TM 5-1260-206-34

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

ANALYTICAL PHOTOGRAMMETRIC POSITIONING SYSTEM (APPS)

AN/UYK-48

NSN 1260-01-061-7081

HEADQUARTERS, DEPARTMENT OF THE ARMY
17 DECEMBER 1986

WARNING

HIGH VOLTAGE is used in the operation of this equipment. SERIOUS INJURY may result if personnel fail to observe safety precautions. Do not be misled by the term "low voltage". Potentials as low as 50 volts may cause death under adverse conditions. Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas. Be careful not to contact 115 Vac input connections when installing or operating this equipment. Remove ac input power from the system when replacing lamps or fuses. Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

Avoid skin contact with tape head and mirror cleaners. Use only where adequate ventilation is provided. Keep away from open flame. Do not take internally.

For artificial respiration and first aid data, refer to FM 21-11.

Voltages as high as 750 volts are produced by the TID Lamp Control Assembly. Contact with this voltage potential can result in death. Never place hands or meter leads inside control assembly unless power switch is set at OFF.

TECHNICAL MANUAL

N0. 5-1260-206-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 17 December 1986

Direct Support and General Support Maintenance Manual For

ANALYTICAL PHOTOGRAMMETRIC
POSITIONING SYSTEM (APPS) AN/UYK-48
NSN 1260-01-061-7081

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

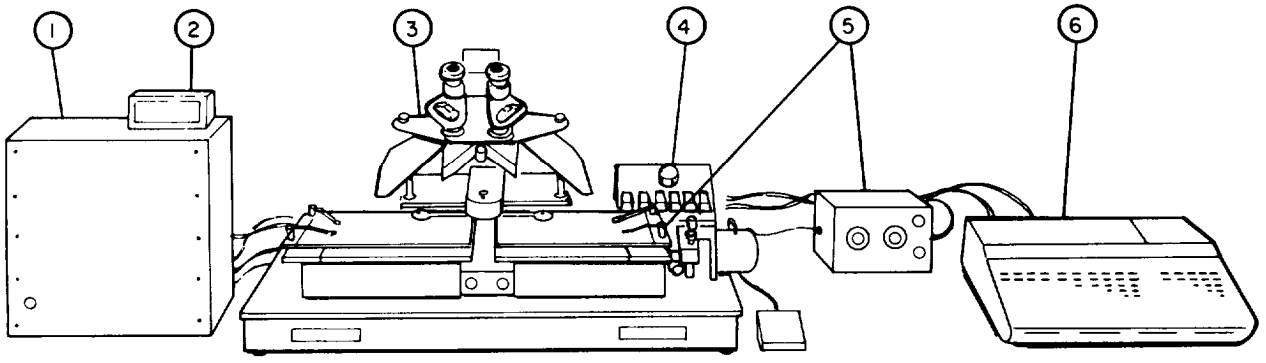
TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF TABLES - Continued



1. Digital Controller
2. Digital Display
3. Optical-Mechanical Scanner
4. Data Input Control
5. Transillumination Device
6. Calculator

Figure 1-1. Analytical Photogrammetric Positioning System (APPS) AN/UYK-48

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE - This manual provides direct support and general support (DS/(GS) maintenance procedures for the Analytical Photogrammetric Positioning System (APPS) AN/UYK-48.

1-2. MAINTENANCE FORMS AND RECORDS - Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS),

1-3. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE - Destruction of Army material to prevent enemy use shall be in accordance with TM 750-244-2.

1-4. PREPARATION FOR STORAGE OR SHIPMENT - Procedures to prepare the APPS for storage or shipment are listed in TM 5-1260-206-12, Operator and organizational Maintenance Manual for Analytical Photogrammetric Positioning System AN/UYK-48.

1-5. REFERENCE lNFORMATION - This information includes a nomenclature cross-reference list and an explanation of terms (glossary) used in this manual.

a. Nomenclature Cross-Reference List

Common Name	Equipment Nomenclature
APPS	Analytical Photogrammetric Positioning System AN/UYK-48.
Calculator	Calculator, Programmable CP-1387/U
DAC	Controller, Digital C-10805/UYK-48
DIC	Control, Data Input C-10134/UYK-31
Digital Display	Display, Digital ID-2239/UYK-48
OMS	Optical-Mechanical Scanner SU-119/UYK-48
TID	Transillumination Device SU-120/UYK-48

b. Glossary

Term	Definition
Analytical	Mathematical approach or simulation of a physical situation.
Data Base	The entire body of information that has to do with a subject.
Feature	A distinctive terrain detail or prominent man-made object.
Parallax	The apparent separation between images. This applies to reference marks or photo images being viewed.
Photogrammetric	Pertaining to measurements of photography, such as the determination of the coordinates of a point by measuring its images on two overlapping photographs.
Point Positioning Data Base (PPDB)	Consists of a data-base index, area index, geodetically-controlled photographic coverage (in stereo) of a data base area and associated database cartridges. The PPDB enables trained operators to determine accurate positional data for any identifiable feature on the photography.
SAE	Shaft angle encoder
Transistor Transistor Logic (TTL) Levels	Digital logic levels. As used in the APPS, a +5.0 volts represents a logic high and a -0.5 volts represents a logic low.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's) - EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Mail directly to U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished to you.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-7. EQUIPMENT CHARACTERISTICS AND CAPABILITIES -

a. Characteristics. The APPS system (figure 1-1) comprises six component assemblies:

- DAC
- OMS
- TID
- Calculator
- DIC
- Digital Display

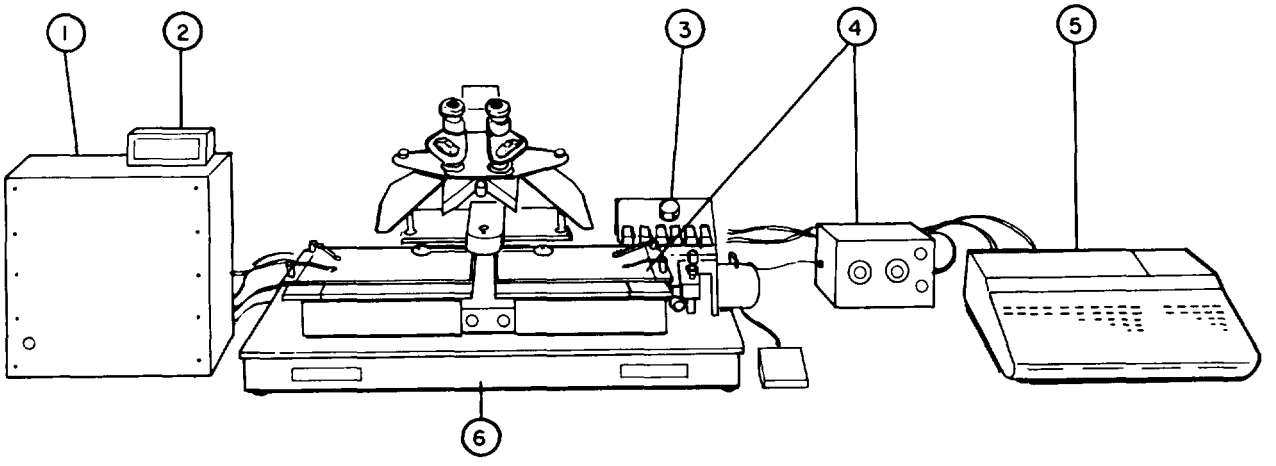
b. Capabilities.

- Measures coordinates of points on PPDB.
- Coordinates can be measured quickly and accurately.
- Computes latitude and longitude or Universal Transverse Mercator (UTM) grid coordinates.
- Records results on paper tape and/or magnetic tape cartridge.
- Is transportable.
- Diagnostic programs provide self-test capability.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Identification information for the APPS system and its components is given on figures 1-2 through 1-8.

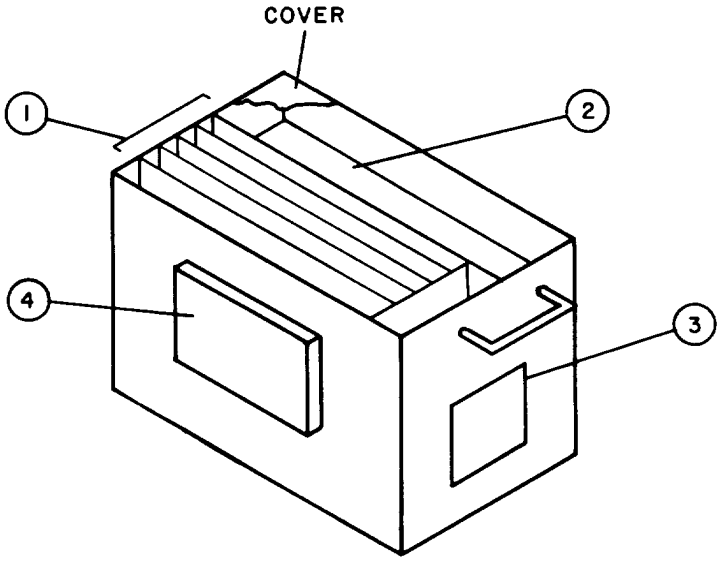
1-9. DIFFERENCES BETWEEN MODELS - All APPS Systems are functionally identical. However, Programmable Calculator CP-1387/U (HP9825 series) may vary because of manufacturer model changes.

1-10. EQUIPMENT DATA - Specifications for the APPS system and its components are given in table 1-1.



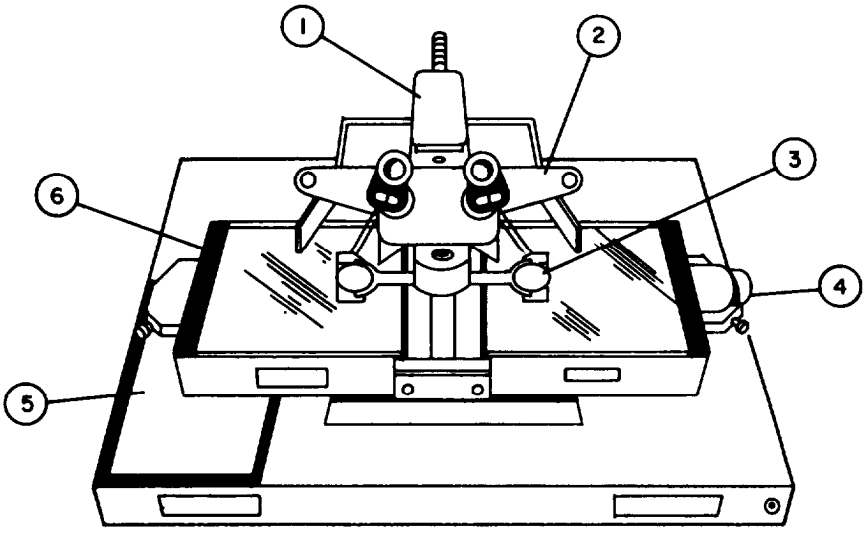
ITEM NO.	COMPONENT	DESCRIPTION
1	DAC	Provides power to all other components in APPS system. Processes measurement data from OMS before it is sent to Calculator.
2	Digital Display	Provides readout of X-axis and Y-axis coordinates of point under measure mark in thousandths of inches.
3	DIC	Provides operator control of APPS system.
4	TID	Back-lights plexiglas photo plates. Holds photo material in place.
5	Calculator	Operator-controlled, programmable computation equipment.
6	OMS	Allows the operator to position PPDB photographs or photo positives to view desired features. Detects and sends X-axis, Y-axis, and ΔX-movement to DAC.

Figure 1-2. APPS System Components Identification



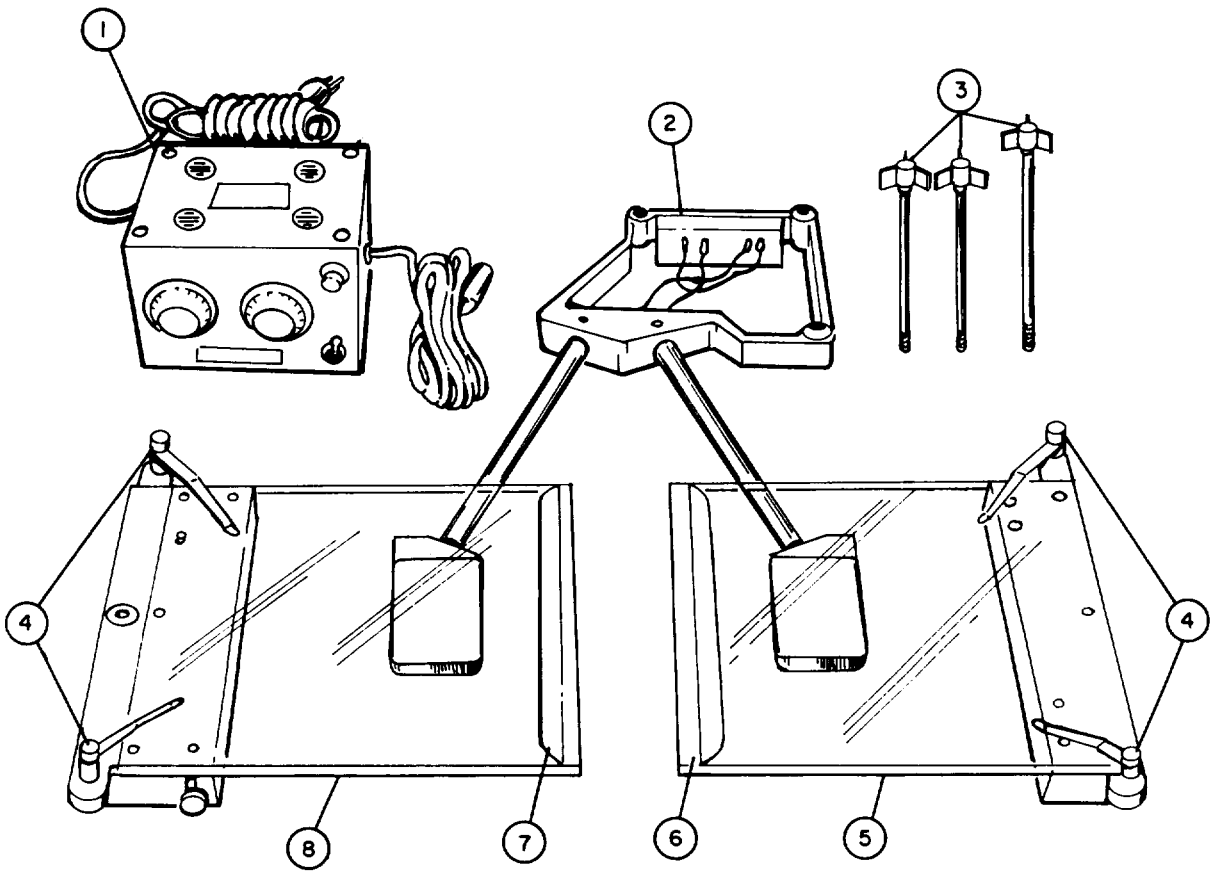
ITEM NO.	COMPONENT	DESCRIPTION
1	Control Unit	Processes measurement data from OMS.
2	Power Supply	Provides dc voltages to control unit.
3	Fan	Provides cooling for power supply and control unit.
4	Power Distribution Assembly	Provides ac power to all other APPS components.

Figure 1-3. DAC Components Identification



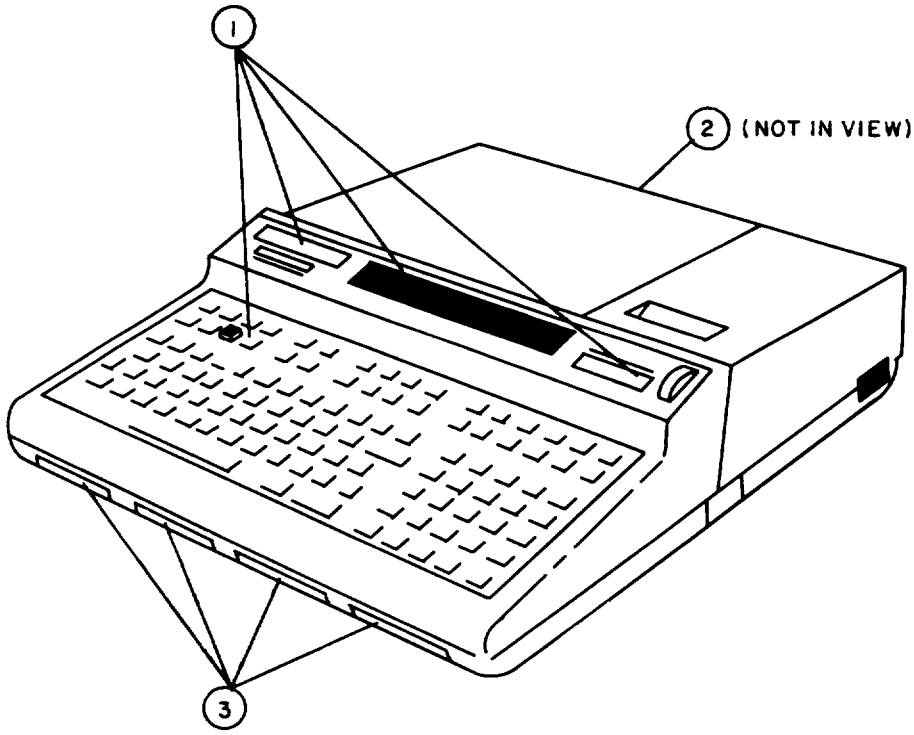
ITEM NO.	COMPONENT	DESCRIPTION
1	Lamp Assembly	Provides illumination.
2	Stereoscope Assembly	Consists of lenses and mirrors used to view photographs or photo positives.
3	Measuring Mark Assembly	Provides reference marks to locate and measure desired features.
4	X-Axis Encoder	Converts right photo holder movement (ΔX) into electronic pulses used by Calculator to compute elevation of feature.
5	Baseplate Assembly	Mounting plate for OMS. Contains electromagnetic datagrid to sense X-axis and Y-axis movement of photo-carriage.
6	Photo-Carriage Assembly	Moveable assembly allows operator to position features under measuring mark.

Figure 1-4. OMS Components Identification



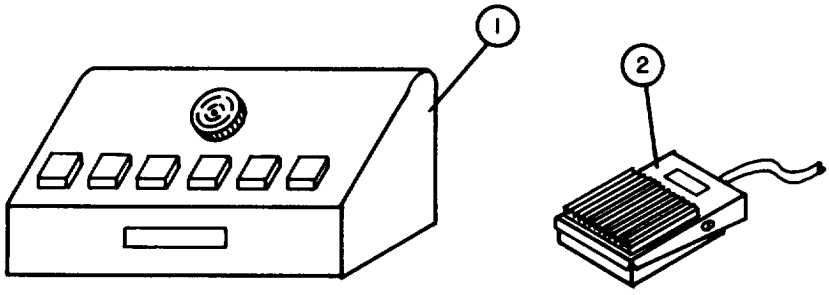
ITEM NO.	COMPONENT	DESCRIPTION
1	Lamp Control Assembly	Controls intensity of back-lights.
2	Illuminator Assembly	Provides back-lighting of photo plates.
3	TID Capstan Bolts (3 each)	Secure illuminator assembly to OMS.
4	Photo Clips (4 each)	Secure photography to photo plates.
5	Right Photo Plate	Moveable assembly to mount photography.
6	Right Photo Holder	Secures photography to right photo plate.
7	Left Photo Holder	Secures photography to left photo plate.
8	Left Photo Plate	Stationary assembly to mount photography.

Figure 1-5. TID Components Identification



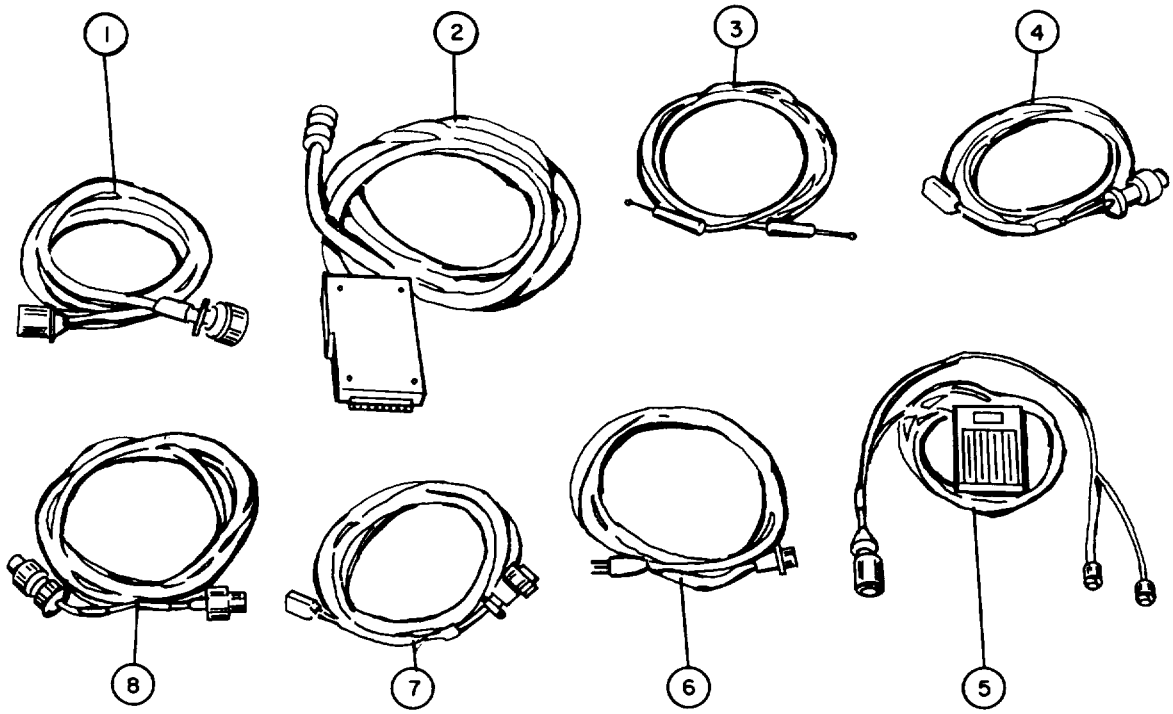
ITEM NO.	COMPONENT	DESCRIPTION
1	Input/Output Devices	Enable operator and Calculator to communicate.
2	Fan	Provides cooling for Calculator.
3	Plug-In-Memory	Read only memory (ROM) cartridges.

Figure 1-6. Calculator Components Identification



ITEM NO.	COMPONENT	DESCRIPTION
1	DIC	Operator control panel that contains switches for system operation.
2	Footswitch	Operator control pedal that provides alternate means of controlling system operation.

Figure 1-7. DIC Components Identification



ITEM NO.	COMPONENT	DESCRIPTION
1	Cable Assembly W101	Connects signals between OMS and DAC.
2	Cable Assembly W102	Connects signals between Calculator and DAC.
3	Cable Assembly W103	Connects output data from DAC to teletype equipment.
4	Cable Assembly W104	Connects power from power distribution assembly to DAC.
5	Cable Assembly W105	Connects baseplate to photo-carriage and footswitch.
6	Cable Assembly W106	Connects power from ac source to power distribution assembly.
7	Cable Assembly W107	Connects power from power distribution assembly to OMS.
8	Cable Assembly W108	Connects power from power distribution assembly to Calculator.

Figure 1-8. System Cables Identification

Table 1-1. APPS System Equipment Data

CHARACTERISTIC	SPECIFICATION
APPS	
Shipping Weight	
Case 1	226.0 lbs. (102.6 kg)
Case 2	113.0 lbs. (51.3 kg)
Case 3	140.0 lbs. (63.6 kg)
Operating Temperature	55 to 85°F (12 to 29°C)
Operating Humidity	10 to 90 percent, noncondensing
Power Requirements	105-125 Vac, 9 amperes, 55-65 Hz
Resolution	0.001 inches (25.4 microns)
Accuracy	0.0012 inches (30.0 microns) rms
DAC	
Size	12.5 inches (31.75 cm) high 15.75 inches (40.0 cm) wide 11.0 inches (27.9 cm) deep
Weight	32.5 lbs. (14.8 kg)
Power: Input	105-125 Vac, 3 amperes, 55-65 Hz
Output	105-125 Vac, 55-65 Hz, +5 V
Fuse	3 ampere, 1 each
Digital Display	
Size	2.25 inches (5.7 cm) high 5.0 inches (12.7 cm) wide 2.25 inches (5.7 cm) deep
Weight	1.0 lb. (0.45 kg)
Power Requirements	+5V, 0.5 ampere
Display Capability	Four digit; 0.000 to 9.999 for X and Y

Table 1-1. APPS System Equipment Data - Continued

CHARACTERISTIC	SPECIFICATION
TID (lamp control assembly)	
Size	3.9 inches (9.9 cm) high 5.9 inches (15.0 cm) wide 5.0 inches (12.7 cm) deep
Weight	5.0 lbs. (2.25 kg)
Power: Input	105-125 Vac, 1.5 ampere, 55-65 Hz
Output	0 to 750 Vac, variable
Fuse	1.5 ampere, 1 each
DIC	
Size	4.25 inches (10.8 cm) high 7.0 inches (17.8 cm) wide 4.25 inches (10.8 cm) deep
Weight	1.0 lb. (0.45 kg)
Power Requirements	+5V, 0.2 ampere
CALCULATOR	
Size	4.75 inches (12.1 cm) high 14.75 inches (37.5 cm) wide 19.75 inches (50.2 cm) deep
Weight	26.75 lbs. (12.1 kg)
Power: Input	105-125 Vac, 3 amperes, 48-66 Hz
Fuse	3 ampere, 1 each
OMS	
Size	16.5 inches (41.9 cm) high 30.0 inches (76.2 cm) wide 25.0 inches (63.5 cm) deep
Weight	101.25 lbs. (46.0 kg)
Power: Input	105-125 Vac, 1.5 amperes, 55-65 Hz
Fuse	1.5 ampere, 1 each

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-11. APPS PRINCIPLES OF OPERATION - F0-1 is a functional block diagram of the APPS. The OMS allows the operator to view the aerial photography through a stereo-optical system. To locate the desired terrain feature, the operator moves the photo-carriage. This movement is converted into electronic pulses by the datagrid/cursor coil, providing X and Y analog position data for the DAC. To measure the height of the feature, the operator adjusts the right photo holder to produce a 3-dimensional image. This movement is converted into electrical pulses by the shaft angle encoder and provides AX rotation data for the DAC. The TID provides illumination of the photography on the OMS.

The DAC continuously monitors and computes the X-axis and Y-axis coordinates of the photo-carriage. These digital coordinates are indicated to the operator by the Digital Display. The AX data from the OMS is also counted. When the operator has measured the terrain feature, he selects this data to be transferred to the Calculator. This is done by the RECORD 1-4 signals from the DIC or footpedal switches. The sonalert sounds to indicate the selection has been received by the DAC. The Calculator performs as programmed by the data base and the computed point position data is printed out on paper tape. The position data may also be stored on the data cartridge.

A dc power supply contained in the DAC provides +5 volts, +15 volts, and -15 volts required by the APPS circuits.

1-12. OMS PRINCIPLES OF OPERATION - The OMS (F0-2) translates the operator-controlled motion of the photography as viewed through the magnifying stereo-optics into electronic signals. These signals are used to compute the position data of the observed feature.

a. Functional Description - The OMS provides two measurement outputs:

- The movement of the cursor coil in the X-Y directions relative to the data grid.
- The movement of the right photo plate in the X direction (AX) relative to the left photo plate.

The data grid is secured in the base plate and serves as the base reference for the optical system. The cursor coil is secured under the photo-carriage and serves as the photography reference. Any movement of the photo-carriage (cursor coil) relative to the base plate (data grid) is seen through the stereo optics as a movement of the measuring mark dots relative to the photography. The photo-carriage contains two photo plates, each having its associated optics. Because the movement of both measuring mark dots is represented by the movement of the cursor coil, both dots must move equal distances in the X-Y directions. The parallelogram prevents any rotation of the measuring mark dots from taking place. This is essential for accurate measurements to be made.

b. Theory Of Operation - The OMS assemblies are:

1. optics
2. Base plate
3. Photo-carriage

The circled numbers are keyed to F0-2.

(1) Optics - The optics allow the operator to view the left photo plate with his left eye and the right photo plate with his right eye. A measuring mark dot within each field of view provides a measurement reference point. When a set of photographs is mounted on the photo plate, the optics transform them into a three-dimensional image.

(2) Base plate - The base plate contains the data grid, an X-Y array of conductors that interact with the electromagnetic signal generated by the cursor coil. The orientation of the data grid to-the base plate is aligned during manufacture.

(3) Photo-carriage - The photo-carriage consists of:

- Two photo plates
- Cursor coil
- X-axis encoder

The operator moves the photo-carriage in the X-Y directions to locate the photographic feature. This causes the cursor coil attached to the photo-carriage to move relative to the data grid. This movement is converted into an amplitude-modulated analog signal. This signal provides position data for the Calculator. The right photo plate can be moved in the X direction using the X-axis parallax adjust, and the Y direction using the Y-axis parallax adjust. The X-axis movement is coupled to the shaft angle encoder. The operator moves the right photo plate relative to the left photo plate in the X-axis direction to superimpose the measuring mark dots. This movement is converted into SAE rotation pulses. These pulses provide elevation data for the Calculator.

1-13. TID PRINCIPLES OF OPERATION - The TID provides back-lighting of the photography placed on the OMS photo plates. The light intensity is controlled individually for the left and right photo plates.

1-14. DIC PRINCIPLES OF OPERATION - The DIC controls the transfer of data from the DAC to the Calculator. The operator-controlled pushbuttons select RECORD 1, 2, 3, 4, and CLEAR signals. The footswitch selects RECORD 1 signals freeing the operator's hands for photo-carriage control. The sonalert provides audible indications when the Calculator receives a command or when an alarm condition is present.

NOTE

Throughout this manual DIC pushbuttons are indicated by [NAME]

1-15. CALCULATOR PRINCIPLES OF OPERATION - The Calculator computes the required position information of the feature observed by the operator. It is programmed by the applicable data base cartridge and prints out the computed position information on paper tape or recorded on the tape cartridge. For further information, refer to TM 11-6660-263-24-2, Organizational, Direct Support, and General Support Maintenance Manual for Calculator Programmable CP-1387/U.

NOTE

Throughout this manual calculator keys are indicated by KEY NAME

1-16. DIGITAL DISPLAY PRINCIPLES OF OPERATION - The Digital Display provides a LED read-out of both the X- and Y-coordinates of the photo-carriage cursor coil relative to the data grid. The read-outs provide a resolution of one one-thousandth of an inch.

1-17. DAC PRINCIPLES OF OPERATION - The DAC is functionally located between the OMS and the Calculator. It accepts the analog position and elevation data from the OMS, converts it to digital data, and provides it to the Calculator. It also provides for the relay of information from the Calculator to a teletype circuit.

a. Functional Description - The DAC consists of seven printed circuit cards and a power supply. Each printed circuit card has an 86-pin edge connector with pins 1, 3, ... 85 (odd numbers) on the component side and pins 2, 4, ... 86 (even numbers) on the back side. 110 volt ac primary power control is provided by the power distribution assembly. All system interconnections are made on the rear panel.

b. Theory of Operation - The DAC is composed of:

- Power Supply
- Digitizer Control (D) Card
- Analog (A) Card
- Axis (B & C) Cards
- Multiplexer Storage (F) Card
- Control (G) Card

(1) Power Supply - The dc power supply provides +5 volts, +15 volts, and -15 volts to the DAC circuit cards and +5 volts to the DIC and Digital Display assemblies.

(2) Digitizer Control (D) Card - The digitizer control (D) card generates the following signals:

- Clock pulses
- Clear Logic
- Hold Logic

The circled numbers are keyed to F0-3.

