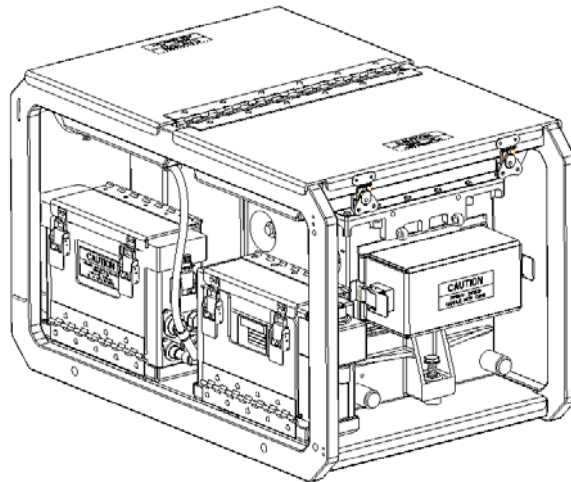


**TECHNICAL MANUAL**  
**OPERATOR AND UNIT**  
**MAINTENANCE MANUAL**  
**INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST**  
**FOR**

**SURVEYING INSTRUMENT AZIMUTH:  
IMPROVED POSITION AND AZIMUTH  
DETERMINING SYSTEM (IPADS) XM111**  
**NSN: 6675-01-515-4610**  
**PN: 7050004-9**

**INCLUDING:**

**CPNU WITH CONTAINER (6605-01-521-7884)**  
**BCU WITH CONTAINER (6130-01-521-6921)**  
**CDU WITH CONTAINER (7010-01-521-7882)**



**PROVIDED UNDER CONTRACT NUMBER:**  
**DAAE20-03-D-0150**  
**Manufactured By: L3 Communications Corporation**

---

**September 2004**  
**Approved for public release; distribution is unlimited**  
**HEADQUARTERS, DEPARTMENT OF THE ARMY**



**WARNING**

To prevent injury to personnel or damage to equipment, disconnect ground cable first, before working with, or around, batteries. Protect the ground cable from accidental contact with other battery cables or posts. When finished with work, connect ground cable last.

**WARNING**

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc. must be removed.

**WARNING**

Vehicle should not be near the helicopter while the helicopter is refueling; start-up of the ground vehicle near the aircraft is especially hazardous due to the potential for spark or backfire around accumulating JP-4 fumes.

**WARNING**

All IPADS components must be secured to the IPADS, or aircraft to avoid becoming a missile hazard during a crash.

**WARNING**

Connecting IPADS to AC power can expose the operator to lethal voltages. Prior to connecting AC power, verify the IPADS BCU **DC INPUT** switch is OFF. Connect the IPADS AC power cable to BCU AC INPUT connector before connecting it to the power outlet.

**WARNING**

When replacing the fuse or back up battery inside the BCU the operator may be exposed to high voltage. The operator must ensure the power is turned off to the BCU, and the AC Power Cable is disconnected from the power outlet, prior to opening the box

**WARNING**

The IPADS transit case weight 195 lbs (88.5 kg) with IPADS inside, use at least six persons to lift. The IPADS weighs approximately 135 lbs (61.3 kg). Use at least four persons to lift it out of the transit case. The empty transit case weighs 60 lbs (27.2 kg) and requires two people to lift it.

**WARNING**

The foam in the IPADS transit case is flammable. Do not expose to open flame or ignition sources. Extinguish burning foam with water spray, or CO2, foam or dry chemical fire extinguisher.

**CAUTION**

While connecting the IPADS DC Power Cable to the vehicle battery it is important to ensure the Positive connector of the Power Cable is connected to the Positive Terminal of the battery and the Negative connector is connected to the Negative Terminal.

**Stay Alert, Stay Alive**

OPERATOR AND UNIT  
MAINTENANCE MANUAL

FOR

SURVEYING INSTRUMENT AZIMUTH:  
IMPROVED POSITION AND AZIMUTH  
DETERMINING SYSTEM (IPADS) XM111

NSN: 6675-01-515-4610

PN: 7050004-9

INCLUDING:

CPNU WITH CONTAINER (6605-01-521-7884)

BCU WITH CONTAINER (6130-01-521-6921)

CDU WITH CONTAINER (7010-01-521-7882)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <http://aeprs.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter or DA Form 2028 direct to: AMSTA-LC-CI Tech Pubs, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

Marine Corp users shall submit NAVMC Form 10772 (Recommended Changes to Technical Publications) to: Commander, Marine Corps System Command, ATTN: PM FSS, 2200 Lester Street, Quantico, VA 22134-6050. Recommended changes may be sent by fax (DSN 378-3550, Commercial (703) 432-3550), or by naval message (in any format, only one publication per message). A reply will be furnished to you. Marine Corps users/maintainers should also provide an informational copy to: Commander, Marine Corps Logistics Bases (Code 850), 814 Radford, Albany, GA 31704-1128.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION.....	1-1
Section I. General information.....	1-1
Section II. Description and data.....	1-2
CHAPTER 2 SERVICE UPON RECEIPT AND INSTALLATION.....	2-1
Section I. Service Upon Receipt of Equipment.....	2-1
Section II. Installation of IPADS Into HMMWV (M998).....	2-8
Section III. Installation of IPADS Into UH-60 Helicopter.....	2-25
Section IV. Installation of IPADS Into SUSV.....	2-35
CHAPTER 3 OPERATING INSTRUCTIONS.....	3-1
Section I. Controls and instruments.....	3-1
Section II. Operation Under Usual Conditions.....	3-11
Section III. Operation Under Unusual Conditions.....	3-80

**TABLE OF CONTENTS - continued**

CHAPTER 4 OPERATOR/CREW MAINTENANCE INSTRUCTIONS.....	4-1
Section I Tools and Equipment.....	4-1
Section II Lubricating Instructions .....	4-1
Section III Inspection.....	4-1
Section IV Operator Preventive Maintenance Checks and Services.....	4-2
Section V Operator Troubleshooting .....	4-6
Section VI Maintenance of IPADS / Getting IPADS repaired.....	4-11
CHAPTER 5 UNIT MAINTENANCE INSTRUCTIONS.....	5-1
Section I Unit Troubleshooting.....	5-1
CHAPTER 6 REPROGRAMMING LRUS AND DOWNLOADING MAPS.....	6-1
Section I. Reprogramming LRUS and Downloading Maps.....	6-1
CHAPTER 7 MATERIAL USED IN CONJUNCTION WITH MAJOR ITEM.....	7-1
Section I. Introduction.....	7-1
Section II. Material used in Conjunction With Major Item.....	7-1

**LIST OF ILLUSTRATIONS**

Figure 1-1 – Location and Description of IPADS in M998 / M1123 / M1097 High-Mobility .....	1-3
Figure 1-2 – Location and Description of IPADS in UH-60 Helicopter .....	1-4
Figure 1-3 – Location and Description of IPADS in M973 Small Utility Support Vehicle (SUSV) .....	1-5
Figure 1-4 – Location and Description of IPADS Assembly Components .....	1-6
Figure 1-5 – Basic Issue Items.....	1-8
Figure 1-6 – Description HMMWV Installation Kit Components .....	1-14
Figure 1-7 – Description UH-60 Installation Kit Components.....	1-16
Figure 1-8 – IPADS and LRU Transit Cases.....	1-18
Figure 1-9 – IPADS Harness Cable (P/N 7204114-9).....	1-19
Figure 1-10 – FOS Cable (P/N 7204136-9).....	1-19
Figure 1-11 – A/C Power Cable (P/N ABP-ACC-TR-1).....	1-20
Figure 1-12 – UH-60 Power Cable (P/N 7204116-2).....	1-20
Figure 1-13 – HMMWV Power Cable (P/N 7204116-1) / SUSV Power Cable (P/N 7204116-3).....	1-21
Figure 1-14 – Reprogramming Cable (P/N 7204143-9).....	1-21
Figure 2-1 – IPADS Transit Case.....	2-1
Figure 2-2 – BCU Component Identification .....	2-4
Figure 2-3 – BCU Heater Removal .....	2-4
Figure 2-4 – BCU Battery Pack Installation.....	2-5
Figure 2-5 – IPADS Floor Plate Alignment .....	2-10
Figure 2-6 – IPADS Floor Plate Installation with CDU Arm and Alignment Bracket.....	2-11
Figure 2-7 – IPADS Mounting Plate and Alignment Bracket Assembly .....	2-13
Figure 2-8 – IPADS Mounting onto Alignment Bracket Assembly .....	2-14
Figure 2-9 – Alignment Pin Adjustment.....	2-14
Figure 2-10 – Mounting Clamps and T-Handle Installation.....	2-15
Figure 2-11 – HMMWV Plumb Bob Mount Location .....	2-16
Figure 2-12 – HMMWV Plumb Bob Dimensional Reference.....	2-16
Figure 2-13 – HMMWV Battery Box and Terminal .....	2-19

**LIST OF ILLUSTRATIONS - continued**

Figure 2-14 – HMMWV Battery Terminal with Plastic Boot .....	2-20
Figure 2-15 – IPADS Assembly .....	2-20
Figure 2-16 – DC Power Input into the BCU .....	2-21
Figure 2-17 – DC Power Cable with NATO Plug Installed .....	2-21
Figure 2-18 – CDU Installation on Support Arm .....	2-23
Figure 2-19 – CDU Mount Installation on Support Arm.....	2-23
Figure 2-20 – CDU Installation onto Holder Pins .....	2-24
Figure 2-21 – Locking CdfU onto Holder via Latches .....	2-24
Figure 2-22 – UH-60 stop bracket installation .....	2-25
Figure 2-23 – UH-60 Plumb Bob Installation.....	2-26
Figure 2-24 – UH-60 CDU and Indexer Holder Assembly .....	2-27
Figure 2-25 – UH-60 CDU Indexer Assembly onto Frame.....	2-28
Figure 2-26 – UH-60 AC/DC Power Connectors.....	2-29
Figure 2-27 – IPADS in UH-60.....	2-30
Figure 2-28 – IPADS Tie Down in UH-60.....	2-30
Figure 2-29 – Belt Assembly Clipped to Cargo Ring.....	2-31
Figure 2-30 – Belt Assembly Ratchet.....	2-32
Figure 2-31 – Cable Tie Installation.....	2-33
Figure 3-1 – BCU Operator/Crew Controls, Indicators, and Connectors .....	3-1
Figure 3-2 – CDU Operator/Crew Controls, Indicators, and Connectors.....	3-3
Figure 3-3 – CDU Keyboard .....	3-4
Figure 3-4 – IPADS Display Page.....	3-8
Figure 3-5 – CPNU / PPA Operator/Crew Controls and Connectors .....	3-10
Figure 3-6 – MENU Interactive Area.....	3-12
Figure 3-7 – BCU Power Switches.....	3-13
Figure 3-8 – CDU Keyboard Layout.....	3-14
Figure 3-9 – IPADS in UH-60.....	3-68
Figure 3-10 – UH-60 AC/DC Power Connectors.....	3-69
Figure 3-11 – Belt Assembly Ratchet.....	3-71
Figure 3-12 – UH-60 IPADS.....	3-71
Figure 3-13 – Belt Assembly Clipped to Cargo Ring.....	3-72
Figure 3-14 – Belt Assembly Ratchet.....	3-73
Figure 3-15 – Cable Tie Installation .....	3-74
Figure 4-1 – BCU Fuse.....	4-13
Figure 4-2 – Component Replacement .....	4-15
Figure 5-1 – Wiring Harness W114.....	5-2
Figure 5-2 – Power Cable W116 .....	5-3
Figure 5-3 – UH-60 Power Cable W116-2 .....	5-4
Figure 5-4 – FOS Cable W136 .....	5-5

**LIST OF TABLES**

Table 1-1 – Components Required for Use of IPADS in Helicopter and Ground Vehicles .....	1-13
Table 1-2 – Characteristics and Performance Data.....	1-22
Table 3-1 – Special Keys Used on IPADS .....	3-6
Table 3-2 – IPADS Function Keys By Screen.....	3-7
Table 3-3 – Ellipsoids and Datums Supported by IPADS .....	3-18
Table 3-4 – ZUPT Operation.....	3-37
Table 3-5 – UPDATE ERROR TROUBLESHOOTING .....	3-45
Table 3-6 – Parts Required for Transfer to UH-60 Helicopter .....	3-68
Table 3-7 – Quick Look-Up to Operating Procedures.....	3-81
Table 4-1 – Pre-Operation Check .....	4-1
Table 4-2 – Operator Preventive Maintenance Checks and Services .....	4-4



## CHAPTER 1

---

### SECTION I. GENERAL INFORMATION

#### 1-1. Scope.

This manual contains information and guidance for the operation and maintenance of the Improved Position and Azimuth Determining System (IPADS).

a. Type of Material.

This manual provides operating instructions and operator and unit maintenance instructions. The Maintenance Allocation Chart in Appendix D assigns maintenance on each part and assembly. Maintenance that cannot be performed because of the need for tools, equipment, or supplies will be referred to a higher maintenance category.

b. Purpose of Equipment.

The IPADS is a highly mobile, self-contained survey instrument that supports field artillery operations.

#### 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). Marine Corps users shall refer to TM 4700-15/1.

#### NOTE

This equipment is not covered by Equipment Serviceability Criteria (ESC).

#### 1-3. Destruction of Army Material to Prevent Enemy Use.

Army and Marine Corps users, refer to Army TM 750-244-2 for procedures for destruction of this equipment to prevent enemy use.

#### 1-4. Administrative Storage.

Refer to TM 740-90-1 for procedures, forms and records, and inspections required during administrative storage of this equipment. Marine Corps users shall refer to MCO 4450.7.

#### 1-5. Calibration.

No scheduled calibration is required.

#### 1-6. Reporting Equipment Improvement Recommendations (EIR).

EIRs 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 tell why the design is unfavorable or why a procedure is difficult. EIRs may be submitted on SF (Standard Form) 368 (Quality Deficiency Report). Mail directly to:

Armament Research, Development & Engineering Center  
ATTN: AMSRD-QEP-A  
Rock Island, IL 61299-7300

Marine Corps users may submit EIRs and Quality Deficiency Reports in accordance with MCO 4855.10B. Mail directly to:

Commanding General  
Marine Corps Logistics Command (code 808)  
Albany, GA 31704-5000

A reply will be sent directly to you.

## SECTION II. DESCRIPTION AND DATA

### 1-7. Purpose of IPADS.

The IPADS is a self-contained inertial surveying system capable of rapidly determining accurate position, altitude, and azimuth when used in either ground or airborne survey operations. The system may be installed in and operate from an M998, M1097, or M1123 series high-mobility multi-purpose wheeled vehicle (HMMWV) and M973 series small utility support vehicle (SUSV). It may also be mounted on a UH-60 utility helicopter (Blackhawk) or transported by a CH-47 cargo helicopter (by sling loading the land vehicle). IPADS may be utilized within any vehicle (ground or air) capable of carrying it, supplying required power, and making periodic stops at five or ten minute intervals. IPADS is used to conduct field artillery surveys critical to the fire-control function, providing a common survey for weapons and target acquisition systems. It will determine the true or grid azimuth lines used to orient weapons and target acquisition systems.

### 1-8. Description.

IPADS is described in figure 1-1 through 1-8.

### 1-9. Differences Between Models.

There is only one model of the IPADS.

### 1-10. Capabilities and Features.

- Self-contained
- Mobile (may be used with land vehicles or helicopter)
- Two-person crew
- Horizontal position
- Altitude
- Azimuth
- Built-in self-test circuits

### 1-11. Tabulated Data.

A list of components required for use of IPADS in helicopter and ground vehicles is given in table 1-1. IPADS characteristics and performance data are given in table 1-2.

### 1-12. Items Comprising Operable Equipment.

All items illustrated and listed in figure 1-1 through figure 1-8 are required for operable equipment.

1

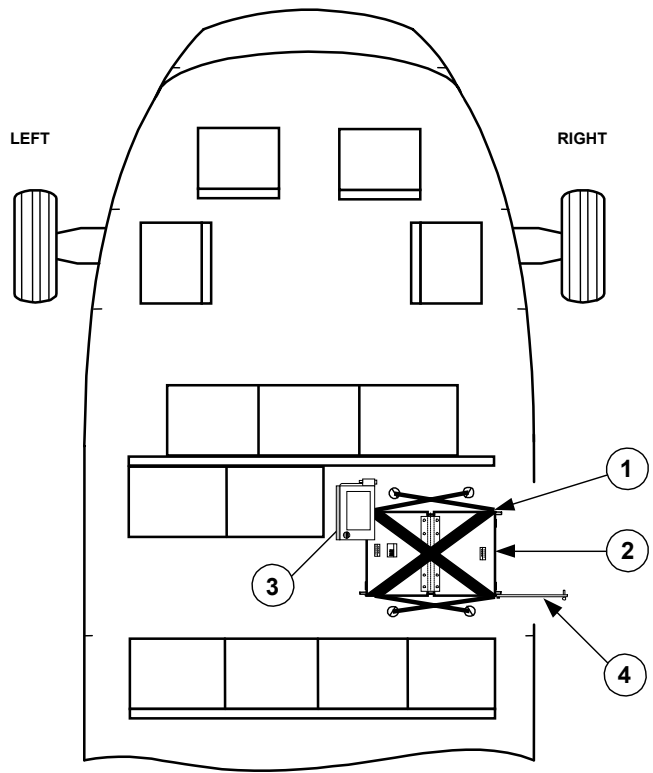
3

2

**Figure 1-1 – Location and Description of IPADS in M998 / M1123 / M1097 High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)**

**Legend for Figure 1-1 – Location and Description of IPADS in M998 / M1123 / M1097 High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)**

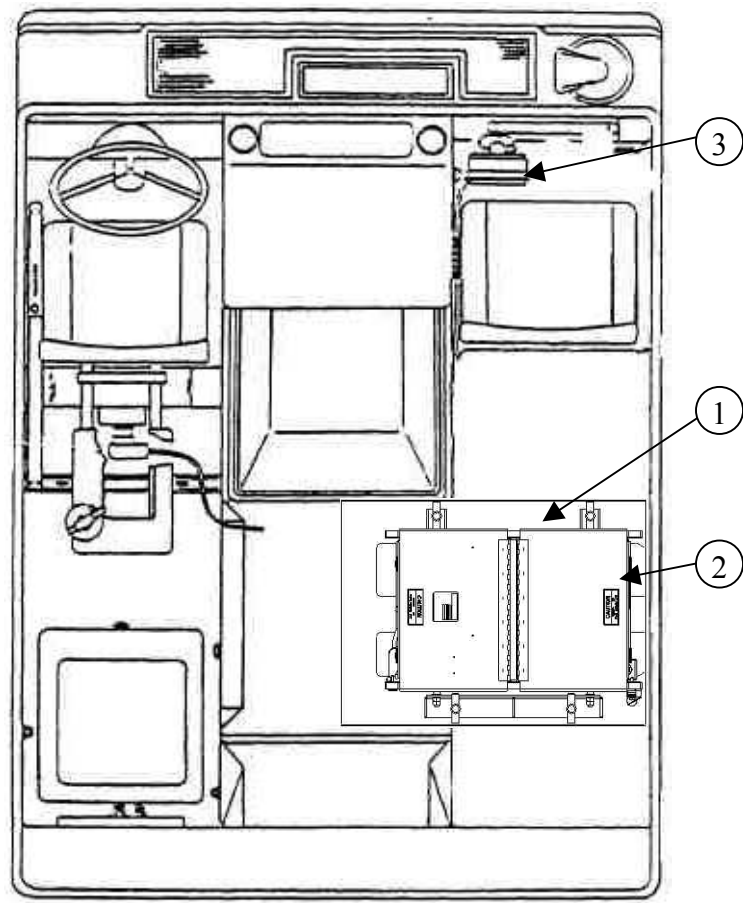
Index No.	Nomenclature	Description
1	HMMWV mounting kit	Contains the mounting hardware and electrical cable needed to install IPADS in a HMMWV.
2	IPADS assembly	Contains the basic electronic components for IPADS, including navigation unit (CPNU), standby battery power (BCU), wiring harness, and storage space for tools, cables, and helicopter CDU mount.
3	Control and Display Unit	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU).



**Figure 1-2 – Location and Description of IPADS in UH-60 Helicopter**

**Legend for Figure 1-2 – Location and Description of IPADS in UH-60 Helicopter**

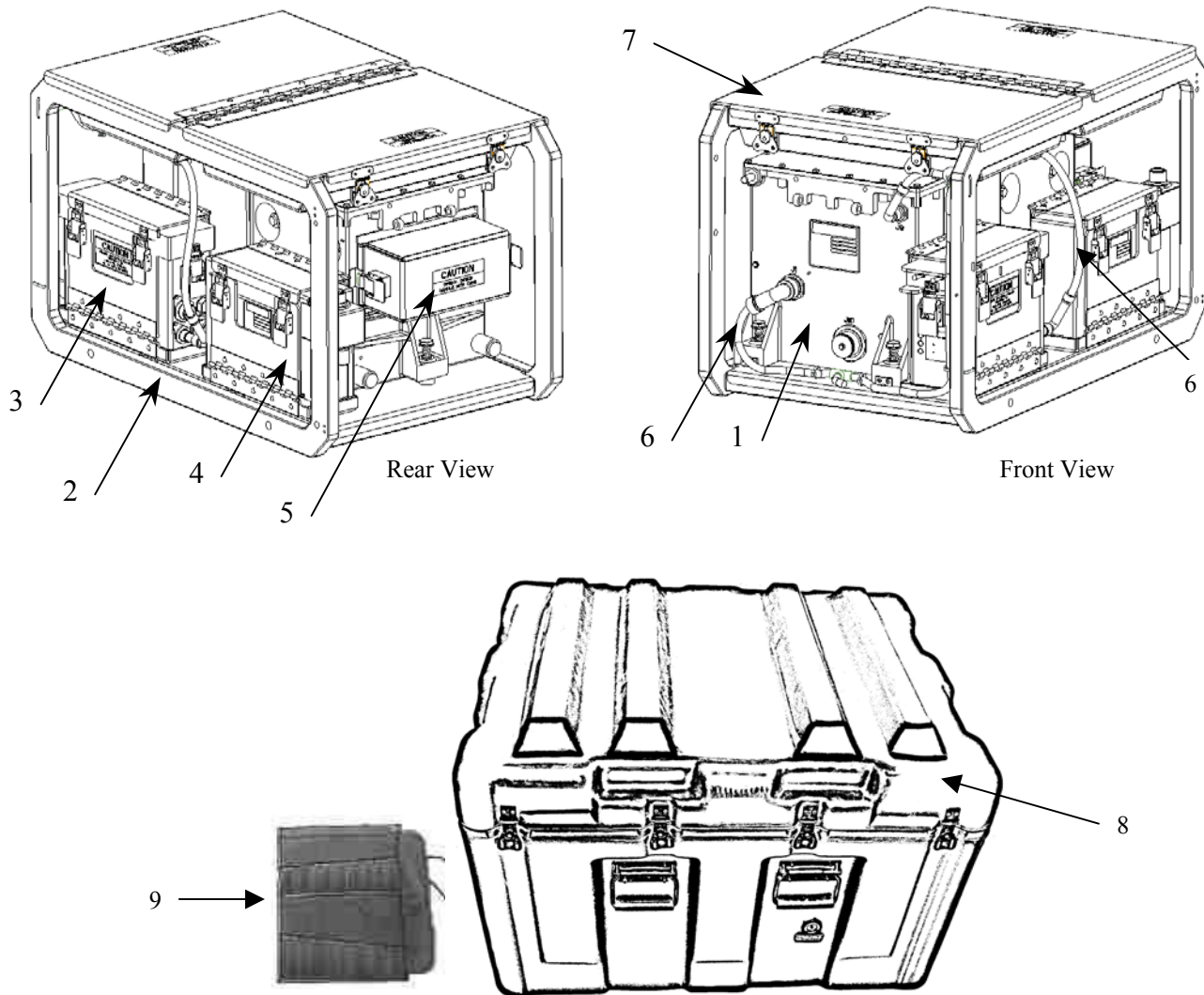
Index no.	Nomenclature	Description
1	UH-60 installation kit	Contains the mounting hardware and electrical cable needed to install IPADS in a UH-60 Helicopter.
2	IPADS assembly	Contains the basic electronic components for IPADS, including navigation unit (CPNU), standby battery power (BCU), wiring harness, and storage space for tools, and cables.
3	Control and Display Unit	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU).
4	Plumb bob arm	Arm to hang plumb bob above survey point.



**Figure 1-3 – Location and Description of IPADS in M973 Small Utility Support Vehicle (SUSV)**

**Legend for Figure 1-3 – Location And Description Of IPADS in M973 Small Utility Support Vehicle (SUSV)**

Index no.	Nomenclature	Description
1	SUSV Mounting kit	Contains the mounting hardware and electrical cable needed to install IPADS in a SUSV.
2	IPADS assembly	Contains the basic electronic components for IPADS, including navigation unit (CPNU), standby battery power (BCU), wiring harness, and storage space for tools, cables, and helicopter CDU mount
3	Control and Display Unit	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU).



**Figure 1-4 – Location and Description of IPADS Assembly Components**

**Legend for Figure 1-4 — Location and Description of IPADS Assembly Components**

Index no.	Nomenclature	Description
1	Compact Position & Navigation Unit (CPNU)	Contains the gyroscope and accelerometer sensors and associated electronics necessary to maintain the survey coordinate frame and measure distance traveled to each coordinate axis. Also contains porro prism for auto-reflection.
2	IPADS assembly	Contains the basic electronic components for IPADS, including CPNU, standby battery power (BCU), transit storage space for CDU, wiring harness, and storage space for tools, cables, and helicopter CDU mount.
3	Battery and Charger Unit (BCU)	Contains IPADS backup batteries and associated switching and charging electronics.
4	Control and Display Unit (CDU)	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU). CDU is mounted outside of IPADS assembly on mounts during operation.
5	Porro Prism Cover	Protects porro prism.
6	IPADS Harness Assembly (W114)	Interconnects BCU, CDU and CPNU.
7	Storage Boxes	Provides storage for IPADS accessory and tool kit, see figure 1-5 for detail.
8	Shipping and Storage Container, IPADS	Container for shipping and storing the IPADS during transit and extended storage when not installed in vehicle.
9	Tool Kit	Tools needed to install and maintain IPADS assembly.

Figure 1-5 – Basic Issue Items










Item Number	Item
1	
2	
3	
4	
5	
6	
7	
8	
9	



Figure 1-5 – Basic Issue Items






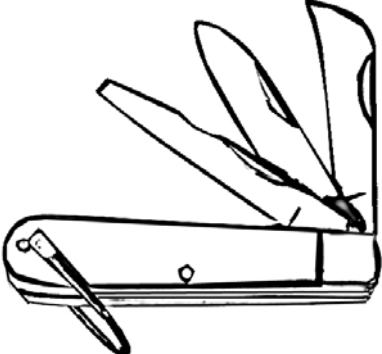


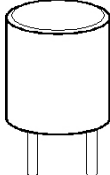

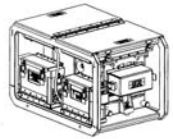
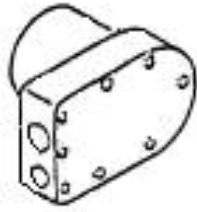
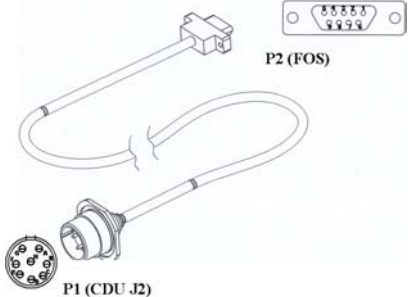
Item Number	Item
10	
11	
12	
13	
14	
15	
16	
17	

Figure 1-5 – Basic Issue Items

Item Number	Item
18	
19	
20	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-size: small;">ARMY TM 9-6675-349-12&amp;P MARINE CORPS TM 11039A-12&amp;P</p> <hr/> <p><b>TECHNICAL MANUAL</b>  <b>OPERATOR AND ORGANIZATIONAL                  MAINTENANCE MANUAL</b>                  INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST                  FOR</p> <p><b>SURVEYING INSTRUMENT AZIMUTH                  IMPROVED POSITION AND AZIMUTH                  DETERMINING SYSTEM (FADS) XM111</b>                  NSN: 6675-01-515-4610                  PN: 7050004-9</p> <p><b>INCLUDING:</b></p> <p>CPNU WITH CONTAINER (6605-01-521-7884)                  BCU WITH CONTAINER (6130-01-521-6921)                  CDU WITH CONTAINER (7010-01-521-7882)</p>  <p><b>PROVIDED UNDER CONTRACT NUMBER:</b>                  DAAE20-03-D-0150                  Manufacturer By: L3 Communications Corporation</p> <hr/> <p style="font-size: x-small;">1 September 2004                  Approved for public release; distribution is unlimited                  HEADQUARTERS, DEPARTMENT OF THE ARMY</p> </div>
21	
22	 <p style="text-align: center;">P2 (FOS)</p> <p style="text-align: center;">P1 (CDU J2)</p>

**Legend for Figure 1-5 – Basic Issue Items**

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	1	5210-01-367-7283	Plumb bob, brass 8 oz. (63474) 108	EA	1
1-5	2		Plumb bob String 25yds (39428) 2178A8	Roll	1
1-5	3	6230-00-264-8261	Flashlight 90°angle (1CSX9) MX-991/U	EA	1
1-5	4	5975-00-899-4606	Strap, Tiedown, Elect.(Nylon) (81343) MS3367-2-0	Bundle	1
1-5	5		Strap, Cable W/Buckle(Velcro) (34054) 6912K54	EA	5
1-5	6	7920-00-205-1427	Brush, Dusting, Lens (80244) 7920-00-205-1427	EA	1
1-5	7	6135-00-835-7210	Wrench, Open End; 5/8 inch (55719) OSH20B	EA	1
1-5	8	5120-01-474-5182	Handle, Ratchet Wrench, 3/8 inch (55719) F936	EA	1
1-5	9	5120-01-187-1784	Socket Set, Socket (55719) 211SFY (12 Point) Set to include: <ul style="list-style-type: none"> <li>• ¼ inch</li> <li>• 5/16 inch</li> <li>• 3/8 inch</li> <li>• 7/16 inch</li> <li>• ½ inch</li> <li>• 9/16 inch</li> <li>• 5/8 inch</li> <li>• 11/16 inch</li> <li>• ¾ inch</li> <li>• 13/16 inch</li> <li>• 7/8 inch</li> </ul>	EA	1
1-5	10	5120-01-428-7830	Pliers, Needle Nose (55719) 196BCP	EA	1
1-5	11	5120-01-300-1152	Screwdriver, Cross Tip 3 & ¾ inch (55719) GSDDP22	EA	1
1-5	12	5120-01-290-8231	Screwdriver, Crosstip, 8 & 13/32 inch (55719) GSDDP42	EA	1
1-5	13	5120-01-335-1235	Wrench, Box and Open End 9/16 inch (55719) OEX18B	EA	1

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	14	5120-01-367-3356	Wrench, Box and Open End ¾ inch (55719) OES24B	EA	1
1-5	15	5110-01-399-9317	Knife, Pocket, Electrician's (1CV05) 18535	EA	1
1-5	16	5140-01-M27-7768	Roll, Tools & Accessories (39428) 6389A11	EA	1
1-5	17		Thumbscrew, 5/16x1 in long (3A054) 91744A583	EA	1
1-5	18	5920-01-493-6642	Fuse, Cartridge (0JR59) 373150041	EA	5
1-5	19	5120-01-335-1233	Wrench, Box and Open 7/16 inch (55719) OEX14B	EA	1
1-5	20		Operator and Unit Maintenance Manual for the IPADS TM 9-6675-262-12&P	EA	1
1-5	21		Connector Plug Electrical, NATO (61090) TGC2338		
1-5	22	5995-01-519-0653	CABLE ASSY, FOS 7204136-9 (1NZ85)	EA	1

**Table 1-1 – Components Required for Use of IPADS in Helicopter and Ground Vehicles**

<b>Nomenclature</b>	<b>Part No/NSN</b>	<b>Quantity Required</b>	<b>UH-60</b>	<b>M998 HMMWV</b>	<b>M1123/M1097 HMMWV</b>	<b>SUSV</b>
IPADS Assembly	7050004-9	1	X	X	X	X
Mounting Kit, HMMWV	7204154-9	1		X	X	
Floor Plate	7204108-1	1		X	X	
Floor Plate Hardware				X	X	
1/2-13 X 3 L screw	MS35307-419	3				
1/2 locking washer	MS35338-143	3				
1/2 flat washer	MS15795-818	3				
CDU Support Arm Assembly	7204155-9	1		X	X	
CDU Support Arm Hardware				X	X	
3/8-16, 1” screw	MS35307-360	4				
3/8 flat washer	MS15795-814	4				
CDU Mount Assembly	7204149-9	1	X	X	X	X
CDU Indexer Mast	7204108-5	1		X	X	
Alignment Bracket Assembly	7204151-9	1		X	X	
Mounting Clamp	7204108-4	2		X	X	
T-Handle	7204108-3	4		X	X	
T-Handle Hardware				X	X	
5/8 washer	98370A035	4				
Plumb Bob Bracket	7204108-8	1		X	X	
PB Bracket Thumbscrew	91744A583	1		X	X	
5/16-18 X 1L						
Power Cable W116	7204116-1	1		X	X	
Plug, NATO	TGC2338	1		X	X	X
M1123/M1097 Hardware					X	
1/2 flange nut	94758A033	3				
Kit, UH-60	7204145-9	1	X			
6000 lb Strap		2	X			
UH-60 CDU Indexer	7170186-9	1	X			
UH-60 Plumb Bob Bracket	7170187-9	1	X			
Horizontal Stop Bracket	7170188-9	1	X			
Vertical Stop Bracket	7170189-9	1	X			
Power Cable W116-2	7204116-3	1	X			
Screw		4	X			
Screw		1	X			
Shoulder washer		2	X			
Flat washer		2	X			
Mounting Kit, SUSV	PL7204144-9					X

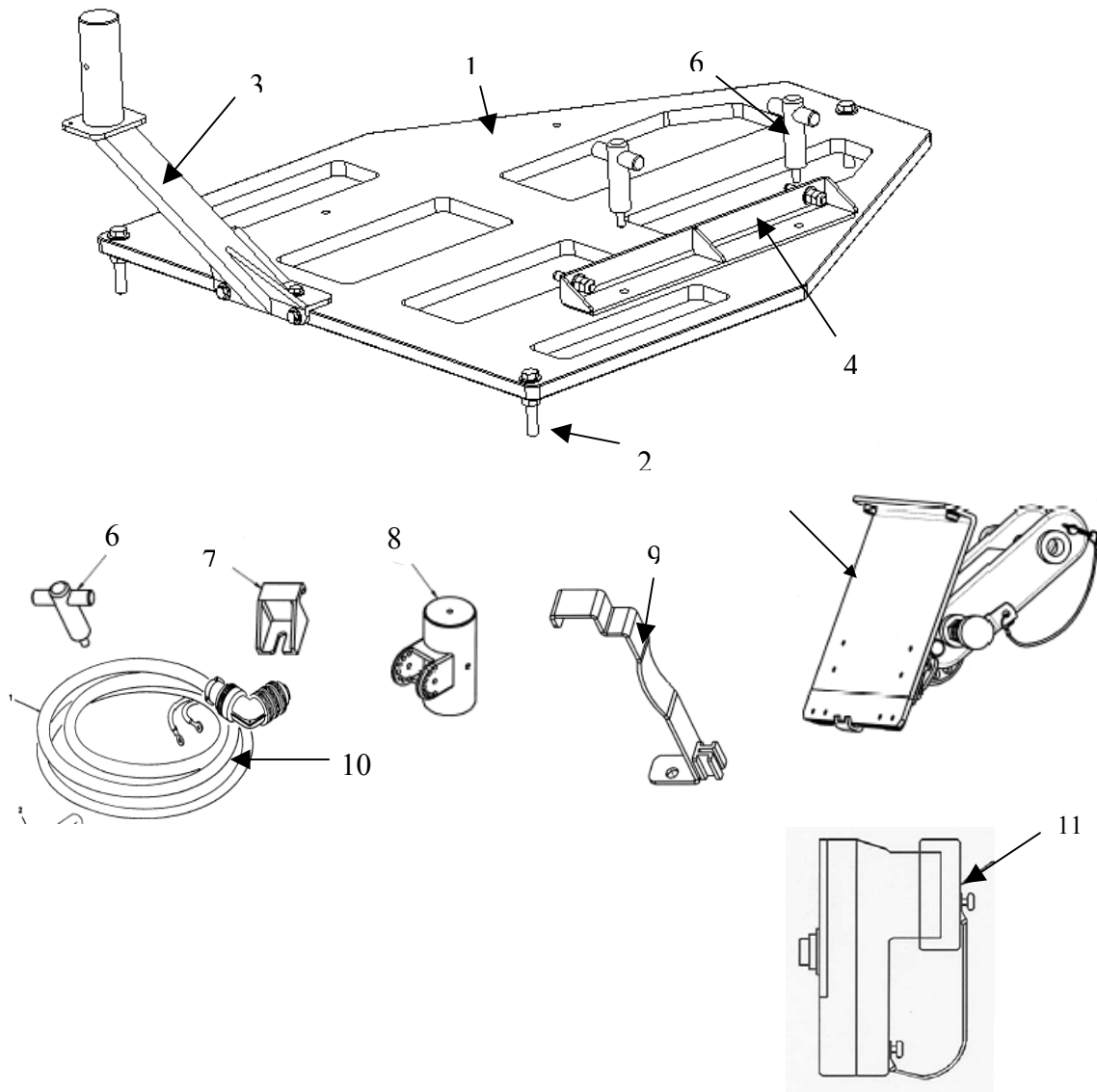


Figure 1-6 – Description HMMWV Installation Kit Components

**Legend for Figure 1-6 – Description HMMWV Installation Kit Components**

Index no.	Nomenclature	Description
1	Floor Plate	Mounts the IPADS Frame to the cargo bed of HMMWV.
2	Floor plate hardware	Three each 1/2-inch diameter by 3-inch long bolts, lock washers and flat washers. Three each 1/2-inch flanged nut used on M1123 and M1097 HMMWVs.
3	CDU Support Arm Assembly	Mounts CDU and its CDU mount assembly to the floor plate
4	Alignment Bracket Assembly	Secures the IPADS Frame (BCU and CDU side) to the floor plate.
5	CDU Mount Assembly	Attaches to CDU indexer mast for mounting the CDU to CDU support arm assembly.
6	T-Handle (four each)	Secures IPADS alignment bracket assembly and mounting clamps to floor plate.
7	Mounting clamp (two each)	Secures the IPADS assembly (CPNU side) to the floor plate.
8	CDU indexer mast	Attaches to the CDU mount assembly for mounting the CDU to the CDU support arm assembly.
9	Plumb bob bracket	HMMWV bracket to hang plumb bob over survey marker.
10	Power cable (W116)	Connects IPADS to HMMWV.
11	Plug, NATO	Connects Power cable (W116) to vehicle NATO power plug.

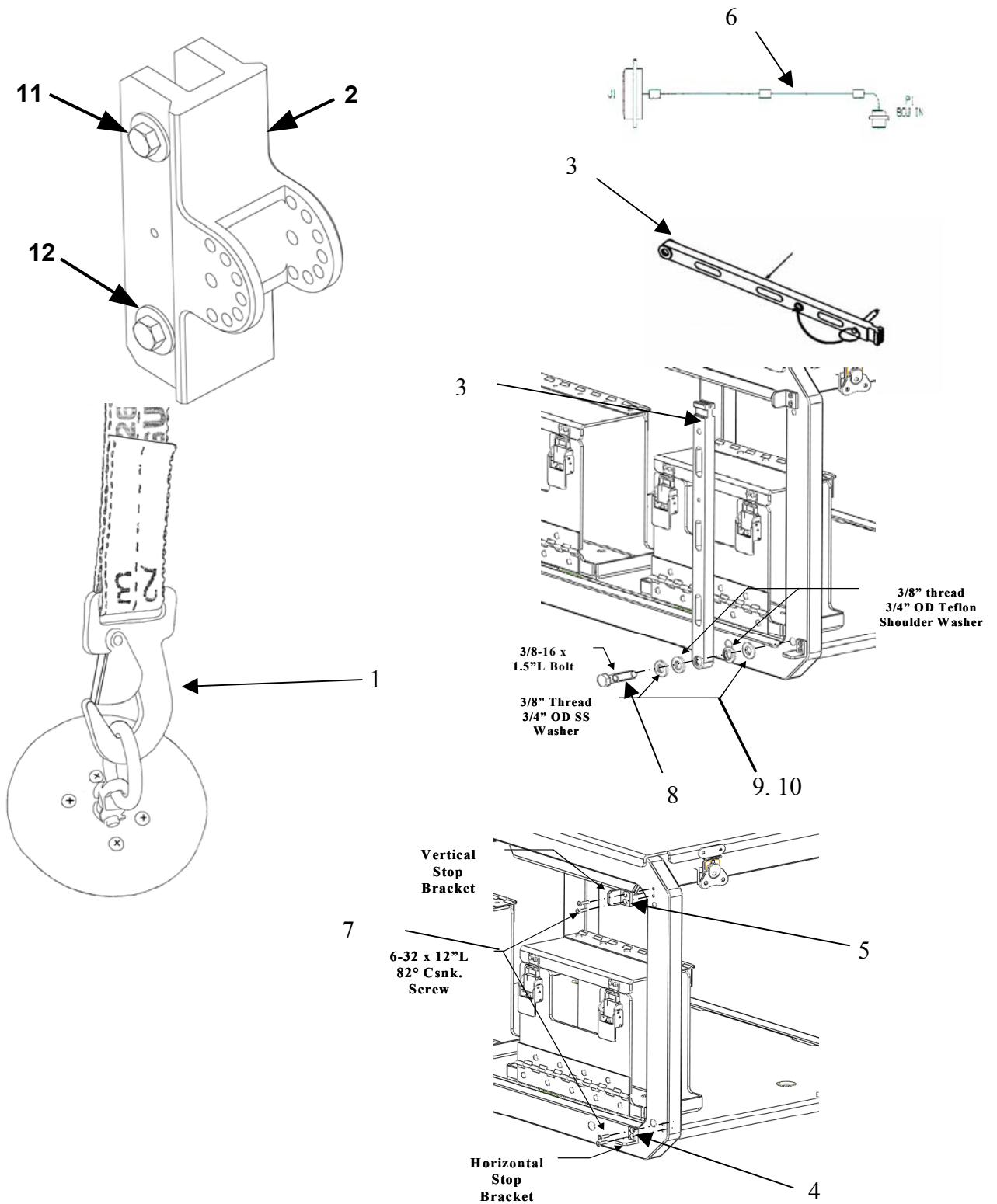
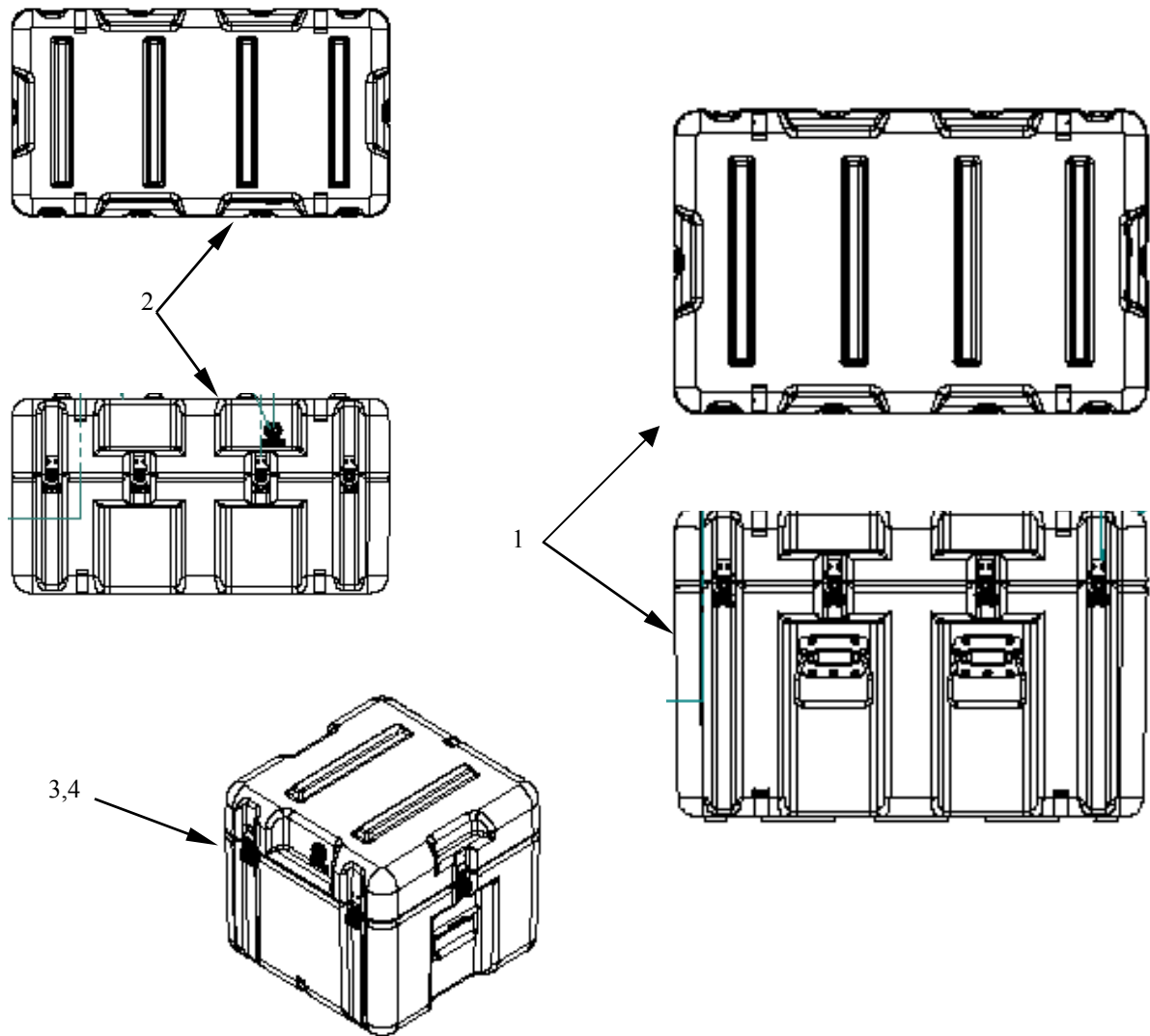


Figure 1-7 – Description UH-60 Installation Kit Components



**Legend for Figure 1-7 – Description UH-60 Installation Kit Components**

<b>Index No.</b>	<b>Nomenclature</b>	<b>Description</b>
1	5000 lb CGU-1/B Strap	Secures IPADS assembly to tie-down points in the UH-60 floor.
2	UH-60 CDU Indexer	Secures CDU and its CDU Mount Assembly onto IPADS assembly during UH-60 operations.
3	UH-60 plumb bob arm	Supports and aligns plumb bob and string on UH-60.
4	Horizontal stop bracket	Allows plumb bob arm to rest in horizontal position when in use.
5	Vertical stop bracket	Allows plumb bob arm to rest in vertical position when not in use.
6	Power cable (W116-2)	Connects IPADS to UH-60 28VDC power source.
7	Screw (4 each)	Secures UH-60 plumb bob arm stops to IPADS frame.
8	Screw	Bearing for UH-60 plumb bob arm.
9	Shoulder washer (2 each)	Bearing for UH-60 plumb bob arm.
10	Flat washer (2 each)	Spacer for UH-60 plumb bob arm.
11	Screw, Machine (2 each)	Secures UH-60 CDU Indexer to the IPADS Frame.
12	Washer, flat (2 each)	Secures retainer of Quick release Pins on CDU Indexer.



