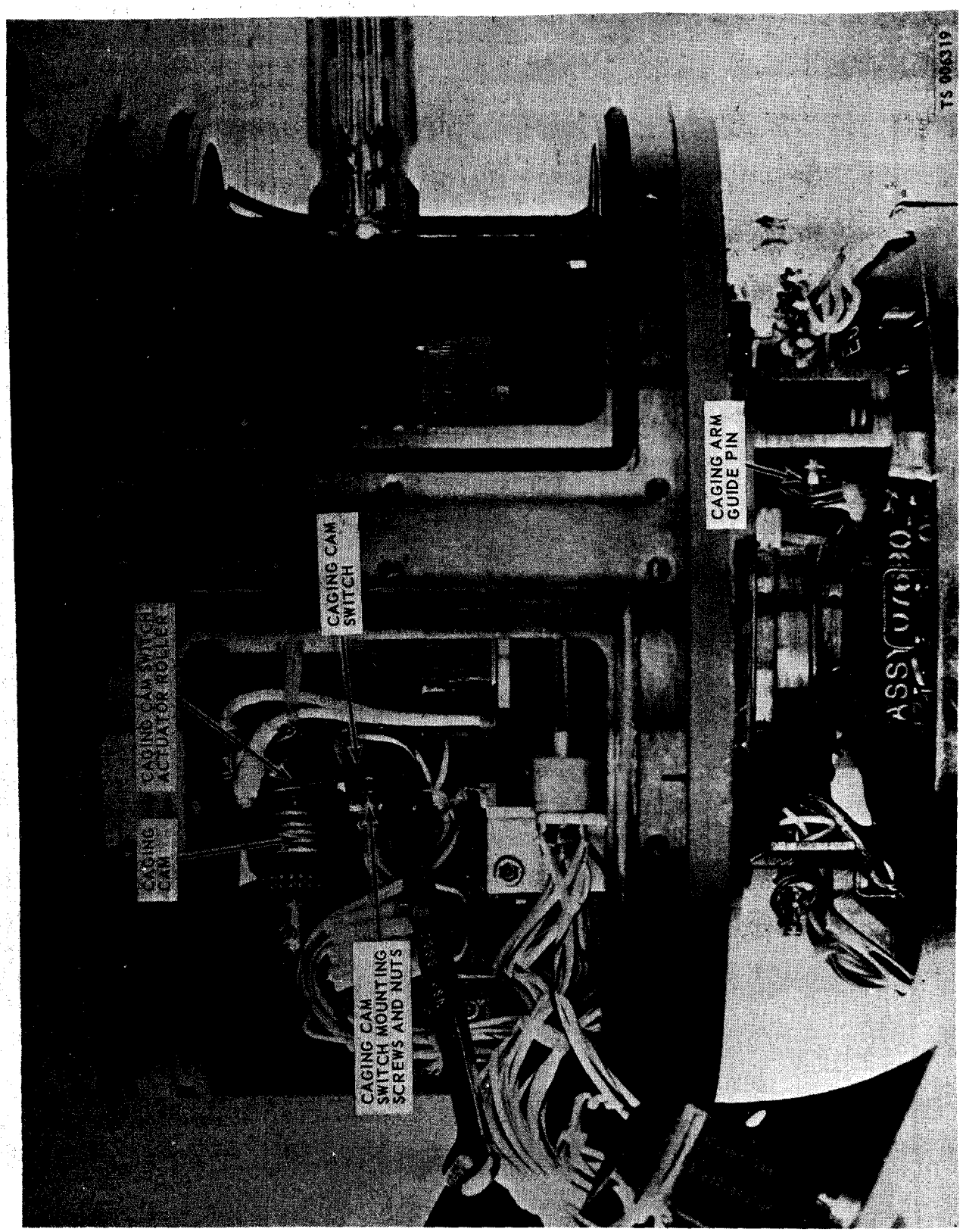


Figure 2-80. Caging cam switch adjustment.

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

(12). The caging cam switch shall be adjusted so that it is actuated when the actuator roller is well into the cam detent, and not at the start of the detent.
(13). Tighten the caging cam switch mounting screws.
(14). With the caging arm switch actuating pin in the proper position and the uncaged indicator lighted, rotate the cage-uncaged knob counterclockwise to cage the pendulum.
(15). Observe the caging cam arm to see whether or not it has gone over center. If it has gone over center rotate the length adjuster (fig. 2-79) counterclockwise until the caging arm does not go over center when repeating step (k).
(16). With the cage cam arm not going over center when the pendulum is caged, rotate the length adjuster 1/16 turn clockwise and repeat the uncaging and caging process. Repeat until the caging cam arm just goes over center, then rotate the length adjuster another 1/16 turn clockwise.
(17). Tighten the jam nut and repeat the uncaging and caging process to see that the caging cam arm passes over center every time. Tightening the jam nut lengthens the caging link slightly, therefore it may be found necessary to loosen the jam nut and make futher clockwise adjustment of the length adjuster. Re-tighten the jam nut.
(18). Repeat the uncaging the caging process at least 10 times after final adjustment to be sure of proper operation.
(19). Install the upper housing and secure with eight screws.
(20). Remove the cage-uncage knob and install the caging mechanism cover and secure with twelve screws. Install cage-uncage knob.
(21). Set the instrument up for operation. Operate the system to see if the pendulum can be biased repeatably. This test will verify that the pedulum is free.

Step 2. Check for defective gear box assembly in Servo and Gyro test modes by performing the following test.
Apply power and check operation as follows:
(1). Place TEST SELECT switch to GYRO; verify that the TEST METER indicates a zero reading.
(2). Place the TEST SELECT switch to Servo CW position; verify that the theodolite rotates in a clockwise direction when looking down on the GRU and verify that the TEST METER pointer is positioned in the green hand of the meter scale.
(3). Place the TEST SELECT switch in the CCW position; verify that the theodolite rotates in a counterclockwise direction when looking down on the GRU and verify that the TEST METER pointer is positioned in the green band of the meter scale. If the theodolite fails to rotate in either direction, the gearbox assembly is bad.
Replace the gearbox assembly.
(4). Remove the main connector housing cover by removing ten screws.
(5). Remove the gearbox assembly access cover by removing ten screws.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

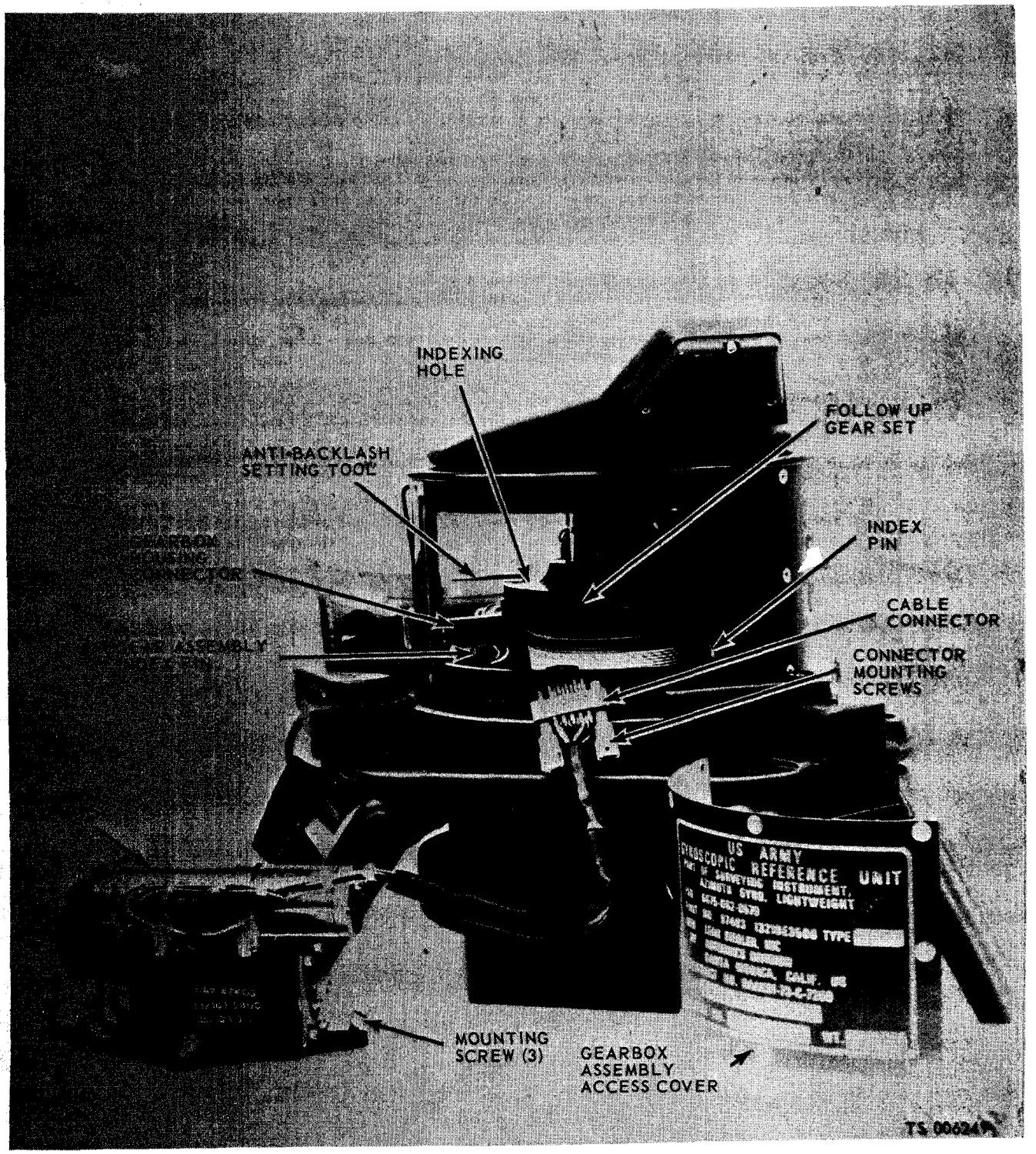


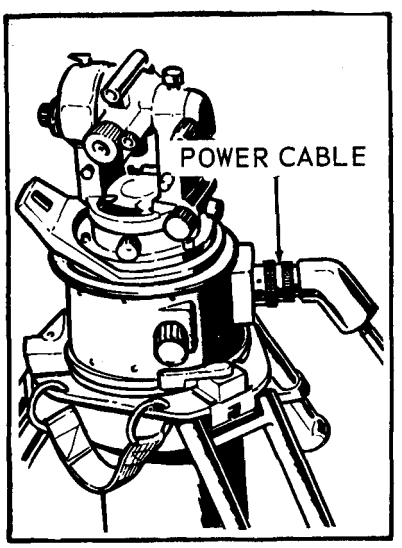
Figure 2-81. Gearbox assembly removal.

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

(6). Remove the three gearbox assembly mounting screws and remove the gear box assembly.
(7). Disconnect the gearbox assembly electrical cable by rotating the connector mounting screws in the counterclockwise direction. Alternate between the two screws every (2 to 3) turns. The connector will be damaged if this technique is not followed.
(8). Install the anti-backlash setting tool (figure 2-81) into the index hole of the upper gear half of the follow-up gear set, with the handle of the tool towards tbe main connector cover.
(9). Place the thumb on one end of the gear set and the index finger on the other and slide the two gear halves together so that the ends are flush.
(10). Press the anti-backlash setting tools into tbe index hole of the lower gear half and relax the thumb and index finger.
(11). Connect the gearbox assembly electrical cable connector to the female receptacle on the housing connector. Rotate the cable connector mounting screws in the clockwise direction, being careful to alternate between the two screws after (2 to 3) turns.
(12). Place the cable between the gearbox assembly mounting pads, so that it will be under the gearbox when the gearbox is in final position.
(13). Rotate the follow-up shaft to the extreme clockwise position by turning tbe theodolite mounting plate.
(14). Install a gearbox assembly through the access hole and place it so that the mounting screw holes are lined up.
(15). Apply sealant primer MIL-S-22473, Grade N, form R, to the threads, and allow to air dry. Apply a small amount of thread locking sealant, MIL-S-46163, Grade N, Type II, to the first few threads. Install the gearbox assembly mounting screws, but do not tighten.
(16). Press the gearbox assembly against the index pins on tbe inner mounting pads and tighten the mounting screws while maintaining the gearbox position.
(17). Remove the anti-backlash setting tool from the index bole.
(18). Install the gearbox assembly access cover and main connector housing screws. Secure each cover with ten screws.

Step 3. Check for defective gyroscopic reference unit (GRU).
Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-82).



TS 006321

Figure 2-82. Gyroscopic reference unit power cable removal.

If the system operates correctly with the new GRU, this indicates the original GRU was bad.
Report a bad GRU to the next higher level of maintenance.

Step 4. Check for a defective UNCAGED indicator lamp.
a. Loosen two setscrews recessed into the UNCAGED knob and remove knob from the switch shaft (fig. 2-83)

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

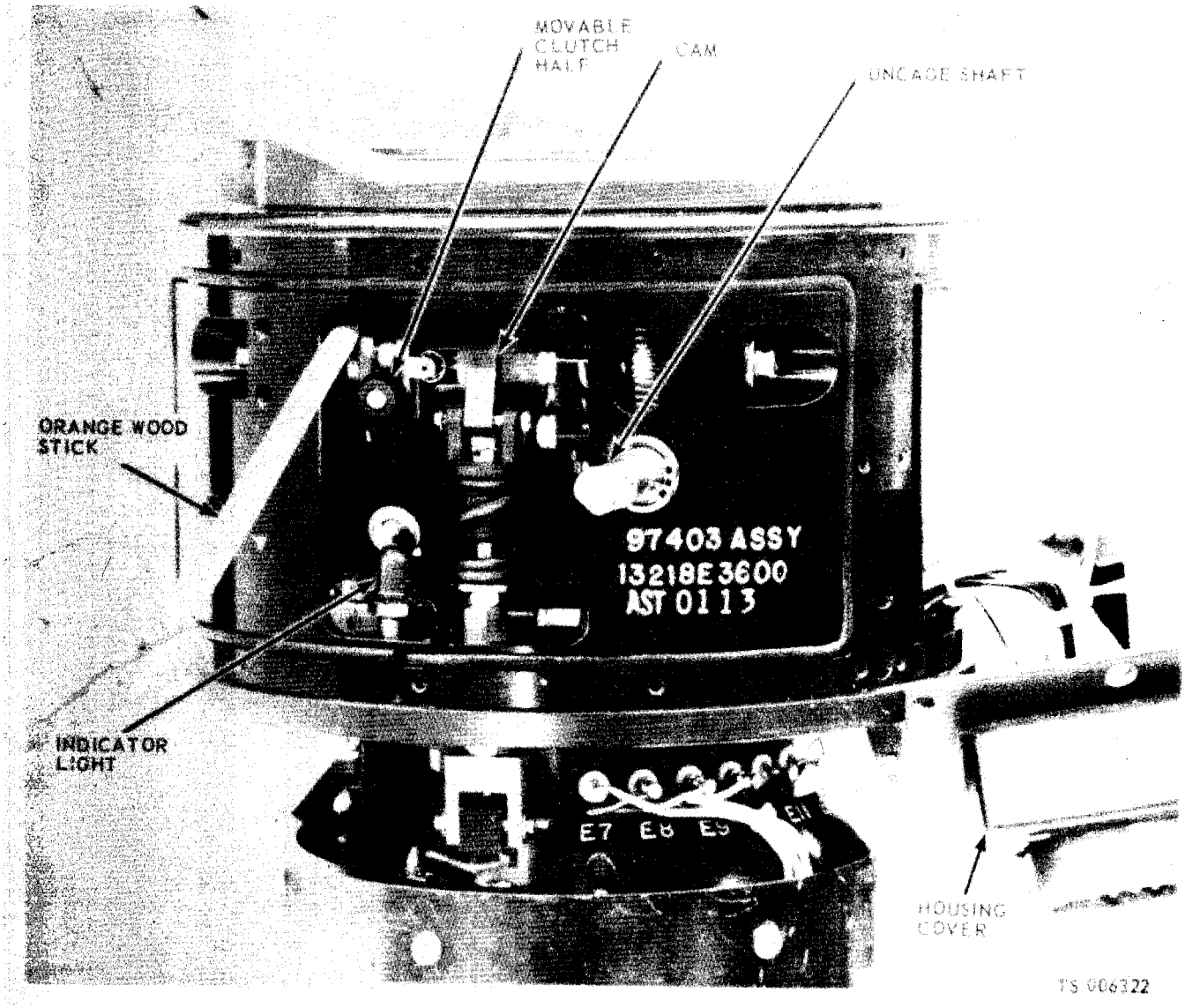


Figure 2-83. Gyroscopic reference unit uncaged indicator,

b. Remove screws and housing cover (fig. 2-83).
c. Visually inepect lamp for a burned filament.

Replace a defective lamp.

(1). Unsolder and disconnect the lamp lead wires from terminal points E17 and E18.
(2). Remove the indicator mounting nut and remove the indicator light from the bracket.
(3). Apply MIL-S-22473, Grade N, Form R primer to the attaching parts threads and allow to air dry. Apply locking sealant MIL-S-46163, Grade N, Type II, to the first few threads of the attaching parts. s.
(4). Install a new indicator light and secure to bracket with the mounting nut.
(5). Connect and solder the lamp lead wires to terminals E17 and E18.
(6). Install housing cover and secure with attaching screws.
(7). Place UNCAGED knob onto the switch shaft, allowing sufficient space between the knob end GRU housing to prevent binding. Tighten knob setscrews.

Step 5. Check for improper adjustment of caging solenoid.

If the caging solenoid does not operate properly, check for improper adjustment.

Adjust caging solenoid as follows:

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
a. Loosen cage-uncage knob setscrews and remove knob from switch shaft. *b.* Remove eight screws attaching the outer shield to the upper housing assembly and remove. *c.* To keep foreign particles from entering the inner parts of the instrument, place masking tape between the housing and the inner shield, except in the area of the caging link. *d.* Set the instrument on the work surfaces resting on the inner shield and in the upright position. Be careful not to damage the shield as the shield material is very soft and sensitive to shock. *e.* Loosen the extender jam nut (fig. 2-84).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

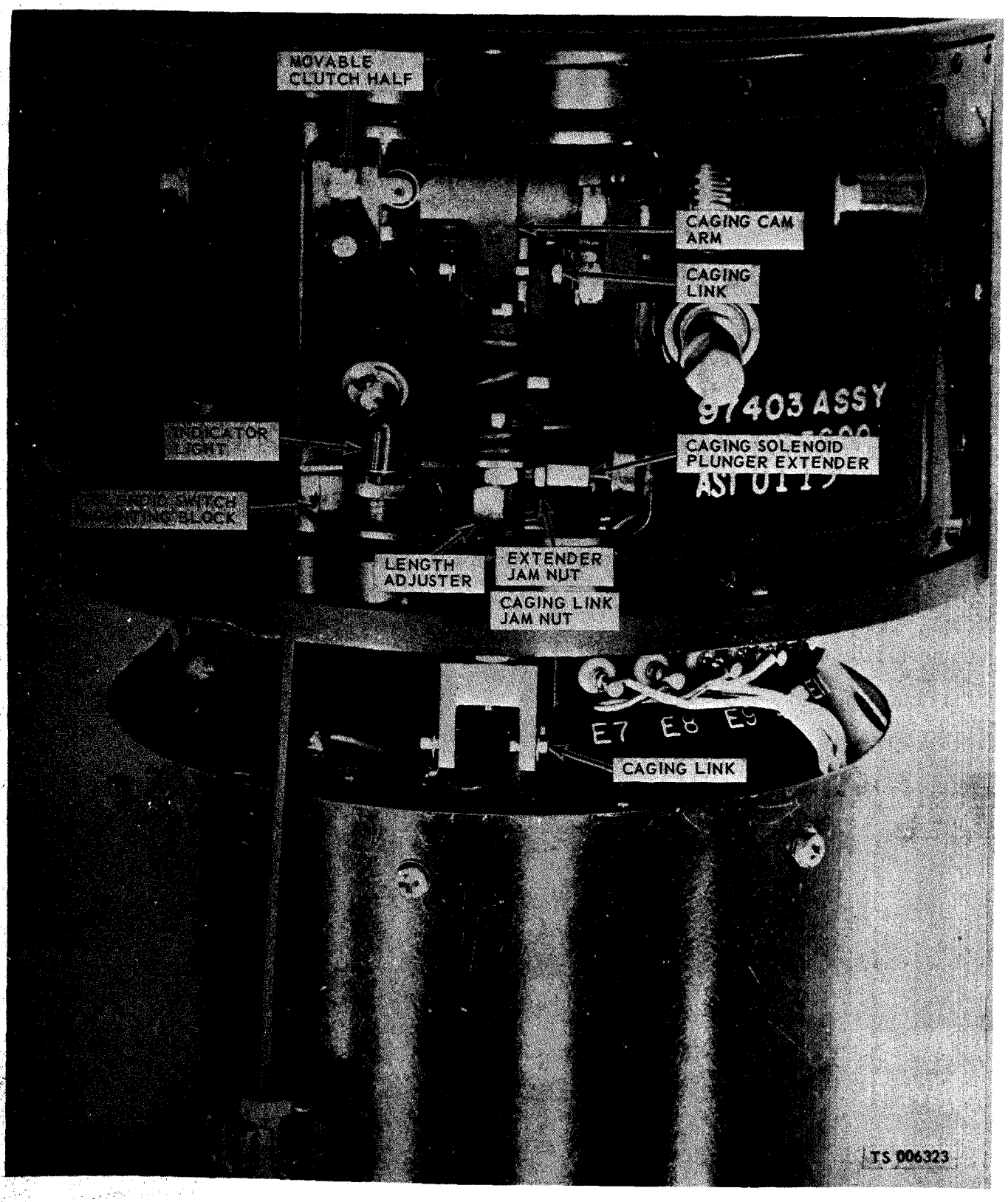


Figure 2-84. Caging solenoid adjustment.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

f. Manually advance the solenoid plunger out of the solenoid until it stops.

g. Adjust the plunger extender so that the movable clutch half enters the caging cam clutch teeth and bottoms out, without the clutch actuator arm moving in relation to the clutch actuator, i.e., the clutch actuator arm and the clutch actuator shall not deflect at the pivot point.

h. Tighten the extender jam nut. Position the solenoid control switch mounting block so that the switch is actuated 0.10 to 0.020 inch (.250 to .500 CM) from full extension of the solenoid plunger.

i. Tighten switch mounting block screws.

j. Connect the GRU to the ECU, using the interconnect breakout box (fig. 2-85).