(1) Clock Pulse Circuitry - The input 6-MHz oscillator signal is divided-by-two to give an output of 3-MHz. Two 3-MHz outputs are provided, CP1 and CP1. CP1, the main system clock pulse, has a pulse width of approximately 80 nanoseconds. Signal CP1 is used to generate a 3-kHz reference square wave (REF), and a 30-Hz clock with a pulse width of 80 nanoseconds (CP4). CP4 acts as a switch sampling pulse to logically debounce switch contacts for use in the logic.

(2) Clear Logic Circuitry - Clear logic circuits generate a reset pulse (CAL) on initial power-up when ZERO is pressed. The inputs to the clear logic circuitry are ZERO and AUTO CLEAR. A clear condition occurs when a high is applied to ZERO input or a low to AUTO CLEAR. A low is automatically applied to AUTO CLEAR for a brief time when system power is turned on. Either signal outputs a low system reset pulse (CAL) and drives CLEAR LOCKOUT low.

(3) Hold Logic Circuitry - The input to the hold logic circuitry is grounded keeping HOLD IND at a logic low.

(3) Analog (A) Card - The analog (A) card provides the following:

- System 6 MHZ clock
- AUTO CLEAR logic
- Driving signal for the cursor coil
- Lockout detection
- Converts X and Y analog inputs to digital outputs

The circled numbers are keyed to F0-3.

(1) System 6 MHz Clock Circuitry - The clock is composed of a 6-MHz crystal-controlled oscillator. It provides the time base (CP1 and CP4) for the DAC circuits.

(2) AUTO CLEAR Logic Circuitry - When power is applied, this circuit generates a low AUTO CLEAR pulse. This momentary low resets the counter circuits and initializes the system.

(3) Cursor Coil Excitation Generator - The cursor coil excitation generator provides the 3-kHz excitation current required by the cursor coil. This current generates a magnetic field which-is detected by the OMS data grid as the cursor coil/photo-carriage is moved.

(4) Lockout Detection Circuitry - The cursor coil lockout detector activates the sonalert and generates a SYNC inhibit signal when data grid signals

drop below 6 to 8 volts peak-to-peak. To clear this condition the output at TP3 must be restored to the proper level and a CLEAR LOCKOUT pulse from the D card must be present. Another input to the circuit is the SAMPLE IND pulse from the G card. This pulse is generated on an 1/0 command to the calculator. It is this input that sounds the sonalert when any button on the DIC is pressed. The third input is the HOLD IND signal from the D card. This input is not used and is disabled on the D card.

(5) X-Y Axis Analog-to-Digital Converter Circuitry - The analog-to-digital converter converts the amplitude-modulated analog inputs from the 0MS data grid to a phase-modulated digital signal. The X = O°, X = 90°, Y = 0°, and y= 90° component signals from the OMS are fed to the analog printed circuit card where they are changed to digital signals (X GRID and Y GRID). These low level signals (millivolt range) from the OMS data grid increase and decrease in amplitude as the cursor coil is moved (amplitude modulated). The gain and phase of these signals are adjusted by R34 and R40 for the X-axis and R65 and R70 for the Y-axis. These signals are then summed, producing the output at TP3 or TP7. This signal is an 18 to 20 volt peak-to-peak phase modulated sine wave. The output amplitude is adjusted by R43 or R72 and is dependent upon the height of the cursor coil from the data grid surface; when the cursor is raised the signal amplitude drops. The signal is then converted from analog to digital. The output of the first stage seen at TP4 or TP8 is a 10 volt peak-to-peak clipped sine wave. The last stage is a switching amplifier converting the signal to a 5-volt square wave (X GRID or Y GRID). The square wave is a phase-modulated signal containing cursor positional information. This signal is sent to the X-axis (B) or Y-axis (C) card.

(4) Axis (B and C) Cards - The two identical axis cards provide the following:

- Count disable logic
- Clear logic
- Determine the incremental change in the X or Y position of the cursor coil.

The axis card installed in the B position operates on the X axis; the axis card in the C position operates on the Y axis. The circled numbers are keyed to F0-4.

(1) Count Disable Logic Circuitry - The count disable circuit disables the position (X or Y) detector whenever SYNC goes low. It prevents circuit operation when cursor coil lockout detector is activated. The HOLD IND input is not used.

(2) Clear Logic Circuitry - The clear logic circuit resets position (X or Y) detector when CAL input from D card goes low in the presence of the 30-Hz CP4 clock. This produces a 15-Hz, 10-nanosecond CLEAR pulse which is applied to the position detector circuitry.

③ Circuitry to Determine the X or Y Position of the Photo-Carriage (Cursor Coil) - The position (X or Y) detector determines the incremental change in the position of the cursor coil. The digital signals (X GRID or Y GRID) from the analog (A) board are compared to a 3-kHz reference signal generated in the error detector circuit. A difference in phases caused by movement of the cursor coil relative to the data grid produces pulses; each one corresponding to 0.001 inch. These pulses are applied to the up/down count and sign detector circuits. The zero reference point can be set for any position of the cursor coil by pressing ZERO. The sign detector logic senses this movable origin and generates a SIGN X or SIGN Y signal.

(5) Multiplexer Storage (F) Card - The multiplexer storage card provides the following functions:

- X-axis encoder (AX) counter and storage register
- X and Y coordinates storage register
- Multiplexer logic
- BCD to ASCII code converter
- Control logic

The circled numbers are keyed to F0-5.

① X-Axis Encoder (AX) Counter and Storage Register Circuitry - The 500 pulse/revolution shaft angle encoder output is applied to the 4-bit up/down counters. These counters feed in parallel to the storage register.

② X and Y Coordinates Storage Register Circuitry - These 4-bit parallel shift registers accept the X-coordinate output from the axis (B) card and the Y-coordinate output from the axis (C) card.

③ Multiplexer Logic Circuitry - The X, Y, and AX data from the storage registers is applied to the two-stage multiplexer. The multiplexer shifts this data out to the BCD to ASCII converter one BCD digit at a time. Selection control is provided by the BCD 1-8 inputs from the control (G) card.

④ BCD to ASCII Code Converter Circuitry - The code converter is a 32-word by eight-bit PROM. The converter is addressed by the BCD data and the ASCII outputs are applied to the Calculator. The XFR COMPLETE signal is fed to the control logic.

⑤ Control Logic Circuitry - This counter circuit controls each BCD character stepped through the multiplexer and code converter. It is driven by the Calculator I/0 signals applied through the control (G) card.

(6) Control (G) Card - The control (G) card provides the following:

- Calculator to teletype data transfer
- Multiplexer select control logic
- Shaft-angle encoder divide-by-four logic

The circled numbers are keyed to F0-6.

(1) Calculator/TTy Interface Control Circuitry - The Calculator/TTY interface circuit allows the parallel transmission of X, Y, and AX data from the Calculator to a serial TTY circuit. The ASCII data lines from the Calculator are applied to a 256-word by 8-bit PROM that converts the 8-level ASCII to a 5-level teletype code. The parallel-to-serial converter is a Universal Asynchronous Receiver/Transmitter (UART) that converts the 5-bit teletype characters from parallel data to serial data. The output driver provides the 20-milliampere loop current required by the TTY circuit. Data transmission is initiated when a strobe (STROBE X-Y or STROBE SAE) is applied through the multiplexer storage (F) card to the Calculator. The Calculator generates a high PCTL signal which is applied to the I/0 control in the DAC/Calculator interface control circuit (2). The resulting FLG IN signal, applied through a one-shot on the F card results in a low FLAG DELAY OUT (PFLG). The Calculator senses this signal and transfers a 5-bit data element. After transmission of the data element, PFLG goes high signaling the Calculator to send the next data element. If the Calculator has additional data to transmit, the I/0 control will enable the converter to start again. PRESET goes low when STOP is pressed to reset the interface circuits.

(2) DAC/Calculator Interface Control Circuitry - The DAC/Calculator interface control circuit allows transmission of the X, Y, multiplexer storage (F) card to the Calculator. The 1/0 control directs the transfer of data from the Calculator to the TTY (1/0 low) or from the DAC to the Calculator (I/0 high). The receive function detector is activated when any of the DIC pushbutton switches are pressed. When the pushbutton switch is released, the audio alarm logic generates a high SAMPLE IND to sound the sonalert on the DIC. Data transmission is initiated when a strobe (STROBE X-Y or STROBE SAE) is applied to the Calculator, as described for the Calculator/TTY interface control circuitry. The resulting low PFLG indicates to the Calculator that a data element is ready for transmittal. When the Calculator has received the 8-bit data element, PCTL goes low. This sequence is repeated until all data is transferred to the Calculator. The reset logic on the multiplexer storage (F) card produces a RESET signal when the data transfer is complete. This signal is applied to the interface logic to terminate the transfer and release control of the Calculator.

(3) Shaft Angle Encoder Divide-by-Four Circuitry - The shaft-angle encoder dividers convert the 2000 pulses/revolution SAE CW and SAE CCW input signals to 500 pulses/revolution CW and CCW output signals applied to the multiplexer storage (F) card.

CHAPTER 2

SYSTEM MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

2-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special tools: Maintenance Kit, APPS, MK-2023/UYK-48
- TMDE: Multimeter, TS-352 (or equivalent)
  Oscilloscope, AN/USM-281 (or equivalent)
- Support Equipment: None

2-3. REPAIR PARTS -Repair parts applicable to DS/GS personnel are listed and illustrated for each of the major components that comprise the APPS in the Repair Parts and Special Tools List, TM 5-1260-206-24P.

Section II. SERVICE UPON RECEIPT

2-4. SITE AND SHELTER REQUIREMENTS - Site and shelter requirements for the APPS are given in TM 5-1260-206-12. Operator and organizational Maintenance Manual for Analytical Photogrammetic Positioning System AN/UYK-48.

2-5. SERVICE UPON RECEIPT OF MATERIAL-Requirements for servicing the APPS upon receipt are given in TM5-1260-206-12, 0perator and Organizational Maintenance Manual for Analytical Photogrammetric Positioning System AN/UYK-48.

2-6. INSTALLATION INSTRUCTIONS -Installation instructions for the APPS are given in TM 5-1260-206-12, Operator and Organizational Maintenance Manual for Analytical Photogrammetric Positioning System AN/UYK-48.

2-7. PRELIMINARY CHECKS - The following procedures should be performed prior to troubleshooting the APPS system. These procedures will help to identify the symptoms of any faulty components. A symptom index is provided in paragraph 2-10 as an aid in troubleshooting the equipment. Figure 2-1 identifies the procedures to be performed.

a. Visual and Mechanical Checks - Table 2-1 is a listing of visual and mechanical checks for the APPS. Refer to table 2-6, section A to identify those fault symptoms noted during these checks. If no fault symptoms are noted, proceed to paragraph 2-7b.

b. Electrical Checks - Table 2-2 is a listing of all electrical checks for the APPS. Refer to table 2-6, section B to identify those fault symptoms noted during these checks. If no fault symtpoms are noted, proceed to paragraph 2-7c.

c. Diagnostic Checks - Tables 2-3 through 2-5 are diagnostic checks that should be performed prior to system troubleshooting. Refer to table 2-6, section C to identify those fault symptoms noted during these checks.

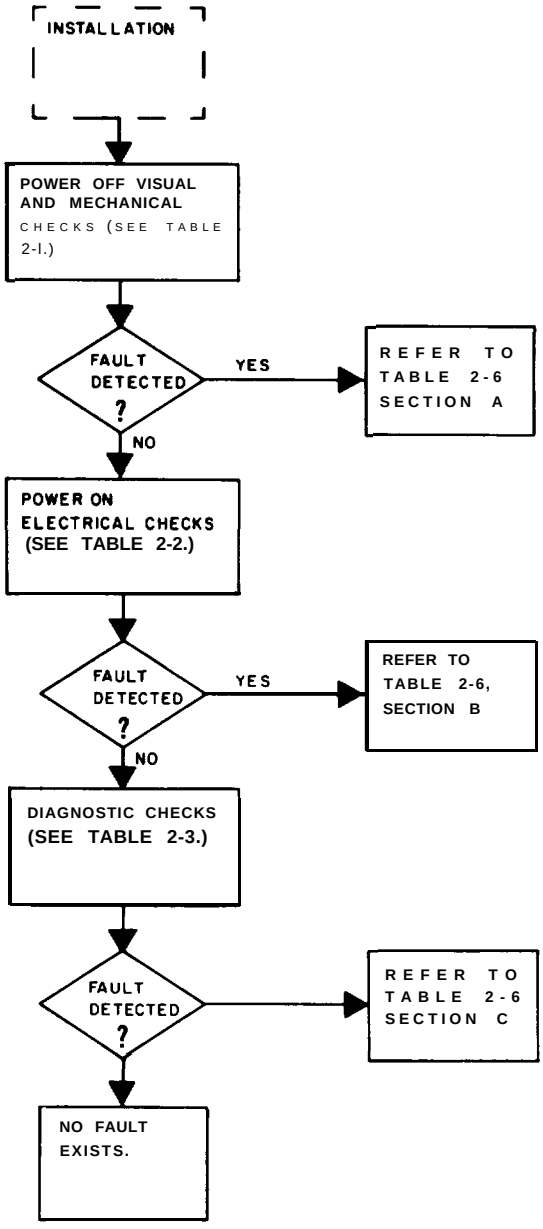


Figure 2-1. APPS Troubleshooting Scheme

Table 2-1. APPS Visual and Mechanical Checks

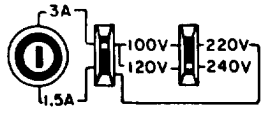
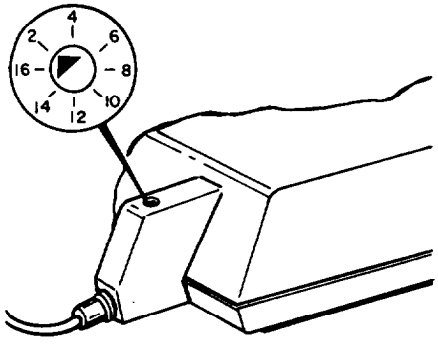
STEP NO.	ITEM PROCEDURE
	APPS SYSTEM
1	Check that APPS system has been assembled correctly. (See paragraph 2-6.)
	DAC
1	Check all connectors for damaged, loose, or broken pins.
	DIGITAL DISPLAY
1	Check display modules for signs of damage.
	INTERCONNECTING CABLES
1	Check that all cable connections are made securely.
2	Check all cables for frayed insulation or other visible defects.
3	Check that DIC unit is firmly seated in plug P1 on OMS.
	CALCULATOR
1	All power off.
2	Open printer access door. Ensure that line voltage selector switches are set for 120 volts. If adjustment is needed:  Switches shown in 120v position a. Insert tip of small screwdriver into slot on switch. b. Slide switch so that slot is in position shown.
3	Check that selector on I/O connector of cable W102 is set at 2. If adjustment is needed:  a. Insert tip of screwdriver into slot on selector. b. Rotate selector so that arrow points at 2.

Table 2-1. APPS Visual and Mechanical Checks - Continued

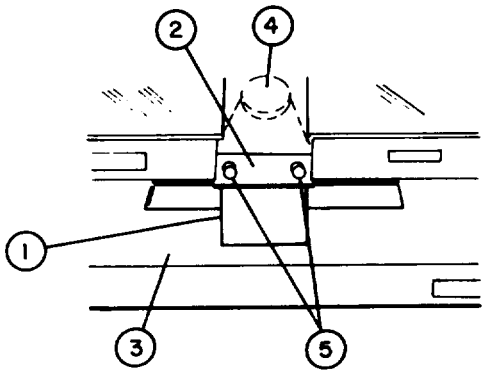
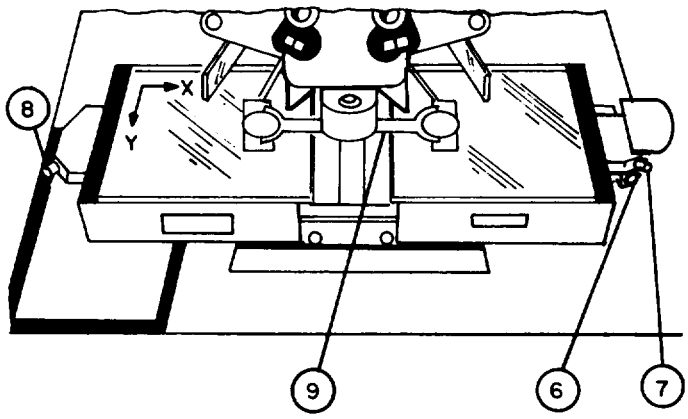
STEP NO.	ITEM PROCEDURE
	OMS
1	All power off. Insert piece of calculator paper (1) face down between cursor coil mounting bracket (2) and base plate (3). Check that cursor coil (4) just clears print. If paper cannot be inserted or if adjustment is needed:  a. Loosen two locking screws (5). b. Move mounting bracket for correct clearance. c. Tighten locking screws. d. Check that coil moves freely over datagrid. e. Repeat if necessary.
2	Remove paper. Check for free movement of photo-carriage by doing the following:  a. Press photo-carriage lock lever (6) up. b. Move photo-carriage across base plate in X and Y directions. No binding or friction should be felt.
3	Check for free movement of the X-axis parallax adjust (7) by rotating it back and forth.
4	Check for free movement of the Y-axis parallax adjust (8) by rotating it back and forth.
5	Check for proper operation of measuring mark holder (9) by rotating it back and forth. It should move easily without making contact with photo plates. Detent should seat at position shown.

Table 2-1. APPS Visual and Mechanical Checks - Continued

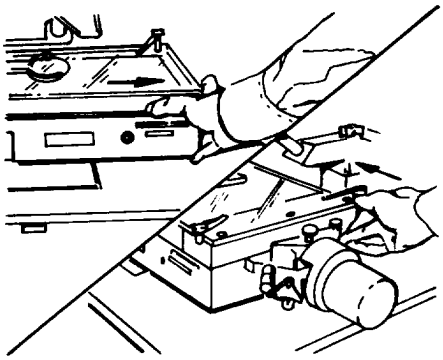
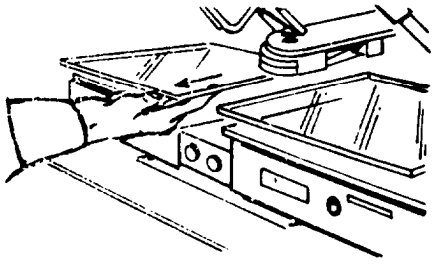
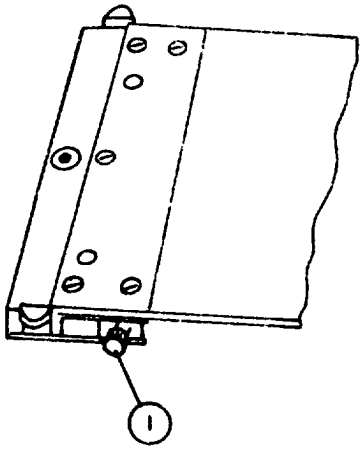
STEP NO.	ITEM PROCEDURE
	TID
1	Check spring movements of right photo plate by doing the following:  a. Push lightly at front right corner. b. Push lightly at rear right corner. c. Photo plate should return to its original position.
2	Check for play of left photo plate by doing the following:  a. Using friction force of finger, try to move photo plate back and forth. b. No play should be felt.
3	 Check for free movement of the screw adjust (1) by rotating it back and forth.

Table 2-2. APPS Electrical Checks

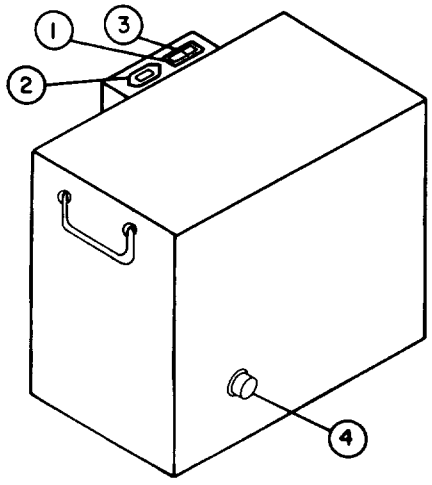
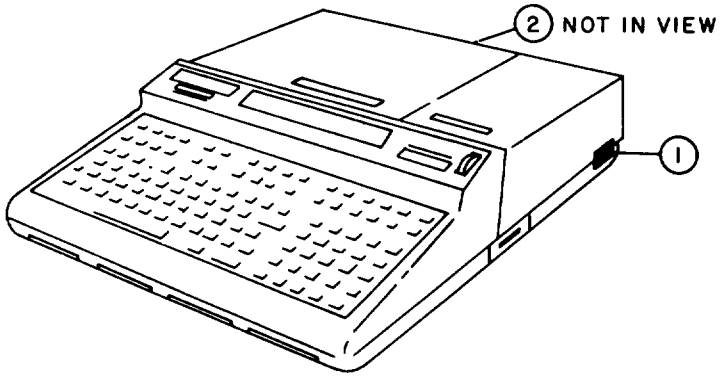
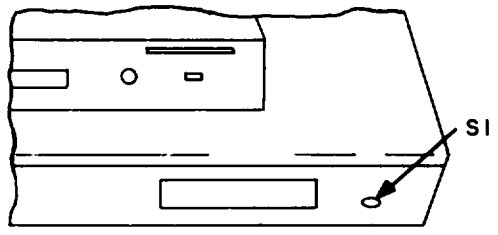
STEP NO.	ITEM PROCEDURE	
1	DAC 	Set A.C. POWER S1 switch (1) at ON. Check that ELAPSED TIME M1 meter (2) operates, power indicators (3) and (4) light, and blower operates.
2	Calculator 	Set ∿ power switch (1) at 1. Check that Calculator displays ⊢ and blower (2) operates. If sonalert sounds press ZERO RESET
3	OHMS 	Press S1 power switch. Hold for several seconds and release. Check that overhead lamp lights. Repeat if lamp does not light.

Table 2-2. APPS Electrical Checks - Continued

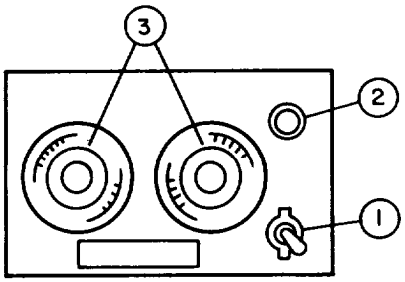
STEP NO.	ITEM PROCEDURE	
4	TID  	Set power switch (1) at ON. Check that indicator (2) lights. Rotate both dimmer controls (3) fully clockwise. Check that illuminators light and brightness increases as dimmer is rotated.
5	DIC Check that all pushbutton indicators are lit.	
6	DIGITAL DISPLAY Check that read-out is lit.	

Table 2-3. IDP 03 Grid Measure in Thousandths of Inch Diagnostic Procedures

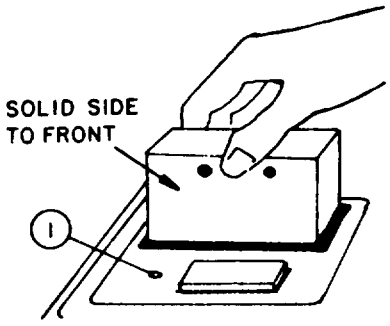
ITEM NO.	ACTION	INDICATION	
		DIGITAL DISPLAY	CALCULATOR PRINTER
1	Apply power to system.	⊢	
2	Secure 10-mm grid on right TID photo plate.		
3	 Insert ITC-001 diagnostic cartridge into Calculator.		
4	Press: [REWIND]		
5	When tape-running light (1) goes out, press: [RESET] [ERASE] [A] [EXECUTE] [T] [R] [K] [O] [EXECUTE] [LOAD] [2] [EXECUTE]	⊢	
6	When tape-running light goes out, press: [RUN]		
7	Move photo-carriage to approximate center of datagrid. Push photo-carriage lock lever down.		

Table 2-3. IDP 03 Grid Measure in Thousandths of Inch Diagnostic Procedures - Continued

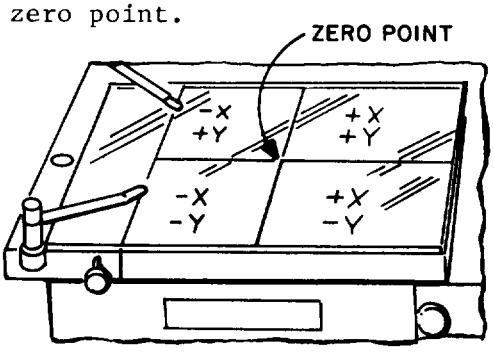
ITEM NO.	ACTION	INDICATION	
		DIGITAL DISPLAY	CALCULATOR PRINTER
8	Press: [ZERO] Sonalert sounds	X=0.000 Y-0.000	BUTTON CODE SAE ZERO 50000.1 Y 0.0 X 0.0
	[MEAS CONT] Sonalert sounds		50000.2 0.0 0.0
	[INDEX] Sonalert sounds		50000.2 0.0 0.0
	[REJECT] Sonalert sounds		50000.3 0.0 0.0
	[TERM] Sonalert sounds		50000.4 0.0 0.0
	[TTY] Sonalert sounds		50000.1 0.0 0.0
9	Press footswitch.		
10	Push photo-carriage lock level up. Move photo-carriage such that measuring mark is over the zero point. 		
11	Press: [ZERO] [MEAS CONT]	X=0.000 Y=0.000	50000.1 0.0 0.0
12	Move photo-carriage such that measuring mark is over the +X, +Y quadrant. Push photo-carriage lock lever down.	X counts Y counts	50000.1 0.0 0.0

Table 2-3. IDP 03 Grid Measure in Thousandths of Inch Diagnostic Procedures - Continued

ITEM NO.	ACTION	INDICATION	
		DIGITAL DISPLAY	CALCULATOR PRINTER
13	Press: [MEAS CONT] or footswitch.	Digital Display read-out identical to Calculator print-out for X and Y.	
14	Repeat 12 and 13 for: +X, -Y quadrant -X, -Y quadrant -X, +Y quadrant		
15	Move photo-carriage to lower left corner.		
16	Press: [ZERO]	X=0.000 Y=0.000	
17	Move photo-carriage very slowly to the right (+X-axis direction).	X displays all numbers 0.001 thru 0.009 0.010 thru 0.090 0.100 thru 0.900 1.000 until stop	
18	If a number is skipped over do the following: a. Move photo-carriage to suspect position b. Press: [MEAS CONT]	Digital Display read-out identical to Calculator print-out for X and Y.	
19	Return photo-carriage to lower left corner.		
20	Move photo-carriage very slowly to the rear (+Y-axis direction).	Y displays all numbers 0.001 thru 0.009 0.010 thru 0.090 0.100 thru 0.900 1.000 until stop	

Table 2-3. IDP 03 Grid Measure in Thousandths of Inch Diagnostic Procedures - Continued

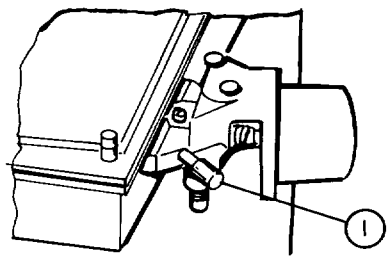
ITEM NO.	ACTION	INDICATION	
		DIGITAL DISPLAY	CALCULATOR PRINTER
21	If a number is skipped over, do step 18. 		
22	Push photo-carriage lock lever down.		
23	Press: ZERO		
24	Rotate X-axis parallax adjust (1) clockwise one revolution.		
25	Press: MEAS CONT		approx. 51000.1 0.0 0.0
26	Press: ZERO	X=0.000 Y=0.000	
27	Rotate X-axis parallax adjust counterclockwise one revolution.		
28	Press: MEAS CONT	X=0.000 Y=0.000	approx. -51000.1 1.0 0.0
29	Rotate X-axis parallax adjust counterclockwise until stop is reached.		
30	Look through right monocular. Rotate X-axis parallax adjust clockwise until 10-mm grid line is directly under measuring mark dot.		
31	Press: ZERO	X=0.000 Y=0.000	

Table 2-3. IDP 03 Grid Measure in Thousandths of Inch Diagnostic Procedures - Continued

ITEM NO.	ACTION	INDICATION	
		DIGITAL DISPLAY	CALCULATOR PRINTER
32	Without moving photo-carriage, rotate X-axis parallax adjust clockwise until next 10-mm grid line is directly under measuring mark dot.		50000.1 0.0 0.0
33	Press: MEAS CONT or footswitch.	X=0.000 Y=0.000	55000.1 (±10.) 0.0 0.0
34	Repeat steps 31 thru 33.		
35	Repeat steps 31 thru 33 again.		
36	Press: ZERO	X=0.000 Y=0.000	50000.1 0.0 0.0
37	Without moving photo-carriage, rotate X-axis parallax adjust counterclockwise until next 10-mm grid line is directly under measuring mark dot.		
38	Press: MEAS CONT or footswitch.	X=0.000 Y=0.000	45000.1 (±10.) 1.0 -1.0
39	Repeat steps 36 thru 38.		
40	Repeat steps 36 thru 38 again.		
	NOTE Always approach grid lines from direction indicated. If a grid line is overshot, back up past the line and continue.		

Table 2-4. IDP 01 Grid Comparator Diagnostic Procedures

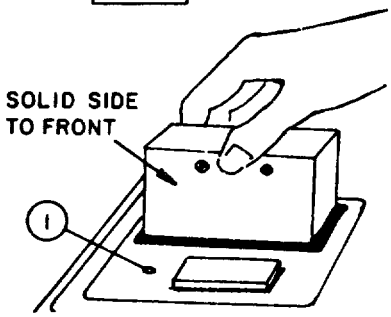
ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
1	Apply power to system.	-
2	Secure 10-mm grid on left TID photo plate.	
3	Press: [RESET]	
4	 Insert ITC-001 diagnostic cartridge into Calculator.	
5	Press: [REWIND]	
6	When tape-running light (1) goes out, press: [RESET] [ERASE] [A] [EXECUTE] [T] [R] [K] [O] [EXECUTE] [LOAD] [0] [EXECUTE]	-

Table 2-4. IDP 01 Grid Comparator Diagnostic Procedures - Continued

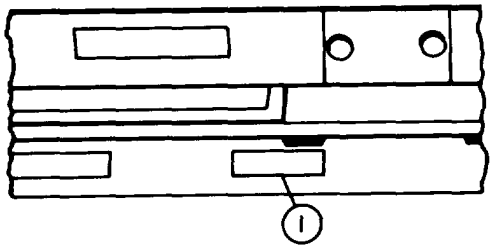
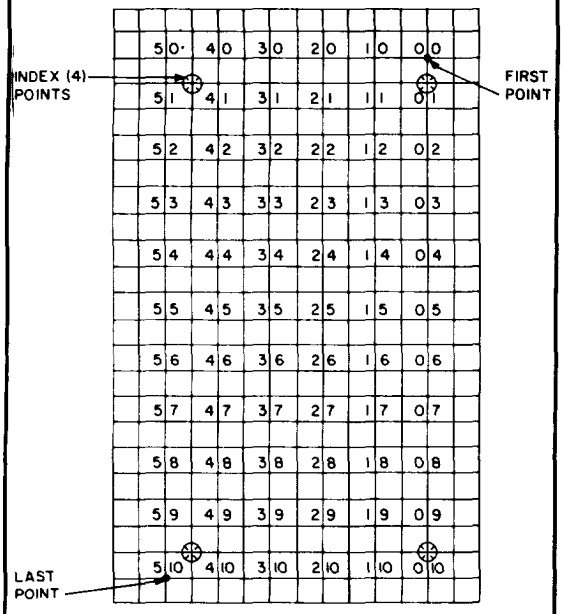
ITEM NO.	ACTION	CALCULATOR INDICATION	
		DISPLAY	PRINTER
7	When tape-running light goes out, press: RUN	K?	IF SYSTEM NEEDS DATA GRID CORRECTIONS PRESS: 1 CONTINUE IF NO CORRECTION NEEDED PRESS: CONTINUE
8	 A red sticker (1) on OMS indicates need for correction coefficients. If sticker is present, do the following: a. Press: 1 CONTINUE	I?	MOUNT CORRECTION COEFFICIENT TAPE ENTER SERIAL NUMBER PRESS: CONTINUE
	b. Press eject bar and remove diagnostic cartridge. c. Insert correction cartridge into Calculator. d. Using numeric keyboard, enter OMS serial number into Calculator. e. Press: CONTINUE		

Table 2-4. IDP 01 Grid Comparator Diagnostic Procedures - Continued

ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
9	If no red sticker is present, press: [0] [CONTINUE]	ZERO APPS IN LOWER LEFT CORNER measure index point
10	Move photo-carriage to front left corner of base plate.	
11	Press: [ZERO]  	
12	Look through left monocular. Move photo-carriage to position an index point under measuring mark dot.	
13	Press: [MEAS CONT] or footswitch	

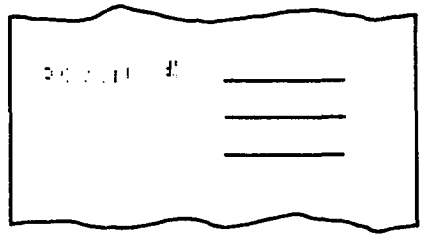


Table 2-4. IDP 01 Grid Comparator Diagnostic Procedures - Continued

ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
14	Proceeding in a counterclockwise direction, repeat steps 12 and 13 for remaining three index points.	point # _____ _____ _____ point # _____ _____ _____ point # _____ _____ _____ residual= pt ____ x= _____ y= _____ residuals pt ____ x= _____ y= _____ residuals pt ____ x= _____ y= _____ residuals pt ____ x= _____ y= _____
15	If any of the four points were measured incorrectly or if residuals are greater than 0.030, do the following: a. Press: [1] [CONTINUE] b. Remeasure all four index points.	
16	Press: [0] [CONTINUE]	measure test point, or reject
17	Look through left monocular. Move photo-carriage to position first point (00) under measuring mark dot.	
18	Press: [MEAS CONT] or footswitch.	x= _____ xres= _____ y= _____ yres= _____

Table 2-4. IDP 01 Grid Comparator Diagnostic Procedures - Continued

ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
19	If point was measured incorrectly, do the following: a. Press: REJECT b. Remeasure point	
20	Repeat steps 16 and 17 for remaining 65 points in right-to-left, top-to-bottom sequence.	
21	Press: TERM	rms X= (less than 30) rms Y= (less than 30) **NOTE** System performance is acceptable when rms x and rms y are both less than 30.