**Figure 1-8 – Transit Cases – P/N 7158019-1**

**Legend for Figure 1-8 – Transit Cases – P/N 7158019-1**

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	7158019-1	CASE, TRANSIT, IPADS	1
2	7158019-2	SHIPPING AND STORAGE, CPNU	1
3	7158019-4	SHIPPING AND STORAGE, BCU	1
4	7158019-5	SHIPPING AND STORAGE, CDU	1

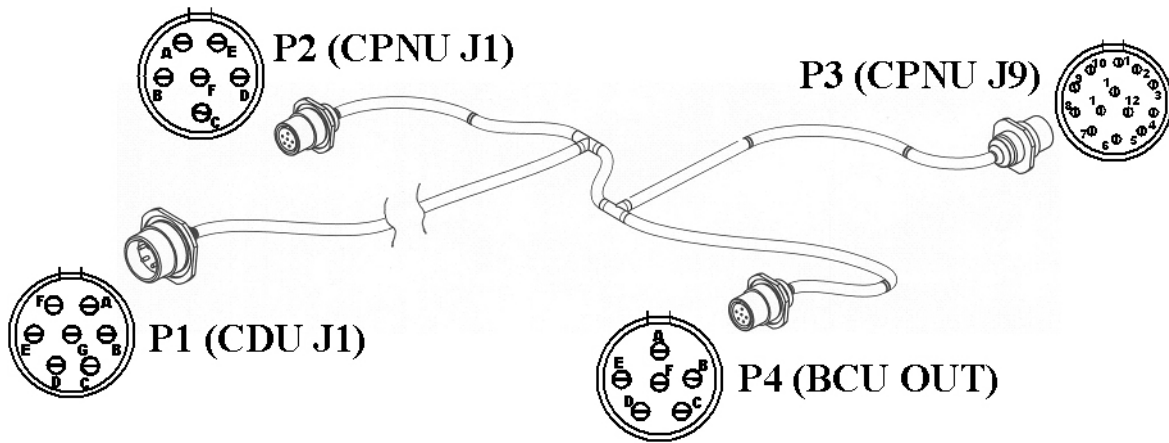


Figure 1-9 – IPADS Harness Cable (P/N 7204114-9)

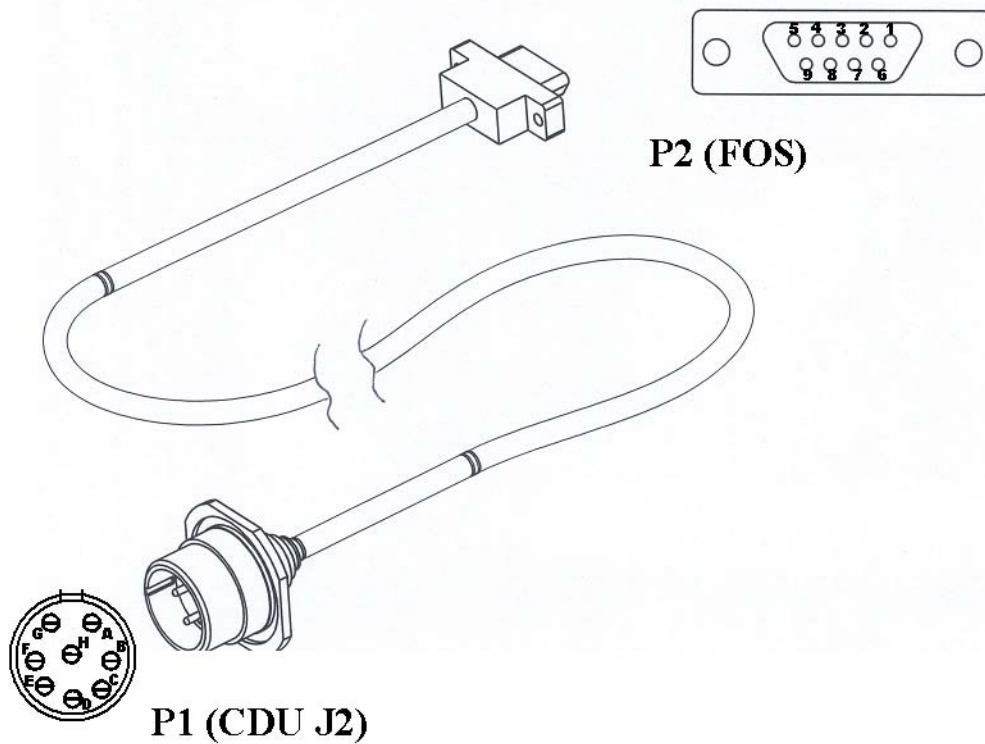


Figure 1-10 – FOS Cable (P/N 7204136-9)

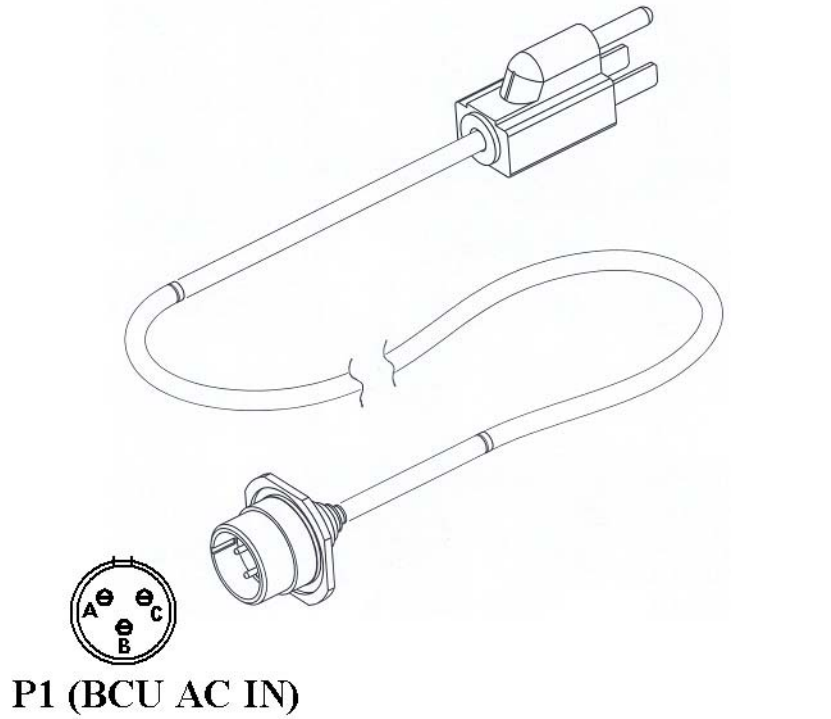


Figure 1-11 – AC Power Cable (P/N ABP-ACC-TR-1)

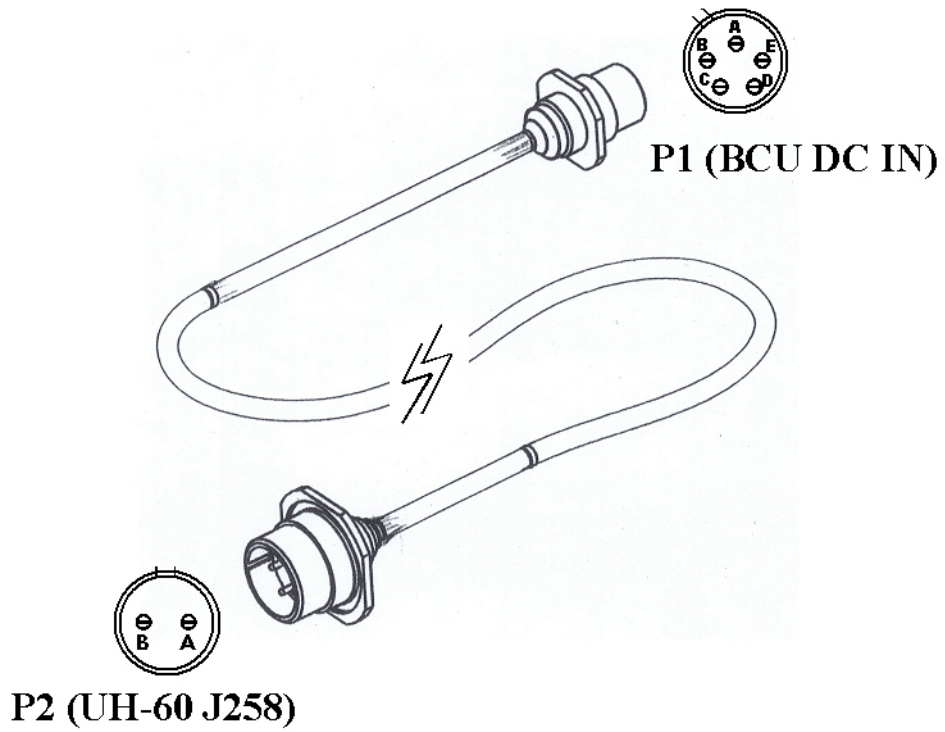
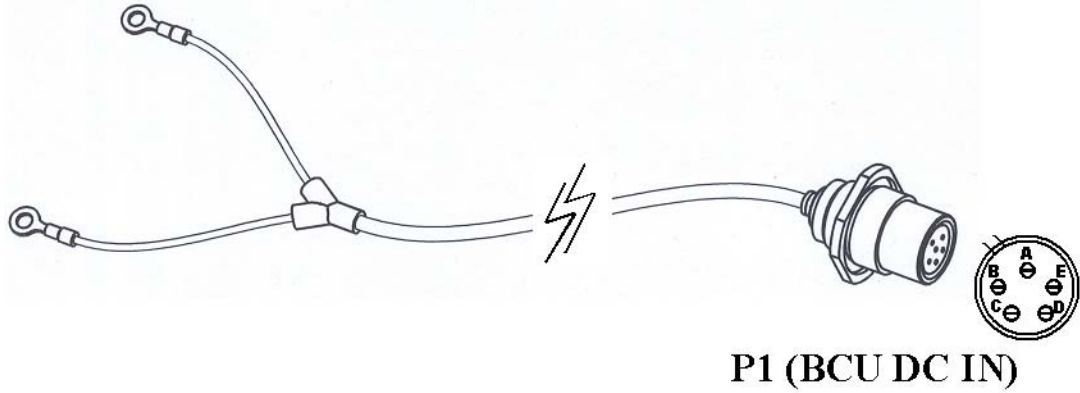
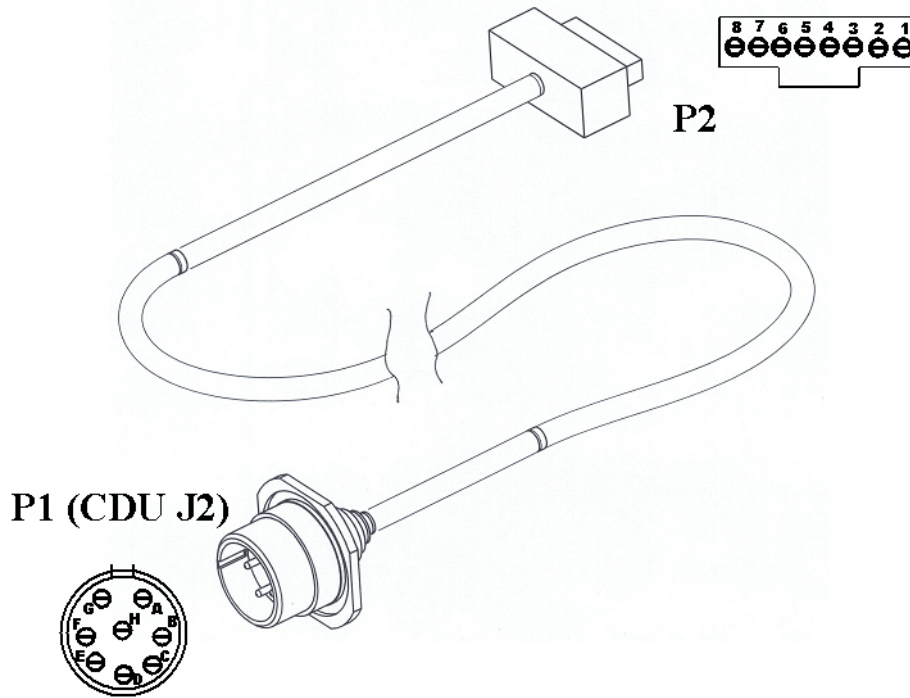


Figure 1-12 – UH-60 Power Cable (P/N 7204116-2)



**Figure 1-13 – HMMWV Power Cable (P/N 7204116-1)**



**Figure 1-14 – Reprogramming Cable (P/N 7204143-9)**

**Table 1-2 – Characteristics and Performance Data**

Item	Item Value			
IPADS Case Height Width Depth Weight	654.0 mm (25.8 in) 838.0 mm (33.0 in) 533.0 mm (21.0 in) 27.3 kg (60 lb)			
Transit Frame Height Width Depth Weight	559.0 mm (22.0 in) 775.0 mm (30.5 in) 495.0 mm (19.5 in) 61.4 kg (135.0 lb)			
Ambient Temperature Limits without CDU: Operation Storage	-46° to +52°C (-50° to +125°F) -46° to +71°C (-50° to +160°F)			
CDU Ambient Temperature Limits: Operation Storage	-30° to +52°C (-22° to +125°F) -40° to +71°C (-40° to +160°F)			
Altitude Limits: Operation Transportation	-150 to +4,500 meters (-500 to +15,000 feet), mean sea level -150 to +15,000 meters (-500 to +50,000 feet), mean sea level			
Warm-up, Initialization, and Alignment Time	10 minutes, increasing to: 15 minutes below -20°C (-5°F) 20 minutes in latitudes greater than 65N or S and temp above -20°C (-5°F) 25 minutes in latitudes greater than 65N or S and temp below -20°C (-5°F)			
Optical Azimuth Transfer Limits:	24 meters from porro prism			
Position Transfer Limits (with plumb bob): Ground Vehicle UH-60 Helicopter	±15° pitch and roll ±10°pitch and roll			
Power Requirements: (24 VDC): Steady State Load	> 10°C and fully charged batteries 104 watts (3.7 amps)	< 10°C and fully charged batteries 145 watts (5.2 amps)	>10°C and depleted batteries 154 watts (5.5 amps)	<10°C and depleted batteries 195 watts (7.0 amps)

**Table 1-2– Characteristics and Performance Data – continued**

Item		Item Value			
Total Mission Duration:		Unlimited			
Survey Area		75 kilometer radius from last update point			
Surveying Accuracy		1:3000 to 1:5000			
Latitude of Operation		<b>0° - 65° N/S</b>		<b>65° - 75° N/S</b>	
Survey Order		<b>4th</b>	<b>5th</b>	<b>4th</b>	<b>5th</b>
Initialization Time (in minutes)		10.0	10.0	20.0	20.0
Hot Start Initialization Time (in minutes)		5.0	5.0	10.0	10.0
Zero-Velocity Update Interval (in minutes)		5.0	10.0	5.0	10.0
Horizontal Position Ground Vehicle	CEP meters	4.0	7.0	4.0	7.0
Horizontal Position Helicopter	CEP meters	8.0	-	8.0	-
Altitude Ground & Helicopter vehicles	PE meters	2.0	3.0	2.0	3.0
Azimuth Error Ground & Helicopter vehicles	PE mils	0.4	0.4	0.6	0.6





## CHAPTER 2

### SERVICE UPON RECEIPT AND INSTALLATION

---

#### SECTION I. SERVICE UPON RECEIPT OF EQUIPMENT

##### 2-1. General.

- a. IPADS is shipped in three containers. These contain the IPADS unit (shipped inside its transit case) and the vehicle installation kits.
- b. Theodolite, tripods, and other survey equipment required to effectively operate the IPADS are unit Table of Organization and Equipment (TO&E) items.

##### 2-2. Removal of IPADS From Transit Case.

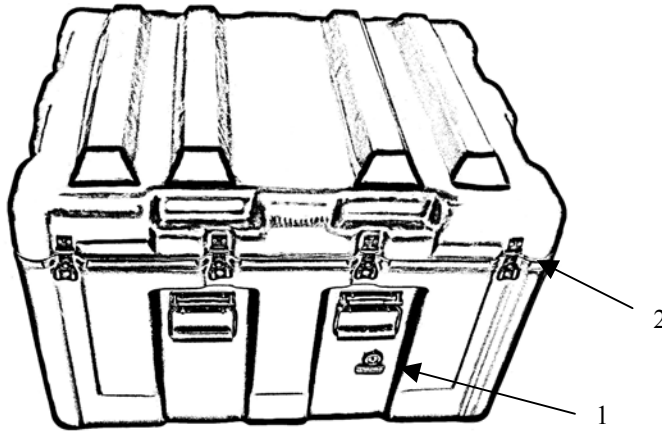


Figure 2-1 – IPADS Transit Case

**WARNING**

The IPADS transit case, with IPADS inside, weighs 195 lbs (88.5 kg); use at least six persons to lift

**CAUTION**

IPADS includes electronic units; use extreme care when handling.

- a. Press pressure relief valve (1) until air pressure is equalized.
- b. Release eight latches (2).

**CAUTION**

The empty transit case with cover open is top heavy. Support cover so transit case does not tip over.

- c. Swing open transit case cover.

**WARNING**

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift it out of the transit case.

- d. Lift IPADS upwards until it clears the transit case and move it to a smooth, flat surface.
- e. Inspect IPADS components, cables, and connectors. If damaged, components must be replaced. Cables must be replaced if frayed or otherwise damaged. Components or cables are exchanged through the supply system, paragraph 4-7
- f. Close transit case cover and secure latches.

**WARNING**

The empty transit case weighs 60.0 lbs (27.3 kg); use two people to lift.

- g. Store empty transit case.

**2-3. Checking Unpacked Equipment.**

- a. Inspect equipment for damage that may have incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (Packaging Improvement Report). Marine Corps users will report damage as prescribed by SECNAV 4355.18A and DLAI.4140.55, Reporting of Supply Discrepancies.
- b. Check the equipment against the packing slip to see if shipment is complete. Army personnel report discrepancies in accordance with SF 361, Discrepancy in Shipment Report (DISREP). Marine Corps personnel will submit SF 361, as prescribed by Marine Corp Users Manuals, UM 4400-123 and -124.
- c. Check to see whether the equipment has been modified. (Equipment that has been modified will have the Modification Work Orders (MWO) number on the front panel near the nomenclature plate.) Check also to see whether all currently applicable MWOs have been applied. (Current MWOs applicable to the equipment are listed in DA PAM 25-40; for Marine Corps users, in SL 1-2 or SL 1-3.)
- d. For dimensions, weights, and volume of packaged items, see table 1-2 or SB 700-20.
- e. Check humidity indicator in transit case for evidence of excess moisture. Take the action shown on the indicator.

- f. When using or storing the IPADS in the field, the case should be kept as dry as possible and the unit wiped clean prior to placement into the case. If fungal growth is noted, wipe the area with a wet cloth (with some soap if possible) or use an alcohol wipe

**CAUTION**

- It is very important to make sure that the IPADS storage case and the IPADS are moisture free/“bone” dry before storing the IPADS for longer than 30 days.
- Ensure that following exposure to salt spray or salt fog, that IPADS is rinsed with clean, fresh water and allowed to dry before placing the IPADS into its dry transit/storage case.

#### 2-4. IPADS Batteries

BCU battery packs are shipped inside BCU when delivered, requiring no installation. Packs may be installed in BCU for up to three months provided they are not stored in a discharged state (Battery Good indicator not lit when connected to external power). Perform a 24-hour charge cycle prior to use.

**WARNING**

- To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc., must be removed.
- BCU contains acid-filled batteries that may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water. If it touches the eyes, flush immediately with water for 30 minutes and seek medical attention without delay.

**CAUTION**

Do not store battery packs in a discharged state or in a hot place. Permanent loss of capacity might occur if battery packs are placed in storage for an extended period of time (greater than 3 months) without charging.

If batteries need to be replaced, see figures 2-2 through 2-4 and perform IPADS battery installation as follows:

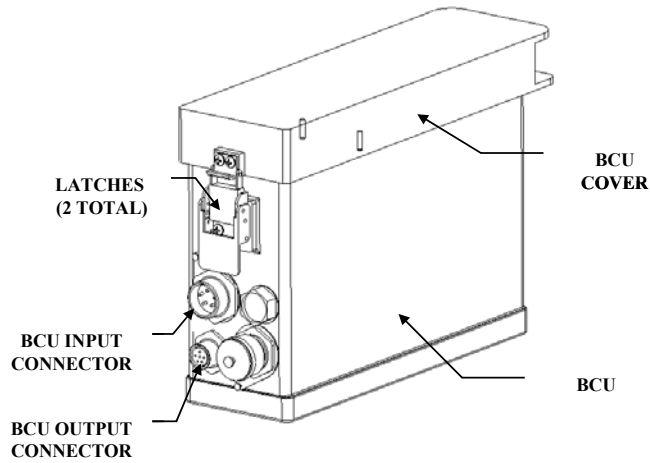


Figure 2-2 – BCU Component Identification (P/N 7204141-9)

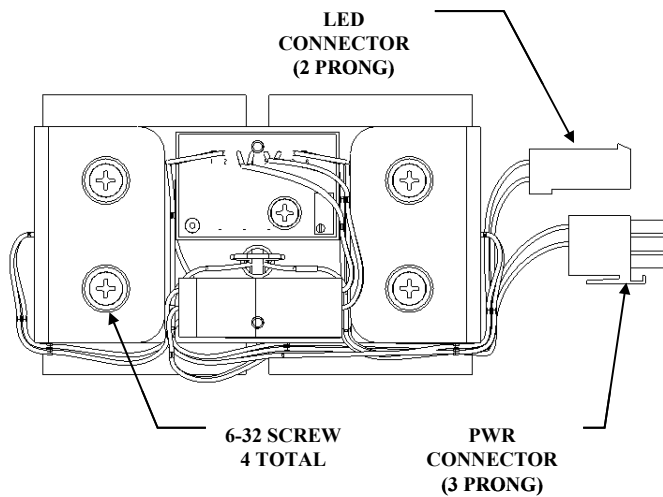


Figure 2-3 – BCU Heater Removal

- a. Turn **DC INPUT** and **OUTPUT** switches to OFF position and remove external power, AC or DC, from BCU.
- b. Unlatch BCU cover by releasing latch on each side, figure 2-2. Cover will not be removable due to securing lanyard.
- c. Disconnect LED and power connectors from heater assembly, figure 2-3.
- d. Loosen, but do not remove, four 6-32 screws using Phillips head screwdriver, figure 2-3.
- e. Remove heater assembly from BCU, figure 2-4.
- f. Disconnect each battery pack cable from receptacle by pressing the lock lever on the battery connector.
- g. Remove battery packs from cavity, figure 2-4.

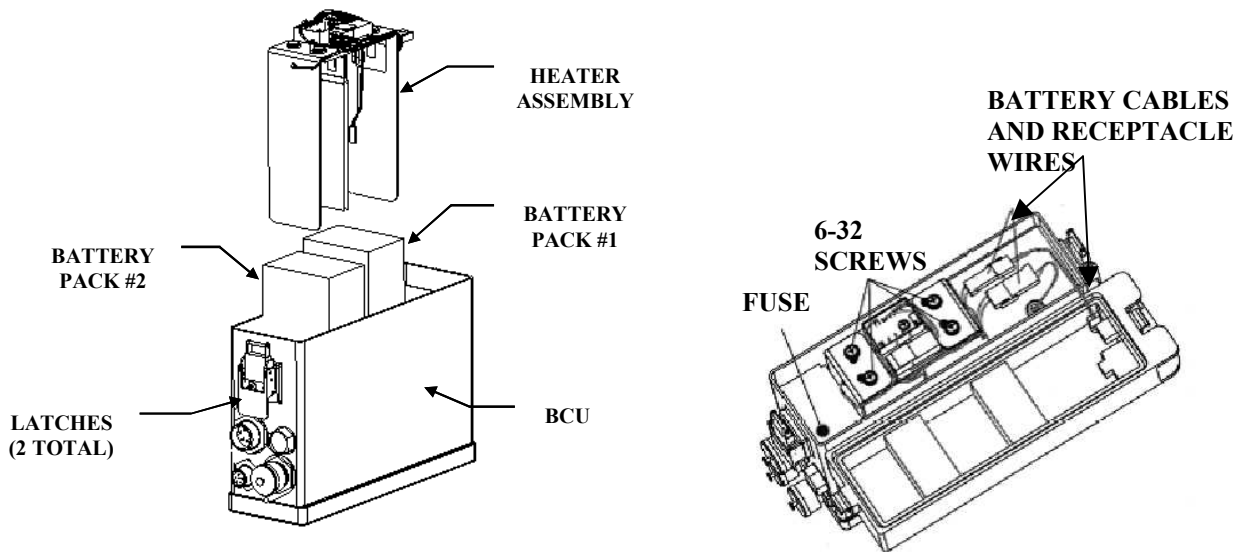


Figure 2-4 – BCU Battery Pack Installation

h. Install IPADS battery packs as follows:

**CAUTION**

Do not pinch battery cable or receptacle wires between cover and chassis, figure 2-4.

- (1) Turn **DC INPUT** and **OUTPUT** switches to OFF position and remove external power, AC or DC, from BCU.
- (2) With cover and heater assembly removed, install battery packs into cavity, figure 2-4.
- (3) Connect battery pack connector to one of the unit's battery receptacles, figure 2-3.
- (4) Verify battery connector is locked to the receptacle.
- (5) Connect second battery similar to BCU heater removal paragraph 2-4c and d.
- (6) Install heater assembly over battery packs and tighten four screws, figure 2-3.
- (7) Connect PWR and LED connectors to equivalent receptacles, figure 2-3.
- (8) Latch BCU cover, figure 2-2.
- (9) Charge new batteries for a minimum of 24 hours.

**2-5. Packing IPADS.**

**CAUTION**

- Remove batteries from BCU before packaging IPADS for shipping or storage beyond 90 days.
- To prevent damage, an IPADS must be placed in a transit case when shipped or stored.

**NOTE**

Packaged BCU batteries may be shipped by normal transportation means without restriction provided the battery is protected against short circuits and securely packaged. For all modes of transportation, each battery and outer package must be labeled: "Non-Spillable" or "Non-Spillable Battery." This label must be visible during transportation.

- a. Remove BCU batteries, paragraph 2-4.
- b. Press pressure relief valve until air pressure is equalized.

**WARNING**

The foam in the IPADS transit case is flammable. Do not expose to open flame or ignition sources. Extinguish burning foam with water spray, CO<sub>2</sub>, foam, or dry chemical fire extinguisher.

**CAUTION**

The empty transit case with cover open is top heavy. Support cover so transit case doesn't tip over.

- c. Unlatch eight latches and open transit case cover.
- d. Ensure harness assembly W114 is stowed to prevent pinching of cable.
- e. When using or storing the IPADS in the field, the case and cushioning should be kept as dry as possible and the unit wiped clean prior to placement in the case. If fungal growth is noted, wipe the area with a wet cloth and soap or use an alcohol wipe.

**WARNING**

IPADS weighs 135 lbs (61.4 kg); use four people to lift.

- f. Position IPADS inside transit case.
- g. Close transit case cover and secure its latches.

## SECTION II: INSTALLATION OF IPADS INTO HMMWV (M998)

### 2-6. Vehicle Configuration.

#### CAUTION

**Any vehicle used with IPADS must supply at least 100 amperes at 24 VDC for IPADS operation.** (Generator/Alternator Kit, Part No. 11630593, Manufacturer Code 19207, NSN 2920-00-413-4338 is recommended for HMMWV series vehicles equipped with a generator/alternator rated at 60 amperes. Installation instructions are in TM 9-2320-218-20.)

- a. Identify which kit components are used with each vehicle. IPADS operators install the components.
- b. The installation kit components required for using IPADS in the M1097 (Truck, Utility: Heavy Variant, 4 x 4), M1123 (Truck, Utility: Heavy Variant, 10,300 GVW, 4 x 4) and M998 (Truck, Utility: Cargo/Troop Carrier, 1-1/4 Ton, 4 x 4) series High Mobility Multipurpose-Wheeled Vehicles (HMMWV) are listed and described in figure 1-6. There are differences in vehicle preparation and IPADS floor plate installation for the HMMWV variants.
- c. Operators must install batteries in the BCU, paragraph 2-4

### 2-7. Tools Required for Installation.

Tools required for installation are in the IPADS accessory tool kit shown in figure 1-5.

### 2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)

#### NOTES

- For reliable operations in high temperatures, the IPADS should be installed in a covered HMMWV.
- Installation differences between the HMMWV variants are noted in the following procedures.

#### a. Prepare HMMWV for Installation.

If a cargo bulkhead is installed immediately behind the driver and commander's seats, remove as follows:

- (1) Use 1/2-inch ratchet and open-end wrenches; remove two bolts from vehicle side pillars.
- (2) After removing bulkhead, install two bolts in vehicle side pillars. Retain vehicle bed bolts for installation.
- (3) Store cargo bulkhead and two bolts.
- (4) If vehicle is equipped with two 1/2-inch thick wooden noise abatement plates located between the two front seats and two rear seats, remove and store with associated hardware. Remove fire extinguisher and bracket from forward plate and reinstall on deck between two front seats where it had previously been mounted.
- (5) If vehicle is equipped with a communication mount for the SINCGARS radio and an external speaker, the lower shelf that holds the speaker will need to be temporarily modified in order to remove the front two cross tip screws under the speaker stand.

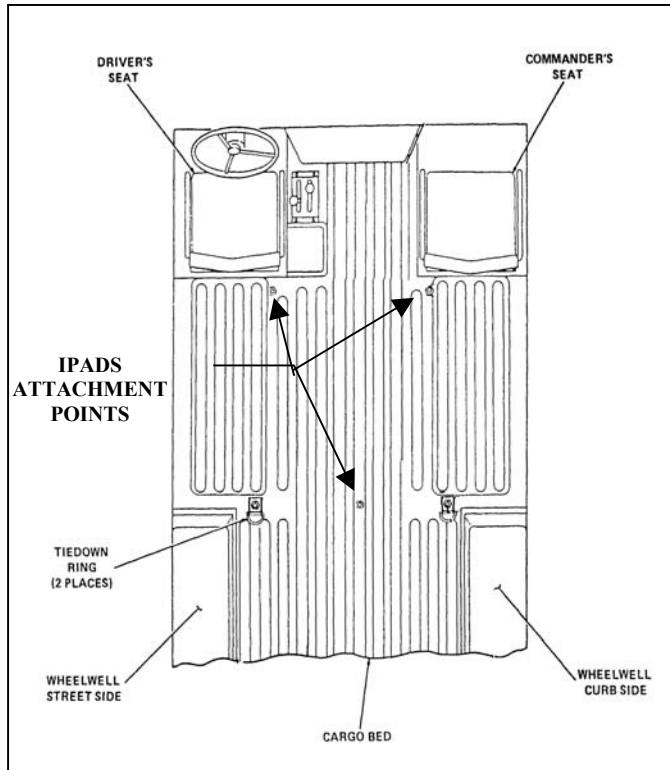


- (a) Using a 7/16-inch socket and a 7/16-inch box end wrench, remove the two bolts that support the front of the speaker shelf.
  - (b) Elevate the speaker shelf to gain access to the front two cross tip screws that secure the wooden noise abatement board. Using a 3-inch cross tip screw driver, remove the two cross tip screws and finish the removal of the noise abatement board.
  - (c) When the noise abatement board has been removed, install the speaker shelf back to its original form using the two 7/16-inch bolts.
- (6) If the vehicle has a PADS installation kit installed, remove it.

**b. Remove Cargo Tiedown Ring:**

**NOTES**

- The M998 has threaded inserts under the cargo floor to secure the cargo tiedown ringbolts. Nuts and lockwashers under the cargo floor of the M1097 and M1123 secure the cargo tiedown ringbolts. Removal of M1097 and M1123 cargo tiedown rings requires a 3/4-inch wrench for the nuts in addition to the 3/4-inch combination wrench needed for the bolts.
- An individual vehicle may or may not have cargo tiedown rings installed at the three IPADS floor plate attachment points, figure 2-5. Remove any cargo tiedown rings from those locations as follows.



**Figure 2-5 – IPADS Floor Plate Alignment**

- (1) Using 3/4-inch socket, remove tiedown ring and bolt near the center of cargo bed.
- (2) Using 3/4-inch combination wrench, remove two tiedown rings and bolts behind driver and commander's seats.
- (3) Store removed cargo tiedown rings and hardware with cargo bulkhead.

**c. Install Floor Plate:**

**WARNING**

- IPADS floor plate weighs approximately 48 lbs (21.8 kg); use at least two persons to lift onto HMMWV cargo bed.
- If operators must install mounting plate nuts, be very cautious of the hot vehicle exhaust pipe when crawling under the vehicle.

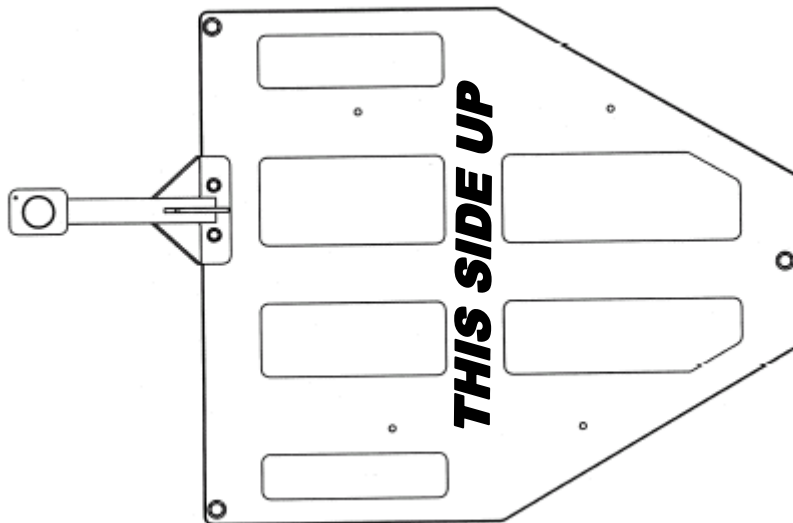
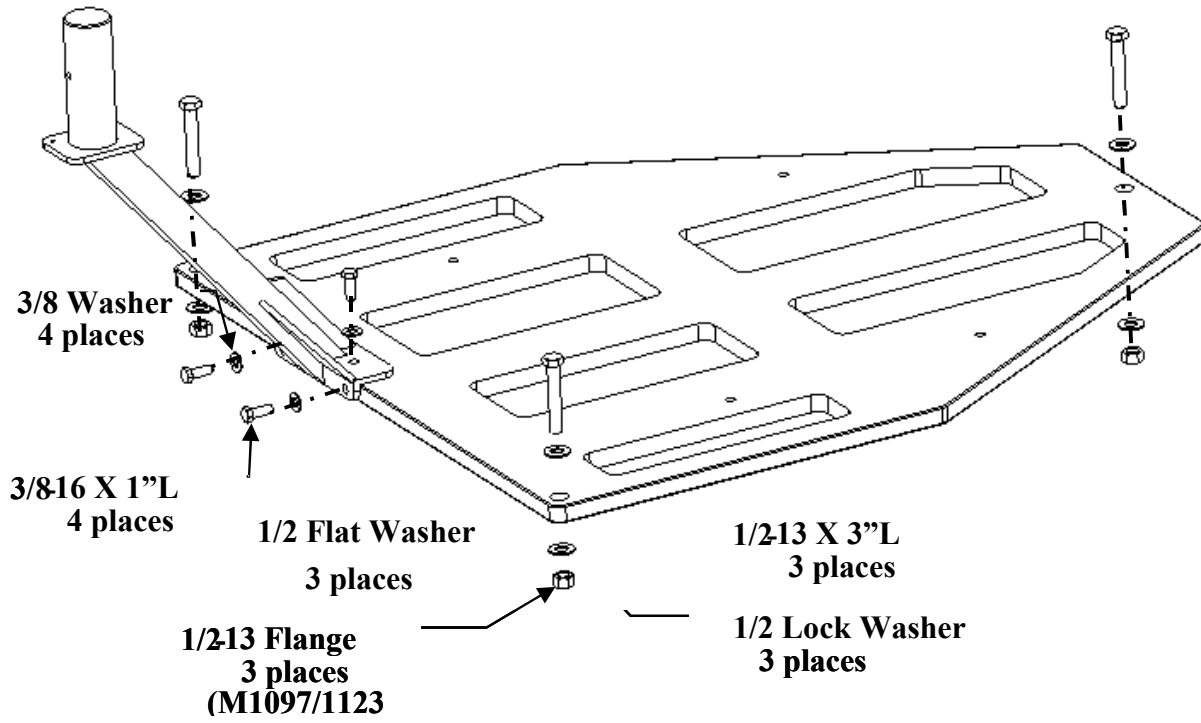


Figure 2-6 – IPADS Floor Plate Installation with CDU Arm and Alignment Bracket

- (1) Place floor plate over three existing holes, figure 2-5, in vehicle cargo bed, two forward and one to the rear. Ensure “THIS SIDE UP” is visible.
- (2) Using 9/16-inch wrench, install and tighten four 3/8-16 UNC-2B by 1-inch long screws and flat washers to secure CDU support arm to floor plate.
- (3) For M998, install three 1/2-13UNC-2A by 3-inch long bolts, with flat and lock washers, through floor plate holes into threaded inserts under vehicle cargo bed, figure 2-6. Finger-tighten only.

**NOTE**

If any of the threaded inserts under the vehicle cargo bed are missing install the floor plate using 3/4-inch flange nuts.

- (4) For M1097 and M1123, install three 1/2-13UNC-2A by 3-inch long screws, flat washers, and lock washers through floor plate holes into holes in vehicle cargo bed, Figure 2-.
- (5) With CDU support arm in place, apply a small amount of forward force (towards radio) to ensure all three floor plate holes and 1/2-inch bolts are aligned.
- (6) Using 3/4-inch wrench, tighten the three 1/2-inch screws securing floor plate to vehicle cargo bed.

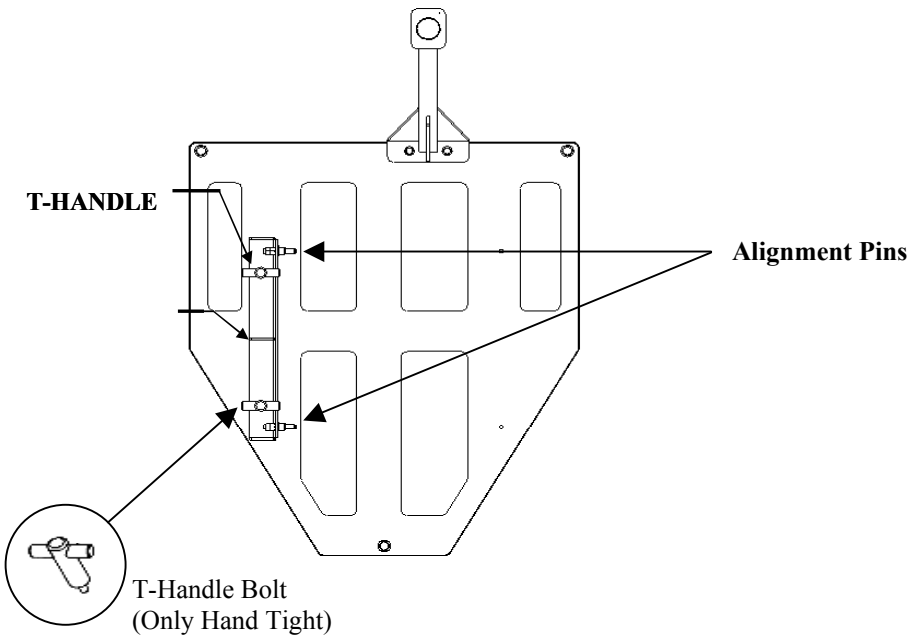
**d. Install IPADS:**

**WARNING**

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

**CAUTION**

**DO NOT lift the IPADS unit using the porro prism cover.**



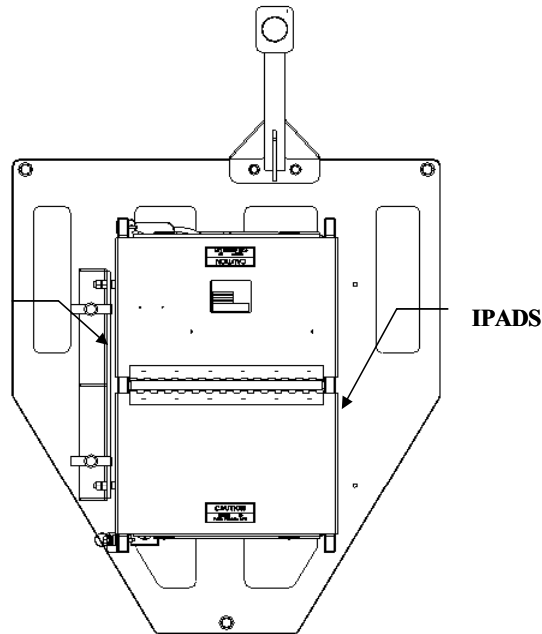
**Figure 2-7 – IPADS Mounting Plate and Alignment Pin Bracket Assembly**

- (1) Locate alignment pin bracket assembly, figure 2-7, and place it over the two threaded inserts on the left side of floor plate with alignment pins facing the right passenger side of the vehicle.
- (2) Hand tighten alignment pin bracket to floor plate with two T-handle bolts, figure 2-7, and two washers.

**CAUTION**

ENSURE THAT ALL T-HANDLE BOLTS ARE ONLY **HAND TIGHTENED**.

- (3) Place IPADS frame, with batteries installed in accordance with paragraph 2-4, on floor. Ensure the Porro Prism Assembly (PPA) and cover face towards the rear of the vehicle.



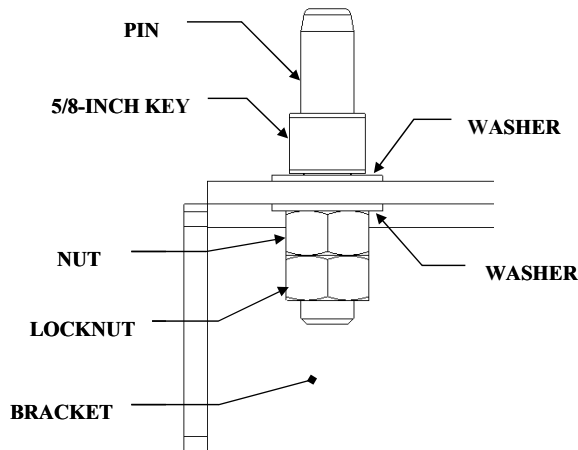
**Figure 2-8 – IPADS Mounting onto Alignment Bracket Assembly**

- (4) Slide IPADS frame onto pins of alignment bracket assembly. Ensure pins of alignment bracket are fully engaged in alignment pinholes in bottom rail of the IPADS frame. If alignment pins do not fit freely into receptacles, adjust as follows:

**e. Alignment Pin Adjustment.**

**NOTE**

The alignment pin bracket must be installed on IPADS floor plate before adjustment.

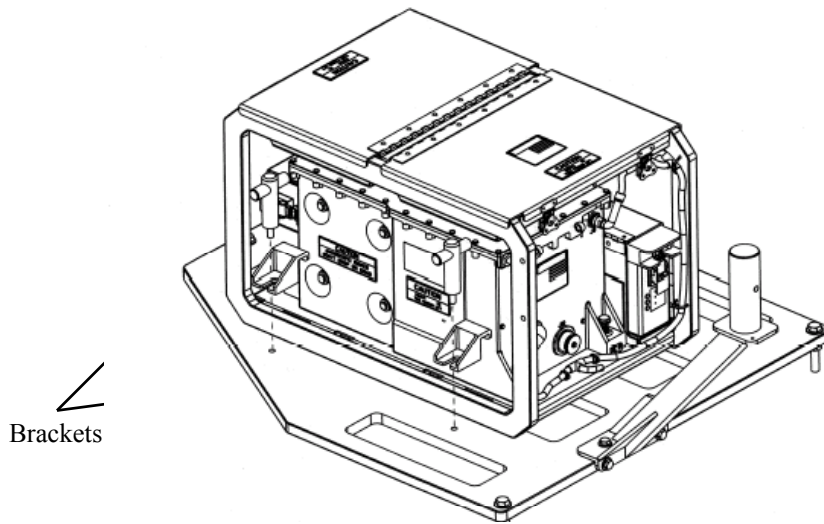


**Figure 2-9 – Alignment Pin Adjustment**

- (1) Hold alignment pin with 5/8" open-end wrench.
- (2) Loosen locking nut with 11/16-inch wrench followed and nut with 3/4-inch wrench.
- (3) Position alignment pin until it mates freely with the pinhole in the frame's bottom rail.
- (4) Hold the position of the alignment pin with 5/8-inch wrench and tighten both nut and locknut.
- (5) Repeat steps (1) through (4) for the other alignment pin, if necessary.

**f. Secure Mounting Clamps and T-Handles.**

Secure opposite rail of the IPADS frame not secured by alignment pin bracket to floor plate with two mounting clamps and T-handle bolts, figure 2-10.

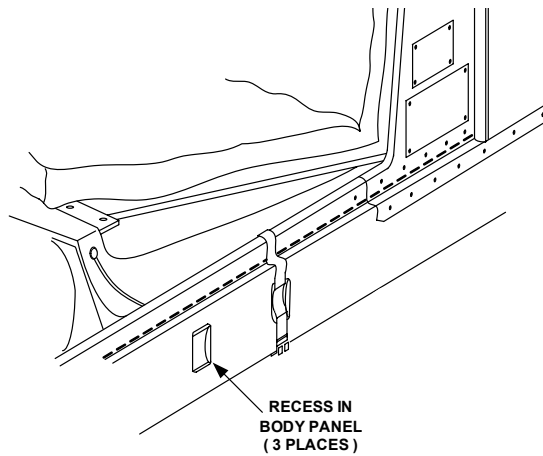


**Figure 2-10 – Mounting Clamps and T-Handle Installation**

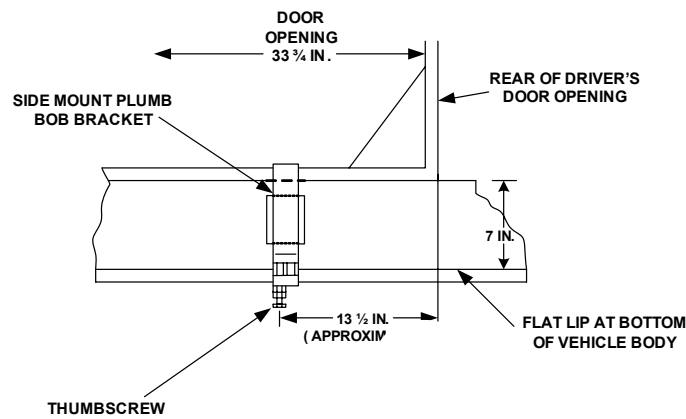
**g. Install Plumb Bob Bracket.**

**NOTE**

- Install plumb bob bracket on driver's side of vehicle approximately 13 1/2 inches forward of the rear of driver's door edge, figure 2-12.
- To hold bracket in place, tighten thumbscrew in drain hole below first recess in body panel, figure 2-11.



**- HMMWV Plumb Bob Mount Location**



**Figure 2-12 - HMMWV Plumb Bob Dimensional Reference**



**h. Installation of the W116-1 IPADS DC power cable:**

**WARNING**

- To prevent injury to personnel or damage to equipment, remove all rings, watches, bracelets, etc.
- Disconnect negative cable before working with or around batteries. The negative cable is the cable that attaches to the current shunt in the battery box, figure 2-13.
- Protect the negative cable from accidental contact with other battery cables or posts.
- When finished with work, connect negative cable last.

**CAUTION**

If the wiring inside the HMMWV's battery box does not reflect figure 2-13 or if additional communication equipment is connected to the battery box, consult your maintenance to verify the location of +24VDC. **IPADS requires +24VDC for operation.**

**NOTE**

- IPADS can be attached to vehicle power by direct connection to the batteries or by using the IPADS NATO plug attachment, figure 2-17. The W116-1 cable, which connects to the vehicle battery terminals, is recommended for permanent installations. A NATO plug attachment, which connects to the vehicle's NATO slave receptacle located under the passenger's seat, may be used with W116-1 cable for temporary installations.
  - The NATO plug attachment is for temporary use only.
  - Use caution when using the NATO plug attachment. It is very easy to dislodge the plug assembly, causing IPADS to lose vehicle power.
  - If using the NATO plug, the front commander's seat does not need to be removed.
- (1) Remove front commander's seat by opening latch and lifting seat out of vehicle.

**NOTE**

- The HMMWV battery terminals may be covered with a plastic boot, figure 2-14. To gain access to the terminal, pop the black center of the cover out using a flat blade screwdriver.
- If the battery terminals were covered with a plastic boot, use the pocketknife to cut a hole into the side of the plastic boot, figure 2-14. Route branch of IPADS DC power cable through the hole cut in the plastic boot before attaching to the battery connectors.

**(2) First Wire (Black).**

In the HMMWV locate the CURRENT SHUNT, figure 2-13 (1).

- (a) Follow the wire from the CURRENT SHUNT to the connecting battery terminal (5). Connect the black lead of the W116-1 to this terminal.
- (b) If the battery plastic boots are installed in the vehicle, use the pocket knife to cut a hole into the side of the plastic boot covering the terminal, figure 2-14. This facilitates insertion of the battery cable for providing DC power to the IPADS.
- (c) Route the end of each cable branch through two 1-inch holes in transmission tunnel, under vehicle body, and through 1 1/2-inch hole in battery box. This hole is located just below current shunt mounted on the inside wall of vehicle battery compartment
- (d) To connect the black lead to the battery terminal (5), use a 9/16" wrench to install the black wire, to the side of the terminal marked IPADS cable (3).

**(3) Second Wire (Red).**

In the HMMWV locate the BATTERY INTERCONNECT CABLE, figure 2-13 (2).

**CAUTION**

The BATTERY INTERCONNECT CABLE and the terminals at both ends are to be left alone. They will not be connected to the IPADS equipment, as damage will occur.

- (a) Connect the red lead to the remaining HMMWV battery terminal. (3)
  - (1) If the battery plastic boots are installed in the vehicle, use the pocketknife to cut a hole into the side of the plastic boot covering the terminal, Figure 2-14. This facilitates insertion of the battery cable for providing DC power to the IPADS.
  - (2) To connect the Red wire to the battery terminal, (5) use a 9/16" wrench to install the red wire, to the side of the terminal marked IPADS Cable (3).
- (b) Replace commander's seat; latch in place.

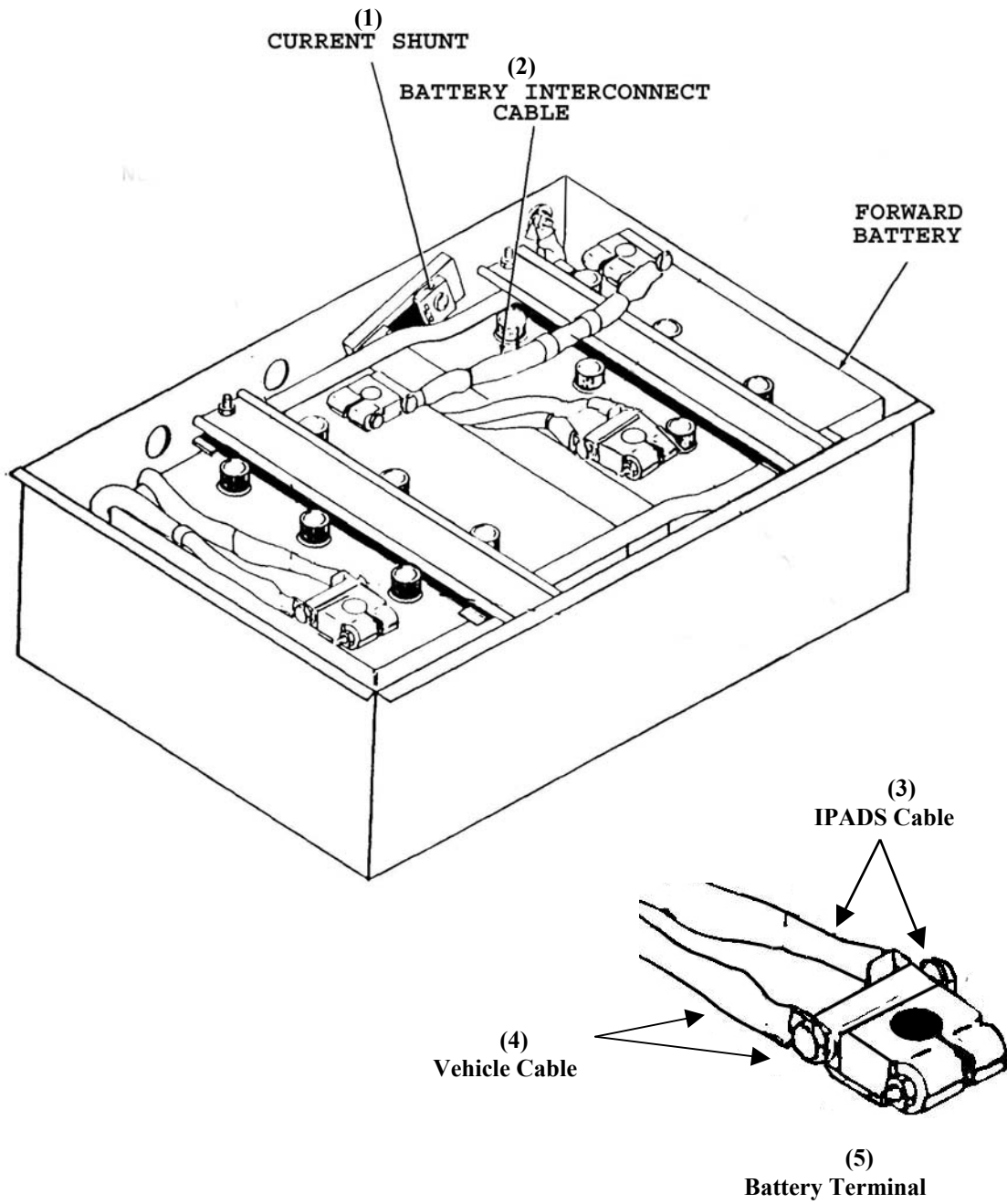
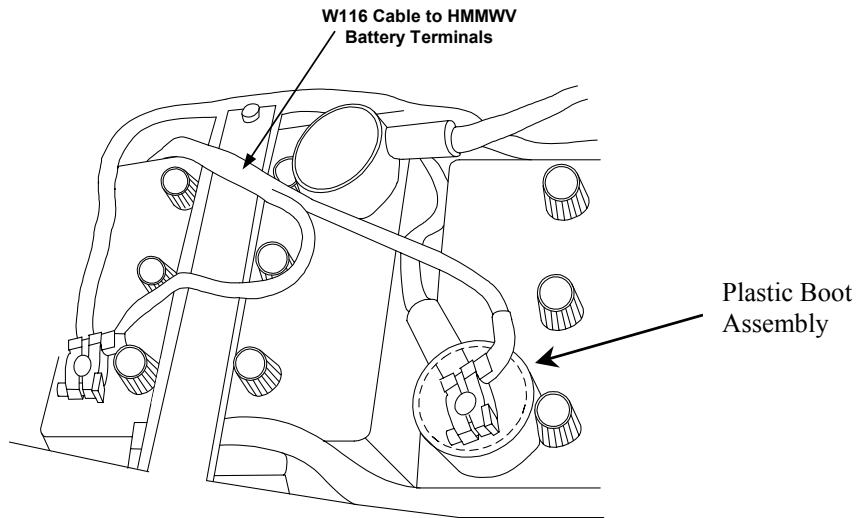
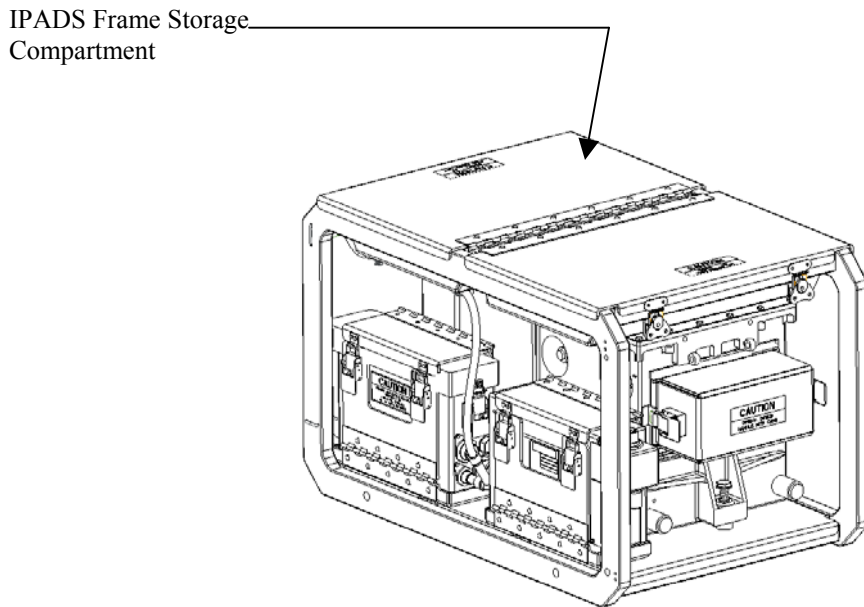


Figure 2-13 – HUMMWV battery box and terminal



**Figure 2-14– HUMMWV Battery Terminal with Plastic Boot**



**Figure 2-15 – IPADS Assembly**

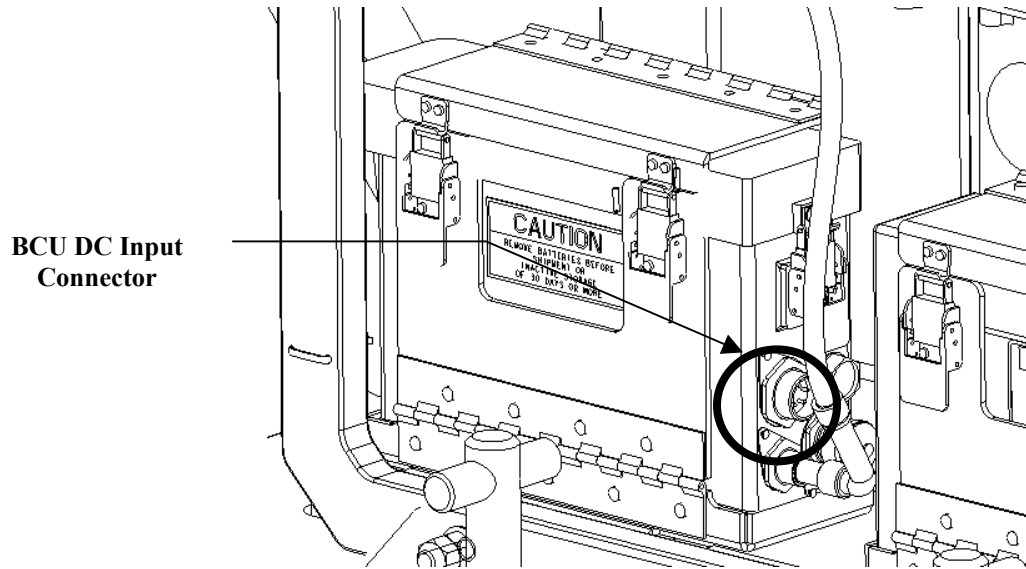


Figure 2-16 – DC Power Input into the BCU

**NOTE**

If using the vehicle's NATO power , use the following steps:

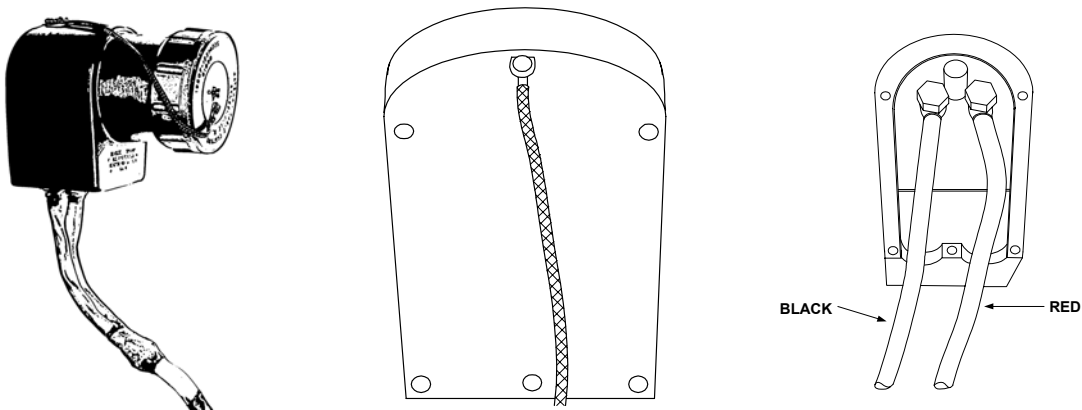


Figure 2-17 – DC Power Cable with NATO Plug Installed

**i. Install NATO Plug.**

Obtain IPADS power cable, figure 1-6 item 10, and NATO connector, figure 2-17, from installation kit. Using an adjustable wrench and flat-tip or cross-tip screwdriver, install two lugs of power cable to the connector.