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

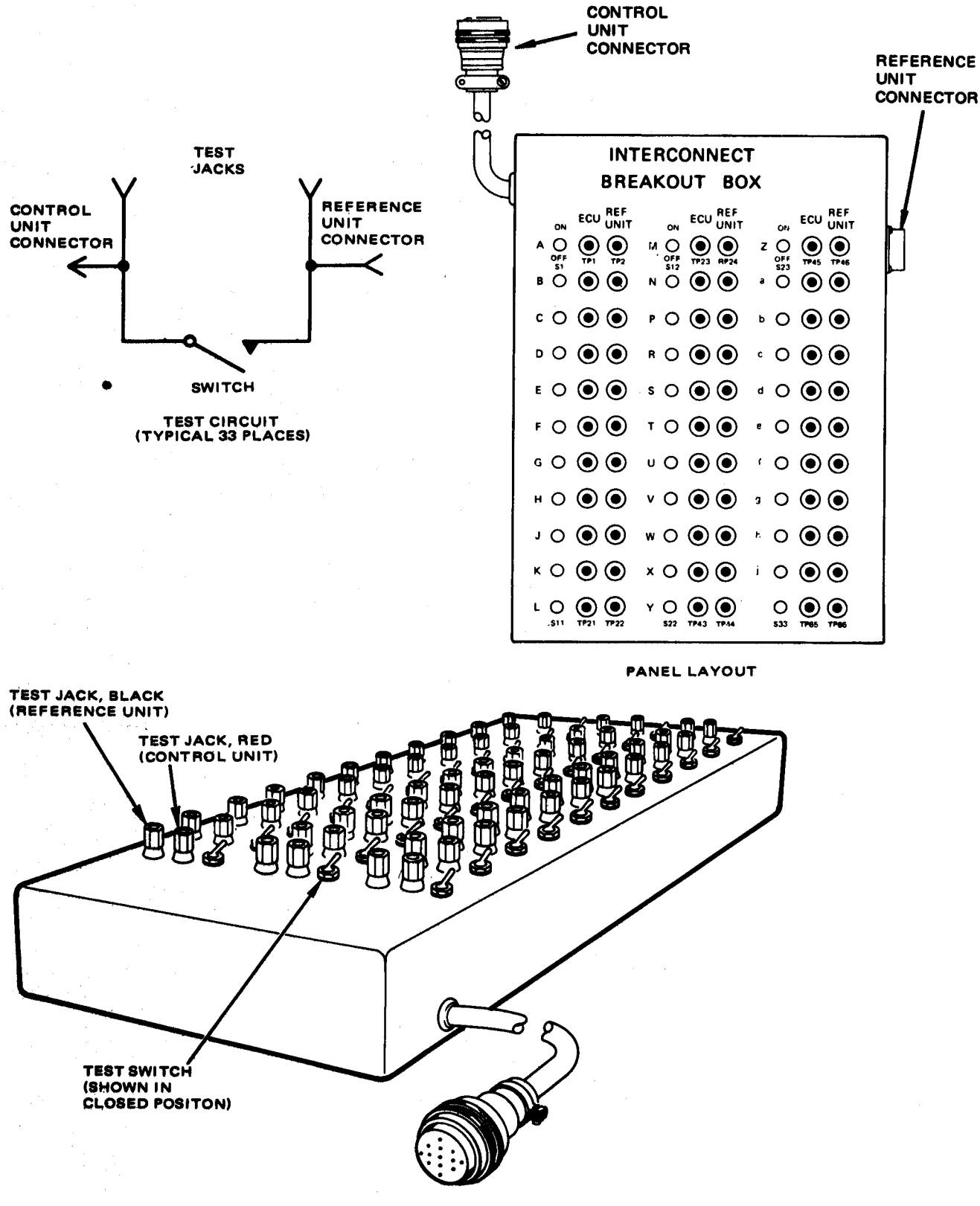


Figure 2-85. Interconnect breakout box.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

k. Connect a TS-352/4 multimeter or equivalent in the 2-5 amp range, acress jacks N of breakout box and open switch N.

l. Energize the system in the BIAS mode and observe the multimeter. If the solenoid switch is adjusted properly, the current should be 0.05 amp. If the solenoid draws 1.5 amps, the switch must be moved closer to the solenoid. Should be solenoid chatter and draw high current, then the switch must be moved away from the solenoid.

m. Switch from BIAS to SELF-TEST several times to insure proper operation.

n. Install the outer shield to the upper housing and secure with eight screws.

o. I nstall cage- uncage knob and secure by tightening setscrews.

Step 6. Check for a defective TILT SWITCH (1A1S3) assembly.

a. Remove eight screws and upper housing cover.

b. Use a ohmmeter and check for continuity between the tilt switch terminals.

If continuity is not present, replace a bad switch.

(1). Remove the main connector housing cover by removing ten screws.

(2). Remove the gearbox assembly access cover by removing ten screws (fig. 2-86).

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

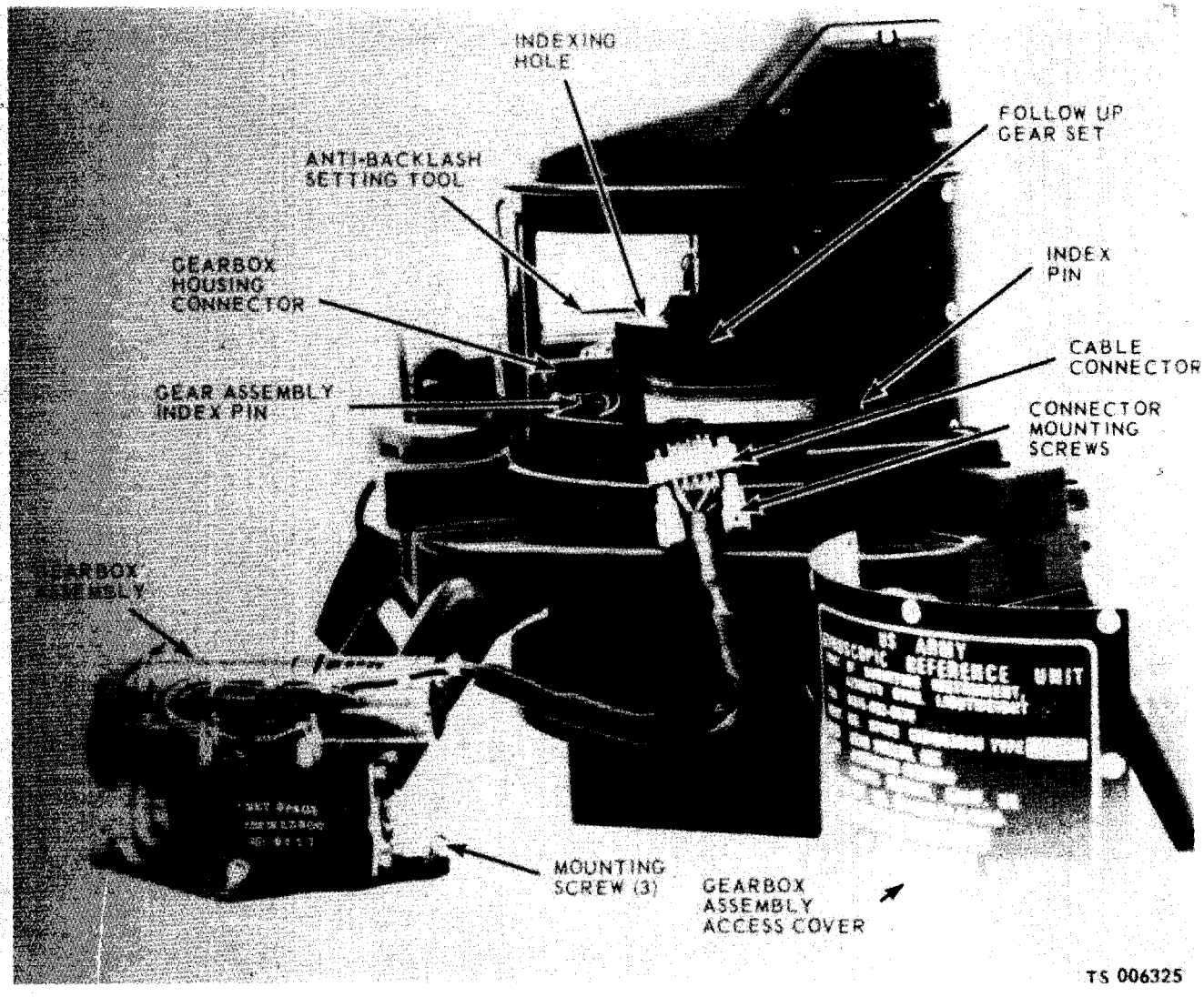


Figure 2-86. Gearbox assembly removal.

Table 2-1. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

(3). Remove the three gearbox assembly mounting screws and remove the gearbox assembly through the access.
(4). Disconnect the gearbox assembly electrical cable by rotating the connector mounting screws in the counter clockwise direction. Alternate between the two screws every (2 to 3) turns. The connector will be damaged if this technique is not followed.
(5). Tag and unsolder the electrical leads from the tilt switch terminals.
(6). Remove the two tilt switch attaching screws and remove the tile switch (fig. 2-87).
(7). Install the gearbox assembly in the housing and secure with two mounting screws. Connect and solder the electrical leads.

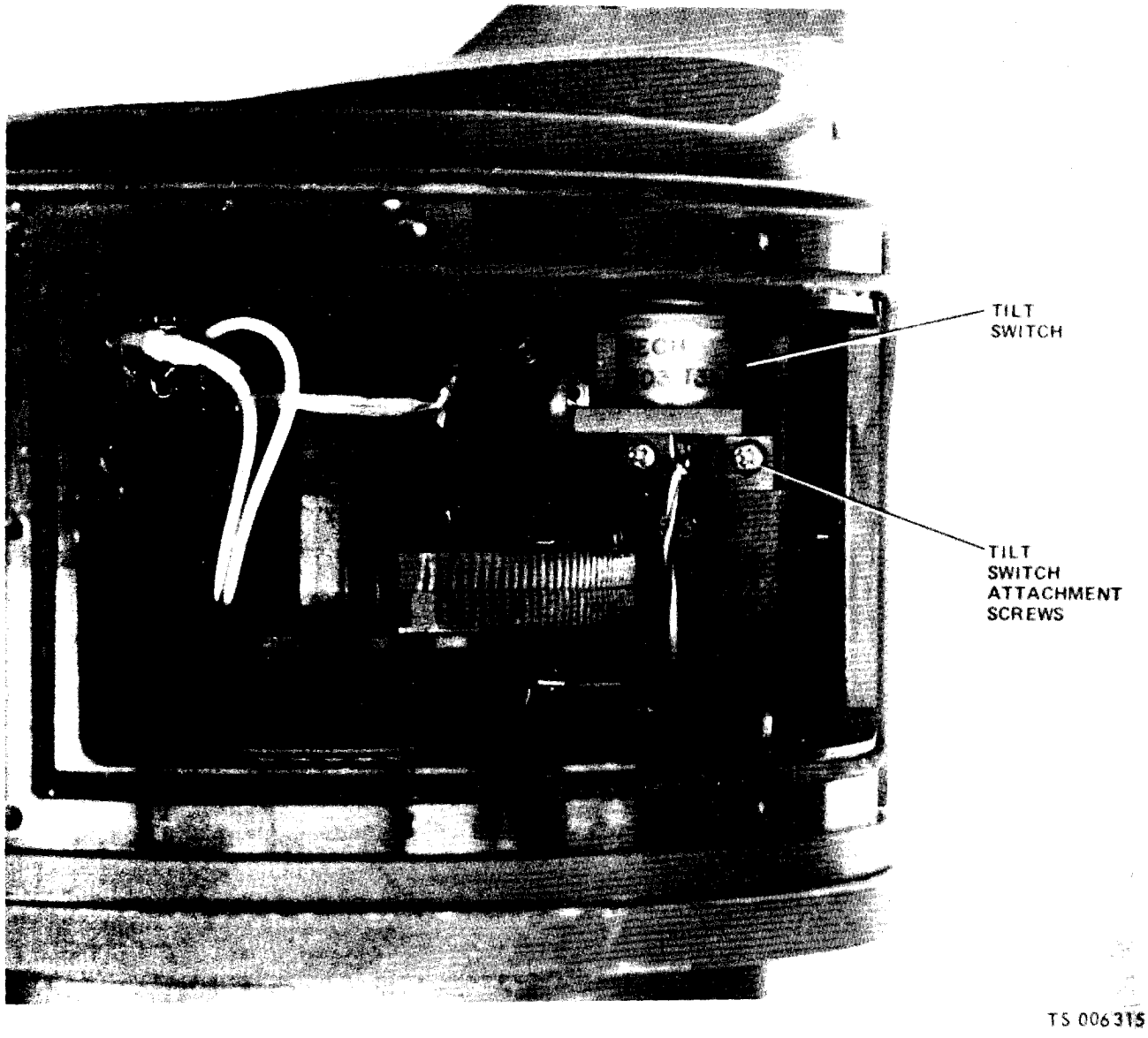


Figure 2-87. Tilt switch removal.

(8). Install the anti-backlash setting tool (fig. 2-87) into the index hole of the upper gear half of the follow-up gear set, with the handle of the tool towards the main connector cover.
(9). Place the thumb on one end of the gear set and the index finger on the other and slide the two gear halves together so the ends are flush.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(10). Press the anti-backlash setting tools into tbe index hole of the lower gear half and relax the thumb and index finger.
(11). Connect the gearbox assembly electrical cable connector to the female receptacle on the housing connector. Rotate the cable connector mounting screws in the clockwise direction, being careful to alternate between tbe two screws after (2 to 3) turns.
(12). Place the cable betweeen the gearbox assembly mounting pads, so that it will be under the gearbox when tbe gearbox is in final position.
(13). Rotate the follow-up shaft to the extreme clockwise position by turning theodolite mounting plate.
(14). Install the gearbox assembly through the access and place it so that the mounting screw holes are lined up.
(15). Apply sealent primer, MIL-S-22473, Grade N, Form R, to the threads, and allow to air dry. Apply a small amount of thread locking sealant, MIL-S-22473, Grade N, Type II, to the first few threads.
(16). Install the gearbox assembly mounting screws but do not tighten. Press tbe gearbox assembly against the index pins (fig. 2-86) on the inner mounting pads and tighten the mounting screws while maintaining the gearbox position.
(17). Remove tbe anti-backlash setting tool from the indexing hole.
(18). Install the gearbox assembly access and main connector housing cover. Secure each cover with three mounting screws.

Step 7. Inspect printed circuit board for evidence of damage or failed components.

a. Loosen the eight captive ecrews and lift the electronic control panel assembly from the case (fig. 2-88).

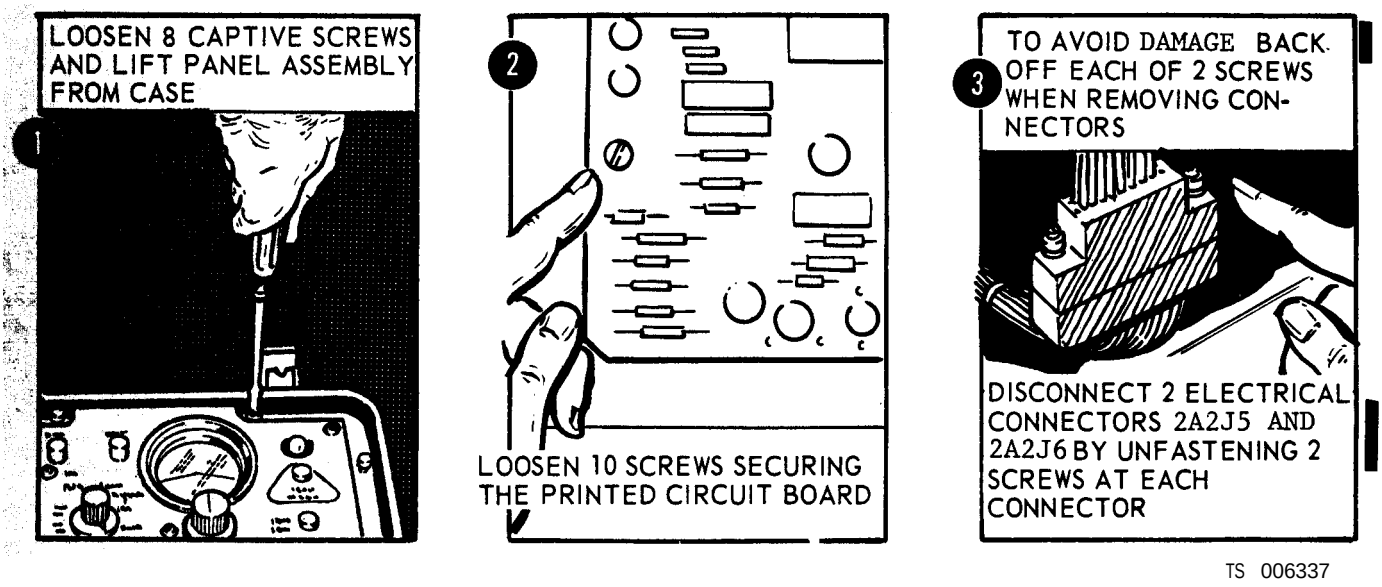


Figure 2-88. Removal of printed circuit board.

b. Unfasten ten screws securing the printed circuit board to the mounting brackets and loosen the board to obtain access to electrical connectors.

CAUTION

To avoid damage to the electrical connectors, alternately back-off each of the two attaching screws when removing the connectors.

c. Disconnect two electrical connectors (2A2J5 and 2A2J6) by unfastening two screws at each connector. Remove printed circuit board.

d. Inspect printed circuit board for visual evidence of cracked circuits, corrosion, burns, or other evidence of defects. Replace a bad printed circuit board.

CAUTION

To avoid damaging the electrical connectors, alternate tightening each of the two screws during reassembly.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

(1). Install a good printed circuit board, but do not tighten mounting screws. Connect the two electrical connectors and secure by tightening two screws. Fasten ten screws that secure printed circuit board to mounting brackets.
(2). Install electronic control panel assembly in case and secure with eight captive screws.

Step 8. Check for a defective ECU.
Replace existing ECU with an ECU that is operable, by disconnecting and connecting power cables (fig. 2-89).

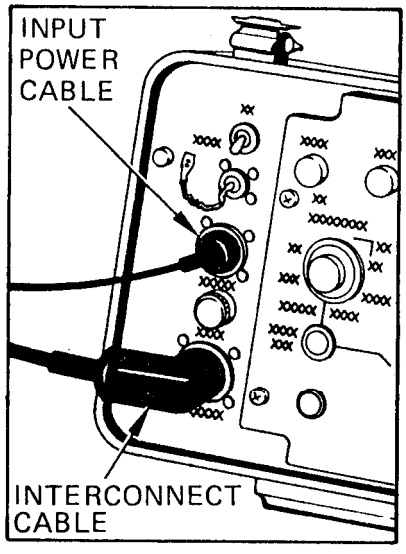


Figure 2-89. Disconnecting power cables.

If the system operates correctly with the new ECU, report the bad ECU to the next higher level of maintenance.

Step 9. Check for defective caging mechanism.
Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-89).
If the system operates correctly with the new GRU, report the bad GRU to the next higher level of maintenance.

15. INACCURATE AZIMUTH READING INDICATIONS.

Step 1. Check for a defective GRU.
Replace existing GRU with a GRU that is operable, by disconnecting and connecting power cables (fig. 2-89).
If the system operates correctly with the new GRU, report the bad GRU to the next higher level of maintenance.

Step 2. Check for a defective ECU.
Replace existing ECU with a ECU that is operable, by disconnecting and connecting power cables (fig. 2-89).
If the system operates correctly with the new ECU report the bad ECU to the next higher level of maintenance.

16. THEODOLITE CONTROLS INOPERATIVE.

Step 1. Check for a defective theodolite.
a. Replace existing theodolite with a theodolite that is operable.

CAUTION

Ensure that the GRU is securely held when removing theodolite. Retain the GRU housing in the tripod assembly or a holding fixture when removing the theodolite.

b. Remove three socket-head screws (fig. 2-90), securing the theodolite to base

Table 2-1. Troubleshooting–Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

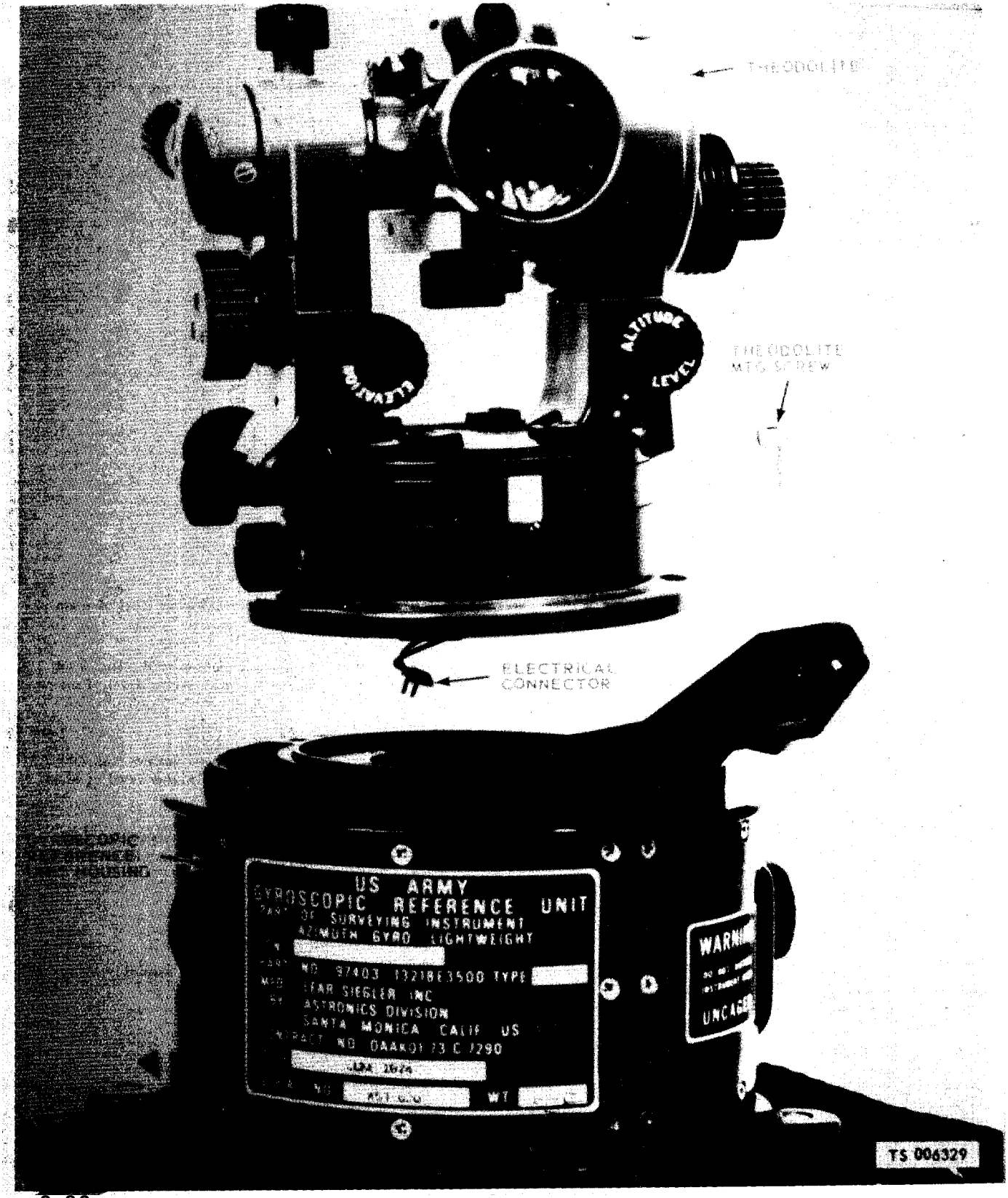


Figure 2-90. Theodolite removal.

Table 2-1. Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

c. Raise the existing theodolite sufficiently to disconnect the electrical connector from J3 between the theodolite and GRU housing.

d. Complete removal of the theodolite by raising clear of the GRU housing.

e. Place the new theodolite over the GRU housing and connect the electrical connector to terminal J3.

CAUTION

Ensure that electrical wire slack is placed adjacent to the inner circular surface of the mounting plate prior to lowering the theodolite.

f. Lower the theodolite to position in place on the mounting plate. Position the white strip on the theodolite base so that it is adjacent to the yellow stripe on the theodolite mounting plate.

g. Secure the theodolite by installing three socket head screws (fig. 2-90). Using a torque wrench, progressively tighten the screws in 10-inch pounds pound increments to 30-inch pounds torque.

If the system operates correctly with the new theodolite, report the bad theodolite to the next higher level of maintenance.

17. TIME TOTALIZING METER INOPERATIVE.

Step 1. Check for a defective time totalizing meter.

a. Operate the GRU and compare elapsed time on the time totalizing meter with a time piece.

b. If the time totalizing meter elapsed is time is incorrect, the meter is bad.

Redate a bad time totalizing meter.

(1). Remove ten screws and remove the main connector housing cover (fig. 2-91) containing the time totalizing meter from the housing. The cover shall remain connected to the housing by the leads to terminal 1A1J1.

(2). Unsolder and remove the wires from the time totalizing meter. Cut the lacing cord holding the lead wires to the meter body.