Table 2-5. X-Y Plot Diagnostic Procedures

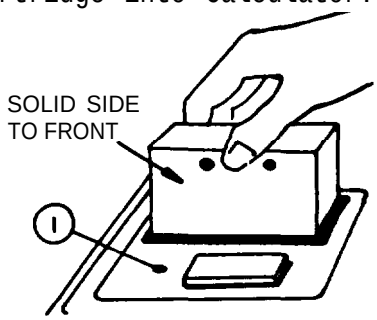
ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
1	Apply power to system.	
2	Secure 10-mm grid on left TID photo plate.	
3	Press: [RESET]	
4	Insert ITC-001 diagnostic cartridge into Calculator.  	
5	Press: [REWIND]	
6	When tape-running light (1) goes out, press: [RESET] [ERASE] [A] [EXECUTE] [LOAD] [1] [EXECUTE]	
7	When tape-running light goes out, press: [RUN]	x axis enter 1, y axis enter 2

Table 2-5. X-Y Plot Diagnostic Procedures - Continued

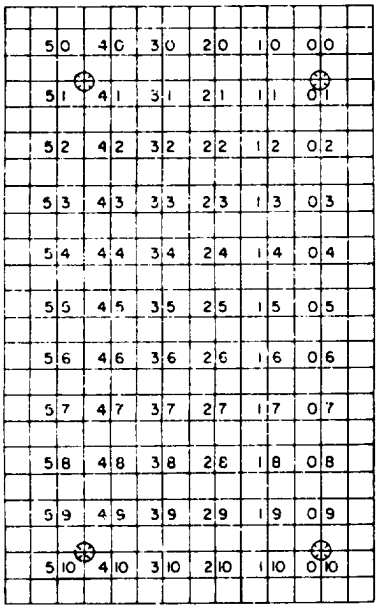
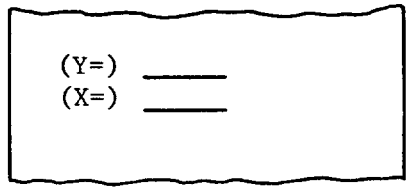
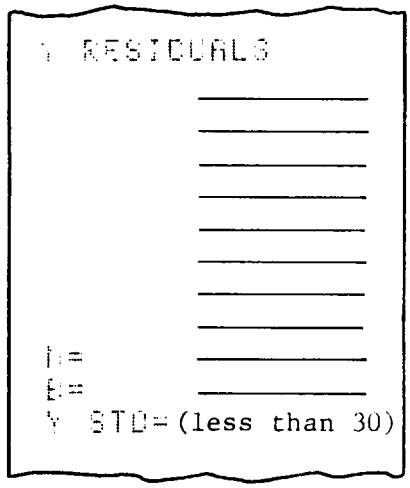
ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
8	Press: [1] [CONTINUE]  	measure point PRESS INDEX AT END
9	Look through left monocular. Move photo-carriage to position point 50 under measuring mark dot.	
10	Press: [ZERO] [MEAS CONT]	0.000 0.000
11	Move photo-carriage to the left to position point 40 under measuring mark dot.	
12	Press: [MEAS CONT]	(Y=) _____ (X=) _____
13	Repeat steps 11 and 12 for points 30, 20, 10, and 00.	

Table 2-5. X-Y Plot Diagnostic Procedures - Continued

ITEM NO.	ACTION	CALCULATOR INDICATION DISPLAY PRINTER
14	Press: [INDEX]	X RESIDUALS X STD=(less than 30)
15	Press: [REWIND]	
16	When tape-running light goes out, press: [RESET] [ERASE] [A] [EXECUTE] [LOAD] [1] [EXECUTE]	-
17	When tape-running light goes out, press: [RUN]	x axis enter 1; y axis enter 2
18	Press: [2] [CONTINUE]	measure point PRESS INDEX AT END
19	Look through left monocular. Move photo-carriage to position point 010 under measuring mark dot.	
20	Press: [ZERO] [MEAS CONT]	0.000 0.000
21	Move photo-carriage to the front to position point 09 under measuring mark dot.	

Table 2-5. X-Y Plot Diagnostic Procedures - Continued

ITEM NO.	ACTION	CALCULATOR INDICATION
		DISPLAY / PRINTER
22	Press: MEAS CONT	 (Y=) _____ (X=) _____
23	Repeat steps 21 and 22 for points 08, 07, 06, 05, 04, 03, 02, 01, and 00.	
24	Press: INDEX	 1 RESIDUALS _____ _____ _____ _____ _____ _____ _____ _____ M= _____ B= _____ Y STD= (less than 30)

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-8. PREVENTIVE MAINTENANCE PROCEDURES-No PMCS requirements are assigned to DS/GS levels. Detailed procedures for all PMCS's are given in TM5-1260-206-12, Operator and Organizational Maintenance Manual for Analytical Photogrammetric Positioning System AN/UYK-48.

Section IV. TROUBLESHOOTING

2-9. GENERAL - This section provides procedures that allow DS/GS maintenance personnel to troubleshoot the APPS system. When a malfunction is isolated to a major unit (DAC, OMS, etc.), refer to the Symptom Index of the applicable chapter. Troubleshooting procedures for the Calculator are given in TM-11-6660-263-24-2, Organizational, Direct Support, and General Support Maintenance Manual for HP9825A Calculator, CP-1387/U.

2-10. SYMPTOM INDEX - Table 2-6 is a symptom index for common malfunctions of the APPS. Each symptom references an applicable troubleshooting procedure for further fault isolation.

2-11. TROUBLESHOOTING PROCEDURES - Troubleshooting the APPS consists of isolating the malfunction to a specific unit. Reference is then made to chapters 3 through 7 for detailed : troubleshooting procedures for each unit to the assembly or component level. Table 2-7 lists troubleshooting procedures for the APPS. If a malfunction is not listed or is not corrected by the procedures given in the table, refer to the DAC functional block diagrams (FO-3 through FO-6) and the APPS interconnecting diagram (FO-7).

Table 2-6. APPS Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
A. VISUAL AND MECHANICAL SYMPTOM		
DAC, OMS, DIC, and TID connectors damaged	2-11	
OMS photo-carriage movement restricted	4-2	1
OMS measuring mark holder does not lock	4-2	1
TID photo plate movement restricted	7-2	3
Digital Display connector damaged	6-6	4
Digital Display modules damaged	6-4	1
B. ELECTRICAL SYMPTOMS		
No power on indications for DAC, OMS, TID, or Calculator	2-7	8
DAC power indicators not lit	3-2	1
DAC cooling fan not operating	3-2	2
DAC ELAPSED TIME Ml meter not advancing	3-2	3
OMS overhead lamps not lit	4-2	1
DIC sonalert sounds repeatedly	2-7	1
DIC pushbutton indicators not lit	2-7	3
Digital Display read-out not lit	2-7	4
DIC pushbutton indicators and Digital Display read-out not lit	2-7	3
TID power indicator not lit	7-2	1
TID illuminators not lit	7-2	2
C. DIAGNOSTIC SYMPTOMS		
Calculator SAE output missing or incorrect	2-7	6
Calculator X STD or Y STD readings out of tolerance	2-8	
DIC pushbuttons do not work	2-7	7
Digital Display read-out does not zero	2-7	5
Digital Display read-out does not display proper numbers or signs	6-2	2
Digital Display read-out and Calculator print-out disagree	2-7	9

Table 2-7. APPS Troubleshooting Procedures

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. SONALERT SOUNDS REPEATEDLY

Step 1. Remove DAC top and bottom cover plates. Using an oscilloscope, check that a 3 kHz, 18 to 20 volt peak-to-peak signal is present at TP3 of card A.

If good, do step 2.
If bad, do step 4.

Step 2. Set up system to perform IDP 03 diagnostic. (See table 2-3, steps 1 thru 5.) Using an oscilloscope, perform the following measurements:

Pin No.	Action	Observe	If good	If bad
G36 G42	Press: RESET	 TTL	refer to table 3-2, malfunction 5.	do step 3

Step 3. Replace Calculator cable W102. Check that malfunction is corrected.

If not, refer to TM 11-6660-263-24-2 for Calculator troubleshooting procedures.

Step 4. Using an oscilloscope, perform the following measurements:

Pin No.	Observe	If good	If bad
A68	3kHz 15V p-p	do step 5.	refer to table 3-2, malfunction 5.
A72	3kHz 2V p-p		

Step 5. Check continuity of OMS cables W101 and W105.

If good, refer faulty OMS to depot maintenance personnel.
If bad, replace faulty cable.

2. DIC SONALERT DOES NOT SOUND WHEN PUSHBUTTONS OR FOOTSWITCH ARE PRESSED

Open DIC unit. Connect Multimeter to PI, pin 4. Disconnect cable W105 from OMS photo-carriage. Check that +5V is present.

If yes, refer to table 5-2, malfunction 1.
If not, refer to table 3-2, malfunction 6.

Table 2-7. APPS Troubleshooting Procedures - Continued

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

3. DIC PUSHBUTTON INDICATORS NOT LIT

Step 1. Check that DAC Power indicator is lit.

If yes, do step 2.
If no, refer to table 3-2, malfunction 1.

Step 2. Disconnect P5 of cable W101 from J5 of 04S. Using a multimeter, perform the following measurement.

Pin No.	Observe	If good	If bad
P5-W	+5V	do step 3.	do step 5.

Reconnect P5.

Step 3. Remove DIC top assembly. Using a multimeter, perform the following measurement.

Pin No.	Observe	If good	If bad
P1-15	+5V	refer to table 5-2 malfunction 2.	do step 4.

Step 4. Check continuity of OMS wiring. (See figure 4-l.) Repair/replace faulty wiring.

Step 5. Disconnect Digital Display from DAC. Check whether DIC pushbutton indicators light.

If yes, refer to table 6-6, step 1.
If no, refer to table 3-2, malfunction 4.

4. DIGITAL DISPLAY READ-OUT NOT LIT

Check that DIC pushbutton indicators are lit.

If yes, refer to table 6-2, malfunction 1.
If no, refer to table 2-7, malfunction 3.

5. DIGITAL DISPLAY READ-OUT DOES NOT ZERO

Step 1. Turn system power off and on. Check that read-out shows all zeros.

If yes, do step 2.
If no, refer to table 3-2, malfunction 9.

Table 2-7. APPS Troubleshooting Procedures - Continued

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 2. Remove DAC bottom cover plate. Using an oscilloscope, perform the following measurement.

Monitor	Press:	Observe	If good	If bad
Pin D57	ZERO	 50-100 USEC TTL	refer to table 3-2, malfunction 9.	do step 3.

Step 3. Check continuity of OMS cables W101 and W105.

If good, refer to table 5-2, malfunction 3.
If bad, replace faulty cable.

6. X-AXIS ENCODER OUTPUT MISSING OR INCORRECT

Step 1. Remove DAC bottom cover plate. Using an oscilloscope, perform the following measurements.

Pin No.	Rotate X-axis Parallax adjust	Observe	If bad
G84	Clockwise	TTL pulses	do step 2.
G82	Counterclockwise		

Step 2. Check continuity of OMS cables W101 and W105.

If bad, replace faulty cable.
If good, refer to table 3-2, malfunction 10.

7. DIC PUSHBUTTONS DO NOT WORK

Remove DAC bottom cover plate. Using an oscilloscope, perform the following measurements:

Pin No.	Press:	Observe	If good	If bad
G80	MEAS CONT	 50-100 USEC TTL	refer to table 3-2, malfunction 6.	refer to table 5-2, malfunction 3.
G76	INDEX			
G74	TERM			
G78	TTY			

Table 2-7. APPS Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
8. NO POWER ON INDICATIONS FOR DAC, OMS, TID, OR CALCULATOR Step 1. Disconnect power cable from power distribution assembly jack J1, J2, J3, or J4 for suspect component. Reconnect to known good jack. If bad, do step 2. If good, replace faulty power distribution assembly component. (See table 3-3.) Step 2. Check continuity of power cable. If bad, replace faulty cable. If good, refer to table 3-1, 4-1, or 6-1 as applicable. 9. DIGITAL DISPLAY READ-OUT AND CALCULATOR PRINT-OUT DISAGREE Replace Calculator cable W102. If malfunction remains, refer to table 3-2, step 7.

Section V. MAINTENANCE PROCEDURES

2-12. GENERAL - Table 2-8 is a summary of maintenance tasks for the APPS system. It identifies the item to be serviced, action, and location of the maintenance procedure associated with each task. Tables 2-9 through 2-11 provide the DS/GS personnel with all authorized system level maintenance procedures for the APPS.

Table 2-8. APPS Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. System	Performance	See tables 2-1 through 2-3.
2. System	Coarse alignment	See table 2-9, step 1.
3. X-axis	Fine alignment	See table 2-10, step 1.
4. Y-axis	Fine alignment	See table 2-10, step 17.
5. Chassis connectors	Removal	See table 2-11, step 1.
6. Chassis connectors	Replacement	See table 2-11, step 3.
7. Cable connectors	Removal	See table 2-11, step 5.
8. Cable connectors	Replacement	See table 2-11, step 7.

2-13. ALIGNMENT - Performance of the alignment procedures given in tables 2-9 and 2-10 is seldom required. Alignment may be needed if the X STD and/or Y STD readings obtained from the X-Y Plot diagnostic are out of tolerance or if the Analog (A) card has been replaced.

Prior to performing an alignment, this diagnostic should be repeated to ensure that an alignment is required. Depending upon the results of the X-y Plot, the X- and Y-axes can be aligned separately. The procedure is a two-stage process: coarse alignment and fine alignment.

a. Coarse Alignment - The coarse alignment contained in table 2-9 aligns the Analog (A) card to the OMS data grid and the data grid to the base plate. Tt must be performed for the X- or Y-axis or both before continuing with the fine alignment.

b. Fine Alignment - The fine alignment contained in table 2-10 ensures that the actual and computed distances that the photo-carriage travels are the same.

Table 2-9. APPS System Coarse Alignment Procedures

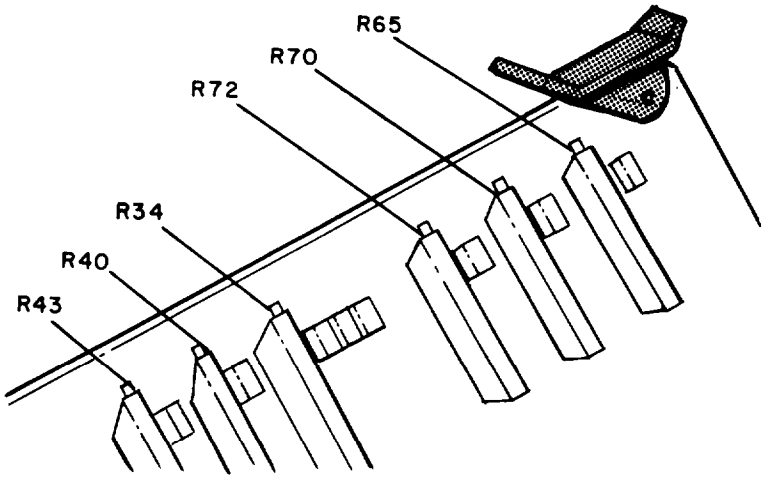
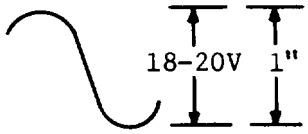
STEP NO.	ITEM PROCEDURE
	ANALOG (A) CARD ALIGNMENT 
1	DAC top cover plate Remove 24 screws and washers. Lift off cover plate.
2	DAC bottom cover plate. Remove 24 screws and washers. Lift off cover plate.
	NOTE The procedures for the X-axis and Y-axis are similar Information in parenthesis ( ) is for the Y-axis
3	Amplitude adjustment R43 (R72) Adjust by doing the following: a. Set oscilloscope: TRIGGER = INTERNAL VOLTS/CM = 5 b. Connect oscilloscope as follows: Ground = TP9 Input = TP3 (TP7)

Table 2-9. APPS System Coarse Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE

c. Perform the following:

Action	Indication
Adjust R43 (R72)	
Move photo-carriage in X-axis (Y-axis) direction	Sine wave is not modulated (changes in amplitude) or distorted (clipped).
While moving photo-carriage back and forth in X-axis (Y-axis) direction, adjust R34 (R65) and R40 (R70).	Minimum modulation and distortion.

NOTE

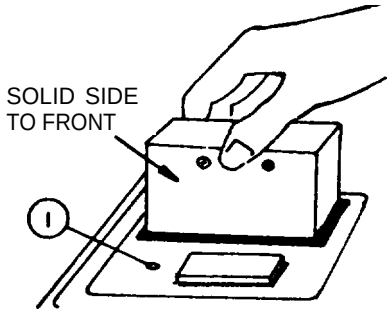
Adjustments interact. Repeat step 3c. Until no further adjustment is needed to obtain an unmodulated, undistorted sine wave. If this cannot be achieved, refer APPS to depot maintenance personnel.

DATA GRID/BASE PLATE ALIGNMENT

4 Performance test

a. Secure 10-mm grid on right TID photo plate.

b.



Insert ITC-001 diagnostic cartridge into Calculator.

c. Press: REWIND

Table 2-9.APPS Svstem Coarse Alignment Procedures - Continued

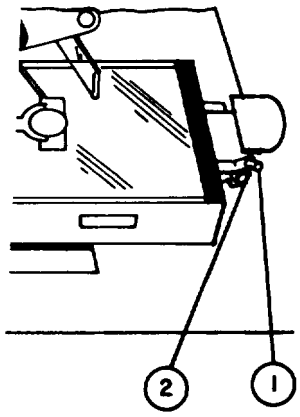
STEP NO.	ITEM PROCEDURE

d. When tape-running light (1) goes out, press:

[RESET] [ERASE] [A] [EXECUTE] [T] [R] [K] [O] [EXECUTE]

[LOAD] [2] [EXECUTE]

e. When tape-running light goes out, press:



f. Rotate X-axis parallax adjust (1) counterclockwise until stop, then back off l/2-turn.

g. Push photo-carriage lock lever (2) up. Move photo-carriage to position point (35) under right measuring mark dot. Push photo-carriage lock lever down.

h. Press: [ZERO] [MEAS CONT]

i. Rotate X-axis parallax adjust clockwise until stop, then back off l/2-turn.

j. Repeat step g.

k. Press: [MEAS CONT]

Table 2-9. APPS System Coarse Alignment Procedures - Continued

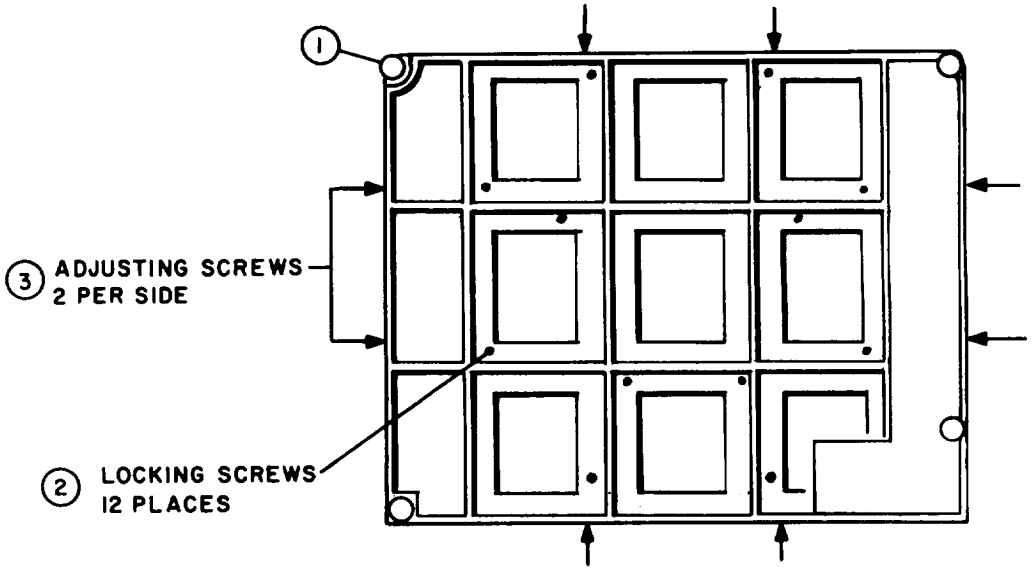
STEP NO.	ITEM PROCEDURE
	1. Check that Y-axis indication on Digital Display is 0.000 ± 0.002.
	NOTE System performance is acceptable when the Y-axis indication is within ±0.002 inches. If this indication is not obtained, the data grid/base plate must be aligned.
	m. If Y-axis indication from step 1. is within tolerance, proceed to step 6.
	
5	Datagrid (1)
	Align by doing the following:
	a. Using Allen wrench loosen 12 screws (2) 1/4 turn.
	b. Adjust eight screws (3) as required to make alignment corrections.
	NOTE It is necessary to loosen opposing screw before tightening required screw to obtain necessary motion.
	c. Repeat steps 4 and 5 until alignment is within 0.002 inches.
	d. Using a torque wrench, tighten 12 screws. Apply Locktight to screws.

Table 2-10. APPS System Fine Alignment Procedures

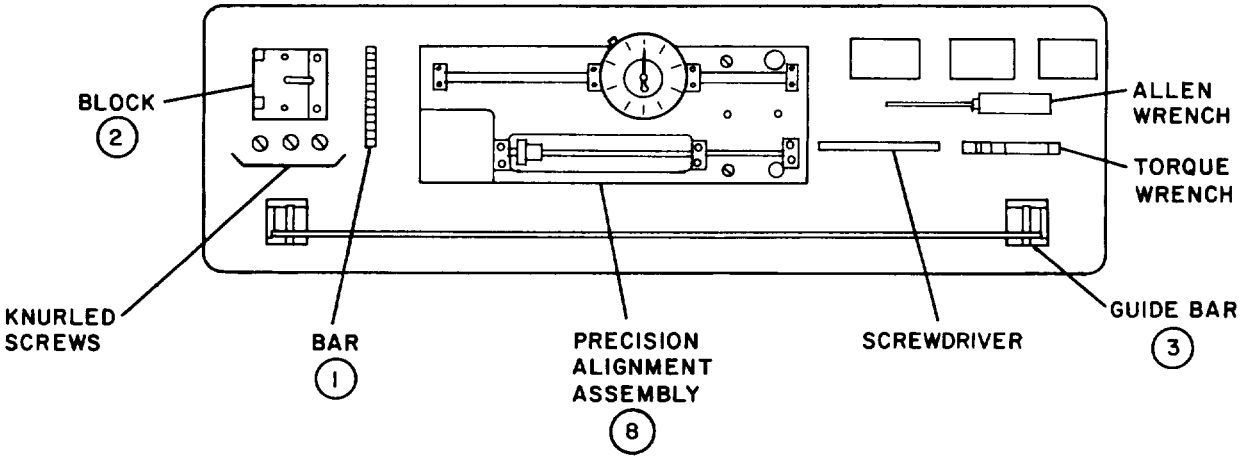
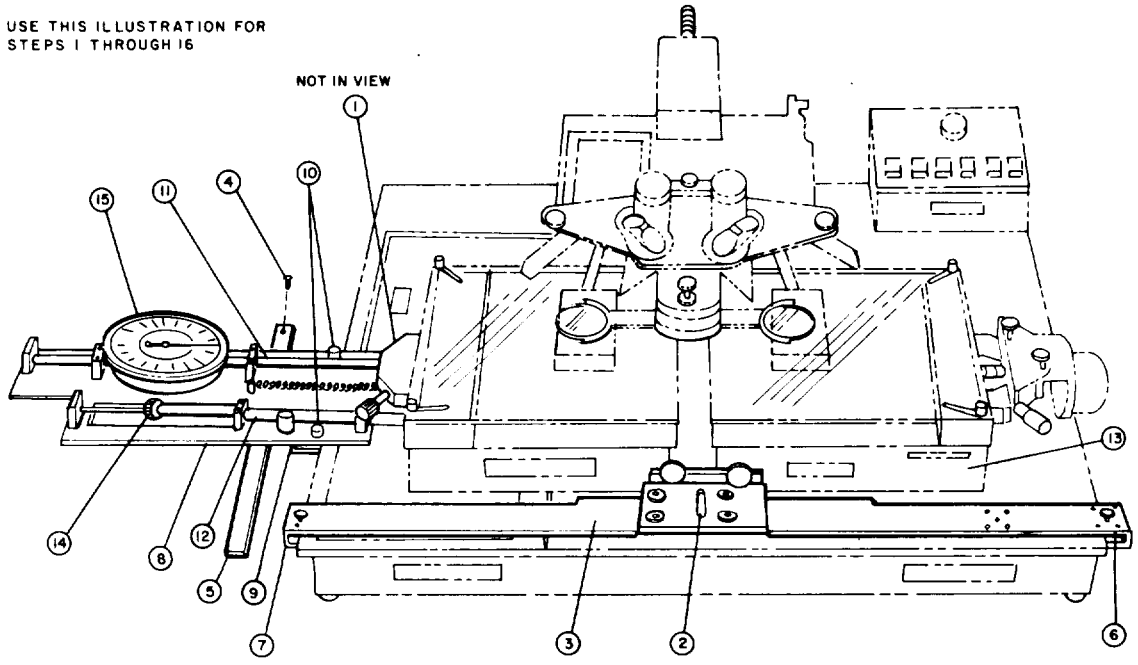
STEP NO.	ITEM PROCEDURE
	X-AXIS ALIGNMENT  
1	Bar (1). Install by doing the following: a. Move photo-carriage to left side of base plate. b. Position bar on left side of photo-carriage. Secure with one knurled screw through center hole.

Table 2-10. APPS System Fine Aligmnent Procedures - Continued

STEP NO.	ITEM PROCEDURE
2	Block (2). Install by doing the following: a. Move photo-carriage to front of base plate. b. Position guide on cursor coil mounting bracket. Secure with two knurled screws.
3	Guide bar (3). Install by doing the following: a. Remove nine screws (4) from base plate. Remove Y-axis stop bar (5) from base plate. b. Insure clamp (6) is in end position. c. Pull spring loaded block (2) to accommodate guide bar. Place guide bar in block to contact three rollers. Position clamps (6 and 7) on right and left edges of base plate. Do not tighten clamps.
4	Precision alignment assembly (8). **CAUTION** The precision alignment assembly is a delicate instrument. Handle with care. Install by doing the following: a. Insert assembly clamps (9) into slots on left side of base plate. Tighten clamp screws (10). b. Move photo-carriage (13) until meter rod (11) and push rod (12) align with bar (l). Tighten guide bar clamps (6) and (7).

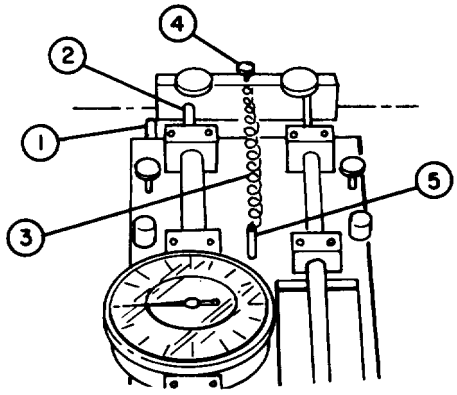
Table 2-10. APPS System Fine Alignment Procedures - Continued

<table>
<tr><th>STEP NO.</th><th>ITEM
PROCEDURE</th></tr>
<tr><td>5</td><td>Guide bar (3)

Align by doing the following:

<table>
<tr><th>Action</th><th>Digital Display Indication</th></tr>
<tr><td colspan="2">a. Apply power to APPS.</td></tr>
<tr><td colspan="2">b. Move photo-carriage to left. Keep slight pressure against guide bar.</td></tr>
<tr><td>c. Press: [ZERO]</td><td>X 0.000 Y 0.000</td></tr>
<tr><td>d. Move photo-carriage to right. Keep slight pressure against guide bar.</td><td>X counts Y 0.000 ±0.003</td></tr>
<tr><td>e. If required indication is not obtained, loosen guide bar clamps (6) and (7) and reposition guide bar. Tighten clamps.</td><td>Y 0.000</td></tr>
<tr><td colspan="2">f. Repeat steps b. through e. as necessary until no adjustment is required.</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>Preliminary settings:

Do the following:

a. Hold tip of meter rod (2) with finger. Slide lock lever (1) to edge. Slowly release meter rod until it contacts bar.

b. Remove spring (3). Reconnect to bar post (4) then to precision alignment assembly post (5).</td></tr>
<tr><td>7</td><td>Photo-carriage (13)

Using push rod adjusting screw (14) move photo-carriage near center of base plate.</td></tr>
</table>

Table 2-10. APPS System Fine Alignment Procedures - Continued

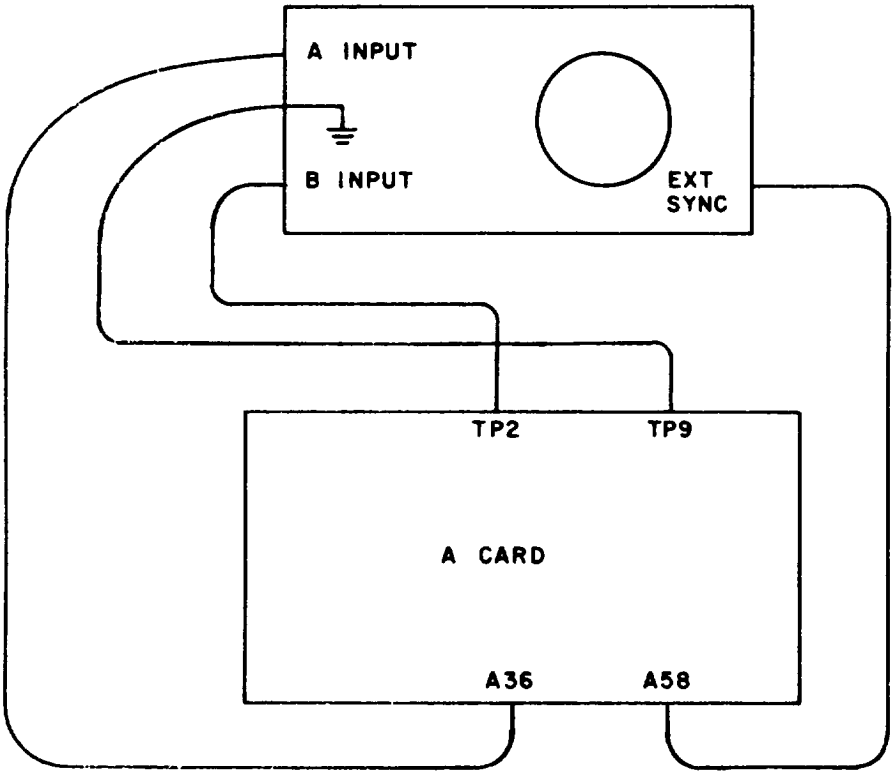
STEP NO.	ITEM PROCEDURE
8	Oscilloscope a. Set as follows: A GAIN = 2 V/CM B GAIN = 1 V/CM Horizontal Sweep = 0.1 msec/cm Display Mode = ALT Trigger Source = EXT Trigger Coupling = DC Trigger Mode = NORMAL b. Connect as shown.  **NOTE** A36 and A58 refer to connector pins on circuit card A. Remove DAC bottom cover to gain access to these pins.