- (1) Remove back of connector and terminal bolts.
- (2) Install red-banded lug (wire marked positive) of power cable to positive terminal of connector (center post).
- (3) Install black-banded lug (wire marked negative) of power cable to negative terminal of connector.
- (4) Tighten hardware to secure lugs.
- (5) Replace back of connector and tighten all screws.
  - (a) Plug NATO plug into NATO receptacle under right passenger seat of HMMWV.
  - (b) Attach connector W116 connector P1 to IPADS BCU DC input connector, figure 2-16.

**j. Install Control and Display Unit (CDU).**

- (1) Install CDU mount assembly onto CDU indexer, figure 2-19.

**CAUTION**

The CDU will be permanently damaged when subjected to temperatures below  $-40^{\circ}\text{C}$ . When temperatures below  $-40^{\circ}\text{C}$  are expected, remove the CDU to a warmer location or provide heat to keep the temperature above  $-40^{\circ}\text{C}$ . This caution applies whether the IPADS is in an operational configuration or in storage.

- (2) Tighten hex screw until indexer and linkage assembly make contact on both sides. Once reached, loosen nut approximately one turn or until indexer and linkage assembly rotate without binding.
- (3) Install CDU mount assembly onto CDU support arm and secure by tightening thumbscrew. Tighten until snug, figure 2-19.
- (4) Remove CDU from storage compartment in IPADS frame, figure 1-4 (item 4).
- (5) Release IPADS harness cable from cable strap on frame. Connect W114 connector P1 to J1 connector on CDU, figure 3-2.

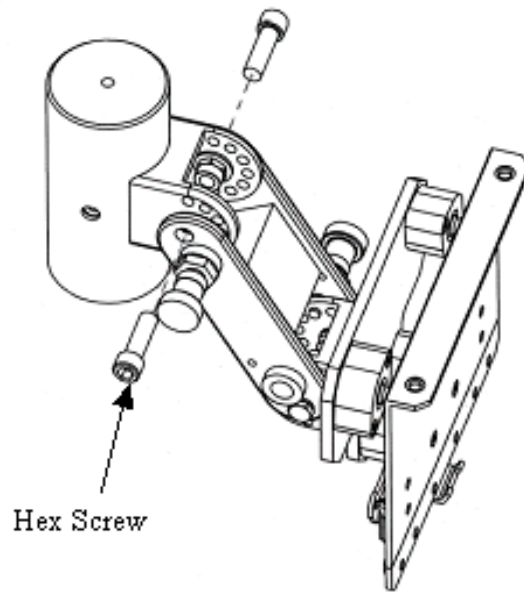


Figure 2-18 – CDU Installation on support arm

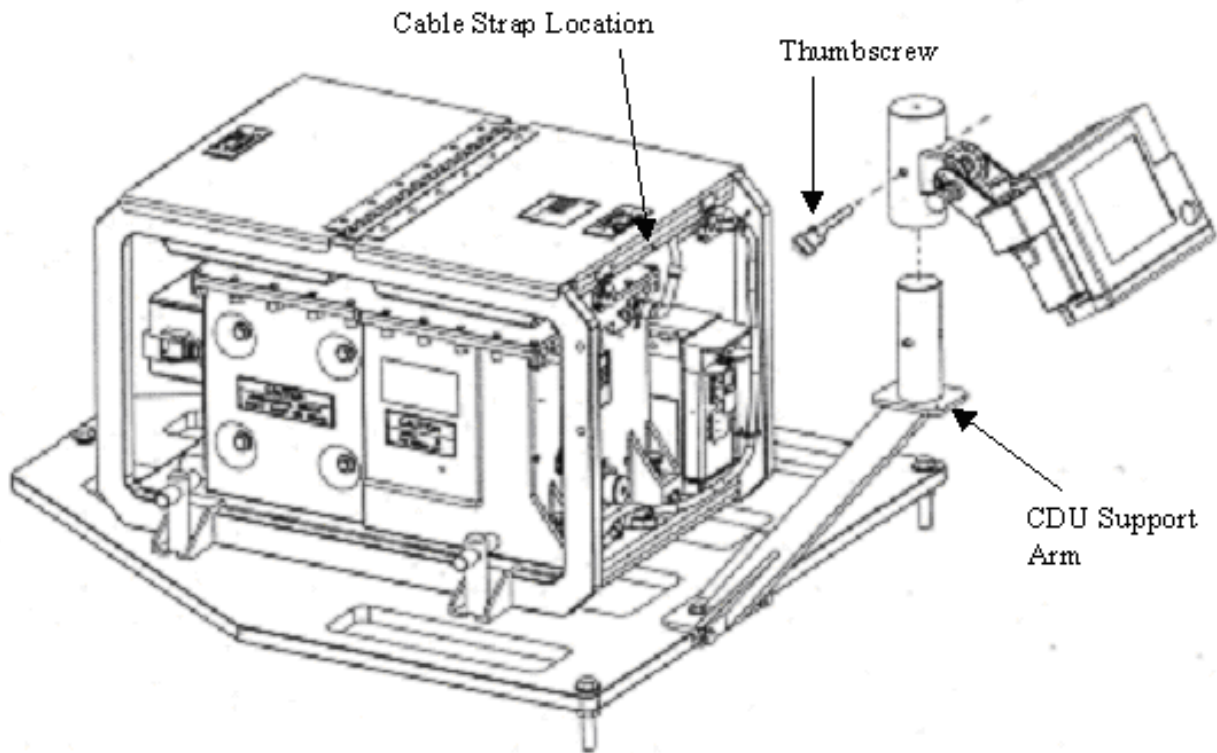
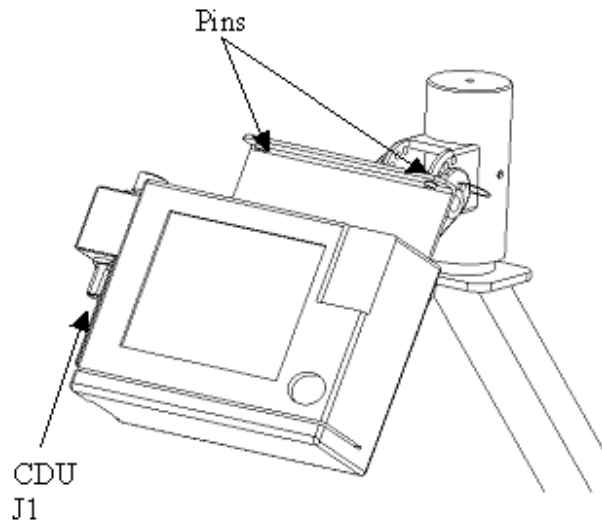
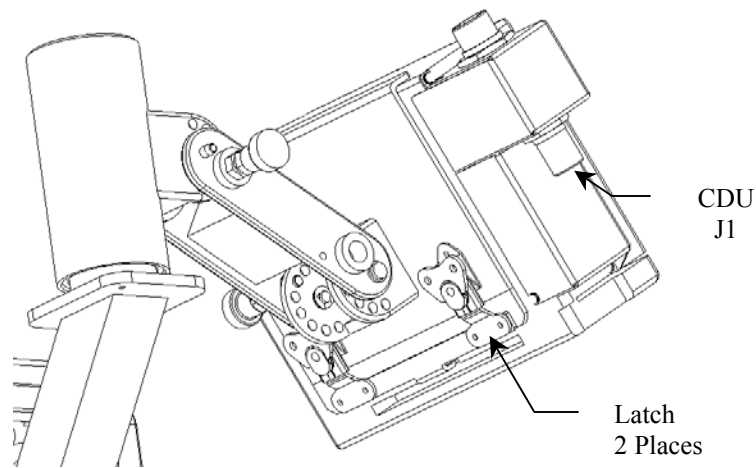


Figure 2-19 – CDU mount installation on support arm

- (6) Attach CDU to bracket assembly by aligning two pins located on CDU plate with CDU and secure using two locking latches on CDU plate, figures 2-20 and 2-21.



**Figure 2-20 – CDU Installation onto Holder Pins**



**Figure 2-21 – Locking CDU onto Holder via Latches**



### SECTION III. INSTALLATION OF IPADS INTO UH-60 HELICOPTER

#### 2-9. UH-60 Kit Installation.

##### NOTE

Prior to running missions in the UH-60, the plumb bob arm and stop brackets from the UH-60 installation kit must be installed on the IPADS frame. Once these components are installed they do not need to be removed. Stow the UH-60 CDU indexer and power cable in one of the storage compartments until needed.

##### a. Install Stop Brackets.

- (1) Using a cross tip screwdriver, install both vertical and horizontal stops, figure 2-22.
- (2) Tighten screws.

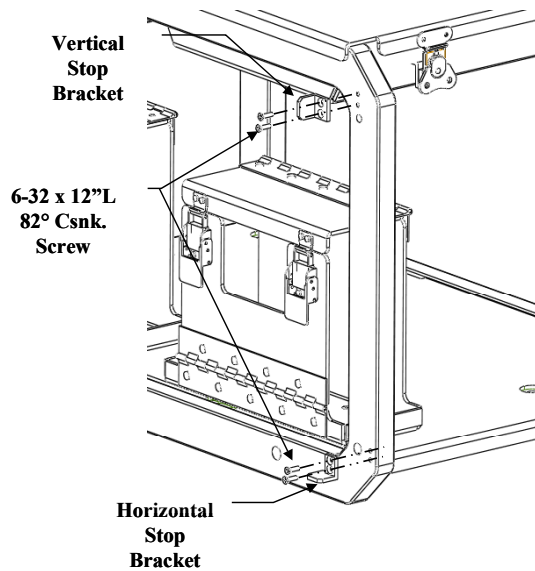
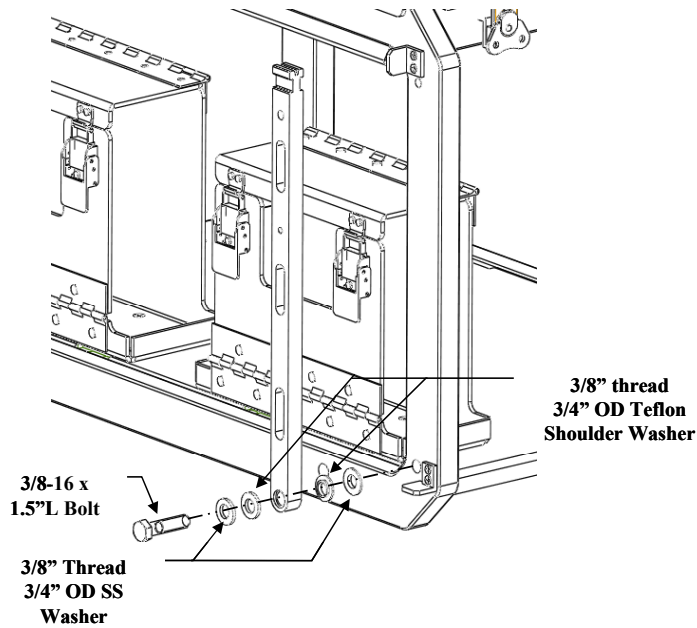


Figure 2-22 – UH-60 stop bracket installation

**b. Install Plumb Bob Arm.**

- (1) Obtain plumb bob arm, washers, and bolts, figure 1-7.
- (2) Install Teflon shoulder washers into plumb bob arm, figure 2-23.
- (3) Using 9/16-inch wrench tighten washers and bolt to bottom rail of frame until snug.

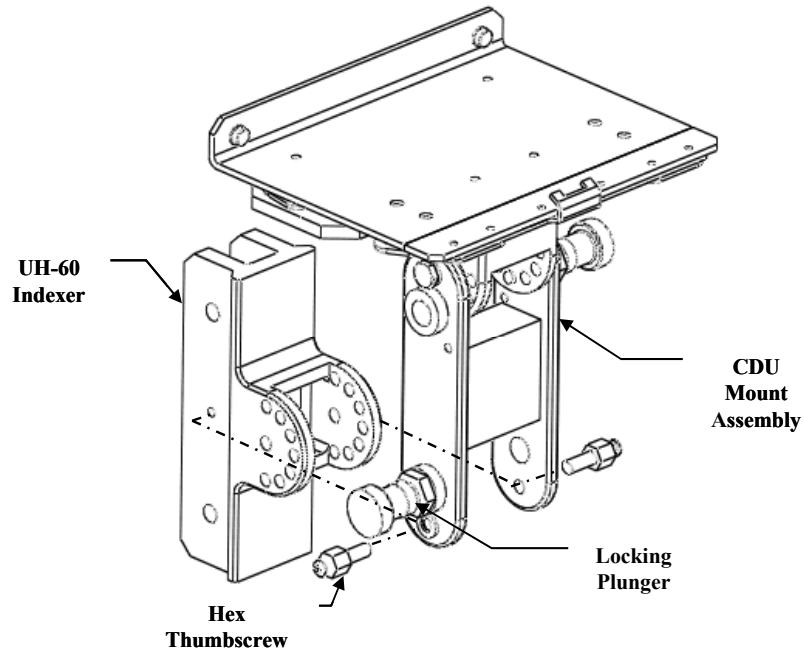


**Figure 2-23 – UH-60 Plumb Bob Installation**

- (4) Check plumb bob arm operation. Arm should rotate without binding.
- (5) Secure arm in vertical position using attached pin. Pin should lock into corresponding pinhole on frame.

**c. Install CDU Mount assembly onto UH-60 Indexer.**

- (1) Obtain UH-60 indexer bracket, figure 1-7, and CDU mount assembly from HMMWV installation kit, figure 1-6.
- (2) Assemble mount assembly onto indexer bracket as shown. Helicoils located on UH-60 indexer shall face inward towards CPNU.
- (3) Secure CDU mount assembly with two hex thumbscrews and washers, figure 2-24.

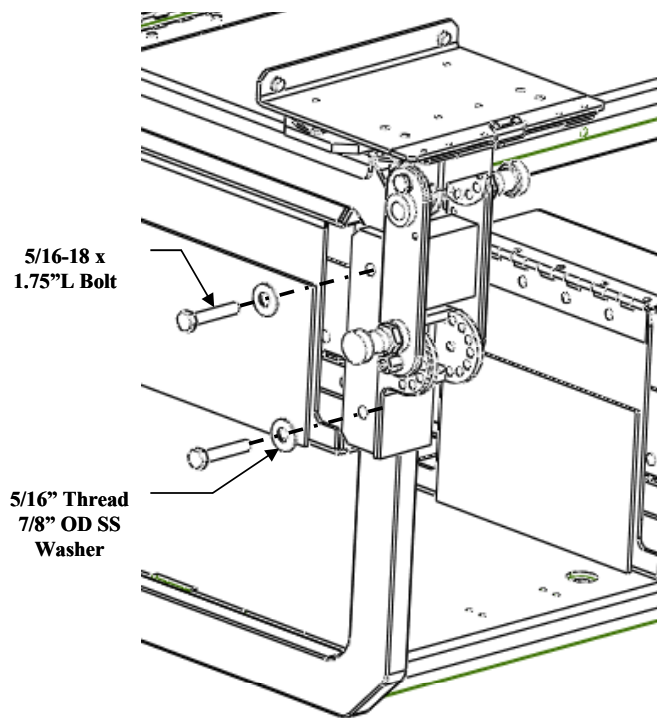


**Figure 2-24 – UH-60 CDU and Indexer Holder Assembly**

- (4) Tighten hex screw until indexer and linkage assembly make contact on both sides. Once reached, loosen nut approximately one turn or until indexer and linkage assembly rotate without binding.

**d. Install UH-60 CDU Assembly onto Frame.**

- (1) Obtain UH-60 CDU mount assembly, bolts, and washers.
- (2) Position assembly as shown in figure 2-25.
- (3) Align indexer holes with frame holes. Note that UH-60 indexer has two helicoils installed on one side of bracket.
- (4) Verify correct bracket orientation with respect to frame.
- (5) Insert bolt and washer through indexer assembly and frame. Hand tighten bolts until threads engage with helicoils.
- (6) Using ½ inch wrench, tighten bolts until snug.
- (7) Install CDU as described in figures 2-20 and 2-21.



**Figure 2-25 – UH-60 CDU Indexer Assembly onto Frame**

e. Install IPADS into UH-60 Helicopter.



If the helicopter rotors are turning, canvas and top bows must be securely tied down in the vehicle.

- (1) Remove IPADS UH-60 power cable W116-2 cable and 8 cable ties (found inside the IPADS toolkit pouch) from storage compartment and connect P2 to helicopter receptacle plug J258, figure 2-26. Store and re-secure IPADS tool kit when complete.
- (2) Use the 8 cable ties to secure power cable W116-2 to the railing of the seat next to where IPADS will be placed, figure 2-31, and the other two cable ties to secure the excess cargo strap when securing the IPADS in the UH-60, paragraph 2-9e(9).
- (3) Using four persons, transfer IPADS frame assembly to the helicopter.
- (4) Adjust location of IPADS frame assembly until positioned approximately as illustrated in figure 2-28. The plumb bob arm must swing clear of the fuselage.
- (5) Connect IPADS UH-60 power cable P1 to BCU DC input power connector.
- (6) IPADS operator will request crew chief to turn on Utility RECP 7.5 AMP circuit breaker. Turn BCU INPUT power switch to ON. BCU external DC power indicator should illuminate.

**NOTE**

When the IPADS is mounted in the helicopter, the vehicle type must be changed to UH-60 (paragraph 3-11b) if IPADS has been transferred from another vehicle. This can be accomplished before or after transferring the IPADS to the helicopter.

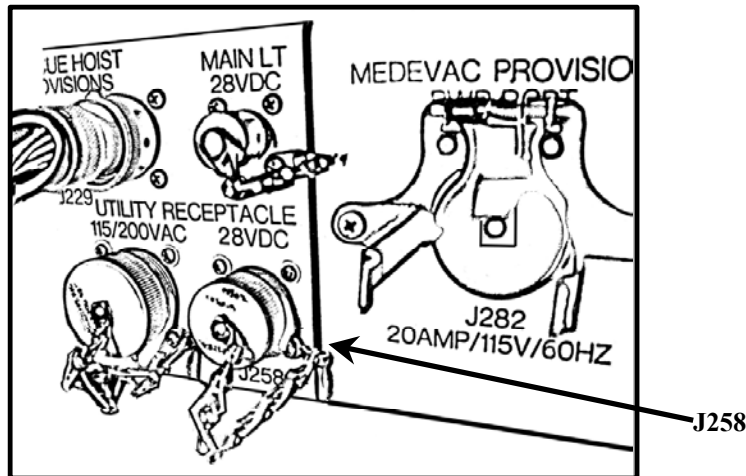


Figure 2-26 – UH-60 AC/DC Power Connectors

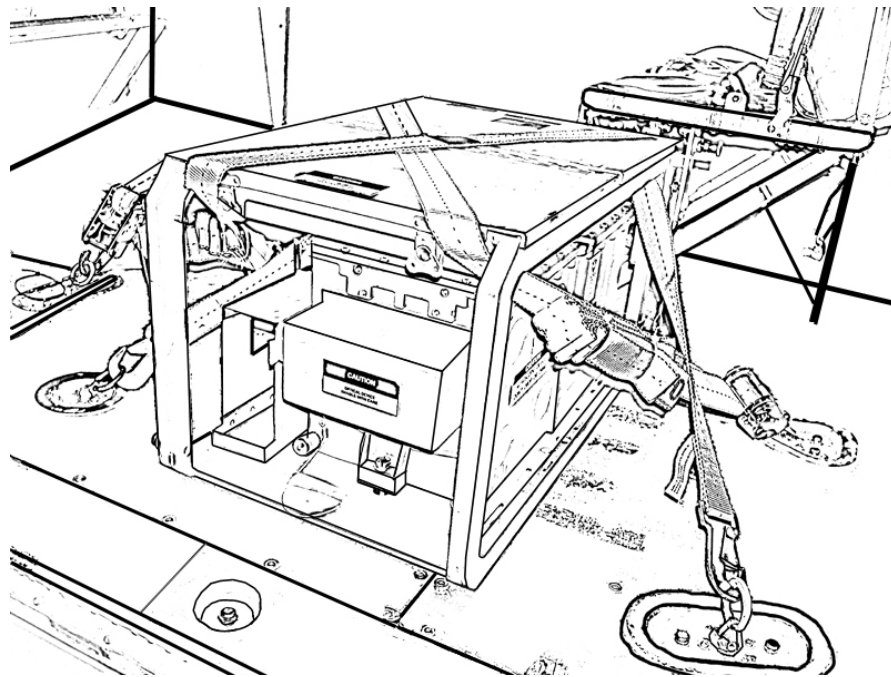


Figure 2-27 – IPADS in UH-60

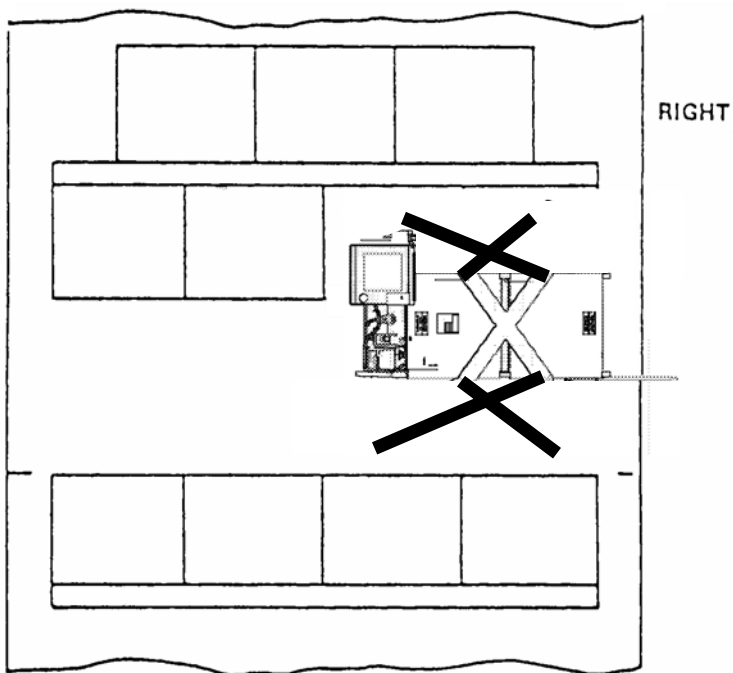


Figure 2-28 – UH-60 IPADS

**WARNING**

Belt assemblies must be wrapped around the IPADS frame as shown in figure 2-30 to prevent the unit from sliding out during helicopter maneuvers.

- (7) Using belt assemblies, tie down IPADS by attaching belt assemblies to aircraft floor cargo rings as illustrated in figure 2-29. Large end of cargo strap must face rear of aircraft. Note that each belt must be wrapped around the IPADS frame as shown in the figure 2-30.



**Figure 2-29 – Belt Assembly Clipped to Cargo Ring**

- (8) Tighten belt assemblies using ratchet handles to insure IPADS frame cannot move after tightening cargo straps. **Do not over tighten and bend IPADS frame.**
- (9) Roll excess cargo strap and secure with black cable tie or tape.

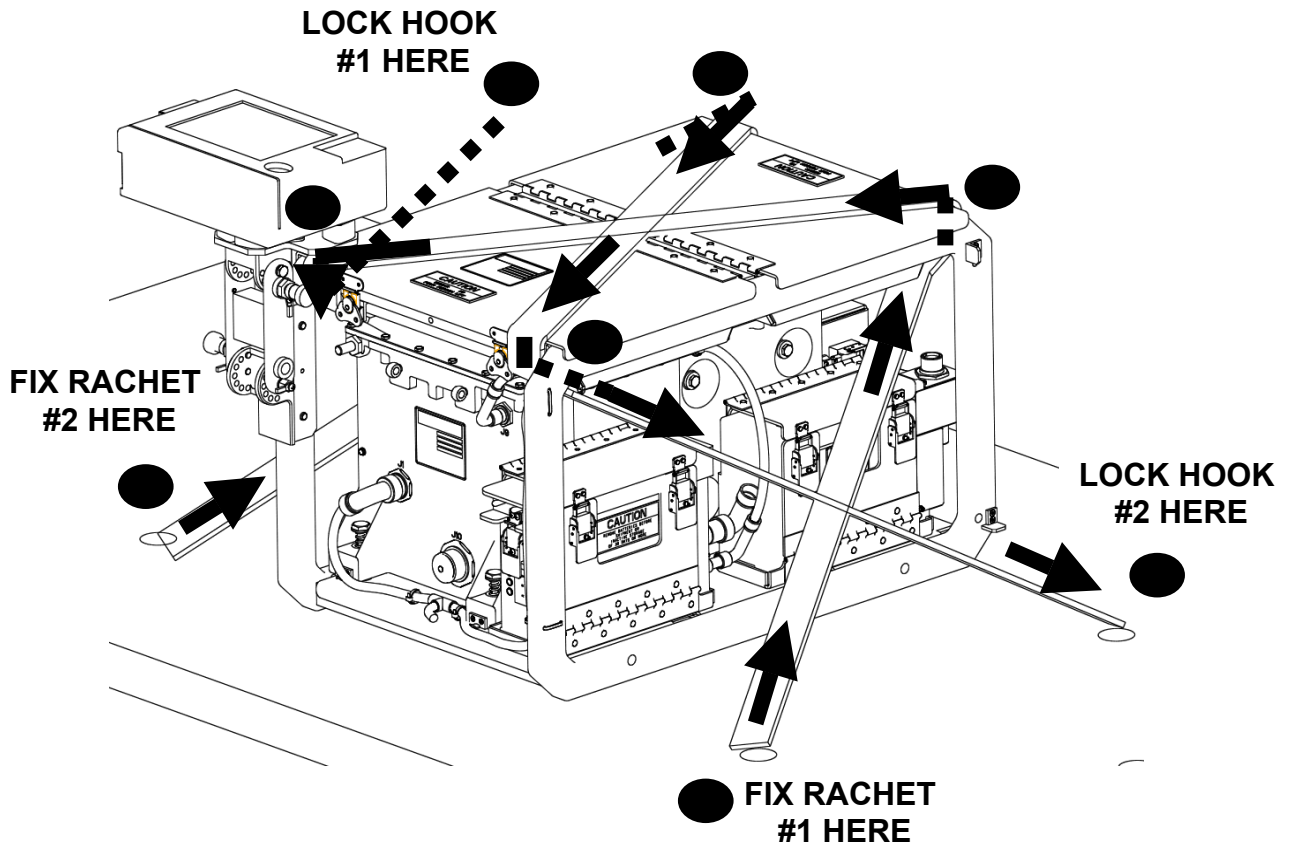
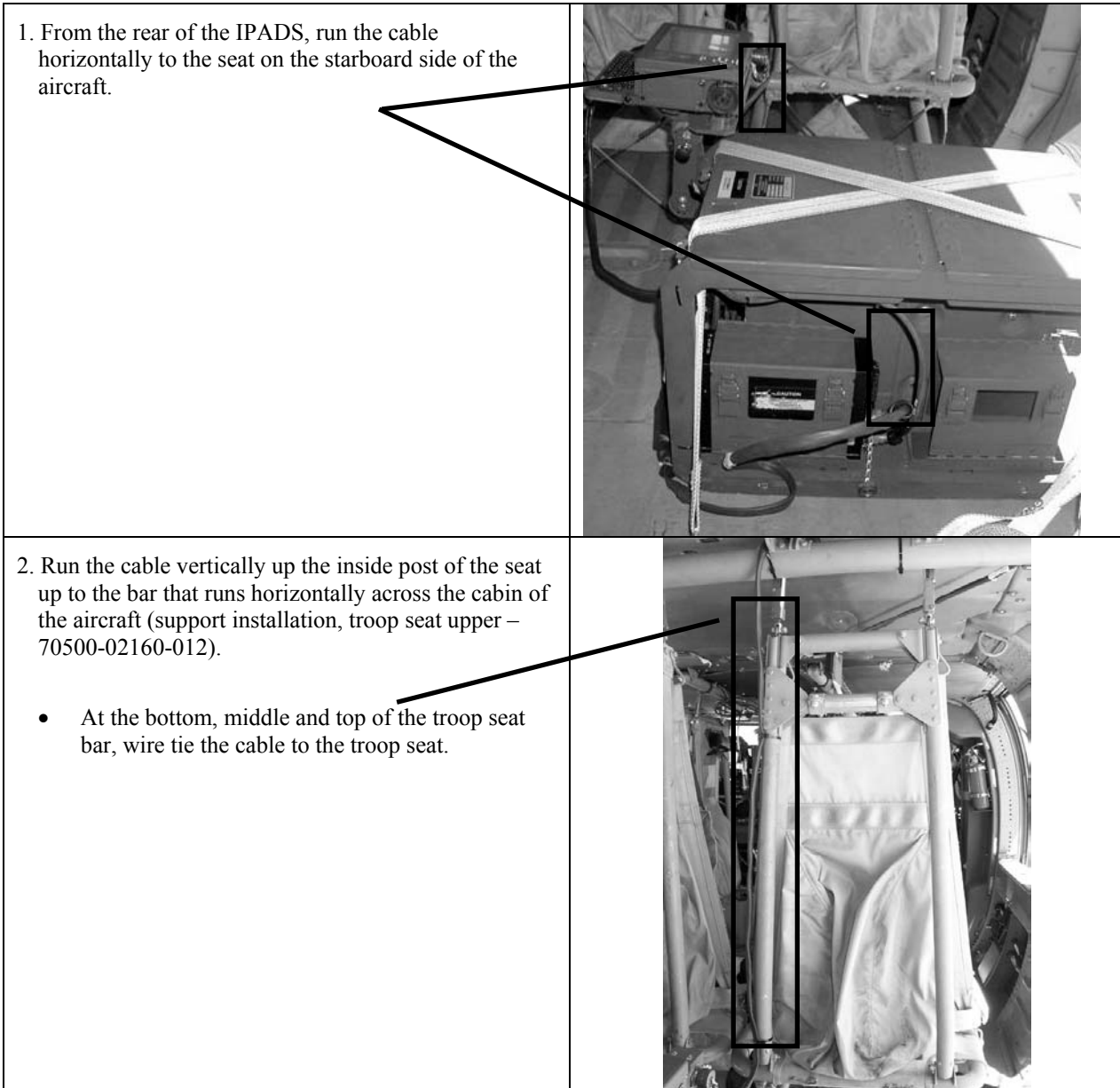


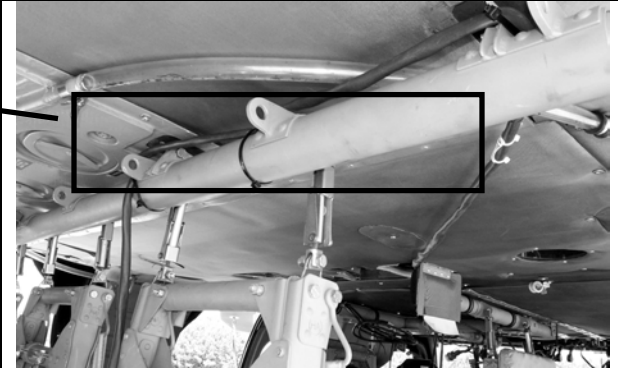


Figure 2-30 – Belt Assembly Ratchet



(10) Install cable tie in accordance with Figure 2-31.

**Figure 2-31 – Cable Tie Installation**



<p>3. Run the cable across the support bar towards the starboard side of the aircraft.</p> <ul style="list-style-type: none"><li>• Where the cable turns right, to run across the top of the bar, place a wire tie.</li><li>• Six inches from that point install another wire tie.</li><li>• Where the cable bends to go forward, place another wire tie.</li></ul>	
<p>4. Run the cable forward to the bar above the crew chief seat.</p>	
<p>5. Run the cable to the AC/DC power connectors on the ceiling near the crew chiefs seat and connect W116-1(P1) to J258 (Utility Receptacle-28VDC).</p> <ul style="list-style-type: none"><li>• The W116-1 cable should be taut. Use additional wire ties to remove any sagging wire.</li></ul>	

**Figure 2-31 – Cable Tie Installation – continued**

- (11) Installation is complete.
- (12) Verify vehicle type is set to UH-60, paragraph 3-11b.
- (13) Stow plumb bob arm.
- (14) Secure helicopter doors.

## **SECTION IV. INSTALLATION OF IPADS INTO SUSV**

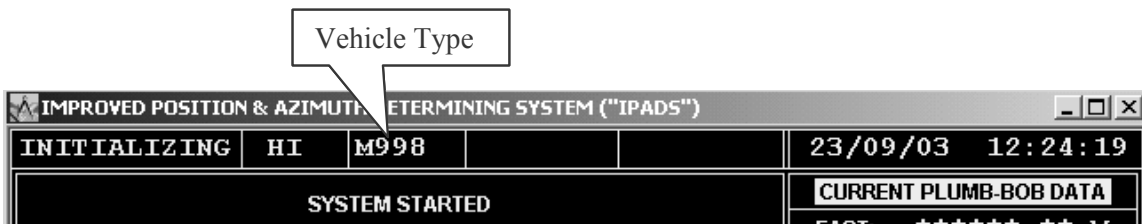
### **2-10. Installing IPADS in M973 Series Small Utility Support Vehicle (SUSV).**

- a. Direct support maintenance personnel, in accordance with TM 9-2350-285-10, must prepare M973 vehicles for IPADS.
- b. Installation kit is currently under development. This section will be updated in a similar fashion to the HMMWV kit installation.

## SECTION V. PRELIMINARY ADJUSTMENT OF EQUIPMENT

### 2-11. Changing Vehicles

- a. The operator must determine the type of vehicle used with IPADS. Each vehicle type will have a different set of dimensions associated with the plumb bob suspension point. The last vehicle used will be displayed.



**Figure 2-32 – Vehicle Type Identification**

- b. If the displayed vehicle type is correct, the operator may proceed with system initialization.
- c. A change of selected vehicle may be effected at any time by following the procedure of paragraph 3-11b.
- d. Adding a new vehicle reference point may be accomplished with great care in the measurement techniques and entered into the system using the instructions in paragraph 3-11b.

### 2-12. Preliminary Checks and Services.

After completing an IPADS installation with all equipment mounted and connected, make the following checks:

- a. Cables connected as in figures 2-13 and 2-14, cables properly routed, and connections tight.
- b. IPADS frame secured firmly to base plate.
- c. No physical obstructions to observing the PPA from outside the vehicle.

## CHAPTER 3

### OPERATING INSTRUCTIONS

#### SECTION I. CONTROLS AND INSTRUMENTS

##### 3-1. Damage from Improper Setting.

No combination of control settings will cause damage to the equipment or create a hazard to personnel.

##### 3-2. Operator/Crew Controls, Indicators, and Connectors.

IPADS controls, indicators, and connectors are illustrated in figures 3-1 through 3-5.

- a. **BCU.** The BCU has switches to control input power (**DC INPUT**) and output power to the CDU and CPNU. There are indicators for input power, battery charge state and battery temperature, and connectors for both input and output power. See figure 3-1.

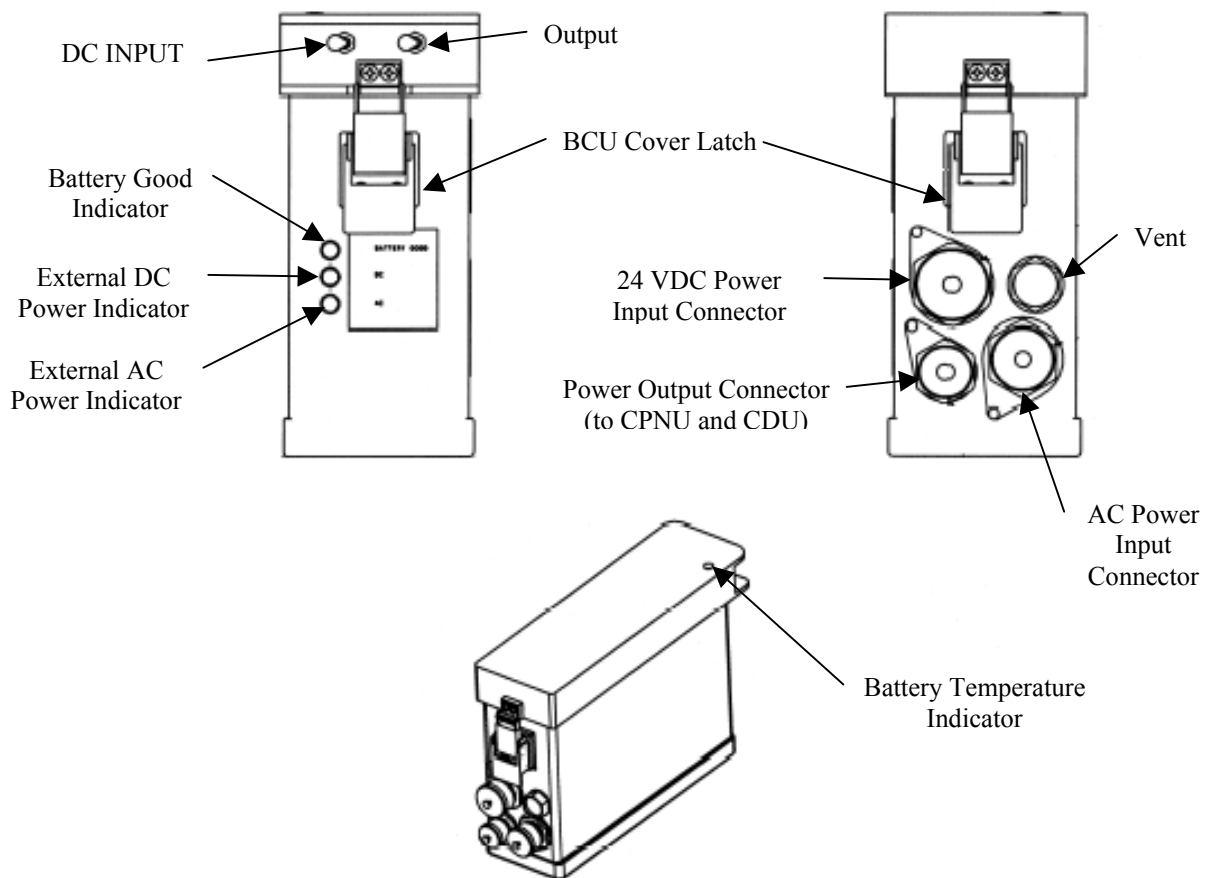


Figure 3-1 – BCU Operator/Crew Controls, Indicators, and Connectors P/N 7204141-9

**3-2. Operator/Crew Controls, Indicators, and Connectors - Continued**

**Legend for Figure 3-1 – BCU Operator/Crew Controls, Indicators, and Connectors and Functions**

Item	Function
DC INPUT Switch	Controls DC power from the vehicle or aircraft to IPADS. Does not control AC power.
Output Switch	Controls power from the BCU to the CPNU and CDU.
Battery Good Indicator	When illuminated, indicates BCU internal batteries are charged to 80 percent of full capacity or greater.
External DC Power Indicator	When illuminated, indicates BCU is receiving DC power from the vehicle or aircraft and the input power switch is ON.
External AC Power Indicator	When illuminated, indicates BCU is receiving external AC power.
Battery Temperature Indicator	When illuminated, and when the Battery Good Indicator is illuminated, there is enough power to support the IPADS for inter-vehicle transfer.
24 VDC INPUT Power Connector	Connects to cable providing 24 VDC power from the vehicle or aircraft.
AC Input Power Connector	Connects to AC power cable that is normally stowed in one of the IPADS storage compartments.
Output Power Connector	Connects to IPADS Wiring Harness to provide power to the CPNU and CDU.
Latch	Two latches secure the BCU cover to the BCU. The cover is opened to inspect and replace the batteries and AC fuse, paragraph 4-9.
Vent	Releases excessive pressure in the BCU in the event of catastrophic battery failure.

- b. **CDU.** The CDU is the primary operator interface with the IPADS. CDU controls, indicators, and connectors are shown in Figure 3-2.

**NOTE**

If possible, the IPADS CDU should be positioned so direct sunlight does not shine on the screen. Direct sunlight on the CDU makes it difficult to read the display.

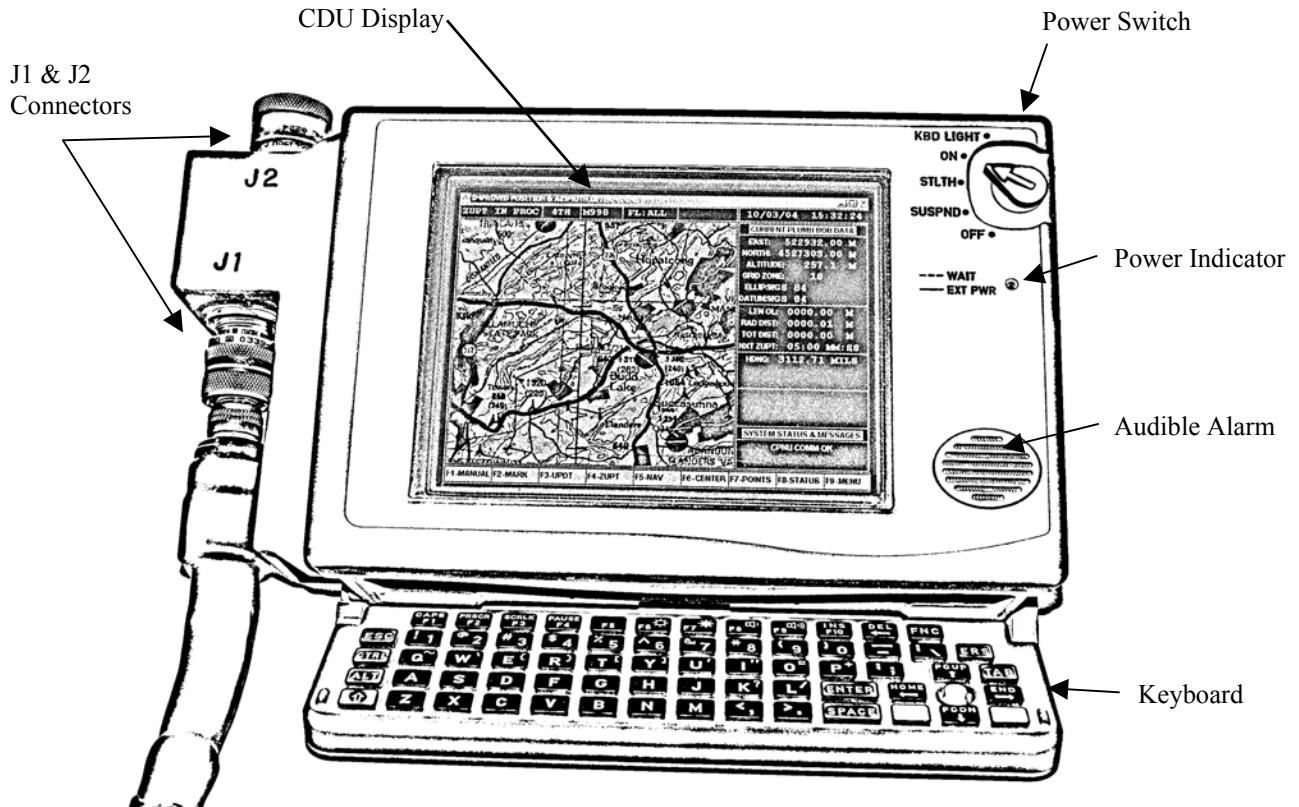


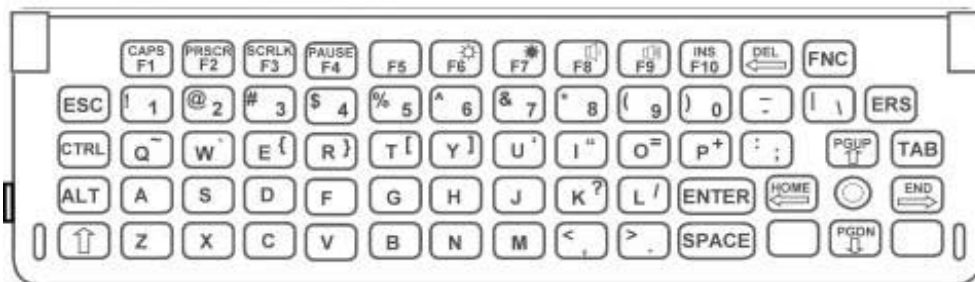
Figure 3-2 – CDU Operator/Crew Controls, Indicators, and Connectors P/N 7204142-9

Legend for Figure 3-2 – CDU Operator/Crew Controls, Indicators, and Connectors	
Item	Function
Power Switch	Controls CDU power and operating modes.
KBD LIGHT ON	Turns CDU on and keyboard is illuminated for use in reduced visibility conditions. Turns CDU on and keyboard is not illuminated. Usual setting for IPADS daytime operation.
STLTH	Stealth mode. CDU Display intensity, keyboard illumination, and audible alarm volume are reduced to minimize detection in the dark.
SUSPND OFF	Suspend mode not used for IPADS. Turns only CDU off. Does not control power of other IPADS components.
Keyboard	Provides data and control function entry, figure 3-3.

Legend for Figure 3-2 – CDU Operator/Crew Controls, Indicators, and Connectors	
Item	Function
Display	Liquid crystal video display (LCD).
Indicator	Green light emitting diode (LED) indicator.
Steady on	CDU is operating with power from the BCU.
Flashing	CDU is warming up at low temperatures. CDU is operational when indicator stops flashing.
Off	CDU is not receiving power from BCU.
Audible Alarm	Provides audible alert that a critical operation is required or completed.
Connector J1	Connects to wiring harness connector P1 to connect CDU to BCU and CPNU.
Connector J2	Connects to FOS data cable connector P1 and to reprogramming cable connector P1.

**NOTES**

- IPADS displays all alphabetic characters in uppercase.
- Bolding in the text of this document identifies actions to be performed by pressing keys or function key legends; e.g., Press **Enter**.
- Low temperatures may require a warm up period before the CDU is operational.



**Figure 3-3 – CDU Keyboard**

- (1) The CDU keyboard layout is shown in figure 3-3 and is more compact than a standard office QWERTY keyboard. Some keys are not located in the same place as on a normal office keyboard. Some keys have added functions that are indicated by a yellow legend at the top of the key. FNC must be pressed simultaneously with these keys to access the additional function. The unique keys used with IPADS are described in table 3-1.

**NOTE**

A flashing function key on the display means that the function requires immediate attention.



- (2) IPADS uses function keys F1 through F9 to perform various operations, table 3-2. When a function key (F1 through F9) is active, a legend will be displayed on the bottom line of the display. The possible legends are listed and their functions described in appendix G.

**CAUTION**



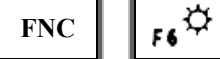

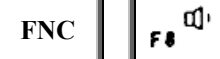
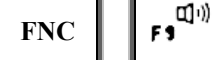

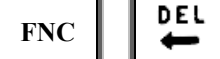
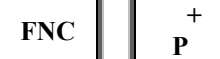
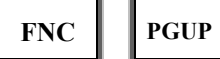




**DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE**

**To render the IPADS unserviceable, thus denying its use by the enemy, the following methods may be used:**

Press FNC and ERS simultaneously to initiate emergency zero procedure, paragraph 3-38a. Improper use may cause the CDU to stop functioning, requiring complete CDU reprogramming.

3-2. Operator/Crew Controls, Indicators, and Connectors - Continued

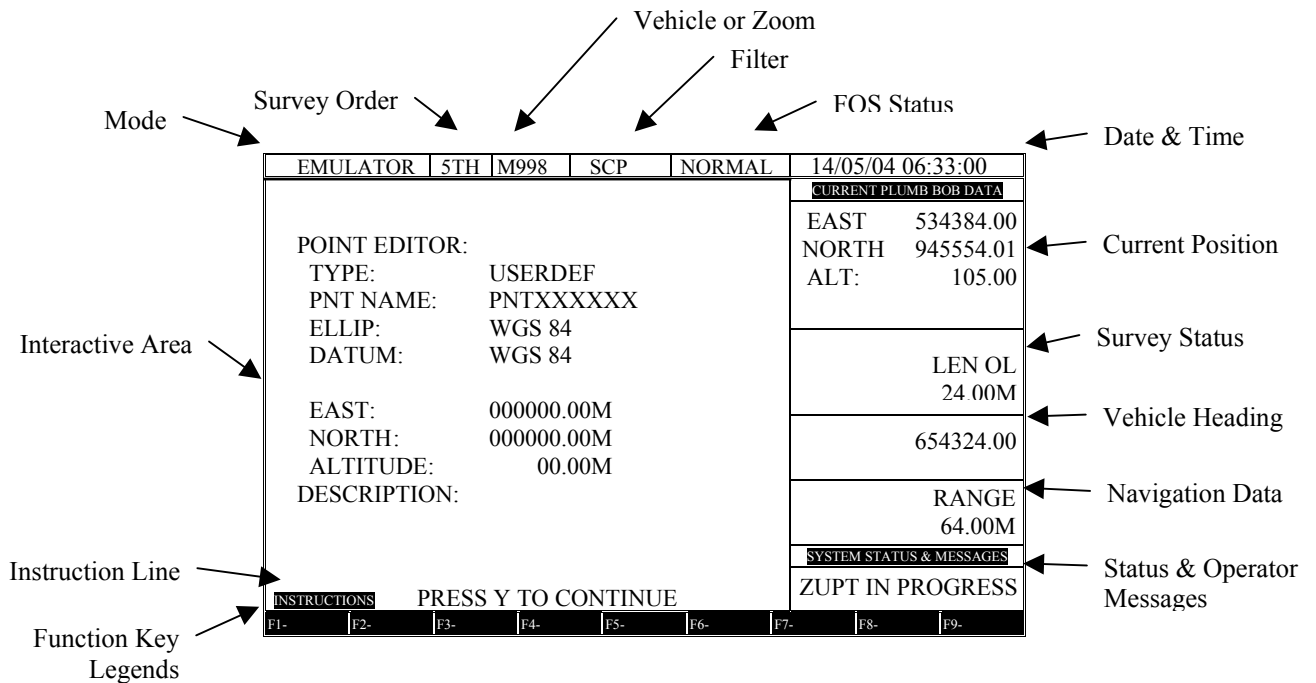
Table 3-1 – Special Keys Used on IPADS

Key(s)	Function
	Used simultaneously with another key to activate yellow top function on the other key.
	Shift key
	Decrease display brightness
	Increase screen brightness
	Decrease audible alarm volume
	Increase audible alarm volume
	Backspace
	Delete
	+ (plus sign)
	Page up
	Page down
	Home
	End
	Initiate Emergency Zeroize

**Table 3-2 – IPADS Function Keys By Screen**

Screen	F1	F2	F3	F4	F5	F6	F7	F8	F9
MENU	MANUAL		“UPDATE”				POINTS	STATUS	SHUTDN
MENU	MANUAL	MARK	UPDATE	ZUPT	NAV	MAP	POINTS	STATUS	SHUTDN
MENU	MANUAL	MARK	UPDATE	ZUPT	NAV AID	MAP	POINTS	STATUS	SHUTDN
OPERATION MODE	NORMAL	EMULAT							MENU
VEHICLE TYPE	M998	M1123	M973	UH-60	OTHE R				MENU
VEHICLE TYPE		USE ALL							EXIT
SURVEY ORDER	4TH	5 <sup>TH</sup>							MENU
ELLIPSOID DATUM		USE ALL	FLAT	MINOR					EXIT
ELLIPSOID DATUM									CANCEL
DISPLAY OPTIONS	GRID	TRUE							MENU
DISPLAY OPTIONS	UTM	DMS	D.D						MENU
DISPLAY OPTIONS	MILS	DMS	D.D						MENU
DISPLAY OPTIONS	ON	OFF							MENU
ZONE FUNCTION	NORMAL	EXTENDE D							EXIT
DATE TIME		USE ALL		GET TIME					MENU
MARK	2 POS	1 POS	F3-/\ AZ	F4-/\ SCP					EXIT
MARK WAIT									CANCEL
MARK 2 POS	MRK EOL								EXIT
MARK 1 POS									EXIT
MARK /\ AZ		USE ALL							EXIT
MARK /\ SCP		USE ALL							EXIT
UPDATE	UPDT PB	UPDT /\							EXIT
UPDATE PB		NEW	SEL PT.						EXIT
UPDATE PB	POS+ALT	POS	ALT						EXIT
UPDATE /\		NEW	SEL PT.						EXIT
UPDATE /\	POS+ALT	POS	ALT						EXIT
NAVIGATON AID	MANUAL	MARK	UPDATE	ZUPT	NAV	MAP	POINTS	STATUS	MENU
NAVIGATON AID	MANUAL	MARK	UPDATE	ZUPT	STOP NAV	MAP	POINTS	STATUS	MENU
STATUS	MANUAL	ALARM							EXIT
MAP	MANUAL	MARK	UPDATE	ZUPT	NAV	CENTE R	POINTS	STATUS	MENU
POINT LIST		NEW	SEL. PT	FILTER	DEL ALL	SND PNT	SND ALL		EXIT
POINT LIST		NEW		FILTER	DEL ALL	SND PNT	SND ALL		EXIT
POINT EDITOR	USER	WAY	SCP						EXIT
POINT EDITOR		USE ALL							EXIT
ALL				ZUPT	ZONE				

**3-2. Operator/Crew Controls, Indicators, and Connectors - Continued**



**Figure 3-4 – IPADS Display Page**

Area	Description
Mode	Current IPADS operational mode. Indications are listed below.
INITIALIZING	Appears momentarily during power up indicating that IPADS software is initializing.
CPNU INIT	Once IPADS software is initialized, CPNU INIT is displayed indicating CDU communications ports are initialized and CDU is attempting to establish communications with CPNU.
ALIGNING NNN	CPNU is aligning. NNN is a countdown, in seconds, to completion.
POS UPD REQ	CPNU failed hot start and position update is required.
ZUPT IN PROC	The vehicle is stopped and IPADS is performing ZUPTs.
NAVIGATION	The vehicle is moving.
P1 -> P2	IPADS is performing a two-position azimuth mark operation.
SYS SHUTDOWN	Appears momentarily during shutdown indicating IPADS is performing an orderly software shutdown. Operator must wait for IT IS NOW SAFE TO SHUTDOWN before turning off power.
SYS INACTIVE	Appears briefly after SYS SHUTDOWN. Indicates IPADS software was successfully shutdown and Windows shutdown is in progress.
CPNU FAILURE	CPNU failure has occurred, see paragraph 4-6, Operator Troubleshooting.
CPNU SHUTDN	If power is recycled on the CDU (e.g. using the CDU power switch) while the CPNU remained powered up following a normal shutdown (F9 on MENU), CPNU SHUTDN is displayed. This indicates CPNU had received a proper shutdown command, but was not power off. Shutdown IPADS fully then power up as described in paragraph 3-6.