(3). Remove the two self locking nuts (fig. 2-91 and two screws securing the time totalizing meter to the housing cover.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

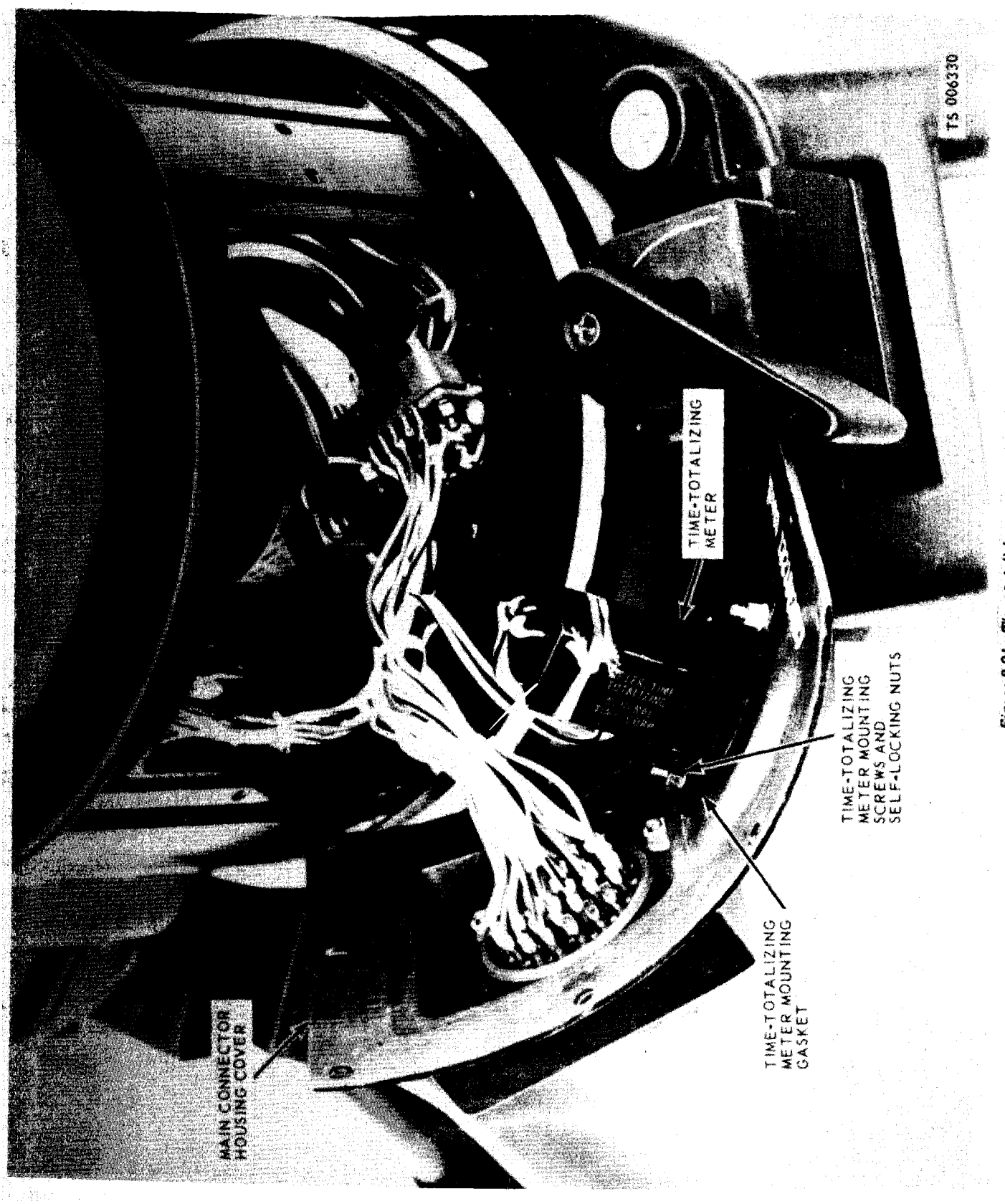


Figure 2-91. Time totalizing meter removal.

Table 2-1. Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
	(4). Remove the time totalizing meter and gasket from housing cover. (5). Install a new gasket and time totalizing meter and secure to connector housing cover with two screws and two nuts (fig. 2-91). (6). Connect and solder the meter wires. The wires may be reversed from the original configuration as there is no polarity involved. Lace the wires to the body of the meter. (7) Apply MIL-S-22473, Grade N, Form R, primer to the screw threads and allow to air dry. Apply locking sealant, Military Specification MIL-S-46163, Grade N, Type II, to the first few threads of the screws. (8). Install the housing cover and secure with ten screws.

Section III. GENERAL MAINTENANCE

2-5. General

This section contains instructions for repairs which are allocated to direct support maintenance by the MAC, and which have common usage in more than one assembly. Instructions peculiar to a specific part or assembly are described in that paragraph.

2-6. Disassembly

a. Discard seals, O-rings, gaskets, lockwashers, and similar parts when removed.

b. Attach identifying tags to electrical leads as disconnected to ensure correct assembly.

2-7. Cleaning

a. Metal Parts.

(1) Clean metal parts with trichloroethane, Federal Specification O-T-620, or equivalent solvent.

(2) Use a stiff-bristle brush to assist removal of stubborn dirt.

(3) Dry with a clean cloth or compressed air.

b. Woven Material.

(1) Soak thoroughly in a detergent solution.

(2) Agitate the material while immersed in the detergent.

(3) Use a stiff-bristle brush to assist removal of stubborn dirt.

(4) Allow to air dry.

2-8. Inspection

a. Visually inspect each item for evidence of wear, corrosion, deterioration, or other defects.

b. Inspect threaded parts for stripped or crossed threads.

c. If a part is normally installed with another part and motion occurs, assemble the parts and check for wear or binding.

d. Inspect parts adjacent to electrical components for burns or other evidence of arcing.

2-9. Repair.

Unless otherwise noted in a procedural paragraph, repair consists of replacing the defective part.

2-10. Reassembly

a. Threaded Parts (when referenced).

(1) Apply sealant primer, MIL-S-22473, Grade N, Form R, to the threads, and allow to air dry.

(2) Apply a small amount of thread locking sealant, MIL-S-46163, Grade N, Type II, to the first few threads,

b. Electrical Leads. Connect electrical leads in accordance with Military Standard, MIL-S-454, using solder, Federal Specification QQ-S-571.

c. Seals.

(1) Using a blunt instrument, such as a cuticle stick (orangewood stick), scrape the defective seal from the flange area.

(2) Clean the seal surface with a cloth moistened with trichloroethane, Federal Specification O-T-620, or equivalent solvent.

(3) Apply a continous bead of RTV sealant, Military Specification MIL-A-46106 RTV103BLA, to the surface to be in contact with the seal.

(4) Press the seal into place.

(5) Wipe excess adhesive from the assembly.

Section IV. REMOVAL AND INSTALLATION OF MAJOR ASSEMBLIES

2-11. General

The following paragraphs describe procedures for removal and installation of major assemblies, of which the SIAGL is comprised, in preparation for maintenance.

2-12. Electronic Control Unit

a. Removal

(1) Verify that the MODE SELECT switch is positioned to PWR OFF.

CAUTION

When placing cables in the electronic control unit lid, 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.

(2) Disconnect the interconnect and power cables. Store the cables in the lid of the electronic control unit case (fig. 2-92).

(3) If the hand lamp was used, disconnect from the electronic control unit, and store with the cables.

(4) Position the lid onto the bottom section of the case and secure the latches.

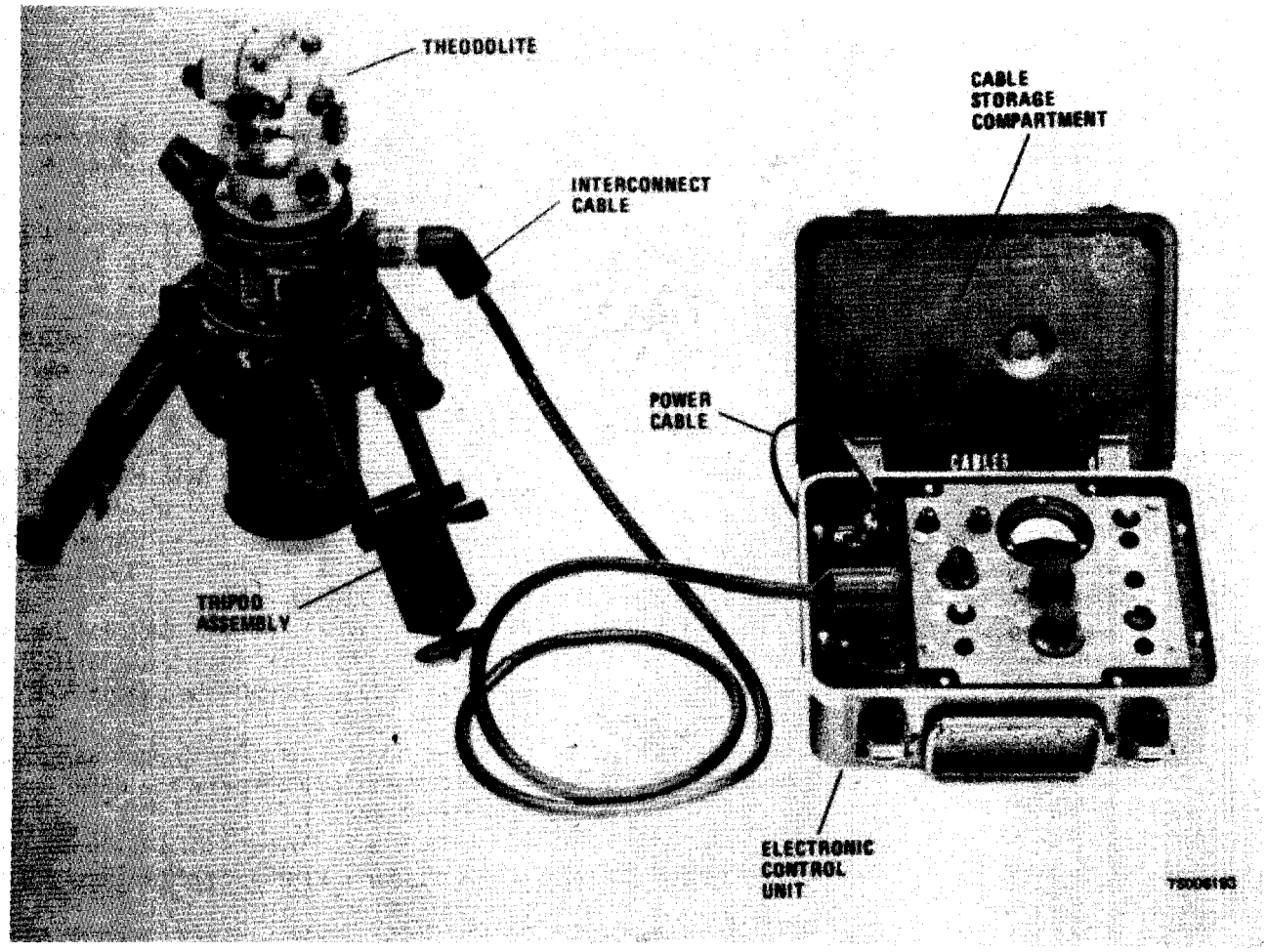


Figure 2-92. Electronic Control Unit-Removal and Installation.

b. Installation.

(1) Press the relief valve on the electronic control unit case to relieve internal pressure.

(2) Unfasten the latches that secure the lid to the lower section of the case.

(3) Remove cable assemblies from the case as required.

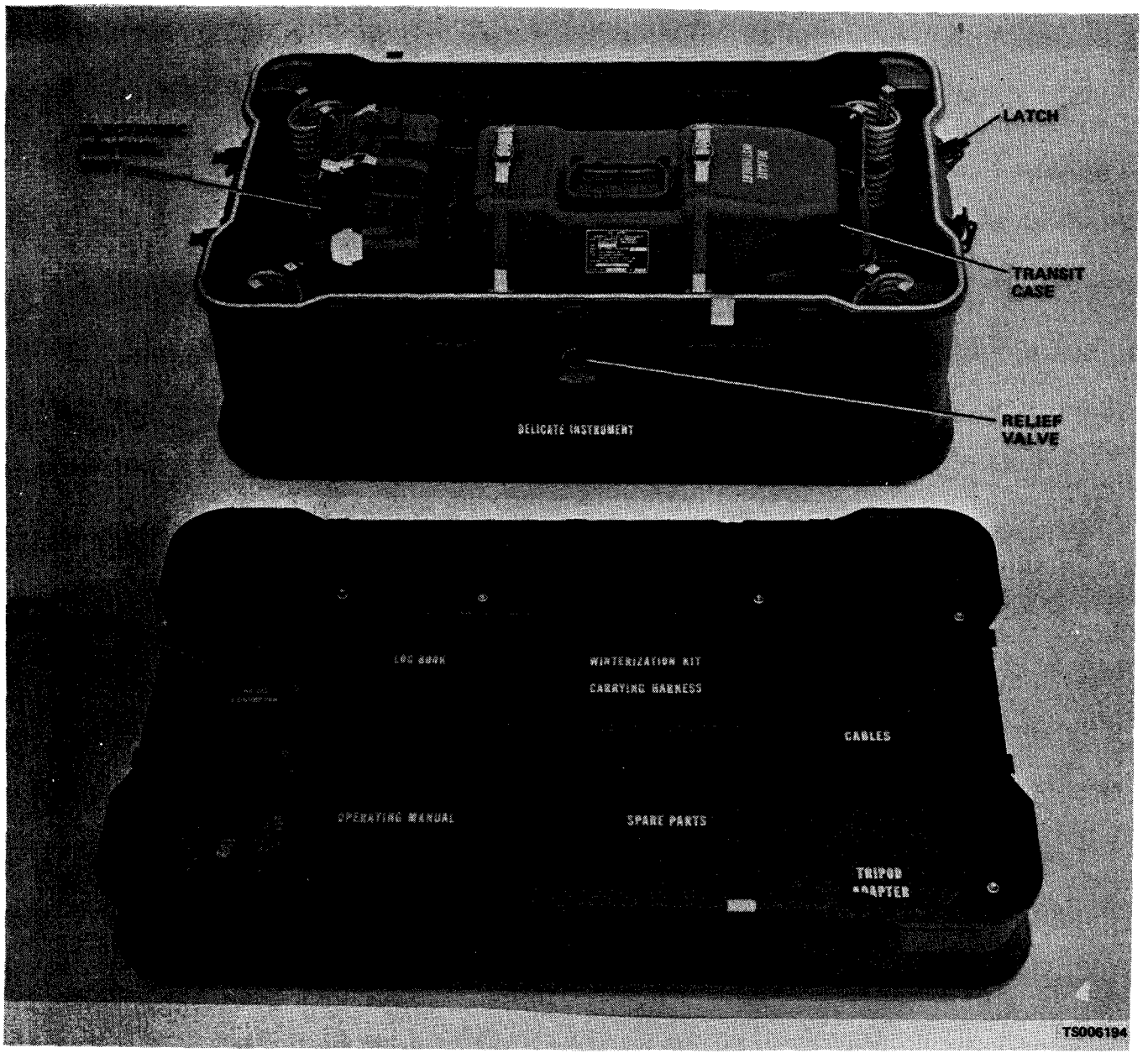


Figure 2-93. Transport Case-Packing and Unpacking.

2-13. Gyroscopic Reference Unit (GRU)

a. Removal.

(1) Ensure that all cables are disconnected.

(2) If the auxiliary tripod was used, separate the GRU from the tripod adapter (fig. 2-94).

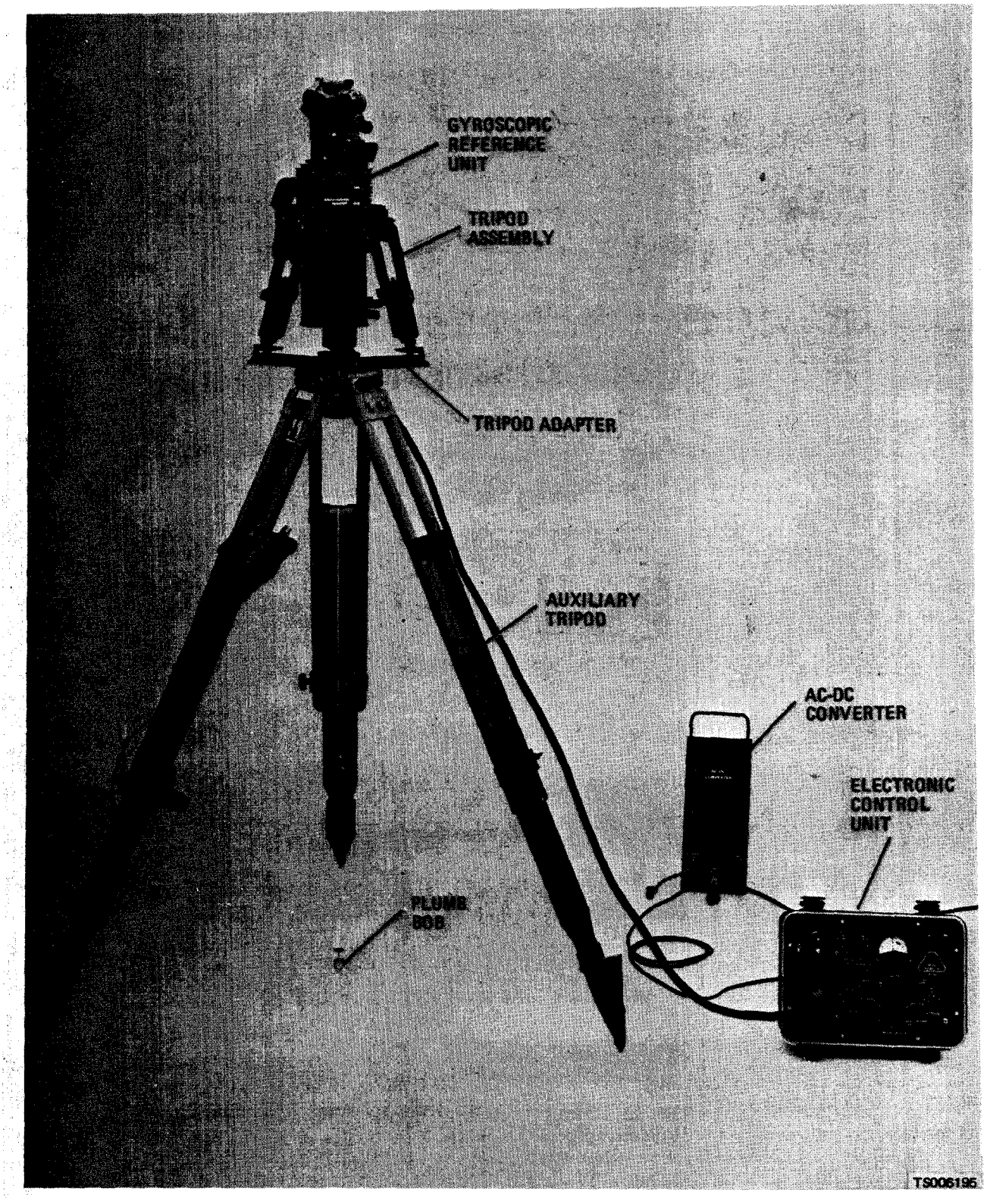


Figure 2-94. Gyroscopic Reference Unit –Subassembly Removal and Installation.

(3) Remove the tripod adapter from the auxiliary tripod.

(4) Loosen each of three tripod hold-down clamps and align the index mark on the theodolite base with the tripod index mark.

(5) Adjust the hold-down clamps in towards the

body of the instrument and tighten.

(6) While holding the equipment, loosen the three locking clamps on the tripod and retract the tripod legs. Lock the legs in the retracted position. Compress the legs against the GRU. If extended, retract the tripod spades into the legs.

(7) Align the alidade index stripe with the theodolite index stripe.

(8) Maintain the theodolite telescope pointing upward and parallel to the vertical plane, align the white stripes on the tripod with the white stripes on the GRU housing.

(9) Release the horizontal lock and tighten the vertical lock on the theodolite.

CAUTION

Exercise care when positioning the GRU in the Transit Case. Incorrect positioning can cause damage to the reference mirror.

(10) With the GRU and the tripod assembled, secure the equipment in the transit case with the clamps (fig. 2-95).

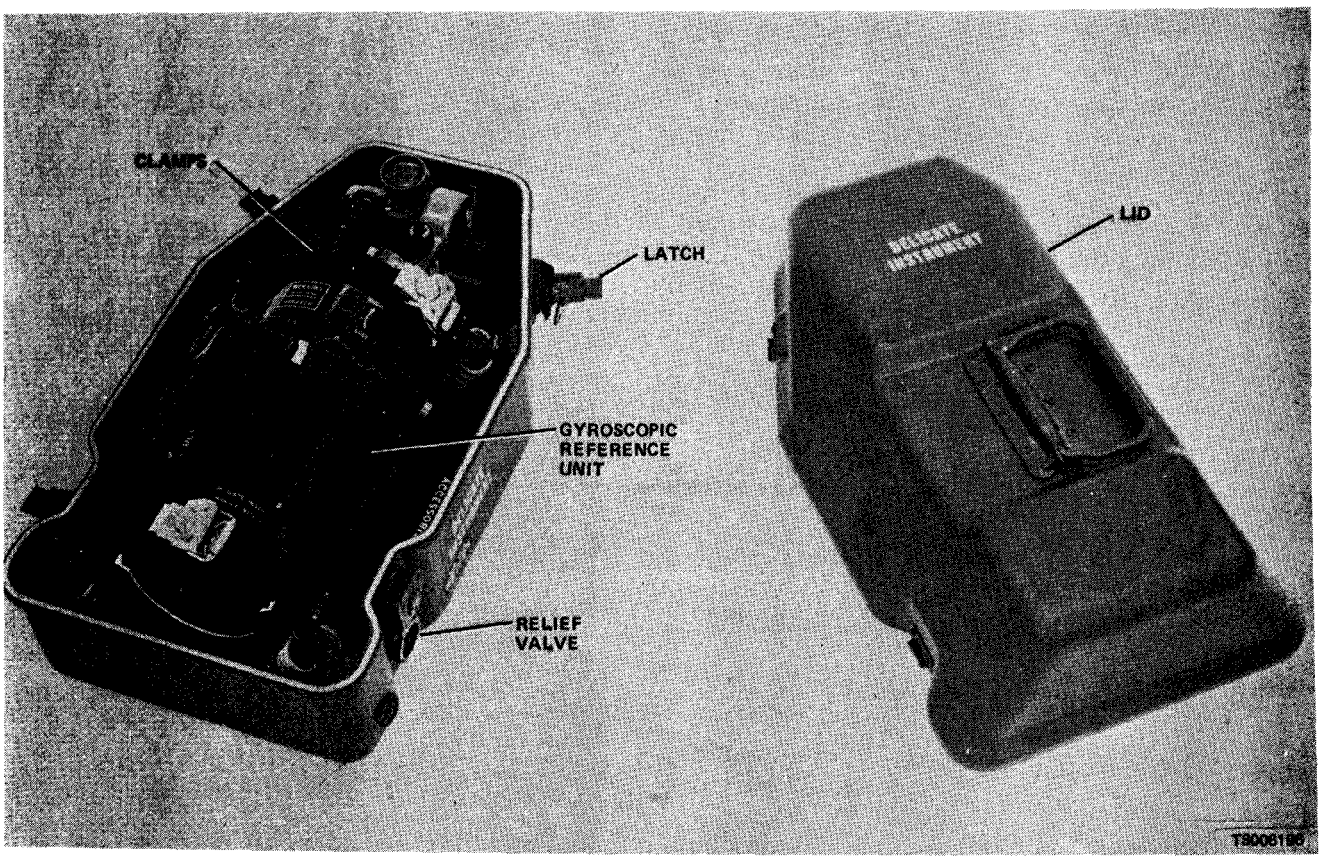


Figure 2-95. Transit Case-Packing and Unpacking.

b. Installation

(1) Press the pressure-relief valve on the transit case to relieve internal pressure.

(2) Unlatch and separate the lid section from the bottom section of the transit case.

(3) Release the clamps that secure the GRU in the case.

(4) Lift the GRU from the transit case.

Section V. FAILURE ANALYSIS

2-14. Interconnect Breakout Box

Monitoring and checkout of signals between the ECU and the GRU are provided through the interconnect breakout box (fig. 2-96). Each pair of test jacks on the breakout box are identified by a letter. Circuits corresponding to the test jacks and indications required during testing are reflected in table 2-93. Figure 2-97 illustrates wave forms that should appear during applicable tests, using an oscilloscope.