Table 2-10. APPS System Fine Alignment Procedures - Continued

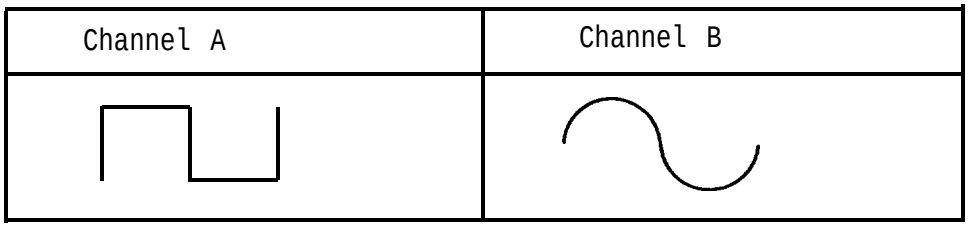
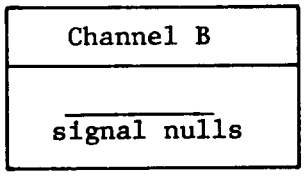
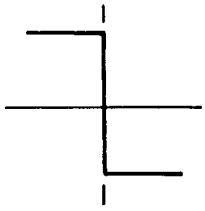
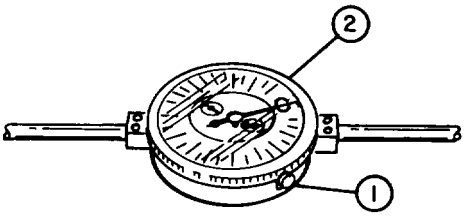
STEP NO.	ITEM PROCEDURE
	c. Observe the following: 
9	Adjust screw (14) Observe that channel B sine wave nulls as adjust screw is rotated. Rotate adjust screw until the following is observed: 
10	Oscilloscope a. Set as follows: Display Mode = Channel A TIME/DIV = 10 usec/cm MAGNIFIER = X10 b. Rotate HORIZONTAL POSITION control until the right-to-low transition is on the center grid line of the oscilloscope.  **NOTE** The square wave transition is used as a zero reference point. As the photo-carriage is moved the reference point will move.

Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE
11	System zero a. Zero alignment meter (15) by doing the following:  1. Loosen locking screw (l). 2. Rotate dial (2) to indicate zero. 3. Tighten locking screw. b. Press: ZERO
12	Fine Alignment **NOTE** When moving photo-carriage with adjust screw, always approach desired meter or oscilloscope indication from the same direction. If desired indication is overshot, back up past it and continue. Do the following procedure:

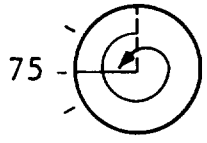
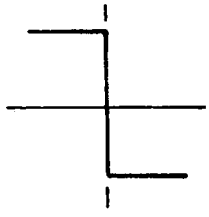
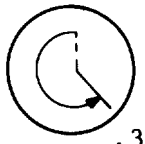
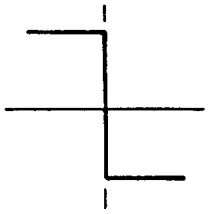
Rotate adjust screw (14)	Observe	Adjust	X Display indication
a. Clockwise	 Alignment Meter	R40	Changes from 0.124 to 0.125
b. Counter-clockwise	 Oscilloscope	High-to-low transition on center grid line	
c. Zero system - (See step 11.)			
d. Repeat steps a. through c. until no further adjustment is needed.			

Table 2-1.0. APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE

Rotate adjust screw (14)	Observe	Adjust	X Display indication
e. Zero system. (See step 11.)			
f. Clockwise	 Alignment Meter	R34 (R65)	Changes from 0.062 to 0.063
g. Counter-clockwise	 Oscilloscope	High-to-low transition on center grid line	
h. Zero system. (See step 11.)			
i. Repeat steps a. through f. as necessary. Adjustments interact.			
j. Perform X-Y Plot diagnostic. (See table 2-5.) If X STD is out of tolerance, repeat steps 7 through 12 using a different zero reference point.			

ALIGNMENT KIT REMOVAL

13 Precision alignment assembly (7)

CAUTION

The precision alignment assembly is a delicate instrument. Handle with care.

Table 2-10.APPS System Fine Alignment Procedures - Continued

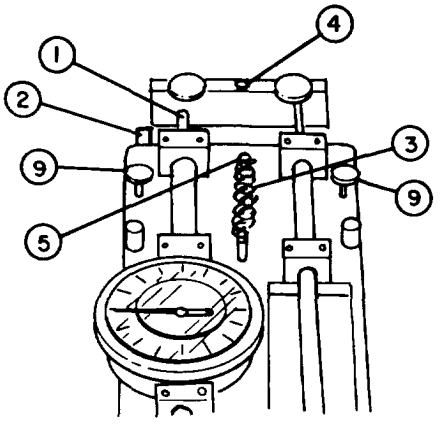
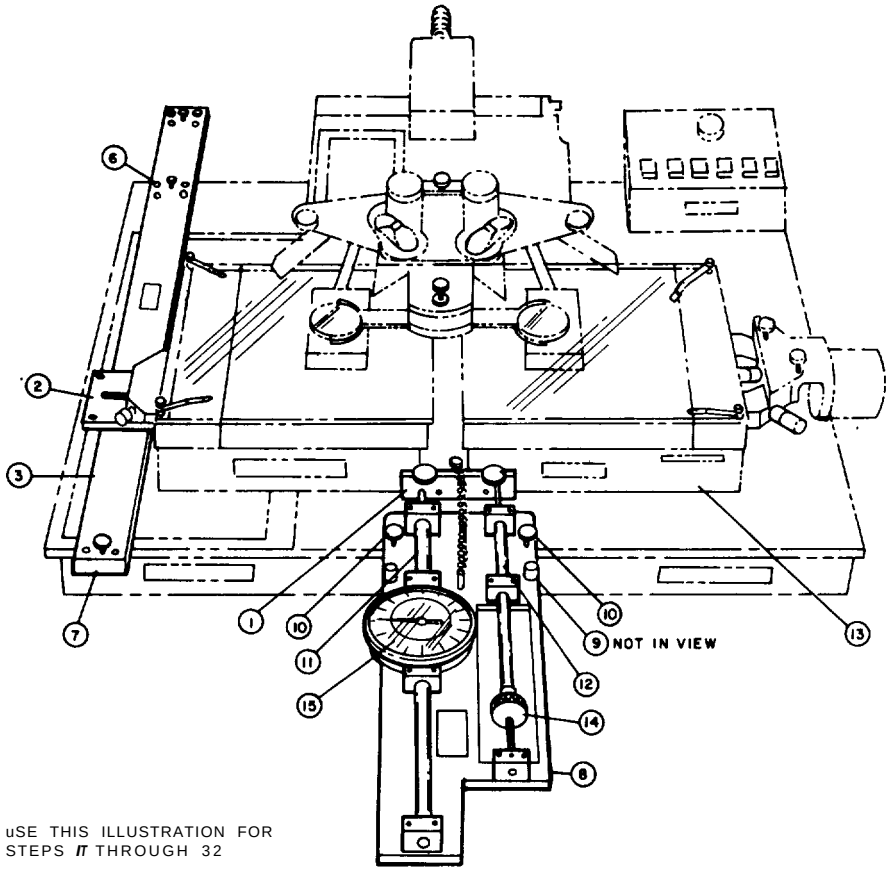
STEP NO.	ITEM PROCEDURE
	Remove by doing the following:  a. Push in meter rod (1) and hold with finger. Slide lock lever (2) to right to cover tip of meter rod. Slowly release meter rod until it contacts lock lever. b. Disconnect spring (3) from bar post (4). Reconnect to storage post (5). c. Loosen clamp screws (9). Pull clamps free of base plate. d. Remove alignment assembly. e. Rotate adjust screw (14) counterclockwise until push rod (12) is even with alignment assembly.
14	Guide bar (3) Remove by doing the following: a. Loosen clamps (6) and (7). b. Move photo-carriage to front and press guide bar down. c. Replace Y-axis stop bar (5) and secure with nine screws (4).
15	Block (2) Remove two knurled screws. Remove block.
16	Bar (1) Remove knurled screw. Remove bar.

Table 2-10.APPS System Fine Alignment Procedures - Continued

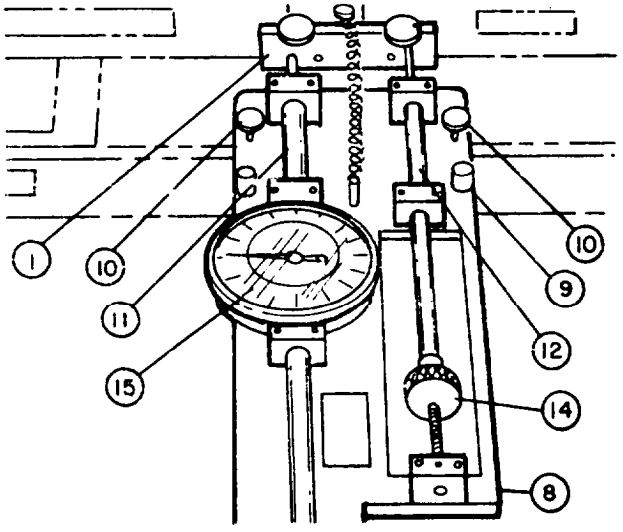
STEP NO.	ITEM PROCEDURE
	Y-AXIS ALIGNMENT



USE THIS ILLUSTRATION FOR STEPS 17 THROUGH 32

17	Bar (1) Install by doing the following: a. Move photo-carriage to right side of base plate. b. Position bar on cursor coil mounting bracket. Secure with two knurled screws through outer holes.
18	Block (2) Install by doing the following: a. Move photo-carriage to left side of base plate. b. Position block on left side of photo-carriage. Secure with one knurled screw through center hole.

Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE
19	Guide bar (3) a. Insure clamp (6) is in middle position. b. Pull spring loaded block (2) to accommodate guide bar. Place guide bar in block to contact three rollers. Position clamps (6 and 7) on back and front edges of base plate. Do not tighten clamps.
20	Precision alignment assembly (8) **CAUTION** The precision alignment assembly is a delicate instrument. Handle with care. Install by doing the following:  a. Insert assembly clamps (9) into slots on front of base plate. Tighten clamp screws (10). b. Move photo-carriage until meter-rod (11) and push rod (12) align with bar (l). Tighten guide for clamps (6) and (7).
21	Guide bar (3) Align by doing the following:

Action	Digital Display Indication
a. Apply power to APPS.	
b. Move photo-carriage to front. Keep slight pressure against guide bar.	
c. PRESS : [ZERO]	X 0.000 X 0.000

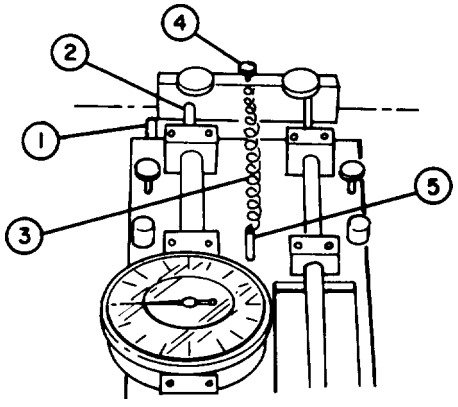
Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE

Action	Digital Display Indication
d. Move photo-carriage to rear. Keep slight pressure against guide bar.	x Y 0.000 counts ±0.003
e. If required indication is not obtained, loosen guide bar clamps (6) and (7) and reposition guide bar. Tighten clamps.	x 0.000
f. Repeat steps b. through e. as necessary until no adjustment is required.	

22 Preliminary settings:

Do the following:



a. Hold tip of meter rod (2) with finger. Slide lock lever (1) to edge. Slowly release meter rod until it contacts bar.

b. Remove spring (3). Reconnect to bar post (4) then to precision alignment assembly post (5).

23 Photo-carriage "(13)

Using push rod adjusting screw (14) move photo-carriage near center of base plate.

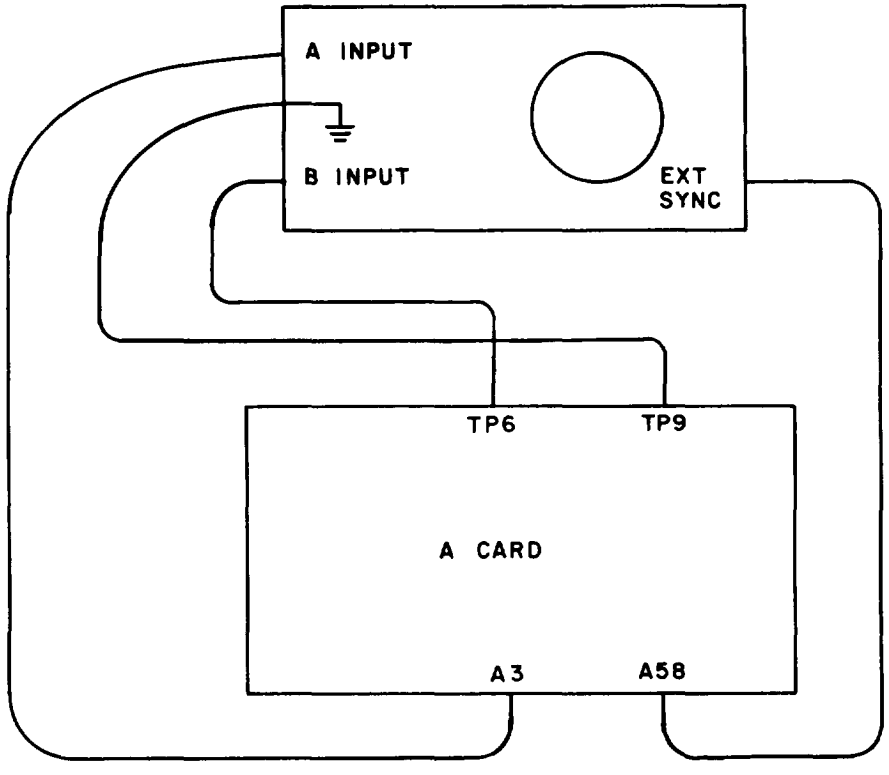
24 Oscilloscope

a. Set as follows:

A GAIN = 2 V/CM
B GAIN = 1 V/CM
Horizontal Sweep = 0.1 msec/cm
Display Mode = ALT
Trigger Source = EXT
Trigger Coupling = DC
Trigger Mode = NORMAL

Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE
	b. Connect as shown.



NOTE

A3 and A58 refer to connector pins on circuit card A. Remove DAC bottom cover to gain access to these pins.

c. Observe the following:

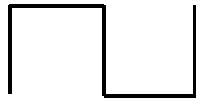
Channel A	Channel B
	

Table 2-10. APPS System Fine Alignment Procedures - Continued

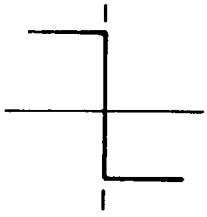
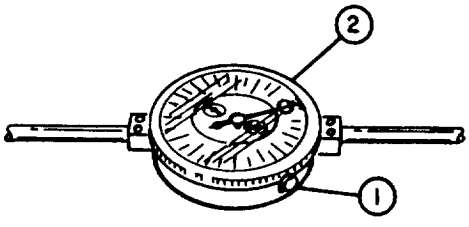
STEP NO.	ITEM PROCEDURE
25	Adjust screw (14) Observe that channel B sine wave nulls as adjust screw is rotated. Rotate adjust screw until the following is observed: **Channel B** **signal nulls**
26	Oscilloscope a. Set as follows: Display Mode = Channel A TIME/DIV = 10 usec/cm MAGNIFIER = X10 b. Rotate HORIZONTAL POSITION control until the high-to-low transition is on the center grid line of the oscilloscope.  **NOTE** The square wave transition is used as a zero reference point. As the photo-carriage is moved the reference point will move.
27	System zero a. Zero alignment meter (15) by doing the following:  1. Loosen locking screw (l). 2. Rotate dial (2) to indicate zero. 3. Tighten locking screw. b. Press: ZERO

Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP No.	ITEM PROCEDURE
28	Fine Alignment

NOTE

When moving photo-carriage with adjust screw, always approach desired meter or oscilloscope indication from the same direction. If desired indication is overshot, back up past it and continue.

Do the following procedure:

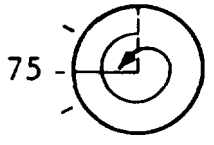
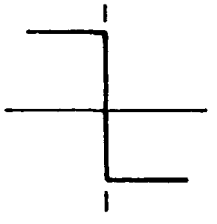
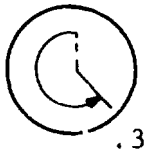
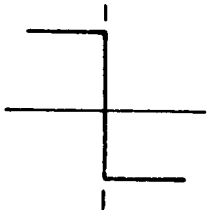
Rotate adjust screw (14)	Observe	Adjust	Y Display indication
a. Clockwise	 Alignment Meter	R70	Changes from 0.124 to 0.125
b. Counter-clockwise	 Oscilloscope	High-to-low transition on center grid line	
c. Zero system. (See step 27.)			
d. Repeat steps a. through c. until no further adjustment is needed.			
e. Zero system. (See step 27.)			
f. Clockwise	 Alignment meter	R65	Changes from 0.062 to 0.063

Table 2-10. APPS System Fine Alignment Procedures - Continued

STEP NO	ITEM PROCEDURE

Rotate adjust screw (14)	Observe	Adjust	Y Display indication
g. Counter-clockwise	 Oscilloscope		High-to-low transition on center grid line
h. Zero system. (See step 27.)			
i. Repeat steps a. through f. as necessary. Adjustments interact.			
j. Perform X-Y Plot diagnostic. (See table 2-5.) If Y STD is still out of tolerance, repeat steps 23 through 28 using a different zero reference point.			

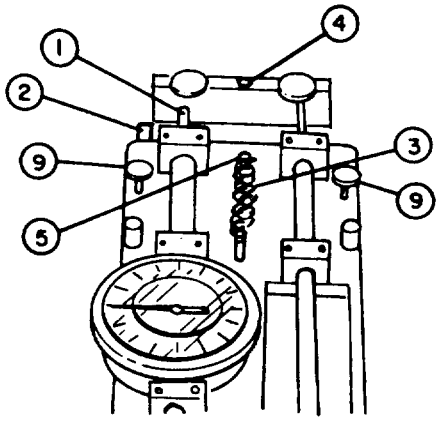
ALIGNMENT KIT REMOVAL

29 Precision alignment assembly (7)

CAUTION

The precision alignment assembly is a delicate instrument. Handle with care.

Remove by doing the following:



a. Push in meter rod (1) and hold with finger. Slide lock lever (2) to right to cover tip of meter rod. Slowly release meter rod until it contacts lock lever.

b. Disconnect spring (3) from bar post (4). Reconnect to storage post (5).

c. Loosen clamp screws (9). Pull clamps free of base plate.

d. Remove alignment assembly.

e. Rotate adjust screw (14) counterclockwise until push rod (12) is even with alignment assembly.

Table 2-10.APPS System Fine Alignment Procedures - Continued

STEP NO.	ITEM PROCEDURE
30	Guide bar (3) Remove by doing the following: a. Loosen clamps (6) and (7). b. Move photo-carriage to left and press guide bar down. c. Relocate clamp (5) to end position.
31	Block (2) Remove two knurled screws. Remove block.
32	Bar (1) Remove two knurled screws. Remove bar.
33	DAC bottom cover plate Replace and secure with 24 screws and washers.
34	DAC top cover plate Replace and secure with 24 screws and washers.

Table 2-11. Connectors Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	CHASSIS CONNECTOR REMOVAL
1	Chassis Disassemble as required to gain access to connector. (See chapters 3 through 7.)
2	Connector Remove by doing the following: a. Unsolder and tag with destination labels all wires attached to connector pins. b. Remove screws, washers, and nuts attaching connector to panel. c. Remove connector.
	CHASSIS CONNECTOR REPLACEMENT
3	Connector Replace by doing the following: a. Insert connector through cutout in panel. Secure with screws, washers, and nuts. b. Resolder wires to connector pins according to destination tags. c. Using a multimeter, check for O ohms resistance through replaced connector. (See chapters 3 through 7.)
4	Chassis Reassemble as required. (See chapters 3 through 7.)
	CABLE CONNECTOR

Table 2-11. Connectors Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
	REMOVAL
5	Strain relief clamp (1) Loosen two screws (2) and remove clamp.
6	Connector Disassemble by doing the following: a. Plug connector into mating chassis connector to prevent it from rotating. b. Rotate strain relief shell (3) counterclockwise. For MS connectors grasp retaining ring with pliers to prevent it from turning. c. Unsolder and tag with destination all wires connected to pins. Remove cable. d. Remove strain relief shell and rubber boat (5).
	REPLACEMENT
7	Connector Reassemble by doing the following: a. Slide rubber boat and strain relief shell onto cable. Insert cable through retaining ring (MS connectors) and collar (6). b. Resolder wires to connector pins according to destination labels. c. For MS connectors slide retaining ring over connector head (7) and engage threads. d. Plug connector into mating chassis connector to prevent it from rotating. e. Slide rubber boat and strain relief shell towards connector head and tighten. For MS connectors grasp retaining ring with pliers to prevent it from turning.
8	Strain relief clamp Replace and secure with two screws.

CHAPTER 3

DIGITAL CONTROLLER C-10133/UYK-48 MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special Tools: None
- TMDE: Multimeter TS-352 (or equivalent)
  Oscilloscope, AN/USM-281 (or equivalent)
  Test Cable, IDEAS Model 1467
- Support Equipment: None

3-3. REPAIR PARTS -Repair parts applicable to DS/GS maintenance personnel are listed and illustrated in the Repair Parts and Special Tools List TM 5-1260-206-24P.

Section II. OPERATIONAL CHECKS

3-4. VISUAL AND MECHANICAL INSPECTION - Visual and mechanical inspection procedures for the DAC are included in table 2-1.

3-5. PERFORMANCE TEST - Performance tests procedures for the DAC are included in tables 2-2 and 2-3.

Section III. TROUBLESHOOTING

3-6. SYMPTOM INDEX - Table 3-1 is a symptom index for common malfunctions of the DAC. Each symptom references an applicable troubleshooting procedure for further fault isolation.

3-7. TROUBLESHOOTING PROCEDURES - Troubleshooting the DAC consists of isolating the malfunction and replacing the faulty part. Figure 3-1 illustrates pin locations on the DAC backplane. Table 3-2 lists troubleshooting procedures for the DAC. If a malfunction is not listed or is not corrected by the procedures given in this table, refer to the DAC functional block diagrams (FO-3 through FO-6), the system interconnecting diagram (FO-7), and the DAC interconnecting diagram (FO-8).

Table 3-1. DAC Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
Connectors damaged	2-11	
Power indicator not lit	3-2	1
Cooling fan not operating	3-2	2
ELAPSED TIME Ml meter not advancing	3-2	3
All DIC lamps are out/DAC lamp is lit	3-2	4
Sonalert sounds repeatedly	3-2	5
Sonalert does not sound	3-2	6
Calculator print-out and Digital Display read-out disagree	3-2	7
Digital Display read-out does not change as photo-carriage is moved	3-2	8
Digital Display read-out does not zero	3-2	9
X-axis encoder output missing or incorrect	3-2	10

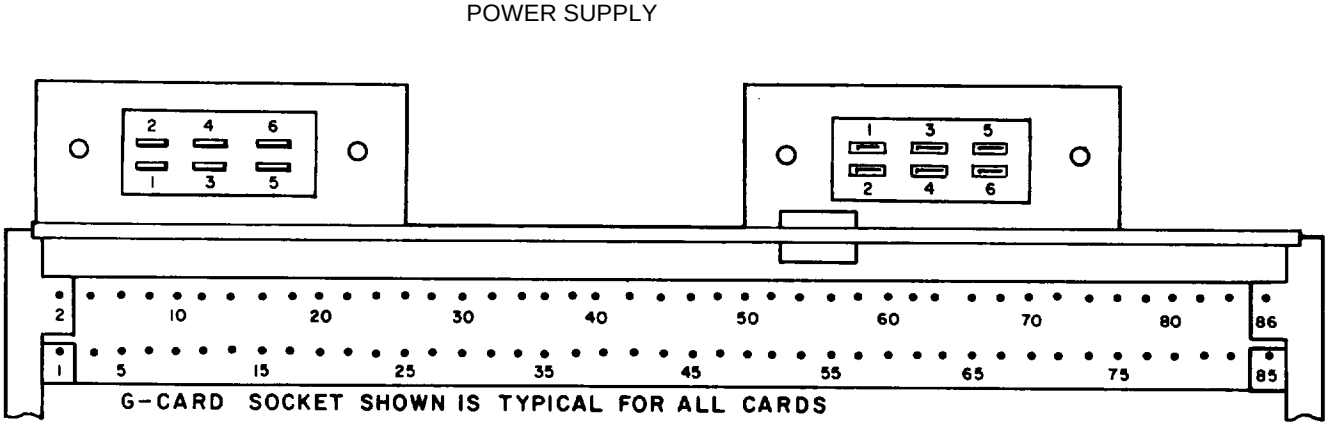


Figure 3-1. Backplane Pin Locations

Table 3-2. DAC Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. POWER INDICATOR NOT LIT
Step 1. Check that A.C. POWER S1 switch/indicator is lit If lit, do step 2. If not lit, do step 4.
Step 2. Check that fuse F1 is good. If good, do step 3. If bad, replace fuse.
Step 3. Check for continuity between J4 and Power indicator. (See table 3-11, step 1.) If bad, replace faulty connector, fuseholder, or lampholder. (See table 3-3.)
Step 4. Check for continuity in power distribution assembly between P5 and P4. If bad, replace faulty connector, line filter, ac spike suppressor or switch. (See table 3-4.) If good, replace faulty W104 cable.
Step 5. Check that malfunction is corrected. If not, refer faulty DAC to depot maintenance personnel.
2. COOLING FAN NOT OPERATING
Step 1. Check for 115 volts ac at fan. If voltage is not present, do step 2. If voltage is present, replace fan. (See table 3-7.)
Step 2. Check for continuity between fan and J4. (See table 3-11, step 1.) If bad, replace faulty wiring.
3. ELAPSED TIME Ml METER NOT ADVANCING
Step 1. Check for 115 volts ac at ELAPSED TIME Ml meter. If voltage is not present, do step 2. If voltage is present, replace meter. (See table 3-13.)

Table 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Check for continuity between meter and J3.

If bad, replace faulty wiring.

4. ALL DIC LAMPS ARE OUT/DAC LAMP IS LIT

Step 1. Do procedure given in table 2-7, malfunction 3.

CAUTION

To prevent damage to electronic components, always reenergize unit before removing or inserting printed circuit cards.

Step 2. Remove DAC top and bottom cover plates.

Remove all printed circuit cards. (See table 3-6, steps 1 & 2.)
Remove power supply. (See table 3-5, step 4.)

Energize DAC.

Using a multimeter, perform the following measurements. (See table 3-11.) If the normal indication disappears, the card/assembly being inserted is shorted.

ACTION	PIN NO.	NORMAL INDICATION	IF NORMAL INDICATION IS NOT OBTAINED
Initially	A86	+5V	Replace power supply. (See table 3-5.)
Reinsert card A			Replace card A. (See para. 2-13.)
Reinsert card B			Replace card B.
Reinsert card C			Replace card C.
Reinsert card D			Replace card D.
Reinsert card F			Replace card F.
Reinsert card G			Replace card G.

Table 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 3. Check that malfunction is corrected.

If not, refer faulty DAC to depot maintenance personnel.

5. SONALERT SOUNDS REPEATEDLY

Step 1. Remove DAC top and bottom cover plates.

Remove all printed circuit cards.

Energize DAC

Using a multimeter, perform the following measurements. (See FO-8.) If the normal indication disappears, the card/assembly being inserted is shorted.

ACTION	PIN NO.	NORMAL INDICATION	IF NORMAL INDICATION IS NOT OBTAINED
Initially	A21 A76	-15V +15V	Replace power supply. (See table 3-5.)
Reinsert card A	A21 A76	-15V +15V	Replace card A. (See para. 2-13.)
Reinsert card B	A21 A76	-15V +15V	Replace card B.
Reinsert card C	A21 A76	-15V +15V	Replace card C.
Reinsert card D	A21 A76	-15V +15V	Replace card D.
Reinsert card F	A21 A76	-15V +15V	Replace card F.
Reinsert card G	A21 A76	-15V +15V	Replace card G.

Step 2. Using an oscilloscope, check that a 3kHz, 18 to 20 volt peak-to-peak signal is present at TP3 of card A.

If good, replace card G.

Step 3. Check for continuity of pins A28, A32, A38, A42, A58, A68, A72, A75, and A84 with J1. (See table 3-11 and FO-8.)

Table 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

If bad, replace faulty connector, or chassis mounted component. (See table 3-11.)

If good, replace card A. (See para. 2-13.)

Step 4. Check that malfunction is corrected.

If not, refer faulty DAC to depot maintenance personnel.

6. SONALERT DOES NOT SOUND WHEN DIC PUSHBUTTONS OR FOOTSWITCH ARE PRESSED

Step 1. Remove DAC top and bottom cover plates.

Check continuity between pins A55 and G52. Check for proper value of resistor R2. (See table 3-11 and FO-8.)

If bad, replace faulty wire or resistor.

Step 2. Remove card G.

If sonalert sounds, replace card G.

If sonalert does not sound, replace card A. (See para. 2-13.)

Step 3. Check that malfunction is corrected.

If not, refer faulty DAC to depot maintenance personnel.

CAUTION

To prevent damage to electronic components, always reenergize unit before removing or inserting printed circuit cards.

7. CALCULATOR PRINT-OUT AND DIGITAL DISPLAY READ-OUT DISAGREE

Step 1. Remove DAC top and bottom cover plates. Using an oscilloscope perform the following measurements.