**Legend for Figure 3-4 – IPADS Display Page**

<b>Area</b>	<b>Description</b>
Survey Order	Current IPADS survey order. Indications are listed below.
4TH	Fourth order equivalent, 5 minutes between ZUPT stops.
5TH	Fifth order equivalent, 10 minutes between ZUPT stops.
DGR	Degraded, paragraph 3-14.
Vehicle or Zoom	Current IPADS vehicle or map zoom value. Indications are listed below.
M998	M998 HMMWV
M1123	M1123 or M1069 HMMWV
M973	M973 SUSV
UH-60	UH-60 (Blackhawk) Utility Helicopter
OTHER	User defined vehicle
Zoom value	Momentarily shows zoom value when zooming in or out on map display, paragraph 3-30b.
Filter	Type of points selected for display. Indications are listed below.
FL: ALL	All points in the IPADS database are displayed.
FL: MISN	All points established by IPADS during the current mission are displayed.
FL: SCP	All survey control points (SCP) are displayed.
FL: WAY	All waypoints are displayed.
FL: MARK	All marked points are displayed.
FL: USER	All user-defined points are displayed.
Date & Time	Date and time in dd/mm/yy hh:mm:ss format for the time zone last set, paragraph 3-11g.
Current Position	Current position of plumb bob reference point in the selected position format, paragraph 3-11b.
Survey Status	
LEN OL	Length of two-position azimuth orienting line in M or KM, depending on length.
RAD DIST	Straight line distance from last position update, in M or KM, depending on distance.
TOT DIST	Total distance traveled from last position update, in M or KM, depending on distance.
NXT ZPT	Time to next required ZUPT in mm:ss format.
Vehicle Heading	Current heading (azimuth) of the vehicle in the selected angle format, paragraph 3-11e(2).
Navigation Data	
RANGE	Straight-line distance to navigation way point in M or KM, depending on distance.
WP AZ	Azimuth to navigation waypoint in selected angle format.
STEER	Steering instructions to place vehicle on vector to the navigation waypoint.
Status & Operator Messages	Current IPADS status information and messages to the operator.
Function Key Legends	Labels for the active function keys F1 through F9, table 3-2.
Instruction Line	Instructions to the operator. Not shown on map display.
Interactive Area	Active area of the display for data entry and display of data, map, and navigation aid.

### 3-2. Operator/Crew Controls, Indicators, and Connectors - Continued

- (3) The CPNU has connectors for power and data and a porro prism assembly used for offset position and azimuth transfers in conjunction with a theodolite or total station instrument. Operator controls and connectors are shown in figure 3-5.

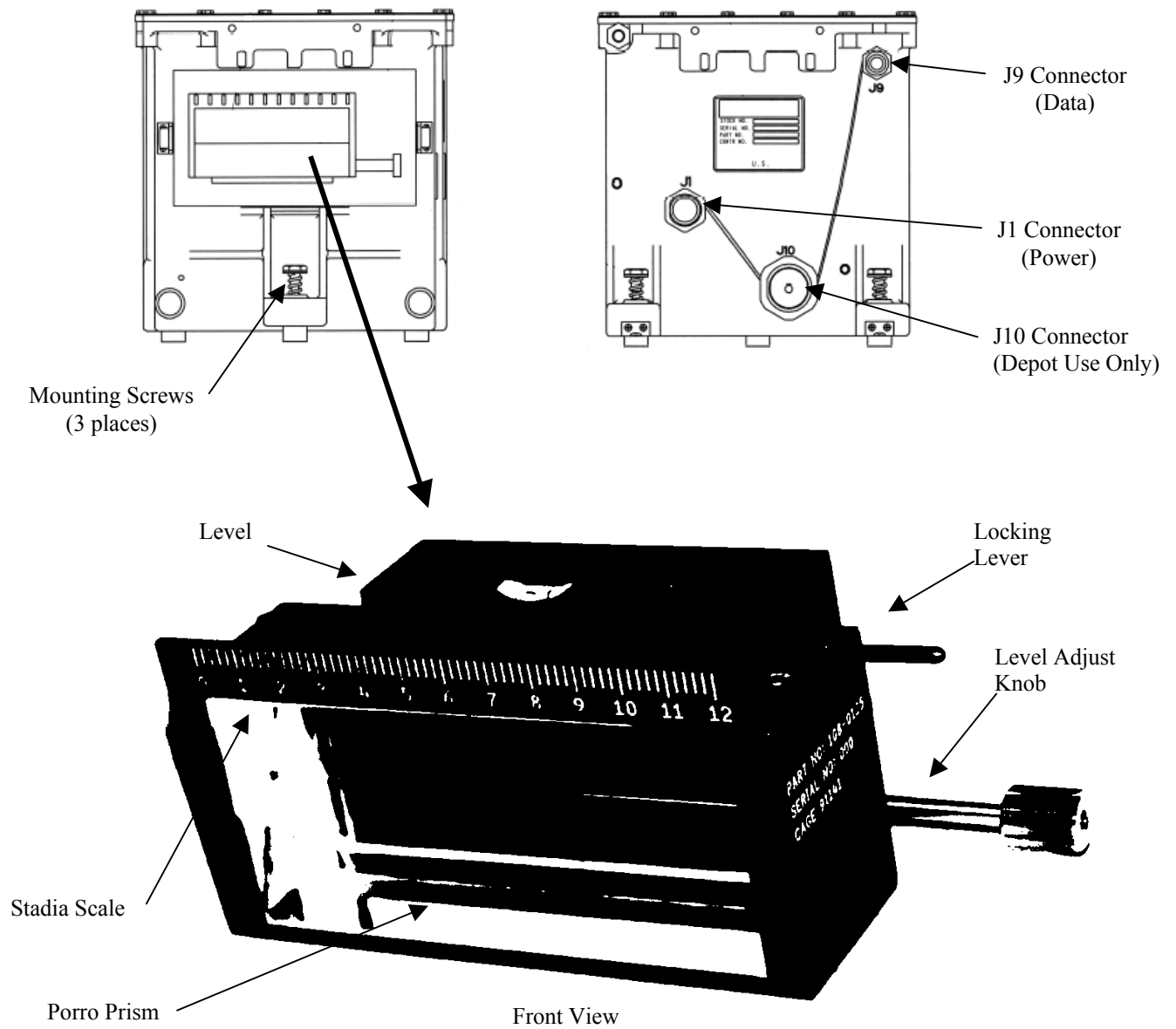


Figure 3-5 – CPNU / PPA Operator/Crew Controls and Connectors

**Legend for Figure 3-5 – CPNU / PPA Operator / Crew Controls and Connectors**

Item	Function
Connector J1	Connects to wiring harness P2 to provide power to the CPNU from the BCU.
Connector J9	Connects to wiring harness P3 to exchange digital data with the CDU.
Connector J10	Connects to depot level test equipment.
Porro Prism	An optical prism used to achieve auto-reflection with a theodolite or total station instrument.
Stadia Scale	Used to determine distance from theodolite to IPADS using the stadia lines in the theodolite reticle.
Level	Used to determine when the porro prism is level.
Locking Lever	Locks the level adjust knob to prevent rotation of the porro prism during travel
Level Adjust Knob	Rotates the porro prism to level it for auto-reflection and stow it for travel. Pressing the knob down disengages the adjustment mechanism allowing coarse adjustment.
Screw (3 each)	Secures CPNU to IPADS frame.

**SECTION II. OPERATION UNDER USUAL CONDITIONS**

**3-3. General.**

IPADS is normally operated from a land vehicle. Helicopters are used in special situations; e.g., great distances between survey points, survey points inaccessible to a land vehicle, or when speed is of paramount concern. IPADS operation in a land vehicle and helicopter are the same. Transfer between vehicle and helicopter is described in paragraphs 3-33 and 3-34.

**NOTE**

The following conventions are used in this manual:

- Bolding of the text in this document identifies actions to be performed by pressing keys or function key legends; e.g., Press **Enter**.
- Keys that are pressed simultaneously have no separator between them; e.g., **FNC DEL**.
- A series of keys that are pressed sequentially are separated by commas; e.g., **A, B, and C**.
- Messages and instructions displayed on the CDU are capitalized; e.g., **INFO: POSITION UPDATE REQUIRED**
- Flashing text on the display is enclosed in quotation marks, e.g., “GO”.

**!!! SURVEY CONTROL POINT (SCP) NAME LENGTH LIMITATION !!!**

**There is a known feature in AFATDS that limits the length of the Survey Control Point (SCP) Name to 8 characters. IPADS and FOS will accept, process, and transmit SCP names of up to 15 characters. But when the SCP message is received at AFATDS, the SCP names will be truncated (shortened) to the first 8 characters. IPADS can automatically generate 15-character long SCP names, but they look identical when shortened to 8 characters. To prevent the loss of SCP name data, the following solution is recommended:**

**AT THE IPADS AND FOS, LIMIT YOUR SURVEY CONTROL POINT NAMES TO 8 CHARACTERS OR LESS. CHANGE IPADS GENERATED 15-CHARACTER SCP NAMES TO YOUR OWN CHOICE OF NAMES UP TO 8 CHARACTERS LONG BEFORE TRANSMITTING TO AFATDS.**

### 3-4. General Use of CDU.

- a. The CDU is the main interface between the operator and IPADS. After system turn on, paragraph 3-6, the CDU display interactive area shows MENU, figure 3-6. This chapter describes operations that involve using the CDU keyboard and observing information displayed on the CDU display. Displayed information is organized in different “pages”. All pages share a general format that includes the following lines and areas:
  - (1) Mode line contains fields reserved for indicators, figure 3-4.
  - (2) Status area (right side of page) contains fields reserved for current data, figure 3-4.
  - (3) Function key legend (bottom of page) identifies the active function keys (F1 through F9), table 3-2.
  - (4) Interactive area (left side of page) displays information that is based on the operation being performed. Figure 3-6 shows the interactive area of the MENU.

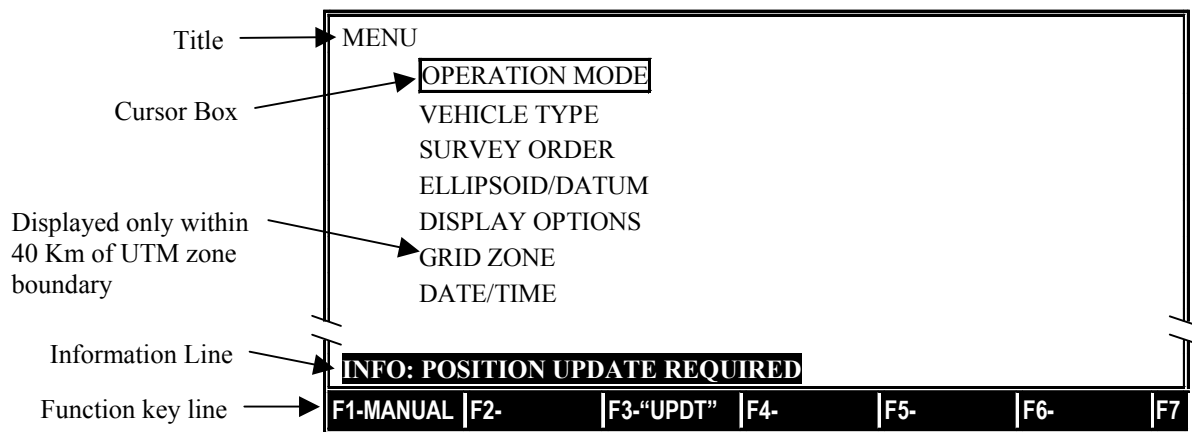


Figure 3-6 – MENU Interactive Area

- b. All pages provide the following common functionality:
  - (1) Information line provides instructions for user action or information on an operation that was performed, except when map is displayed.
  - (2) A cursor box surrounds an active field, figure 3-6.
  - (3) Navigation on a page – Pressing ↑ or ↓ moves the cursor box through the active user entry fields on the page.
  - (4) Pressing FNC DEL clears the active data entry field.
  - (5) Data fields have fixed formats with decimal points and delimiters in fixed locations.
  - (6) Characters enter a field from the right.
  - (7) Press ↵ (backspace) to delete the last character entered.



(8) For example, the actions required to set time from 14:38:22 to 16:39:00 are:

Operation	Action	Display
Select TIME SET field	See paragraph 3-33g	TIME SET: 14:38:22
Clear field	Press <b>FNC DEL</b>	TIME SET: 00:00:00
Enter 1	Press <b>1</b>	TIME SET: 00:00:01
Enter 6	Press <b>6</b>	TIME SET: 00:00:16
Enter 3	Press <b>3</b>	TIME SET: 00:01:63
Enter 9	Press <b>9</b>	TIME SET: 00:16:39
Enter 0	Press <b>0</b>	TIME SET: 01:63:90
Enter 6 (Error)	Press <b>6</b>	TIME SET: 16:39:06
Clear erroneous 6	Press <b>←</b>	TIME SET: 01:63:90
Enter 0	Press <b>0</b>	TIME SET: 16:39:00

(9) Navigation between pages - All other pages can be reached from three main pages: MENU, MAP, and NAVIGATION AID. Any page can be exited by pressing **F9** until MENU is reached.

### 3-5. IPADS Mission Procedure.

The mission begins with pre-turn-on checks and services, followed by configuration and initialization. Next, IPADS is updated using the position and altitude update procedure. IPADS then performs a series of marks, where position, altitude, and azimuth are recorded. You can end a mission by performing an update, data recall, or shutdown. Table 3-7 references paragraphs where mission phases are explained in detail. If a malfunction occurs, refer to paragraph 4-6, Operator Troubleshooting.

#### NOTE

IPADS CDU can be configured for normal operation with a complete IPADS or as a stand-alone emulator for training. Procedures below are for normal operation. See paragraph 3-35 for emulator operation.

### 3-6. Turn On and Turn Off Sequences.

- a. **Turn On Sequence.** Perform the following steps to turn on IPADS:
  - (1) Set BCU power input switch (**DC INPUT**) to **ON** to apply power to IPADS.
  - (2) Set BCU power output switch (**OUTPUT**) to **ON** to turn on IPADS. CDU indicator flashes or illuminates steadily.

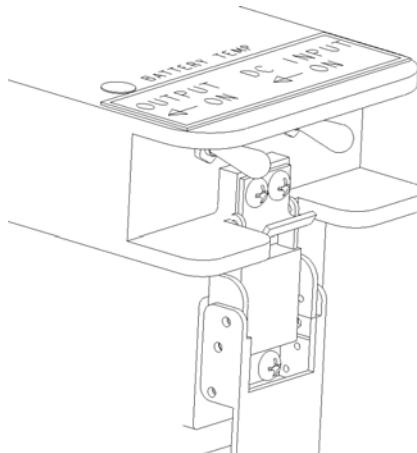


Figure 3-7 BCU Power Switches

### 3-6. Turn On and Turn Off Sequences -Continued

**When CDU indicator illuminates steadily, observe that Windows and IPADS software boot up.**

- (3) When MENU is displayed with function key, legends F1-MANUAL, F3-“UPDT”, F7-POINTS, F8-STATUS, and F9-SHUT DN, IPADS is ready for configuration, paragraph 3-11, and initialization, paragraph 3-12 (if any of the turn on procedures fail, refer to paragraph 4-6, Operator Troubleshooting).

#### CAUTION

IPADS saves information during shutdown. Improper shutdown may cause next turn-on to perform recovery operations.

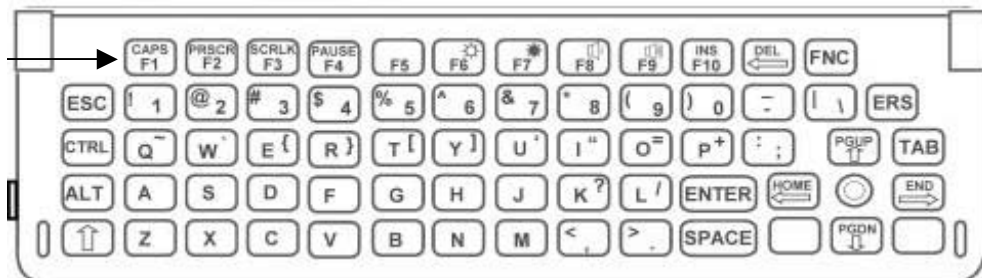
#### NOTE

IPADS performs “hot start” alignment within five minutes when not moved since previous shutdown. If “hot start” is planned for next mission, wait until vehicle is parked and secured at next mission turn-on point before turning IPADS off. Vehicle must be parked on a firm and stable surface to minimize motion that could cause “hot start” rejection.

- b. **Turn Off Sequence.** Perform the following steps to turn off IPADS:
  - (1) Press **F9** until MENU is displayed.
  - (2) Function key legend shows F9-SHUT DN.
  - (3) Press **Y** to confirm shutdown or press any other key to cancel.
  - (4) Observe that IPADS software closes and Windows performs an orderly shutdown.
  - (5) When the screen displays IT IS NOW SAFE TO SHUTDOWN, leave CDU power switch in ON position and set BCU POWER (OUTPUT) switch to OFF, figure 3-7.
  - (6) Set BCU POWER (**DC INPUT**) switch to **OFF**, figure 3-7.
  - (7) IPADS is now powered off (if any of the turnoff procedures fail, refer to paragraph 4-6, Operator Troubleshooting).

### 3-7. Display Technical Manual.

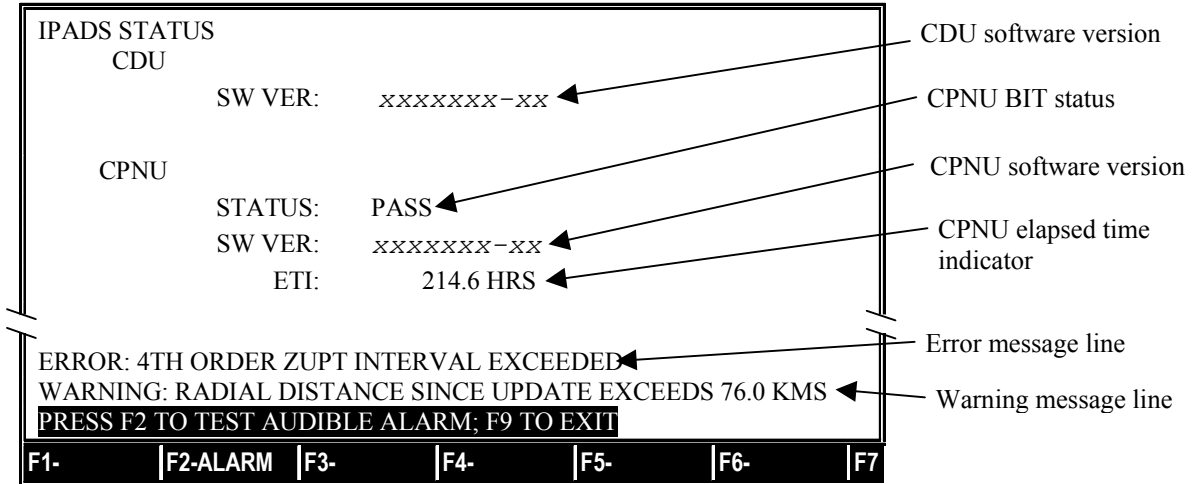
When function key line shows F1-MANUAL, this technical manual can be displayed by pressing **F1**, figure 3-8. The manual may be searched using search features of Adobe Acrobat Reader™. Close Acrobat Reader™ to return to IPADS software.



**Figure 3-8 – CDU Keyboard Layout**

### 3-8. IPADS Status Display.




When function key line shows F8-STATUS, STATUS page can be displayed by pressing **F8**. A message flashes and audible alarm sounds when a condition requiring immediate attention occurs. STATUS shows CDU and CPNU software versions, CPNU BIT STATUS, and any error or warning messages. Press **F9** to exit STATUS.






### 3-9. Brightness Setting.

Adjust CDU display brightness and keyboard lighting for ambient light conditions or blackout operation as follows:

#### a. Dim Display.

Press FNC **F6**  to dim CDU display. Each press of FNC **F6**  decreases brightness slightly until full dark is reached. Release FNC **F6**  when desired brightness is reached.

#### b. Brighten Display.

Press FNC **F7**  to brighten CDU display. Each press of FNC **F7**  increases brightness slightly until full brightness is reached. Release FNC **F7**  when desired brightness is reached.

#### c. Keyboard Lighting.

Set CDU power switch to **KBD LIGHT** to illuminate keyboard for operation in the dark. Set CDU power switch to **ON** to turn off keyboard illumination.




#### d. Stealth Mode.

An alternate method to dim display is to set CDU power switch to **STLTH**. This also dims keyboard lighting and reduces audible alarm loudness. Set CDU power switch to **ON** or **KBD LIGHT** to restore normal brightness and loudness.




### 3-10. Audible Alarm.

Turn audible alarm on and off from the STATUS Screen. When audible alarm is on, set volume as follows:

#### a. Lower volume



Press FNC **F8**  to decrease volume. Each press of FNC **F8**  decreases volume slightly until fully off. Release FNC **F8**  when desired volume is reached.

#### b. Raise volume

Press FNC **F9**  to increase volume. Each press of FNC **F9**  increases volume slightly until full on is reached. Release FNC **F9**  when desired volume is reached.

#### c. Test alarm

Perform the following steps to test audible alarm:

- (1) From MENU, MAP, or NAVIGATION AID page, press **F8-STATUS**. STATUS page is displayed. Function key legend shows F2-ALARM and F9-EXIT.
- (2) Press **F2**.
- (3) If audible alarm is turned on, audible alarm should sound and IF ALARM IS NOT AUDIBLE PRESS FNC F9; PRESS ANY KEY TO SILENCE is displayed.
  - (a) If audible alarm sounds, press any key. Audible alarm goes silent.
  - (b) If audible alarm does not sound, verify it is turned on and press FNC **F9**  to raise volume.
  - (c) Press **F9** to exit STATUS page.
- (4) If audible alarm is turned off, display should read ALARM IS DISABLED; PRESS Y TO CONFIRM TEST; OTHER KEY TO CANCEL is displayed.
  - (a) Press **Y** to initiate test. Audible alarm should sound and IF ALARM IS NOT AUDIBLE PRESS FNC F9; PRESS ANY KEY TO SILENCE is displayed.
  - (b) If audible alarm sounds, press any key. Audible alarm goes silent.
  - (c) If audible alarm does not sound, verify it is turned on and press FNC **F9**  to raise volume.
  - (d) Press **F9** to exit STATUS page.

### 3-11. Configuration.

#### NOTE

IPADS retains configuration settings after shutdown. It is not necessary to reconfigure IPADS for settings that do not change from previous mission.

IPADS must be configured for the current mission including: normal operation mode or emulator for training, vehicle type, survey order, ellipsoid and datum, display settings, grid zone (if using UTM coordinates and operating within 40 km of a zone boundary) and date and time. IPADS is configured from MENU, figure 3-6. Perform the following steps, as required, to configure IPADS:

**a. Operation Mode.**

IPADS indicates it is in EMULATOR MODE in SYSTEM STATUS & MESSAGE area of display. Perform the following steps to change from emulator mode to normal operation:



- (1) Scroll to OPERATION MODE on MENU and press **ENTER** (PRESS F1 FOR NORMAL OPERATION is displayed).
- (2) Press **F1** (PRESS Y TO SWITCH TO NORMAL MODE/RESTART CDU is displayed). Press **Y** (Pressing Y will confirm normal operation. CDU software will shut down and start in normal operation mode).

**b. Vehicle Type.**

IPADS must be configured for the host vehicle to accurately reference position to plumb bob reference point. IPADS supports four vehicles listed below and an additional vehicle (OTHER) with operator entered parameters. Current vehicle selection is shown in third field of mode line.

Display	Vehicle	Plumb Bob Reference Point
M998	M998 HMMWV	Left side driver plumb bob
M1123	M1123 or M1097 HMMWV	Left side driver plumb bob
M973	M973 SUSV	Left side driver plumb bob
UH-60	UH-60 Helicopter	IPADS mounted plumb bob arm

Perform the following steps to change vehicle type:

- (1) Scroll to VEHICLE TYPE on MENU and press **ENTER**. Function key line shows F1-M998, F2-M1123, F3-M973, F4-UH-60 and F5-OTHER.
- (2) Press function key corresponding to host vehicle.
- (3) If a standard vehicle was selected, MENU is displayed with selected vehicle shown on mode line.
- (4) If OTHER was selected, unique vehicle parameters are displayed with function key legend F9-EXIT. If parameters are correct, press **F9**. MENU is displayed with OTHER on mode line.

**c. Survey Order.**

IPADS supports two orders of survey: fourth order equivalent (4TH) using five-minute intervals between ZUPTs; and fifth order equivalent (5TH), using ten-minute intervals between ZUPTs. To obtain IPADS specified accuracy for battalion survey, the operator must perform 5TH order survey. For division artillery survey, the operator must perform 4TH order survey. Current survey order is shown in second field of mode line. Perform the following steps to change survey order:

**3-11. Configuration - Continued**

Scroll to **SURVEY ORDER** on **MENU** and press **ENTER**. Function key line will display **F1-4TH**, and **F2-5TH**. Press function key corresponding to mission survey order. **MENU** is displayed with selected survey order shown on the mode line.

**d. Ellipsoid and Datum.**



- Ellipsoid and datum can be changed at any point during a mission. Datum shifts have unknown associated errors. Do not initialize and close IPADS surveys at SCPs on different datums. SCPs on different datums likely were established by different, unconnected surveys. Closing at an SCP on a different datum may introduce significant error into adjusted coordinates.
- IPADS can store two sets of user-defined datum parameters for each predefined ellipsoid and for each of two user-defined ellipsoids. Verify parameters are for the intended datum when selecting a user-defined datum. Incorrect parameters may introduce significant position error.

**(1) Change Ellipsoid and Datum**

IPADS must be configured for the datum of initial update SCP. Ellipsoid and datum can be changed later if output of coordinates on a different datum is required. Datums are associated with ellipsoids. IPADS supports the ellipsoids and associated datums in table 3-3. IPADS accepts entry of user defined ellipsoid and datum parameters, paragraph 3-11d(4). Ellipsoid and datum currently in use are identified in **CURRENT PLUMB BOB DATA** area of display. Perform the following steps to change ellipsoid and datum:

**Table 3-3 – Ellipsoids and Datums Supported by IPADS**

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
AA	AIRY 1830	OGB-M	OSGB 36 (MEAN)
		OGB-A	OSGB 36 (ENG)
		OGB-B	OSGB 36(ENG&WL)
		OGB-C	OSGB 36 (SCOT)
		OGB-D	OSOB 36 (WALES)
			USER DEFINED <i>n</i>
AN	AUSTRALIAN NATL	ANO	ANNA 1 ASTRO 65
		AUA	AUSTRLN GEOD 66
		AUG	AUSTRLN GEOD 84
			USER DEFINED <i>n</i>
BR	BESSEL 1841	BUR	BUKIT RIMPAH
		BAT	DJAKARTA BATAV
		EST	ESTONIA
		GSE	GUNUNG SEGARA
		HER	HERMANNSKOGEL
		MAS	MASSAWA

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
BR - cont		CCD	S-JTSK
		TOY-M	TOKYO (MEAN)
		TOY-A	TOKYO (JAPAN)
		TOY-B1	TOKYO (KOREA)
		TOY-C	TOKYO (OKINAWA)
			USER DEFINED <i>n</i>
BN	BESSEL (NAMIBIA)	SCK	SCHWARZECK
			USER DEFINED <i>n</i>
CC	CLARKE 1866	AMA	AM SAMOA 1962
		BER	BERMUDA 1957
		CAC	CAPE CANAVERAL
		GUA	GUAM 1963
		LCF	L C 5 ASTRO 61
		LUZ-A	LUZON (PHILPNS)
		LUZ-B	LUZON (MIND IL)
		NAS-C	NA 27 (CONUS)
		NAS-B	NA 27 (WEST US)
		NAS-A	NA 27 (EAST US)
		NAS-D	NA 27 (ALASKA)
		NAS-V	NA 27 (ALN IS E)
		NAS-W	NA 27 (ALN IS W)
		NAS-Q	NA 27 (BAHAMAS)
		NAS-R	NA 27 (SAN SLV)
		NAS-E	NA 27 (CANADA)
		NAS-F	NA 27 (ALB&BC)
		NAS-G	NA 27 (E CANDA)
		NAS-H	NA 27 (MAN&ONT)
		NAS-I	NA 27 (NW TERR)
		NAS-J	NA 27 (YUKON)
		NAS-O	NA 27 (CANL ZN)
		NAS-P	NA 27 (CARIBAN)
		NAS-N	NA 27 (C AMER)
		NAS-T	NA 27 (CUBA)
		NAS-U	NA 27 (GREENLD)
		NAS-L	NA 27 (MEXICO)
		OHA-M	OLD HWN (MEAN)
		OHA-A	OLD HWN (HAWAI)
		OHA-B	OLD HWN (KAUAI)
		OHA-C	OLD HWN (MAUI)
		OHA-D	OLD HWN (OAHU)
		PUR	PUERTO RICO
			USER DEFINED <i>n</i>
CD	CLARKE 1880	ADI-M	ADINDAN (MEAN)
		ADI-E	ADINDAN (BURK)
		ADI-F	ADINDAN (CAMRN)
		ADI-A	ADINDAN (ETHOP)
		ADI-C	ADINDAN (MALI)
		ADI-D	ADINDAN (SENEG)
		ADI-B	ADINDAN (SUDAN)

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
CD - cont		AIA	ANTIGUA IL AST
		ARF-M	ARC 1950 (MEAN)
		ARF-A	ARC 1950 (BOTS)
		ARF-H	ARC 1950 (BURU)
		ARF-B	ARC 1950 (LESO)
		ARF-C	ARC 1950 (MALA)
		ARF-D	ARC 1950 (SWZL)
		ARF-E	ARC 1950 (ZAIR)
		ARF-F	ARC 1950 (ZAMB)
		ARF-G	ARC 1950 (ZIMB)
		ARS-M	ARC 1960 (MEAN)
		ARS-A	ARC 1960 (KENA)
		ARS-B	ARC 1960 (TANZ)
		PHA	AYABELLE LIGHT
		CAP	CAPE
		CGE	CARTHAGE
		DAL	DABOLA
		DID	DECEPTION IS
		FOT	FT THOMAS 1955
		LEH	LEIGON
LIB	LIBERIA 1964		
MIK	MAHE 1971		
		MER	MERCHICH
		MIN-A	MINNA (CAMRN)
		MIN-B	MINNA (NIGERIA)
		ASM	MONTERRAT IL
		MPO	M'PORALOKO
		NAH-A	NAHRWAN (OMAN)
		NAH-B	NAHRWAN (UAE)
		NAH-C	NAHRWAN (SAUDI)
		NSD	NOR SAHARA 1959
		FAH	OMAN
		PTB	POINT 58
		PTN	POINTE NOIRE 48
		SRL	SIERRA LEONE 1960
		VOI	VOIROL 1874
		VOR	VOIROL 1960
		MVS	VITI LEVU 1916
			USER DEFINED <i>n</i>
EB	EVEREST (BRUNEI)	TIL	TIMBALAI 1948
			USER DEFINED <i>n</i>
EA	EVEREST (1830)	IND-B	INDIAN (BANGLD)
		INF-A	INDIAN 1954
		ING-A	IND 1960 (VIET)
		ING-B	IND 1960 (CS IS)
		INH-A1	INDIAN 1975
		KAN	KANDAWALA
			USER DEFINED <i>n</i>



Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
EC	EVEREST (1956)	IND-I	INDIA & NEPAL
			USER DEFINED <i>n</i>
EF	EVEREST (PAKIS)	IND-P	INDIAN (PAKIS)
			USER DEFINED <i>n</i>
EE	EVEREST (1948)	KEA	KERTAU 1948
			USER DEFINED <i>n</i>
RF	GRS 80	NAR-A	NA 83 (ALASKA)
		NAR-E	NA 83 (ALUT IS)
		NAR-B	NA 83 (CANADA)
		NAR-C	NA 83 (CONUS)
		NAR-H	NA 83 (HAWAII)
		NAR-D	NA 83 (MX&C AM)
		SIR	SIRGAS
	USER DEFINED <i>n</i>		
HE	HELMERT	OEG	OLD EGYPT 1907
			USER DEFINED <i>n</i>
HO	HOUGH 1960	ENW	WAKE-ENIWETOK
			USER DEFINED <i>n</i>
ID	INDONESIAN 1974	IND	INDONESIAN 1974
			USER DEFINED <i>n</i>
IN	INTERNATIONAL	AIN-A	AIN ABD 70 (BAR)
		AIN-B	AIN ABD 70 (SAU)
		ASC	ASCENSION IL 58
		ATF	ASTRO BEACON E
		SHB	ASTRO DOS 71/4
		TRN	ASTRO TERN IL
		ASQ	ASTRO STA 1952
		IBE	BELLEVUE IGN
		BID	BISSAU
		BOO	BOGOTA OBSERVTY
		CAZ	CAMP AREA ASTRO
		CAI	CAMPO INCHAUSPE
		CAO	CANTON ASTRO 66
		CHI	CHATHAM IL 71
		CHU	CHUA ASTRO
		COA	CORREGO ALEGRE
		GIZ	DOS 1968
		EAS	EASTER IL 67
		EUR-M	EUR 50 (MEAN)
		EUR-E	EUR 50 (CYPRUS)
		EUR-F	EUR 50 (EGYPT)
		EUR-G	EUR 50 (BRT IL)
		EUR-B	EUR 50 (GREECE)
		EUR-H	EUR 50 (IRAN)
		EUR-S	EUR 50 (IRAQ)
		EUR-I	EUR 50 (SARDIN)
		EUR-J	EUR 50 (SICILY)
		EUR-L	EUR 50 (MALTA)
		EUR-C	EUR 50 (NOR&FN)

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
IN -cont		EUR-D	EUR 50 (PGL&SP)
		EUR-A	EUR 50 (W EUR)
		EUR-T	EUR 50 (TUNISA)
		EUS	EUR 79
		GAA	GAN 1970
		GEO	GEOD DATUM 49
		GRA	GRACIOS BASE SW
		DOB	GUX 1 ASTRO
		HEN	HERAT NORTH
		HJO	HJORSEY 1955
		HKD	HONG KONG 1963
		HTN	HU-TZU-SHAN
		ISG	ISTS 061 AST 68
		IST	ISTS 073 AST 69
		JOH	JOHNSTON IL 61
		KEG	KERGUELEN IL 49
		KUS	KUSAIE ASTRO 51
		MID	MIDWAY ASTRO 61
		NAP	NAPARIMA BWI
		FLO	OBSERVIO MET 39
		OHI-M	OLD HWN (MEAN)
		OHI-A	OLD HWN (HAWAI)
		OHI-B	OLD HWN (KAUAI)
		OHI-C	OLD HWN (MAUI)
		OHI-D	OLD HWN (OAHU)
		PLN	PICO DE LAS NVS
		PIT	PITCAIRN AST 67
		POS	PORTO SANTO 36
		PRP-M	PR SA 56 (MEAN)
		PRP-A	PR SA 56 (BOLV)
		PRP-B	PR SA 56 (N CH)
		PRP-C	PR SA 56 (S CH)
		PRP-D	PR SA 56 (COLM)
		PRP-E	PR SA 56 (ECUD)
		PRP-F	PR SA 56 (GUYN)
		PRP-G	PR SA 56 (PERU)
		PRP-H	PR SA 56 (VENZ)
		HIT	PR S CHILE 1963
		QAT	QATAR NATIONAL
		QUO	QORNOQ
		REU	REUNION
		MOD	ROME 1940
		SAE	SANTO DOS 1965
		SAO	SAO BRAZ
		SAP	SAPPER HILL 43
		SGM	SELVAGEM GRANDE
		TAN	TANANARIVE OBS
	TDC	TRISTAN AST 68	
	WAK	WAKE ISLAND AST	

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
IN -cont		YAC	YACARE
		ZAN	ZANDERIJ
			USER DEFINED <i>n</i>
KA	KRASSOVSKY 1940	AFG	AFGOOYE
		PUK	PULKOVO 1942
		SPK-A	S-42 (HUNGARY)
	KRASSOVSKY 1940	SPK-B	S-42 (POLAND)
		SPK-C	S-42 (CZECH)
		SPK-D	S-42 (LATVIA)
		SPK-E	S-42 (KAZAKSTN)
		SPK-F	S-42 (ALBANIA)
		SPK-G	S-42 (ROMANIA)
	USER DEFINED <i>n</i>		
AM	MOD AIRY	IRL	IRELAND 1965
			USER DEFINED <i>n</i>
FA	MOD FISCHER 60	SOA	SOUTH ASIA
			USER DEFINED <i>n</i>
SA	SO AMERICAN 69	SAN-M	SA 69 (MEAN)
		SAN-A	SA 69 (ARGENTA)
		SAN-B	SA 69 (BOLIVIA)
		SAN-C	SA 69 (BRAZIL)
		SAN-D	SA 69 (CHILE)
		SAN-E	SA 69 (COLMBIA)
		SAN-F	SA 69 (ECUADOR)
		SAN-J	SA 69 (GALP IL)
		SAN-G	SA 69 (GUYANA)
		SAN-H	SA 69 (PARAGUA)
		SAN-I	SA 69 (PERU)
		SAN-K	SA 69 (TRN&TBG)
		SAN-L	SA 69 (VENEZLA)
	USER DEFINED <i>n</i>		
WD	WGS 72		WGS 72
			USER DEFINED <i>n</i>
WE	WGS 84	KGS	KOREAN GS 1995
			WGS 84
			USER DEFINED <i>n</i>
	USER DEFINED <i>n</i>	USER DEFINED <i>n</i>	

\* ID per NIMA TR 8350.2, third edition, January 2000 update.  
*n* = index number 1 or 2.

**NOTES**

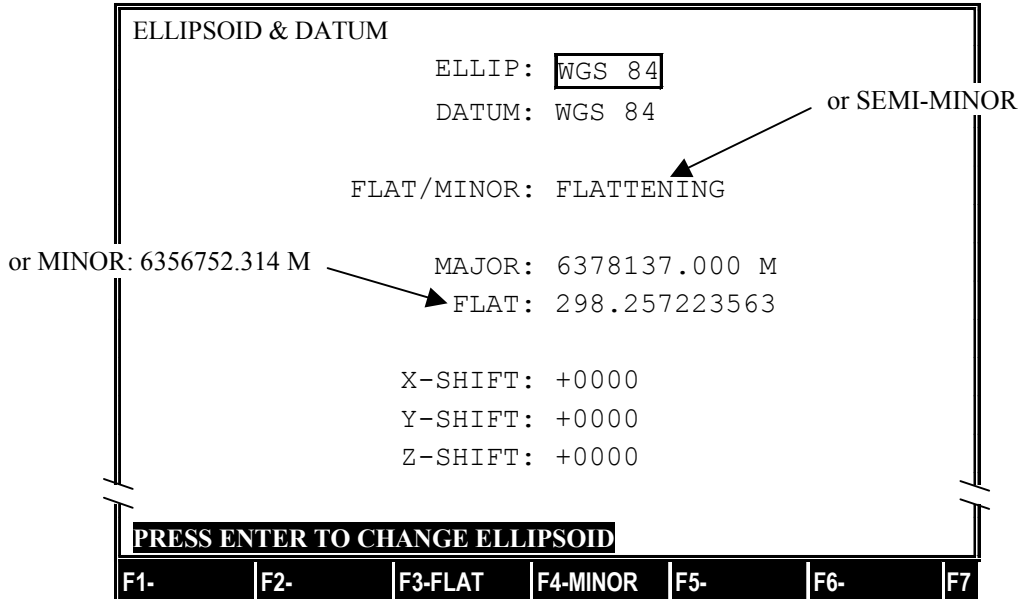
- A new datum must be selected if a new ellipsoid is selected.
- User defined ellipsoid and datum parameters are retained by IPADS until changed by operator.
- User defined datum shifts must be entered if a user-defined ellipsoid is selected.
- ELLIPSOID & DATUM page displays the second ellipsoid parameter either as inverse flattening (FLAT) or semi-minor axis (MINOR).

**3-11. Configuration - Continued**

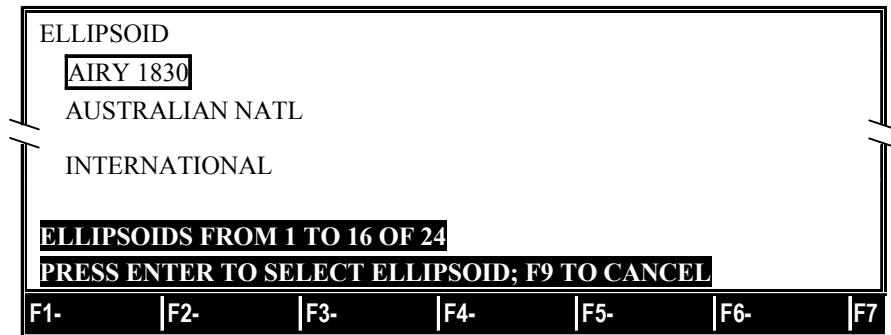
**(2) Select ellipsoid and datum.**

Perform the following steps to set a predefined ellipsoid and datum or previously entered user-defined ellipsoid and datum parameters when ellipsoid is changed:

- (a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed showing current ellipsoid and datum parameters. Cursor box is on ELLIP field. Function key line shows F3-FLAT, F4-MINOR, and F9-EXIT.



- (b) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.
- (c) If desired ellipsoid is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling.



- (d) Scroll to desired ellipsoid and press **ENTER**. DATUM page is displayed with a list of datums associated with selected ellipsoid. Function key line shows F9-CANCEL.

DATUM - ELLIPSOID: INTERNATIONAL						
AIN ABD 70 (BAR)						
AIN ABD 70 (SAU)						
CORREGO ALEGRE						
<b>DATUMS FROM 1 TO 16 OF 82</b>						
<b>PRESS ENTER TO SELECT DATUM; F9 TO CANCEL</b>						
F1-	F2-	F3-	F4-	F5-	F6-	F7

- (e) If desired datum is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling. Some ellipsoids have several pages of associated datums.
- (f) Scroll to desired datum and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections and parameters. Function key legend shows F2-USE ALL, F3-FLAT, F4-MINOR, and F9-EXIT.
- (g) If ellipsoid and datum selections are incorrect, press **F9** to cancel and retain current settings or repeat procedure with step 3-11d(2).
- (i) If selections are correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed with function key legend F3-FLAT, F4-MINOR, and F9-EXIT.
- (j) Press **F9** to exit ELLIPSOID & DATUM page.

### (3) Select datum.

Perform the following steps to set a predefined datum or previously entered user defined datum, when ellipsoid has not changed:

- (a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed, showing current ellipsoid and datum parameters. Cursor box is on ELLIP field. Function key line shows F3-FLAT, F4-MINOR, and F9-EXIT.
- (b) Scroll to DATUM field and press **ENTER**. DATUM page is displayed with a list of datums associated with the ellipsoid. Function key line shows F9-CANCEL.
- (c) If desired datum is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling. Some ellipsoids have several pages of associated datums.
- (d) Scroll to desired datum and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selection and parameters. Function key line shows F2-USE ALL, F3-FLAT, F4-MINOR, and F9-CANCEL.
- (e) If datum selection is incorrect, press **F9** to cancel and retain current settings or repeat procedure with step (a).
- (f) If datum selection is correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed. Function key line shows F3-FLAT, F4-MINOR, and F9-EXIT.
- (g) Press **F9** to exit ELLIPSOID & DATUM page.

### 3-11. Configuration – Continued

#### (4) Enter user-defined ellipsoid and datum.

Perform the following steps to enter user defined ellipsoid and datum parameters:

- (a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed, showing current ellipsoid and datum parameters. Cursor box is on ELLIP field. Function key line shows F3-FLAT, F4-MINOR, and F9-EXIT.
- (b) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.
- (c) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, on second page and press **ENTER**. DATUM page is displayed listing USER DEFINED 1 and USER DEFINED 2. Function key line shows F9-CANCEL.
- (d) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections. Function key line shows F2-USE ALL, F3-FLAT, F4-MINOR, and F9-CANCEL.
- (e) Second ellipsoid parameter can be entered as semi-minor axis or inverse flattening (i/f). Current selection is displayed next to FLAT/MINOR. Press **F3** to enter inverse flattening or **F4** for semi-minor axis.
- (f) Scroll to MAJOR field and enter semi-major axis value in meters.
- (g) Scroll to FLAT or MINOR field and enter inverse flattening value or semi-minor axis value in meters.
- (h) Scroll to X-SHIFT field and enter x-axis datum shift value in meters.
- (i) Scroll to Y-SHIFT field and enter y-axis datum shift value in meters.
- (j) Scroll to Z-SHIFT field and enter z-axis datum shift value in meters.
- (k) Verify entered parameters are correct. Scroll to an erroneous parameter and enter it or press **F9** to cancel and retain current settings.
- (l) If all parameters are correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed with function key line F3-FLAT, F4-MINOR, and F9-EXIT.
- (m) Press **F9** to exit ELLIPSOID & DATUM page.

#### (5) Select predefined ellipsoid and enter user-defined datum.

Use this procedure to select a predefined ellipsoid and enter user-defined datum parameters.

- (a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed, showing current ellipsoid and datum parameters. Cursor box is on ELLIP field. Function key line shows F3-FLAT, F4-MINOR, and F9-CANCEL.
- (b) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.
- (c) If desired ellipsoid is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling.
- (d) Scroll to desired ellipsoid and press **ENTER**. DATUM page is displayed with a list of datums associated with selected ellipsoid. Function key line shows F9-CANCEL.
- (e) If USER DEFINED 1 and USER DEFINED 2 are not listed, press **FNC Pg Dn** to display next page, scroll to bottom of list and continue scrolling, or press **FNC END** to display last page. Some ellipsoids have several pages of associated datums.

- (f) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections. Function key line shows F2-USE ALL, F3-FLAT, F4-MINOR, and F9-CANCEL.
- (g) Scroll to X-SHIFT field and enter x-axis datum shift value in meters.
- (h) Scroll to Y-SHIFT field and enter y-axis datum shift value in meters.
- (i) Scroll to Z-SHIFT field and enter z-axis datum shift value in meters.
- (j) Verify entered parameters are correct. Scroll to an erroneous parameter and enter it or press **F9** to cancel and retain current settings.
- (k) If all parameters are correct, press **F2**. SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed. Function key line shows F3-FLAT, F4-MINOR, and F9-EXIT.
- (l) Press **F9** to exit ELLIPSOID & DATUM page.

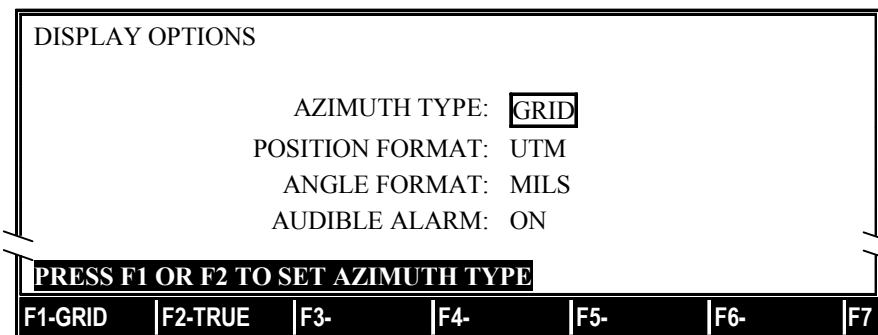
**e. Display Options.**

IPADS display parameters can be set for: azimuth type, grid or true (geodetic); position coordinate format, UTM or latitude and longitude in decimal degrees or degrees, minutes, and seconds; angle format in mils, decimal degrees or degrees, minutes, and seconds; and audible alarm, on or off. Perform the following steps to change display options:

**NOTES**

- Menu on DISPLAY OPTIONS page may be scrolled through using  $\uparrow$  and  $\downarrow$ . This does not change current settings. Press **F9** to return to MENU when all changes are made.
- Normal display settings for field artillery survey are: grid azimuth, UTM coordinates, angles in mils, and audible alarm on.

- (1) Scroll to DISPLAY OPTIONS on MENU and press **ENTER**. DISPLAY OPTIONS page is displayed with cursor box on AZIMUTH TYPE field. Function key line shows F1-GRID, F2-TRUE, and F9-MENU.
- (2) To change AZIMUTH TYPE, press **F1** for grid azimuth or **F2** for true (geodetic) azimuth. AZIMUTH TYPE field reflects the selection, cursor box moves to POSITION FORMAT field, and function key line shows F1-UTM, F2-DMS, F3-D.D, and F9-MENU.



- (3) To change POSITION FORMAT: press **F1** for UTM coordinates; **F2** for latitude and longitude in degrees, minutes and seconds; or **F3** for latitude and longitude in decimal degrees. POSITION FORMAT field and CURRENT PLUMB BOB DATA reflect the new format, cursor box moves to ANGLE FORMAT field, and function key line shows F1-MILS, F2-DMS, F3-D.D, and F9-MENU.

**3-11. Configuration – Continued**

CURRENT PLUMB BOB DATA	
EAST:	522932.00 M
NORTH:	4527303.00 M
ALTITUDE:	326.6 M
GRID ZONE:	18
ELLIP:	WGS 84
DATUM:	WGS 84

**UTM Position Format**

CURRENT PLUMB BOB DATA	
LAT:	40/53/47.389/N
LONG:	074/43/39.919/W
ALTITUDE:	326.6 M
ELLIP:	WGS 84
DATUM:	WGS 84

**Degree, Minute, Second  
Position Format**

CURRENT PLUMB BOB DATA	
LAT:	40.8964968/N
LONG:	074.7277552/W
ALTITUDE:	326.6 M
ELLIP:	WGS 84
DATUM:	WGS 84

**Decimal Degree Position  
Format**

- (4) To change ANGLE FORMAT, press **F1** for mils, **F2** for degrees, minutes and seconds, or **F3** for decimal degrees. ANGLE FORMAT field and HDNG reflect the new format, cursor box moves to AUDIBLE ALARM field, and function key line shows F1-ON, F2-OFF, and F9-MENU.

HDNG: 6398.59 MILS
--------------------

**Mils Angle Format**

HDNG: 359/49/18 DMS
---------------------

**Degrees, Minutes, Seconds  
Angle Format**

HDNG: 359.822 DEG
-------------------

**Decimal Degrees Angle  
Format**

- (5) To turn AUDIBLE ALARM on or off, press **F1** for ON or **F2** for OFF. AUDIBLE ALARM field reflects the selection; cursor box will move to AZIMUTH TYPE field, function key line shows F1-GRID, F2-TRUE, and F9-MENU.
- (6) Press **F9** to return to MENU when display options are set.

**f. Grid Zone**

GRID ZONE is displayed on MENU only when display position format is UTM and current IPADS position is within 40 kilometers of a UTM grid zone boundary. When operating within 40 kilometers of a UTM grid zone boundary, UTM coordinates can be displayed with respect to the normal grid zone or the extended zones east or west of the boundary. EXT after the zone number indicates UTM coordinates are relative to extended east or west zone. Perform the following steps to change grid zone reference:

- (1) Scroll to GRID ZONE on MENU and press **ENTER**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx), F3 FOR EAST GZ (yy), where xx is the extended west zone number and yy is the extended east zone number. Function key line shows F1-NORMAL, F2-WEST GZ, F3 EAST GZ, and F9-EXIT.

CURRENT PLUMB BOB DATA	
EAST:	239632.00 M
NORTH:	4303840.50 M
ALTITUDE:	326.6 M
GRID ZONE:	18 EXT
ELLIP:	WGS 84
DATUM:	WGS 84



- (2) To change ZONE IN USE, press **F1** for normal zone, **F2** for extended west zone, or **F3** for extended east zone. Selection is displayed in ZONE IN USE field.

ZONE FUNCTION

ZONE IN USE: **NORMAL**

PRESS F1 FOR NORMAL (xx); F2 FOR EXTENDED (yy) GRID ZONE

F1-NORMAL | F2-EXTEND | F3- | F4- | F5- | F6- | F7

- (3) If setting is correct, press **F9** to exit ZONE FUNCTION page.

### NOTES

- When connected to FOS, IPADS time automatically sets to FOS time. There is no need to manually set IPADS time.
- IPADS time sets to that in TIME ENTRY field on DATE/TIME page when **F2-USE ALL** is pressed. To perform a time hack, enter (future) time of the time hack in the TIME ENTRY field and press **F2** at the time hack.
- Changing time zone by itself does not change displayed time. When time zone is changed, correct time for new time zone must be entered in TIME ENTRY field.
- Changing IPADS date and time also sets the computer system date and time. If running IPADS emulator software on a computer other than IPADS CDU, be careful that changing its system time does not adversely affect other applications.

### g. Date and Time

Date and time are displayed on right side of mode line. Perform the following steps to change date and time:

DATE/TIME

DATE SET: **24/01/04**

TIME SET: 16:01:45

TIME ZONE: N

DAYLIGHT SAVINGS: YES

ENTER DATE USING DD/MM/YY FORMAT

F1- | F2-USE ALL | F3- | F4- | F5- | F6- | F7

- (1) Scroll to DATE/TIME on MENU and press **ENTER**. DATE/TIME page is displayed with cursor box on DATE SET field. Function key line shows F2-USE ALL and F9-MENU.
- (2) Change date by entering today's date for desired time zone in DD/MM/YY format.

### 3-11. Configuration – Continued

- (3) Scroll to TIME SET field and enter correct time for desired time zone in 24 hour HH:MM:SS format.
- (4) Scroll to TIME ZONE field and enter letter corresponding to desired time zone.
- (5) Scroll to DAYLIGHT SAVINGS field. Function key line shows F2-USE ALL, F3-YES, F4-NO, and F9-MENU.
- (6) Press **F3** to enable daylight savings time or **F4** to disable it.
- (7) When settings are correct, press **F2-USE ALL** at the time hack. INFO: DATE AND TIME HAVE BEEN SET is displayed.
- (8) Press **F9** to return to MENU.