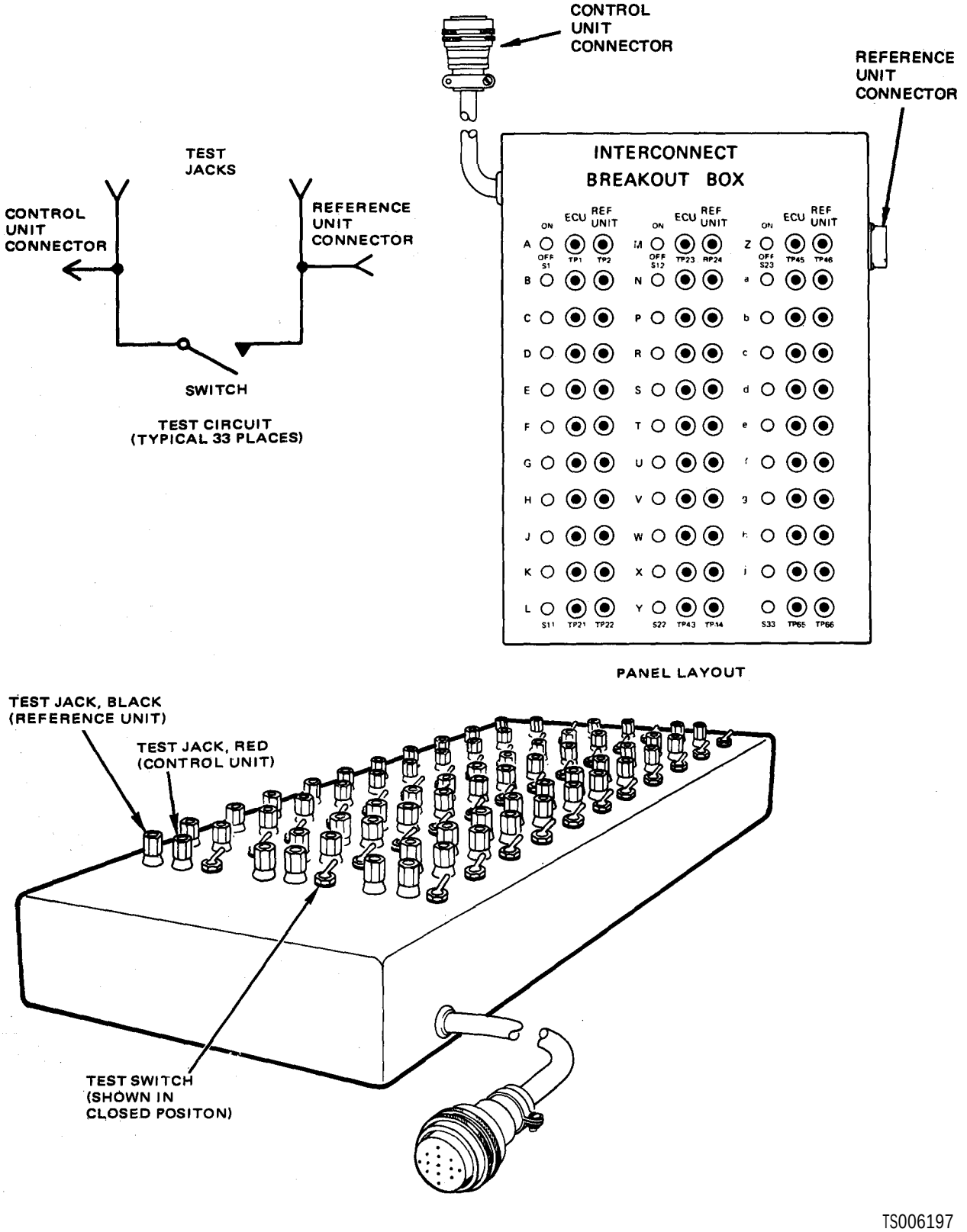


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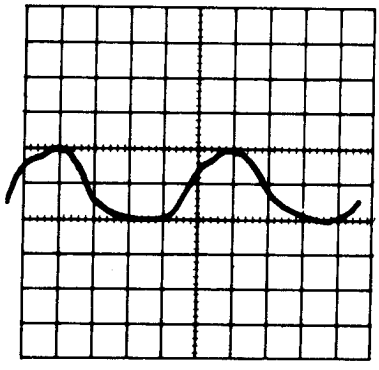
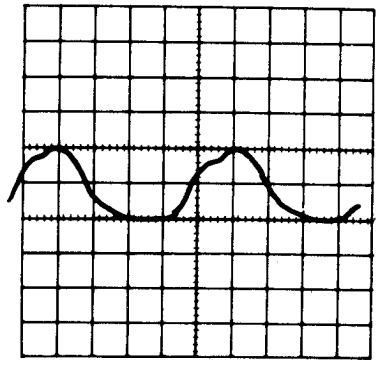
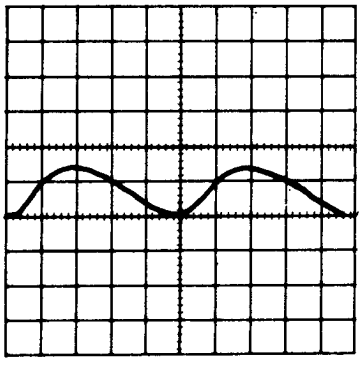
Figure 2-96. Interconnect breakout box.



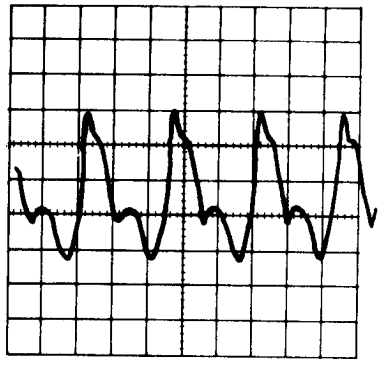
F. GYRO MOTOR RETURN
50MV/CM



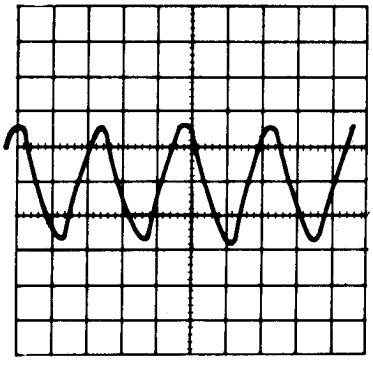
R. SERVO AMP OUTPUT
5 VOLTS/CM



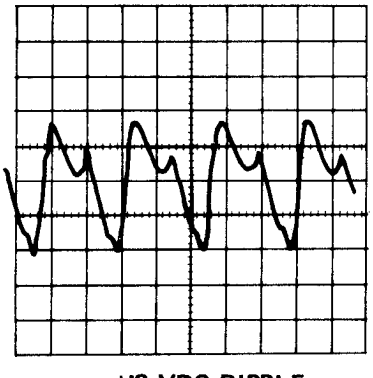
W. TACH OUTPUT
5VOLT/CM



c. 2MV/CM +9 VDC RIPPLE



f. PRE-AMP OUTPUT
.I VOLT/CM



g. +I8 VDC RIPPLE
5MV/CM

TS006198

Figure 2-97. Oscilloscope Wave Forms.

2-15. Signal Summary

In conjunction with failure analysis instructions (paragraph 2-16) the following signal descriptions are provided to facilitate the isolation of defects when troubleshooting. The modes of operation in which the signals are active are indicated in the subsequent paragraph. Test jacks A, B, and C are spares. The function of all other jacks and associated signals are as follows:

Test Jack — *Signal*

D Uncage light high side - A positive dc voltage measured with respect to pin M; the panel illumination control varies this between 14 Vdc and 28 Vdc; measured with a dc voltmeter or oscilloscope.

E Time totalizar meter high side - 26 Vac, 400 Hz when measured with respect to pin F; measured with an ac voltmeter or oscilloscope.

F Gyro motor return - This wire is connected to ground in the ECU but a small 400 Hz signal can be seen when measured with respect to pin X; measured with an oscilloscope (the amplitude of the signal depends upon the current through the wire and will vary from mode to mode); an ac ammeter placed in series with the line wilf record currents up to 0.5 amps.

G Gyro motor high side - An ac current normally 0.23 amps but increasing to as much as 0.5 amps during gyro runup; measured with an ac ammeter in series with the line (this current is monitored in the SELF TEST gyro position).

H

Deleted.

J Tilt switch - This line is connected to ground (pin M) if the reference unit is tilted at least 10°, this should be measured in the power off mode using an ohmmeter.

K Uncage switch hot side - This line is connected to the source voltage through the mode select switch and is measured with respect to pin M; measured with a dc voltmeter or, oscilloscope.

L Uncage switch switched side - This line is connected to pin K when the pendulum is fully uncaged; measured the same as pin K.

M DC power ground (No. 2 GND) - This line is the return for dc current in the GRU (expecting the gyro brake current). Refer to resistance check (paragraph 2-16a) for measurement.

N Uncage solenoid high side - A dc voltage slightly less than the source voltage and measured with respect to pin M; measured with a dc voltmeter.

P Servo motor and tachometer excitation high side - A 26 vac, 400 Hz measured with respect to pin V; measured with an ac voltmeter or oscilloscope.

R Servo amplifier output (one side) - A 400 Hz signal with a dc voltage component which is slightly less than the source voltage (the amplitude of the ac signal will depend upon servo speed); measured with an oscilloscope referenced to pin M.

S B+ to servo motor and speed changer high side - A positive dc voltage equal to the source voltage measured with respect to pin M; measured with a dc voltmeter.

T Speed changer low side - A dc voltage equal to pin S or zero, volts depending upon whether the speed changer is energized; measured the same as pin S. Timing signals to the speed changer match the setting of the LATITUDE switch:

Test Jack — Signal

Setting	*Delay (sec)*
0	78
25	82
40	89
50	98
60	108
65	123
70	133
75	154

U Servo amplifier output (one side) - Same as pin R (the ac signal will be 180° out-of-phase with pin R when observed with an oscilloscope).

V Servo motor and tachometer excitation return - This wire is connected to ground in the ECU and carries 400 Hz current; an ac ammeter placed in this line will read 0.155 amps. Refer to resistance check (paragraph 2-16a) for additional measurements.

W Tachometer output – This is a 400 Hz signal with a +9 Vdc component, measured with an oscilloscope with respect to pin X.
Servo Motor:
Stopped - Less than 0.02 peak to peak
Full Speed - Greater than 2.7 peak to peak

X Signal ground (No. 1 GND) - This line supplies power to the pre-amplifier and is the primary reference for the system. Refer to resistance check (paragraph 2-16a) for measurement.

NOTE

The best way to monitor Y and Z is to insert a dc ammeter in either line and check for a current variation of ±0.2 ma as the bias pot is rotated through its entire range.

Y Bias coil (one side) - This line is connected to the bias pot and can be varied between zero and +18 Vdc measured with respect to pin X using dc voltmeter.

Z Bias coil (one side) - A dc voltage varying between ±60 mv when measured with respect to pin Y (changes with bias pot position) using a dc voltmeter).

a Torquer coil (one side) - A dc current varying between ±380 ma depending upon mode and condition of operation; measured with a dc ammeter in series with line.

b Torquer coil (one side) - same as pin a.

c Excitation coils high side - 26 VAC, 400 Hz measured with respect to pin F; with an ac voltmeter or oscilloscope.

d Torquer reference coil - A dc current with a specific value of each latitude setting; use a dc ammeter.

Setting	*Current (ma)*
0	12.1
25	10.9
40	9.2
50	7.8
60	6.0
65	5.1
70	4.1
75	3.1

e +9 VDC - A regulated dc voltage measured with respect to pin X.
DC: 9 ±0.1 Vdc
Ripple: 40 m V peak to peak (maximum)
Measured with a dc voltmeter and an oscilloscope.

f Pre-amplifier output GRU - A 400 Hz signal with 9 Vdc component; the ac signal amplitude will depend upon the angular displacement of the follow-up assembly, with respect to the pendulum; measured with an oscilloscope with respect to pin X.

Test Jack	Signal
g	+18 VDC – A regulated dc voltage measured with respect to pin X. DC: 18 ± 0.2 Vdc Ripple: 80 mV peak to peak (maximum) Measured with a dc voltmeter and an oscilloscope.
h	Chassis ground (no. 5 GND) – This line is connected to ground in the ECU and supplies the return path for the theodolite illumination circuit. Refer to resistance check (para 2-16a) for measurement.
j	Theo illumination (high side) – A dc voltage varied by the THEO BRT control with a maximum value equal to the source voltage; measured with a dc voltmeter with respect to pin h.

2-16. Failure Analysis (Table 2-2)

a. Resistance Check. With the ECU in the power off condition, connect the breakout box between the GRU and ECU (figure 2-96. Place all switches on the breakout box in the OFF position. Using an ohmmeter, check for the following resistances (±10 percent unless otherwise indicated).

(1) *Gyroscopic reference unit (GRU)*

BLACK TEST JACKS

FROM	TO	OHMS	SCALE	Tested Component
D	M	50 to 300	X100	Uncage lamp
E	F	500	X100	Time totalizer meter
G	F	15	X1	Gyro motor
H(+)	M	Open	X100	
*J	M	Open	X100	Tilt switch
**J	M	0 to 5	X1	Tilt switch
K	L	Open	X100	Uncage switch
N	M	10	X1	Caging solenoid
P	V	65	X2	Tach/servo motor reference windings

NOTE

Meter leads may have to be reversed to obtain proper readings.

R	S	90	X1	Servo motor control windings
S(+)	T	5 to 50	X1	Speed changer solenoid suppression diode
T(+)	S	210	X100	Speed changer solenoid
U	S	90	X1	Servo motor control winding
W	e	850	X100	Tach output winding
Y	Z	300	X100	Bias coil
a	b	3000	X100	Torquer coil
c	F	6000	X100	Pick-off excitation coils
d	F	420	X100	Torquer reference coil
j	h	50 to 200	X1	Theo lamps

*GRU in vertical position
*GRU in horizontal position

(2) *Electronic control unit.*

RED TEST PINS

FROM	TO	OHMS	SCALE	Test Component
X	F	0 to 1	X1	Pendulum return
X	M	0 to 1	X1	B + return
X	V	0 to 1	X1	Servo excitation return
X	h	0 to 1	X1	Chassis ground

b. Theodolite Illumination. With the breakout box connected between the GRU and the ECU, connect power to the system and place the MODE SELECT switch to THEO ILLUM and THEO BRT rotated fully CW. Perform the following to determine the operability of the circuit.

(1) Monitor jacks h and j for a reading equal to the source voltage using a dc voltmeter.

(2) Close switches h and j.

(3) Verify that the theodolite illumination in the GRU is controlled through the ECU (rotation of THEO BRT control and MODE SELECT switch) in THEO ILLUM position.

(4) Monitor jacks h and j on breakout box to verify that voltage varies when THEO BRT is rotated.

c. Constant Signals. Lines requiring signals during all power-on operations are indicated in the following paragraphs.

(1) Place the MODE SELECT switch in the SELF TEST position.

(2) Monitor the following lines at the ECU red test jacks (indicated on the breakout box): K, Y, Z, c, d, e, and g (fig. 2-5).

(3) Close the following switches: F, J, K, M, V, X, Y, X, c, d, e, g, and h.

(4) Monitor the lines specified in step (2).

(5) Unsatisfactory readings in step (2) indicate a malfunction in the ECU; unsatisfactory readings in step (4) indicate a malfunction in the GRU. The signals specified in step (2) are needed in all power-on operations, they should be checked when a failure occurs in any mode of operation. Through the signal summary (para 2-15) and the system diagrams (fig. 1-6 and 1-7) malfunctions may be isolated to components of subcircuits.

d. Variable Signals. Signals required in some modes of operation but not in others are listed in the failure analysis chart (table 2-2). The chart shows which signals must be present for each mode of operation to function correctly, The symptom column in the chart shows what indications can be seen should a failure occur. Do the following to isolate failures to the GRU or the ECU.

(1) Check signals in the operating modes shown in table 2-2, following the sequence shown from left to right.

(2) If a malfunction occurs, monitor the signals in that column, following the numerical order shown,

(3) Note in order, all signals which are not correct.

(4) Repeat steps (1) and (2) for all remaining columns applicable to the signal. In this manner all failures will be noted and checked in more than one mode of operation.

(5) The first failure in each column indicates which unit is malfunctioning. Conditions noted in the failure column indicate a failure in the GRU or ECU.

(6) Examples of failure analysis are provided in the following paragraphs.

(a) Bias mode, pin f (pre-amp output): This should be an ac signal riding on + 9 vdc component. If there is no ac signal, this indicates that the failure is in the GRU. To verify this condition, open the toggle switch for pin f on the breakout box and check for the signal at the GRU terminal. If the signal is present, the failure is in the ECU.

(b) Fuse in the ECU blows each time the pendulum is uncaged: Open the toggle switch for pin L on the breakout box. If the fuse does not blow, the uncage switch is a possible failure. Additional tests of signal associated with the uncaging circuit will isolate the fault.

Table 2-2. Failure Analysis Chart

PIN	SIGNAL	SELF TEST													SYMPTOM	FAILURE	
		SOURCE VOLTAGE	REG AC	REG DC	BIAS	SERVO CW	SERVO CCW	BRAKE	GYRO	BIAS	START UP	GC	READ	BRAKE		REF UNIT	ECU
D	UNCAGE LIGHT HIGH SIDE									3		5	5		FAILS TO COME ON AFTER UNCAGING	SIGNAL PRESENT	NO SIGNAL
E	ET1 HIGH SIDE										2	2	2		NO TIME INCREASE	SIGNAL PRESENT	NO SIGNAL
G	GYRO MOTOR HIGH SIDE							1			1	1	1	1	NO SYNC LIGHT, NO METER DEFLECTION IN SELF TEST GYRO	SIGNAL PRESENT	NO SIGNAL
H	K1 COIL HIGH SIDE					9	9	2	1		3			2	GYRO LOOSES CURRENT WHEN UNCAGED (K1 ALWAYS ENGAGED)	NO SIGNAL	SIGNAL PRESENT WHEN NOT REQUIRED
L	UNCAGE SWITCH RETURN									2		4	4		NO UNCAGE LIGHT, MODE SEL SOLENOID DOES NOT ENGAGE, SERVO DOES NOT RUN IN GC	NO SIGNAL	SIGNAL PRESENT
N	UNCAGE SOLENOID HIGH SIDE									1		3	3		CLUTCH DOES NOT ENGAGE	SIGNAL PRESENT	NO SIGNAL
P	SERVO & TACH EXCITATION HIGH SIDE					1	1					6	7		SERVO MOTOR WILL NOT RUN; NO TACH OUTPUT	SIGNAL PRESENT	NO SIGNAL
R	SERVO AMP OUTPUT					3	3					9			SERVO MOTOR WILL NOT RUN OR WAS HIGH THRESHOLD	NO DC	NO AC
S	B+ TO SERVO MOTOR & SPEED CHANGER					2	2				4	7	8		SERVO MOTOR WILL NOT RUN NO HIGH SPEED GEARING	SIGNAL PRESENT	NO SIGNAL
T	SPEED CHANGER LOW SIDE					8	8					14			NO HIGH SPEED GEARING	LOW LEVEL SIGNAL PRESENT	HIGH LEVEL SIGNAL PRESENT
U	SERVO AMP OUTPUT					4	4					10			SAME AS ABOVE		
W	TACH OUTPUT					5	5					11			NO METER DEFLECTION IN SELF TEST 5 & 6 PENDELUM WILL NOT DAMP IN GC	NO SIGNAL	SIGNAL PRESENT
a	TORQUER COIL				1	6	6			5		12			NO DAMPING IN BIAS OR GC	VOLTAGE SIGNAL PRESENT	NO VOLTAGE SIGNAL
b	TORQUER COIL				2	7	7			6		13			NO DAMPING IN BIAS OR GC	VOLTAGE SIGNAL PRESENT	NO VOLTAGE SIGNAL
f	PRE-AMP OUTPUT									4		8	6		NO METER DEFLECTION EXCEPT IN SELF TEST (TEST SWITCH ENGAGED)	NO AC SIGNAL PRESENT	AC SIGNAL PRESENT
i	THEO LIGHT HIGH SIDE												9		THEO IS NOT ILLUMINATED	SIGNAL PRESENT	NO SIGNAL

CHAPTER 3

REPAIR OF ELECTRONIC CONTROL UNIT

3-1. General

The ECU consists of a control panel assembly with related electronic parts, installed in a portable case. When connected to the GRU and electric power source, the ECU provides controls and instruments for operating and testing the GRU.

Repair of the ECU consists of replacing defective components. Refer to troubleshooting procedures (table 2-1) and failure analysis (para 2-16) to isolate defective components.

3-2. Electronic Control Panel Assembly

Repair of the electronic control panel assembly consists of replacing defective components authorized by the MAC. Procedures for removal and installation of components are described in following paragraphs.

a. Removal.

(1) Press the pressure relief valve on the case to relieve internal pressure.

(2) Unlatch and separate the lid from the bottom section.

(3) Loosen the eight captive screws and lift the electronic control panel assembly from the case (fig. 3-1).

b. Installation.

(1) Position the electronic control panel assembly in the case and tighten eight captive screws.

(2) Secure the lid onto the bottom section of the case.

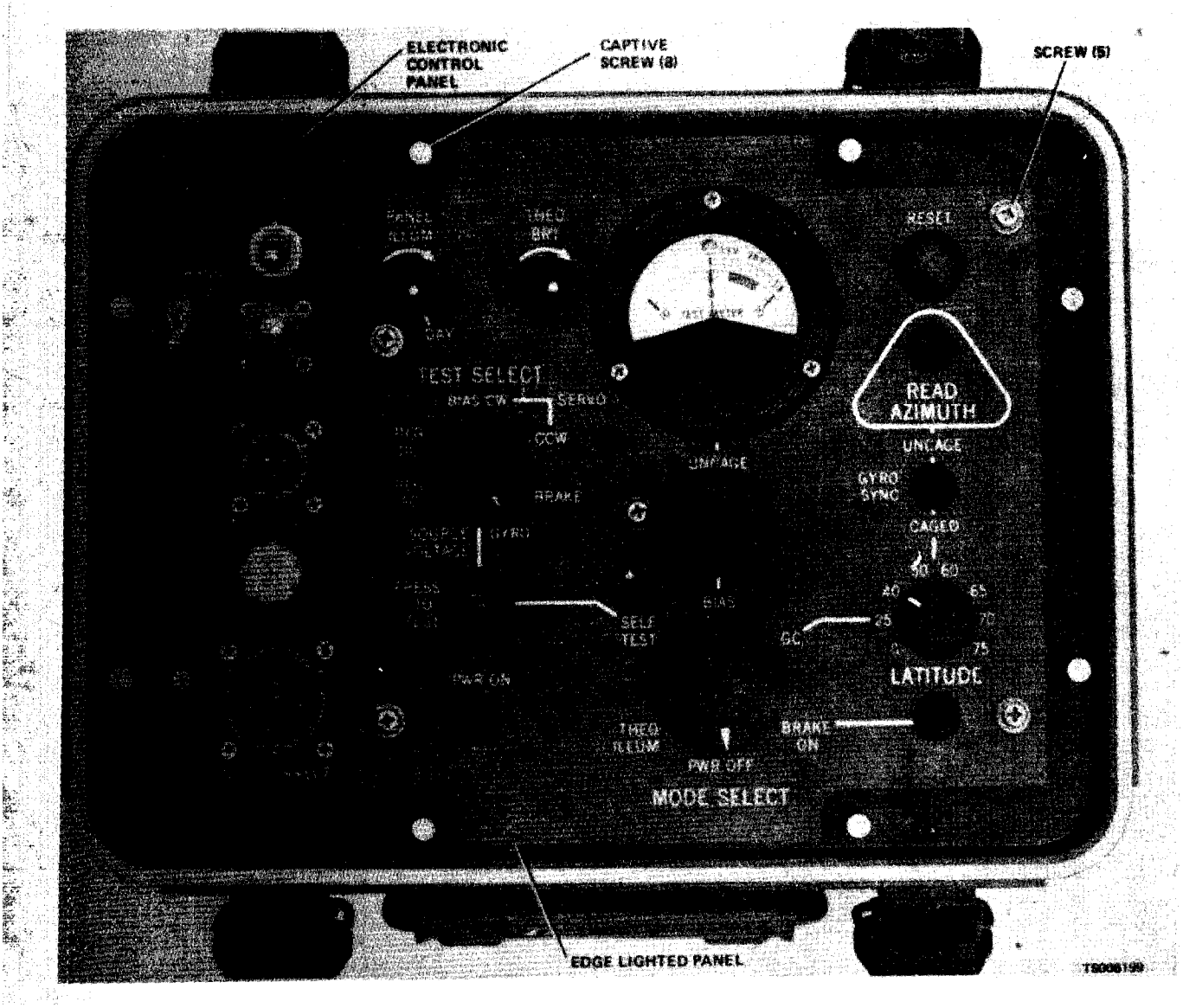


Figure 3-1. Electronic Control Panel.