Monitor pin G56	Press:	Observe:	If good replace card F	If bad replace card G
	MEAS CONT	1 USEC TTL		

TAble 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 2. Check continuity between B card and C card, pins 10, 12, 13, 15, 16, 18, 25, 26, 27, 29, 30, 34, 35, 37, 40, 42, 46, 47, and 48. (See table 3-11 and FO-8.) If bad, replace or repair faulty wire.
Step 3. Check that malfunction is corrected. If not, refer faulty DAC to depot maintenance personnel.
8. DIGITAL DISPLAY READ-OUT DOES NOT CHANGE AS PHOTO-CARRIAGE IS MOVED
Step 1. Move photo-carriage diagonally across base plate. Check whether one display (X or Y) or both X and Y do not change. If one display, do step 2. If both displays, replace card D.
Step 2. Remove DAC top and bottom cover plates.
CAUTION To prevent damage to electronic components, always reenergize unit before removing or inserting printed circuit cards.
Swap position of B card (X-axis) with C card (Y-axis). Check which display does not change. If same display as step 1, replace card A. (See para. 2-13.) If other display, replace card B or card C.
Step 3. Check continuity between card A, pins A3 and A36, and cards B and C. (See table 3-11 and FO-8.) If bad, replace or repair faulty wire.
Step 4. Check that malfunction is corrected. If not, refer faulty DAC to depot maintenance personnel.

Table 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

9. DIGITAL DISPLAY READ-OUT DOES NOT ZERO

Step 1. Remove DAC top and bottom cover plates. Using an oscilloscope, perform the following measurements.

Monitor Pin D9	Press:	Observe	If good do step 2.	If bad replace card D.
	ZERO	TTL		

Step 2. Check continuity between card D, pins D9, D25, and D32, and cards B and C. (See table 3-11 and FO-8.)

Replace or repair faulty wire.

Step 3. Check that malfunction is corrected.

If not, refer faulty DAC to depot maintenance personnel.

10. X-AXIS ENCODER OUTPUT MISSING OR INCORRECT

Step 1. Remove DAC top and bottom cover plates. Using an oscilloscope, perform the following measurements. (See table 3-11.)

PIN NO.	ROTATE X-AXIS PARALLAX ADJUST	NORMAL INDICATION	REMARKS
G43	clockwise	pulses	If pulses are not resent, replace G card.
G53	counterclockwise		
F45	clockwise		If pulses are not present, replace F card.
F47	counterclockwise		

Step 2. Using an oscilloscope, perform the following measurement.

Monitor Pin G64	Press:	Observe	If good replace F card.	If bad replace G card.
	MEAS CONT	TTL 1 USEC		

Table 3-2. DAC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 3. Check continuity between F card, pins F45 and F47, and G card. (See table 3-11 and FO-8.) If bad, replace or repair faulty wire. Step 4. Check that malfunction is corrected. If not, refer faulty DAC to depot maintenance personnel.

Section IV. MAINTENANCE PROCEDURES

3-8. GENERAL - Tables 3-3 and 3-4 provide a summary of maintenance tasks for the DAC. They identify the item to be serviced, action, and location of the maintenance procedure associated with each task. Tables 3-5 through 3-15 provide the DS/GS personnel with all authorized maintenance procedures for the DAC. During the performance of these maintenance procedures, interconnecting wires will be disconnected and reconnected. Note the presence of crimp connectors, heat shrinkable tubing, connector caps, and wire wraps prior to disassembly. Ensure these items are reinstalled or replaced during reassembly.

Table. 3-3. DAC Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. Power supply	Test	See table 3-5, step 1.
2. Power supply	Removal	See table 3-5, step 4.
3. Power supply	Replacement	See table 3-5, step 6.
4. Printed circuit cards	Removal	See table 3-6, step 1.
5. Printed circuit cards	Replacement	See table 3-6, step 3.
6. Cooling fan	Removal	See table 3-7, step 1.
7. Cooling fan	Replacement	See table 3-7, step 6.
8. Lampholder	Removal	See table 3-8, step 1.
9. Lampholder	Replacement	See table 3-8, step 3.
10. Fuseholder	Removal	See table 3-9, step 1.
11. Fuseholder	Replacement	See table 3-9, step 3.
12. AC line filter	Removal	See table 3-10, step 1.
13. AC line filter	Replacement	See table 3-10, step 3.
14. Chassis wiring	Continuity checks	See table 3-11, step 1.
15. Chassis wiring	Component Removal	See table 3-11, step 3.
16. Chassis wiring	Component Replacement	See table 3-11, step 5.
17. Connectors	Removal	See table 2-11, step 1.
18. Connectors	Replacement	See table 2-11, step 3.
19. Rubber Feet		

Table 3-4. Power Distribution Assembly Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. A.C. POWER S1 switch	Removal	See table 3-12, step 1.
2. A.C. POWER S2 switch	Replacement	See table 3-12, step 3.
3. ELAPSED TIME M1 meter	Removal	See table 3-13, step 1.
4. ELAPSED TIME M1 meter	Replacement	See table 3-13, step 3.
5. AC spike suppressors	Removal	See table 3-14, step 1.
6. AC spike suppressors	Replacement	See table 3-14, step 3.
7. AC line filter	Removal	See table 3-15, step 1.
8. AC line filter	Replacement	See table 3-15, step 3.
9. Connectors	Removal	See table 2-11, step 1.
10. Connectors	Replacement	See table 2-11, step 3.

Table 3-5. Power Supply Maintenance Procedures

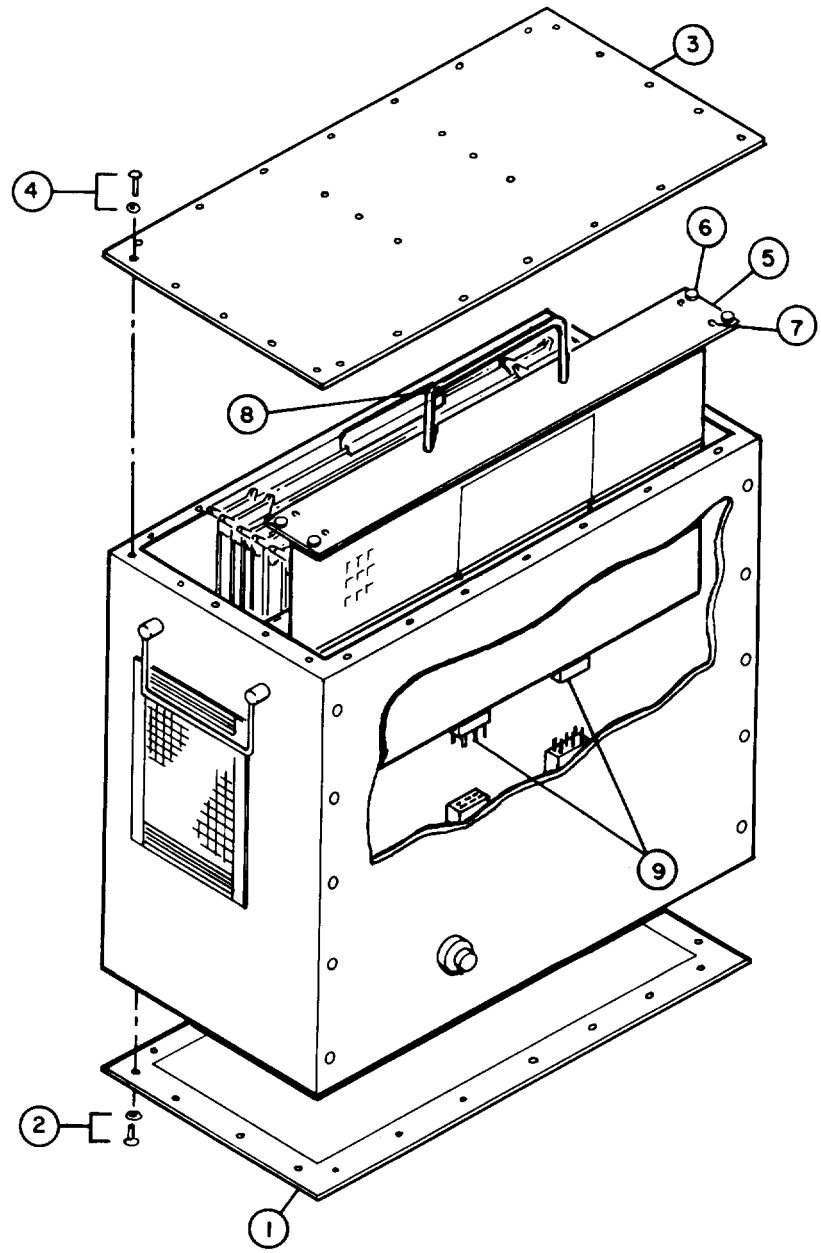
STEP NO.	ITEM PROCEDURE
	 TEST
1	Bottom cover plate (1) Remove 24 screws and washers (2). Lift off cover plate.

Table 3-5. Power Supply Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
2	Power supply Energize DAC Using a multimeter, perform the following measurements.

PIN NO.	NORMAL INDICATION	TOLERANCE
A86	+ 5V	±0.5V
A76	+15V	±0.5V
A46	-15v	±0.5V

3	Bottom cover plate Replace and secure with 24 screws and washers
	REMOVAL
4	Top cover plate (3) Remove 24 screws and washers (4). Lift off cover plate.
5	Power supply (5) Remove by doing the following: a. Loosen four captive screws (6) b. Insert screwdriver through four holes (7) and loosen captive screws. c. Grasp handle (8) and pull power supply out of DAC unit.
	REPLACEMENT
6	Power supply Replace by doing the following: a. Insert power supply into DAC unit. b. Press down firmly until connectors (9) are fully mated. c* Insert screwdriver through four holes and tighten captive screws. d. Tighten four captive screws.
7	Top cover plate Replace and secure with 24 screws and washers.

Table 3-6. Printed Circuit Cards Maintenance Procedures

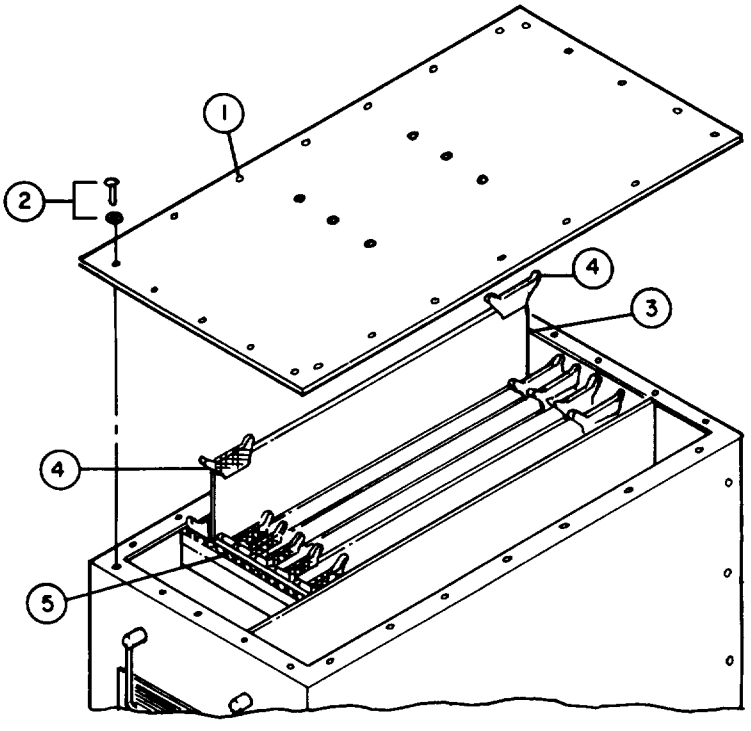
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Top cover plate (1) Remove 24 screws and washers (2). Lift off cover plate.
2	Printed circuit card (3) Remove by doing the following: **CAUTION** To prevent damage to electronic components, always make sure that power is removed from DAC unit before replacing printed circuit cards. a. Place thumbs under inner edge of plastic ejectors (4). Pull upward simultaneously with both thumbs. b. Slide card out of DAC unit.

Table 3-6. Printed Circuit Cards Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
	REPLACEMENT
3	Printed circuit card Insert card into designated slot with red ejectors facing red labeled strip (5). Press down simultaneously with both thumbs until card is firmly seated.
4	Top cover plate Replace and secure with 24 screws and washers.

Table 3-7. Cooling Fan Maintenance Procedures

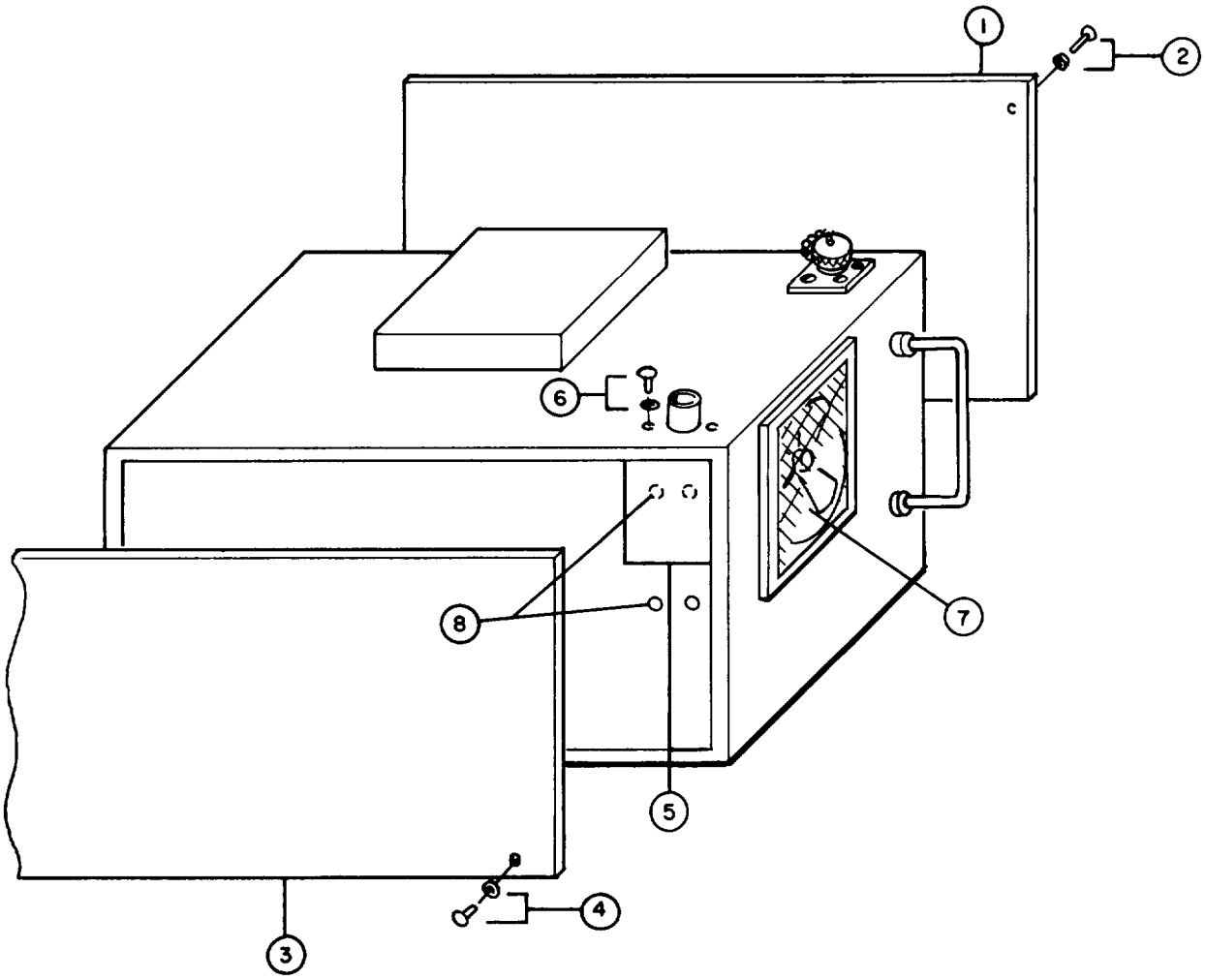
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Top cover plate (1) Remove 24 screws and washers (2). Lift off cover plate.
2	Bottom cover plate (3) Remove 24 screws and washers (4). Lift off cover plate.
3	AC line filter (5) Remove two screws and washers (6). Pull filter out of panel cutout.

Table 3-7. Cooling Fan Maintenance Procedures - Continued

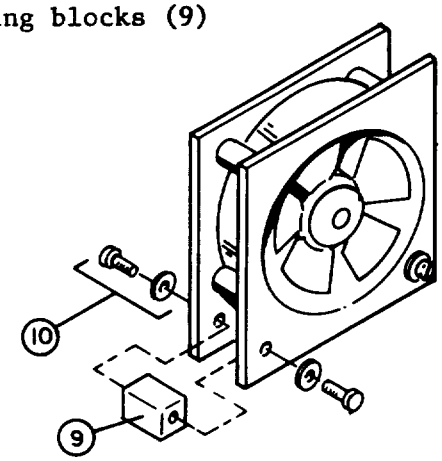
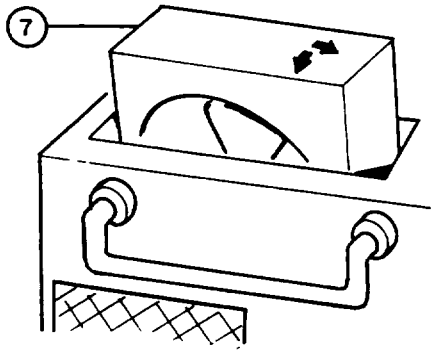
STEP NO.	ITEM PROCEDURE
4	Cooling fan (7) Remove by doing the following: a. Remove four screws (8). b. Unsolder and tag with destination labels wires attached to fan terminals. c. Pull fan out through top of DAC unit.
5	Mounting blocks (9)  Loosen four screws and washers (10). Remove blocks.
	REPLACEMENT
6	Mounting blocks Replace and secure with four screws and washers.
7	Cooling fan Replace by doing the following:  a. Insert fan through top of DAC unit. b. Resolder wires to fan terminals according to destination labels. c. Align mounting blocks with holes. Secure with four screws and washers.

Table 3-7. Cooling Fan Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
8	AC line filter Insert through cutout and secure with two screws and washers.
9	Bottom cover plate Replace and secure with 24 screws and washers.
10	Top cover plate Replace and secure with 24 screws and washers.

Table 3-8. Lampholder Maintenance Procedures

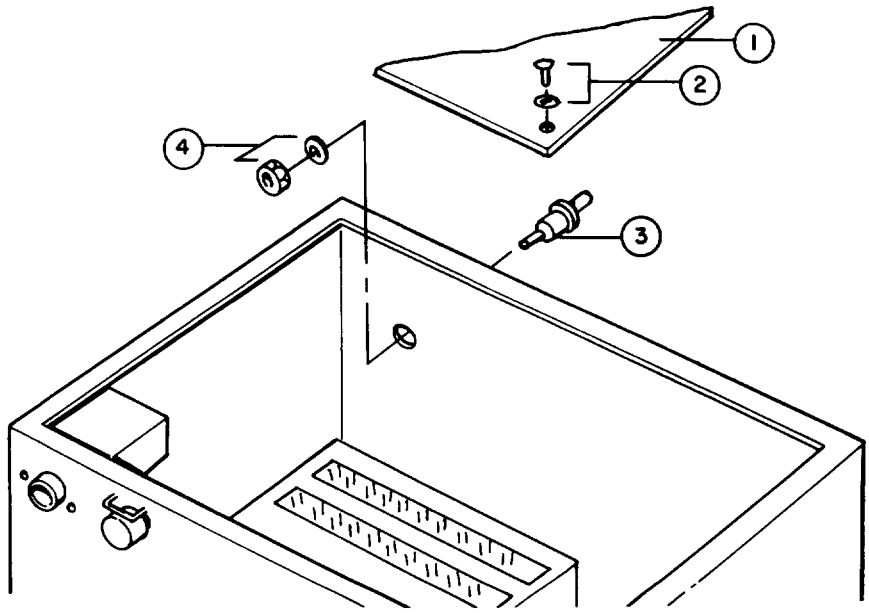
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Remove 24 screws and washers (2) and lift off cover plate.
2	Lampholder (3) Remove by doing the following: a. Unsolder and tag with destination labels 2 wires attached to lampholder terminals. b. Remove nut and washer (4). Pull lampholder out through front panel cutout.
	REPLACEMENT
3	Lampholder Replace by doing the following: a. Insert lampholder through cutout in front panel. Secure with nut and washer. b. Resolder 2 wires to lampholder terminals according to destination.
4	Bottom cover plate Replace and secure with 24 screws and washers.

Table 3-9. Fuseholder Maintenance Procedures

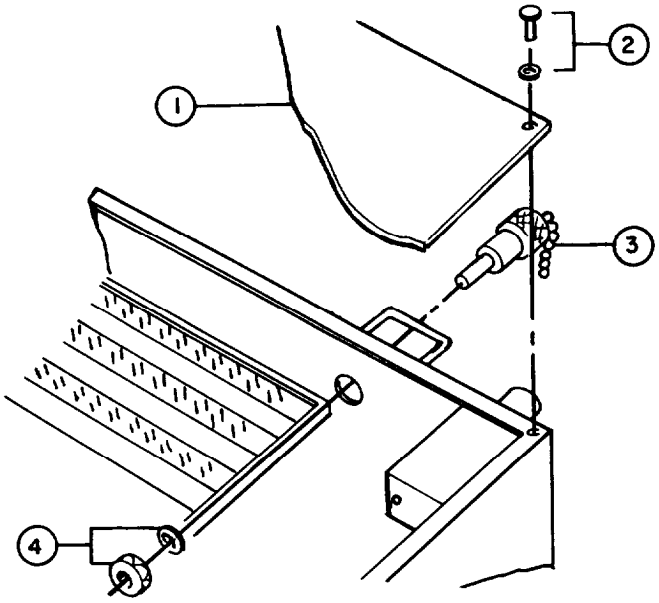
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Remove 24 screws and washers (2). Lift off cover plate.
2	Fuseholder (3) Remove by doing the following: a. Unsolder and tag with destination labels 2 wires attached to fuseholder terminals. b. Remove nut and washer (4). Pull fuseholder out through rear panel cutout.
	REPLACEMENT
3	Fuseholder Replace by doing the following: a. Insert fuseholder through cutout in rear panel. Secure with nut and washer. b. Resolder 2 wires to fuseholder terminals according to destination labels.
4	Bottom cover plate Replace and secure with 24 screws and washers.

Table 3-10. DAC AC Line Filter Maintenance Procedures

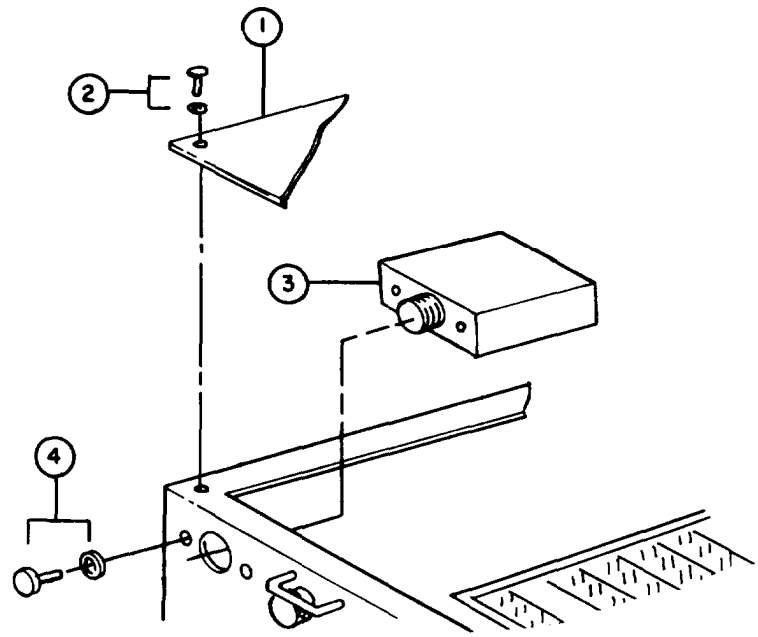
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Remove 24 screws and washers (2). Lift off cover plate.
2	AC line filter (3) Remove by doing the following: a. Unsolder and tag with destination labels 2 wires attached to line filter terminals. b. Remove 2 screws and washers (4). Pull line filter out through cutout in rear panel.
	REPLACEMENT
3	AC line filter Replace by doing the following: a. Insert through cutout in rear panel. Secure with 2 screws and washers. b. Resolder 2 wires according to destination labels.
4	Bottom cover plate Replace and secure with 24 screws and washers.

Table 3-11. Chassis Wiring Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	CONTINUITY CHECKS
1	Bottom cover plate
	Remove 24 screws and washers. Lift off cover plate.
2	Wiring
	Perform continuity checks by doing the following:
	a. Locate pins to be checked. (See figure 3-1.)
	b. Using multimeter, check for O ohms resistance between pins.
	COMPONENT REMOVAL
3	Card A, B, C, D, F, and G
	Remove. (See table 3-6, steps 1 and 2.)
4	Component
	Note pins to which resistor or capacitor is connected. Unsolder and remove component.
	COMPONENT REPLACEMENT
5	Component
	a. Put insulating material or shrinkable tubing on component leads that may touch other wirewrap pins.
	b. Resolder resistor or capacitor.
6	Card A, B, C, D, F, and G
	Replace (See table 3-6, steps 3 and 4.)
7	Bottom cover plate
	Replace and secure with 24 screws and washers.

Table 3-12. AC POWER S1 Switch Maintenance Procedures

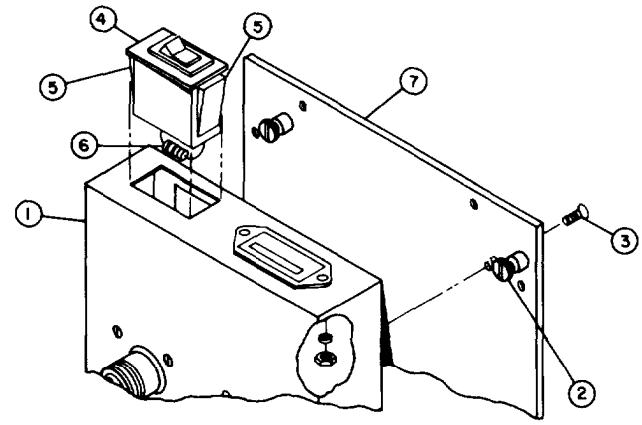
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Power distribution assembly (1) a. Loosen four captive screws (2) and remove assembly from DAC. b. Remove eight screws (3) and lift off cover plate (7).
2	A.C. POWER S1 switch (4) Remove by doing the following: a. Press plastic clamps (5) on both sides of switch. Slide switch out through cutout in case. b. Unsolder and tag with destination labels wires attached to switch terminal pins. c. Unsolder and remove resistor (6) connected between LOAD and pin 3 of switch.
	REPLACEMENT
3	A.C. POWER S1 switch Replace by doing the following: a. Resolder resistor between LOAD and Pin 3 of switch. b. Resolder wires to switch terminal pins according to destination labels. c. Insert switch through cutout in case until firmly seated.
4	Power distribution assembly a. Replace cover plate and secure with eight screws. b. Position assembly on DAC rear panel and secure with four screws.

Table 3-13. ELAPSED TIME M1 Meter Maintenance Procedures

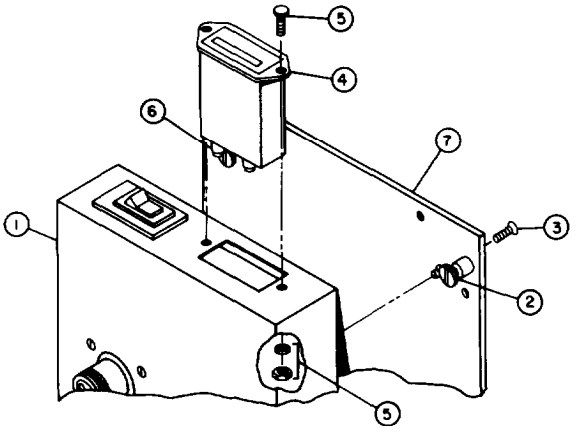
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Power distribution assembly (1) a. Loosen four captive screws (2) and remove assembly from DAC. b. Remove eight screws (3) and lift off cover plate (7).
2	ELAPSED TIME M1 meter (4) Remove by doing the following: a. Remove two screws, washers, and nuts (5). Pull meter out through cutout in case. b. Loosen two screws (6) on meter terminal posts. c. Remove and tag with destination labels wires attached to meter terminals.
	REPLACEMENT
3	ELAPSED TIME M1 meter Replace by doing the following: a. Connect wires to meter terminal according to destination labels. Tighten two screws. b. Insert meter through cutout in case. Secure with two screws, washers, and nuts.
4	Power distribution assembly a. Replace cover plate and secure with eight screws. b. Position assembly on DAC rear panel and secure with four screws.

Table 3-14. AC Spike Suppressors Maintenance Procedures

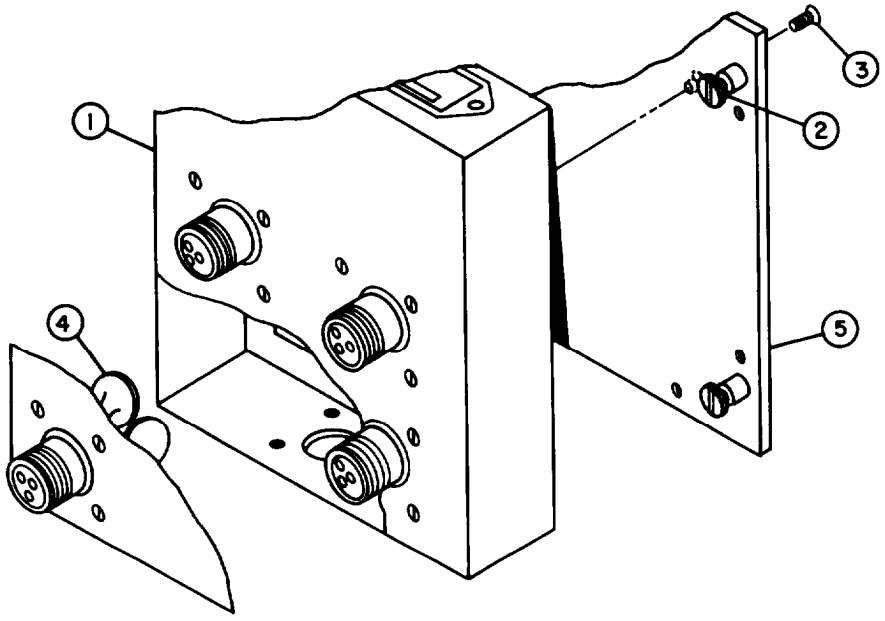
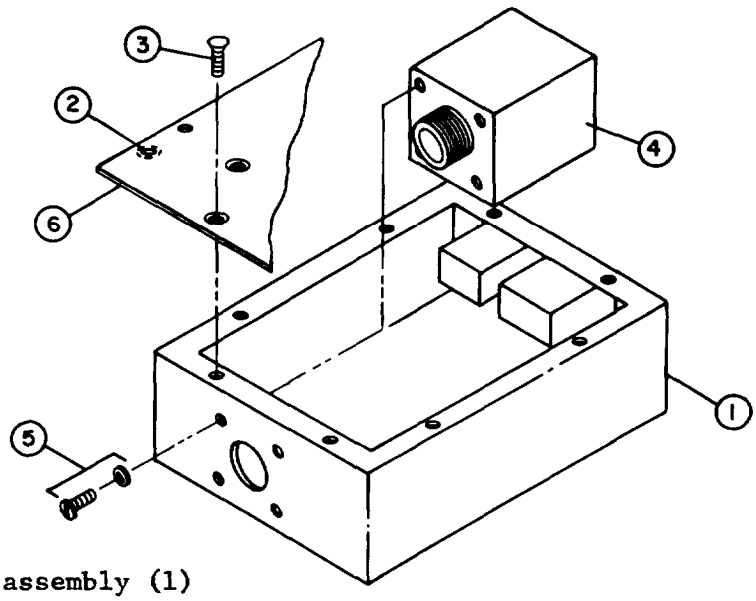
STEP NO.	ITEM PROCEDURE
	
	REMOVAL
1	Power distribution assembly (1) a. Loosen four captive screws (2) and remove assembly from DAC. b. Remove eight screws (3) and lift off cover plate (5).
2	AC spike suppressors (4) Note pins to which suppressor is connected. Unsolder both leads and remove suppressors.
	REPLACEMENT
3	AC spike suppressors Solder leads to connector pins noted during removal.
4	Power distribution assembly a. Replace cover plate and secure with eight screws. b. Position assembly on DAC rear panel and secure with four captive screws.