### 3-12. Initialization, Hot Start.

**CAUTION**

IPADS must be initialized on a firm surface. Alignment failure can result from vehicle movement on soft surfaces such as mud, snow, or ice, and shocks caused by operator movement or wind gusts. Operator should ensure vehicle is off and stand clear of vehicle during alignment. Face vehicle into high winds and block wheels.

#### NOTE

IPADS should be left running even if the vehicle must be turned off. Hot start should only be used when it is absolutely necessary to shut down IPADS.

- a. IPADS must be initialized before it can survey. Two types of initialization are used, “normal” and “hot start.” To save time, IPADS tries a “hot start” using position and azimuth stored at last shutdown. If IPADS senses motion since the last shutdown, it automatically switches to normal initialization where IPADS automatically aligns after operator enters approximate IPADS position.
- b. Initialization site must have a firm surface. Site horizontal position coordinates should be known to  $\pm 10$  meters. Initialization takes 9-20 minutes depending upon temperature and latitude of operation.

#### NOTE

During initialization of the IPADS, the alignment countdown should appear in the upper left-hand corner of the control and display unit (CDU). If the alignment countdown does not appear in the upper left-hand corner, recycle or reboot the CPNU one time. If this does not clear the problem, go to paragraph 4-6, Operator Troubleshooting.

#### c. Pre-operations.

- (1) With the IPADS operating in the survey mode, close and adjust the current survey.
- (2) With vehicle parked at a suitable site, apply emergency/parking brake and perform a single mark recording at the marked coordinates. With the operator outside the vehicle, power down the IPADS.

- (3) Do not allow excessive movement into or out of the vehicle. Excessive movement can interfere with Hot Start even with the system off.

**d. Conducting operations.**

- (1) Without moving or getting into the vehicle, turn on the vehicle and power up the IPADS.
- (2) The IPADS will internally and automatically check if a hot start is possible. If the IPADS can conduct a hot start it will automatically align using the last stored survey position and direction stored in the database. If the IPADS cannot conduct a hot start the operator must perform a normal initialization using the coordinates from the mark conducted in step 3-12c(1).
- (3) Once alignment is completed IPADS can begin survey operations.
- (4) If an adjustment was not conducted prior to performing a hot start, update over an SCP must be completed prior to conducting survey operations.

**e. Post operations.**

Do not move the vehicle or readjust cargo: Excessive movement will prevent IPADS from being able to conduct a hot start

**f. IPADS position initialization.**

IPADS requires position initialization if indicated by a flashing "F3-UPDT" on the function key line. IPADS does not need to be initialized at a SCP; however, initialization site horizontal coordinates must be accurate within  $\pm 100$  meters and altitude within  $\pm 10$  meters.

- (1) When initialized with approximate coordinates, position must be updated at a SCP after alignment is finished and before starting the survey.
- (2) Use vehicle plumb bob reference for initializing IPADS. If initializing IPADS at a SCP where survey marker is offset from the vehicle, use approximate initial coordinates. Theodolite can be set up over marker while IPADS is aligning and a theodolite position update performed when alignment is finished.
- (3) Horizontal position and altitude are required for position initialization.
- (4) Set ellipsoid, datum, and position coordinate type before entering initial position.
- (5) The procedure to enter initial positions is similar for UTM and geodetic (latitude and longitude) coordinates

**3-13. Entering Initial Position (UTM or Geodetic).**

- a. Perform the following steps to initialize position and altitude by selecting a point from the IPADS database, entering coordinates for a new point, or searching for a point name:
  - (1) Verify position format is set correctly, paragraph 3-11e(3)
  - (2) From MENU, press **F3**. UPDATE: page is displayed with PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE on information line and F1-UPDT-PB, F2-UPDT-↵, and F9-EXIT on function key line.
  - (3) Press F1. UPDATE: PLUMB BOB: UTM or geodetic page is displayed with cursor box on PNT NAME: field. Function key line shows F2-NEW, F3-SEL PT, and F9-EXIT.
- b. Perform the following steps to select an existing point from database list:

**CAUTION**

If F5 (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y** permanently deletes all points in displayed list.

- (1) Press **F3**. POINT LIST page is displayed with function key lines F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

POINT LIST: UTM			
NAME	EAST M	NORTH M	GZ
-----	-----	-----	---
> ALPHA 1	522930.45	4527353.78	18
> ALPHA 2	522234.18	4527329.87	18
> BETA 1	527764.15	4520037.22	18
> -----	-----	-----	---
> -----	-----	-----	---

ALL WAY PTS: FROM 1 TO 3 OF 3  
 INFO: READY

F1-
F2-NEW
F3-SEL PT.
F4-FILTER
F5-DEL ALL
F6-
F7

- (2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Waypoints	FL:WAY	ALL WAY PTS	Points created by the user as Navigation waypoints.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

- (3) Scroll to desired initialization point (e.g. point ALPHA 2) and press **F3**. UPDATE: PLUMB BOB: UTM or GEODETIC page is displayed with fields populated for the selected point.

```

UPDATE:  PLUMB BOB: UTM

      PNT NAME: ALPHA 2
            EAST: 522234.18 M
            NORTH: 4527329.87 M
            ALTITUDE: 106.9 M
            GRID ZONE: 18

> 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION

F1-  | F2-NEW | F3-SEL PT. | F4-  | F5-  | F6-  | F7
  
```

- (4) PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.
- (5) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key lines F2-NEW, F3-SEL PT., and F9-EXIT.
- (6) If displayed coordinates are incorrect, press any other key to reject the update. Then press **F2** to enter coordinates for a new point, paragraph 3-13c(1), or press **FNC DEL** to clear PNT NAME field, then **F3** to select a different point from database list, paragraph 3-13f(1).
- (7) If displayed data are correct, press **F9** to return to MENU. Wait until alignment is complete before moving vehicle.

### 3-13. Entering Initial Position (UTM or Geodetic) - Continued

c. Perform the following steps to enter coordinates for a new point:

- (1) Press **F2**. POINT EDITOR page is displayed with cursor box on a pre-assigned name and function key line shows F2-USE ALL and F9-EXIT.

POINT EDITOR:

TYPE: USERDEF

PNT NAME: PNTXXXXXXXXXXXXXX

ELLIP: WGS 84

DATUM: WGS 84

EAST: 000000.00 M

NORTH: 00000000.00 M

ALTITUDE: 0000.0 M

GRID ZONE: 00

CREATION DATE: 00/00/00

CREATION TIME: 00:00:00

DESCRIPTION

>

PRESS ENTER TO ACCEPT NAME OR TYPE NEW NAME

F1-
F2-USE ALL
F3-
F4-
F5-
F6-
F7

- (2) Press **ENTER** to accept pre-assigned name or press **FNC DEL** to clear PNT NAME field and enter the new name.
- (3) Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d(5).
- (4) Verify datum is correct for coordinates being entered. If datum is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d(5).

d. For UTM coordinates, perform the following steps:

- (1) Scroll to EAST field and enter easting value in meters.
- (2) Scroll to NORTH field and enter northing value in meters.
- (3) Scroll to ALTITUDE field and enter altitude value in meters.
- (4) Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere or negative (-) UTM grid zone value for Southern Hemisphere.
- (5) Optional – scroll to DESCRIPTION and enter a description of the point.
- (6) Verify entered data. If it is correct, press **F2**. If not, scroll to incorrect field and enter correct data.

- e. For GEODETIC coordinates, perform the following steps:
- (1) Scroll to LAT field and enter latitude value. Press **N** for Northern Hemisphere, **S** for Southern.
  - (2) Scroll to LONG field and enter longitude value. Press **E** for Eastern Hemisphere, **W** for Western.
  - (3) Scroll to ALTITUDE field and enter altitude value.
  - (4) Optional – scroll to DESCRIPTION and enter a description of the point.
  - (5) Verify entered data. If it is correct, press **F2**. If not, scroll to incorrect field and enter correct data.
  - (6) UPDATE: PLUMB BOB: UTM page is displayed populated with parameters for the new point. PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.
  - (7) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key line F2-NEW, F3-SEL PT., and F9-EXIT.
  - (8) If displayed coordinates are incorrect, press any other key to reject the update. Then press **F2** to enter coordinates for a new point, paragraph 3-13c, or press **FNC DEL**, to clear PNT NAME field and then **F3** to select a different point from database list, paragraph 3-13f.
  - (9) If displayed data are correct, press **F9** to return to menu. Wait until alignment is complete before moving the vehicle.
- f. Perform the following steps to search for a point by name from POINT LIST, paragraph 3-28a.
- (1) Enter point name in PNT NAME field (e.g. point ALPHA 2) and press **F3**. If point is found in POINT LIST, UPDATE: PLUMB BOB: UTM or GEODETIC page is displayed with fields populated for the selected point and function key legends F2-NEW, F3-SEL PT., and F9-EXIT.

UPDATE: PLUMB BOB: UTM						
	PNT NAME:	ALPHA 2				
	EAST:	522234.18 M				
	NORTH:	4527329.87 M				
	ALTITUDE:	106.9 M				
	GRID ZONE:	18				
> 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION						
F1-	F2-NEW	F3-SEL PT.	F4-	F5-	F6-	F7

- (2) If point name was not found in database, ERROR: POINT NOT FOUND; PRESS F2 TO CREATE POINT is displayed. Press **FNC DEL** followed by **F2** to enter coordinates for a new point, paragraph 3-13c(1); or press **FNC DEL** to clear PNT NAME field and then **F3** to select a point from database list, paragraph 3-13f(1), or reenter point name, paragraph 3-13c(1).
- (3) PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed.
- (4) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key line F2-NEW, F3-SEL PT., and F9-EXIT.

**3-13. Entering Initial Position (UTM or Geodetic) - Continued**

- (5) If displayed coordinates are incorrect, press any other key to reject the update. Then press **FNC DEL** followed by **F1** and **F2** to enter coordinates for a new point, paragraph 3-13c, or press **FNC DEL**, to clear PNT NAME field and then **F3** to select a different point from database list, paragraph 3-13f(1).
- (6) If displayed coordinates are correct, press **Y**, then press **F9** to return to MENU. Wait until alignment is complete before moving vehicle.

POINT LIST: (D/M/S)		
NAME	LAT (D/M/S)	LONG (D/M/S)
> ALPHA 1	40/53/49/N	74/43/40/W
> ALPHA 2	40/53/48/N	74/44/10/W
> BETA 1	40/53/48/N	74/40/13/W
> -----	--/--/--	---/--/--
> -----	--/--/--	---/--/--

ALL WAY PTS: FROM 1 TO 3 OF 3  
 INFO: READY

F1- | F2-NEW | F3-SEL PT. | F4-FILTER | F5-DEL ALL | F6- | F7

**3-14. Zero-velocity Updates (ZUPTs).**

**CAUTION**

Failure to perform ZUPTs when requested may cause survey mission failures. IPADS indicates degraded operation (DGR) when the time since the last ZUPT exceeds the ZUPT interval by 30 seconds.

**NOTES**

- ZUPTs should be performed whenever vehicle is stopped.
  - NXT ZUPT shows the time remaining until a ZUPT stop is required.
  - Frequent ZUPTs improve survey accuracy.
  - Helicopters must land for ZUPTs.
  - Audible alarm is silenced by pressing any key.
- a. ZUPTs are needed for accurate surveying. One begins automatically during initialization. Thereafter, IPADS requests ZUPT stops at 5-minute intervals in 4TH order survey or 10-minute intervals in 5TH order survey. IPADS automatically performs a ZUPT at all mark and update procedures.
  - b. IPADS requests a ZUPT by flashing function key line F4-“ZUPT”, flashing “NXT ZUPT” indicator, and sounding audible alarm 30 seconds before next required ZUPT. Sequence of operations to perform a ZUPT is:



**Table 3-4 – ZUPT Operation**

<b>Operation</b>	<b>F4 Legend</b>	<b>NXT ZUPT Time</b>	<b>SYSTEM STATUS &amp; MESSAGES</b>
Stop vehicle and set brake.	ZUPT or “ZUPT”	Counts down or 00:00	PRESS Y TO ZUPT  ZUPT COMPLETE IN: xx SECONDS  “-GO-”
Press <b>F4</b> .	ZUPT or “ZUPT”	Counts down or 00:00	
Press <b>Y</b> .	ZUPT or “ZUPT”	Counts down or 00:00	
ZUPT completed.	ZUPT	05:00 or 10:00	
Vehicle moves.	ZUPT	Counts down	

- c. Operator has 30 seconds to stop the vehicle and initiate a ZUPT. If a ZUPT is not initiated within 30 seconds of NXT ZUPT time becoming 00:00, survey order will change to DGR, PERF. ERROR; SEE STATUS will flash under SYSTEM STATUS & MESSAGES, and audible alarm will sound with a different tone than for a ZUPT request.
- (1) Press **F8** to display STATUS page and, depending on survey order, will show:
    - ERROR: 4TH ORDER ZUPT INTERVAL EXCEEDED  
STOP AT AN SCP AND UPDATE POSITION AND ALTITUDE;  
OR SWITCH TO 5TH ORDER SURVEY (10 MINUTES BETWEEN ZUPTS ); or
    - ERROR: 5TH ORDER ZUPT INTERVAL EXCEEDED  
STOP AT AN SCP AND UPDATE POSITION AND ALTITUDE
  - (2) Press **F9** to exit to previous page.
  - (3) If 4TH order ZUPT interval was exceeded, a position update must be performed at a known SCP to restore survey accuracy, or you may switch to 5TH order with reduced accuracy, paragraph 3-14c.
  - (4) If 5TH order ZUPT interval was exceeded, a position update must be performed at a known SCP to restore survey accuracy.
- d. If vehicle moves before a ZUPT is completed, NXT TIME automatically reverts to the prior zero-velocity countdown time.

### 3-15. Updating.

#### NOTES

- An update may be cancelled any time before completion by pressing **F9**. A completed update cannot be eliminated.
- Position and altitude updates may be performed independently.

### 3-15. Updating - Continued

- a. Inserting accurate position and/or altitude data into IPADS is called updating. All updates are performed using known survey control points. IPADS must be updated after initialization before it can provide accurate survey data. The first update after initialization is called the initial update. The survey mission starts after the initial update. It is essential to update IPADS at the end of a survey mission.
- b. At update completion, IPADS automatically adjusts all data recorded since the previous update. Adjusted data are stored in the SCP database filter. Unadjusted data are stored in the USER DEF database filter with the first character of the name changed to U.
- c. After the operator has entered the known trig list position and/or altitude data of the survey control point into the IPADS, the system tests the difference between the update coordinates (trig list data) and the actual IPADS position coordinates. If the difference (error) is within the acceptable tolerance, the update is accepted.

### 3-16. Plumb Bob Position Update.

Perform the following steps to update and adjust UTM or Geodetic position and/or altitude by selecting a point from IPADS database, entering coordinates for a new point or searching for a point name:

#### NOTES

- Procedures for updating UTM or geodetic coordinates are similar. UTM will be used in the examples. See paragraph 3-13e for Geodetic coordinate entry.
  - IPADS performs an update only if no points were marked since the last update. IPADS performs an update and adjusts previously marked points if points were marked since the last update. Indications differ for update, only, and update with adjust are as described below:
- a. Maneuver vehicle to center plumb bob reference point over SCP survey marker.
  - b. Initiate a ZUPT, paragraph 3-14, Table 3-4.
  - c. Verify position format is set to format of update coordinates, paragraph 3-11e(3).
  - d. From MENU, MAP or NAVIGATION AID page, press **F3**. UPDATE page is displayed with **PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE** on information line and **F1-UPDT-PB, F2-UPDT-↖, and F9-EXIT** on function key line.
  - e. Press **F1**. UPDATE: PLUMB BOB: page is displayed with cursor box on UPDATE TYPE FIELD and function key legend line **F1-POS+ALT, F2-POS, F3-ALT, and F9-EXIT**.
  - f. Press **F1** to update position and altitude, **F2** to update position only, or **F3** to update altitude only. Cursor box moves to PNT NAME: field. Function key line shows **F2-NEW, F3-SEL PT, and F9-EXIT**.

```

UPDATE:  PLUMB BOB:  UTM

UPDATE TYPE:  POSITION AND ALTITUDE
PNT NAME:  -----
EAST:      000000.00 M
NORTH:    00000000.00 M
ALTITUDE:      0000.0 M
GRID ZONE:      00

PRESS F1 – F3 TO SET UPDATE OPTIONS
F1-POS+ALT|F2-POS|F3-ALT|F4-|F5-|F6-|F7
  
```

g. Perform the following steps to select an existing point from POINT LIST:

- (1) Press F3. POINT LIST page is displayed with function key line F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

**CAUTION**

If F5 (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing Y permanently deletes all points in displayed list.

```

POINT LIST:  UTM
NAME          EAST M      NORTH M      GZ
-----
> ALPHA 1    522930.45  4527353.78  18
> ALPHA 2    522234.18  4527329.87  18
> BETA 1     527764.15  4520037.22  18
> -----
> -----
> -----

ALL WAY PTS: FROM 1 TO 3 OF 3
INFO: READY
F1-|F2-NEW|F3-SEL PT.|F4-FILTER|F5-DEL ALL|F6-|F7
  
```

- (2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing F4 until desired point filter type is displayed.
- (3) Scroll to desired update point (e.g. point ALPHA 2) and press F3. UPDATE: PLUMB BOB: UTM page is displayed with fields populated for the selected point. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

### 3-16. Plumb Bob Update - Continued

UPDATE:	PLUMB BOB:	UTM
UPDATE TYPE:	POSITION AND ALTITUDE	
PNT NAME:	ALPHA 2	
EAST:	522234.18	M
NORTH:	4527329.87	M
ALTITUDE:	106.9	M
GRID ZONE:	18	
<b>&gt; 100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION</b>		
<b>NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED</b>		
F1-	F2-NEW	F3-SEL PT.
F4-	F5-	F6-
F7		

- (4) Press **F3**. **PRESS Y TO UPDATE/ADJUST POINTS** is displayed. If radial error is within tolerance, press **Y**. Update is completed
- (5) One of the following messages is displayed if update coordinates are more than 100 meters from IPADS location or radial error exceeds adjustment tolerance:
  - **100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION**
  - **NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED**
  - **RAD ERR= xxxx.x M**
  - **ERROR: RAD ERR TOO LARGE TO ADJUST; PRESS Y TO UPDATE POSITION**
  - **NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED**
  - (a) Determine cause of error and take appropriate corrective action.
  - (b) Press **Y** to update using displayed data. Update is completed and **INFO: POSITION UPDATE COMPLETED** is displayed. Re-alignment will start. Previous data will not be adjusted.
  - (c) Press any key (other than **Y**) to cancel update.
  - (d) Press **FNC DEL** to clear PNT NAME field, then press **F2** to enter coordinates for a new point, paragraph 3-13c(1), or press **F3** to select a different point from POINT LIST, paragraph 3-13f(1).
- (6) Press **F9** to exit UPDATE page. If realignment was initiated, wait until alignment is complete before moving vehicle.

### 3-17. Theodolite Position Update.

Perform the following steps to update and adjust UTM or Geodetic position and/or altitude by selecting a point from IPADS database, entering coordinates for a new point, or searching for a point name:

#### NOTES

- Procedures for updating UTM or geodetic coordinates are similar. UTM will be used in the examples.
  - Because IPADS is offset from the update SCP marker, CURRENT PLUMB DATA coordinates will differ from update SCP coordinates when update is completed.
- a. Stop vehicle close to update SCP marker.
  - b. Exit vehicle and initiate a ZUPT, paragraph 3-14, Table 3-4.
  - c. Set up theodolite over SCP marker and achieve auto-reflection, paragraph 3-24(a).
  - d. Vehicle operator becomes the recorder for IPADS operator.
  - e. Measure and record vertical angle and offset distance, paragraph 3-24, subparagraphs b and d.
  - f. Verify position format is set to format of update coordinates, paragraph 3-11e(3), and angle format is set to format of theodolite, paragraph 3-11e(4).
  - g. From MENU, MAP or NAVIGATION AID page, press **F3**. UPDATE page is displayed with PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE on information line and F1-UPDT-PB, F2-UPDT-↖, and F9-EXIT on function key line.
  - h. Press **F2**. UPDATE: THEODOLITE: page is displayed with cursor box on DISTANCE TO PRISM field. Function key line shows F9-EXIT.

### 3-17. Theodolite Position Update - Continued

UPDATE:		THEODOLITE: UTM				
THEODOLITE DATA:						
DISTANCE TO PRISM:		0000.00 M				
VERT ANGLE TO PRISM:		+0000.000 MILS				
UPDATE TYPE: POSITION AND ALTITUDE						
PNT NAME: -----						
EAST:		000000.00 M				
NORTH:		00000000.00 M				
ALTITUDE:		0000.0 M				
GRID ZONE:		00				
ENTER DISTANCE TO PRISM (1 TO 3500 METERS)						
F1-	F2-	F3-	F4-	F5-	F6-	F7

- i. Enter distance to prism within the range of 1 to 3500 meters and press **ENTER**. Cursor box moves to VERT ANGLE TO PRISM field.
- j. Enter vertical angle from the theodolite to the porro prism within the range of -1511 to 1511 mils and press **ENTER**. Cursor box moves to UPDATE TYPE field. Function key line shows F1-POS+ALT, F2-POS, F3-ALT, and F9-EXIT.
- k. Press **F1** to update position and altitude, **F2** to update position only, or **F3** to update altitude only. Cursor box moves to PNT NAME: field. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.
  - (1) Perform the following steps to select an existing point from POINT LIST. Press **F3**. POINT LIST page is displayed with function key line F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

#### CAUTION

If **F5** (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS, OTHER KEY TO CANCEL Pressing **Y** permanently deletes all points in displayed list.

POINT LIST: UTM			
NAME	EAST M	NORTH M	GZ
> ALPHA 1	522930.45	4527353.78	18
> ALPHA 2	522234.18	4527329.87	18
> BETA 1	527764.15	4520037.22	18
> -----	-----	-----	---
> -----	-----	-----	---

ALL WAY PTS: FROM 1 TO 3 OF 3  
INFO: READY

F1- | F2-NEW | F3-SEL PT. | F4-FILTER | F5-DEL ALL | F6- | F7

- (2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing F4 until desired point filter type is displayed.
- (3) Scroll to desired update point and press F3 (e.g. point ALPHA 2). UPDATE: PLUMB BOB: UTM page is displayed with fields populated for the selected point. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.
- (4) PRESS Y TO UPDATE POSITION will be displayed if no points to adjust exist.

UPDATE: THEODOLITE: UTM	
THEODOLITE DATA:	
DISTANCE TO PRISM:	0012.34 M
VERT ANGLE TO PRISM:	-0067.890 MILS
UPDATE TYPE:	POSITION AND ALTITUDE
PNT NAME:	ALPHA 2
EAST:	522234.87 M
NORTH:	45277329.87 M
ALTITUDE:	106.9 M
GRID ZONE:	18

INFO: POSITION UPDATE COMPLETED

F1- | F2-NEW | F3-SEL PT. | F4- | F5- | F6- | F7

- (5) If points to adjust exist and are within tolerance for adjustment, RAD ERR= x.x M PRESS Y TO UPDATE/ADJUST POINTS is displayed. If radial error is within tolerance, press Y. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed.

**3-17. Theodolite Position Update - Continued**

UPDATE:	THEODOLITE: UTM					
THEODOLITE DATA:						
DISTANCE TO PRISM:	0012.34 M					
VERT ANGLE TO PRISM:	-0067.890 MILS					
UPDATE TYPE:	POSITION AND ALTITUDE					
PNT NAME:	ALPHA 2					
EAST:	522234.87 M					
NORTH:	45277329.87 M					
ALTITUDE:	106.9 M					
GRID ZONE:	18					
RAD ERR= x.x M						
<b>PRESS Y TO UPDATE/ADJUST POINTS</b>						
F1-	F2-NEW	F3-SEL PT.	F4-	F5-	F6-	F7

**3-18. Update Errors.**

- a. While updating the system, IPADS tests the difference between the update coordinates (trig list data) and the actual IPADS position coordinates.
- b. Depending on the difference and whether data will be adjusted, one of the following confirmation messages will be displayed:
  - PRESS Y TO USE POSITION
  - 100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION
  - RAD ERR= x.x M, PRESS Y TO UPDATE/ADJUST POINTS
  - RAD ERR= x.x M, ERROR: RAD ERR TOO LARGE TO ADJUST; PRESS Y TO UPDATE ONLY
- c. Operator must decide whether the radial error is low enough to adjust data based on the distance traveled and time since the last update. Operator will check the probable reason and take the appropriate corrective action(s) for high radial errors, table 3-5. Operator must decide whether to confirm update by pressing Y or cancel update by pressing F9.

**NOTE**

Update errors may occur at the initial SCP or at SCPs during the survey mission. This table is divided into two parts. Part I pertains to rejection at the initial update SCP. Part II comprises all other update rejections occurring during the survey mission or when closing the survey mission.



<b>Table 3-5 - UPDATE ERROR TROUBLESHOOTING</b>	
<b>PART I</b>	
Update Rejections at Initial Update SCP	
Reason for > 100 METERS FROM CURRENT message	Operator Corrective Action
1. Operator entered coordinates incorrectly	a. If displayed coordinates are incorrect, enter the correct coordinates. b. If displayed coordinates are correct, see part I, reason 2.
2. Accuracy of initialization coordinates is questionable	Check map spot or coordinates used to initialize system. If accuracy not within 100 meters, press <b>Y</b> to accept update. IPADS will align. If accuracy within 100 meters, see part I, reason 3.
3. Accuracy of initial update SCP is questionable	Press <b>F9</b> to cancel update. Proceed to another known SCP and update system.
<b>PART II</b>	
Update Rejections During or Closing Survey Mission	
Reason for high radial error	Operator Corrective Action
1. Operator entered coordinates incorrectly	a. If displayed coordinates are incorrect, enter the correct coordinates. b. If displayed coordinates are correct, see part II, reason 2.
2. Accuracy of present SCP is questionable	a. Press <b>F9</b> to cancel update. Proceed to another known SCP and update system. b. If update is accepted, continue with mission. The accuracy of the last SCP where update was rejected is questionable. c. If update is rejected, the accuracy of the initial update SCP or the initialization data is questionable. See part II, reason 3.
3. Accuracy of initial update is questionable, or initialization data was incorrect	Troubleshoot all data. Update over known accurate SCP. IPADS will align.

**3-19. PAE Code.**

At completion of a mark, IPADS summarizes the results by displaying the following on the MARK page:

PAE x x x (x means the value does not matter for this illustration)

- a. PAE stands for Position, Azimuth, Elevation (altitude). PAE code also is displayed on POINT EDITOR page when IPADS marked point data are displayed.
- b. A " - " (dash) means the parameter in that PAE code location was not marked. A "d" or "D" means the parameter in that PAE code location was marked using the vehicle drivers interface (plumb bob) reference point. A "t" or "T" means the parameter in that PAE code location was marked using a theodolite. Lower case "t" or "d" indicates the data are not adjusted. Upper case "T" or "D" indicates the data are adjusted. An "E" indicates the data for that PAE code location may not meet accuracy requirements and should not be used. PAE codes are summarized below:

PAE Code	Meaning
PAE ---	Point has not been marked
PAE t-t	Position and altitude have been marked, but not adjusted, using a theodolite.
PAE ttt	Position, azimuth and altitude have been marked, but not adjusted, using a theodolite.
PAE T-T	Position and altitude have been marked and adjusted using a theodolite.
PAE TTT	Position, azimuth and altitude have been marked and adjusted, using a theodolite.
PAE d-d	Position and altitude have been marked, but not adjusted, using drivers interface reference.
PAE ddd	Position, azimuth and altitude have been marked, but not adjusted, using drivers interface reference.
PAE D-D	Position and altitude have been marked and adjusted using drivers interface reference.
PAE DDD	Position, azimuth and altitude have been marked and adjusted, using drivers interface reference.
PAE E-E	Position and altitude have been marked but may not meet accuracy requirements.
PAE EEE	Position, azimuth and altitude have been marked but may not meet accuracy requirements.
PAE tEt	Position and azimuth have been marked, but not adjusted, using a theodolite. Azimuth has been marked but may not meet accuracy requirements.
PAE TET	Position and azimuth have been marked and adjusted using a theodolite. Azimuth has been marked but may not meet accuracy requirements.
PAE dEd	Position and azimuth have been marked, but not adjusted, using drivers interface reference. Azimuth has been marked but may not meet accuracy requirements.
PAE DED	Position and azimuth have been marked and adjusted using drivers interface reference. Azimuth has been marked but may not meet accuracy requirements.

- c. An "E" in position and altitude indicates the radial or total distance traveled limit was exceeded or the travel time between ZUPTs was exceeded. The STATUS page will identify the cause. Accuracy can be restored by performing a position update at a known SCP. If exceeding the 4TH order ZUPT interval caused the error indication, the operator may elect to switch to 5TH order survey if the reduced accuracy is acceptable for the mission.
- d. An "E" in azimuth of a 2-position azimuth mark indicates the distance between points was not at least 100 meters or the travel time between points was too long. This can be corrected by deleting the point from POINT LIST and repeating the mark.

### 3-20. Data Recall.

IPADS assigns a point name (which may be changed by the user) to identify the data when a mark or update is completed.

- a. The points may be reviewed in the POINT LIST page by pressing **F7** in the MENU, MAP, or NAVIGATION AID pages.
- b. The point name appears in the NAME column of the list.
- c. Scroll up or down the list until the point name is found.
- d. Press **ENTER** to recall all other data associated with the point, e.g. altitude, azimuth to one or two other points, PAE code, date and time of creation, and description.

### 3-21. Marking.

#### NOTES

- IPADS measures altitude at ground level under the plumb bob. If the survey marker is at a different height, adjust the altitude for the difference.
  - Marking points for both a HMMWV and a UH-60 are covered in this section.
- a. The establishment of survey coordinates and azimuth with IPADS is called “marking”. IPADS can store data for more than 360 positions. Marks are assigned names and are saved in the point database as discussed in paragraphs 3-27 and 3-28. The operator may change IPADS assigned names.
  - b. Positions can be established using the plumb bob as reference or can be offset from the IPADS system using a theodolite (optical position mark, no azimuth).
  - c. Azimuths to distant landmarks can be established using a theodolite (optical position and azimuth mark). An azimuth of a short line (100 to 1000 meters) can be established by marking both ends of the required azimuth line with IPADS (2-position azimuth mark using plumb bob) or using theodolite and performing an optical position and azimuth mark.
  - d. An optical position and azimuth mark requires the operator to auto-reflect, measure a horizontal angle, vertical angle, and the offset distance with a theodolite, paragraph 3-24. Marking procedures are described in paragraphs 3-21, 3-22, 3-23, and 3-25.
  - e. If the wrong vehicle has been selected for the vehicle in use, the effective position of the IPADS to the plumb bob reference point is incorrect and will provide incorrect mark/update information.
  - f. IPADS automatically assigns point names and mark identifiers at mark completion. Operator should change assigned names and identifiers to more meaningful descriptors.
  - g. After adjustment, IPADS stores adjusted data in the SCP and MARK POINT LISTs and unadjusted data in the USER DEF POINT LIST. First character in PNT NAME or MARK ID changes to “U” for unadjusted data. Where space permits, the first two characters of entered names and identifiers should be spaces to allow for unadjusted identification without changing the name or identifier.

### 3-22. Marking Position and Altitude Using Plumb Bob.

The following procedure establishes position and altitude coordinates of a point:

- a. Maneuver vehicle to place plumb bob over point to be established.
- b. When helicopter is landed and stationary, command a ZUPT if IPADS remains in NAVIGATION mode.
- c. Extend plumb bob arm out helicopter door and hang plumb bob.
- d. Set survey marker under plumb bob and drive witness stake. Stow plumb bob, plumb bob arm, and other equipment in vehicle.
- e. From MENU, MAP, or NAVIGATION AID page, press **F2**. MARK page will be displayed with function key legends F1-2POS, F2-1POS, F3-  $\nabla$  AZ, F4-  $\nabla$  SCP, and F9-EXIT.
- f. Press **F2**. SYSTEM STATUS & MESSAGES will show MARK – WAIT *x.x* SECONDS.
- g. At mark completion, MARK page shows data for the marked point with cursor box on PNT NAME field and INFO: MARK COMPLETE; PRESS ENTER TO EDIT POINT NAME is displayed. Function key line shows F9-EXIT.
- h. Press **ENTER** to change point name. POINT EDITOR page is displayed with data for the mark. Function key line shows F2-USE ALL and F9-EXIT.
- i. Press **FNC DEL** to clear PNT NAME field, enter new name, and press **ENTER**. Cursor box moves to DESCRIPTION field.
- j. If desired, enter a point description up to 34 characters long.
- k. Press **F2** to accept the name and description changes. MARK page is displayed with new name. Record data.
- l. Press **F9** to return to MENU, MAP, or NAVIGATION AID page.
- m. Proceed to next point.

### 3-23. Marking 2-Position Azimuth Using Plumb Bob.

The following procedure establishes position and altitude coordinates of a point and azimuth of an OL.

#### NOTES

- IPADS will not adjust azimuth.
  - Vehicle must be able to travel quickly between both ends of the OL, 100 to 1000 meters long. If distance between OS and EOL is less than 100 meters or travel time exceeds 60 seconds, the accuracy of the computed azimuth may be degraded and PAE code will show E in azimuth location, meaning there is a probable error in azimuth.
- a. Maneuver vehicle to place plumb bob over point to be established.
  - b. When helicopter has landed and is stationary, command a ZUPT if IPADS remains in NAVIGATION mode.
  - c. Extend plumb bob arm out helicopter door and hang plumb bob.
  - d. Set OS survey marker under plumb bob and drive witness stake. Stow plumb bob, plumb bob arm, and other equipment in vehicle.

- e. From MENU, MAP, or NAVIGATION AID page, press **F2**. MARK page will be displayed with function key line F1-2POS, F2-1POS, F3-  $\nabla$  AZ, F4-  $\nabla$  SCP, and F9-EXIT.
- f. Press **F1**. MARK page shows PERFORMING TWO POSITION MARK. SYSTEM STATUS & MESSAGES will show MARK – WAIT x.x SECONDS. Function key line shows F9-CANCEL.
- g. At OS mark completion, audible alarm sounds and MARK page shows data for the marked point OS (P1) MARKED; MOVE TO EOL (P2) POSITION and TIME IN P1 – P2 OPERATION xx.xx.

**NOTE**

You have 60 seconds to move to the EOL position and mark EOL. OL must be between 100 and 1000 meters long. Current OL length is displayed in LEN OL field.

- h. Immediately after OS mark is completed, proceed to EOL position.
- i. Set vehicle brake. Function key line shows F1-MRK EOL and F9-CANCEL.
- j. When helicopter has landed and is stationary, press **F1** to mark EOL.
- k. At mark completion, MARK page shows data for the marked point with cursor box on PNT NAME field and INFO: MARK COMPLETE; PRESS ENTER TO EDIT POINT & MARK NAMES. Function key line shows F9-EXIT.
- l. Press **ENTER** to change point name. POINT EDITOR page is displayed with data for the mark. Function key line shows F2-USE ALL and F9-EXIT.
- m. Press **FNC DEL** to clear PNT NAME field, enter new name, and press **ENTER**. Cursor box moves to mark identifier.
- n. Press **FNC DEL** to clear mark identifier, enter new identifier, and press **ENTER**. Cursor box moves to DESCRIPTION field.
- o. If desired, enter a point description up to 34 characters long.
- p. Press **F2** to accept the name and description changes. MARK page is displayed with new name and identifier. Record data.
- q. Extend plumb bob arm out helicopter door and hang plumb bob.
- r. Set EOL survey marker under plumb bob and drive witness stake. Stow plumb bob, plumb bob arm, and other equipment.
- s. Press **F9** to return to MENU, MAP, or NAVIGATION AID page.
- t. Proceed to next point.

**3-24. Theodolite Measurements.**

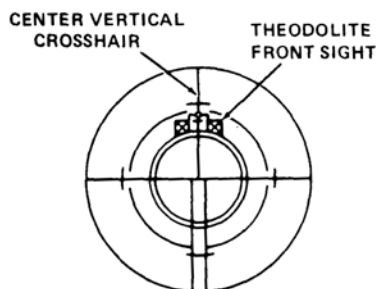
Optical measurements may be performed any time in the survey mission, but must always be performed when an update SCP is inaccessible to the IPADS vehicle, when a position to be established is inaccessible to the IPADS vehicle, or when an azimuth line of less than 100 meters is required.

**NOTES**

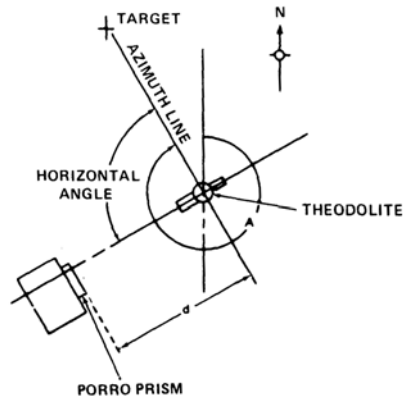
- Color theodolite sight white with typewriter correction fluid to increase visibility.
- At night, illuminate theodolite sight with theodolite lighting kit.
- If possible, position IPADS so sunlight does not shine directly on porro prism. Operator will have difficulty performing auto-reflection if sun is reflected by porro prism.

### 3-24. Theodolite Measurements – Continued

- Stand directly behind the theodolite and look for your reflection in the Porro Prism mirror to achieve rough auto reflection
- a. **Auto-Reflection.** Prior to making any optical measurements, the IPADS operator must achieve auto-reflection. To achieve auto-reflection, perform the following procedure:
- (1) Stop vehicle close to SCP or point to be established, exit vehicle, and initiate a ZUPT, paragraph 3-14, table 3-4.
  - (2) Set up theodolite over SCP or point to be established. If a known azimuth reading is required, set up range pole over azimuth marker.
  - (3) Uncover and roughly level porro prism.
  - (4) Vehicle operator makes certain ZUPT was completed and maneuvers vehicle so porro prism is visible from the theodolite and is within 24 meters.
    - (a). IPADS operator, standing behind the theodolite, instructs vehicle operator to slowly maneuver vehicle until theodolite is reflected in porro prism and auto-reflection is obtained.
    - (b). An alternate procedure, especially useful for helicopter operations, is to keep vehicle stationary and move theodolite until auto-reflection is achieved.
  - (5) Vehicle operator exits vehicle, initiates a ZUPT, paragraph 3-14, and accurately levels porro prism, table 3-4.
  - (6) IPADS operator checks if auto-reflection can still be achieved. If not, repeat steps (4) and (5).
  - (7) Focus theodolite so reflected image of theodolite front sight is centered on center vertical. Theodolite line-of-sight is now perpendicular to porro prism.



- b. **Vertical Angle Measurement.**
- (1) Measure and record vertical angle with theodolite auto-reflected on porro prism.
  - (2) Plunge theodolite telescope and measure and record reverse vertical angle to porro prism (auto reflect).
  - (3) Repeat measurements if difference between direct and reverse pointings is greater than 0.2 mil.
  - (4) Mean direct and reverse pointings to obtain mean vertical angle.
- c. **Mean Horizontal Angle Measurement.** Not required for position update or position, only mark.
- (1) Auto-reflect on porro prism.
  - (2) Measure and record direct angle from porro prism clockwise to azimuth target.



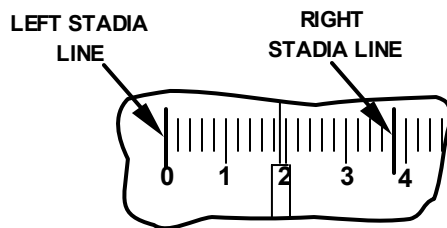
- (3) Plunge theodolite telescope and measure and record reverse angle from azimuth target to porro prism (auto reflect).
- (4) Repeat measurements if difference between direct and reverse pointings is greater than 0.2 mil.
- (5) Mean direct and reverse pointings to obtain mean horizontal angle.

**d. Offset Distance Measurement.**

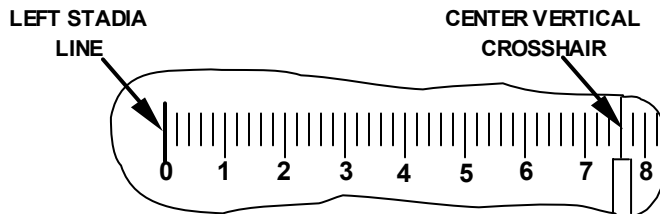
**NOTE**

At night, illuminate porro prism scale flashlight. Porro prism has two scales for inverting and non-inverting instruments.

- (1) If distance between porro prism scale and theodolite is less than 12 meters, locate left vertical stadia line on porro prism scale zero mark. Read the scale where the right stadia line intersects the scale. Example: Stadia lines on 0 and 3.8 on scale. Offset distance is 3.8 meters.



- (2) If offset distance is between 12 and 24 meters, locate left stadia line on zero mark and read distance to center vertical crosshair where it intersects the scale; then, multiply it by two. Example: left stadia line is at zero, vertical crosshair is on 7.6 of scale, offset distance equals  $7.6 \times 2$  or 15.2 meters.



### 3-25. Marking Position, Azimuth, and Altitude Using Theodolite.

#### NOTES

- IPADS will not adjust azimuths obtained in position, azimuth, and altitude marks using a theodolite.
  - IPADS can establish two OLs for an OS using a theodolite.
- a. Stop vehicle close to point to be established.
  - b. Exit vehicle and initiate a ZUPT, paragraph 3-14, table 3-4.
  - c. Set up theodolite over OS marker to be established and achieve auto-reflection, paragraph 3-24a.
  - d. If a short OL will be established, set up range pole over EOL marker.
  - e. Vehicle operator becomes the recorder for IPADS operator.
  - f. Measure and record offset distance, vertical angle and mean horizontal angle, paragraph 3-24, subparagraphs b, c, and d. If applicable, measure and record mean horizontal angle for second OL.
  - g. From MENU, MAP, or NAVIGATION AID page, press **F2**. MARK page will be displayed with function key legend showing F1-2POS, F2-1POS, F3-  $\nabla$  AZ, F4-  $\nabla$  SCP, and F9-EXIT.
  - h. Press **F3**. MARK page shows PERFORMING THEODOLITE AZIMUTH MARK. SYSTEM STATUS & MESSAGES will show MARK – WAIT x.x SECONDS. Function key line shows F9-CANCEL.
  - i. At mark completion, MARK page shows data for the marked point and ENTER DISTANCE TO PRISM (1 TO 3500 METERS) OR F2-USE ALL. Cursor box is on DISTANCE TO PRISM field. Function key line shows F2-USE ALL, and F9-EXIT.
  - j. Enter measured offset distance (in meters) and press **ENTER**. Cursor box moves to HORIZ ANGLE TO EOL field.
  - k. Enter measured mean horizontal angle and press **ENTER**. Cursor box moves to VERT ANGLE TO PRISM field.
  - l. Enter measured vertical angle and press **F2**. MARK page shows data for the marked point with cursor box on HORIZ ANGLE TO EOL field and INFO: AZ 1 MARKED; ENTER AZ 2 ANGLE OR MOVE TO PNT NAME TO EDIT. Function key line shows F2- USE ALL and F9-EXIT.
  - m. If not establishing a second OL, scroll to PNT NAME field.
  - n. To establish a second OL, press FNC DEL to clear HORIZ ANGLE TO EOL field, enter second mean horizontal angle, and press F2. MARK page displays data for second OL and INFO: MARK COMPLETE; PRESS ENTER TO EDIT POINT & MARK NAMES. Cursor box moves to PNT NAME field. Function key line shows F9-EXIT.
  - o. Press **ENTER** to change point name. POINT EDITOR page is displayed with data for the mark. Cursor box is on PNT NAME Field. Function key line shows F2-USE ALL and F9-EXIT.
  - p. Press **FNC DEL** to clear PNT NAME field, enter new name and press **ENTER**. Cursor box moves to MARK 1 IDENTIFIER.
  - q. Press **FNC DEL** to clear MARK 1 IDENTIFIER, enter new identifier and press **ENTER**. Cursor box moves to DESCRIPTION field or MARK 2 IDENTIFIER if two OLs were established.
  - r. Press **FNC DEL** to clear MARK 2 IDENTIFIER, enter new identifier, and press **ENTER**. Cursor box moves to DESCRIPTION field.
  - s. If desired, enter a point description up to 34 characters long (unless using AFATDS, then the limit is eight characters, CAUTION 3-28).
  - t. Press **F2** to accept the name and description changes. MARK page is displayed with new name and identifier. Record data.



- u. Drive witness stake(s) and stow theodolite and other equipment in vehicle.
- v. Press **F9** to return to MENU, MAP, or NAVIGATION AID page.
- w. Proceed to next point.

**3-26. Adjacent Grid Zone.**

**NOTE**

GRID ZONE is displayed on MENU only when display position format is UTM and current IPADS position is within 40 kilometers of a UTM grid zone boundary.

**a. Grid Zone Selection.**

When operating within 40 kilometers of a UTM grid zone boundary, UTM coordinates can be displayed with respect to the normal grid zone or the extended zones east or west of the boundary. EXT after the zone number indicates UTM coordinates are relative to extended east or west zone. Perform the following steps to change grid zone reference:

CURRENT PLUMB BOB DATA	
EAST:	239632.00 M
NORTH:	4303840.50 M
ALTITUDE:	326.6 M
GRID ZONE:	18 EXT
ELLIP:	WGS 84
DATUM:	WGS 84

- (1) Scroll to GRID ZONE on MENU and press **ENTER**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy), where xx is the extended west zone number and yy is the extended east zone number. Function key line shows F1-NORMAL, F2-WEST GZ, F3-EAST GZ, and F9-EXIT.

ZONE FUNCTION					
ZONE IN USE: <b>NORMAL</b>					
PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy)					
1-NORMAL	2-WEST GZ	3-EAST GZ	4-	5-	6-

- (2) To change ZONE IN USE, press **F1** for normal zone, **F2** for extended west zone, or **F3** for extended east zone. Selection is displayed in ZONE IN USE field.

- (3) If setting is correct, press **F9** to exit ZONE FUNCTION page.

**b. Grid Zone Boundary Crossing.**

IPADS sounds the audible alarm and flashes function key line F5-ZONE when it crosses the boundary between two grid zones for the first time in a mission. Operator performs following steps when this occurs:

- (1) Press **F5**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy), where xx is the extended west normal zone number and yy is the extended east zone number. Function key line shows F1-NORMAL, F2-WEST GZ, F3-EAST GZ, and F9-EXIT.

### 3-26. Adjacent Grid Zone - Continued

- (2) Press **F1** for normal zone, **F2** for extended west zone, or **F3** for extended east zone. Selection is displayed in ZONE IN USE field.
- (3) If setting is correct, press **F9** to exit ZONE FUNCTION page.
- (4) IPADS will retain the new setting for subsequent crossings of the zone boundary. However, when IPADS goes outside the 40 km zone overlap area, operation automatically switches to normal zone.

### 3-27. Recording IPADS Data.

- a. **Mark.** Record point name, mark identifier, PAE code, zone, easting, northing, altitude, grid azimuth (if measured), and distance for each position marked.
  - (1) Record all mean-horizontal angles, vertical angles, and offset distances measured.
  - (2) Also record all malfunctions which occur during the survey mission.

#### NOTE

IPADS does not adjust distances or azimuths.

- b. **Update.** After any update (except the initial one), recall and record all adjusted data stored since the last update. The assistant operator should check all data.
- c. For examples of recording IPADS data, refer to FM 6-2, chapter 8.

### 3-28. Data Management.

#### CAUTION

IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL when **F5** (DEL ALL) is pressed. Pressing **Y** permanently deletes all points in displayed list.

#### CAUTION

#### !!! SURVEY CONTROL POINT (SCP) NAME LENGTH LIMITATION !!!

There is a known feature in AFATDS that limits the length of the Survey Control Point (SCP) Name to 8 characters. IPADS and FOS will accept, process, and transmit SCP names of up to 15 characters. But when the SCP message is received at AFATDS, the SCP names will be truncated (shortened) to the first 8 characters. IPADS can automatically generate 15-character long SCP names, but they look identical when shortened to 8 characters. To prevent the loss of SCP name data, the following solution is recommended:

**AT THE IPADS AND FOS, LIMIT YOUR SURVEY CONTROL POINT NAMES TO 8 CHARACTERS OR LESS. CHANGE IPADS GENERATED 15-CHARACTER SCP NAMES TO YOUR OWN CHOICE OF NAMES UP TO 8 CHARACTERS LONG BEFORE TRANSMITTING TO AFATDS.**

#### NOTES

- Operator can view, edit, delete, and enter new points in the IPADS POINT LIST. Operator can also import and export data to/from FOS, paragraph 3-29, subparagraphs d and e.
- When time permits, operator should enter data for update SCPs and navigation waypoints prior to proceeding on the mission. During the mission the applicable update or waypoint coordinates can just be recalled from stored data.

- Operator can enter points in the waypoint, SCP, or user defined lists. Since IPADS also enters points in the SCP and user defined lists, it is suggested that the operator enter update and navigation way points in the waypoint list to minimize the effort required to clean up the database after the mission.
  - Operator must verify mission data has been accurately recorded and/or downloaded to FOS before deleting any data.
  - Operator should delete points that will not be used again by IPADS after a mission or before starting the next mission.
  - Points in the MARK list are for the second point (EOL) of a two-position azimuth. Unless there is need to consider the EOL as another SCP, points in the MARK list should be deleted and not exported to FOS. The first point of a two-position azimuth is considered the OS.
  - An OS is an Orienting Station used to position howitzers for firing. The EOL is the end of orienting line where you get the azimuth from the first position to the other. The OS and EOL are marked points and **not for updating the IPADS**. Its data will be in the SCP file with OS coordinates and azimuth to EOL.
  - IPADS automatically assigns a name to new points, whether entered by the operator or created by IPADS. Formats for assigned names are PNTxxxxxxxxxxx for operator-entered points, SCPxxxxxxxxxxx for IPADS marked points, and MRKxxxxx for azimuth mark identifiers, including the second point (EOL) of a two-position azimuth. xxxxxxxxxxxx and xxxxx are numbers which increment each time a new point is created.
  - Operator should replace IPADS assigned names with more meaningful names.
- a. Access POINT LIST by pressing **F7** from the MENU, MAP, or NAVIGATION AID page. POINT LIST page is displayed with function key line F2-NEW, F4-FILTER, F5-DEL ALL, and F9-EXIT.

**3-28. Data Management - Continued**

POINT LIST: UTM			
NAME	EAST M	NORTH M	GZ
-----	-----	-----	---
> ALPHA 1	522930.45	4527353.78	18
> ALPHA 2	522234.18	4527329.87	18
> BETA 1	527764.15	4520037.22	18
> -----	-----	-----	---
> -----	-----	-----	---

ALL WAY PTS: FROM 1 TO 3 OF 3  
INFO: READY

F1-	F2-NEW	F3-	F4-FILTER	F5-DEL ALL	F6-	F7
-----	--------	-----	-----------	------------	-----	----

- b. Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Press **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment. Known SCP
Way point	FL:WAY	ALL WAY PTS	Navigation way points entered by operator. They are used for navigation.
Mark	FL:MARK	ALL MARKED PTS	Points in the MARK list are for the second point (EOL) of a two-position azimuth. Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment. User Defined point could be a point established by GPS for an initiation point until a SCP can be located to adjust the mission.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

- c. Perform the following steps to delete a single point from the displayed list:
- (1) Scroll to point to be deleted.
  - (2) Press **FNC DEL**. IPADS prompts PRESS Y TO DELETE SELECTED POINT; OTHER KEY TO CANCEL.
  - (3) Press **Y** to permanently delete selected point from displayed list. "Point name" DELETED is displayed. Press any other key to cancel delete.
- d. Perform the following steps to delete all points in the displayed list:
- (1) Press **F5**. IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; PRESS OTHER KEY TO CANCEL.

- (2) Press **Y** to permanently delete all points in displayed list. Press any other key to cancel delete.
- e. Perform the following steps to view data for a point in displayed list:
- (1) Scroll to point to be displayed.
  - (2) Press **ENTER**. POINT EDITOR page is displayed for selected point. For example, STATION AZ is selected from SCP list.

POINT EDITOR:	(UTM)
TYPE:	USERDEF
PNT NAME:	<input type="text" value="STATION AZ"/>
ELLIP:	WGS 84
DATUM:	WGS 84
EASTING:	523405.15 M
NORTHING:	4527118.20 M
ALTITUDE:	105.2 M
GRID ZONE:	18
CREATION DATE:	12/02/04
CREATION TIME:	14:11:44
AZIMUTH TYPE:	GRID
AZIMUTH 1:	0984.420 MILS TO AZ A
AZIMUTH 2:	2342.431 MILS TO AZ B
PAE CODE:	ttt
ADJUSTMENT:	UN-ADJUSTED
DESCRIPTION:	
>	Theodolite Mark
<b>PRESS F1 FOR USER DEFINED POINT; F2 FOR WAY POINT; F3 FOR SCP</b>	
<b>F1-USER</b>	<b>F2-WAY</b>
<b>F3-SCP</b>	<b>F4-</b>
<b>F5-</b>	<b>F6-</b>
<b>F7</b>	

- (3) Press **F9** to return to POINT LIST page.

#### NOTES

- Point name, mark identifier(s) and point description for a stored point may be edited. No other fields may be changed. If coordinates for an operator entered point are incorrect, the point must be deleted, paragraph 3-28c, and correct data entered as a new point, paragraph 3-13f(5).
  - PNT NAME and DESCRIPTION fields will always be displayed on POINT EDITOR page. AZIMUTH field(s) will be displayed only if IPADS determined azimuth(s) for that point.
- f. Perform the following steps to edit data for a point in displayed list:
- (1) Scroll to point to be displayed.
  - (2) Press **ENTER**. POINT EDITOR page is displayed for selected point with cursor box on PNT NAME field.