3-3. Edge-lighted Panel (fig. 3-1)

a. Removal.

(1) Place MODE SELECT switch to GC position.

(2) Place TEST SELECT switch to SOURCE VOLTAGE position.

(3) Loosen MODE SELECT knob setscrews with 5/64-inch hex wrench and remove knob from switch shaft.

(4) Loosen TEST SELECT knob setscrews with 0.050-inch hex wrench and remove knob from switch shaft.

(5) Loosen BIAS knob setscrews with 5/64-inch hex wrench and remove knob from switch shaft.

(6) Unscrew BIAS control locking knob from BIAS control shaft and remove.

(7) Remove five screws securing edge-lighted panel to control panel.

(8) Using orangewood sticks, lift edge-lighted panel off control panel.

b. Installation.

(1) Place edge-lighted panel over connector and seat properly.

(2) Install five mounting screws to secure panel in place.

(3) Install BIAS control locking knob on BIAS switch shaft.

(4) Apply MIL-S-22473, Grade N, Form R primer to the setscrew and allow to air dry. Then apply MIL-S-46163 Grade N, Type II, to the first few threads of the setscrews.

(5) Install BIAS knob on shaft and secure by tightening setscrews.

(6) Install TEST SELECT knob on shaft pointer at SOURCE VOLTAGE position. Secure knob by tightening setscrews.

(7) Install MODE SELECT knob on shaft with pointer at GC position. Secure knob by tightening setscrews.

3-4. Printed Circuit Board (fig. 3-2)

a. Removal.

(1) Remove control unit panel assembly from case.

(2) Unfasten screws securing printed circuit board to mounting brackets and move board sideways to obtain access electrical connectors.

CAUTION

To avoid damaging the electrical connectors, alternately back off each of the two securing screws during disassembly.

(3) Disconnect two electrical connects (2A1J5 and 2A2J6) by unfastening two screws from each connector.

b. Installation.

(1) Position the printed circuit board to permit connection of the two connectors (2A2J5 and 2A2J6).

(2) Connect 2A2J5 with 2A1P5 and 2A2J6 with 2A1P6 and secure such with two screws.

(3) Secure the printed circuit board to the mounting brackets with ten screws.

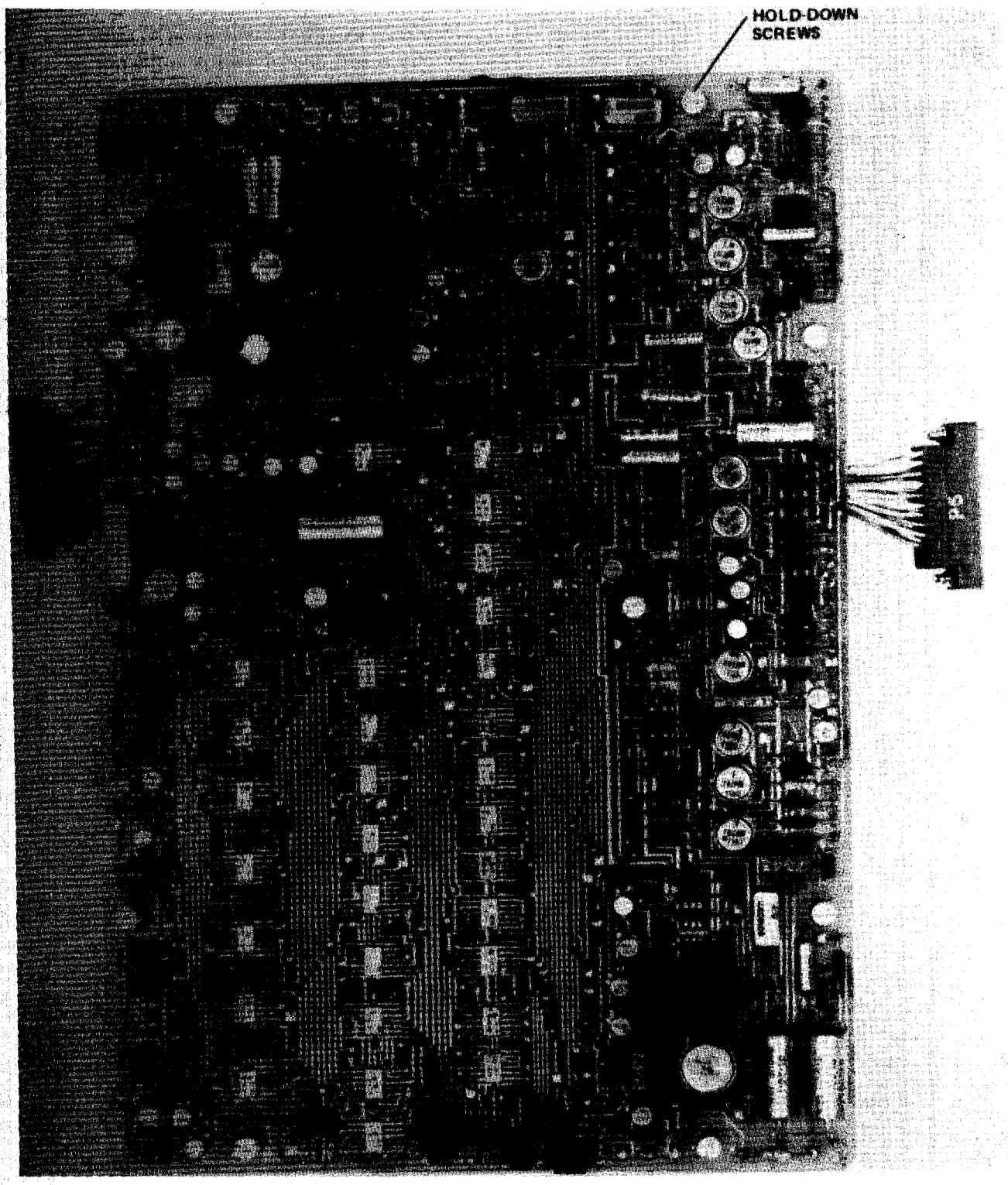


Figure 3-2. Printed Circuit Board.

(3) Deleted

3-5. Test Meter

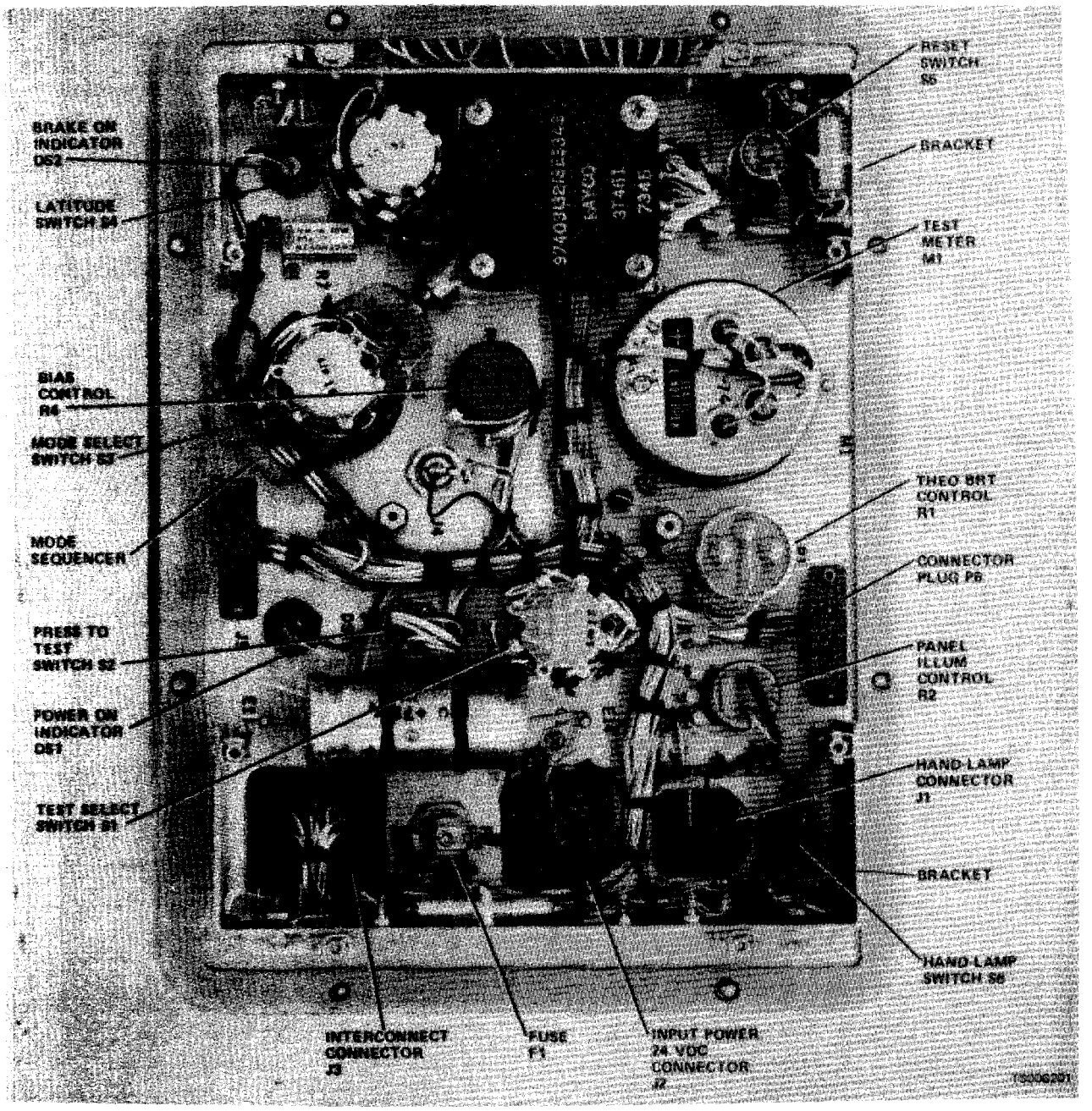
a. Removal.

(1) Remove printed circuit board (para 3-3) to obtain access to the test meter from the back of the control unit panel assembly (fig. 3-3).

(2) Undersolder the electrical leads to the meter and tag for identification.

(3) Remove the three screws, and nuts securing the meter.

(4) Remove the meter from the panel assembly.



TM 5-6675-250-34

Figure 3-3. Electronic Control Unit Panel Assembly.

b. Inspection.

(1) Visually inspect for cracked or badly scratched lens.

(2) Inspect indicating needle for corrosion.

(3) Inspect for legibility of meter face.

c. Reassembly.

(1) Install the meter in the panel assembly and secure with three screws and nuts.

(2) Solder the electrical leads to the meter in accordance with the identification tags on the wires (para 2-6).

3-6. Controls and Switches

Controls and switches replaceable at the direct and general support maintenance levels of HAND LAMP, PANEL ILLUM, BIAS CONTROL, THEO BRT, PRESS TO TEST, RESET, MODE SELECT, TEST SELECT, and LATITUDE. Do the following to remove and replace the switches or controls,

a. Removal.

(1) Remove the printed circuit board (para 3-4) to obtain access to the back of the control unit panel assembly (fig. 3-3).

(2) Unsolder the electrical leads from the defective control or switch and tag for identification.

(3) Remove knob or switch cover, edge lighted panel as applicable, to obtain access to the attaching parts.

(4) Remove the attaching parts securing the switch or control to the panel assembly.

(5) Remove the panel assembly.

b. Inspection.

(1) Visually inspect the exterior electrical connectors for evidence of burns or short circuits.

(2) Operate the switch or control to check for smooth action.

c. Installation.

(1) *position the* switch in the panel assembly.

(2) Install attaching parts to secure the switch in place.

(3) Install edge-lighted panel, knob, or switch cover, as applicable, over the shaft.

(4) Solder the electrical leads to the switch or control in accordance with the identification tags on the wires (para 2-10 b).

(5) Install the printed circuit board (para 3-4).

CHAPTER 4

REPAIR OF GYROSCOPIC REFERENCE UNIT

4-1. General

Repair and adjustment of the gyroscopic reference unit (GRU) consists of; replacing the theodolite, tripod assembly, gearbox assembly, tilt switch, caging link, time totalizing meter, uncage indicator light, upper housing cover seals, and adjustment of the caging mechanism and the upper band clamp assembly.

4-2. Theodolite (fig. 4-1)

a. Removal.

CAUTION

Ensure that the GRU is securely held when removing theodolite. Retain the GRU housing in the tripod assembly or a holding fixture when removing the theodolite.

(1) Remove three socket-head screws securing the theodolite.

(2) Raise the theodolite sufficiently to disconnect the electrical connector from 1A1J3 between the theodolite and GRU housing.

(3) Complete removal of the theodolite by raising clear of the GRU housing.

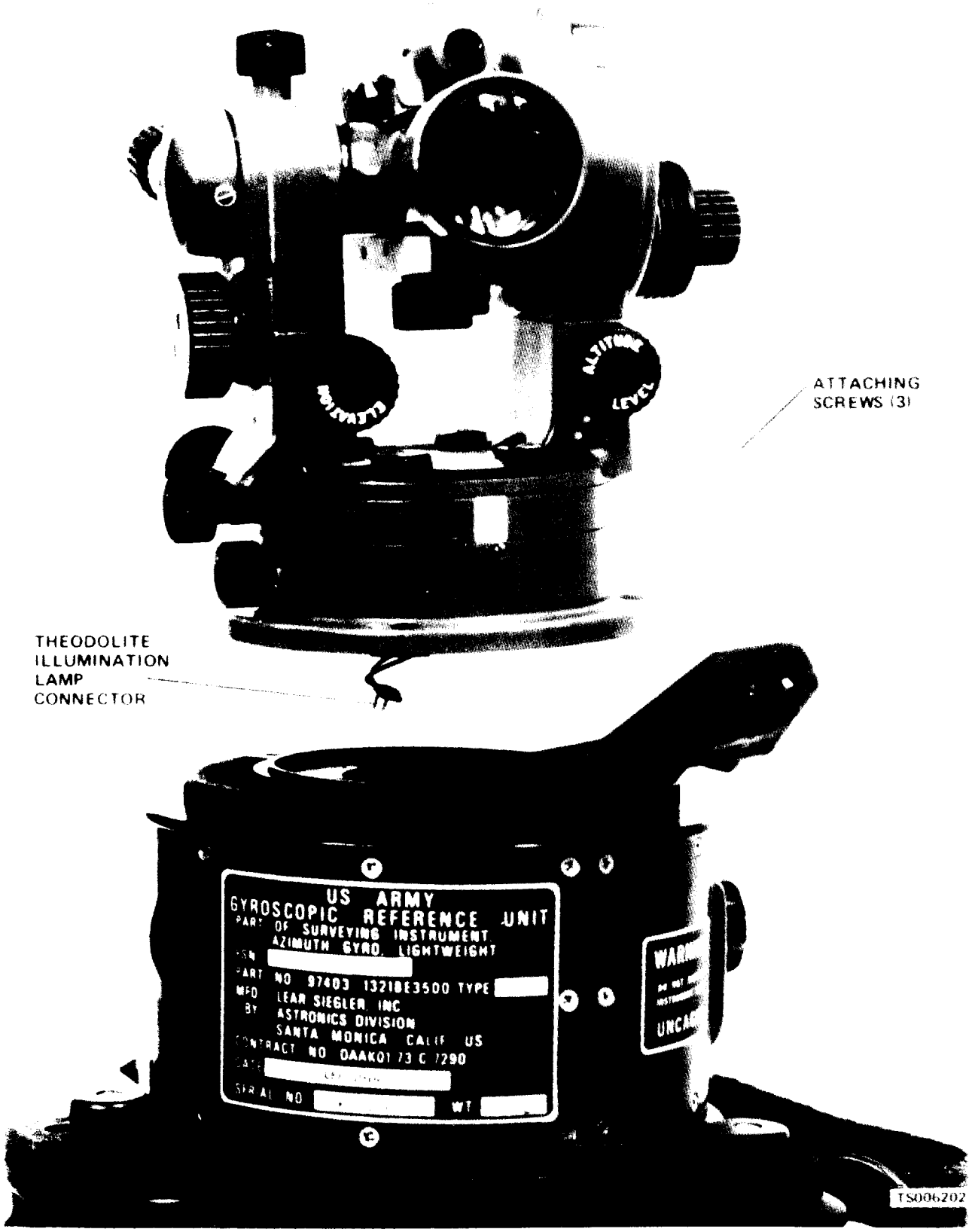


Figure 4-1. Theodolite Removal and Installation.

b. Installation.

(1) Place the theodolite over the GRU housing and connect the electrical connector to 1A1J3.

CAUTION

Ensure that electrical wire slack is placed adjacent to the inner circular surface of the mounting plate prior to lowering the theodolite.

(2) Lower the theodolite to position in place on the mounting plate. Position the white strip on the theodolite base so that it is adjacent to the yellow stripe on the theodolite mounting plate.

(3) Secure the theodolite by installing three sockethead screws. Using a torque wrench, progressively tighten the screws in 10-inch pound increments to 30-inch pounds torque.

4-3. Upper Housing Assembly

Upper housing assembly maintenance consists of service procedures listed in the MAC and removal and installation of the outer shield, described in the following paragraphs.

4-4. Outer Shield

a. Removal (fig. 4-2).

(1) Remove tripod assembly.

(2) Remove eight screws attaching the outer shield to the upper housing assembly.

(3) Remove the outer shield.

(4) Remove and discard the seal from the upper assembly.

(5) If defective, remove the bumper from the outer shield.

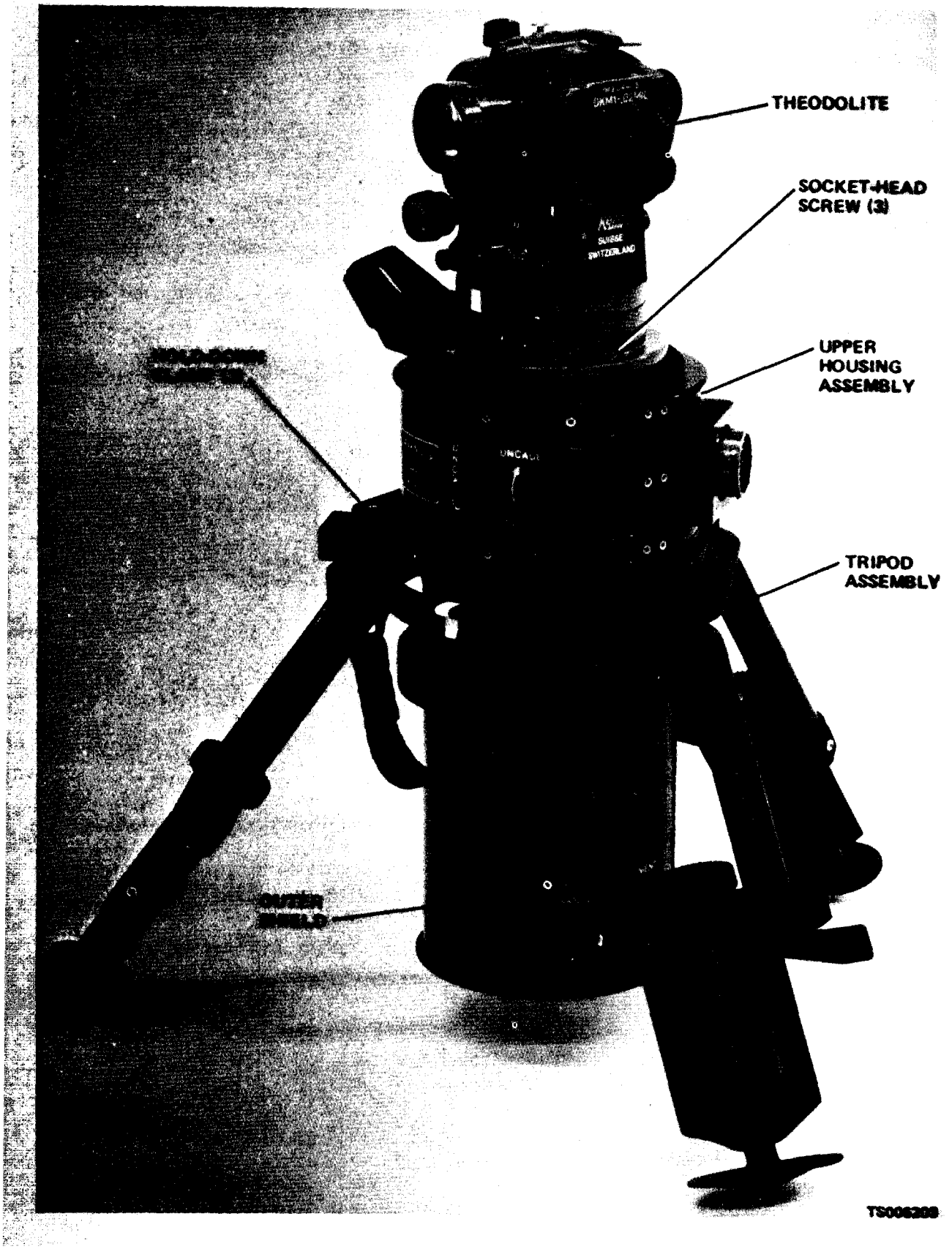


Figure 4-2. Gyroscopic reference unit-subassembly removal and installation.

b. Installation.

(1) Affix the tripod burnper to the outer shield with RTV sealant, Military Specification MIL-A-46106RTV1O3BLA.

(2) Place a new seal in the groove in the upper assembly.

(3) Mount the outer shield with the "DELICATE INSTRUMENT" placard, below CAGE/UNCAGE knob and attach it to the upper housing assembly with eight screws.

4-5. Gearbox Assembly (fig. 4-3)

a. *Removal.*

(1) Remove the main connector housing cover by removing ten screws.

(2) Remove the gearbox assembly access cover by removing ten screws.

(3) Remove the three gearbox assembly mounting screws.

(4) Remove the gearbox assembly through the access.

(5) Disconnect the gearbox assembly electrical cable by rotating the connector mounting screws in the counter clockwise direction. Alternate between the two screws every (2 to 3) turns. The connector will be damaged if this technique is not followed.