Table 3-15. Power Distribution Assembly AC Line Filter Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Power distribution assembly (1) a. Loosen four captive screws (2) and remove assembly from DAC. b. Remove eight screws (3) and lift off cover plate (6).
2	AC line filter (4) Remove by doing the following: a. Remove four screws and washers (5). b. Push line filter into assembly and remove through opening. c. Unsolder and tag with destination labels wires attached to filter.
	REPLACEMENT
3	AC line filter Replace by doing the following: a. Resolder wires to filter terminals according to destination labels. b. Insert line filter connector through cutout in power distribution assembly. Secure with four screws.
4	Power distribution assembly a. Replace cover plate and secure with eight screws. b. Position assembly on DAC rear panel and secure with four screws.

CHAPTER 4

OPTICAL-MECHANICAL SCANNER SU-119/UYK-48 MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special Tools: None
- TMDE: Multimeter, TS-352 (or equivalent)

  Oscilloscope, AN/USM-281 (or equivalent)
- Support Equipment: None

4-3. REPAIR PARTS -Repair parts applicable to DS/GS maintenance are listed and illustrated in the Repair Parts and Special Tools List, TM 5-1206-206-24P.

Section II. OPERATIONAL CHECKS

4-4. VISUAL AND MECHANICAL INSPECTION - Visual and mechanical inspection procedures for the OMS are included in table 2-1.

4-5. PERFORMANCE TEST - Performance test procedures for the OMS are included in table 2-2.

Section III. TROUBLESHOOTING

4-6. SYMPTOM INDEX - Table 4-1 is a symptom index for uncommon malfunctions of the OMS. Each symptom references an applicable troubleshooting procedure for further fault isolation.

Table 4-1. OMS Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
Connectors damaged	2-11	
Photo-carriage binds when moved	4-2	1
X-axis parallax adjust binds	4-2	1
Y-axis parallax adjust binds	4-2	1
Measuring mark holder does not lock	4-2	1
Overhead lamps not lit	4-2	2

4-7. TROUBLESHOOTING PROCEDURES - Troubleshooting the OMS consists of isolating the malfunction and replacing the faulty part. Table 4-2 lists troubleshooting procedures for the OMS. If a malfunction is not listed *or is not* corrected by the procedures given in this table, refer to the OMS functional block diagram (FO-2), the OMS interconnecting diagram (figure 4-1), and the system interconnecting diagram (FO-7).

Table 4-2. OMS Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. MECHANICAL COMPONENTS BIND OR HAVE RESTRICTED OR IMPROPER MOVEMENT
Verify that malfunction exists. (See table 2-1.)
Refer faulty OMS to depot maintenance personnel.
2. OVERHEAD LAMPS NOT LIT
Step 1. Check whether both lamps do not light.
If both, do step 2. If one, do step 3.
Step 2. Check that fuse F1 is good.
If good, do step 3. If bad, replace fuse.
Step 3. Exchange unlit lamp with known good one. Check that lamp lights.
If lamp lights, replace faulty lamp. If lamp does not light, do step 4.
Step 4. Check for continuity between jack J3 and lamp assembly.
If bad, replace faulty wiring, connector, fuseholder, switch, or ballast transformer. (See table 4-3.)
Step 5. Check that malfunction is corrected.
If not, refer faulty LAMP ASSEMBLY to depot maintenance personnel.

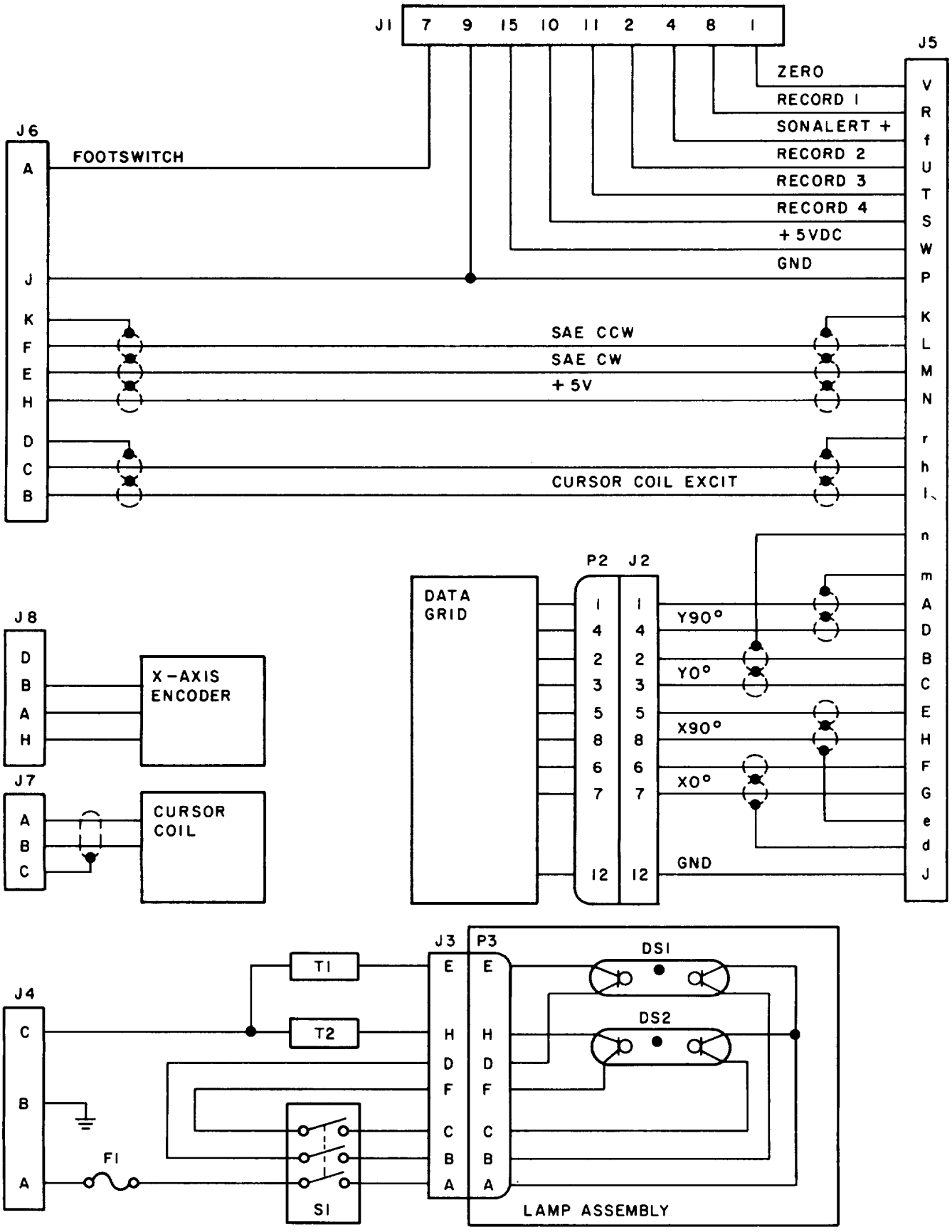


Figure 4-1. OMS Interconnecting Diagram

Section IV. MAINTENANCE PROCEDURES

4-8. GENERAL -Table 4-3 is a summary of the maintenance tasks for the OMS. It identifies the item to be serviced, action, and location of the maintenance procedures associated with each task. Tables 4-4 through 4-8 provide the DS/GS personnel with all authorized maintenance procedures for the 0MS.

Table 4-3. OMS Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. Lamp switch	Removal	See table 4-4, step 1.
2. Lamp switch	Replacement	See table 4-4, step 3.
3. Lamp transformer	Removal	See table 4-5, step 1.
4. Lamp transformer	Replacement	See table 4-5, step 3.
5. Fuseholder	Removal	See table 4-6, step 1.
6. Fuseholder	Replacement	See table 4-6, step 3.
7. Shaft angle encoder	Removal	See table 4-7, step 1.
8. Shaft angle encoder	Replacement	See table 4-7, step 3.
9. Large mirrors	Removal	See table 4-8, step 2.
10. Large mirrors	Replacement	See table 4-8, step 4.
11. Small mirrors	Removal	See table 4-8, step 1.
12. Small mirrors	Replacement	See table 4-8, step 3.
13. Connectors	Removal	See table 2-11, step 1.
14. Connectors	Replacement	See table 2-11, step 3.

Table 4-4. Lamp Switch Maintenance

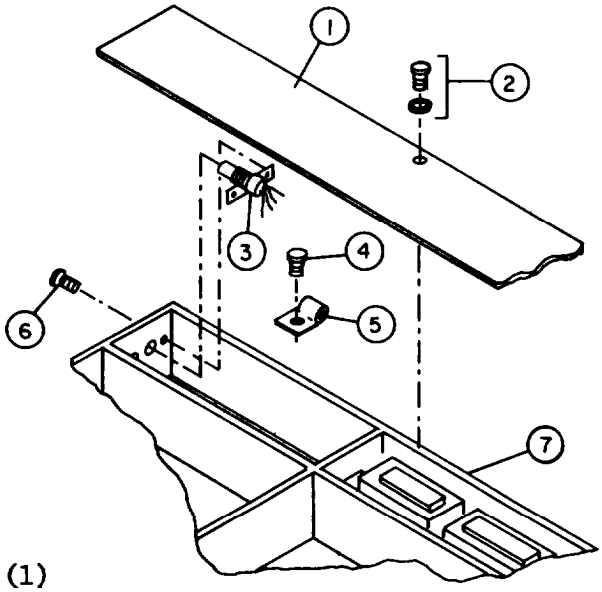
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Protective cover (1) Remove 20 screws and washers (2). Lift off protective cover.
2	Lamp switch (3) Remove by doing the following: a. Loosen screw (4) and remove cable clamp (5). b. Disconnect and tag with destination labels wires attached to switch leads. c. Remove two screws (6). Remove lamp switch from cutout in baseplate (7).
	REPLACEMENT
3	Lamp switch Replace by doing the following: a. Connect wires according to destination labels. b. Insert wires in cable clamp and tighten screw (4). c. Insert switch through cutout in baseplate. Secure with two screws (6).
4	Protective cover Replace and secure with 20 screws and washers.

Table 4-5. Lamp Transformer Maintenance Procedures

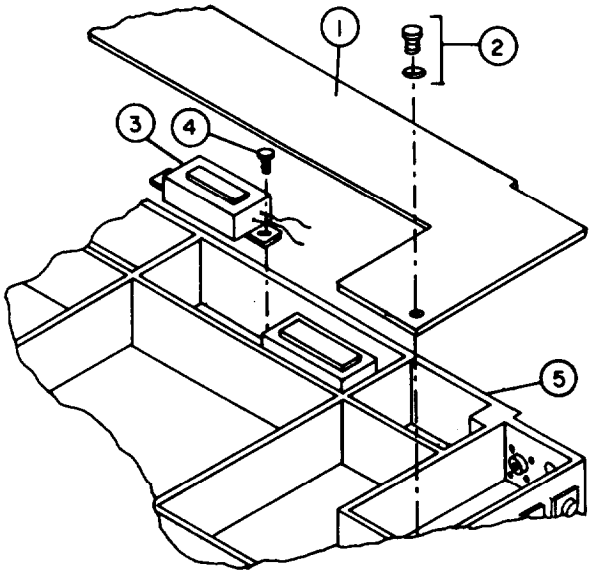
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Protective cover (1) Remove 20 screws and washers (2). Lift off protective cover.
2	Lamp transformer (3) Remove by doing the following: a. Remove two screws (4). b. Disconnect and tag with destination labels wires attached to transformer leads. c. Remove transformer from base plate (5).
	REPLACEMENT
3	Lamp transformer Replace by doing the following: a. Connect wires to transformer leads according to destination labels. b. Position transformer in base plate. Secure with two screws (4).
4	Protective cover Replace and secure with 20 screws and washers.

Table 4-6. Fuseholder Maintenance Procedures

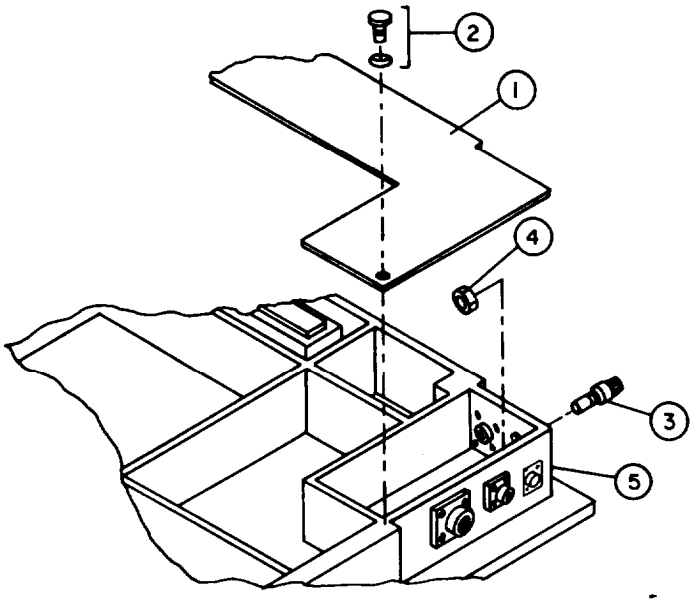
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Protective cover (1) Remove 20 screws and washers (2). Lift off protective cover.
2	Fuseholder (3) Remove by doing the following: a. Unsolder and tag with destination labels wires attached to fuseholder. b. Remove nut (4) and pull fuseholder out through cutout in base plate (5).
	REPLACEMENT
3	Fuseholder Replace by doing the following: a. Insert fuseholder through cutout in baseplate. Secure with nut (4). b. Resolder wires to fuseholder according to destination labels.
4	Protective cover Replace and secure with 20 screws and washers.

Table 4-7. X-axis Encoder Maintenance

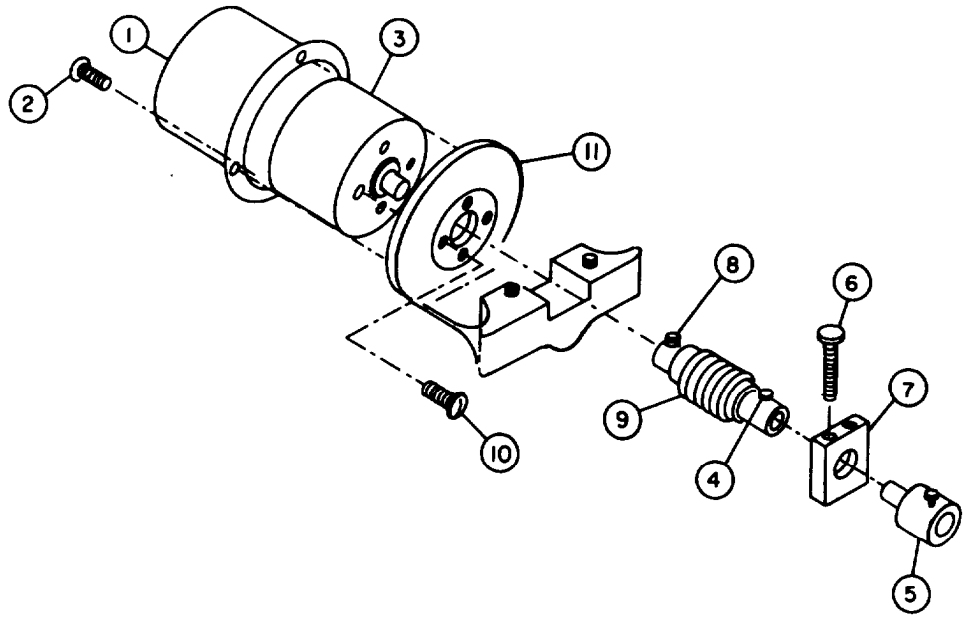
STEP NO.	ITEM PROCEDURE
	
	REMOVAL
1	Housing (1) Remove four screws (2) and lift off housing.
2	Shaft angle encoder (3) Remove by doing the following: a. Loosen screw (4) and remove shaft coupling (5). b. Remove two screws (6) and lift off support block (7). c. Loosen set screw (8) and remove flexible coupling (9). d. Remove four recessed screws (10). Remove shaft angle encoder from frame (11).
	REPLACEMENT
3	Shaft angle encoder Replace by doing the following: a. Position shaft angle encoder on frame. Secure with four recessed screws.

Table 4-7. X-axis Encoder Maintenance - Continued

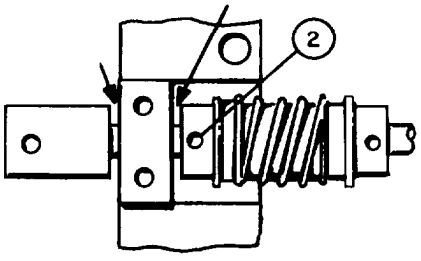
STEP NO.	ITEM PROCEDURE
	b. Slide flexible coupling onto encoder shaft. Tighten set screw. c. Replace support block and secure with two screws. d. Insert shaft coupling through support block. Adjust position so that there is clearance. e. Tighten screw. 
4	Housing Reassemble housing on encoder frame. Secure with four screws.

Table 4-8. Mirrors Maintenance Procedures

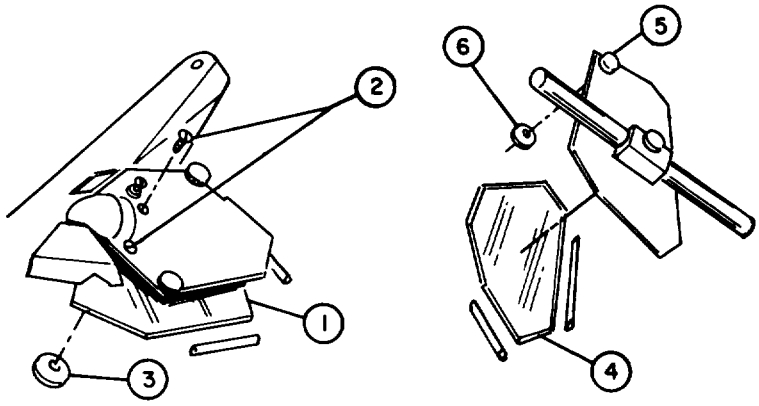
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Small mirrors (1) Remove by doing the following: a. Remove 2 screws (2) and offset nuts (3). b. Slide mirror out of holder.
2	Large mirrors (4) Remove by doing the following: a. Remove screw (5) and offset nut (6). b. Slide mirror out of holder.
	NOTE When removing mirrors be sure not to lose Teflon cushioning strips.
	REPLACEMENT
3	Small mirror Replace by doing the following: a. Seat mirror firmly against Teflon strips in holder. b. Install screws and offset nuts. Do not tighten. c. Rotate offset nuts until they are firm against mirror. Tighten screws.

Table 4-8. Mirrors Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
4	Large mirror Replace by doing the following: a. Seat mirror firmly against Teflon strips in holder. b. Install screw and offset nut. Do not tighten. c. Rotate offset nut until it is firm against mirror. Tighten screw.

CHAPTER 5

CONTROL, DATA INPUT C-10134/UYK-31 MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

5-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MT0E) applicable to your unit.

5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special Tools: None
- TMDE: Multimeter, TS-352 (or equivalent)
  Oscilloscope, AN/USM-281 (or equivalent)
- Support Equipment: None.

5-3. REPAIR PARTS -Repair parts applicable to DS/GS maintenance are listed and illustrated in the Repair Parts and Special Tools List, TM 5-1260-206-24P.

Section II. OPERATIONAL CHECKS

5-4. VISUAL INSPECTION - Visual inspection procedures for the DIC are included in table 2-1.

5-5. PERFORMANCE TEST - Performance test procedures for the DIC are included in table 2-2.

Section III. TROUBLESHOOTING

5-6. SYMPTOM INDEX - Table 5-1 is a symptom index for common malfunctions of the DIC. Each symptom references an applicable troubleshooting procedure for further fault isolation.

Table 5-1. DIC Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
Connector damaged	2-11	
Sonalert sounds repeatedly	2-7	1
Sonalert does not sound when pushbuttons or footswitch are pressed	5-2	1
Pushbutton indicators not lit	5-2	2
Pushbutton or footswitch do not work	5-2	3

5-7. TROUBLESHOOTING PROCEDURES - Troubleshooting the DIC consists of isolating the malfunction and replacing the faulty part. Table 5-2 lists troubleshooting procedures for the DIC. These procedures must be performed with the DIC installed in an operational APPS system. If a malfunction is not listed or is not corrected by the procedures given in the table, refer to the DIC interconnecting diagram (figure 5-1) and the system interconnecting diagram (F0-7) .

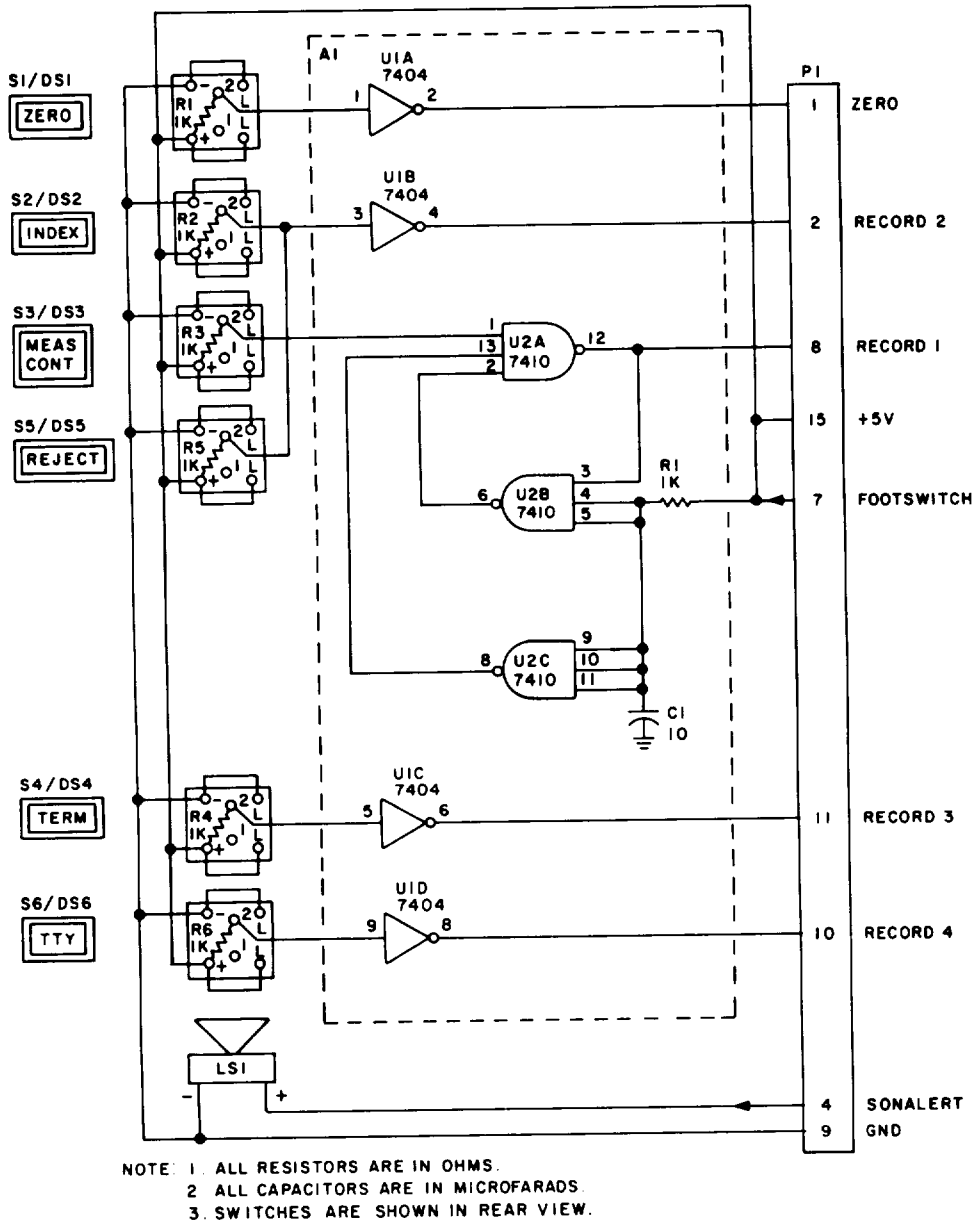


Figure 5-1. DIC Interconnecting Diagram

Table 5-2. DIC Troubleshooting Procedures

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. SONALERT DOES NOT SOUND WHEN PUSHBUTTONS OR FOOTSWITCH ARE PRESSED

Step 1. Set up system to perform IDP 03 diagnostic. (See table 2-3, steps 1 through 5.) Press each pushbutton switch and footswitch in turn. Check when sonalert does not sound.

If sonalert does not sound for all switches, do step 2.
If sonalert does not sound for only one switch, do step 4.

Step 2. Remove top assembly. Connect oscilloscope to + terminal of sonalert. Check that positive TTL pulse is present when any pushbutton is pressed.

If present, replace faulty sonalert. (See table 5-6.)
If not present, check for continuity between sonalert and plug P1.

Step 3. Check that malfunction is corrected.

If not, refer faulty DIC to depot maintenance personnel.

Step 4. Connect oscilloscope to pin 2 of pushbutton switch in question or P1, pin 7 for footswitch. (See figure 5-1.) Check for:

- Negative TTL pulse for pushbutton switches.
- Positive TTL pulse for footswitch.

If present, do step 5.
If not present, replace faulty switch or resistor. (See table 5-4.)

Step 5. Connect oscilloscope to:

P1, pin 1 for [ZERO]
pin 2 for [INDEX] or [REJECT]
pin 8 for [MEAS CONT] or footswitch
pin 10 for [TTY]
pin 11 for [TERM]

Table 5-2. DIC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Check that positive TTL pulse is present when corresponding switch is pressed. If not present, replace faulty printed circuit board. Step 6. Check that malfunction is corrected. If not, refer faulty DIC to depot maintenance personnel. 2. PUSHBUTTON INDICATORS NOT LIT Step 1. Remove top assembly. Connect multimeter between pin + and pin - for suspect pushbutton. Check that +5 volts is present. If voltage is present, replace faulty switch. If voltage is not present, do step 2. Step 2. Connect multimeter between P1 pin 15 (+) and pin 9 (-). Check that +5 volts is present. If voltage is present, replace faulty wire. If voltage is not present, problem is in DAC or OMS base plate wiring. Refer to chapter 3 or 4 and perform continuity checks. 3. PUSHBUTTONS OR FOOTSWITCH DO NOT WORK Step 1. Remove top assembly. Connect oscilloscope to pin 2 of pushbutton switch in question or P1, pin 7 for footswitch. (See figure 5-1.) Check for: • Negative TTL pulse for pushbutton switches. • Positive TTL pulse for footswitch. If present, do step 5. If not present, replace faulty switch or resistor. (See table 5-4.)

Table 5-2. DIC Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 2. Connect oscilloscope to: P1, pin 1 for ZERO pin 2 for INDEX or REJECT pin 8 for MEAS CONT or footswitch pin 10 for TTY pin 11 for TERM Check that positive TTL pulse is present when corresponding switch is pressed. If not present, replace faulty printed circuit board. Step 3. Check that malfunction is corrected. If not, refer faulty DIC to depot maintenance personnel.

Section IV: MAINTENANCE PROCEDURES

5-8. GENERAL - Table 5-3 is a summary of the maintenance tasks for the DIC. It identifies the item to be serviced, action, and location of the maintenance procedures associated with each task." Tables-5-4 through 5-7 provide the DS/GS personnel with all authorized maintenance procedures for the DIC.

Table 5-3. DIC Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. Pushbutton switch	Removal	See table 5-4, step 1.
2. Pushbutton switch	Replacement	See table 5-4, step 3.
3. Connector P1	Removal	See table 5-5, step 1.
4. Connector P1	Replacement	See table 5-5, step 3.
5. Sonalert	Removal	See table 5-6, step 1.
6. Sonalert	Replacement	See table 5-6, step 3.
7. Printed circuit board	Removal	See table 5-7, step 1.
8. Printed circuit board	Replacement	See table 5-7, step 3.
9. Footswitch	Disassembly	See table 5-8, step 1.
10. Footswitch	Reassembly	See table 5-8, step 3.

Table 5-4. Pushbutton Switch Maintenance Procedures

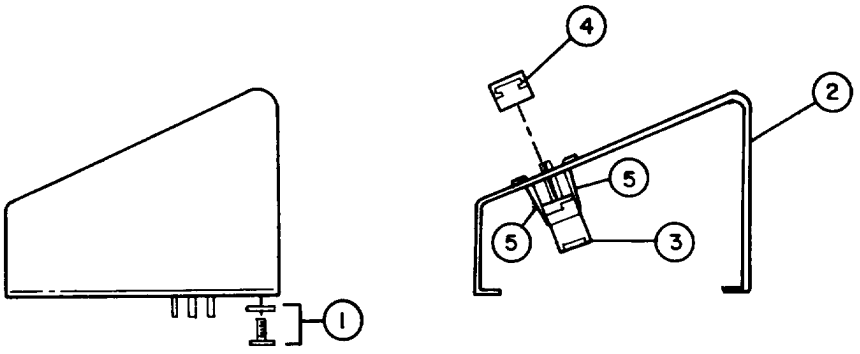
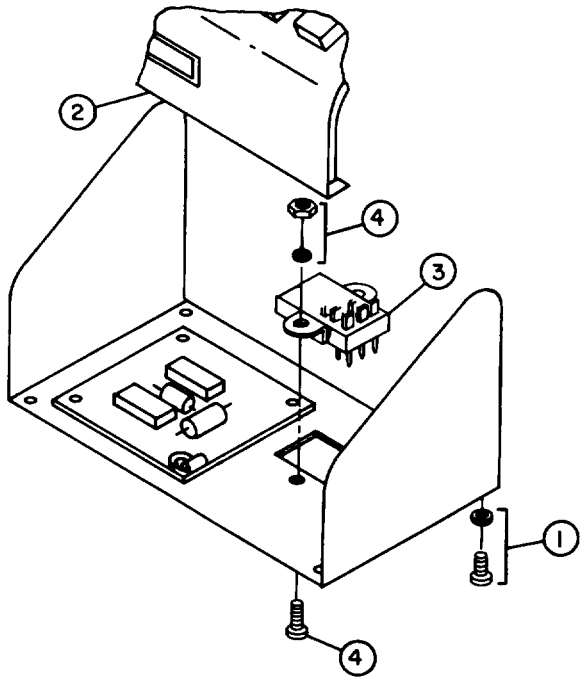
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Case Remove four screws and washers (1) from bottom panel. Lift off top assembly (2).
2	Pushbutton switch (3) Remove by doing the following: a. Unsolder and tab with destination labels wires and resistor attached to switch terminal lugs. b. Remove switch cap (4). c. Press in on retaining clips (5) and push switch out through front panel.
	REPLACEMENT
3	Pushbutton switch Replace by doing the following: a. Insert switch through cutout in top assembly. b. Press down on top of switch to seat. c. Replace switchcap. d. Resolder wires and resistor according to destination labels.
4	Case Reassemble and secure with four screws and washers.

Table 5-5. Connector P1 Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	REMOVAL
1	Case Remove four screws and washers (1). Lift off top assembly (2).
2	Connector P1 (3) Remove by doing the following: a. Unsolder and tag with destination labels wires attached to connector terminals. b. Remove two screws, washers, and nuts (4). c. Remove connector.
	REPLACEMENT
3	Connector P1 Replace by doing the following: a. Insert connector in cutout. Secure with two screws, nuts, and washers. b. Resolder wires according to destination labels.
4	Case Reassemble and secure with four screws and washers.