**3-28. Data Management - Continued**

- (3) Scroll to field(s) to be changed, press **FNC DEL** to clear field, and enter new name or description.
- (4) When all desired fields are changed, press **F2**. INFO: POINT WAS SUCCESSFULLY MODIFIED is displayed.
- (5) If data are correct, press **F9** to return to POINT LIST page. Otherwise, scroll to incorrect field and enter correct data, paragraph 3-28g.

g. Perform the following steps to add a new point:

- (1) Press **F2**. POINT EDITOR page is displayed with cursor box on TYPE field. Function key line shows F1-USER, F2-WAY, F3-SCP and F9-EXIT.

POINT EDITOR:		(UTM)
TYPE:	<input style="border: 1px solid black;" type="text" value="USERDEF"/>	
PNT NAME:	PNTxxxxxxxxxxxxxxxx	
ELLIP:	WGS 84	
DATUM:	WGS 84	
EASTING:	000000.00 M	
NORTHING:	00000000.00 M	
ALTITUDE:	0000.0 M	
GRID ZONE:	00	
CREATION DATE:	00/00/00	
CREATION TIME:	00:00:00	
ADJUSTMENT:		
DESCRIPTION:		
>		
<b>PRESS F1 FOR USER DEFINED POINT; F2 FOR WAY POINT; F3 FOR SCP</b>		
F1-USER	F2-WAY	F3-SCP
F4-	F5-	F6-
F7		

- (2) Press **F1** to store point data in the user defined list, **F2** for waypoint list, or **F3** for SCP list. Cursor box moves to PNT NAME field. Function key line shows F2-USE ALL and F9-EXIT.
- (3) Press **ENTER** to accept pre-assigned name or press **FNC DEL** to clear PNT NAME field and enter the new name.
- (4) Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d.
- (5) Verify datum is correct for coordinates being entered. If ellipsoid is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d.
- (6) Scroll to EASTING field and enter easting value in meters.
- (7) Scroll to NORTHING field and enter northing value in meters.
- (8) Scroll to ALTITUDE field and enter altitude value in meters.
- (9) Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere, or negative (-) UTM grid zone value for Southern Hemisphere.
- (10) Optional – scroll to DESCRIPTION and enter a point description.

- (11) If data is correct, press **F9** to return to POINT LIST page. If not, scroll to incorrect field and enter correct data, steps (3) through (10) above.

### 3-29. FOS.

IPADS can communicate with a Forward Observer System (FOS). When connected to FOS, IPADS allows the operator to import and export data from and to the FOS.

#### NOTES

- Upon establishing communications, IPADS will synchronize its date/time to the FOS current date/time. At any time thereafter, the operator can synchronize the IPADS date and time to the FOS current date and time by sending a request from the IPADS CDU.
  - From FOS the operator can request IPADS current position for storage on FOS and subsequent transmission to AFATDS via vehicle combat net radio.
  - From IPADS CDU the operator can send IPADS SCP data to the FOS for subsequent transmission to AFATDS.
  - From FOS the operator can send a trig list of SCPs received from AFATDS to IPADS.
- a. Connect IPADS to FOS using the FOS cable assembly. Connect P1 to CDU J2 connector. If using Handheld Terminal Unit (HTU) as FOS, connect W136 P2 to HTU J7. If using Rugged Handheld Computer (RHC) as FOS, connect W136 P2 to RHC Com 1.
- b. Connect FOS to power and initialize it per the FOS operator's manual, TB 11-7021-228-10-1 or -2 depending on the platform.
- c. Verify that the FOS Status indicator (fifth field on the mode line) indicates FOS. If not, see paragraph 4-6, Operator Troubleshooting.
- d. Once communications are established, the IPADS clock is automatically synchronized to the FOS current date/time. If immediately after connecting IPADS and FOS IPADS time is not within one second of FOS time, see paragraph 4-6, Operator Troubleshooting. To re-synchronize the IPADS date/time, perform the following procedure:
- (1) Scroll down to DATE/TIME on the MENU, then press **ENTER**.
  - (2) DATE / TIME page is displayed with the function key legends: F2-USE ALL, F5-GET TIME, and F9-MENU.
  - (3) Press **F5** to synchronize time. DATE / TIME page is displayed with INFO: FOS TIME DATA RECEIVED on information line.
  - (4) Press **F9** to return to MENU.
- IPADS current position can be imported into FOS once IPADS has been initialized with position, paragraph 3-12. To import IPADS current position, follow instructions in the FOS operator's manual, TB 11-7021-228-10-1 or -2 depending on the platform.**
- e. **To export SCPs from IPADS to FOS**, perform the following procedure:
- (1) Press **F7** on the MENU, MAP, or NAVIGATION AID pages. POINT LIST page is displayed with function key line: F2-NEW, F4-FILTER, F5-DEL ALL, F6-SND PNT, F7-SND ALL, and F9-EXIT.

**3-29. FOS - Continued**



If **F5** (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y** permanently deletes all points in displayed list.

- (2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Waypoint	FL:WAY	ALL WAY PTS	Navigation waypoints entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

- (3) To send a single point, scroll to the point and press **F6** (SND PNT). POINT LIST page is displayed with INFO: xxxx SENT TO FOS on information line, where xxxx is the name of the point. Verify that FOS received the point per instructions in the FOS operator's manual TB 7021-228-10-1 or -2, depending on the platform.
- (4) To send the full list of SCPs (only SCPs may be sent to FOS; MARK, USER DEF, and WAYPOINTS may not be sent) to FOS, press **F7** (SND ALL). POINT LIST page is displayed with INFO: SEND ALL POINTS: NV SECONDS REMAINING: PRESS F9 TO CANCEL on information line, and F9-CANCEL on function key legend, where NV is the number of seconds remaining for transmission to complete.
  - (a) Pressing F9 terminates the send operation. POINT LIST page is displayed with INFO: SEND ALL POINTS TO FOS CANCELED on information line.
  - (b) The POINT LIST page is displayed with INFO: NV SURVEY CONTROL POINTS SENT TO FOS on information line upon completion of the send all operation, where NV is the number of points sent to the FOS. Verify that FOS received the points per instructions in the FOS operator's manual TB 7021-228-10-1 or 2, depending on the platform.
- (5) Press **F9** to display previous page.
- (6) To transmit a trig list to IPADS, follow instructions in the FOS operator's manual, TB 11-7021-228-10-1 or 2, depending on the platform.

**NOTE**

The POINT LIST page will display INFO: FOS DATA RECEIVED on the information line if the POINT LIST page is active. Otherwise INFO: FOS DATA RECEIVED will be displayed the next time the POINT LIST page is activated.



### 3-30. Map Display.



**WARNING**

To avoid the risk of driving accidents, the driver's attention must at all times be focused on safe driving. Prolonged diversion of driver's attention to the CDU screen while driving should be avoided.

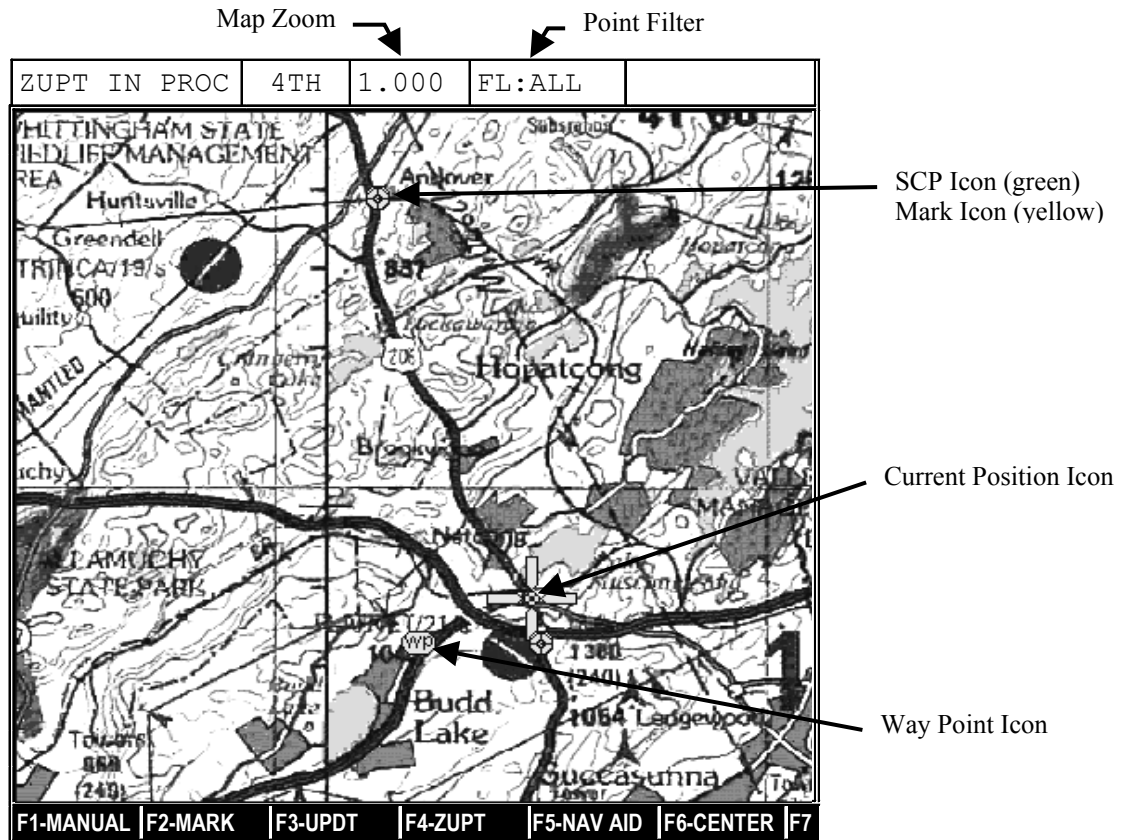
**NOTE**

IPADS provides a digital map display capability to aid in navigation and provide a visual display of point locations. Map display is not required to conduct survey operations.

**If a digital map of the local area is loaded in CDU memory, IPADS will display it after the IPADS has been initialized, paragraph 3-12f. A green cross identifies IPADS current position on the map. Icons identify locations of points on the map according to the point filter type. Operator may zoom in or out on map and change map position on the screen. Map operations are described in the following subparagraphs:**

- (1) Press **F6-MAP** on MENU or NAVIGATION AID page to display MAP page. If no map data are loaded covering the current IPADS location, MAP and INFO: MAP NOT OPEN; SURVEY FUNCTIONS FULLY AVAILABLE are displayed. If map data are available, a map will be displayed centered on current IPADS location. Function key line shows F1-MANUAL, F2-MARK, F3-UPDT, F4-ZUPT, F5-NAV or F5-NAV AID, F6-CENTER, F7-POINTS, F8-STATUS, and F9-MENU.
- (2) Press – (minus) to zoom out (reduce zoom). Press FNC + (plus) to zoom in (increase zoom). Third field on mode line will show zoom level for a few seconds and then reverts to vehicle type.

3-30. Map Display - Continued



NOTE

When map is centered, IPADS current position remains centered and map moves in response to vehicle motion. When map is not centered, map remains stationary and current position icon moves in response to vehicle motion.

- (3) Press ← to move map westward, ↑ to move map northward, → to move map eastward, or ↓ to move map southward.
- (4) Press **F6-CENTER** to center map and restore zoom to 1.000.
- (5) Perform the following steps to change type(s) of points displayed on map:
  - (a) Press **F7-POINTS**. POINT LIST page is displayed. Function key line shows F2-NEW, F4-FILTER, F5-DEL ALL, and F9-EXIT.
  - (b) Press **F4** until desired point filter type is displayed in fourth field of mode line.
  - (c) Press **F9** to return to MAP page.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS), before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Way point	FL:WAY	ALL WAY PTS	Navigation waypoints entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL), before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL), after closure adjustment.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

### 3-31. Waypoint Navigation

- a. Perform the following steps to use the waypoint navigation feature by selecting a point from IPADS database or entering coordinates for a new point.



To avoid the risk of driving accidents, the driver's attention must at all times be focused on safe driving. Prolonged diversion of driver's attention to the CDU screen while driving should be avoided.

#### NOTES

- After position is initialized, IPADS provides data to assist in navigating to an operator-entered waypoint. Waypoint navigation is not required for IPADS to perform survey operations.
- IPADS provides two sources of navigation data after a waypoint is set. RANGE and waypoint azimuth (WP AZ) and steering instructions (e.g. STEER: TURN RIGHT) are available in the navigation data area on the right side of all pages. A graphical navigation aid is available on the NAVIGATION AID page and can be selected by pressing **F5-NAV AID** on the MENU or MAP pages.
- IPADS marked points can be used as waypoints to back track the survey route.
- After IPADS is initialized at a known SCP, the NAVIGATION AID can be useful in recovering other SCPs.
- Position data is in UTM format and angle format is in mils. Latitude/longitude and decimal degrees or degrees, minutes, seconds formats may also be used, paragraph 3-11e(3).

### 3-31. Waypoint Navigation - Continued

- b. **Perform the following steps to set a waypoint and display navigation data:** If a waypoint was previously set and navigation data is displayed, press **F5-NAV AID** from MENU or MAP page to display NAVIGATION AID page. Press **F5-STOPNAV** to stop navigation. Navigation data is no longer displayed and F5 legend changes to F5-NAV.

## CAUTION

If **F5-DEL ALL** is pressed, IPADS prompts **PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL**. Pressing **Y** permanently deletes all points in displayed list.

- (1) From MENU, MAP, or NAVIGATION AID page, press **F3-NAV**. POINT LIST page is displayed with function key legends F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

POINT LIST: UTM			
NAME	EAST M	NORTH M	GZ
> ALPHA 1	522930.45	4527353.78	18
> RAILROAD CROSS	522234.18	4537329.87	18
> BETA 1	527764.15	4520037.22	18
> -----	-----	-----	---
> -----	-----	-----	---

ALL WAY PTS: FROM 1 TO 3 OF 3  
INFO: READY

F1-	F2-NEW	F3-SEL PT.	F4-FILTER	F5-DEL ALL	F6-	F7
-----	--------	------------	-----------	------------	-----	----

- (2) Perform the following steps to select an existing point from database list:
- (a) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Waypoint	FL:WAY	ALL WAY PTS	Navigation way points entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL) before closure; adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

- (b) Scroll to desired navigation waypoint (e.g. RAILROAD CROSS) and press **F3**.

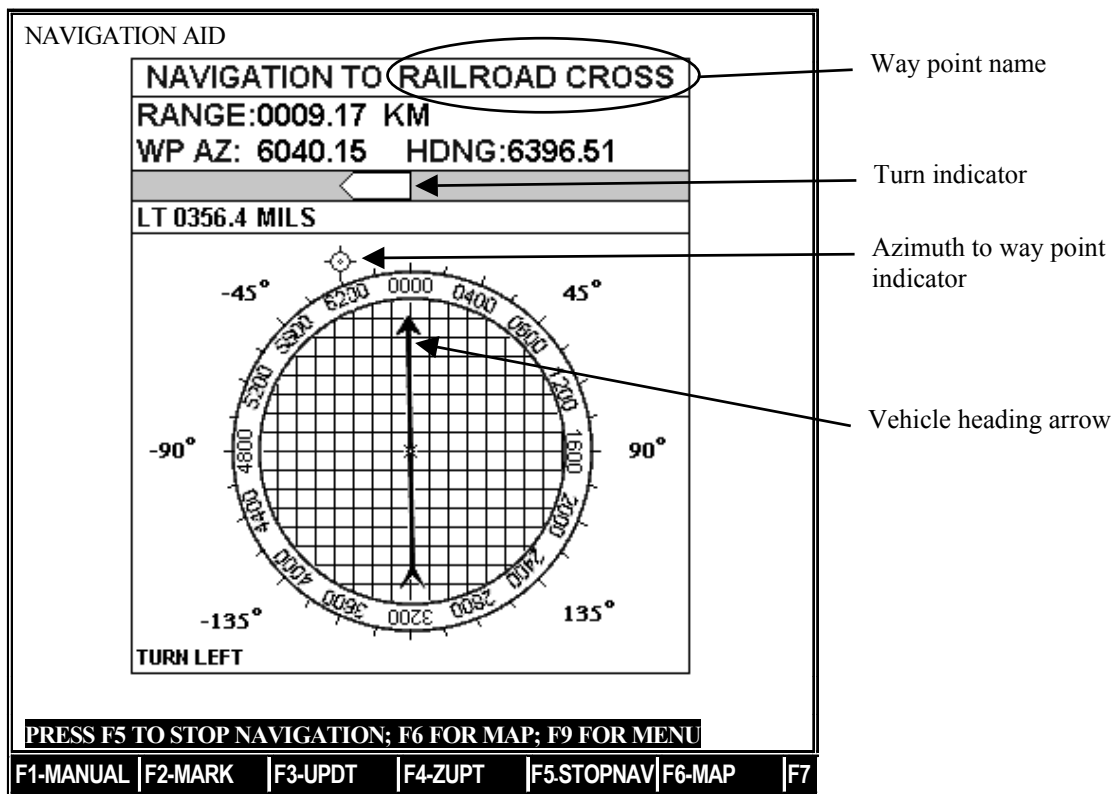
- (3) Perform the following steps to enter coordinates for a new point:
- Press **F2**. POINT EDITOR page is displayed with cursor box on TYPE field and function key line F1-USER, F2-WAY, F3-SCP, and F9-EXIT.
  - Press **F1** for user defined point type, **F2** for waypoint, or **F3** for SCP. Selected point type is displayed. Cursor box moves to PNT NAME field. Function key line shows F2-USE ALL and F9-EXIT.

POINT EDITOR:						
TYPE:	USERDEF					
PNT NAME:	PNTXXXXXXXXXXXXXX					
ELLIP:	WGS 84					
DATUM:	WGS 84					
EAST:	000000.00 M					
NORTH:	00000000.00 M					
ALTITUDE:	0000.0 M					
GRID ZONE:	00					
CREATION DATE:	00/00/00					
CREATION TIME:	00:00:00					
DESCRIPTION						
>						
PRESS ENTER TO ACCEPT NAME OR TYPE NEW NAME						
F1-	F2-USE ALL	F3-	F4-	F5-	F6-	F7

- Press **ENTER** to accept pre-assigned name or press FNC DEL to clear PNT NAME field and enter the new name.
- Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d(1).
- Verify datum is correct for coordinates being entered. If ellipsoid is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d(2).
- Scroll to EASTING field and enter easting value in meters.
- Scroll to NORTHING field and enter northing value in meters.
- Scroll to ALTITUDE field and enter altitude value in meters.
- Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere, or negative (-) UTM grid zone value for Southern Hemisphere.
- Optional – scroll to DESCRIPTION and enter a point description.
- Verify entered data. If it is correct, press **F2**. Otherwise, scroll to incorrect field and enter correct data.
- INFO: POINT WAS SUCCESSFULLY ADDED is displayed. Press **F9-EXIT** to return to POINT LIST page.
- Scroll to newly entered point and press **F3-SEL PT**.

### 3-31. Waypoint Navigation - Continued

- (4) NAVIGATION AID page is displayed. Function key line shows F1-MANUAL, F2-MARK, F3-UPDT, F4-ZUPT, F5-STOPNAV, F6-MAP, F7-POINTS, F8-STATUS, and F9-MENU.



- (5) Press **F5** to stop navigation data display, **F6** to display MAP page, or **F9** to display MENU.

### 3-32. Transfer between Land Vehicles

#### CAUTION

When transferring the IPADS from vehicle to vehicle or to a helicopter with the W114 cable still connected to the CDU, place the CDU back in the CDU holder on the IPADS frame.

- a. If the IPADS will be transported to a vehicle that already has a full vehicle installation kit (base plate, CDU mount, and W116 power cable) installed, remove IPADS as follows:
  - (1) Place the CDU back in the CDU carrier on the IPADS frame keeping the CDU switch in the ON position and the W114 cable connected.
  - (2) Keep both BCU power switches (DC INPUT and OUTPUT) in the ON position.
  - (3) Disconnect W116-1 from the BCU.
  - (4) Using a four-man lift, remove the IPADS assembly from one vehicle and place it in the next vehicle.
  - (5) Install the IPADS in the next vehicle, paragraph 2-6.
  - (6) If vehicle types are different, change vehicle type on the CDU, paragraph 3-11b.

- b. If IPADS will be transported to a vehicle that does not have a base plate already installed, remove as follows:
- (1) Since this procedure will take longer than the 15 minutes of back up battery power provided by the IPADS, you will need to shut down the IPADS system.
  - (2) Remove W114 cable from CDU and place the CDU back in the CDU carrier on the IPADS frame
  - (3) Disconnect W116-1 from the BCU.
  - (4) Using a four-man lift, remove the IPADS assembly from one vehicle and place it in a secure location.
  - (5) From the vehicle that will be losing the IPADS, remove the W116-1 from the vehicle battery.
  - (6) Remove the IPADS base plate from the floor of the vehicle.
  - (7) Install the IPADS in the next vehicle, paragraph 2-6.
  - (8) If vehicle types are different, change vehicle type on the CDU, paragraph 3-11b.

### **3-33. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped.**

IPADS may be transferred while operating from a land vehicle to a UH-60 helicopter. The legend for Figure 1-7 and Table 3-6 list the components required to transfer IPADS to the helicopter.

#### **WARNINGS**

- IPADS crew must wear hearing protection at all times when working around aircraft.
- Use extreme care when working under helicopter blades.
- To prevent injury, use at least four persons to transfer IPADS.
- The IPADS CDU must be secured to the IPADS frame to avoid becoming a crash hazard.

#### **NOTES**

- In the event of aircraft generator failure, the IPADS will operate on the IPADS batteries (battery capacity is approximately 15 minutes).
- Ensure BCU BATTERY GOOD and BATTERY TEMP indicators are illuminated prior to transferring IPADS to the UH-60.
- Transfer system to helicopter power quickly to minimize discharge of batteries.
- Initiate a ZUPT whenever the system is stationary.
- Use extreme caution when rerouting cargo tie down straps. Reroute small end of cargo strap thru IPADS frame. Large end could damage system.
- IPADS crew needs a headset and should let the aviation unit know prior to installation.

**3-33. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped - Continued**

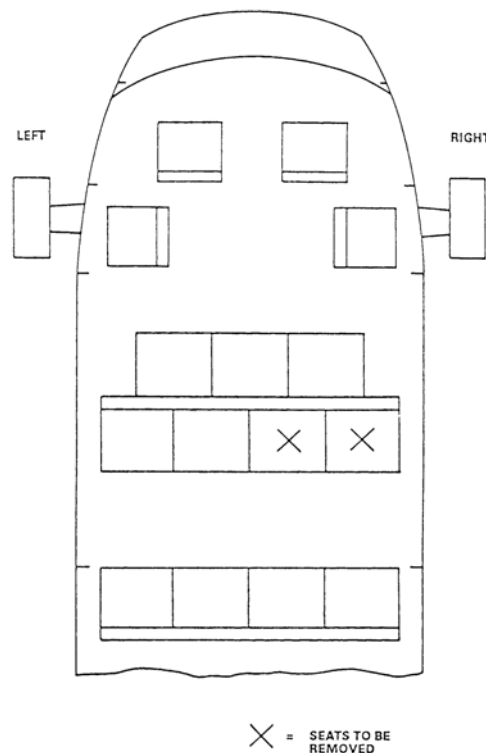
The UH-60 plumb bob arm and stops must be installed on the IPADS frame prior to conducting a mission in the UH-60, paragraph 2-9a and b.

**Table 3-6 – Parts Required for Transfer to UH-60 Helicopter**

Item	Purpose	Quantity	Part Number
UH-60 Indexer	Mounts CDU mount to IPADS frame.	1	7170186-9
UH-60 Power Cable	Connects IPADS to aircraft power.	1	7204116-2
Belt Assembly	Secure IPADS frame to aircraft.	2	CGU-1-B Class 2

**a. Prepare helicopter for IPADS transfer.**

- (1) IPADS operator will request the crew chief remove and stow two seat sections indicated in Figure 3-9.



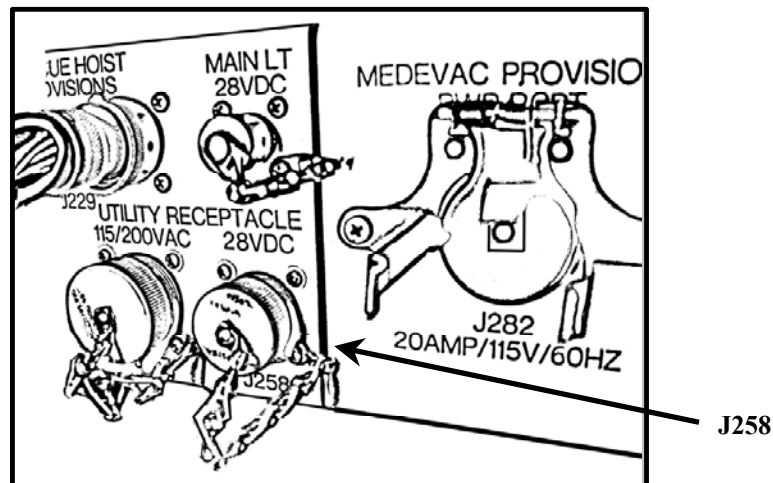
**Figure 3-9 – UH-60 Cockpit and Troop Compartment Layout**

- (2) Verify with UH-60 crew chief that power is applied in aircraft.
- (3) Before starting installation procedures ensure the UH-60 APU is running.
- (4) Verify with crew chief that UTILITY RECP 7.5 AMP circuit breaker is off. This is located on the #1 primary DC bus circuit breaker panel.
- (5) Plug in headset to communicate with crew.



**b. Prepare IPADS for transfer.**

- (1) If connected, disconnect FOS data cable W136 P1 from CDU J2 and place caps on CDU and cable connectors.
- (2) Verify helicopter plumb bob arm is stowed and secured with its quick release pin.
- (3) Without disconnecting the cable, remove the CDU from its mount(see figure 2-21).
- (4) Detach CDU mount from CDU indexer mast.
- (5) Attach CDU mount to UH-60 CDU indexer.
- (6) Secure UH-60 CDU indexer to IPADS frame using quick release pin.
- (7) Without disconnecting cable, install the CDU in the CDU mount and secure latches.
- (8) Remove IPADS UH-60 power cable W116-2 cable and 8 cable ties (found inside the IPADS toolkit pouch) from storage compartment and connect P2 to helicopter receptacle plug J258, Figure 3-10. Store and re-secure IPADS tool kit when complete.
- (9) Use the 8 cable ties to secure power cable W116-2 to the railing of the seat next to where IPADS will be placed, figure 3-15, and the other two cable ties to secure the excess cargo strap when securing the IPADS in the UH-60, paragraph 3-33c.



**Figure 3-10– UH-60 AC/DC Power Connectors**

**c. Transfer of IPADS from Vehicle to Helicopter.**

IPADS, while in operation, may be transferred from a vehicle to helicopter with or without the rotor stopped using the following procedure:

### 3-33. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped - Continued

**WARNING**

If the helicopter rotors are turning, canvas and top bows must be securely tied down in the vehicle.

- (1) Position vehicle outside the rotor disk, approximately 30 feet from helicopter right cargo door.
- (2) Verify that helicopter has been prepared for IPADS transfer, paragraph.3-33a.
- (3) Remove theodolite, tripods, and other gear from vehicle and set aside, if necessary.
- (4) Remove two T-handles and two washers securing two clamping brackets to vehicle floor plate.
- (5) Move IPADS frame assembly a few inches to disengage pins in alignment bracket assembly.
- (6) Reattach T-handles, washers, and clamping brackets to floor plate after IPADS has been moved.
- (7) When ready to transfer, turn the BCU INPUT power switch to OFF (IPADS should remain operational, running on internal IPADS batteries; all BCU LEDs will be extinguished).
- (8) Disconnect IPADS ground vehicle power cable P1 from BCU input power connector.
- (9) Using four persons, transfer IPADS frame assembly to the helicopter.
- (10) Adjust location of IPADS frame assembly until positioned approximately as illustrated in figure 3-12. The plumb bob arm must swing clear of the fuselage.
- (11) Connect IPADS UH-60 power cable P1 to BCU DC input power connector.
- (12) IPADS operator will request crew chief to turn on Utility RECP 7.5 AMP circuit breaker. Turn BCU INPUT power switch to ON. BCU external DC power indicator should illuminate.

#### **NOTE**

When the IPADS is mounted in the helicopter, the vehicle type must be changed to UH-60 (paragraph 3-11b) if IPADS has been transferred from another vehicle. This can be accomplished before or after transferring the IPADS to the helicopter.

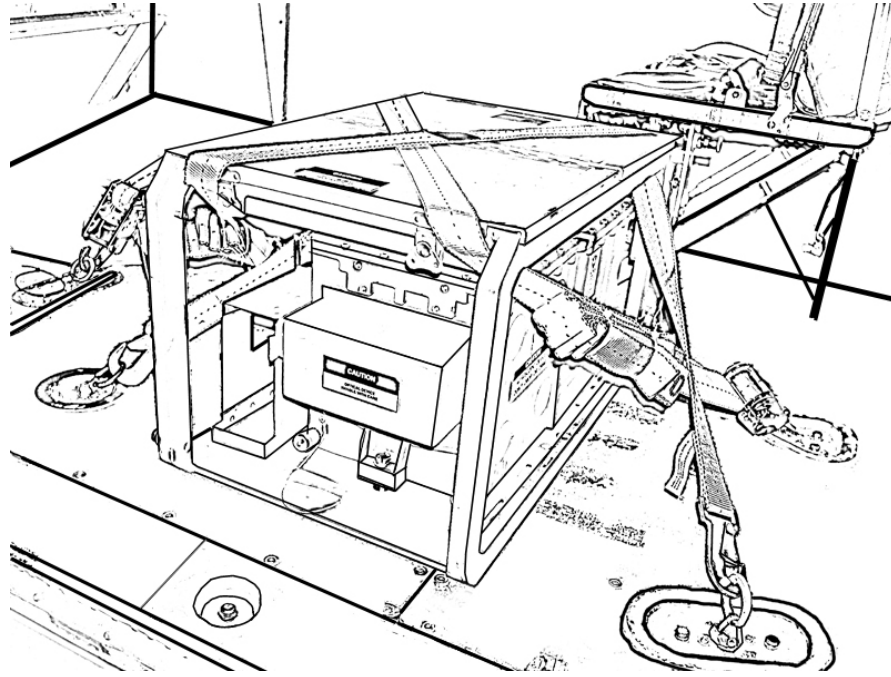


Figure 3-11 – IPADS in UH-60

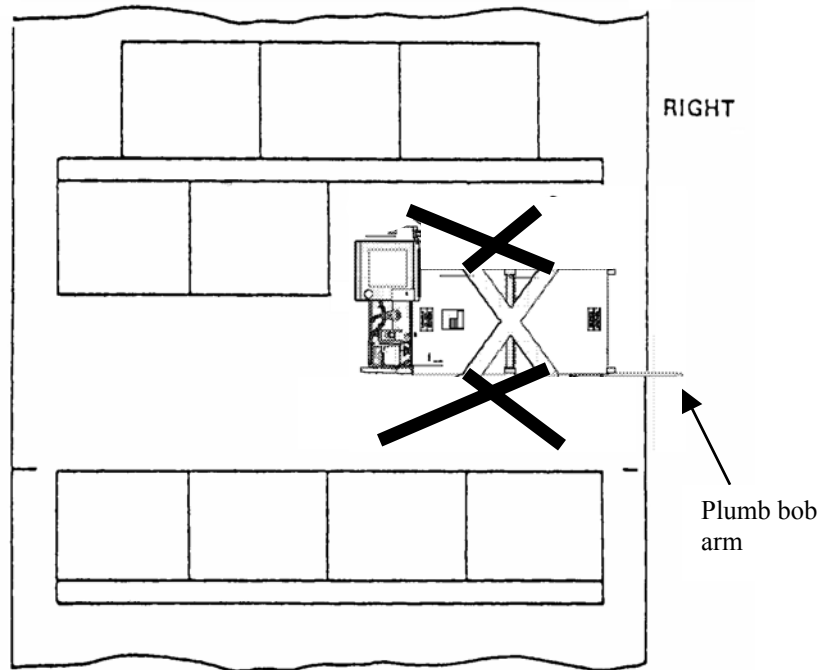


Figure 3-12 – UH-60 IPADS

### 3-33. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped - Continued

#### WARNING

Belt assemblies must be wrapped around the IPADS frame as shown in Figure 3-14 to prevent the unit from sliding out during helicopter maneuvers.

- (13) Using belt assemblies, tie down IPADS by attaching belt assemblies to aircraft floor cargo rings as illustrated in Figure 3-13. Large end of cargo strap must face rear of aircraft. Note that each belt must be wrapped around the IPADS frame as shown in the Figure 3-14.



**Figure 3-13 – Belt Assembly Clipped to Cargo Ring**

- (14) Tighten belt assemblies using ratchet handles to insure IPADS frame cannot move after tightening cargo straps. **Do not over tighten and bend IPADS frame.**
- (15) Roll excess cargo strap and secure with black cable tie or tape.

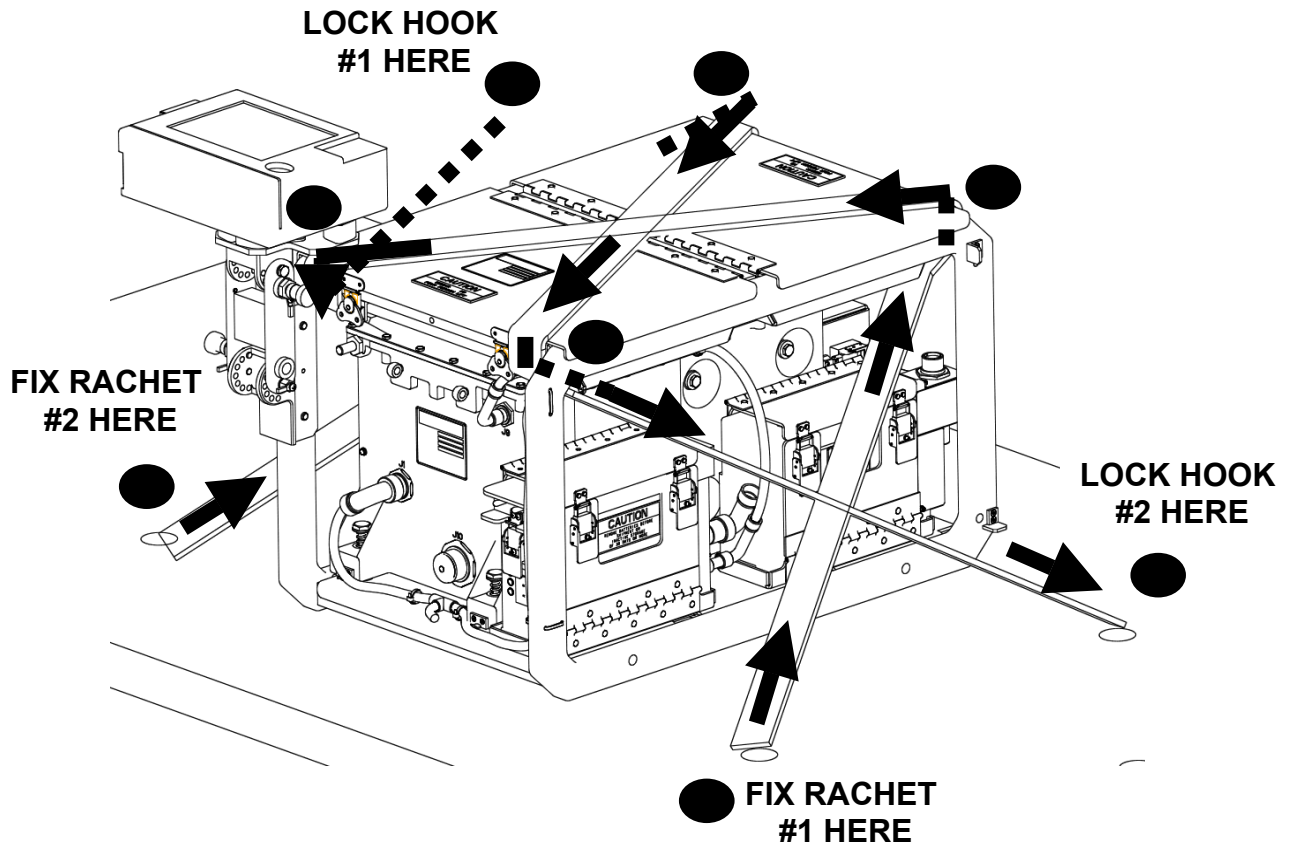
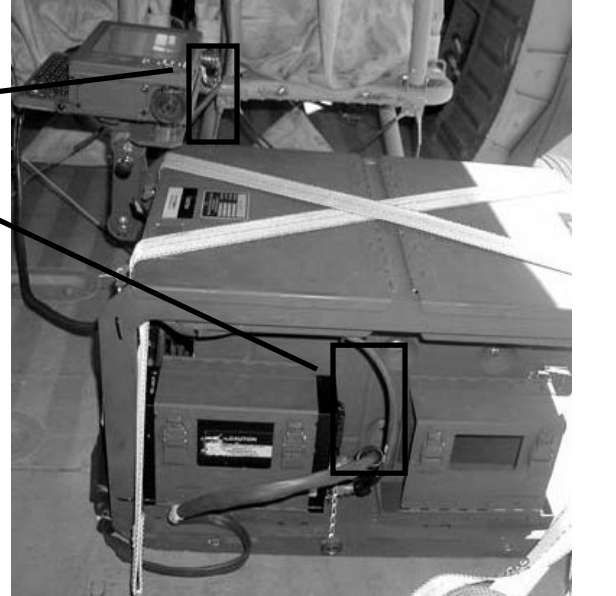
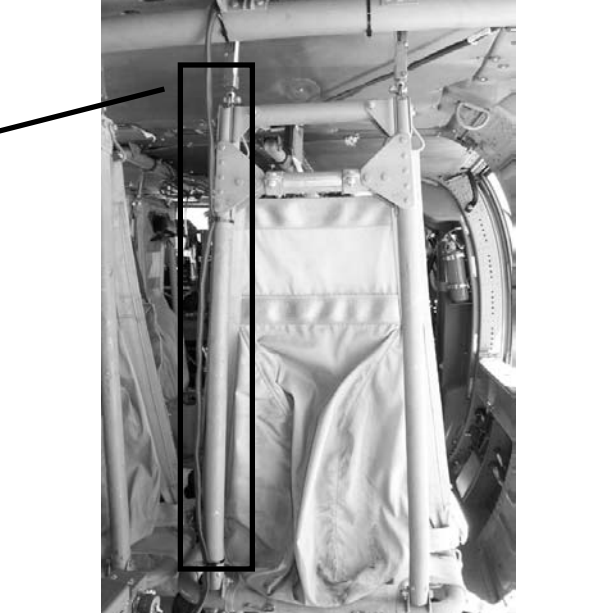
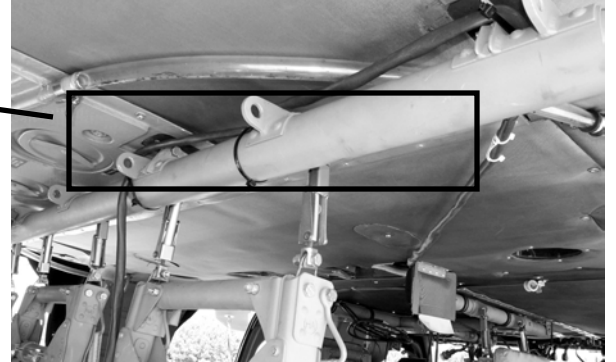

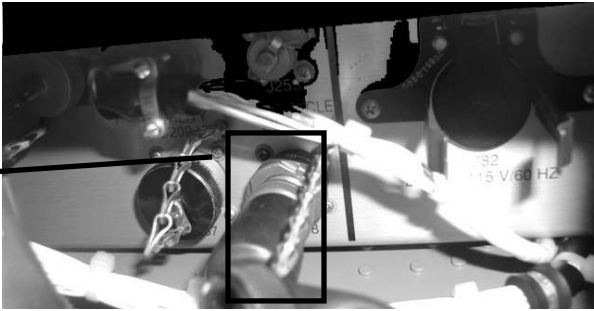


Figure 3-14 – Belt Assembly Ratchet

### 3-33. Transfer to UH-60 (Blackhawk) Helicopter with Rotor Stopped - Continued

**Figure 3-15 Cable Tie Installation**

<p>1. From the rear of the IPADS, run the cable horizontally to the seat on the starboard side of the aircraft.</p>	 <p>A black and white photograph showing the interior of a helicopter cabin. A cable is being run from the rear of the IPADS (Intelligent Personal Avionics Display System) towards the starboard side of the aircraft. A black box highlights the cable at the IPADS, and another black box highlights the cable as it runs horizontally across the cabin towards the seat. A large black arrow points from the text in the left column to the cable in the photograph.</p>
<p>2. Run the cable vertically up the inside post of the seat up to the bar that runs horizontally across the cabin of the aircraft (support installation, troop seat upper – 70500-02160-012).</p> <ul style="list-style-type: none"><li>• At the bottom, middle and top of the troop seat bar, wire tie the cable to the troop seat.</li></ul>	 <p>A black and white photograph showing the interior of a helicopter cabin. A cable is being run vertically up the inside post of the seat. A black box highlights the cable as it runs vertically. A black arrow points from the text in the left column to the cable in the photograph.</p>
<p>3. Run the cable across the support bar towards the starboard side of the aircraft.</p> <ul style="list-style-type: none"><li>• Where the cable turns right, to run across the top of the bar, place a wire tie.</li><li>• Six inches from that point install another wire tie.</li><li>• Where the cable bends to go forward, place another wire tie.</li></ul>	 <p>A black and white photograph showing the interior of a helicopter cabin. A cable is being run across the support bar towards the starboard side of the aircraft. A black box highlights the cable as it runs across the support bar. A black arrow points from the text in the left column to the cable in the photograph.</p>

<p>4. Run the cable forward to the bar above the crew chief seat</p>	
<p>5. Run the cable to the AC/DC power connectors on the ceiling near the crew chiefs seat and connect W116-1(P1) to J258(Utility Receptacle-28VDC).</p> <p>The W116-1 cable should be taut. Use additional wire ties to remove any sagging wire.</p>	

- (16) Installation is complete.
- (17) Verify vehicle type is set to UH-60, paragraph 3-11b
- (18) Stow plumb bob arm.
- (19) Secure helicopter doors.
- (20) Load ground vehicle with survey and personal gear that will not be used during the helicopter mission.
- (21) Install protective cap on ground vehicle power cable P1.

### 3-34. Transfer to Ground Vehicle from UH-60 (Blackhawk) Helicopter.

IPADS may be transferred to a land vehicle from a UH-60 helicopter while operating. The procedure for transfer with the helicopter rotor stopped is given below.

#### **WARNINGS**

- IPADS crew must wear hearing protection at all times when working around aircraft.
- Use extreme care when working under helicopter blades.
- To prevent injury, use at least four persons to transfer IPADS.

#### **NOTES**

- BCU battery good and battery temperature indicators should be illuminated prior to transfer IPADS to ground vehicle. If battery good is not lit, there are two options to ensure that IPADS remains operational during transfer.
  - (1) Allow IPADS extra time while running off UH-60 DC power.
  - (2) Plug the IPADS AC power cable found in the IPADS storage box and the standard extension cord connector to the UH-60 or facility 150v AC power prior to disconnecting UH-60 DC power.
- Transfer system to ground vehicle power quickly to minimize discharge of batteries.
- Initiate a ZUPT whenever the system is stationary.
- When the IPADS is mounted in the ground vehicle the vehicle type must be changed. This can be accomplished before or after transferring the IPADS to the ground vehicle. See paragraph 3-11b for this procedure.
- Transfer of IPADS from Helicopter to Ground Vehicle. IPADS, while in operation, may be transferred from a helicopter to a ground vehicle with the rotor stopped. Use the following procedure:
  - a. Position vehicle so IPADS access is next to helicopter right side cargo door. Secure cargo door in the fully open position.
  - b. Remove theodolite, tripods, and other gear from vehicle and set aside, if necessary, to provide unobstructed access to the IPADS floor plate.
  - c. Stow IPADS plumb bob arm.
  - d. Release and remove belt assemblies securing IPADS to the UH-60 cargo tiedown rings.
  - e. When ready to transfer, turn the BCU INPUT power switch to OFF.
    - (1) Turn helicopter J258 DC to OFF. Disconnect the IPADS UH-60 power cable from BCU input power connector.
    - (2) Using four persons, transfer the IPADS frame assembly to IPADS floor plate in the ground vehicle.



- (3) Remove protective cap and connect IPADS ground vehicle power cable P1 to BCU input power connector.
- (4) Turn BCU INPUT power switch to ON. BCU external DC power indicator should illuminate.
- (5) Adjust location of IPADS frame assembly until holes in bottom frame rail on BCU side are next to pins on alignment bracket assembly.
- (6) Slide IPADS frame assembly onto pins on alignment bracket assembly until pins are fully engaged.
- (7) Remove two T-handles, washers, and clamping brackets from IPADS storage compartment.
- (8) Install two clamping brackets on lower rail of CPNU side of IPADS frame and secure to floor plate with T-handles and washers.

**CAUTION**

Use caution when pulling off cargo tie down straps.

- (9) Disconnect UH-60 W116-2 power cable from helicopter J258. Cut and remove the cable ties securing the cable ensuring all pieces of the ties are removed from the UH-60 and stow W116-2 in IPADS storage compartment.
- (10) Without disconnecting cable, remove CDU from CDU mount.
- (11) Remove pins securing UH-60 CDU indexer to IPADS frame.
- (12) Detach CDU mount from UH-60 CDU indexer. Stow UH-60 CDU indexer in IPADS storage compartment.
- (13) Attach CDU mount to CDU indexer mast.
- (14) Without disconnecting cable, install CDU in CDU mount and secure latches.
- (15) Installation is complete.
- (16) Verify vehicle type is set for ground vehicle, paragraph 3-11b.
- (17) Load ground vehicle with survey and personal gear.
- (18) If required for the mission, connect FOS data cable W136 P1 to CDU J2.
- (19) If required re-install seats previously removed from helicopter.

### 3-35. Operation in Emulator Mode.

The IPADS software can be operated in emulator mode for training purposes on an IPADS CDU, with or without a CPNU, or on a standard IBM Personal Computer (PC)-compatible machine.

#### CAUTION

Points created using the emulator mode should be deleted prior to switching to normal mode if not valid.

#### NOTE

Switching from normal operational mode to emulator mode for training requires operator confirmation. When using IPADS, the CDU will then be restarted. When using a PC, the PC will not be restarted, but the IPADS emulator will be exited. The operator must then re-start the emulator. All other operations described below operate the same on a PC or CDU.

- a. **Turn on and turn off sequences.** Start up the IPADS, paragraph 3-6.
- b. **Operation Mode.** IPADS indicates it is in EMULATOR MODE in SYSTEM STATUS & MESSAGES area of display. If in normal operation, this is indicated in SYSTEM STATUS & MESSAGES by CPNU COMM OK if CPNU is connected to CDU and CPNU COMM FAIL. If CPNU is not connected, perform the following steps to change from normal operation to emulator mode:
  - (1) Scroll to OPERATION MODE on MENU and press **ENTER**. **PRESS F1 FOR NORMAL OPERATION** and **F2 FOR EMULATOR** is displayed with function key line **F1-NORMAL** and **F2-EMULAT**.
  - (2) Press **F2**. Instruction line prompts **PRESS Y TO SWITCH TO EMULATOR MODE / RESTART CDU**.
  - (3) Press **Y** to confirm emulator mode. CDU software will shut down and then restart in normal operation mode.
- c. **Emulator mode capabilities.**

Verify IPADS is in the emulator mode as indicated in the SYSTEM STATUS & MESSAGES area of display. While in the emulator mode the IPADS CDU will not communicate with the CPNU, and will not be capable of performing normal survey operations. However the operator can simulate:

  - (1) Position initialization simulation. See paragraph 3-13 for entering initial position in either UTM or geodetic form.
  - (2) Motion simulation. Once position is initialized, simulate movement by entering the MAP page (press **F6** on the MENU) and using the A, W, D, and X keys to simulate motion in the westerly, northerly, easterly, and southerly directions. Prolonged depression of any of these will rapidly increase simulated vehicle speed. Use S to stop motion.
  - (3) Marking simulation – simulate mark operations as described in paragraph 3-21. To simulate 2-position azimuth marking when the CDU displays **OS (P1) MARKED; MOVE TO EOL (P2) POSITION** paragraph 2-23, simulate movement to EOL as described above (motion simulation). The LEN OL indicator and TIME IN P1 – P2 OPERATION xx:xx will operate as normal.
  - (4) Update simulation. Once simulation of mission is complete (points were marked), an update can be simulated. Simulate motion from the last marked point to a few meters from the initial or another survey control point. Follow instructions in paragraph 3-15a to simulate the update using the initial or other SCP point data. The IPADS position will appear to be updated as described in paragraph 3-15c, and the marked points will be adjusted based on their simulated total distance traveled from the initialization point, and the error between the SCP used and the simulated IPADS closing position.
- d. Map display capability is available and operates as described in paragraph 3-29.

**Waypoint navigation is available and operates as described in paragraph 3-30, except that vehicle heading remains pointing TRUE north.**

**To switch to normal operation follow instructions in paragraph 3-11a(1).**

e. To shut down, follow instructions in paragraph 3-6b.

### SECTION III. OPERATION UNDER UNUSUAL CONDITIONS

**3-36. Operation in Extremely Rough Terrain.** Not applicable.

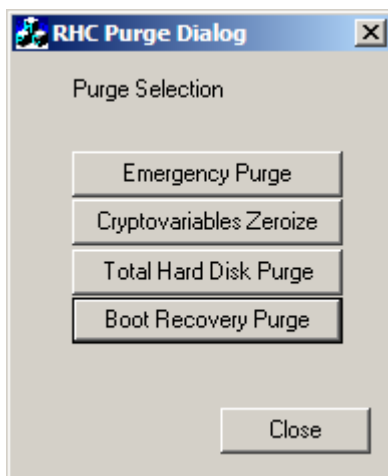
**3-37. Operation at Temperature Extremes.** Not applicable

**3-38. Operation Under Emergency Conditions.**

The IPADS CDU has the capability to perform an emergency zeroize to avoid compromising sensitive data.

a. Emergency Zeroize of the IPADS

**Press the FNC and ERS simultaneously. A menu will be displayed as shown below.**



Using the up or down arrows, select the Emergency Purge button and press **ENTER**.

**Table 3-7 – Quick Look-Up to Operating Procedures**

<b>Paragraph Number</b>	<b>Operation</b>	<b>Page</b>
3-6	Turn On and Turn Off Sequences	3-13
3-7	Display Technical Manual	3-14
3-8	IPADS Status Display	3-15
3-9	Brightness Setting	3-15
3-10	Audible Alarm	3-16
3-11	Configuration	3-16
3-12	Initialization, Hot Start	3-30
3-13	Entering Initial Position (UTM or Geodetic)	3-32
3-14	Zero-velocity Updates (ZUPTs)	3-36
3-15	Updating	3-37
3-16	Plumb Bob Position Update	3-38
3-17	Theodolite Position Update	3-41
3-18	Update Errors	3-44
3-19	PAE Code	3-46
3-20	Data Recall	3-47
3-21	Marking	3-47
3-22	Marking Position and Altitude Using Plumb Bob	3-48
3-23	Marking 2-Position Azimuth Using Plumb Bob	3-48
3-24	Theodolite Measurements	3-49
3-25	Marking - Position, Azimuth, and Altitude Using Theodolite	3-52
3-26	Adjacent Grid Zone	3-53
3-27	Recording IPADS Data	3-54
3-28	Data Management	3-54
3-29	FOS	3-59
3-30	Map Display	3-61
3-31	Waypoint Navigation	3-63
3-32	Transfer Between Land Vehicles	3-66
3-33	Transfer to UH-60 (Blackhawk) Helicopter w/ Rotor Stopped	3-67
3-34	Transfer to Ground Vehicle from UH-60 (Blackhawk) Helicopter	3-76
3-35	Operation in Emulator Mode	3-78
3-36	Operation in Extremely Rough Terrain	3-80
3-37	Operation at Temperature Extremes	3-80
3-38	Operation Under Emergency Conditions	3-80



## CHAPTER 4

### OPERATOR/CREW MAINTENANCE INSTRUCTIONS

---

#### SECTION I. TOOLS AND EQUIPMENT

- 4-1. General.** Tools required for most operator/crew maintenance are contained in a kit located in the storage box on the IPADS frame and are listed in the Basic Issue Items List, Appendix B, Section III.
- a. Paint IPADS with CARC paint (app F, item 4) and a small brush (app F, item 5) for touchup painting only.
  - b. Assistance in troubleshooting battery problems may be obtained from Unit Maintenance personnel.

#### SECTION II. LUBRICATING INSTRUCTIONS

- 4-2. General.** There is no lubrication required for IPADS.

#### SECTION III. INSPECTION

- 4-3. General.** The operator must perform the following inspection prior to survey operations. These steps will ensure the IPADS is operational and capable to perform survey operations.

**Table 4-1 – Pre-Operation Check**

<b>Item to be inspected</b>	<b>Procedure</b>
BCU	Check that BCU power switches SW1 and SW2 are in the OFF position.
IPADS frame	Check that IPADS frame is securely fastened. Check IPADS frame and all clamshell latches for proper operation.
Cables Wiring harness	Check that power cable W116 is securely connected to BCU and vehicle power. Check that wiring harness W114 is securely connected to BCU, CDU and CPNU. If used, ensure the FOS cable W136 is securely connected to CDU J2 and the FOS. If not used, check that CDU J2 connector is covered.
Porro-prism cover	Check that porro-prism cover is securely latched.
Equipment in general	Inspect for excessive accumulation of dirt and debris.
Cable assemblies	Check all cable assemblies for presence of cuts or torn sheathing, kinks, pinches, and scrapes. If present, ask maintenance support to troubleshoot the cable.
HMMWV Installation kit	Check that hardware securing floor plate to the vehicle is tight .
Alignment bracket	Ensure that all t-handle bolts are hand tight.
CDU	Check that hardware securing CDU support arm to floor plate is tight.