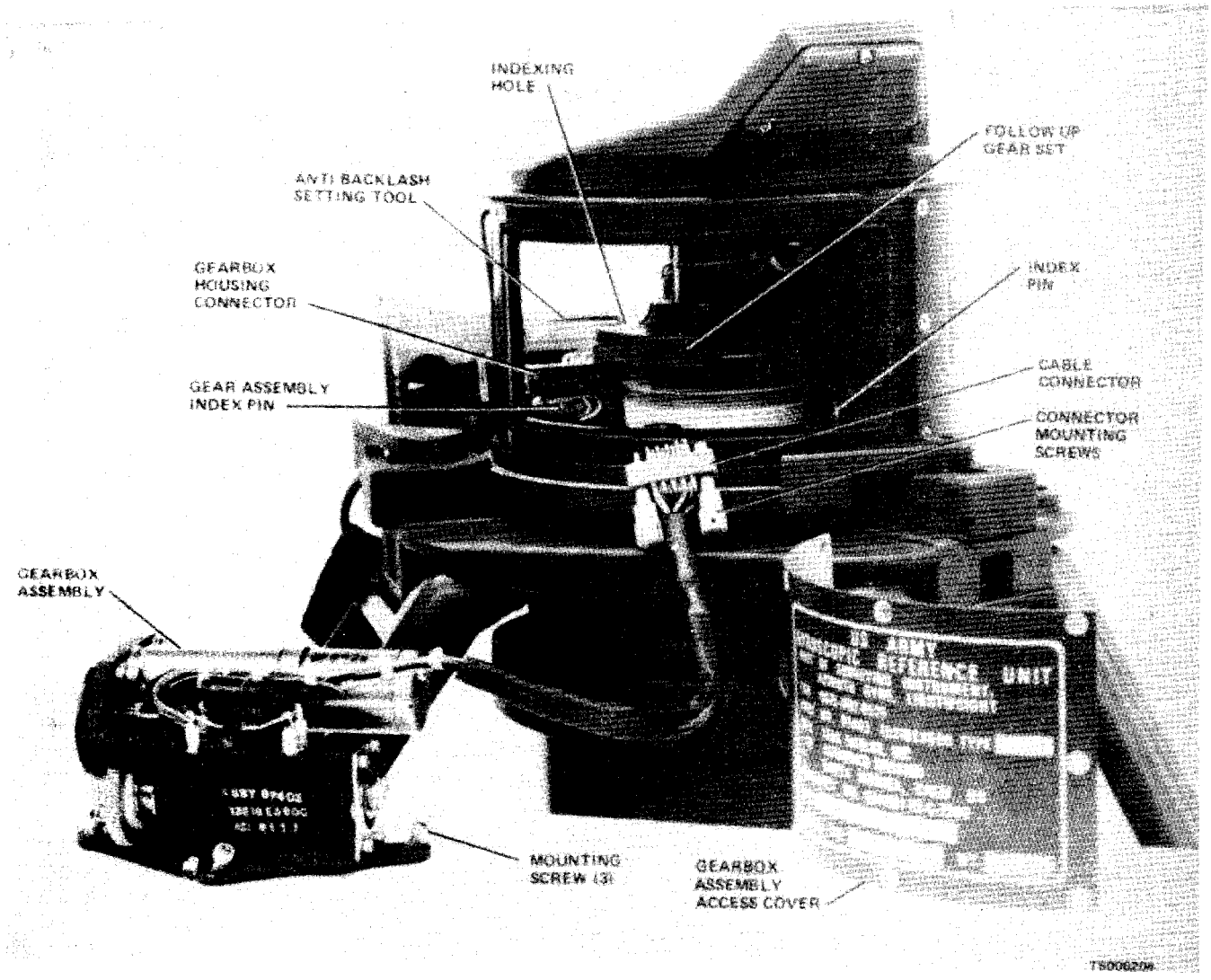


Figure 4-3. Gear box assembly-replacement.

b. Installation.

(1) Install the anti-backlash setting tool (fig. 4-3) *into* the index hole of the upper gear of the follow-up gear set, the handle of the tool towards main connector cover.

(2) Place the thumb on one end of the gear set and the index finger on the other and slide the two gear halves together so the ends are flush.

(3) Press and anti-backlash setting tools into the index of lower gear half and relax the thumb and index finger.

(4) Connect the gearbox assembly electrical cable connector to the female receptacle on the housing connector. Rotate the cable connector mounting screws in the clockwise direction, being careful to alternate between the two screws after (2 to 3) turns.

(5) Place the cable between the gearbox assembly mounting pads, so that it will be under the gearbox when the gearbox in in final position.

(6) Rotate the follow-up shaft to the extreme clockwise position by turning theodolite mounting plate.

(7) Install the gearbox assembly through the access and place it so that the mounting screw holes are lined up.

(8) Prepare the three gearbox assembly mounting screws (para 2-10a).

(9) Install the screws but do not tighten.

(10) Press the gearbox assembly against the index pins (fig. 4-3) on the inner mounting pads and tighten the mounting screws while maintaining the gearbox position.

(11) Remove the anti-backlash setting tool from the indexing hole,

(12) Prepare the ten (10) access cover mounting screws (para 2-10a).

(13) Install the gearbox assembly access cover.

(14) Install the main connector housing cover.

c. Test. Test gearbox by setting up the instruments as for operation and check for proper meter indication and follow-up shaft rotation in the servo positions during self test. Refer to TM5-6675-250-12.

4-6. Caging Mechanism.

a. Inspection.

(1) Remove the cage-uncage knobby loosening the two knob setscrews.

(2) Remove the caging mechanism cover by removing twelve (12) cover attachment screws.

(3) Lay the GRU on its side and remove the tripod by backing out the three tripod attachment screws and sliding back the tripod hold-down damps.

(4) Remove outer shield (para 4-4).

(5) Inspect for visual evidence of corrosion of other defects.

b. Adjust (fig. 4-4).

(1) To keep foreign particles from entering the inner parts of the instrument, place masking tape between the housing and the inner shield, except in the area of the caging link.

(2) Set the instrument on the work surfaces, resting on the inner shield and in the upright position. Be careful not to damage the shield as the shield material is very soft and sensitive to shock.

(3) Loosen the caging link jam nut (fig. 4-4).

(4) Install the cage-uncage knob temporarily, so that the caging mechanism may be actuated.

(5) Connect the GRU to the ECU and apply power in the BIAS mode.

(6) Rotate the cage-uncage knob until the caging cam arm passes over center of the caging link. At the point where arm crosses over center, observe that a small gap (approximately 1/64-inch) is present between the head of the shoulder screw and the upper clevis.

(7) If the gap described in step (6) is not correct, rotate the length adjuster counterclockwise to increase the gap and clockwise to decrease the gap.

(8) Continue rotating the cage-uncage knob until the caging arm guide pin (fig. 4-8) moves about 1/32-inch in the guide slot. The uncaged indicater should light at that point. If the indicator does not light at the proper point, refer to para 4-12, 4-13, and 4-14 for instructions on adjusting the caging control switches.

CAUTION

The pendulum is now uncaged, being supported by a metal band. Leave the instrument in the upright position and handle it gently while in this state.

(9) With the caging arm switch actuating pin in the proper position and the uncaged indicator lighted, rotate the cage-uncaged knob counterclockwise to cage the pendulum.

(10) Observe the caging cam arm to see whether or not it has gone over center. If it has gone over center rotate the length adjuster (fig. 4-4) counterclockwise until the caging arm does not go over center when repeating step (9).

(11) With the caging cam arm going over center when the pendulum is caged, rotate the length adjuster 1/16 turn clockwise and repeat the uncaging and caging process.

(12) Repeat (11) until the caging cam arm just goes over center, then rotate the length adjuster another 1/16 turn clockwise.

(13) Tighten the jam nut and repeat the un-

caging and caging process to see that the caging cam arm passes over center every time. Tightening the jam nut lengthens the caging link slightly, it may be found necessary to loosen the jam nut and make further clockwise adjustment of the length adjuster. Re-tighten the jam nut.

(14) Repeat the uncaging and caging process at least 10 times after final adjustment to be sure of proper operation.

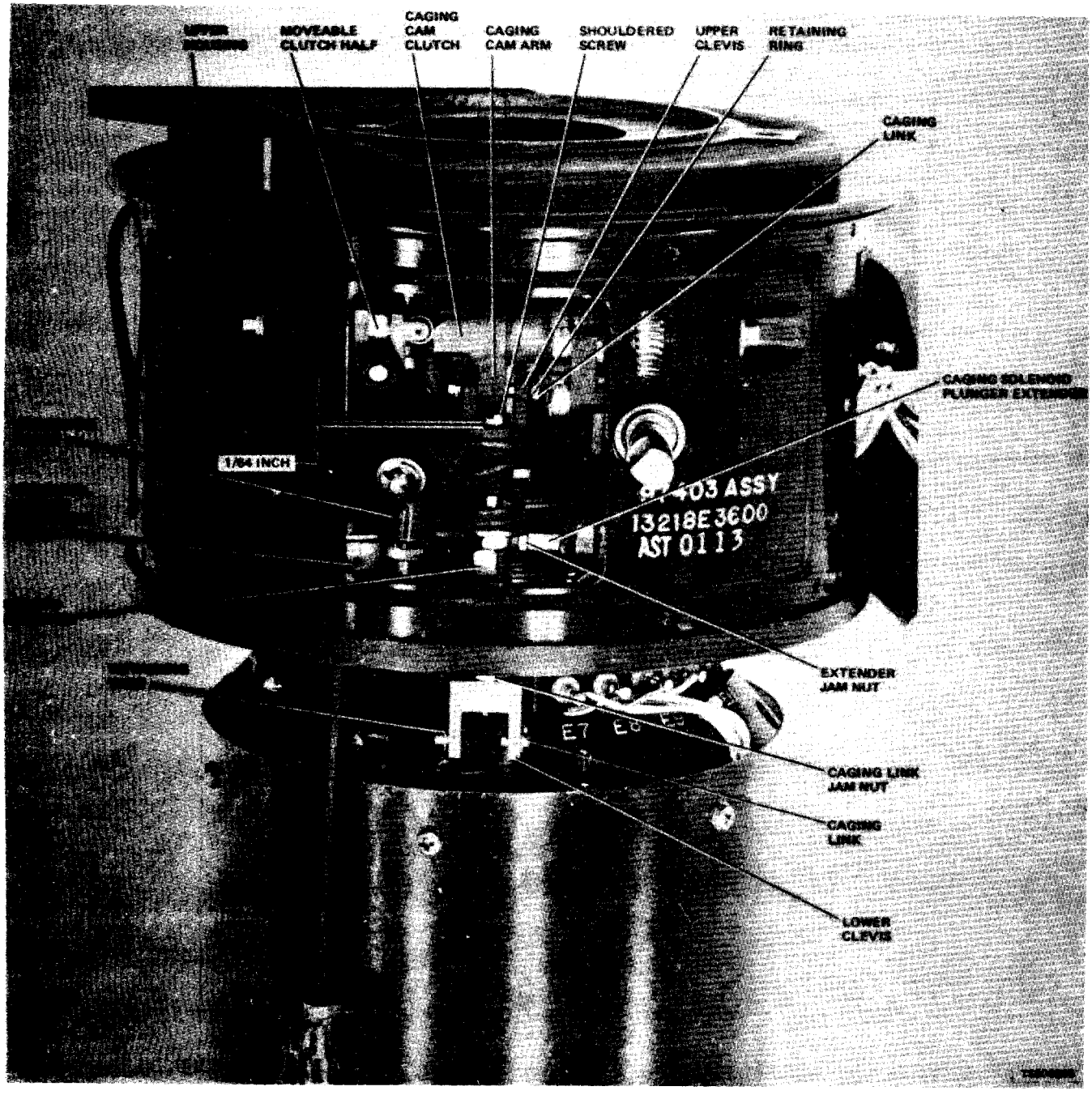


Figure 4-4. Caging mechanism adjustment.

c. Reassembly.

(1) Prepare the outer shield mounting screws per paragraph 2-10a, install the seal, and mount the outer shield with the "DELICATE INSTRUMENT" marking below the cage-uncage knob.

(2) Attach the tripod to the housing.

(3) Remove the cage-uncage knob and install

the caging mechanism cover with twelve (12) mounting screws prepared as in (para 2-10a).

(4) Install the cage-uncage knob.

(5) Set the instrument, refer to TM5-6675-250-12 and see that the pendulum can be biased repeatably. This test will verify that the pendulum is free.

4-7. Upper Band Clamp Adjustment (fig. 4-5).

a. Adjust. Adjustment of the upper band clamp is necessary when the bias control reaches its limit in positioning the test meter needle to (O) during the biasing operation. The adjustment procedure shall be as follows:

(1) Set the instrument up as for operation, refer to TM5-6675-250-12, being sure that the GRU is level.

(2) Remove the theodolite (para 4-2).

CAUTION

Store the theodolite on a soft clean surface so as not to damage the theodolite mounting pads.

(3) Install the upper band clamp adjusting tool, using the two- 4-40 by 3/8-inch attachment screws.

(4) Loosen the bias control lock and rotate the bias control to the extreme clockwise position, then rotate the bias control 5 turns counterclockwise. This sets the bias control at mid range and the pendulum biasing current to (O).

(5) Loosen the four upper band clamp mounting screws enough so that the clamp can be rotated with the adjustment tool.

(6) Place the TEST SELECT switch to the BIAS position.

(7) Energize the system in the BIAS mode and uncage the pendulum.

(8) Depress PRESS TEST and observe that the TEST METER pointer comes to rest after swinging left and right several times.

(9) While depressing PRESS TO TEST switch, move the meter pointer to zero by rotating the upper band clamp. Moving the meter pointer to zero from the left side of the meter requires clockwise rotation of the upper band clamp, and moving the pointer towards (O) from the right side of the meter requires rotating the upper band clamp clockwise. Moving the upper band clamp is best accomplished by tapping the end of the setting tool with a screwdriver handle or similar object.

(10) When the meter pointer is on (O), release the PRESS TO TEST switch.

(11) With the PRESS TO TEST switch released, the gain to the meter is increased and further adjustment will probably be necessary.

(12) Continue to tap the setting tool to rotate the upper band clamp in small increments until the meter pointer shows on scale. There is no reason to adjust for a perfect (O) adjustment; on scale is adequate.

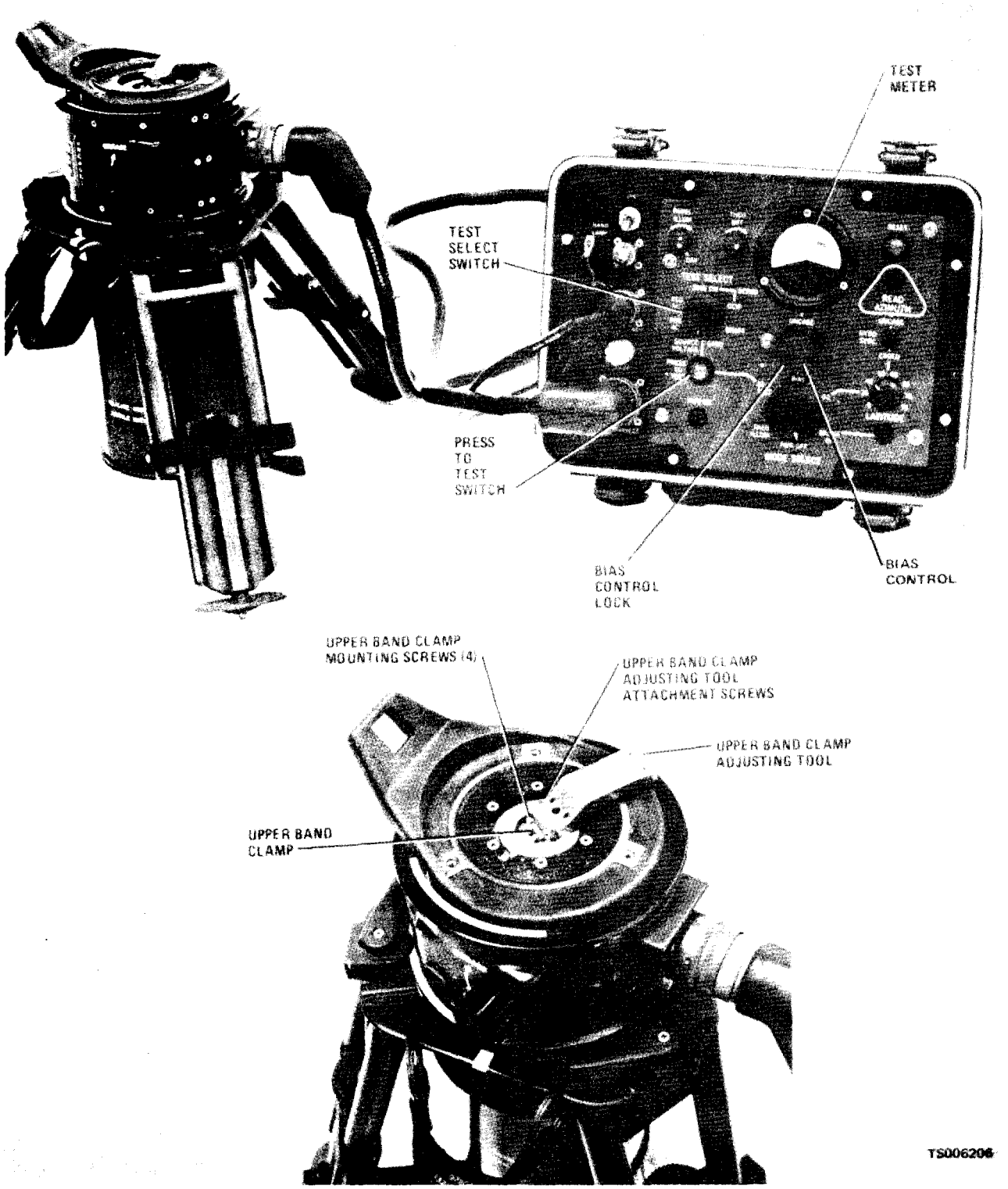


Figure 4-5. Upper band clamp adjustment.

(13) Tighten the four upper band clamp mounting screws and remove the setting tool.

(14) With the bias control, set the test meter pointer to (O), then cage and uncage several times while observing the bias stability. The test meter pointer shall not drift more than half way through the yellow band.

(15) Install the theodolite per (para 4-2b).

4-8. Tilt Switch Assembly (fig. 4-6)

a. Removal.

(1) Remove the gearbox assembly, refer to (para 4-5a).

(2) Unsolder and disconnect the lead wires from the tilt switch terminals.

(3) Remove the two tilt switch assembly attachment screws and remove the assembly from the housing.

b. Inspection.

(1) Check for bent or missing pins.

(2) Visually inspect for burned surfaces.

(3) Check for shorts between the pins and housing.

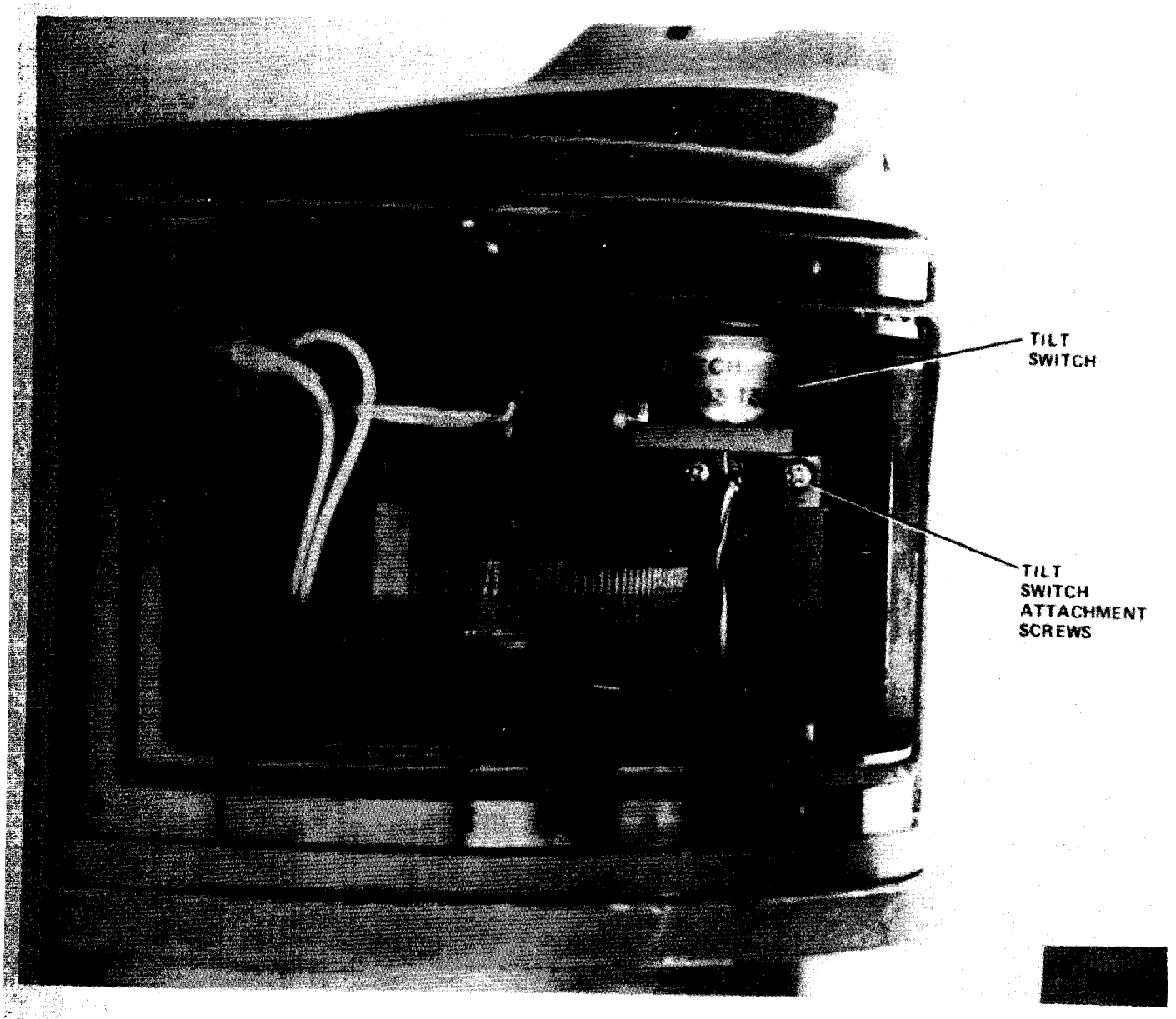


Figure 4-6. Tilt switch assembly.

c. Installation.

(1) Prepare the two attachment screws per (para 2-10a).

(2) Place the tilt switch assembly in the housing and secure with the two attachment screws.

(3) Connect and solder the leads.

(4) Replace the gearbox assembly and cover, refefer to (para 4-5b).

4-9. Time Totalizing Meter (fig 4-7)

a. *Removal.*

(1) Remove ten attachment screws and remove the main connector housing cover containing the time totalizing meter from the housing. The cover shall remain connected to the housing by the leads to 1A1J1.

(2) Unsolder and remove the wires from the time totalizing meter.

(3) Cut the lacing cord holding the lead wires to the body of the meter.

(4) Remove the two self locking nuts and two screws securing the time totalizing meter to the housing cover.

(5) Remove the time totalizing meter and gasket from the cover.

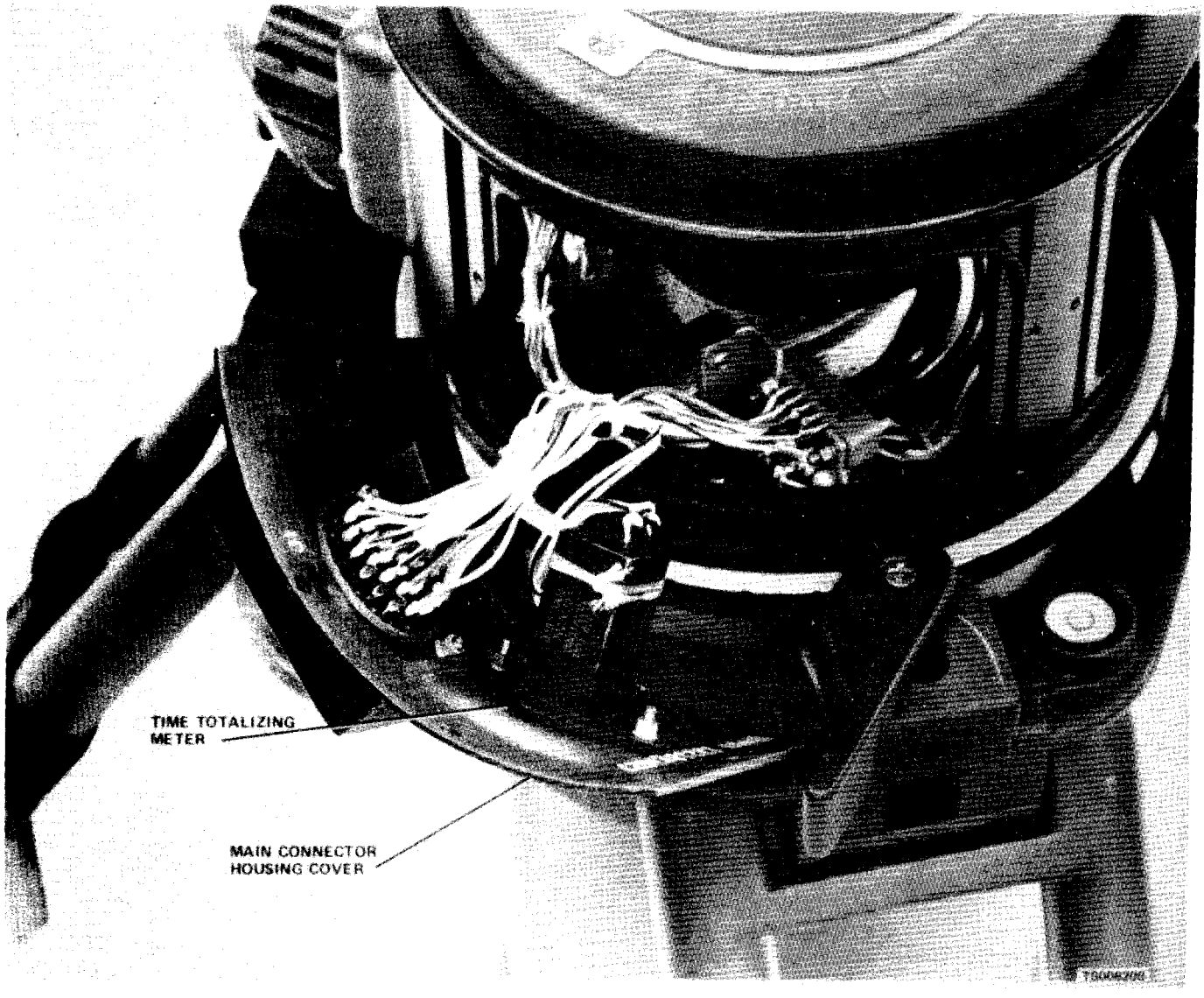


Figure 4-7. Time totalizing meter removal and installation.

b. Installation.