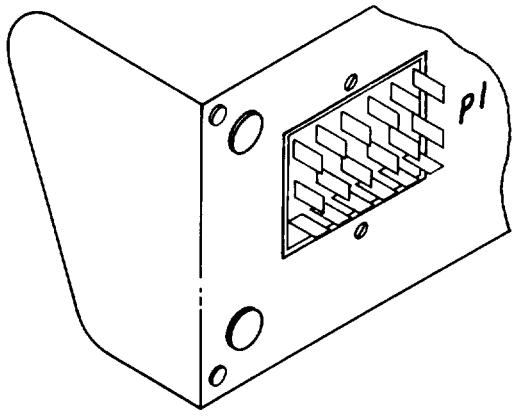


Table 5-6. Sonalert Maintenance Procedures

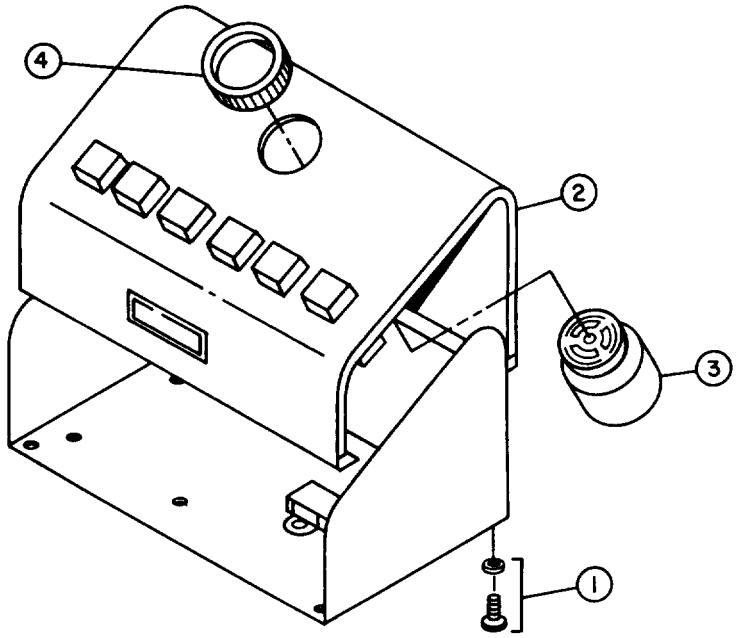
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Case Remove four screws and washers (1). Lift off top assembly (2).
2	Sonalert (3) Remove by doing the following: a. Unscrew sleeve (4). Pull sonalert free of front panel. b. Disconnect and tag with destination labels wires attached to sonalert terminal lugs. c. Remove sonalert.
	REPLACEMENT
3	Sonalert Replace by doing the following: a. Connect wires to terminal lugs according to destination tags. b. Insert sonalert in front panel cutout. Secure with sleeve.
4	Case Reassemble and secure with four screws and washers.

Table 5-7. Printed Circuit Board Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	REMOVAL
1	Case Remove four screws and washers (1). Lift off top assembly (2).
2	Printed circuit board (3) Remove by doing the following: a. Remove nut, washer, and cable clamp (4). b. Remove four screws (5). c. Unsolder and tag with destination labels wires attached to board. d. Remove board.
	REPLACEMENT
3	Printed circuit board Replace by doing the following: a. Resolder wires to printed circuit board according to destination labels. b. Attach board to bottom panel with four screws. c. Replace cable clamp and secure with nut and washer.
4	Case Reassemble and secure with four screws and washers.

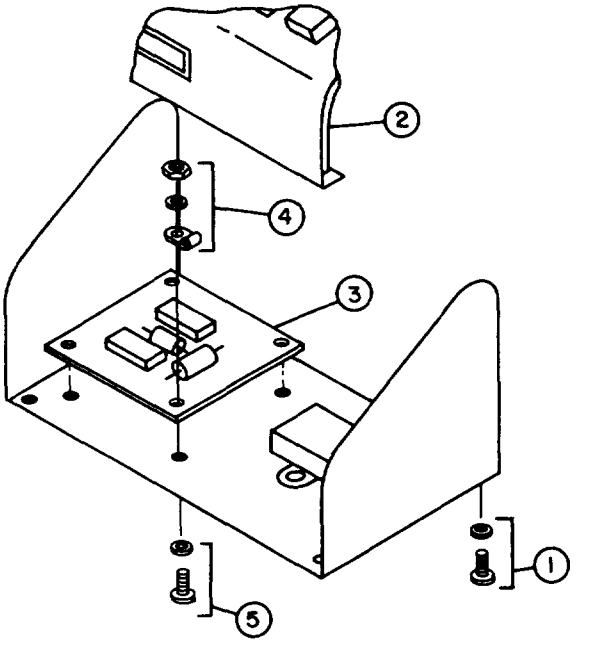
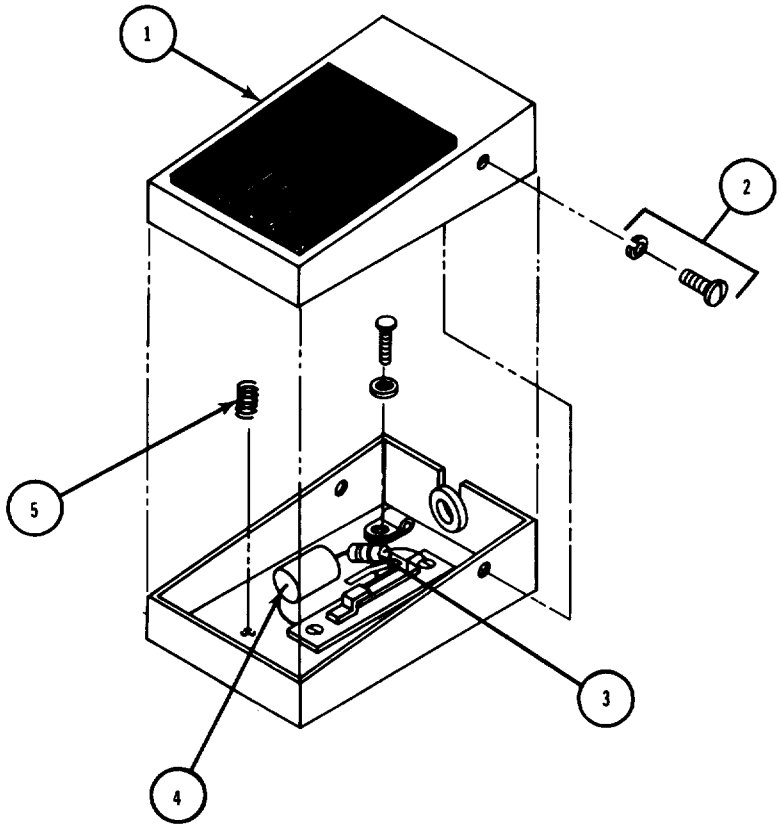


Table 5-8. Footswitch Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	
	DISASSEMBLY
1	Pedal (1) Remove two screws and washers (2). Lift off pedal.
2	Resistor (3) or capacitor (4) Unsolder and remove.
	REASSEMBLY
3	Resistor or capacitor Resolder in proper position
4	Pedal Replace by doing the following: a. Place spring (5) as shown. b. Position pedal on base and secure with two screws and washers.

CHAPTER 6

DIGITAL DISPLAY MAINTENANCE ID-2239/UYK-48

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

6-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MT0E) applicable to your unit.

6-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special Tools: None
- TMDE: Multimeter, TS-352 (or equivalent}
- Support Equipment: None

6-3. REPAIR PARTS -Repair parts applicable to DS/GS personnel are itemized and illustrated in the Repair Parts and Special Tools List, TM 5-1260-206-24P.

Section II. OPERATIONAL CHECKS

6-4. VISUAL INSPECTION - Visual inspection procedures for the Digital Display are included in table 2-1.

6-5. PERFORMANCE TEST - Performance test procedures for the Digital Display are included in table 2-2.

Section 111. TROUBLESHOOTING

6-6. SYMPTOM INDEX - Table 6-1 is a symptom index for common malfunctions of the Digital Display. Each symptom references an applicable troubleshooting procedure for further fault isolation.

6-7. TROUBLESHOOTING PROCEDURES - Troubleshooting the Digital Display consists of isolating the malfunction and replacing the faulty part. Table 6-2 lists troubleshooting procedures for the Digital Display. If a malfunction is not listed or is not corrected by procedures given in the table, refer to the wiring list given in table 6-7.

Table 6-1. Digital Display Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
1. Display modules damaged	6-4	1
2. Read-out not lit	6-2	1
3. Read-out does not zero	3-2	9
4. Sign or numbers do not light	6-2	2
5. Read-out does not change as photo-carriage is moved	3-2	8
6. Connector damaged	6-6	4

Table 6-2. Digital Display Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. READ-OUT NOT LIT
Step 1. Check for continuity between plug P1, pin 20 and plug P5-r. (See table 6-7.) If good replace faulty printed circuit board. (See table 6-5.) If bad replace faulty cable. (See table 6-6.)
Step 2. Check that malfunction is corrected. If not, refer faulty Digital Display to depot maintenance personnel.
2. SIGN OR NUMBER DOES NOT LIGHT
Step 1. Check for continuity between plug P1 or P2 and plug P5. (See table 6-7.) If good, do step 2. If bad, replace faulty cable. (See table 6-6.)
Step 2. Exchange unlit sign or number with known good module. (See table 6-4.) Check that sign or number lights. If sign or number lights, replace faulty module. (See table 6-4.) If sign or number does not light, replace printed circuit board. (See table 6-5.)
Step 3. Check that malfunction is corrected. If not, refer Digital Display to depot maintenance personnel.

Section IV. MAINTENANCE PROCEDURES

6-8. GENERAL - Table 6-3 is a summary of the maintenance tasks for the Digital Display. It identifies the item to be serviced, action, and location of the maintenance procedures associated with each task. Tables 6-4 through 6-6 provide the DS/GS personnel with all authorized maintenance procedures for the Digital Display.

Table 6-3. Digital Display Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. Display modules	Removal	See table 6-4, step 1.
2. Display modules	Replacement	See table 6-4, step 4.
3. Printed circuit boards	Removal	See table 6-5, step 1.
4. Printed circuit boards	Replacement	See table 6-5, step 4.
5. Cable	Removal	See table 6-6, step 1.
6. Cable	Replacement	See table 6-6, step 3.

Table 6-4. Display Modules Maintenance Procedures

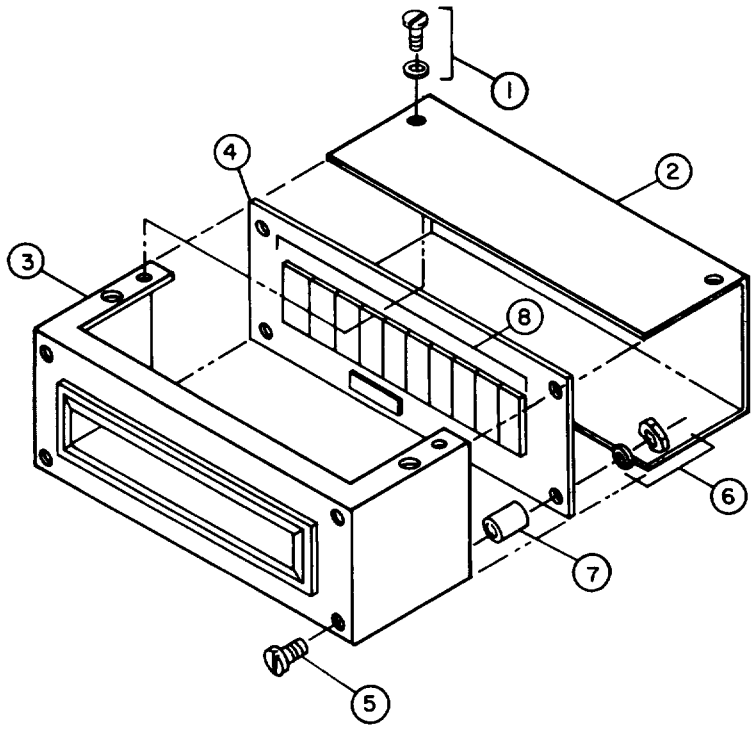
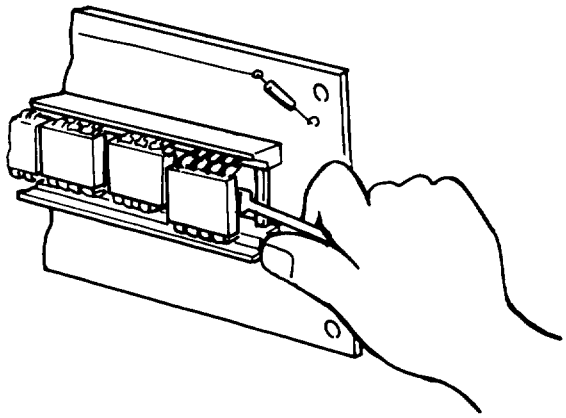
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Case Remove four screws and washers (1). Separate rear panel (2) from front assembly (3).
2	Printed circuit board (4) Loosen four screws (5). Remove four nuts and washers (6). Separate board from front assembly. Remove four spacers (7).
3	Display modules (8) Remove by doing the following:  **CAUTION** Pry up evenly on both sides of module when removing. a. Start at end closest to faulty module. Place a screwdriver under module and pry it straight up. b. Repeat with remaining modules until faulty module is removed.

Table 6-4. Display Modules Maintenance Procedures - Continued

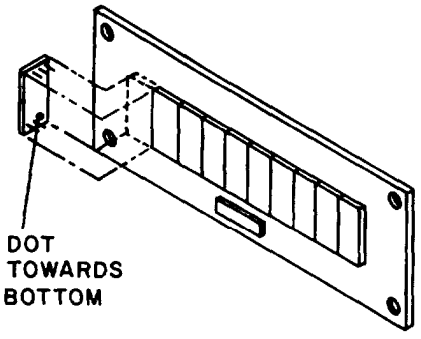
STEP NO.	ITEM PROCEDURE
	REPLACEMENT
4	Display modules Replace by doing the following:  a. Select proper module, sign, or number, for position. b. Place module into position and press firmly on both sides until seated. c. Repeat a. and b. for remaining modules.
5	Printed circuit board Replace by doing the following: a. Replace four screws. b. Position board into front assembly on four spacers. c. Replace four nuts and washers.
6	Case Slide rear panel onto front assembly. Replace four screws and washers.

Table 6-5. Printed Circuit Board Maintenance Procedures

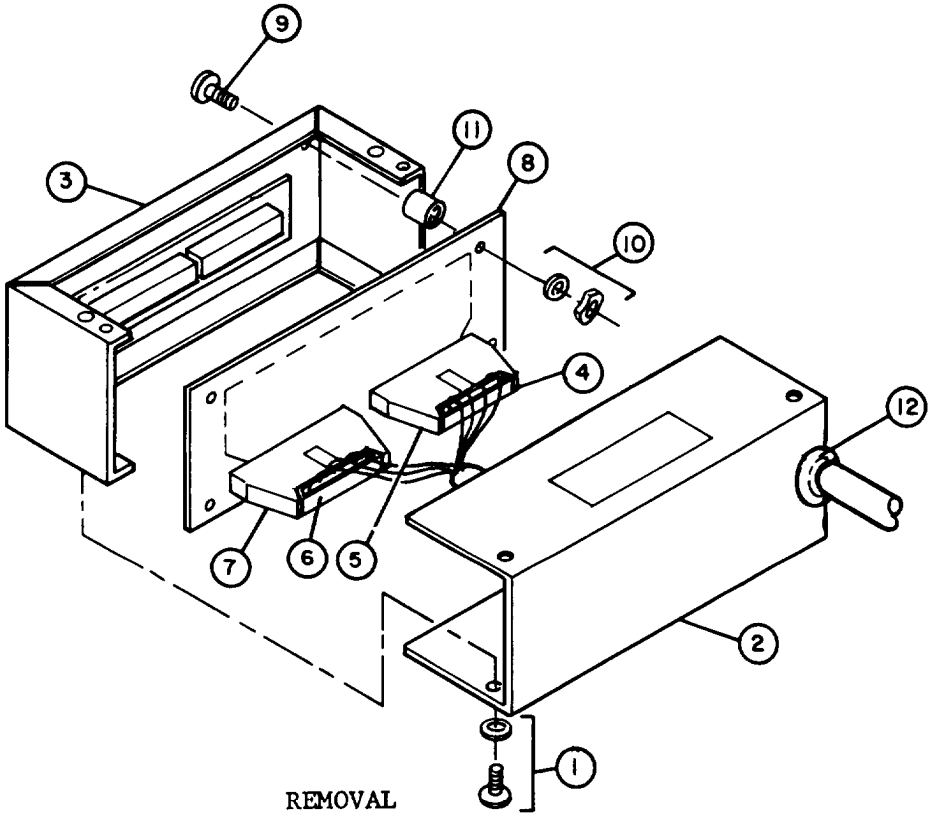
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Case Remove four screws and washers (1). Separate rear panel (2) from rear front assembly (3).
2	Cable Disconnect plug P1 (4) from jack J1 (5) and P2 (6) from J2 (7).
3	Printed circuit board (8) Loosen four screws (9). Remove four nuts and washers (10). Separate board from front assembly. Remove four spacers (11).
	REPLACEMENT
4	Printed circuit board Replace four screws. Position board into front assembly on four spacers. Replace four nuts and washers.

Table 6-5. Printed Circuit Board Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
5	Cable Replace by doing the following: a. Connect plug P1 to jack J1. b. Connect plug P2 to jack J2.
6	Case Slide rear panel onto front assembly. Replace four screws and washers.

Table 6-6. Digital Display Cable Maintenance

STEP NO.	ITEM PROCEDURE
	REMOVAL
1	Case Remove four screws. Separate rear panel from front assembly.
2	Cable Disconnect jack J1 from plug P1 and J2 from P2.
	REPLACEMENT
3	Cable Replace by doing the following: a. Connect plug P1 to jack J1. b. Connect plug P2 to jack J2. c. Slip cable grommet (12) into cutout in case.
4	Case Slide rear panel onto front assembly. Replace four screws and washers.

Table 6-7. Digital Display Cable Wiring List

X-AXIS	P2 PIN	P5 PIN	Y-AXIS	P1 PIN	P5 PIN
MSD	4	A	MSD	4	T
MSD	3	B	MSD	3	U
MSD	6	C	MSD	6	V
MSD	5	D	MSD	5	W
3rd	12	E	3rd	12	X
3rd	13	F	3rd	13	Y
3rd	14	G	3rd	14	Z
3rd	10	H	3rd	10	a
2nd	11	J	2nd	11	b
2nd	9	K	2nd	9	c
2nd	17	L	2nd	17	d
2nd	18	M	2nd	18	e
LSD	8	N	LSD	8	f
LSD	7	P	LSD	7	g
LSD	16	R	LSD	16	h
LSD	15	S	LSD	15	j
Sign X	20	n	Sign Y	2	k
GND	1	m	+5 V	19	r
GND	2	m	+5 V	20	r

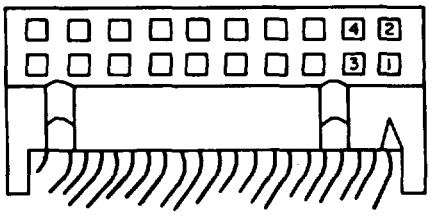


Figure 6-1. Digital Display Cable Plug Pin Location

CHAPTER 7

TRANSILLUMINATION DEVICE SU-120/UYK-48 MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

7-1. COMMON TOOLS AND EQUIPMENT - For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MT0E) applicable to your unit.

7-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT -

- Special Tools: None
- TMDE: Multimeter, TS-352 (or equivalent)
- Support Equipment: None

7-3. REPAIR PARTS- Repair parts applicable to DS/GS personnel for the TID are listed and illustrated in the Repair Parts and Special Tools List,TM 5-1260-206-24P.

Section II. OPERATIONAL CHECKS

7-4. VISUAL INSPECTION - Visual inspection procedures for the TID are included in table 2-1.

7-5. PERFORMANCE TEST - Performance test procedures for the TID are included in table 2-2.

Section III. TROUBLESHOOTING

7-6. SYMPTOM INDEX - Table 7-1 is a symptom index for common malfunctions of the TID. Each symptom references an applicable troubleshooting procedure for further fault isolation.

Table 7-1. TID Symptom Index

SYMPTOM	PROCEDURE	
	TABLE	MALFUNCTION
1. Power indicator not lit	7-2	1
2. Illuminators not lit	7-2	2
3. Connectors damaged	2-11	
4. Left or right photo plate movement restricted	7-2	3

7-7. TROUBLESHOOTING PROCEDURES - Troubleshooting the TID consists of isolating the faulty part. Table 7-2 lists troubleshooting procedures for the TID. If a malfunction is not listed or is not corrected by procedures given in the table, refer to the TID interconnecting diagram (figure 7-1) and the system interconnecting diagram (F0-7).

WARNING

Voltages as high as 750 volts are produced by the TID lamp control assembly. Contact with this voltage potential can result in death. Never place hands or meter leads inside control assembly unless power switch is set at OFF.

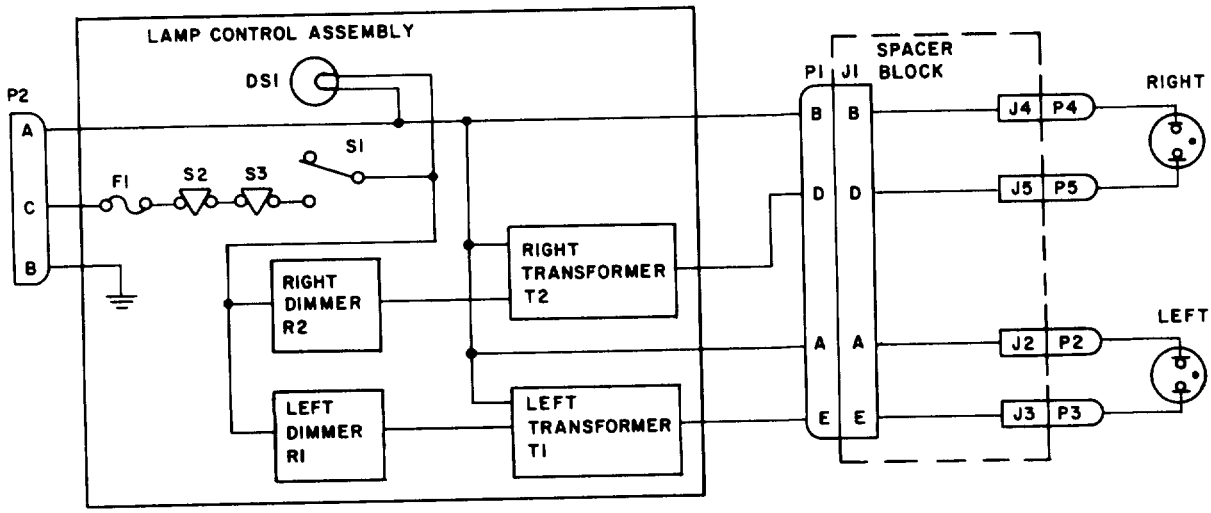


Figure 7-1. TID Interconnecting Diagram

Table 7-2. TID Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. POWER INDICATOR NOT LIT. Step 1. Check that fuse F1 on lamp control assembly is good. If good, do step 2. If bad, replace fuse. Step 2. Rotate left and right lamp dimmers fully clockwise. Using multimeter, check P1 between pin B and pin D or between pin A and pin E for approximately 750 volts ac. If voltage is present, replace power indicator. (See table 7-3.) If voltage is not present, refer to figure 7-1 and make continuity checks to locate faulty wire, connector, fuseholder, power ON/OFF switch or interlock switch or transformer. Replace faulty component. (See table 7-3.) Step 3. Check that malfunction is corrected. If not, refer faulty TID to depot maintenance personnel.
2. ILLUMINATORS NOT LIT. Step 1. Check that TID power indicator is lit. If lit, do step 2. If not lit, refer to item 1 above. Step 2. Rotate left and right lamp dimmers fully clockwise. Using multimeter, check P1 between pin B and pin D for right illuminator and between pin A and pin E for left illuminator. Approximately 750 volts ac should be present. If voltage is present at both pins, refer to figure 7-1 and make continuity checks to locate faulty wire, connector, or illuminator. Replace faulty component. (See table 7-3.) If voltage is not present at one pin, refer to figure 7-1 and make continuity checks to locate faulty wire, lamp dimmer transformer, or connector. Replace faulty component. (See table 7-3.)

Table 7-2. TID Troubleshooting Procedures - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
If voltage is not present at both pins, refer to figure 7-1 and make continuity checks to locate faulty wire or connector. Replace faulty component.
Step 3. Check that malfunction is corrected.
If not, refer faulty TID to depot maintenance personnel.
3. LEFT OR RIGHT PHOTO PLATE MOVEMENT RESTRICTED
Verify that malfunction exists. (See table 2-1.)
Refer faulty TID to depot maintenance personnel.

Section IV. MAINTENANCE PROCEDURES

7-8. Table 7-3 is a summary of the maintenance tasks for the TID. It identifies the item to be serviced, action, and location of the maintenance procedures associated with each task. Tables 7-4 through 7-9 provide the DS/GS personnel with all authorized maintenance procedures for the TID.

Table 7-3. TID Maintenance Summary

ITEM TO BE SERVICED	ACTION	PROCEDURE
1. Power ON/OFF switch	Removal	See table 7-4, step 1.
2. Power ON/OFF switch	Replacement	See table 7-4, step 3.
3. Power ON/OFF lamp	Removal	See table 7-5, step 1.
4. Power ON/OFF lamp	Replacement	See table 7-5, step 3.
5. Lamp dimmer	Removal	See table 7-6, step 1.
6. Lamp dimmer	Replacement	See table 7-6, step 3.
7. Transformer	Removal	See table 7-7, step 1.
8. Transformer	Replacement	See table 7-7, step 4.
9. Connectors	Removal	See table 2-11, step 1.
10. Connectors	Replacement	See table 2-11, step 3.
11. High voltage interlock	Removal	See table 7-8, step 1.
12. High voltage interlock	Replacement	See table 7-8, step 3.
13. Fuseholder	Removal	See table 7-9, step 1.
14. Fuseholder	Replacement	See table 7-9, step 3.

Table 7-4. Power ON/OFF Switch Maintenance Procedures

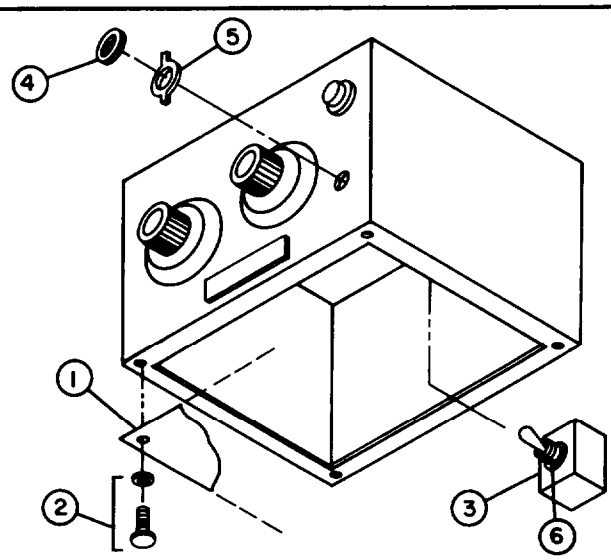
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Loosen four screws and washers (2) and remove.
2	Switch (3) Remove by doing the following: a. Loosen and remove threaded washer (4) and switch plate (5). b. Slide switch inside lamp control assembly through cutout hole. c. Disconnect and tag with destination labels wires attached to switch leads. d. Remove switch.
	REPLACEMENT
3	Switch Replace by doing the following: a. Connect wires to switch leads according to destination labels. b. Insert switch through hole in front panel. c. Align key in switchplate with keyway on switch (6). d. Secure switch and switchplate to front panel with threaded washer (4).
4	Bottom cover plate Secure to unit with four screws and washers.

Table 7-5. Power ON/OFF Lamp Maintenance Procedures

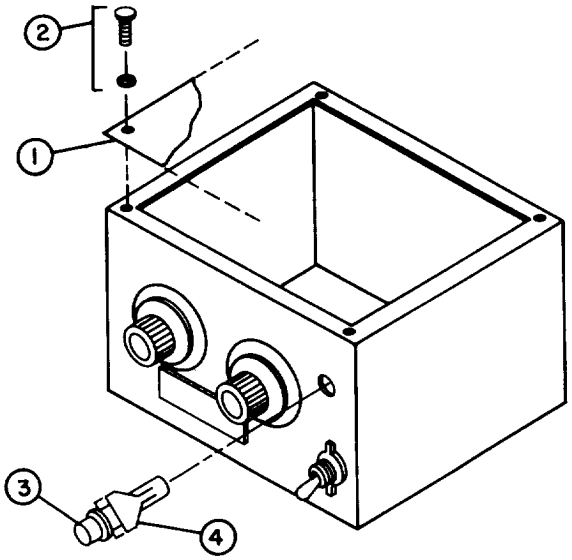
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Top cover plate (1) Loosen four screws and washers (2) and remove.
2	Lamp (3) Remove by doing the following: a. Disconnect two wires from lamp. b. Cut off four plastic tabs (4). c. Remove lamp through front panel.
	REPLACEMENT
3	Lamp Replace by doing the following: a. Press four plastic tabs. b. Insert lamp through cutout in front panel. c. Reconnect two wires.
4	Top cover plate Secure with four screws and washers.

Table 7-6. Lamp Dimmer Maintenance Procedures

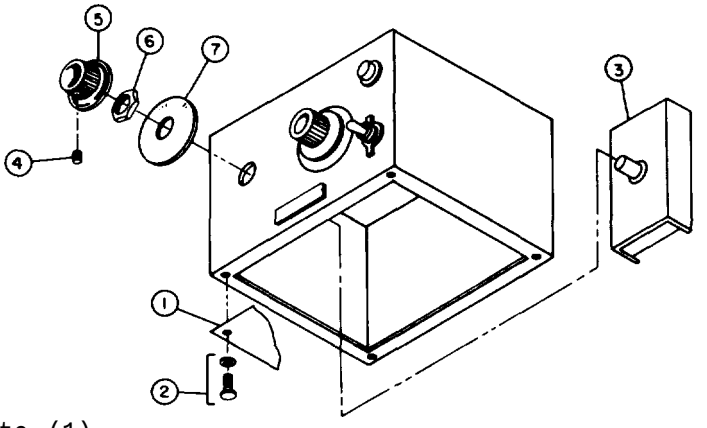
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Loosen four screws and washers (2) and remove.
2	Dimmer (3) Remove by doing the following: a. Loosen set screw (4) and remove knob (5). b. Remove hex nut (6) and graduated scale (7). c. Slide dimmer through cutout hole. d. Disconnect and tag with destination labels wires attached to dimmer leads. e. Remove dimmer.
	REPLACEMENT
3	Dimmer Replace by doing the following: a. Connect wires to diMmer leads according to destination labels. b. Insert dimmer through hole in front panel. c. Replace graduated scale onto dimmer shaft and secure with hex nut. d. Replace knob and tighten set screw.
4	Bottom cover plate Secure to unit with four screws and washers.