**SECTION IV. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES**

**4-4. General.** Safe and efficient IPADS operation requires regular checks of equipment. When performing PMCS, the operator discovers equipment malfunctions or performs routine maintenance for upkeep of the IPADS. Malfunctions require corrective action to avoid equipment failure or injury to personnel. The necessary preventive maintenance checks and services to be performed are listed and described in table 4-2. Item numbers in the tables indicate sequence of minimum inspection requirements. Note defects discovered during operation for correction after operation. Stop operation immediately if a deficiency is noted which would damage the equipment. When performing table 4-2, observe the following:

- a. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. Warnings and cautions appear before applicable procedures. You must observe these WARNINGS to prevent serious injury to yourself and others and CAUTIONS to prevent your equipment from being damaged.
- b. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750, The Army Maintenance Management System (TAMMS). Marine Corps users shall refer to TM 4700-15/1.



**4-5. Explanation of Table Entries.**

- a. Item Number column. Numbers in this column are for reference. When completing DA Form 2404 or DA Form 5988-E (Equipment Inspection and Maintenance Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.
- b. Interval column. This column tells you when you must do the procedure listed in the procedure column. BEFORE operation procedures must be done before you operate or use the equipment for its intended mission. AFTER operation procedures must be done immediately after you have operated or used your equipment.
- c. Item to be Inspected column. This column provides the item to be checked or serviced.
- d. Procedure column. This column gives the procedure you perform to check or service the item listed in the Item to be Inspected column so you know if the equipment is ready or available for its intended mission or for operation. You must do this procedure at the time stated in the Interval column.
- e. Equipment Not Ready/Available If column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show fault listed in this column, do not operate the equipment until it is repaired or becomes fully operational. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.
- f. Other Table Entries. Be sure to observe all special information and notes that appear in your PMCS table.

**Table 4-2. Operator Preventive Maintenance Checks and Services**

<b>NOTE</b> Within designated interval, these checks are to be performed in the order listed		
<b>B</b> - before	<b>A</b> - After	<b>M</b> - Monthly
<b>D</b> - During	<b>W</b> - Weekly	

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	D	A	W	M			
1	•					Flashlight	<div style="border: 2px solid black; padding: 5px; text-align: center;"><b>CAUTION</b></div> <p>Cable connectors may be damaged by improper operation. Release connectors by turning locking ring counterclockwise. Never turn the backshell. Align keyways before mating connectors. Secure connectors by turning locking ring clockwise until it locks.</p> <p><b>Pre-Turn On Checks and Services</b>                      Check operation of flashlight.</p>	
2	•					Porro-prism assembly	<p>Inspect porro-prism assembly for damage or degraded reflectivity. Check leveling mechanism for smooth operation throughout its range and that level vial is not damaged. Check that porro-prism cover is securely latched.</p>	
3	•					Alignment bracket assembly	<p>Check all t-handle bolts on the alignment bracket assembly for hand tightness.</p>	
4						IPADS frame	<p>Check that IPADS frame is securely fastened.</p> <p><b>Initialization Inspection</b> Perform immediately after turn-on for each mission.</p>	
5		•				Power indicators	<p>Check BCU indicator lights for presence of vehicle power.</p>	Vehicle power not present.
6		•				Battery Good indicator	<div style="border: 2px solid black; padding: 5px; text-align: center;"><b>CAUTION</b></div> <p>IPADS may shut down if disconnected from vehicle power and the charge state indicator is not illuminated. Check that BCU Battery Good Indicator is illuminated. New batteries require 4 hours to charge.</p>	
7		•				CDU status display	<p>During CDU boot up, check status display for failure indications. Check that audible alarm is operational. With switch in STLTH position, check that screen dims and sound decreases. With switch in KBD, check that keyboard illuminates.</p>	Any indicated failure.

**Table 4-2. Operator Preventive Maintenance Checks and Services - continued**

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	D	A	W	M			
8						FOS connection	If FOS is connected and operating, check that FOS and IPADS are communicating. <b>Battery Test</b>  <b>NOTE</b> This test provides a check of IPADS battery operation under load. A battery test will be performed at the end of a mission to minimize the impact of a defective battery and IPADS shutdown. a. While IPADS is operating, note that the BCU charge state indicator is illuminated. b. Disconnect vehicle power by setting BCU <b>DC INPUT</b> power switch SW1 to OFF. IPADS should remain operating with the input power indicator dark. c. After 30 seconds of battery operation, either set BCU <b>DC INPUT</b> power switch SW1 to ON to continue operation or turn IPADS off.	
9		•						
10			•			BCU batteries	Inspect BCU batteries for cracked case, leakage, or corrosion.	Case is cracked, or leakage or corrosion is present.
11			•			BCU connectors	Inspect connectors for bent or damaged pins and covers are present and attached.	Cable connector pins are damaged.
12			•			Vehicle battery power cable connections	Check that connections to the vehicle batteries are tight. If NATO connector is used, insure connector plugs are secure.	
13					•	Porro-prism alignment	Check for loose screws and level vials not broken and not cloudy to the point that stadia scale is not readable.	
14		•			•		<b>Porro-Prism Alignment Test</b> a. Turn on and initialize IPADS. b. Update IPADS over 4 <sup>th</sup> order or higher SCP that has a known accurate azimuth. c. Maneuver vehicle, if required, to achieve auto reflection from porro-prism with prism leveled and with theodolite plumbed over SCP. d. With theodolite sighted on porro-prism and instrument initial circle reading set, measure and record horizontal angle to EOL. Measure and record distance and vertical angle. e. Repeat step d. Mean the two horizontal angles, distances, and vertical angles. Two angles must agree within .050 mils.	

**Table 4-2. Operator Preventive Maintenance Checks and Services - continued**

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	D	A	W	M			
15			•			Alignment bracket assembly	f. With IPADS, establish the position, elevation and azimuth. Use the mean angles and distance. g. If the azimuth determined in step f differs more than 0.40 mils from the known azimuth, record difference. h. Double check theodolite readings.  i. Double check the porro-prism assembly and insure level is correct and it is securely fastened to CPNU with no visible damage. Check all t-handle bolts for hand tightness.	Difference remains greater than 0.40 mils.
16			•			IPADS frame	Check all t-handle bolts for hand tightness.	

**SECTION V. OPERATOR TROUBLESHOOTING**

**4-6. General.** When an IPADS component fails, the failed area is readily identified through the internal fault isolation process. IPADS possesses a Built-In Test (BIT). This BIT allows the operator to identify the component or group of components with the fault. Fault identification is displayed in one of three ways. For the CPNU, a message will be sent via the CDU. The CDU contains its own internal BIT that will notify of a specific failure in the CDU. A BCU failure is displayed through the LEDs on the front top of the BCU. On the CDU STATUS page the operational status of the CPNU can be checked. The software versions used on IPADS and the IPADS Elapsed Time Indicator (ETI) are also displayed on the STATUS page. This section describes troubleshooting to isolate faults to a specific LRU (BCU, CDU, or CPNU).

Before performing troubleshooting tasks, carefully read the operating instructions and follow all notes, cautions, and warnings.

---

**Malfunction**

**Test or Inspection**

**Corrective Action**

---

**NOTE**

If possible, troubleshoot by replacing with another known good LRU.  
This will isolate to the LRU or cable.

1. IPADS will not power up.
  - Step 1. Check to ensure all power switches on the BCU and CDU are ON.
    - a. Place switches to the ON position.
    - b. If switches are already on go to step 2.
  - Step 2. Inspect all cables to ensure they are not cut or pinched and are connected securely at the connectors.
    - a. If all cables are in serviceable condition, take off and reconnect at each connector.
    - b. Notify maintenance support.
    - c. If any cable is not serviceable, turn in for repair, paragraph 4-7.
    - d. Recycle power and try to power up IPADS.
    - e. If IPADS still will not power up, go to step 3.
  - Step 3. If connected to vehicle, check to ensure the BCU DC Power Input LED is illuminated.
    - a. If LED is not illuminated, check W116 cable.
    - b. If power cable is good, check vehicle battery.
    - c. If vehicle battery is good, turn in BCU for repair, paragraph 4-7.
  - Step 4. If connected to AC power, check to ensure the BCU AC LED is illuminated.
    - a. If not illuminated, check the AC cable.
    - b. Notify maintenance support.
    - c. If cable is not serviceable, turn in for repair.
    - d. If AC cable is serviceable, replace BCU fuse, paragraph 4-11.
    - e. If BCU fuse is good, turn in BCU for repair, paragraph 4-7.
2. The CPNU will not power up.
  - Step 1. Inspect wiring harness W114 cable connectors for looseness.
    - a. If tight, go to step 2.
    - b. If loose, tighten and recycle power and try to power up IPADS.
    - c. If the CPNU will not power up, go to step 2.
  - Step 2. Inspect wiring harness W114 to ensure it is not cut or pinched and there are no bent or damaged pins.
    - a. If damaged, replace wiring harness by turning in, paragraph 4-7.
    - b. Recycle power and try to power up IPADS.
    - c. If CPNU will not power up, turn in CPNU for repair, paragraph 4-7.
    - d. If cable appears serviceable, notify maintenance support.
    - e. If maintenance support verifies wiring harness is serviceable, turn in CPNU for repair, paragraph 4-7.

---

**Malfunction****Test or Inspection****Corrective Action**

---

3. The CPNU powers up and then shuts down during initialization.
  - Step 1. Check the CDU Sys Status Screen for errors.
    - a. If there are no errors, go to step 2.
  - Step 2. Check initialization grid coordinates for accuracy.
    - a. If grid coordinates more than 100 meters off, enter correct grid and initialize.
    - b. If CPNU shuts down or errors shown in the Sys Status, turn CPNU in for repair, paragraph 4-7.
4. The CDU will not power up.
  - Step 1. Inspect wiring harness W114 cable connectors for looseness.
    - a. If tight, go to step 2.
    - b. If loose, tighten and recycle power and try to power up IPADS.
    - c. If CDU will not power up, go to step 2.
  - Step 2. Inspect wiring harness W114 to ensure it is not cut or pinched and there are no bent or damaged pins.
    - a. If damaged, replace wiring harness by turning in, paragraph 4-7.
    - b. Recycle power and try to power up IPADS.
    - c. If CDU will not power up, turn in CDU for repair, paragraph 4-7.
    - d. If cable appears serviceable, notify maintenance support.
    - e. If maintenance support verifies wiring harness is serviceable, turn in CDU for repair, paragraph 4-7.
5. CDU fails BIT.
  - Step 1. Recycle power as described in paragraph 3-6a.
    - a. Observe CDU boot up for BIT.
    - b. If the CDU does not pass BIT, turn in CDU for repair, paragraph 4-7.
6. CPNU fails BIT.
  - Step 1. Recycle power as described in 3-6a.
    - a. If the CPNU does not pass BIT (CPNU COMM OK on IPADS Status and Operator Messages indicator), turn in for repair, paragraph 4-7.
7. IPADS shuts down during transfer to another vehicle.
  - Step 1. Check BCU Battery Good indicator to see if it is illuminated.
    - a. If LED is not illuminated, charge backup battery for four hours.
    - b. With IPADS running on vehicle power, turn **DC INPUT** Switch off.
    - c. If IPADS continues to run, backup battery is good.
    - d. If IPADS shuts down, replace both backup batteries.
8. BCU Battery Temp LED not illuminated.

**NOTE**

If IPADS is operating on AC power or battery backup power, the battery temperature light will not be illuminated.

- Step 1. Run IPADS for 30 minutes to allow time to heat backup battery.
  - a. If Battery Temp LED still not illuminated, check fuse and battery heater.
  - b. If fuse and battery heater are good, turn in BCU for repair, paragraph 4-7.

---

**Malfunction**

**Test or Inspection**

**Corrective Action**

---

9. IPADS CDU fails to communicate with FOS.
  - Step 1. Inspect FOS cable W136 to ensure it is not cut or pinched it is connected securely at the connectors and there are no bent or damaged pins.
    - a. If cable is serviceable, disconnect and reconnect at each connector.
    - b. Notify maintenance support.
    - c. If cable is not serviceable, turn in for repair, paragraph 4-7.
  - Step 2. Check the System Status for error messages.
    - a. If there is an error message, turn in CDU for repair, paragraph 4-7.
    - b. If there is no error message, go to step 3.
  - Step 3. Replace FOS with serviceable FOS.
    - a. Retry communication.
    - b. If communication is good, go to step 3.
    - c. If communication fails, turn in CDU for repair, paragraph 4-7.
10. IPADS Commo failure.
  - Step 1. Check wiring harness W114 cable connectors for looseness.
    - a. If tight, go to step 2.
    - b. If loose, tighten, recycle power, and try to power up IPADS.
    - c. If CDU will not power up, go to step 2.
  - Step 2. Inspect FOS cable W136 to ensure it is not cut or pinched, is connected securely at the connectors, and there are no bent or damaged pins.
    - a. If cable is serviceable, disconnect and reconnect at each connector.
    - b. Notify maintenance support.
    - c. If cable is not serviceable, turn in for repair, paragraph 4-7.
  - Step 3. Check the System Status for error messages.
    - a. If there is an error message, turn in CDU for repair, paragraph 4-7.
    - b. If there is no error message, go to step 4.
  - Step 4. Replace CDU with known good CDU.
    - a. Recycle power. If Commo Failure still present, return CPNU for repair, paragraph 4-7.
    - b. If Commo failure not present, turn in CDU for repair, paragraph 4-7.
11. IPADS WARNING: ERROR ACCESSING MAIN DATABASE CONNECTION, ATTEMPTING RESTORE OF BACKUP DATABASE.
  - Step 1. Press Enter.
    - a. If CDU display comes up normally, press **F7-POINTS** and review stored data.
    - b. Enter data for any points that were lost.
    - c. Continue with mission.
    - d. If IPADS WARNING: ERROR ACCESSING MAIN DATABASE CONNECTION, ATTEMPTING RESTORE OF BACKUP DATABASE is displayed, go to step 2.
  - Step 2. Press Enter.
    - a. If CDU display comes up normally, enter data for any points that were lost.
    - b. Continue with mission.
    - c. If IPADS FATAL ERROR: ERROR ESTABLISHING DATA BASE CONNECTION, PROGRAM TERMINATING is displayed, go to step 3.
  - Step 3. Press Enter.
  - Step 4. Turn BCU OUTPUT switch OFF when IT IS NOW SAFE TO TURN OFF YOUR COMPUTER is displayed.

- Step 5. Reprogram CDU, paragraph 6-1.
- Step 6. Power IPADS ON and enter any required point data in the empty database.

12. IPADS FATAL ERROR: ERROR ACCESSING EGM DATABASE FILE, PROGRAM TERMINATING.

- Step 1. Press Enter.
- Step 2. Turn BCU OUTPUT switch OFF when IT IS NOW SAFE TO TURN OFF YOUR COMPUTER is displayed.
- Step 3. Reprogram CDU, paragraph 6-1.
- Step 4. Power IPADS ON and verify normal CDU display.



## SECTION VI. MAINTENANCE OF IPADS

- 4.7. General.** Unit level personnel are qualified to perform all required maintenance of the IPADS. Once identified, the component that has failed will be removed from the IPADS frame, IAW paragraphs 4-7 through 4-13. Call the supply technician at TACOM-RI, AMSTA-LC-CFSQ, DSN 793-5578 or commercial (309) 782-5578 for shipping instructions. Marine Corps users shall call the Marine Corps IPADS item manager at DSN 567-8160, commercial (229) 639-8160, or e-mail at elizabeth.bradshaw@usmc.mil. L-3 will repair the component and send it back to the owning unit within 72 hours (after it has been in their custody). If L-3 cannot repair that particular component within the 72-hour period they will replace the component and send it to the unit as soon as possible.
- a. Maintainability.** The IPADS design is easy to troubleshoot, identify, and replace the failed component. Upon identification of the failed component and using the IPADS tool kit, figure 1-5, removal and replacement can be accomplished within 10 minutes if PLL authorized. This allows the survey mission to continue with minimal delay when the replacement components are on-hand. The CPNU is bolted to the frame while the CDE and BCU are connected to the frame with clamshell type connectors allowing for easy removal and replacement. Operator maintenance consists of cleaning and spot painting, CDU, BCU, and CPNU replacement, cables, and mounting hardware replacement.
- 4.8. Replace CPNU.** Each component of IPADS is easily removed. The CPNU is the only LRU that requires tools for removal.

### CAUTION

Do not lift the CPNU by the porro prism cover as the prism may become damaged or misaligned.

- a. Remove CPNU.**
- (1) Power down the IPADS, paragraph 3-6b, and ensure all power switches are off on BCU.
  - (2) Disconnect the DC power cable W116 or AC power cable W116-2 from the BCU.
  - (3) Disconnect the wiring harness W114 from the BCU, CDU, and CPNU.
  - (4) Remove the BCU, paragraph 4.9a, and CDU, paragraph 4-10a.
  - (5) Using the 11/16 double-end ratchet remove three bolts securing the CPNU to the IPADS frame.
  - (6) Using two-man lift slide CPNU out of the porro prism end of the IPADS frame without damaging the prism.
  - (7) Place CPNU into transit case for shipment to repair facility. Ensure that the CPNU and the inside of the container, including the cushioning, are dry prior to placing the LRU into the container.
- b. Install CPNU.**
- (1) Using two-man lift slide CPNU into the IPADS frame from rear end of the frame.
  - (2) Using the 11/16 double-end ratchet secure the CPNU with three bolts and tighten to IPADS frame.
  - (3) Replace the BCU, paragraph 4-9a, and CDU, paragraph 4-10a.
  - (4) Connect the wiring harness W114 to the BCU and the CDU and CPNU.
  - (5) Connect the DC power cable W116 or AC power cable 116-2 to the BCU.
  - (6) Power up the IPADS to ensure proper operation of the CPNU, paragraph 3-6a.

#### **4.9. Replace BCU.**

##### **a. Remove BCU.**

- (1) Power down the IPADS and ensure all power switches are off on BCU.
- (2) Disconnect DC power cable W116 or AC power cable W116-2 from the BCU.
- (3) Disconnect wiring harness W114 from the BCU.
- (4) Lift latches to release clamshell latches.
- (5) Open clamshell latches and remove BCU.
- (6) Place BCU into transit case for shipment to repair facility. Ensure that the BCU and the inside of the container, including the cushioning, are dry prior to placing the BCU into the container.

##### **b. Install BCU.**

- (1) On the IPADS frame, open clamshell latches and install BCU.
- (2) Lock connectors by hooking clamp on clamshell connector and pulling down to tighten clamshell connector.
- (3) Connect wiring harness W14 to the BCU connector OUTPUT.
- (4) Connect DC power cable W116 to EXT DC or AC power cable W116-2 to BCU connector EXT AC.
- (5) Power up IPADS to ensure proper operation of BCU, paragraph 3-6a.

#### **4.10. Replace CDU.**

##### **a. Remove CDU.**

- (1) Power down the IPADS, paragraph 3-b, and ensure all power switches are off on CDU.
- (2) Disconnect DC power cable W116 or AC power cable W116-2 from the BCU.
- (3) Disconnect wiring harness W114 from the CDU connector J1 and install electrical covers.
- (4) If connected, disconnect the FOS cable W143 from the CDU connector J2. Install electrical covers.
- (5) If CDU is located on the CDU support arm, turn locking latches counter-clockwise to release CDU from mounting bracket, figure 2-21, and remove.
- (6) If the CDU is in the clamshell storage case on the IPADS frame, lift latches to release clamshells and remove CDU.
- (7) Place CDU into transit case for shipment to repair facility. Ensure that the CDU and the inside of the container, including the cushioning, are dry prior to placing the CDU into the container.

##### **b. Install CDU.**

- (1) Open clamshell latches on the IPADS frame and install the CDU.
- (2) Secure latches by hooking clamp on CDU and pulling down to tighten clamshell latches.
- (3) Connect wiring harness W114 to CDU J1 connector.
- (4) Connect DC power cable W116 or AC power cable W116-2 to the BCU.
- (5) Remove CDU from clamshell storage case and install on CD support arm, paragraph 2-8j.
- (6) Power up IPADS to ensure proper operation of the CDU, paragraph 3-6a.

#### 4-11. Replace BCU Fuse

### CAUTION

Use extreme care when opening the BCU cover to ensure interior wires are not pulled or stretched.

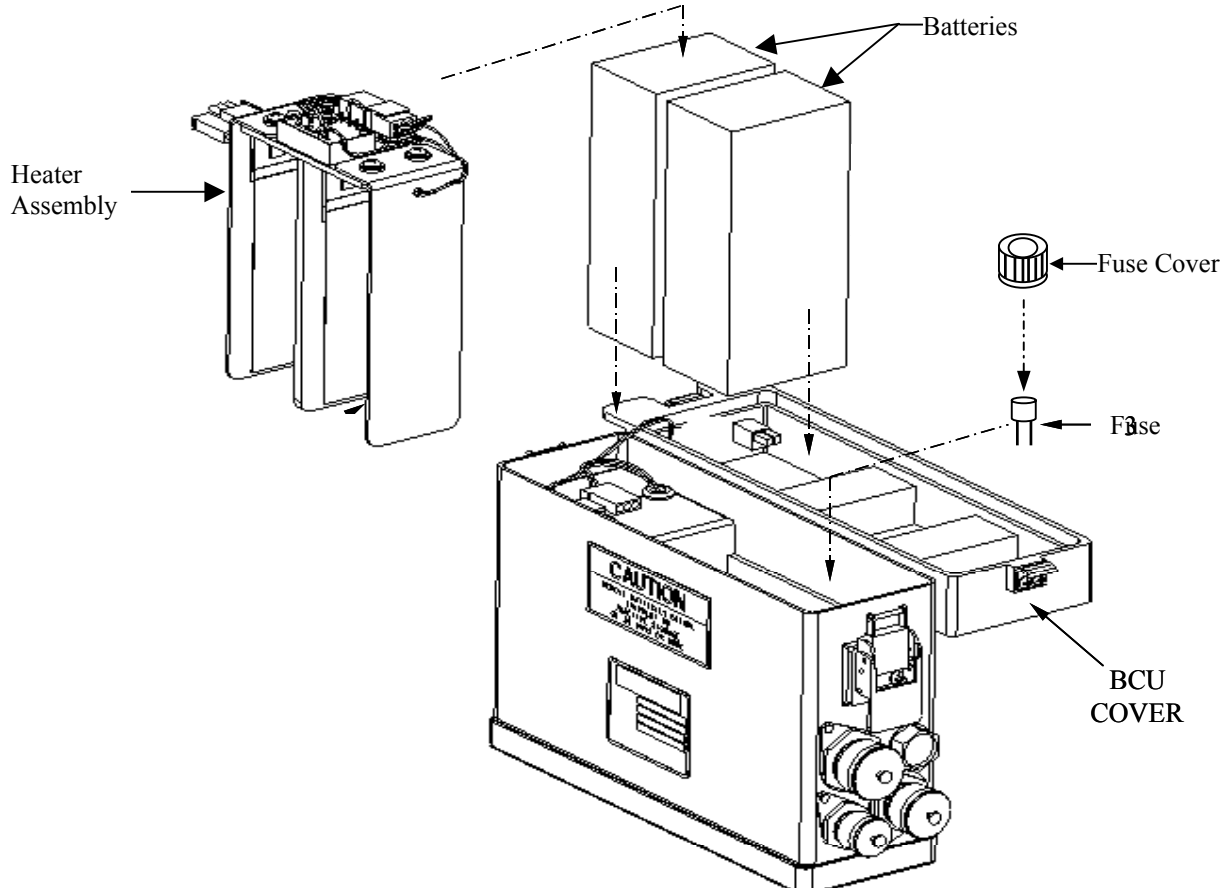


Figure 4-1 – BCU Fuse

##### a. Remove BCU Fuse.

- (1) Remove BCU from IPADS frame, paragraph 4-9a.
- (2) Open cover on BCU by lifting latches on ends.
- (3) Lift cover and lean to side. Be careful not to pull the wires out.
- (4) On the rear end of the BCU is the fuse holder. Turn fuse cover counterclockwise and pull out.
- (5) Carefully reach in and remove fuse by pulling straight up on the fuse.

##### b. Install BCU Fuse.

- (1) Insert fuse into fuse holder inside BCU ensuring the two prong holes are lined up.
- (2) Position fuse cover over fuse and turn clockwise to tighten.
- (3) Close cover on BCU and secure latches to attach cover.
- (4) Replace BCU in clamshell storage compartment on IPADS frame, paragraph 4-9b.

**4-12. Replace Backup Battery Pack.** The BCU contains a backup battery that allows the IPADS to continue to operate without external power being applied. The backup battery can be replaced while the IPADS is operational.

- a. **Remove BCU Fuse Backup Battery Pack** – See figure 4-1.

**CAUTION**

Use extreme care when removing the BCU cover to ensure interior wires are not pulled or stretched.

- (1) Open BCU cover by lifting latches on ends.
  - (2) Lift cover and lean to side. Be careful not to pull wires out.
  - (3) Disconnect Velcro strap holding wire connectors inside front of BCU.
  - (4) Unclip wire connector on long white wire attached to rear of BCU.
  - (5) Unclip wire connector on the black and white wires that are attached to BCU cover.
  - (6) Using a number 2 cross tip screwdriver, loosen four screws on top of battery heater.
  - (7) Carefully lift battery heater straight up to remove.
  - (8) Unclip the remaining two wire connectors to backup battery pack.
  - (9) Lift backup battery out of BCU.
  - (10) If the backup battery must be removed while IPADS is running, perform these steps by lean the BCU outward and perform steps (1) through (9).
- b. **Install Backup Battery Pack** – see figure 4-1.
- (1) Place backup battery into BCU.
  - (2) Connect two wires from backup battery to BCU.
  - (3) Carefully place battery heater down over the backup battery pack and secure four screws on top of heater with a number 2 cross tip screwdriver.
  - (4) Connect white wire to battery heater.
  - (5) Connect black and white wires to battery heater.
  - (6) Wrap wire connectors with Velcro strap to keep them together and out of the way.
  - (7) Replace BCU cover. Be careful not to pinch any wires in the edge.
  - (8) Secure latches on ends to secure cover.
  - (9) If the backup battery must be replaced with IPADS running, lean the BCU outward and perform steps (1) through (8).



**Figure 4-2 Component Replacement**

**4-13. Cleaning and Spot-Painting.** Perform cleaning and spot-painting instructions as follows:

**CAUTION**

Do not paint over unpainted areas. These areas are EMI bonding surfaces that must remain unpainted for maximum conductance.

- a. Spot painting is limited to touchup of scratched, scraped, or otherwise marred surfaces. Clean CDU screen and porro prism with lens paper to prevent scratching the surface. Wipe down cables and IPADS components with a soft lint free cloth. When using water to spray off IPADS, ensure all electrical connectors are securely connected or covered with their electrical cap.

**WARNING**

Denatured alcohol is flammable and gives off harmful vapors. Use only in well-ventilated areas away from open flames and sparks. Avoid prolonged or repeated inhalation of vapors.

- b. The area to be painted must be thoroughly cleaned, dry, and free from oil or grease. Use steel wool or fine sand paper to clean rust from all steel surfaces. Do not sand any items that are aluminum or plastic. Use isopropyl alcohol as a cleaning solvent. Do not use soap and water because soap reacts with aluminum to produce a waxy film. Cover connectors and unpainted areas with masking tape before painting. The system probably will not work if connector contacts get painted. Make sure moving parts, such as clamping latches, are not immobilized by paint.

Carefully apply CARC paint with a small paintbrush. Brush out any runs or drips. Allow paint to air dry for at least 24 hours before subjecting it to wear.



## CHAPTER 5 UNIT MAINTENANCE INSTRUCTIONS

---

### SECTION I. UNIT TROUBLESHOOTING

**5-1. General.** When an IPADS LRU fails, Unit maintenance personnel are required to troubleshoot the associated cable to determine if it is serviceable. If so, the cable is returned to the operator and the LRU is turned in for repair.

---

Malfunction	Test or Inspection	Corrective Action
-------------	--------------------	-------------------

---

1. Wiring harness W114 appears to be unserviceable.
  - Step 1. Perform continuity check of wiring harness W114, figure 5-1.
    - a. If serviceable, return to operator.
    - b. If unserviceable, turn in for repair, Paragraph 4-7.
2. Power cable W116 appears to be unserviceable.
  - Step 1. Perform continuity check of wiring harness W116, figure 5-2.
    - a. If serviceable, return to operator.
    - b. If unserviceable, turn in for repair, Paragraph 4-7.
3. UH-60 power cable W116-2 appears to be unserviceable.
  - Step 1. Perform continuity check of power cable W116-2, figure 5-3.
    - a. If serviceable, return to operator.
    - b. If unserviceable, turn in for repair, Paragraph 4-7.
4. AC power cable appears to be unserviceable.
  - Step 1. Perform continuity check of AC power cable, figure 5-4.
    - a. If serviceable, return to operator.
    - b. If unserviceable, turn in for repair, Paragraph 4-7.
5. FOS cable appears to be unserviceable.
  - Step 1. Perform continuity check of FOS cable, figure 5-5.
    - a. If serviceable, return to operator.
    - b. If unserviceable, turn in for repair, Paragraph 4-7.

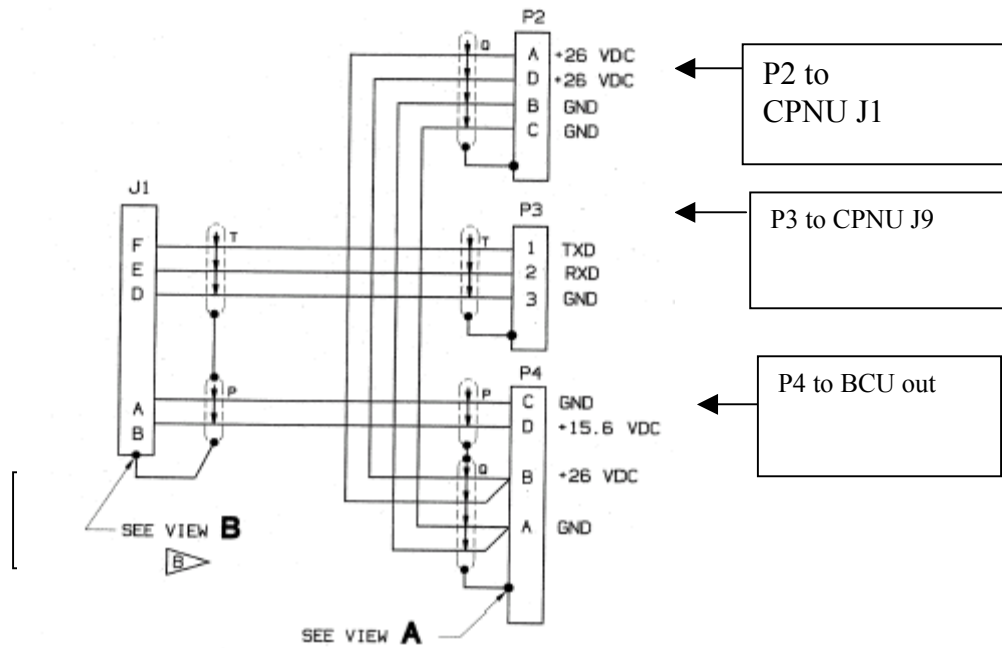


Figure 5-1 – Wiring Harness W114

Legend for Figure 5-1

Wire	P-1 CDU J1	P-2 CPNU J1	P-3 CPNU J9	P-4 BCU AUX OUT	TEST
Ground		B, C		A	Check pin A on P-4 end and pins B and C on the P-2 end for continuity.
+26 volts DC		A, D		B	Check pins A and D on the P-2 end and pin B on the P-4 end for continuity.
Ground	A			C	Check pin C on BCU end and pin A on CDU end for continuity.
+15.6 volts DC	B			D	Check pin B on P-1 end and pin D on the P-4 end for continuity.
Transmit	F		1		Check pin F on P-1 end and pin 1 on P-3 end for continuity.
Receive	E		2		Check pin E on P-1 end and pin 2 on P-3 end for continuity.
Ground	D		3		Check pin D on P-1 end and pin 3 on P-3 end for continuity.



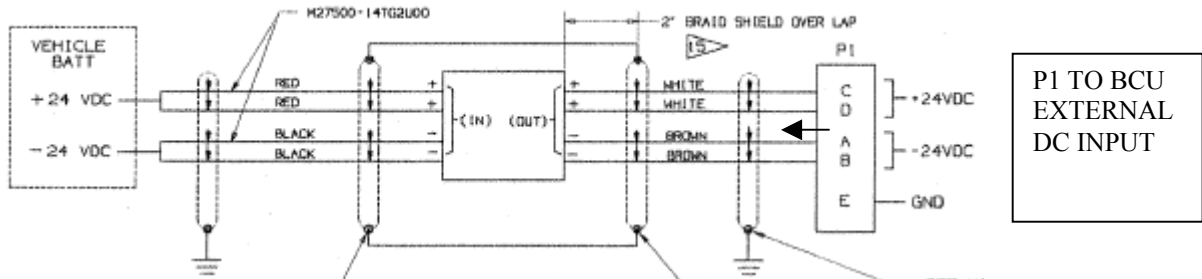
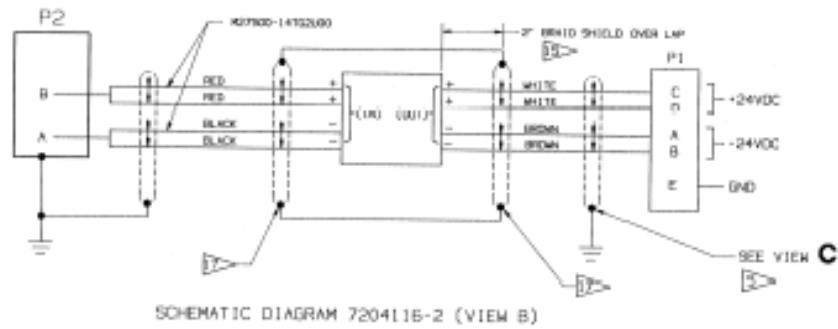


Figure 5-2 – Power Cable W116

Legend for Figure 5-2

Wire	P-2 Vehicle Battery	P-1 BCU DC Power Input	Test
+24 volts DC	B	CD	Connect P-2 end to vehicle battery and check pin CD on the P-1 end to ensure +24 volts DC are being carried.
Ground	A	ABE	Connect P-2 end to vehicle battery and check pins A, B, and E on P-1 end to ensure Neg / Ground.



P2 TO UH-60  
 J258

Figure 5-3 – UH-60 Power Cable W116-2

P1 TO BCU  
 EXTERNAL  
 DC INPUT

Legend for Figure 5-3

Wire	P-2 UH-60 Plug in	P-1 BCU DC Power Input	Test
+28 volts AC	B	CD	Connect P-2 end of W116-2 power cable to vehicle battery and check pin CD on the P-1 end to ensure +24 volts DC are being carried.
Ground	A	ABE	Connect P-2 end of W116-2 power cable to J258 on the UH-60 and check pins A, B, and E on P-1 end to ensure Neg / Ground.

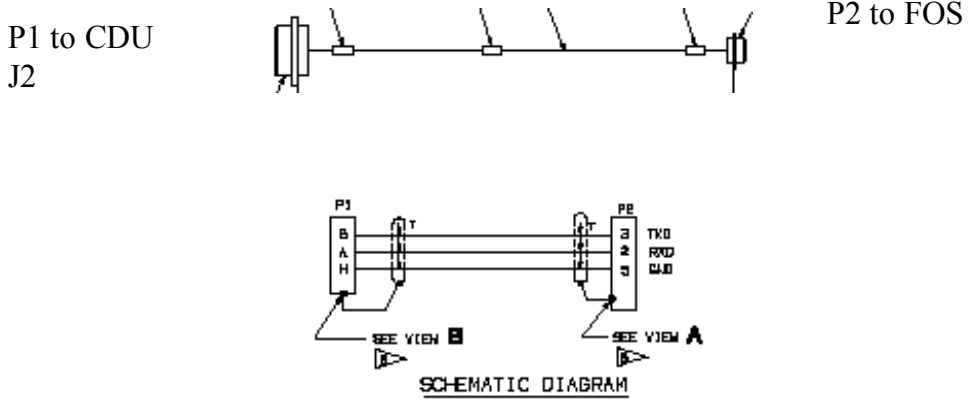


Figure 5-4 – FOS Cable W136

Legend for Figure 5-5

Wire	P-1 CDU J2		P-2 Miltope		Test
Transmit	G		3		Check pin G on P-1 end and pin 3 on P-2 end for continuity.
Receive	A		2		Check pin A on P-1 end and pin 2 on P-2 end for continuity.
Ground	H		5		Check pin H on P-1 end and pin 5 on the P-2 end for continuity.



## CHAPTER 6

### REPROGRAMMING LRUS AND DOWNLOADING MAPS

---

#### SECTION I. REPROGRAMMING LRUS AND DOWNLOADING MAPS

**6-1. General.** IPADS LRUs can be reprogrammed using the Maintenance Support Device (MSD) or equivalent, the reprogramming cable W143 (PN 7204143-9) and TB 9-6675-262-12-1 (CD). The same configuration is used for downloading maps, using TB 9-6675-262-12-2 (CD).

**6-2. Reprogramming the CPNU and CDU.** Load TB 9-6675-262-12-1 (CD) into the MSD and follow instructions.

**6-3. Downloading Maps.** Load TB 9-6675-262-12-2 (CD) into the MSD and follow instructions.



## CHAPTER 7

### MATERIAL USED IN CONJUNCTION WITH MAJOR ITEM

---

#### SECTION I. INTRODUCTION

7-1. **General.** This chapter lists auxiliary equipment items that are used by operator/crew to transfer position and azimuth in performing the IPADS mission as described in chapter 3.

#### SECTION II. MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

7-2. Following is a list of material used in conjunction with major item.

- a. Theodolite: (with sight painted white to aid in auto reflection).
  - (1) W07701 Theodolite Survey: direct 0.002 mil 30 ±5 power detach tribrach, or:
  - (2) W07838 Theodolite Survey: direct 0.2 mil with tripod and carrying case.
  
- b. Surveying Set, Supplementary Equipment for Improved Position and Azimuth Determining System, NSN 6675-01-073-3832.





**APPENDIX A  
REFERENCES**

**A-1. Scope.**

This appendix lists all forms, field manuals, technical bulletins, and technical manuals referenced in this manual.

**A-2. Forms**

NAVMC Form 10772	Recommended Changes to Technical Publications
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2028-2	Recommended Changes to Equipment and Technical Publications
DD Form 6	Packaging Improvement Report
SF 361	Discrepancy in Shipment Report (DISREP)
SF 368	Quality Deficiency Report

**A-3. Shipment and Storage**

TB 740-97-2	Preservation of USATROSCOM Mechanical Equipment for Shipment and Storage
TM 740-90-10 or MCO 4450.7	Administrative Storage of Equipment: MC Warehousing Manual

**A-4. Maintenance**

DA PAM 738-750	The Army Maintenance Management System (TAMMS)
TM 4700-15-1	Equipment Record Procedures
TM 1-1520-253-10	Operator's Manual: Army Model UH-60 Helicopter
TM 9-2320-362-14&P	Organizational Maintenance Manual for HMMWV
TM 9-2320-272-20	Organizational Maintenance Manual for M973 SUSV
TM 9-2320-280-10	Organizational Maintenance Repair Parts and Special Tools List for HMMWV
TM 9-2320-272-10	Operator's Manual for M973 SUSV

**A-5. Demolition**

TM 750-244-2	Destruction of Equipment to Prevent Enemy Use
--------------	---

**A-6. Miscellaneous**

CTA 50-970	Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items)
MCO 4430.3	Report of Item and Packaging Discrepancies (ROD)
MCO P4610.19C	Transportation and Travel Report of Transportation Discrepancies and Shipments
MCO 4855.10B	Quality Deficiency Report
DA PAM 750-10	US Army Equipment Index of Modification Work Orders SL 1-2 1-3
SB 700-20	Army Adapter/Other Items Selected for Authorization List of Portable Items



**APPENDIX B**  
**COMPONENTS OF END ITEM LIST**  
**COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LIST**

---

**SECTION I. INTRODUCTION**

**B-1. Scope.**

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

**B-2. General.**

The components of end item (COEI) and basic issue items (BII) lists are divided into the following sections.

**a. Section II, Components of End Item.**

This listing is for information purposes only and is not authority to requisition replacements. These items are part of the IPADS but they are to be removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the items.

**b. Section III, Basic Issue Items.**

These essential items are required to place the IPADS in operation, operate it, and do emergency repairs. Although shipped separately packaged, BII must be with the IPADS during operation and when transferred between property accounts. Listing these items is your authority to requisition them for replacement based on authorization of the end item by the TOE/MTOE (Table of Organization and Equipment/Modified Table of Organization and Equipment). Illustrations are furnished to help you find and identify the items.

**B-3. Explanation of columns**

**a. Column 1. Illustration Item Number.**

Indicates the callout number used to reference the item in the illustration.

**b. Column 2. National Stock Number (NSN).**

Indicates the NSN assigned to the item that will be used for requisitioning.

**c. Column 3. Description.**

Part Number, Description, and Usable On Code identify the federal item name followed by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

**d. Column 4. Unit of Issue (U/I).**

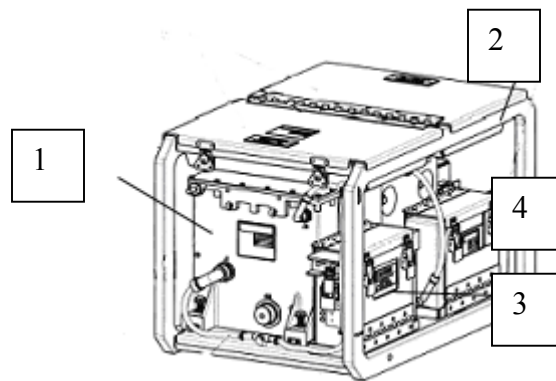
This column indicates how the item is issued for the national stock number shown in column 2.

**e. Column 5. Quantity Required (Qty Req'd).**

This column lists the quantity of each item required for a complete major item.

**SECTION II. COMPONENTS OF THE END ITEM**

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
4-4	1		Compact Position and Navigation Unit/Porro Prism Assembly (CPNU) (PPA) 7204153-9	EA	1
4-4	2		IPADS Frame	EA	1
4-4	3		Battery Charger Unit (BCU) 7204141-9	EA	1
4-4	4		Control and Display Unit (CDU) 7204142-9	EA	
1-6	1-10	5340-01-522-1647	Installation Kit (HMMWV) 7204154-9	EA	1
1-7		Appendix E (E-8)	Installation Kit (UH-60) 7204145-9	EA	AR
			Installation Kit (SUSV) 7204144-9	EA	AR
5-1			IPADS Harness Assembly W114 7204114-9	EA	1
1-5	1-19	5180-01-521-3695	IPADS TOOL Kit 7204146-9	EA	1



**CPNU P/N**

**SECTION III. BASIC ISSUE ITEMS**

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	1	5210-01-367-7283	Plumb bob, brass 8 oz. (63474) 108	EA	1
1-5	2	402001M278309	Plumb bob String 25yds (39428) 2178A8	Roll	1
1-5	3	6230-00-264-8261	Flashlight 90°angle (1CSX9) MX-991/U	EA	1
1-5	4	5975-00-899-4606	Strap, Tiedown, Elect.(Nylon) (81343) MS3367-2-0	Bundle	1
1-5	5	597501M278308	Strap, Cable W/Buckle(Velcro) (34054) 6912K54	EA	5
1-5	6	7920-00-205-1427	Brush, Dusting, Lens (80244) 7920-00-205-1427	EA	1
1-5	7	6135-00-835-7210	Wrench, Open End; 5/8 inch (55719) OSH20B	EA	1
1-5	8	5120-01-474-5182	Handle, Ratchet Wrench, 3/8 inch (55719) F936	EA	1
1-5	9	5120-01-187-1784	Socket Set, Socket (55719) 211SFY(12 Point) Set to include: <ul style="list-style-type: none"> <li>• ¼ inch</li> <li>• 5/16 inch</li> <li>• 3/8 inch</li> <li>• 7/16 inch</li> <li>• ½ inch</li> <li>• 9/16 inch</li> <li>• 5/8 inch</li> <li>• 11/16 inch</li> <li>• ¾ inch</li> <li>• 13/16 inch</li> <li>• 7/8 inch</li> </ul>	EA	1
1-5	10	5120-01-428-7830	Pliers, Needle Nose (55719) 196BCP	EA	1
1-5	11	5120-01-300-1152	Screwdriver, Cross Tip 3 & ¾ inch (55719) GSDDP22	EA	1
1-5	12	5120-01-290-8231	Screwdriver, Crosstip, 8 & 13/32 inch (55719) GSDDP42	EA	1
1-5	13	5120-01-335-1235	Wrench,Box and Open End 9/16 inch (55719) OEX18B	EA	1

ARMY TM 9-6675-349-12&P  
MARINE CORPS TM 11039A-12&P

1-5	14	5120-01-367-3356	Wrench, Box and Open End ¾ inch (55719) OES24B	EA	1
1-5	15	5110-01-399-9317	Knife, Pocket, Electrician's (1CV05) 18535	EA	1
1-5	16	5140-01-M27-7768	Roll, Tools & Accessories (39428) 6389A11	EA	1
1-5	17	5305-01-M27-7465	Thumbscrew, 5/16x1 in long (3A054) 91744A583	EA	1
1-5	18	5920-01-493-6642	Fuse, Cartridge (0JR59) 373150041	EA	5
1-5	19	5120-01-335-1233	Wrench, Box and Open 7/16 inch (55719) OEX14B	EA	1
1-5	20		Operator and Unit Maintenance Manual for the IPADS TM 9-6675-262-12&P	EA	1
1-5	21	5935-00-567-0128	Connector Plug Electrical, NATO (61090) TGC2338	EA	1
1-5	22	5995-01-519-0653	CABLE ASSY, SPECIAL (FOS) 7204136-9 (1NZ85)	EA	1
1-5	23	5995-01-522-2631	CABLE ASSEMBLY SPECIAL (REPROGRAMMING) (1NZ85) 7204143-9	EA	1

**APPENDIX C**  
**ADDITIONAL AUTHORIZATION LIST**

**SECTION I. INTRODUCTION**

**C-1. Scope.**

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

**C-2. General.**

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

**C-3. Explanation of Listing.**

National stock number, description, and quantities are provided to help you identify and request the additional items you require to support this equipment.

**SECTION II. ADDITIONAL AUTHORIZATION LIST**

NATIONAL STOCK NUMBER	PART NUMBER (CAGEC)	DESCRIPTION	U/M	QUANTITY AUTHORIZED
6135-00-835-7210	BA 3030/U (81349)	Battery, Dry, 1.5 Volts	EA	12
2540-00-051-3839	8712420 (19207)	Kit, Winterization for Truck Utility, ¼-ton (NOTE: For operation below -30°C (-25°F))	EA	1
	D13222E2450 (97403)	Installation Kit, SUSV, Electronic Equipment, IPADS (NOTE: Used to install IPADS on small utility support vehicle M973 series).	EA	1
5120-01-288-2510	GSDD44 (55719)	Screwdriver, flat tip	EA	1
5120-01-439-0677	00858 (4D864)	Screwdriver, cross tip	EA	1
5110-01-399-9317	18535 (1CV05)	Pocket knife, Electrician's	EA	1
5120-00-264-3796	D712 (96508)	Wrench Adjustable 12 in long	EA	1
5120-01-335-1260	OEX28B (55719)	Combination wrench 7/8 inch	EA	1
5120-01-367-3356	OES24B (55719)	Combination wrench ¾¾ inch	EA	1
5120-01-335-1235	OEX18B (55719)	Combination wrench 9/16 inch	EA	1
5120-01-367-3352	OES16 (55719)	Combination wrench ½½ inch	EA	1
6625-01-458-5183	179 (89536)	Multimeter	EA	1
8145-01-M27-7002	7158019-5 (1NZ85)	Shipping and Storage, CDU (Figure 1-8)	EA	1



## APPENDIX D MAINTENANCE ALLOCATION CHART

### SECTION I. INTRODUCTION

#### D-1. Scope.

The Maintenance Allocation Chart provides an explanation of all maintenance and repair functions authorized at various maintenance levels under the Army maintenance system concept. The IPADS maintenance concept will be somewhat different due to the fact that there is only operator level maintenance and the depot level maintenance, which is L-3 Communications. The maintenance allocation chart in Appendix D Section II lists the actions and estimated times to conduct the maintenance required.

#### D-2. General.

Maintenance Functions are limited to and defined as follows:

- a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.
- b. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.
- c. **Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module in a manner to allow the proper functioning of an equipment or system.
- d. **Repair.** The application of maintenance services, including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and restore a serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module, end item, or system.

#### D-3. Explanation of the columns.

- a. **Column 1, Group Number:**  
Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.
- b. **Column 2, Component/Assembly:**  
Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
- c. **Column 3, Maintenance Functions:**  
Column 3 lists the functions to be performed on the item listed in Column 2. (See Maintenance Functions paragraph above.)
- d. **Column 4, Maintenance Level:**  
Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3 by indicating work time required (expressed as man hours in whole hours or decimals) in the appropriate sub column.
- e. **Column 5, Tools and Equipment:**  
Column 5 lists the tools and equipment required to perform the maintenance function. Because the IPADS maintenance concept is simple, all tools required for any operator maintenance will be found in the tool kit.
- f. **Column 6, Remarks:**  
Column 6 (when applicable) contains a letter code, in alphabetical order, which is keyed to the remark contained in another section.

**Section II. Maintenance Allocation Chart**

GROUP NUMBER	COMPONENT/ASSEMBLY	MAINT FUNCTION	MAINTENANCE LEVEL		TOOLS AND EQUIPMENT	REMARKS
			OPR	DEPOT		
00	IPADS ASSEMBLY 705004-9	Inspect Repair Replace	0.5 0.4 0.4	0.5 8.0 1.5	1,2,3	
01	(CPNU/PPA) Compact Position Navigation Unit (CPNU) 7204153-9	Test Replace Repair	1.0 0.8	0.5 4.5	1,2	
0101	Porro Prism Assembly (PPA) 7158017-1	Inspect Service Test Repair	0.1 0.2 0.8	0.2 1.5	1	
02	Battery Charger Unit (BCU) 7204141-9	Inspect Test Replace Repair	0.1 0.5 0.2 0.3	0.2 0.5 2.0	1,2,3	
0201	Battery Charger Heater Control 7204148-9	Inspect Replace		0.1 0.2	1,2	
03	Control and Display Unit (CDU) 7204142-9	Inspect Replace Repair	0.1 0.3	0.5 2.5	1,2	
04	W-114 Wiring Harness 7204114-9	Inspect Test Replace	0.1 0.8 0.2		3	
05	Chassis, Weldment 7204056-9	Inspect replace repair	0.1 0.3 0.5		1,2	
06	Installation Kit, HMMWV (Vehicle) 7204154-9	Inspect Replace Repair	0.3 0.3	0.2 1.5	1,2	
0601	Floor Plate 7204108-1	Inspect Replace Repair	0.1 0.5	0.1 0.5	1,2	
0602	Control Display Unit (CDU) Support Arm 7204155-9	Inspect Replace	0.1 0.3		1,2	
0603	Control Display Unit (CDU) Mount Assembly 7204149-9	Inspect Replace Repair	0.1 0.1	0.5 2.5	1,2	
0604	Alignment Bracket Assembly 7204151-9	Inspect Replace	0.1 0.2		1,2	
07	Kit, Installation , UH-60 7204145-9	Inspect replace		0.1 0.2	1,2	
0701	Bracket assembly, CDU 7170186-9	Inspect Repair Replace	0.1 0.2	0.1 0.5	1,2	

GROUP NUMBER	COMPONENT/ASSEMBLY	MAINT FUNCTION	MAINTENANCE LEVEL		TOOLS AND EQUIPMENT	REMARKS
			OPR	DEPOT		
0702	W-116-2 UH-60 Power Cable 7204116-2	Inspect Test Replace	0.1 0.5 0.2		3	
08	W-116-1 BCU Vehicle Power Cable (D.C.) 7204116-1	Inspect Test Replace	0.1 0.3 0.2		3	
09	W-136 Forward Observer Software Cable 7204136-9	Inspect Test Replace	0.1 0.3 0.2		3	
10	W-143 Reprogramming Cable 7204143-9	Inspect Test Replace	0.1 0.3 0.2		3	
11	Installation Kit, SUSV 7204144-9	Inspect Replace Repair	0.1 0.2 1.5		1, 4	
1101	Frame Assembly 7204193-9	Inspect Replace Repair	0.1 0.2 0.5		1,4	
1102	Plumb Bob Assembly 7204201-9	Inspect Replace Repair	0.1 0.2 0.5		1,4	
1103	CDU Mount Assembly 7204202-9	Inspect Replace Repair	0.1 0.2 0.5		1,4	
1104	Cable, Power, SUSV 7204116-3	Inspect Replace	0.1 0.2		3	

**SECTION III. TOOLS AND TEST EQUIPMENT REQUIREMENTS**

<b>ITEM NUMBER</b>	<b>MAINT-LVL</b>	<b>NOMENCLATURE</b>	<b>NSN</b>	<b>PART NO.</b>
1	CREW/ORG	IPADS Tool Kit	5180-01-521-3695	7204146-9
2	ORG	Mechanic's Tool Kit	5180-01-483-0249	5180-95-B47
3	ORG	Multimeter	6625-01-458-5183	(89536) 179
4	ORG	SUSV Operator's Tool Kit		SUSV Basic Issue Item

**APPENDIX E.**  
**REPAIR PARTS AND SPECIAL TOOLS LIST**

**SECTION I. INTRODUCTION**

**E-1. Scope.**

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment TMDE; and other special support equipment required for performance of organizational, direct support, and general support maintenance of the Improved Position and Azimuth Determining System. It authorizes the requisitioning, issue and disposition of spares, repair parts, special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

**E-2. General.**

In addition to this section (Introduction), this Repair parts and Special Tools List is divided into the following sections:

**SECTION II. Repair Parts List.** A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. This list also includes parts that must be groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in the item name sequence. Repair parts kits are listed separately in their own functional group within Section II. Repair parts for repairable special tools are also listed in this section. Hems are shown in the associated illustration(s)/figure(s).