(1) Mount the replacement time totalizing meter to the main connector housing cover, using two nuts and two screws. Make sure that the rubber gasket is in place between the cover and the meter.

(2) Connect and solder meter wires. The wire may be reversed from the original configuration as there is no polarity involved.

(3) Lace the lead wires to the body of the meter.

(4) Prepare ten cover attachment screws (para 2-10a).

(5) Mount the housing cover to the housing using the ten attachment screws.

4-10. Caging Link (fig. 4-4)

a. *Removal.*

(1) Remove the caging mechanism cover and outer shield by following the instructions in paragraph 4-6a, steps (1) through (4), and set up the instrument per paragraph 4-6b, steps (1) and (2).

(2) Engage the caging clutch by inserting an orangewood stick, or similar tool, between the upper housing and the clutch, half (fig. 4-8).

(3) Rotate the GAGE/UNCAGE knob clockwise until the gap between the shouldered screw and the clevis is zero.

(4) Remove retaining rings from the pins attaching each end of the caging link.

(5) Remove the pins and separate the caging link from the caging cam and caging arm.

b. Inspection. Visually inspect for deformed, worn or otherwise defective parts.

c. Installation.

(1) Attach the upper clevis of the caging link to the caging cam with one pin and two retaining rings.

(2) Attach the lower clevis to the caging arm with one pin and two retaining rings.

(3) Remove the clutch engaging tool, installed in paragraph 4-10a (2).

(4) Do not install caging mechanism cover lower shield at this time.

d. Adjustment. Adjust the caging link per (para 4-6b).

e. Install caging mechanism cover and outer shield, per paragraph 4-6c.

4-11. Caging Solenoid

a. Inspection.

(1) Remove the theodolite per (para 4-2a).

(2) Remove the cage-uncage knob (para 4-6a).

(3) Remove all of the GRU housing covers by removing attachment screws.

(4) Remove the gearbox assembly (para 4-5a).

(5) Remove the outer shield (pars 4-4).

(6) Install to cage-uncage knob.

(7) Remove the caging link (pars 4-10).

(8) Visually inspect for corrosion and other evidence of defects.

b. Adjust (fig. 4-4).

(1) Manually advance the solenoid plunger out of the solenoid until it stops.

(2) Adjust the plunger extender so that the movable clutch half enters the caging cam clutch teeth and bottoms out, without the clutch actuator arm moving in relation to the clutch actuator, i.e., the clutch actuator arm and the clutch actuator shall not deflect at the pivot point.

(3) Loosen switch mounting black screws. Position the solenoid control switch mounting block so that the switch is actuated 0.010 to 0.020 inch from full extension of the solenoid plunger.

(4) Tighten the switch mounting block screws.

(5) Connect the GRU to the ECU, using the interconnect breakout box.

(6) Connect a TS-352/U multimeter or equivalent in the 2-5 amp range, across jacks N of the breakout box and open switch N.

(7) Energize the system in the BIAS mode and observe the current meter. If the solenoid switch is adjusted properly, the current should be 0.05 amp. If the solenoid draws 1.5 amps, the switch must be moved closer to the solenoid. Should the solenoid chatter and draw high current, then the switch must be moved away from the solenoid.

(8) Switch from BIAS to SELF-TEST several times to ensure proper operation.

c. Test.

(1) Check to see that the solenoid plunger is running free. It is sometimes necessary to loosen the solenoid mounting screws and re-position the solenoid to attain a free running condition.

(2) Install the caging link (para 4-10c).

(3) Install the outer shield (para 4-4d).

(4) Install the gear box assembly and housing covers (para 4-16).

(5) Install cage-uncage knob (para 4-6c).

(6) Operate the unit to test for correct adjustment.

4-12. Solenoid Control Switch

a. Inspect.

(1) Remove the cage-uncage knob and the caging mechanism housing cover (pars 4-6a).

(2) Remove the outer shield (para 4-4a).

(3) Inspect for visual evidence of damage or corrosion.

b. Adjust.

(1) Refer to (para 4-11b) and adjust the solenoid control switch.

(2) Install the outer shield (para 4-4a).

(3) Install the caging mechanism cover and cage-uncage knob (para 4-6c).

4-13. Caging Cam Switch

a. Inspection.

(1) Remove cage-uncage knob and the caging mechanism covers.

(2) Visually inspect parts for darnage or corrosion.

b. Adjust (fig. 4-8).

(1) With the caging link adjusted (Pam 4-6b) set up the system for operation and energize the caging mechanism by placing the MODE SELECT SWITCH in the BIAS mode. Manually hold the clutch in the engaged position so that it is not released while adjusting the caging arm switch.

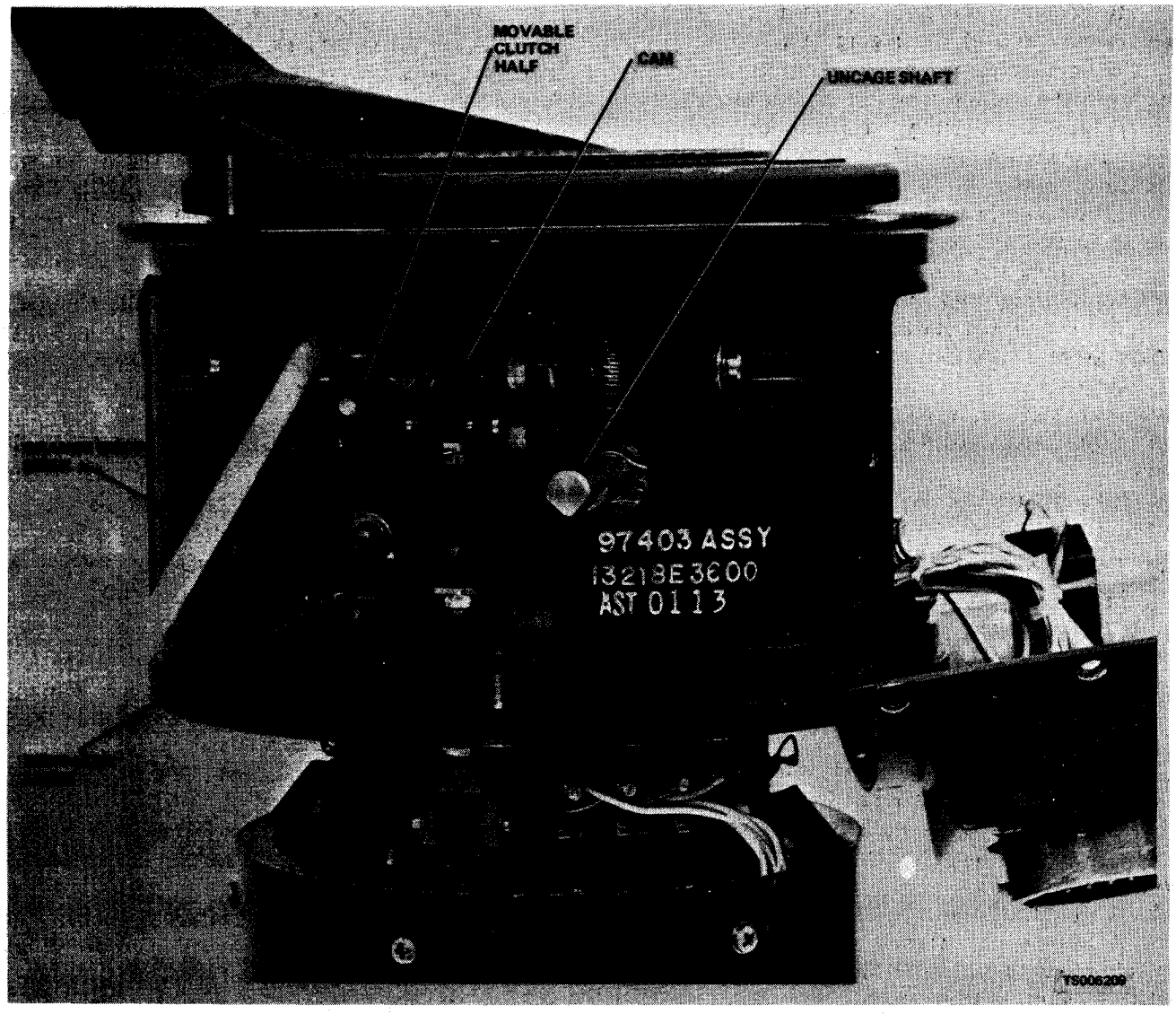


Figure 4-8. Caging cam switch adjustment (sheet 1 of 2).

(2) Loosen the caging cam switch mounting screws. Adjust the caging cam switch so that the actuator roller follows the depression on the cam and is actuated when the caging arm guide pin is 1/32-inch from the top of its guide slot (fig 4-9).

(3) The caging cam switch shall be adjusted so that it is actuated when the actuator roller is well **into the cam detent, and not at the start of the detent.**

(4) Tighten the caging cam switch mounting screws.

(5) Replace the housing covers (para 4-16).

(6) Install cage-uncage knob.

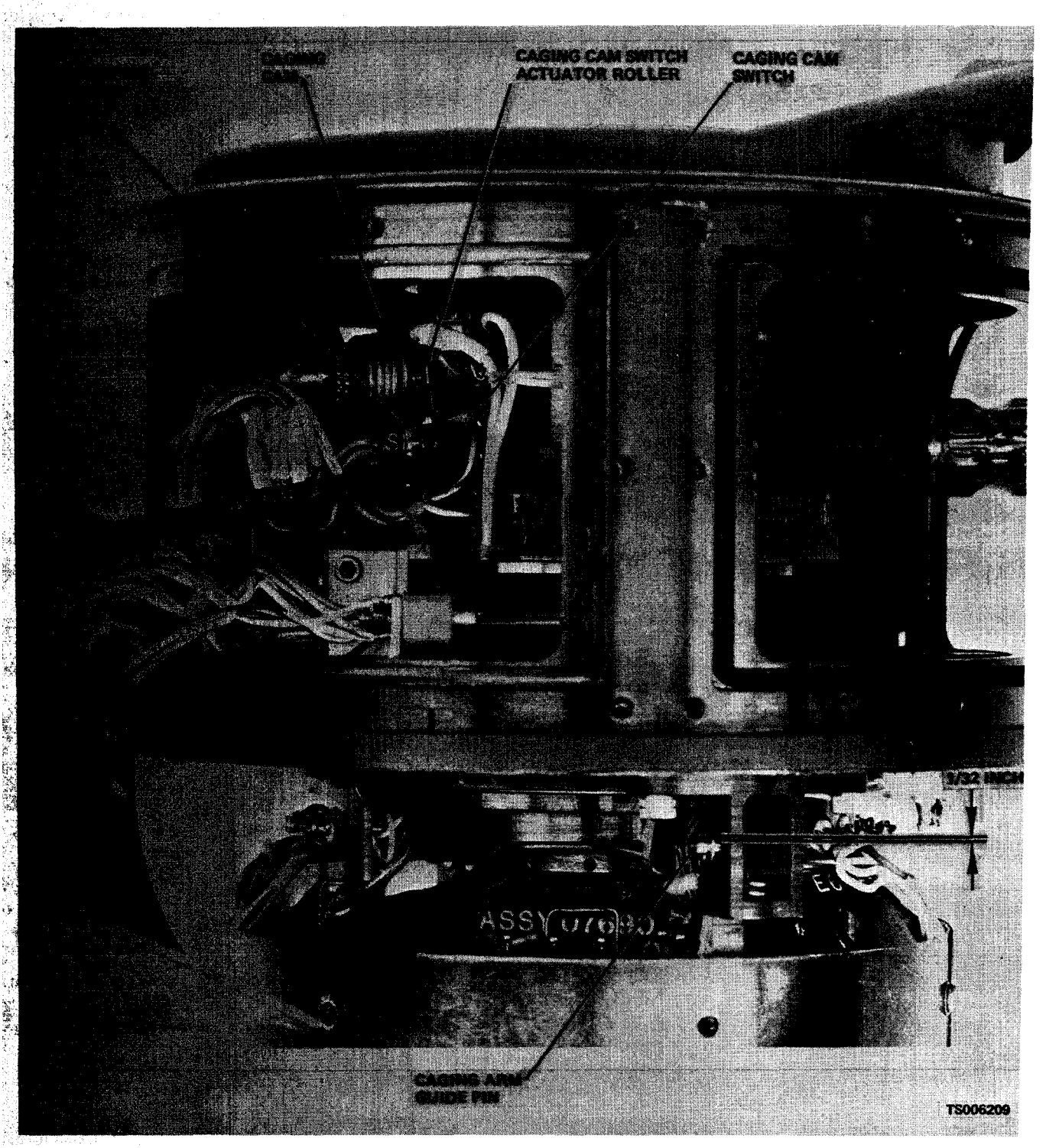


Figure 4-8. Caging cam *switch adjustment (sheet 2 of 2).*

4-14. Caging Arm Switch (fig. 4-9)

a. Inspection.

(1) Remove the outer shield (para 4-4).

(2) Visually inspect for damage or corrosion.

b. Adjust.

(1) Set-up the GRU in the operating position while resting on the inner shield.

(2) Connect the GRU to the ECU and actuate the caging mechanism in the BIAS mode.

(3) Loosen the caging arm switch mounting screws.

(4) The caging arm switch should be adjusted so that it is actuated when the guide pin is in approximately the center of travel in the guide slot when uncaging the pendulum.

(5) When the caging arm switch is actuated the pendulum shall be automatically caged, due to removal of power to the caging solenoid.

(6) When correct adjustment is made, tighten the switch mounting screws.

(7) Install the outer shield (para 4-4d).

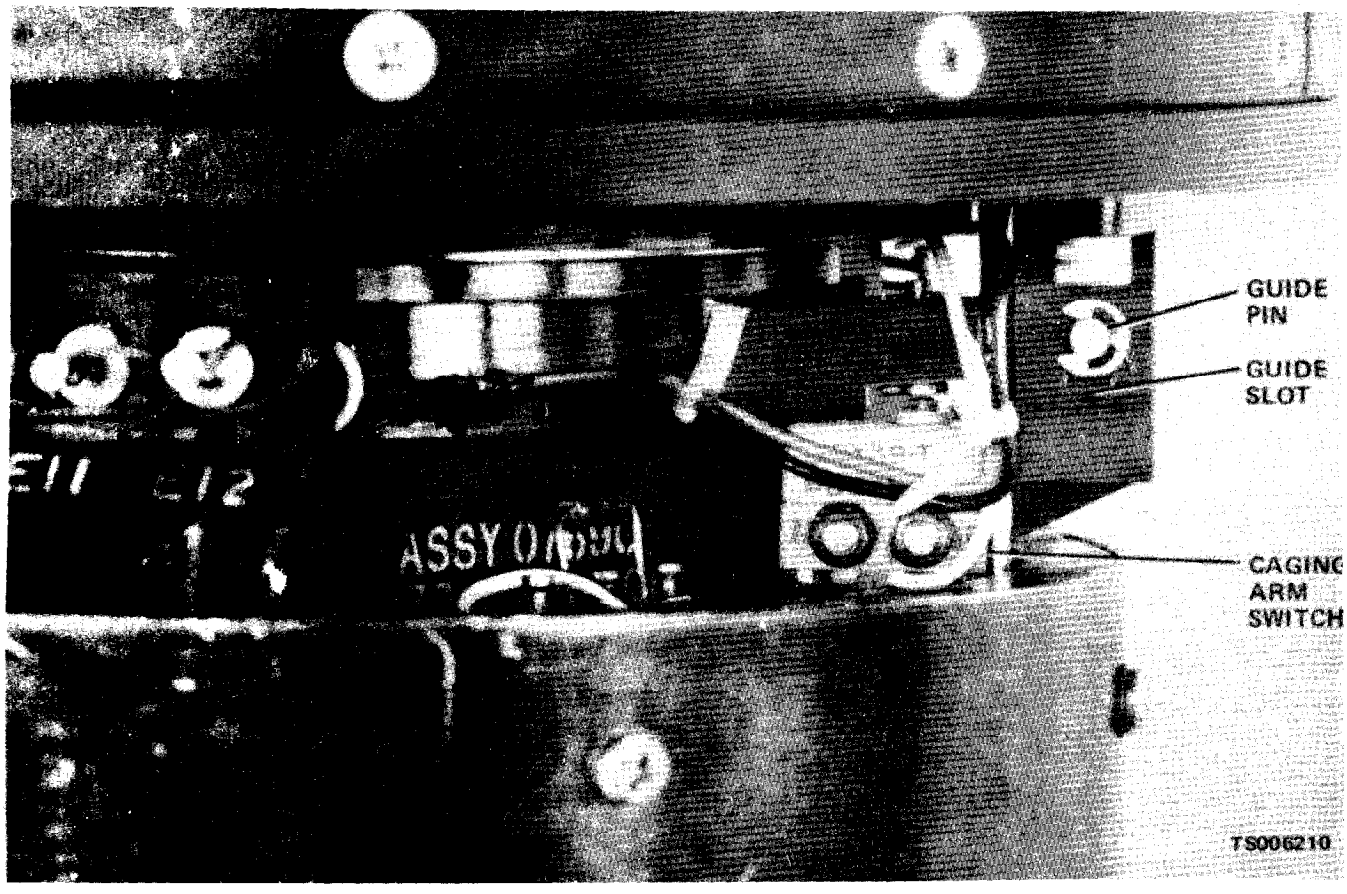


Figure 4-9. Caging arm switch adjustment.

4-15. Uncaged Indicator Light (fig. 4-8)

a. Removal.

(1) Remove the cage-uncage knob and housing cover per (para 4-6).

(2) Unsolder and disconnect the lamp lead wires from terminal points E17 and E18.

(3) Remove the indicator light mounting nut and remove the indicator light from the bracket.

b. Installation.

(1) Install the replacement indicator into the bracket.

(2) Prepare the mounting nut (para 2-10a).

(3) Attach the indicator light to the bracket with the mounting nut.

(4) Connect and solder the lamp lead wires to terminals E17 and E18.

(5) Apply MIL-S-22473, Grade N, Form R primer to the screw threads and allow to air dry. Apply locking sealant, MIL-S-46163, Grade N, Type II, to the first few threads of the screws.

(6) Position the cover and attach with screws.

(7) Install the setscrews partially into the knob. Place the knob onto the switch shaft, allowing sufficient space between the knob and GRU housing to prevent binding. Tighten the two setscrews.

4-16. Upper Housing Seals

a. *Removal.*

(1) Remove cage-uncage knob (para 4-6).

(2) Remove the applicable cover over the defective seal.

(3) Remove the defective seal and its adhesive.

CAUTION

Take care not to damage the finish on the housing.

(4) Using a blunt-edged instrument, such as an orangewood stick, scrape adhesive residue from the seal cavity.

b. Installation.

(1) Cut a piece of seal material to the length needed to run the entire length of the seal cavity in the housing.

(2) Clean the gasket and seal cavity and trichloroethane, Federal Specification, O-T-236, or equivalent solvent.

(3) Apply a continuous thin layer of RTV sealant, Military Specification MIL-A-46106RTV103BLA, in the seal cavity.

(4) Install the seal so that the splice joint is in the lower groove.

(5) Press the gasket in place and wipe off any excess adhesive.

(6) Prepare attaching screws per (para 2-10a).

(7) Attach the cover to the upper housing.

CHAPTER 5

REPAIR OF AC-DC CONVERTER

5-1. General

Repair of the ac-dc converter at the direct and general support maintenance levels consists of replacing defective components.

Perform resistance checks specified in table 5-1 to isolate defective components.

Table 5-1. AC-DC Converter Resistance Check

Component	Points of Measurement	Required Indication
	NOTE Perform resistance checks with an ohmmeter and with power removed from the converter.	
Transformer T1	T1-1 to T1-2	Less than 1 ohm
	T1-3 to T1-4	Less than 1 ohm
	T1-5 to T1-4	Less than 1 ohm
Resistor R1	E3 to E4	10K ohms ± 10%
Diode CR1 and CR2	Meter pos lead to diode pos term; meter neg lead to bus bar.	Approximately 50 ohms with meter on Xl scale.
Capacitor C1	(C1 checked in ripple voltage test, para 5-4c)	
Filter FL1	T1-1 to T1-3	Less than 1 ohm
	T1-2 to T1-5	Less than 1 ohm

5-2. Disassembly (fig. 5-1)

a. Removal.

(1) Remove six screws and lift the cover from the case.

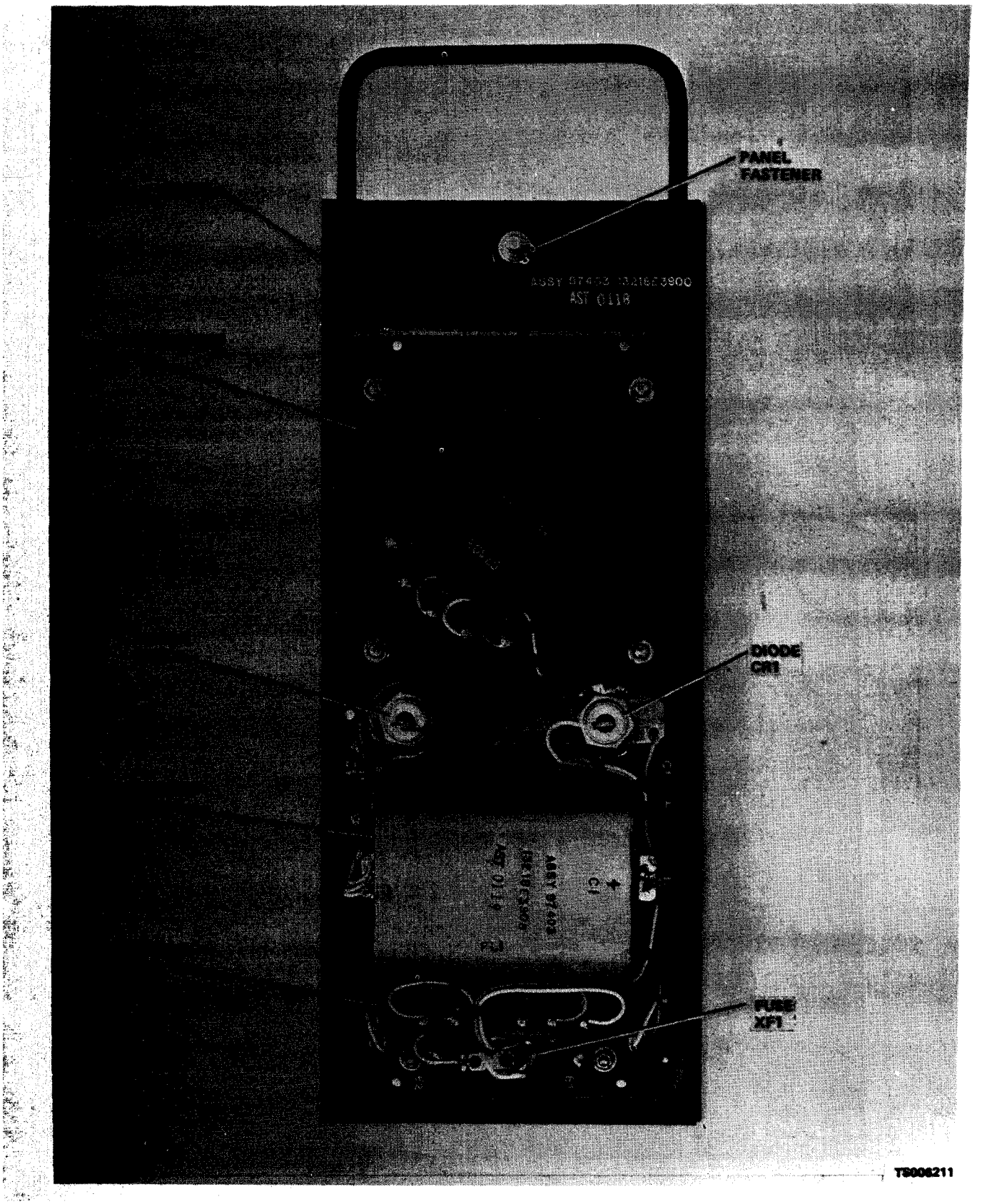


Figure 5-1. AC-DC Converter - Component Removal and Installation

b. Cleaning.