Table 7-7. Transformers Maintenance Procedures

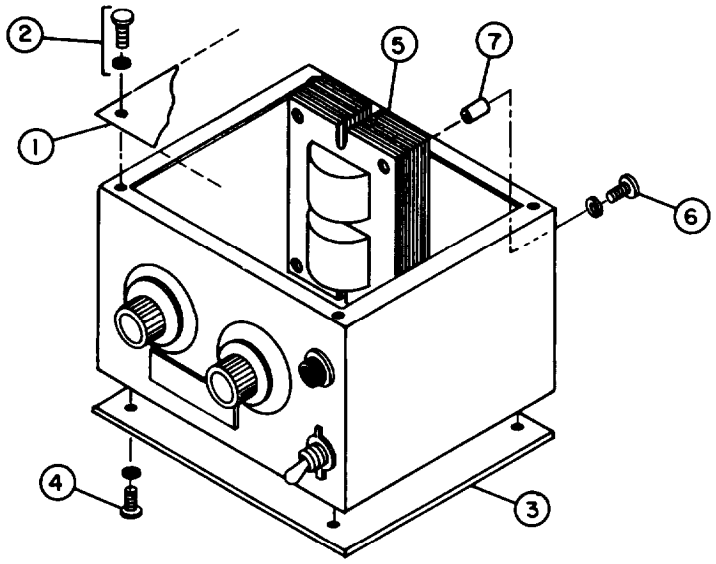
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Top cover plate (1) Loosen four screws and washers (2) and remove.
2	Bottom cover plate (3) Loosen four screws and washers (4) and remove.
3	Transformer (5) Remove by doing the following: a. Remove four screws (6). b. Disconnect and tag with destination labels wires attached to transformer leads. c. Remove transformer. d. Unscrew standoffs (7) from transformer.
	REPLACEMENT
4	Transformer Replace by doing the following: a. Install standoffs removed from old transformer in place of hex nuts. Discard hex nuts.

Table 7-7. Transformers Maintenance Procedures - Continued

STEP NO.	ITEM PROCEDURE
4	b. Insert transformer in unit. c. Connect wires to transformer leads according to destination tags. d. Secure inside unit with four screws.
5	Bottom cover plate Secure to unit with four screws and washers.
6	Top cover plate Secure to unit with four screws and washers.

Table 7-8. High Voltage Interlock Maintenance Procedures

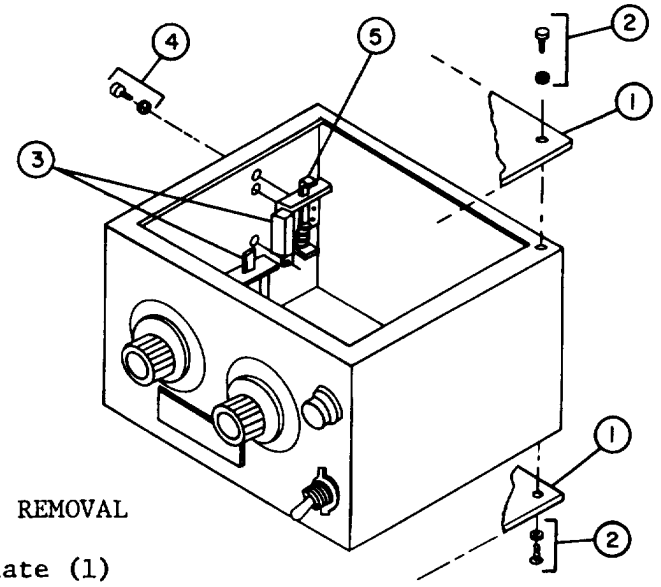
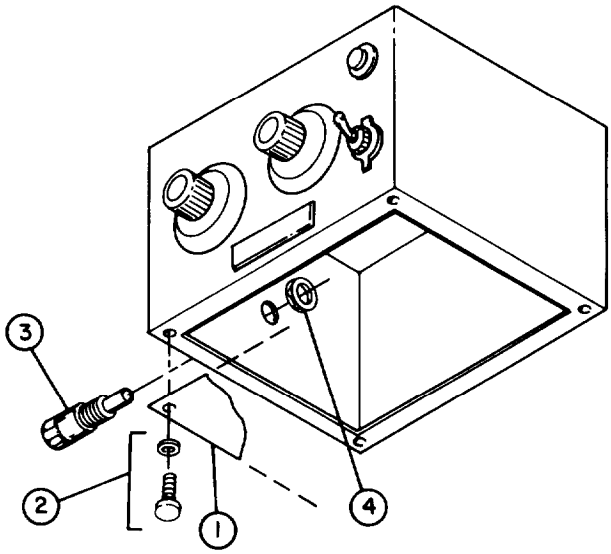
STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Top or bottom cover plate (1) Loosen four screws and washers (2) and remove.
2	High voltage interlock (3) Remove by doing the following: a. Loosen three screws and washers (4). b. Unsolder and tag with destination labels wires attached to interlock terminals. c. Remove interlock.
	REPLACEMENT
3	High voltage interlock Replace by doing the following: a. Resolder wires to interlock terminals according to destination labels. b. Align interlock so that plunger (5) contacts cover plate. c. Secure interlock with three screws and washers.
4	Top or bottom cover plate Secure to unit with four screws and washers.

Table 7-9. Fuseholder Maintenance Procedures

STEP NO.	ITEM PROCEDURE
	 REMOVAL
1	Bottom cover plate (1) Loosen four screws and washers (2) and remove.
2	Fuseholder (3) Remove by doing the following: a. Loosen nut (4). b. Slide fuseholder out through cutout hole. c. Unsolder and tag with destination labels wires attached to fuseholder terminals. d. Remove fuseholder and nut.
	REPLACEMENT
3	Fuseholder Replace by doing the following: a. Insert fuseholder through cutout in side panel. b. Thread nut onto wires. c. Resolder wires to fuseholder terminals according to destination labels. d. Tighten nut.
4	Bottom cover plate Secure to unit with four screws and washers.

APPENDIX

REFERENCES

A-1 . SCOPE.

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

A-2. FORMS .

Recommended Changes to DA Publications . . . . . DA Form 2028

Recommended Changes to Equipment Technical Manuals . . . . . DA Form 2028-2

Equipment Inspection and Maintenance Worksheet . . . . . DA Form 2404

Maintenance Request . . . . . DA Form 2407

Packaging Improvement Report . . . . . DD Form 6

A-3. TECHNICAL MANUALS AND OTHER PUBLICATIONS.

Classification, Reclassification, Maintenance, Issuance, and Reporting of Maintenance Training Aircraft . . . . . AR 700-42

Operator's Manual for Analytical Photogrammetric Positioning System (HP 9825A Model) . . . . . DMATM 80-001

Depot Maintenance Work Requirement for Analytical Photogrammetric Positioning System, AN/UYK-48 NSN 1260-01-061-7081 . . . . . DMWR 5-1260-206

First Aid for Soldiers . . . . . FM 21-11

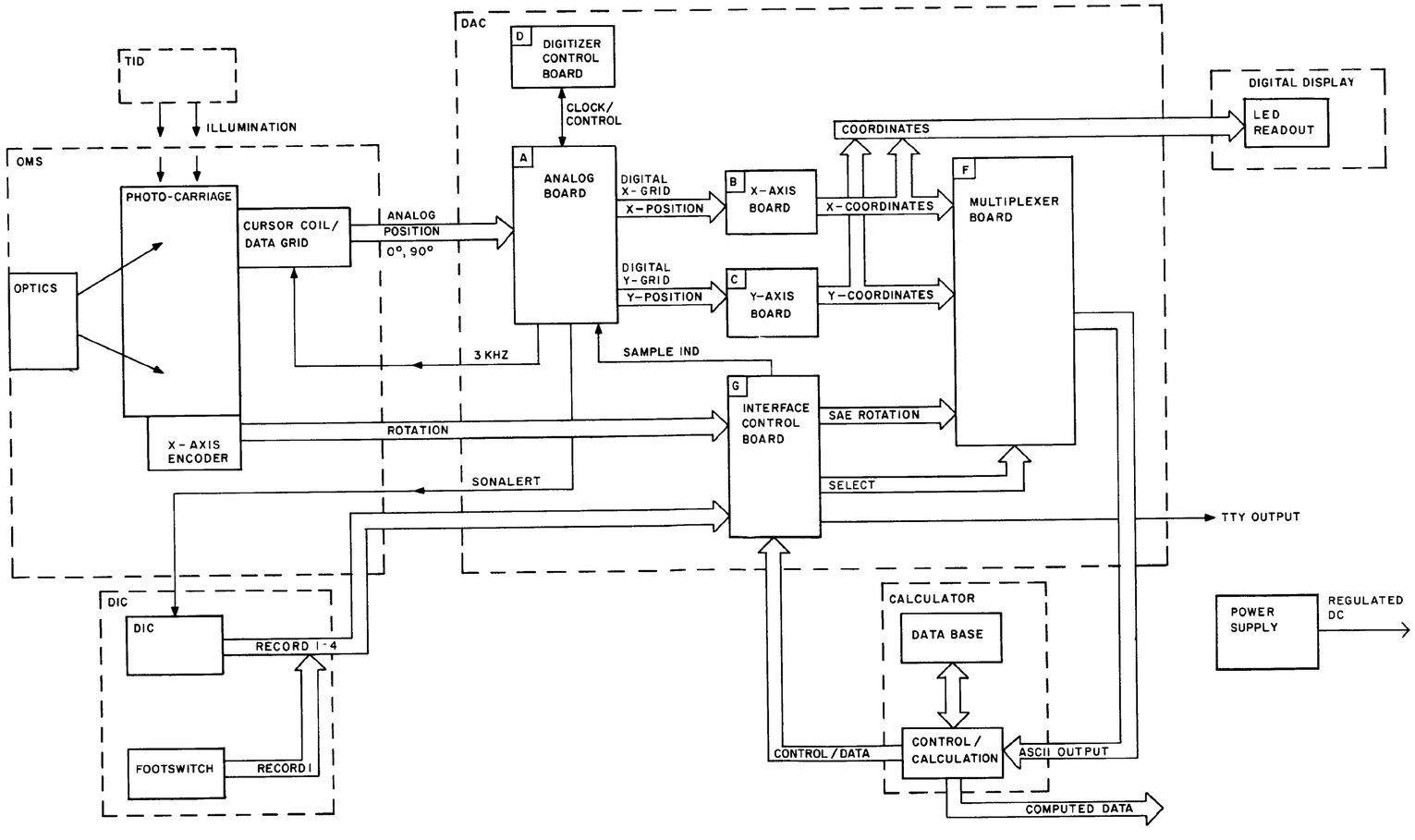
Hand Receipt Covering Content of Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) for APPS, AN/UYK-48 (NSN 1260-01-061-7081) . . . . . TM 5-1260-206-12-HR

Operator and Organizational
Maintenance Manual for Analytical
Photogrammetric Positioning System
AN/uyk-48 . . . . . .TM 5-1260 -206-12

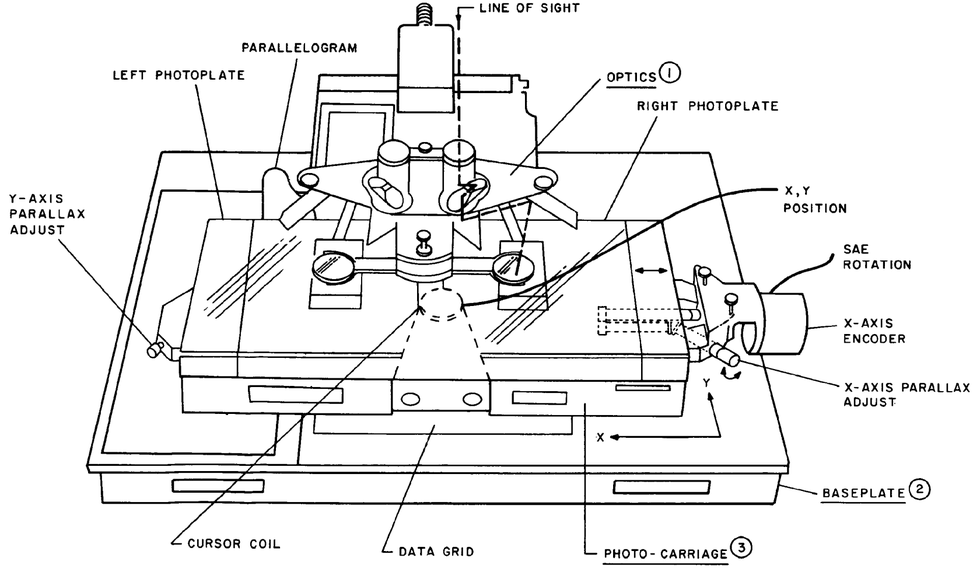
Organizational, Direct Support, and
General Support Maintenance Manual
for HP 9825A Calculator, CP-1387/U . . . . . TM 11-6660-263-24-2

The Army Maintenance Management
System (TAMMS) . . . . . DA PAM 738-750

Destruction of US Army Electronics
Command Technical Equipment to
Prevent Enemy Use . . . . . .TM 750-244-2

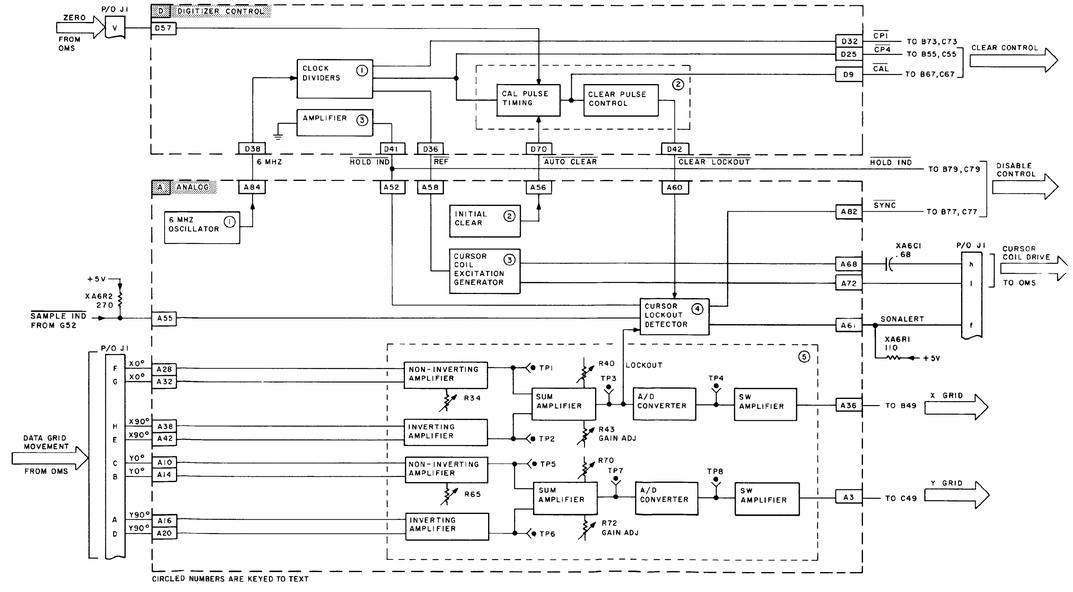


FO-1. APPS Functional Block Diagram

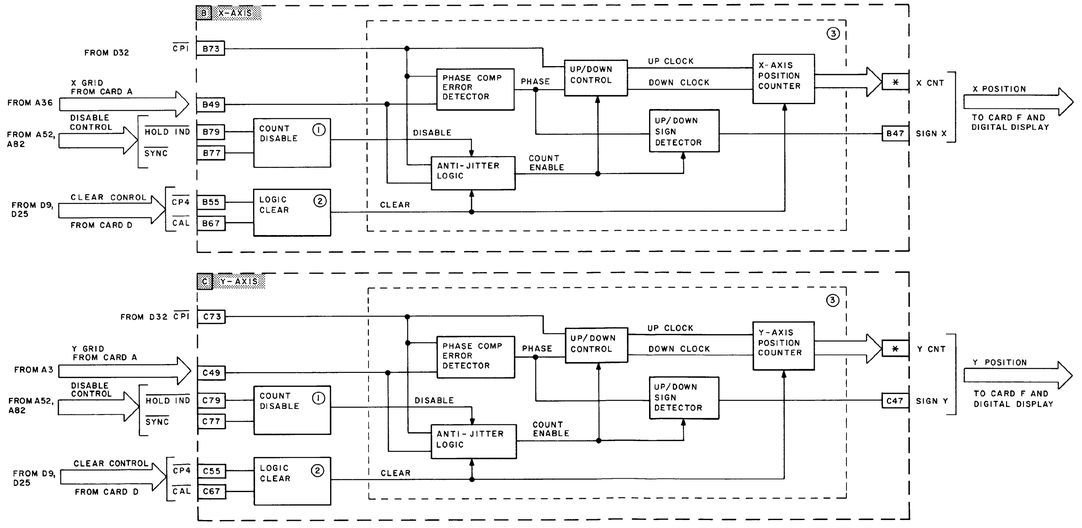


CIRCLED NUMBERS ARE KEYED TO TEXT

FO-2. OMS Functional Block Diagram

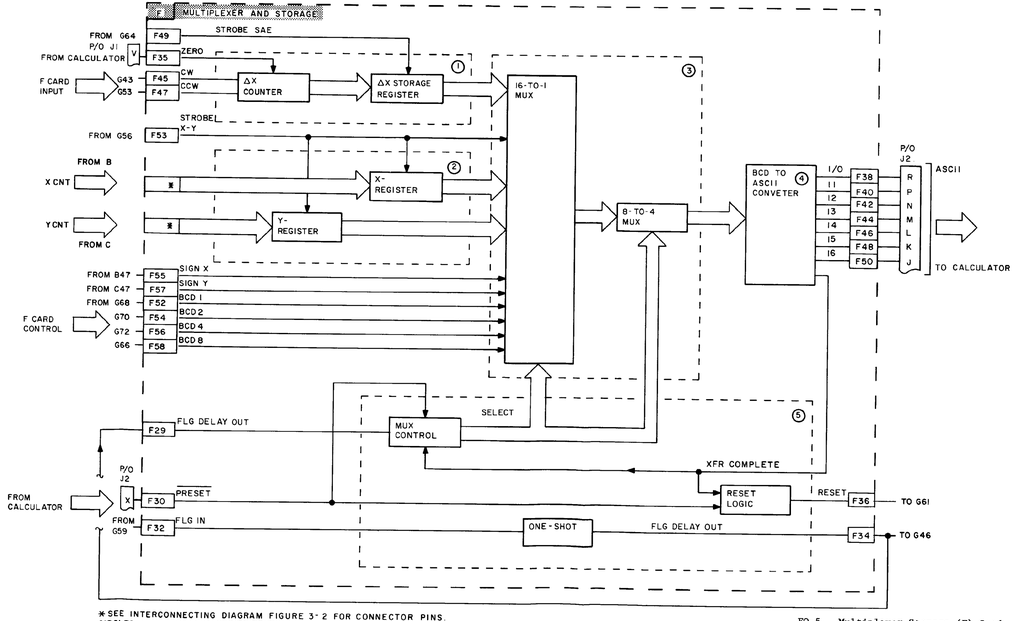


FO-3. Digitizer Control (D) Card and Analog (A) Card Functional Block Diagram



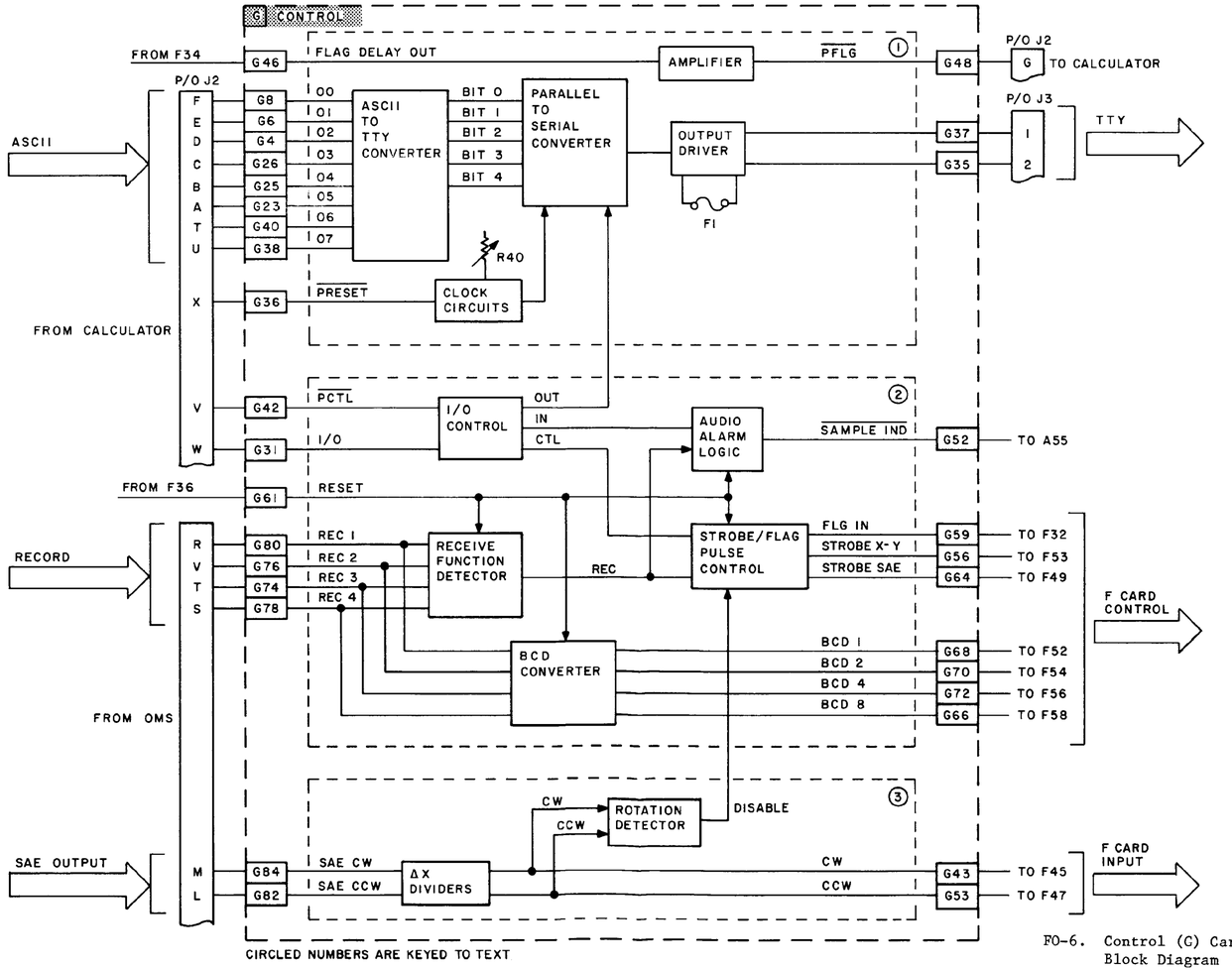
* SEE DAC INTERCONNECTING DIAGRAM FOR CONNECTOR PINS.
CIRCLED NUMBERS ARE KEYED TO TEXT.

FO-4. Axis (B and C) Cards
Functional Block Diagram

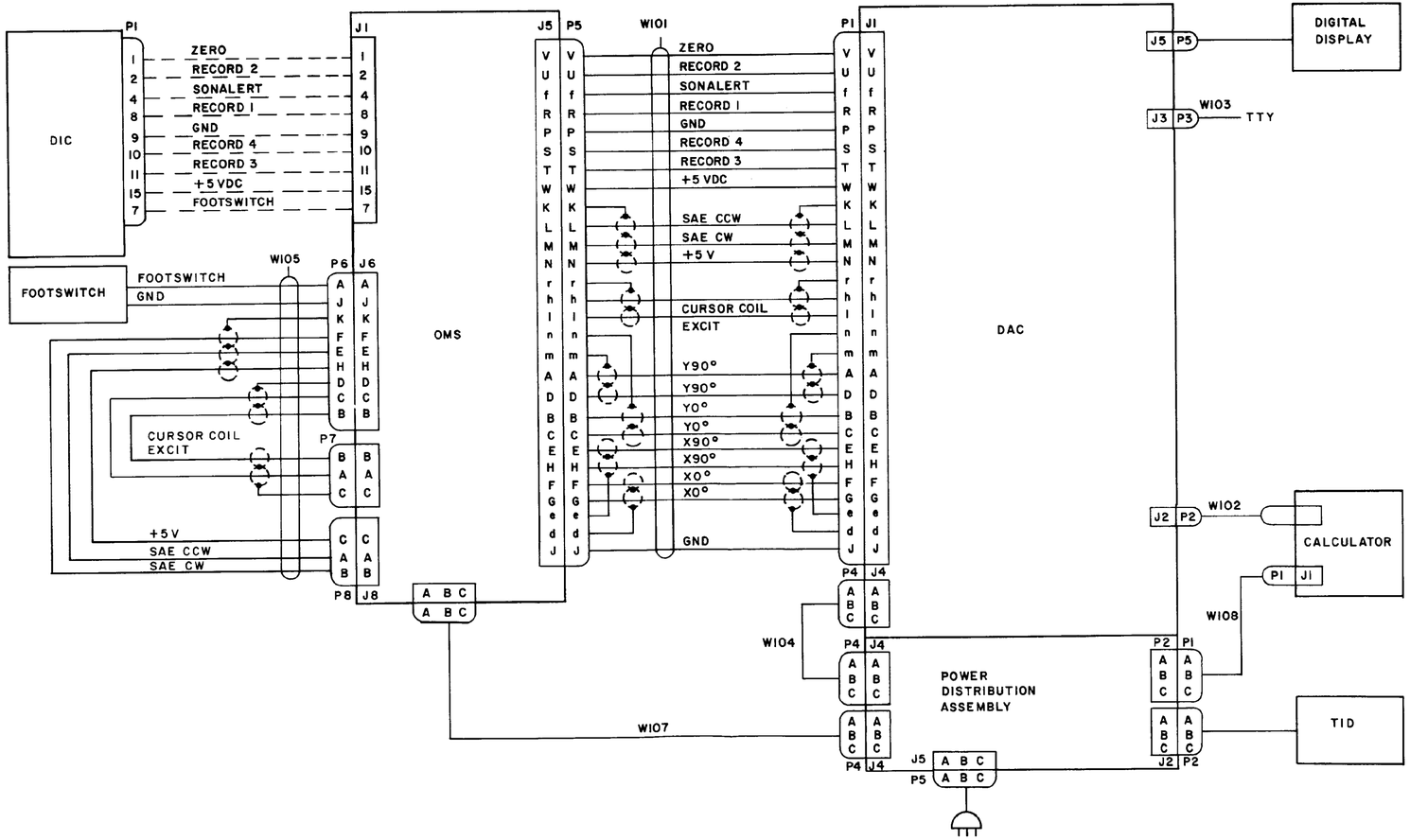


*SEE INTERCONNECTING DIAGRAM FIGURE 3-2 FOR CONNECTOR PINS.
CIRCLED NUMBERS ARE KEYED TO TEXT.

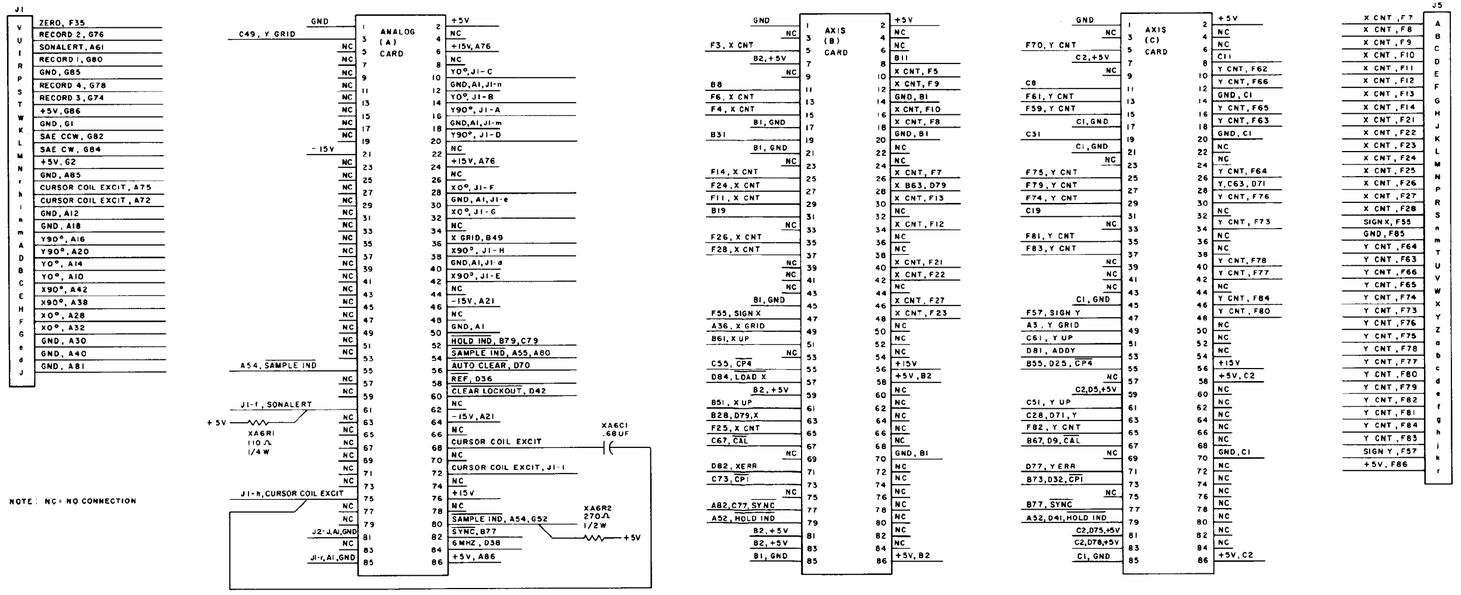
FO-5. Multiplexer Storage (F) Card Functional Block Diagram



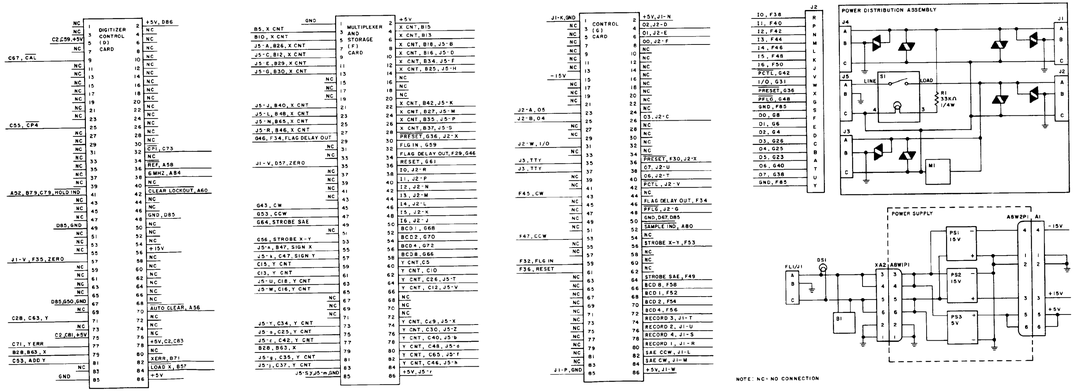
FO-6. Control (C) Card Functional Block Diagram



FO-7. APPS Interconnecting Diagram



FO-8. DAC Interconnecting Diagram
(Sheet 1 of 2)



FO-8. DAC Interconnecting Diagram (Sheet 2 of 2)

By Order of the Secretary of the Army:

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

Offcial:

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

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Direct Support and General Support Maintenance requirements for Topographic Support System, Analysis Section (ADC-TSS-12)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

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

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-1260-206-34	17 Dec 1986	Analytical Photogrammetric Positioning System (APPS)

BE EXACT. . . PIN-POINT WHERE IT IS

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

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

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

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please Correct one or the Other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE John Doe
JOHN DOE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 1, 1 Nov 80

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

TEAR ALONG PERFORATED LINE

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-1260-206-34	17 Dec 1986	Analytical Photogrammetric Positioning System (APPS)

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 **2028-2**

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

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

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-1260-206-34	17 Dec 1986	Analytical Photogrammetric Positioning System (APPS)

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 **2028-2**

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

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

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-1260-206-34	17 Dec 1986	Analytical Photogrammetric Positioning System (APPS)

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 **2028-2**

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

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

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

The Metric System and Equivalents

Linear Measures

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = .32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metricton = 10 quintals = 1.1 short tons

Liquid Measures

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	To	*Multiply by*	*To Change*	To	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2,113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C