(1) Use low pressure, 5 to 10 psi, compressed air to clean the converter interior.

(2) Wipe the case with a lint free cloth moistened with trichloroethane, Federal Specification, O-T-236, or equivalent solvent.

c. *Inspection.*

(1) Visually inspect the components for evidence of burns and arcing.

(2) Inspect connectors for bent pins and evidence of burns.

(3) Test output voltage.

(a) Connect a 20-ohm 100 watt load resistor across the converter DC OUTPUT receptacle 3A1J2, pins A and C. (fig. 5-2).

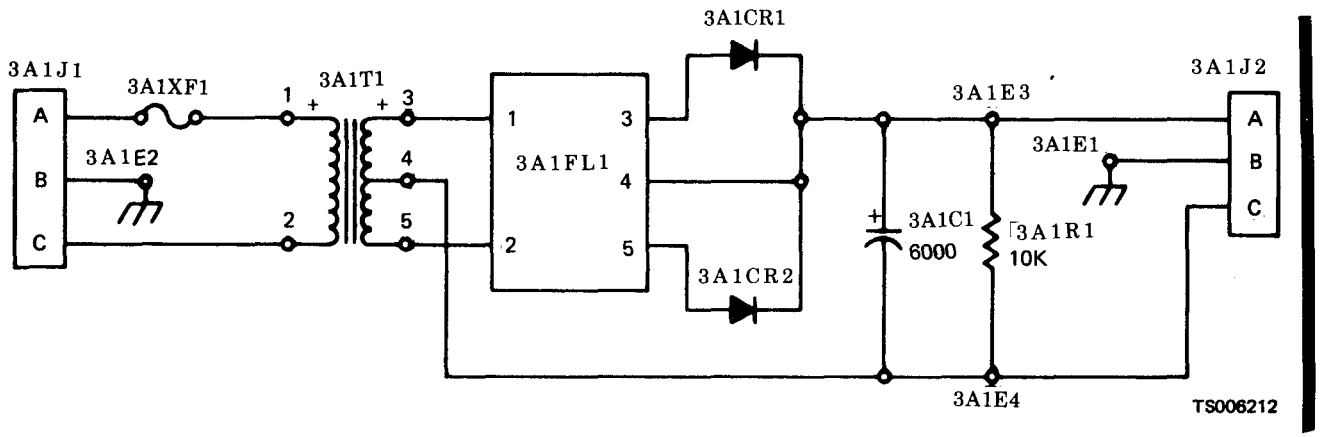


Figure 5-2. AC-DC Converter Schematic Diagram.

(b) Through the AC INPUT receptacle, connect the converter to a 115 ± Vac, 60-400 Hz power source.

(c) Using a multirneter, check the output voltage at the DC OUTPUT receptacle.

(d) Verify that the output voltage is 26 to 30 Vdc.

(e) Verify that the output ripple is 0.25 to 0.40 Vrms.

(4) Test voltage regulation of loads by checking the converter output across pins A and C of receptacle 3A1J2 with no load, a 40-ohm, 50 watt, load, and a 10-ohm, 100 watt, load. Verify the voltage output is as follows:

Load	*Input*	*output (±10%)*
No load	115 Vac, *60* Hz	33.5 Vdc
No load	115 Vac, 400 Hz	32.5 Vdc
40 ohm	115 Vac, 60 Hz	29.7 Vdc
40 ohm	115 Vac, 400 Hz	28.9 Vdc
10 ohm	115 Vac, 60 Hz	24.1 Vdc
10 ohm	115 Vac, 400 Hz	23.2 Vdc

5-3. Repair (fig. 5-1)

a. Transformer and Capacitor.

(1) Unsolder electrical leads and tag for identification.

(2) Remove attaching parts securing component to converter (four places).

(3) Position new component in place and secure with attaching parts.

(4) Solder electrical leads to component in accordance with identifying tags.

b. Resistor.

(1) Unsolder electrical leads from defective resistor and tag for identification.

(2) Position new resistor in place and solder electrical leads in accordance with identifying tags.

c. *Diodes.*

(1) Unsolder electrical lead from top of diode.

(2) Remove nut and washer securing diode to bracket.

(3) Position new diode in place. The insulated washers must be in place to insure that the diode is properly insulated. Secure with nut and washers.

(4) Solder electrical lead to terminal of diode.

d. Filter.

(1) Unsolder electrical leads from defective filter and tag for identification.

(2) Remove attaching parts securing filter to housing and converter (two places).

(3) Position new filter in place and secure with attaching parts.

(4) Solder electrical leads to filter.

5-4. Reassembly

Position the cover onto the housing and secure with six screws.

APPENDIX A

REFERENCES

A-1. Maintenance

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8 and 9) Supply Bulletins, Lubrication Orders.
DA Pam 310-7	Index to Modification Work Orders.
TM 38-750	The Army's Maintenance Management System.
TM 11-6140-203-15-3	Operator, Organizational DS, GS, and Depot Maintenance Manual including Repair Parts and Special Tools Lists. Nonaircraft Nickel-Cadmium Batteries.

A-2. Operating Instructions

TM 5-6675-250-12	Operator and Organizational Maintenance Manual for Survey Instrument: Azimuth, Gyro, Lightweight (SIAGL).

A-3. Shipment and Storage

TM 740-90-1	Administration Storage of Equipment

A-4. Destruction to Prevent Enemy Use

TM 750-244-3	Procedures of Destruction of Equipment to Prevent Enemy Use.

INDEX

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:

PAUL T. SMITH
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block no. 175), Direct/General Support requirements for Surveying Equipment.

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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
CoA, 3d ENGINEER BN
FT. LEONARD WOOD MO 63108

DATE: 16 DEC 74

PUBLICATION NUMBER	DATE	TITLE
TM5-6115-200-20 AND P	1 APR 72	GENERATOR SET 10 KW NSN 6115-00-231-7296

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER: JOHN DOE, PFC (268) 317-7111

SIGN HERE: John Doe

DA FORM 1 AUG 74 2028-2 (TEST)

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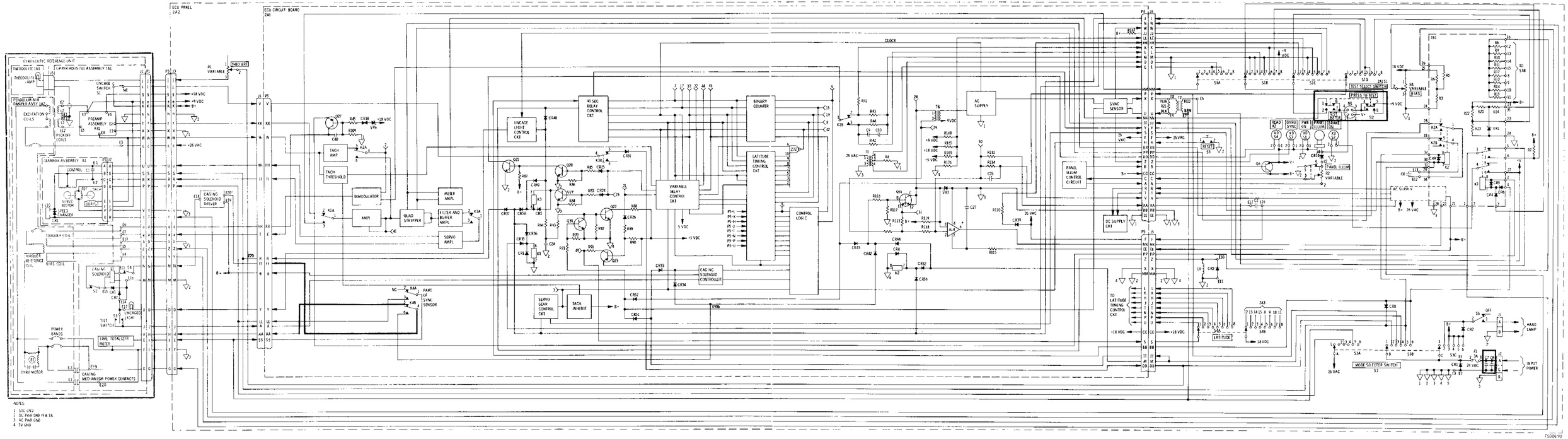


NOTES:
1. SIG GND
2. DC PWR GND (9 & 18)
3. AC PWR GND
4. 5V GND

Figure 1-6. Functional block diagram.

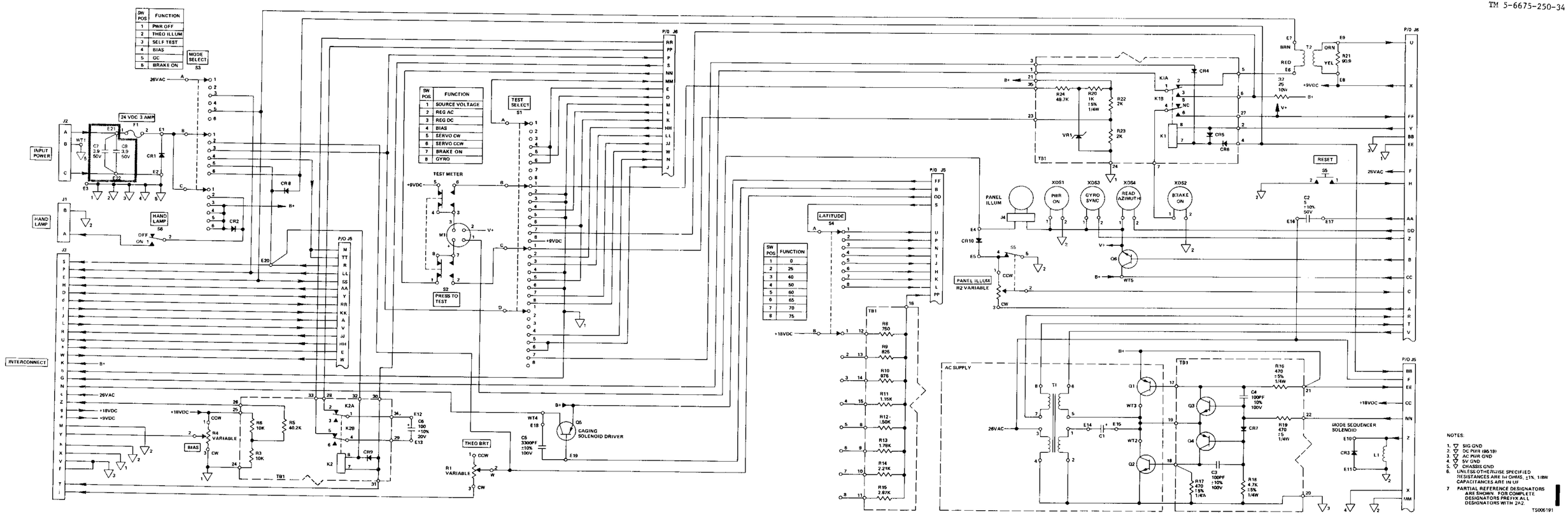
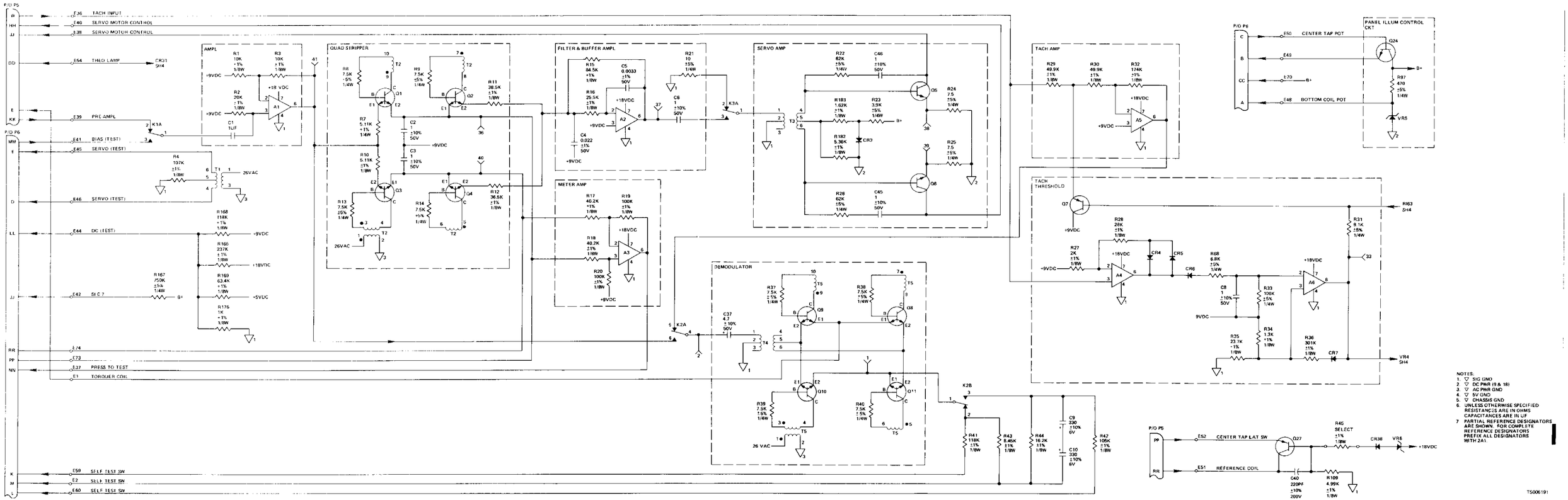


Figure 1-7. Electronic control unit schematic diagram (sheet 1 of 5).



NOTES:
1. ▽ SIG GND
2. ▽ DC PWR (9 & 18)
3. ▽ AC PWR GND
4. ▽ 5V GND
5. ▽ CHASSIS GND
6. UNLESS OTHERWISE SPECIFIED RESISTANCES ARE IN OHMS CAPACITANCES ARE IN UF
7. PARTIAL REFERENCE DESIGNATORS ARE SHOWN. FOR COMPLETE REFERENCE DESIGNATORS PREFIX ALL DESIGNATORS WITH 2A1.

TS006191

Figure 1-7. Electronic control unit schematic diagram (sheet 2 of 5).

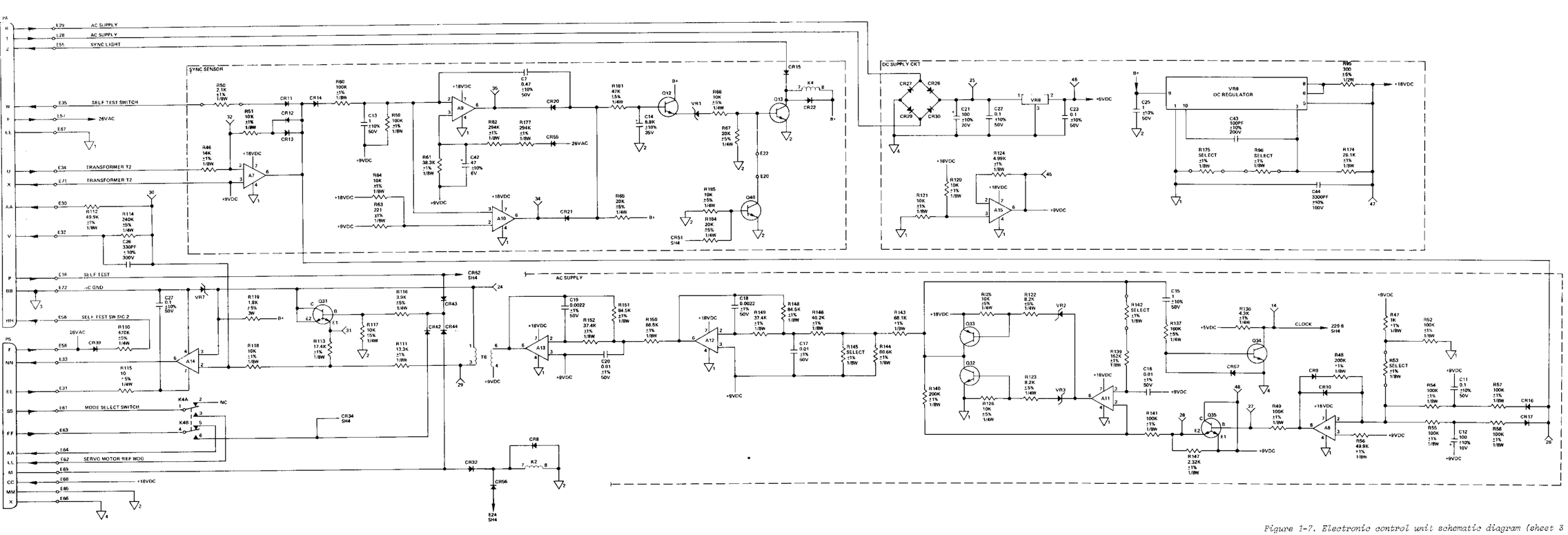


Figure 1-7. Electronic control unit schematic diagram (sheet 3 of 5).

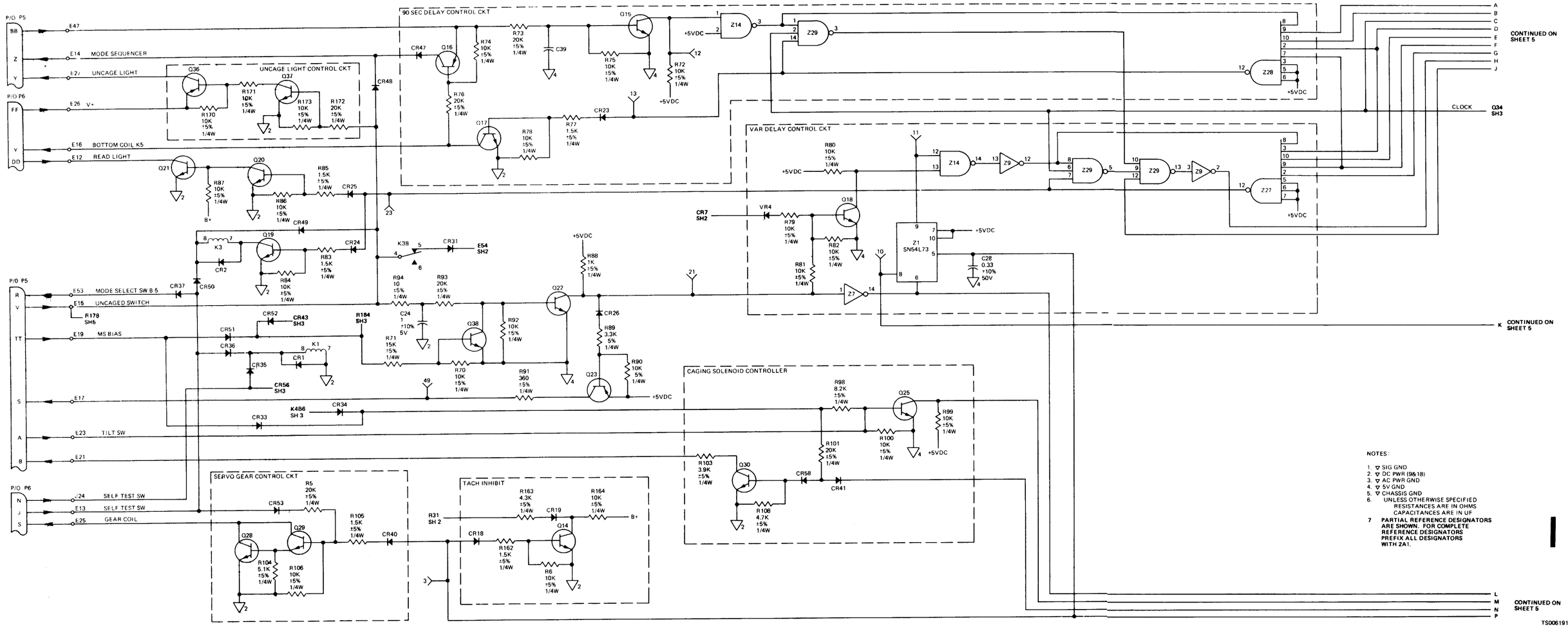


Figure 1-7. Electronic control unit schematic diagram (sheet 4 of 5).

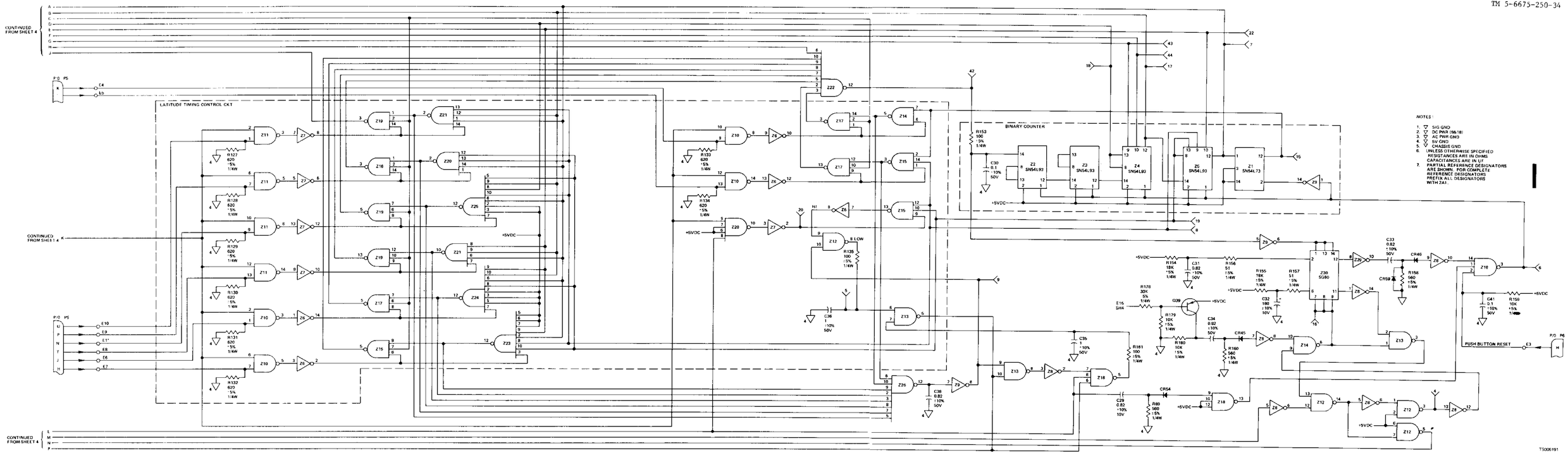


Figure 1-7. Electronic control schematic diagram (sheet 5 of 5).