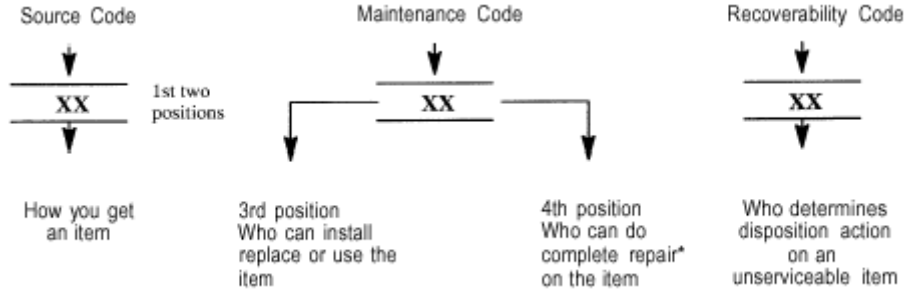
**SECTION III. Special Tools List.** A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in DESCRIPTION AND USABLE ON CODE column) for the performance of maintenance.

**SECTION IV. Cross-references Indexes.** A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure and item number index lists figure and item number in alphanumeric sequence and cross-references NSN, CAGEC, and part number.

**E-3. Explanation of Columns (SECTIONS II AND III).**

**ITEM NO. (Column (1)).** Indicates the number used to identify items called out in the illustration.

**SMR Code (Column (2)).** The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:



**\*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the “Repair” function in a use/user environment in order to restore serviceability to a failed item.**

**Source Code.** The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source code follows:

Code	Explanation
PA	Stocked items; use the applicable NSN to requested/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR code.  NOTE: Items coded PC are subject to deterioration.
PB	
PC**	
PD	
PE	
PF	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
PG	
KD	
KF	
KB	

- |   |   |  |
|---|---|--|
| <p>MO - (Made at org/AVUM Level)<br/>MP - (Made at DS/AVUM Level)<br/>MH - (Made at GS Level)<br/>ML - (Made at Specialized Repair Activity (SRA))<br/>MD - (Made at Depot)</p> | } | <p>Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION and USABLE ON CODE (UOC) column and listed in the Bulk Material group of the repair parts list in this RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.</p> |
| <p>AO - (Assembled by org/AVUM Level)<br/>AF - (Assembled by DS/AVUM Level)<br/>AH - (Assembled by GS Category)<br/>AL - (Assembled by SRA)<br/>AD - (Assembled by Depot)</p>   | } | <p>Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position code of the SMR code authorizes you to replace the item, but the source code indicates the items are assembled at a higher level, order the item from the higher level of maintenance.</p>   |
- XA - Do not requisition "XA"-coded item. Order its next higher assembly. (Also, refer to the NOTE below.)
- XB - If an "XB" item is not available from salvage, order it using the CAGEC and part number given.
- XC - Installation drawing, diagram, instruction sheet, field service drawing, that is identified by Reciprocating Compressor manufacturer's part number.
- XD - Item is not stocked. Order an "XD"-coded item through normal supply channels using the CAGEC and part number given if no NSN is available.

**NOTE**

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

**Maintenance Code.** Maintenance codes tell you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance:

<b>Code</b>	<b>Application/Explanation</b>
C -	Crew or operator maintenance done with unit or aviation unit maintenance.
O -	Unit or aviation unit category can remove, replace, and use the item.
F -	Direct support or aviation intermediate level can remove, replace, and use the item.
H -	General support level can remove, replace, and use the item.
L -	Specialized repair activity can remove, replace, and use the item.
D -	Depot level can remove, replace, and use the item.
K -	Repairable item removed or replaced at contractor's facility

The maintenance code entered in the fourth position tells whether the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions.)

**NOTE**

Some limited repair may be done on an item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes. This position will contain one of the following maintenance codes.

<b>Code</b>	<b>Application/Explanation</b>
O -	Unit or (aviation unit) is the lowest level that can do complete repair of the item.
F -	Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H -	General Support is the lowest level that can do complete repair of the item.
L -	Specialized repair activity is the lowest level that can do complete repair of the item.
D -	Depot is the lowest level that can do complete repair of the item.
Z -	Nonreparable. No repair is authorized.
B -	No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded Item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.
K -	Repairable support item. complete repair capability exists at a designated contractor's facility.



**Recoverability Code.** Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR code as follows:

<b>Recoverability Codes</b>	<b>Application/Explanation</b>
Z -	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3rd position of SMR Code.
O -	Reparable item. When not economically reparable, condemn and dispose of the item unit or aviation unit level
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support or aviation intermediate level
H -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L -	Reparable item. Condemnation and disposal not authorized below specialized repair activity (SRA).
A -	Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
K -	Repairable item. Condemnation and disposal to be performed at contractor's facility.

**CAGEC (Column (3)).** The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code that is used to identify the manufacturer, distributor, or Government agency, etc. that supplies the item.

**PART NUMBER (Column (4)).** Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) that controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

#### **NOTE**

When you use an NSN to requisition an item, the item you receive may have a different part number from the part ordered.

**DESCRIPTION AND USABLE ON CODE (UOC) (COLUMN (5)).** This column includes the following information:

The Federal item name and, when required, a minimum description to identify the item.

The physical security classification of the item is indicated by the parenthetical entry, e.g., PhySec C1 – Confidential, PhySec C1 (S) – Secret, PhySec C1 (T) – Top Secret.

Items that are included in kits and sets are listed below the name of the kit or set.

Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UOC).

The usable on code, when applicable (see paragraph 5, Special Information).

In the Special Tools List section, the basis of issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorization is increased proportionately.

The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both SECTION II and SECTION III.

The indenture, shown as dots appearing before the repair part, indicates that the item is a repair part of the next higher assembly.

**QTY (Column (6)).** The QTY (quantity per figure column) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, sub-functional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and may vary from application to application.

#### E-4. EXPLANATION OF COLUMNS (SECTION IV).

##### NATIONAL STOCK NUMBER (NSN) INDEX.

**STOCK NUMBER column.** This column lists the NSN by National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN, i.e.

When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

NSN
5305-01-574-1467
NIIN

**FIG column.** This column lists the number of the figure where the item is identified/located. The figures are in numerical order in SECTIONS II and III.

**ITEM column.** The item number identifies the item associated with the figure listed in the adjacent FIG. Column. This item is also identified by the NSN listed on the same line.

**PART NUMBER INDEX.** Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

**CAGEC column.** The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

**PART NUMBER column.** Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

**STOCK NUMBER column.** This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and CAGEC columns to the left.

**FIG column.** This column lists the number of the figure where the item is identified/located in SECTIONS II and III.

**ITEM column.** The item number is that number assigned to the item as it appears in the figure referenced in adjacent figure number column.

## FIGURE AND ITEM NUMBER INDEX.

**FIG column.** This column lists the number of the figure where the item is identified/located in SECTIONS II and III.

**ITEM column.** The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

**STOCK NUMBER column.** This column lists the NSN for the item.

**CAGEC column.** The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

**PART NUMBER column.** Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity) that controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

### E-5. SPECIAL INFORMATION

**USABLE ON CODE.** The usable on code appears in the lower corner of the Description column heading. Usable on codes are shown as “UOC:...” in the Description Column justified left on the last line applicable item description/nomenclature. Uncoded items are applicable to all models.

**ASSOCIATED PUBLICATIONS.** There are no other publications pertaining to the Improved Position and Azimuth Determining System and its components.

### E-6. HOW TO LOCATE REPAIR PARTS.

When National Stock Number or Part *is* known:

Using the Index of National Stock Numbers and Parts Numbers, find the pertinent National Stock Number or Part Number. The NSN index is in the National Item Identification Number (NIIN) sequence, paragraph E-4. The part numbers in the Part Number index are listed in ascending alphanumeric sequence, paragraph E-4. Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

After finding the figure and item number, verify that the item is the one you are looking for, locate the item number in the repair parts list for the figure.

When National Stock Number or Part Number is *NOT* known:

Using the table of contents, determine the assembly or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

Find the figure covering the assembly or subassembly group to which the item belongs.

Identify the item on the figure and note the item number.

Refer to the Repair Parts List for the figure to find the part number for the item number noted on the figure.

Refer to the Part Number Index to find the NSN, if assigned.

### E-7. ABBREVIATIONS.

Abbreviations used in this manual are listed in MIL-STD-12.

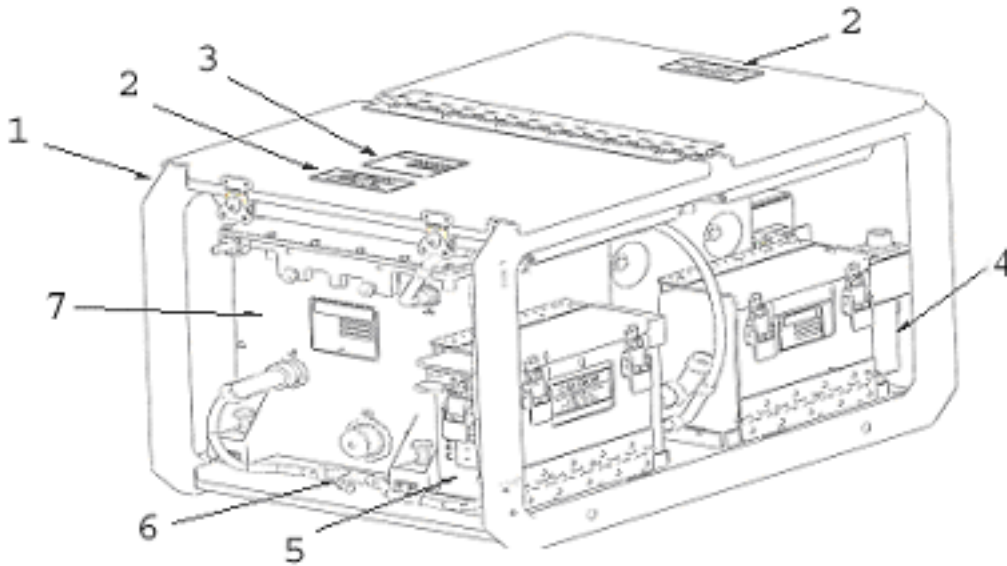


Figure E-1 – IPADS End Item P/N 7050004-9, Group 00

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOOK	7690-01-522-4819	1NZ85	7204056-9	CHASSIS WELDMENT	1
2	XDOZZ		1NZ85	7170172-2	DECAL	2
3	XDOZZ		1NZ85	10162862	PLATE SET, IDENTIFICATION	1
4	PAOKK	7010-01-521-7883	19200	11838924-3	CONT & DISPLAY UNIT W/CONTAINER	1
5	PAOKK	6130-00-521-6921	19200	11838924-2	BAT & CHARGER UNIT W/CONTAINER	1
6	PAOKK	5995-01-522-5485	1NZ85	7204114-9	CABLE, CORD, AND WIRE	1
7	PAOKK	6605-01-521-7884	19200	11838924-1	POSITION & NAV UNIT W/ CONTAINER	1

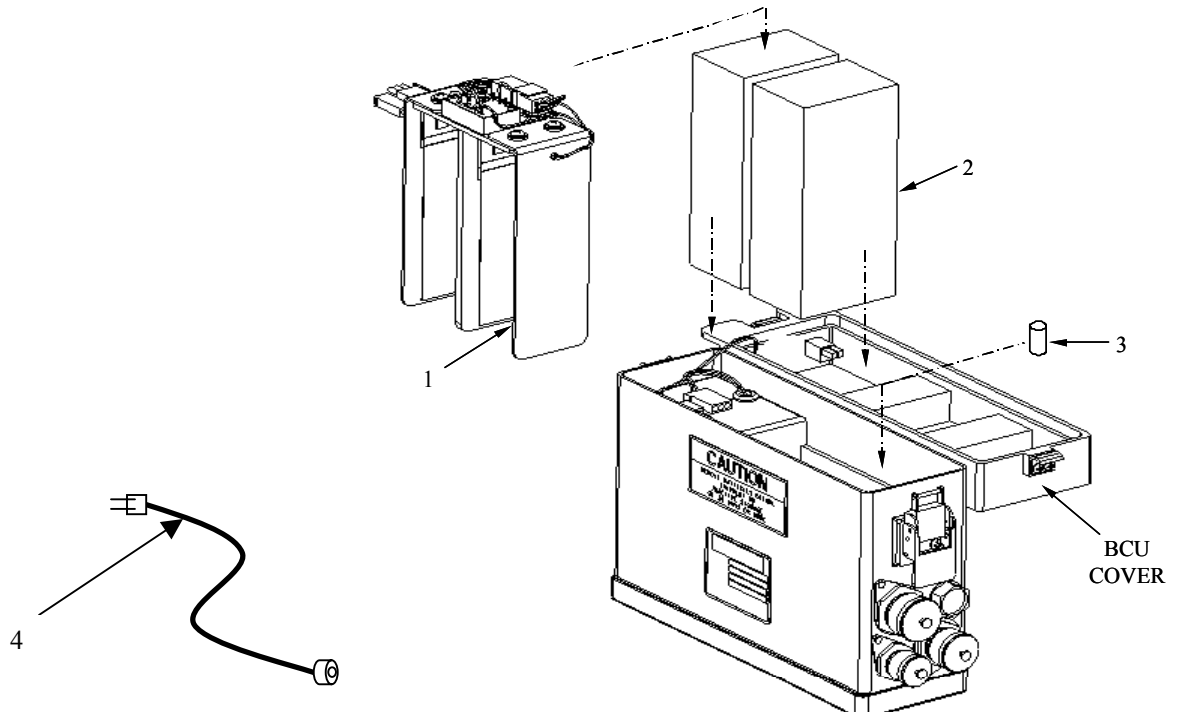


Figure E-2 – Battery and Charging Unit (BCU Assembly) P/N 7204141-9, Group 01

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDOZZ		08TP4	7204148-9	BCU HEATER CONTROLLER	1
2	PCOZZ	6401-01-493-8357	08TP4	ABP-BT- 24V/1.9AH	BATTERY, STORAGE	2
3	PAOZZ	5920-01-493-6642	OJR59	373150041	FUSE, CARTRIDGE	1
4	PAOZZ	5995-01-493-8358	08TP4	ABP-ACC- TR-1	CABLE ASSEMBLY, SPECIAL, 115VAC (W-6)	1

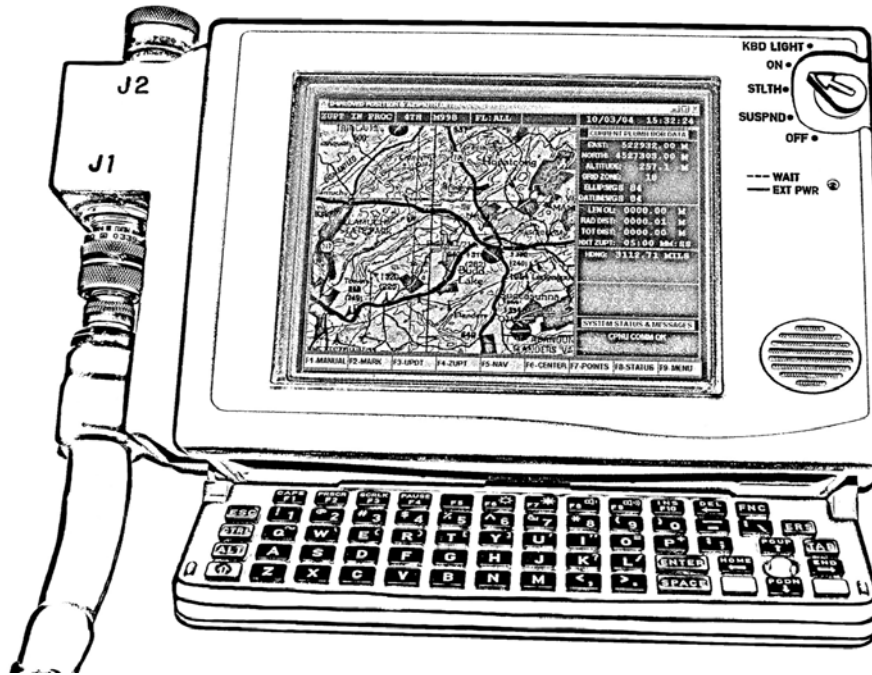


Figure E-3 – Control and Display Unit P/N 11838924-3, Group 02

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDDKK		1NZ85	7204142-9	CONT & DISPLAY UNIT	1

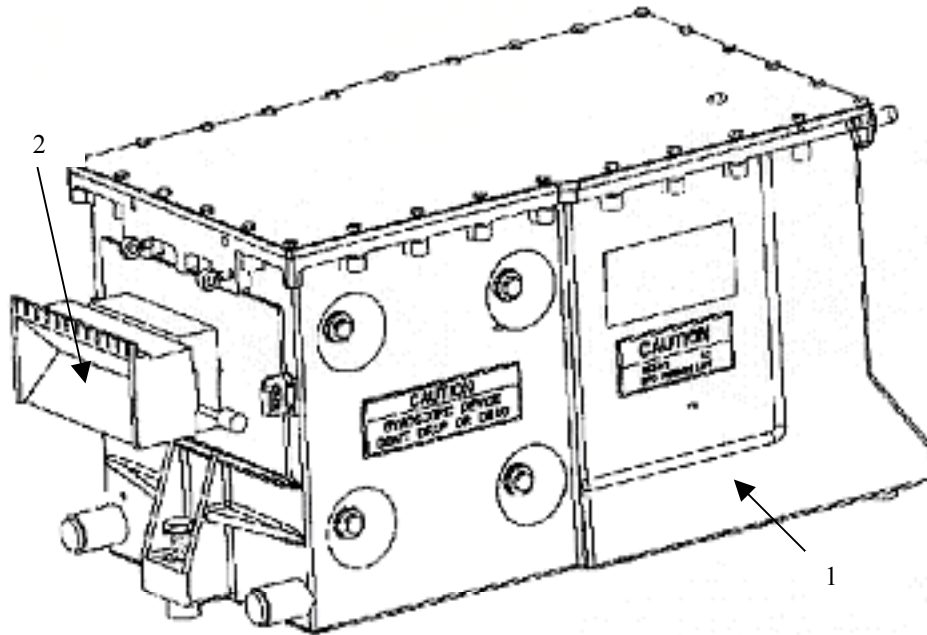


Figure E-4 – Compact Position Navigation Unit and Porro Prism Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDDKK		1NZ85	7204153-9	POSITION & NAV UNIT	1
2	PAOOO	1260-01-521-4556	1NZ85	7170155-9	COVER, FIRE CONTROL	1

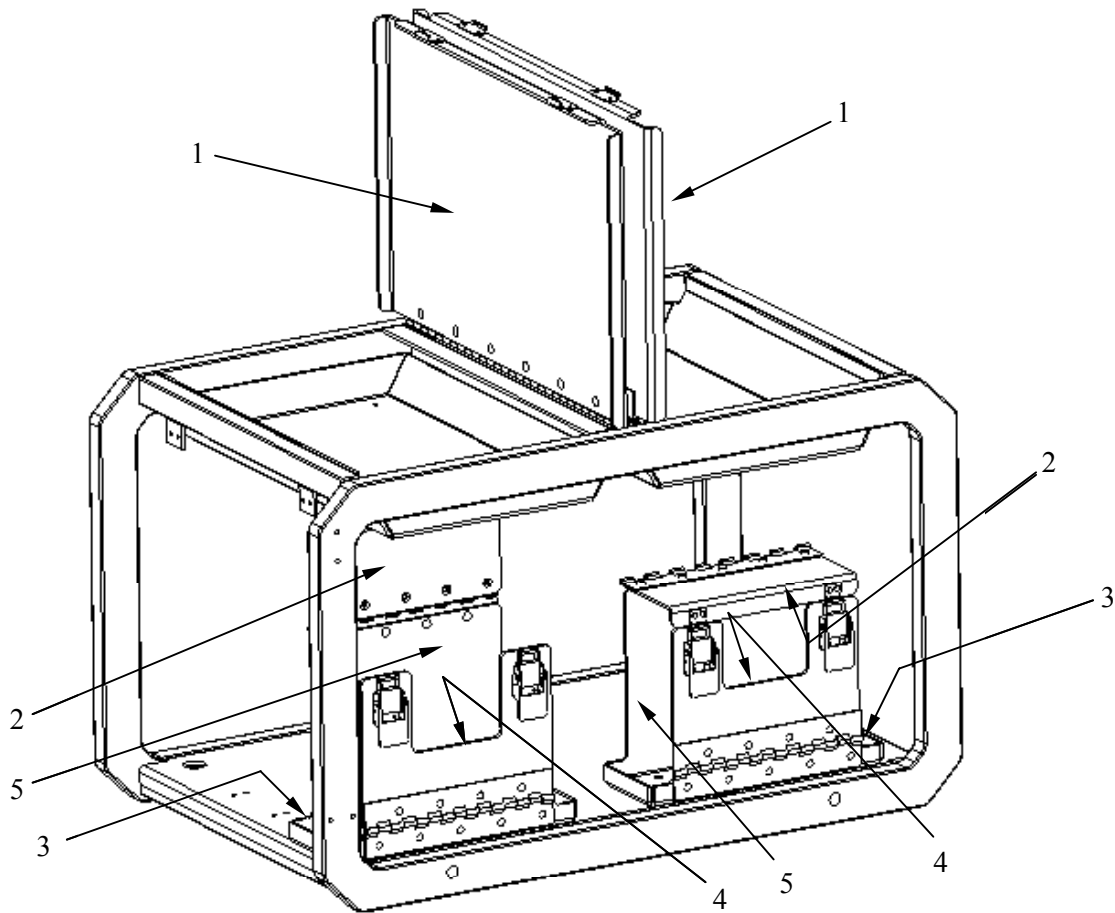


Figure E-5 – Chassis Weldment P/N 7204056-9, Group 04

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDOZZ		1NZ85	7170174-7	GASKET	2
2	XDOZZ		1NZ85	7170174-3	GASKET	2
3	XDOZZ		1NZ85	7170174-5	GASKET	2
4	XDOZZ		1NZ85	7170174-4	GASKET	2
5	XDOZZ		1NZ85	7170174-6	GASKET	2



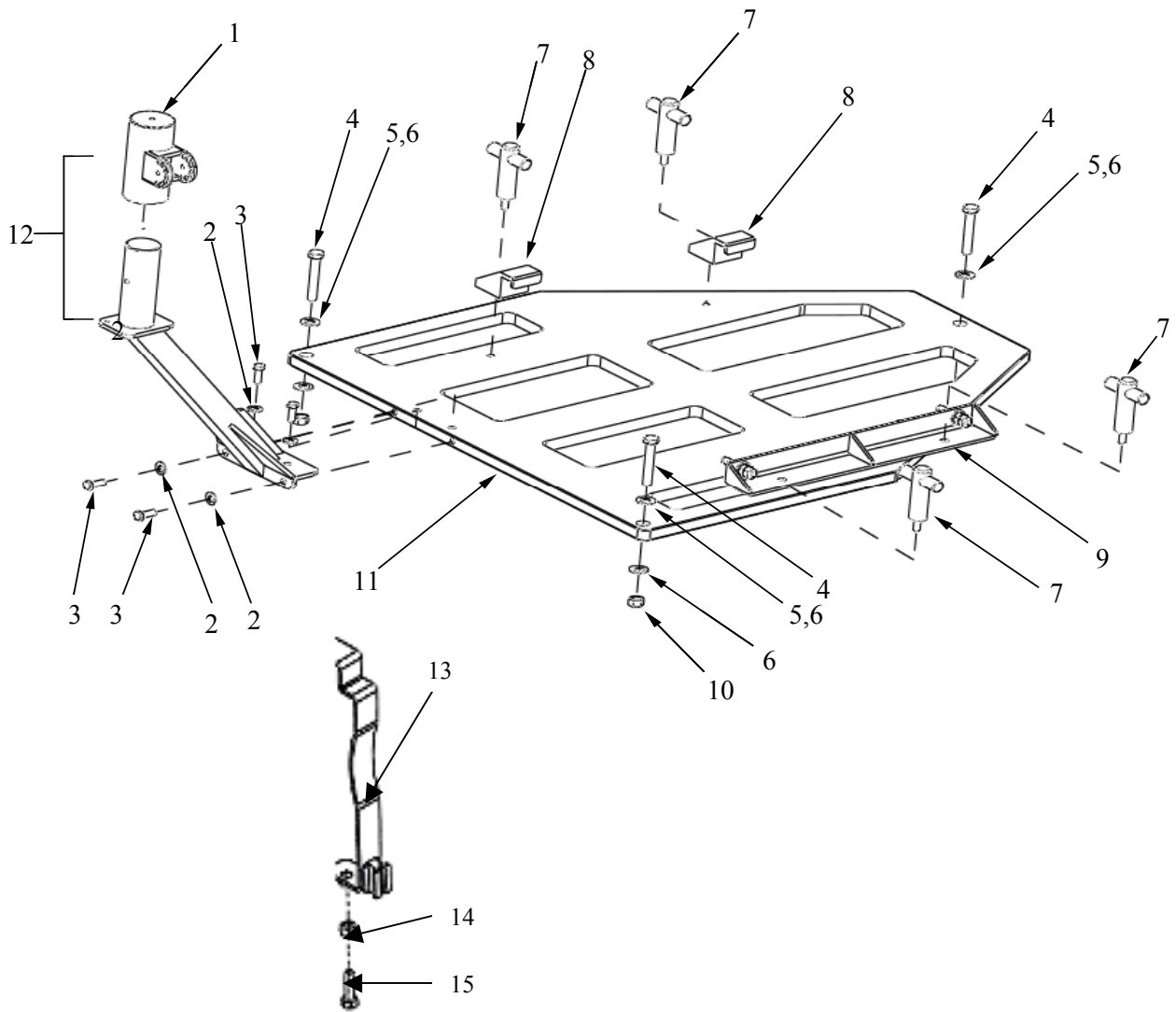


Figure E-6 – Hardware Kit, Electronic Mounting (HMMWV Mounting Kit) P/N 7204154-9, Group 05

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOOZ	5985-01-517-6193	1NZ85	7204108-5	MAST SECTION	1
2	PAOZZ	5310-00-773-7618	80205	MS15795-814	WASHER, FLAT	4
3	PAOZZ	5305-00-576-5417	80205	MS35307-360	SCREW, CAP, HEXAGON	4
4	PAOZZ	5305-00-103-2072	96906	MS35307-419	SCREW, CAP, HEXAGON	3
5	PAOZZ	5310-00-933-8778	80205	MS35338-143	WASHER, LOCK	3
6	PAOZZ	5310-00-767-9425	80205	MS15795-818	WASHER, FLAT	6
7	XDOZZ		1NZ85	7204108-3	BOLT, TEE HEAD	4
8	XDOZZ		1NZ85	7204108-4	CLAMP, SYNCHRO	4
9	XAOOO		1NZ85	7204151-9	BRACKET ASSY, ALIGN	1
10	PAOZZ	4730-01-493-9632	2V507	94758A033	NUT, TUBE COUPLING	3
11	PAOKK	5340-01-519-8010	1NZ85	7204108-1	PLATE, MOUNTING	1
12	XDOZZ		1NZ85	7204155-9	ARM ASSY, CDU SPRT	1
13	XDOZZ		1NZ85	7204108-8	BRACKET, MOUNTING	1
14	PAOZZ	5310-00-767-0445	80205	MS51971-2	NUT, PLAIN, HEXAGON	1
15	XDOZZ		2V507	91744A583	THUMBSCREW	1

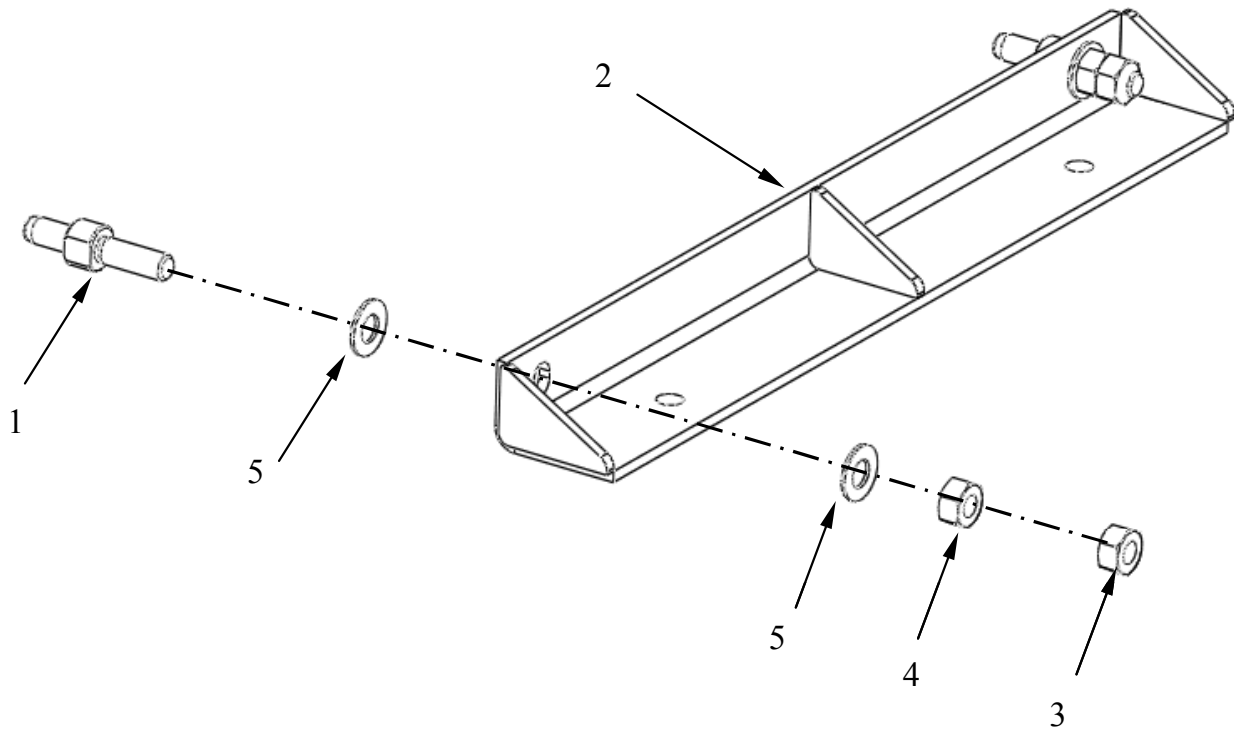


Figure E-7 – Alignment Bracket Assembly - P/N 7204151-9, Group 06

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDOZZ		1NZ85	7170176-1	PIN, SHOULDER, HEADLESS	2
2	XDOZZ		1NZ85	7204108-7	BRACKET, ALIGNMENT	1
3	XDOZZ		5T847	90045A462	NUT, LOCKING	2
4	PAOZZ	5310-00-965-1800	96906	MS51971-4	NUT, PLAIN, HEXAGON	2
5	PAOZZ	5310-00-184-8628	80205	MS15795- 816	WASHER, FLAT	4

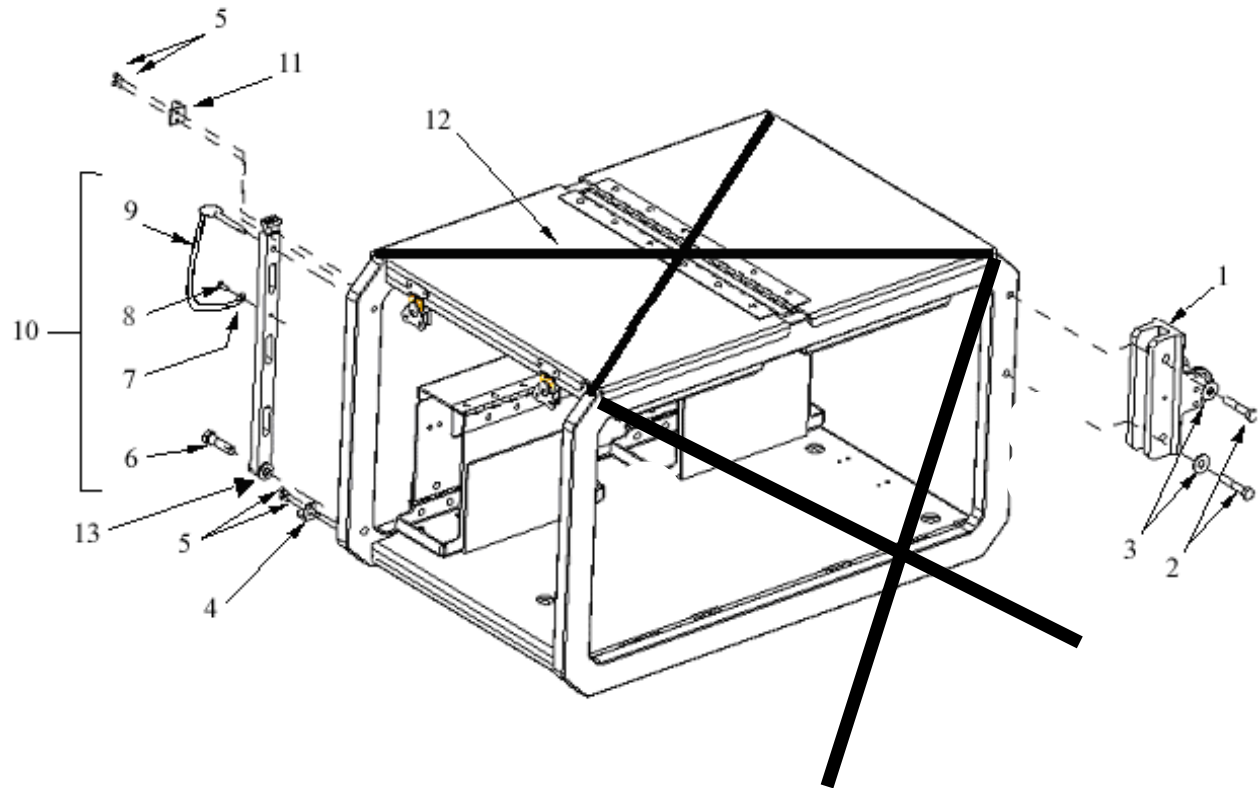


Figure E-8 – UH-60 Mounting Kit – P/N 7204145-9, Group 07

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOOO	5340-01-519-5716	1NZ85	7170186-9	BRACKET ASSY, CDU INDEXER	1
2	PAOZZ	5306-00-727-4578	80205	MS35307- 339	BOLT, MACHINE	2
3	PAOZZ	5310-00-802-4701	80205	MS15795- 813	WASHER, FLAT	2
4	XDOZZ		1NZ85	7170188-1	BRACKET, MOUNTING	1
5	PAOZZ	5305-00-719-5064	80205	MS51959- 30	SCREW, MACHINE	4
6	PAOZZ	5305-00-021-3740	80205	MS35307- 364	SCREW, CAP, HEXAGON	1
7	PAOZZ	5310-00-225-5328	80205	MS15795- 841	WASHER, FLAT	1
8	PAOZZ	5305-00-054-6670	96906	MS51957- 45	SCREW, MACHINE	1
9	PAOZZ	4010-01-510-4931	2V507	30345T7	WIRE ROPE ASSEMBLY	1
10	XDOZZ		1NZ85	7170187-9	BRACKET ASSY, PLUMB	1
11	XDOZZ		1NZ85	7170189-1	BRACKET, MOUNTING	1
12	PAOZZ	1670-00-725-1437	81868	CGU-1-B Class 2	TIE DOWN, CARGO, AIRCRAFT	2
13	XDOZZ		38428	98370A019	WASHER, SPACER	3

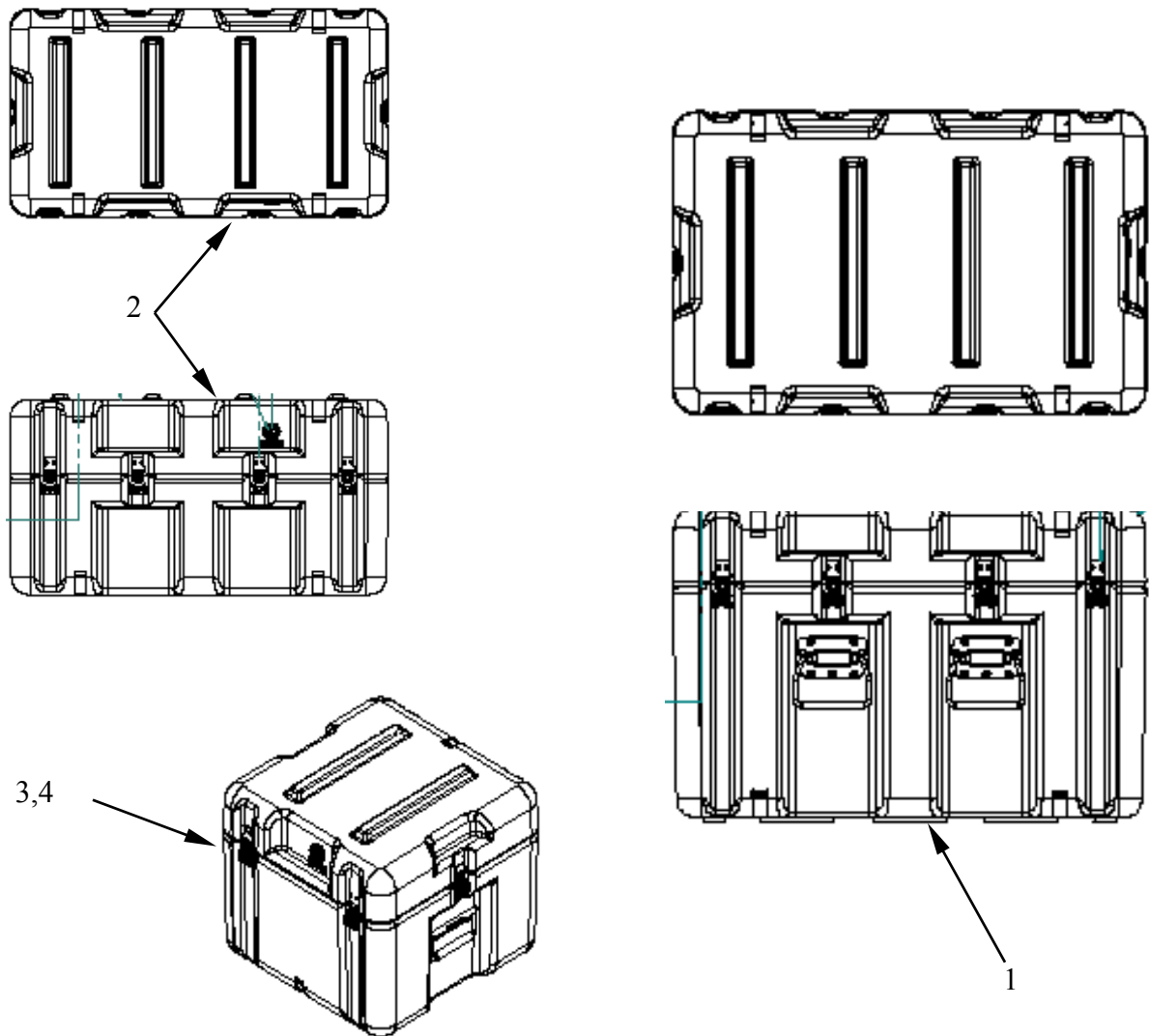


Figure E-9 – Transit Cases P/N 7158019-1, Group 08

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDOZZ		1NZ85	7158019-1	CASE, TRANSIT	1
2	XDOZZ		1NZ85	7158019-2	SHIPPING AND STORAGE, CPNU	1
3	XDOZZ		1NZ85	7158019-4	SHIPPING AND STORAGE, BCU	1
4	XDOZZ		1NZ85	7158019-5	SHIPPING AND STORAGE, CDU	1

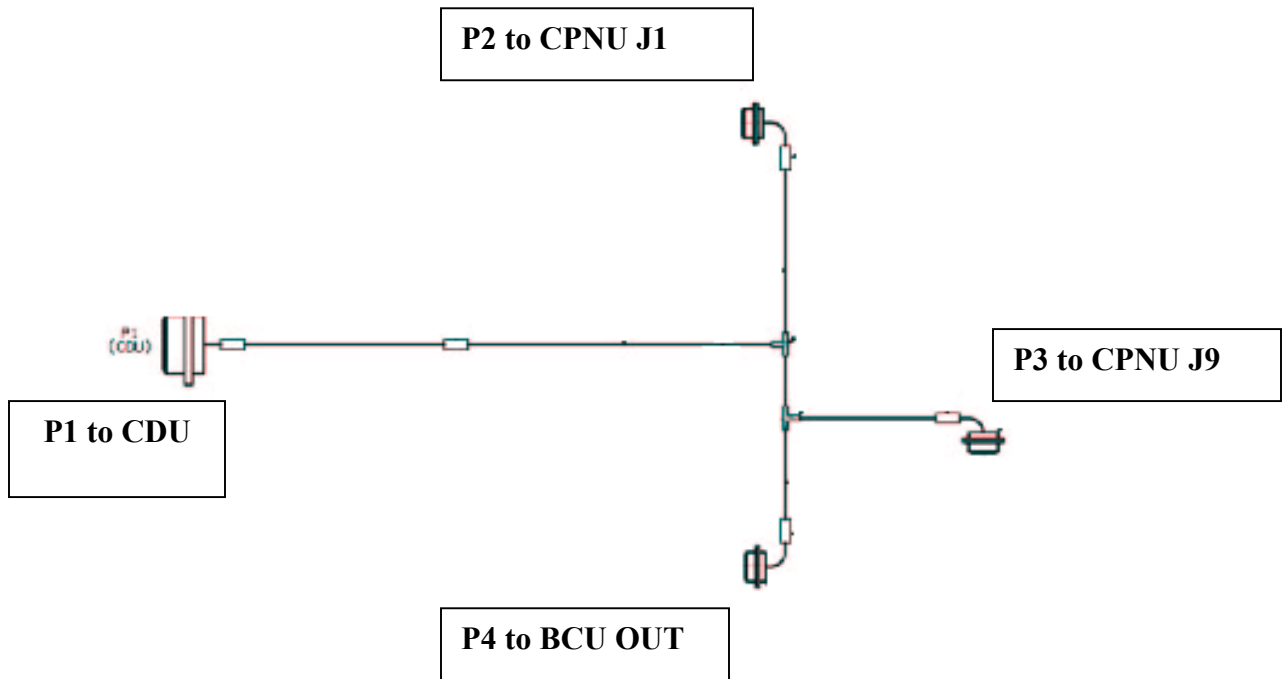
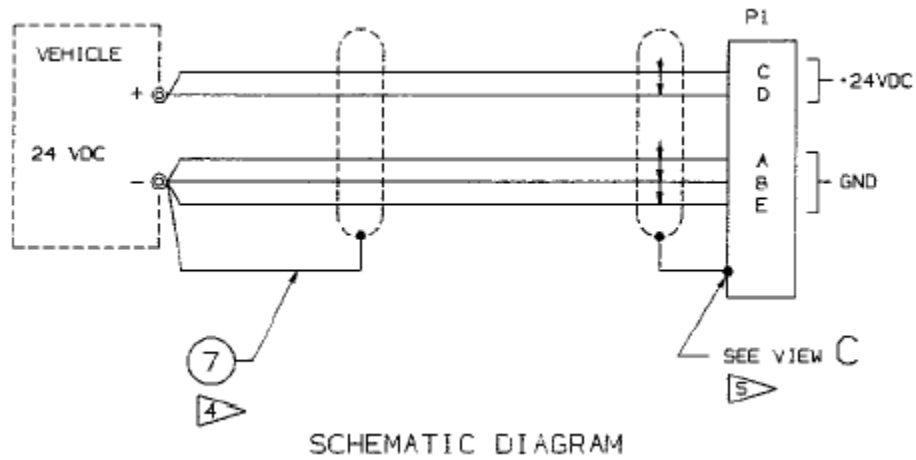


Figure E-10 – Cable, Cord, and Wire W114 P/N 7204114-9, Group 09

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOKK	5995-01-522-5485	1NZ85	7204114-9	CABLE, CORD, AND WIRE	1



W116 HMMWV Power Cable Assembly, P/N 7204116-1



W116-2 UH-60 Power Cable Assembly, P/N 7204116-2

Figure E-11 – W116 HMMWV and W116-2 UH-60 Power Cable Assemblies, Group 10

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	XDOKK		1NZ85	7204116-1	CORD ASSY, ELECT	1
2	PAOKK	6150-01-521-7885	1NZ85	7204116-2	CABLE ASSY, POWER	1



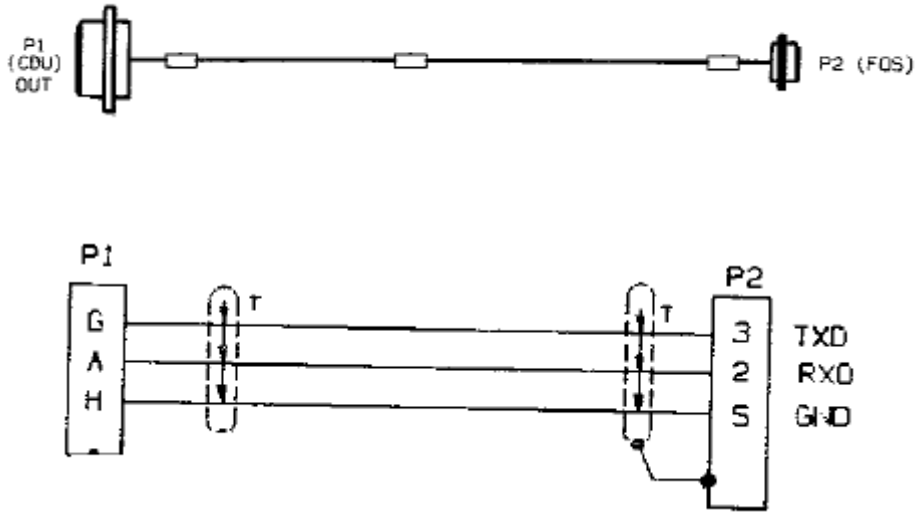
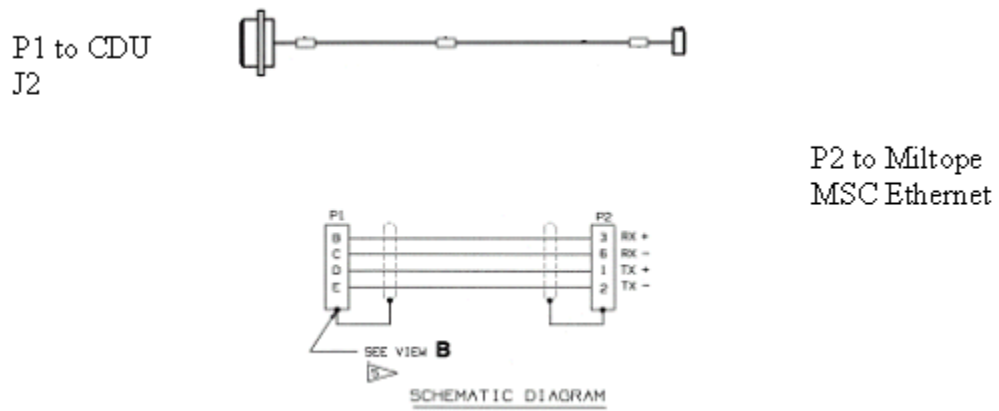


Figure E-12 – W136 FOS Cable Assembly P/N 7204136-9, Group 11

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOKK	5995-01-519-0653	1NZ85	7204136-9	CABLE ASSY, FOS	1



**Figure E-13 – W143 Reprogramming Cable Assembly, P/N 7204143-9, Group 12**

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
1	PAOKK	5995-01-522-2631	1NZ85	7204143-9	CABLE ASSY, REPROGRAMMING	1

## APPENDIX F

### EXPENDABLE SUPPLIES AND MATERIALS LIST

#### SECTION I: INTRODUCTION

##### F-1. Scope.

This appendix lists expendable supplies and materials required to operate and maintain the IPADS. These items are authorized by CTA50-970, Expendable Items (except medical, Class V, Repair Parts, and Heraldic Items).

##### F-2. Explanation of Columns.

- a. **Column 1, Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., use cleaning compound, Item 5, App. F).
- b. **Column 2, Level.** This column identifies the lowest level of maintenance that requires the listed item. (Enter as applicable):
- c. **Column 3, National Stock Number.** This is the National Stock Number assigned to the item; use it to request or requisition the item.
- d. **Column 4, Description.** Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.
- e. **Column 5, Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two – character alphabetical abbreviation (eg., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

**SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST**

<b>ITEM NUMBER</b>	<b>LEVEL</b>	<b>NATIONAL STOCK NUMBER</b>	<b>DESCRIPTION</b>	<b>U/M</b>
1	C	6810-00-201-0906	Alcohol, denatured (OMUS3) 27 CFR 21.35	BX
2	C	7910-00-044-9281	Cloth, Lint-free (51200) Miracle WipeL001	BX
3	C	6640-00-436-5000	Paper, Lens (81348) NNNP40, Type I, Class 1	PKG
4	O	8010-01-414-8422	Epoxy Coating Kit (81349) M22750-002Q-24410	KT
5	O	8020-00-285-1167	Brush Set, Artist's (80244) PD8020-00-285-8010	SE
6	O	8030-00-081-2339	Sealing Compound, Loctite (81349) MIL-S-22473	BX
7	O	7510-00-290-2026	Tape, Pressure Sensitive, Masking (52152) 250 2IN	RO

**APPENDIX G**  
**CDU Function Keys**

<b>Legend</b>	<b>Description</b>	<b>Reference</b>
F1-MANUAL	Displays IPADS Technical Manual.	
F1-2POS	Marks the first point, orienting station (OS), of a two-position mark, using vehicle plumb bob reference.	
F1-4 <sup>TH</sup>	Sets survey order for fourth order (five-minute ZUPT interval).	
F1-GRID	Sets azimuth type to grid azimuth.	
F1-M998	Sets IPADS vehicle type for operation in M998 HMMWV.	
F1-MILS	Sets angle display format to mils.	
F1-MRK EOL	Marks the second point, end of orienting line (EOL), of a two-position mark, using vehicle plumb bob reference.	
F1-NORMAL	Selects normal operational mode. Confirmation required to switch from emulator mode and the CDU will be restarted.	
F1-ON	Enables audible alarm.	
F1-POS+ALT	Selects update of position and altitude.	
F1-UPDT-PB	Initiates position update and adjusts previously established points using vehicle plumb bob reference point.	
F1-USER	Sets point type to user defined when creating a point in the point editor.	
F1-UTM	Sets position display format to UTM.	
F2-1POS	Initiates one position survey control point mark using vehicle plumb bob reference.	
F2-5 <sup>TH</sup>	Sets survey order for fifth order (ten-minute ZUPT interval).	
F2-ALARM	Tests the audible alarm. Accessible from within the STATUS screen.	
F2-DMS	Sets display position format to latitude/longitude or angle format in degrees, minutes and seconds.	
F2-EMULAT	Selects emulator mode for training. Confirmation required to switch from normal operational mode and the CDU will be restarted	
F2-M1123	Sets IPADS vehicle type for operation in M1069 or M1123 HMMWV.	
F2-MARK	Initiates marking (establishing) a point.	
F2-NEW	Displays the point editor page to add a new point to the database.	
F2-OFF	Disables audible alarm.	
F2-POS	Selects update of position only.	
F2-TRUE	Sets azimuth type to true (geodetic) azimuth.	
F2-UPDT-↖	Initiates position update using an offset (theodolite) reference and adjusts previously established points. Must be confirmed to complete.	
F2-USE ALL	Apply the data that was entered on a page. IPADS will validate the data and display an appropriate response.	
F2-WAY	Sets point type to waypoint when creating a point in the point editor.	
F3-↖ AZ	Initiates offset (theodolite) position and azimuth mark.	
F3-ALT	Selects update of altitude only.	
F3-D.D	Sets display position format to latitude/longitude or angle format in decimal degrees.	

Legend	Description	Reference
F3-FLAT	Selects display of inverse flattening during entry of user defined ellipsoid and datum.	
F3-M973	Sets IPADS vehicle type for operation in M973 SUSV.	
F3-SCP	Sets point type to SCP when creating a point in the point editor.	
F3-PT SEL.	Displays point list to select position update point or navigation way point.	
F3-UPDT	Initiates a position update and adjustment of previously established points.	
F3-YES	Enables usage of daylight savings in date / time screen.	
F4- $\overline{\wedge}$ SCP	Initiates offset (theodolite) position only mark.	
F4-FILTER	Toggles through the type of points to be displayed on map and point list.	
F4-MINOR	Selects display of semi-minor axis during entry of user defined ellipsoid and datum.	
F4-NO	Disables usage of daylight savings in date / time screen.	
F4-UH-60	Sets IPADS vehicle type for operation in UH-60 utility helicopter.	
F4-ZUPT	Initiates a ZUPT, which must be confirmed to complete.	
F5-DEL ALL	Initiates deletion of all points from the point list for the displayed filter type. Must be confirmed to complete deletion. Use the delete function (FNC and DEL keys) to delete a single selected point.	
F5-GETTIME	Synchronizes CDU date and time to FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F5-NAV	Initiates input of navigation waypoint.	
F5-NAV AID	Displays navigation aid (compass rose).	
F5-OTHER	Sets IPADS vehicle type for operation in a user-defined vehicle.	
F5-STOPNAV	Discontinues waypoint navigation.	
F5-ZONE	Initiates setting normal or extended zone when zone boundary crossed.	
F6-CENTER	Centers map on current location, resets zoom to 1.00, and loads an adjacent map if current location moves off the previously loaded map.	
F6-MAP	Displays map.	
F6-SND PNT	Sends the selected point within the point list to the FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F7-POINTS	Displays point list.	
F7-SND ALL	Sends all SCPs stored on IPADS to the FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F8-STATUS	Displays current IPADS status.	
F9-CANCEL	Cancels the operation in process.	
F9-EXIT	Returns display to previous page.	
F9-MENU	Returns display to the menu.	
F9-SHUTDN	Initiates shutdown of IPADS. Must be confirmed to complete.	

## APPENDIX H

### Acronyms and Abbreviations

1/f	Inverse Flattening
AC	Alternating Current
AEPS	Army Electronic Product Support
ALT	Altitude
AZ	Azimuth
BCU	Battery and Charger Unit
BII	Basic Issue Item
BIT	Built In Test
BITE	Built In Test Equipment
C	Degrees Celsius
CADRG	Compressed ARC Digitized Raster Graphics
CAGEC	Commercial Activity Government Entity Code
CDU	Control and Display Unit
CEP	Circular Error Probable
CM	Configuration Management
COEI	Component of End Item
CPNU	Compact Position and Navigation Unit
CSCI	Computer Software Configuration Item
D.D	Decimal Degrees
D/M/S	Degrees/Minutes/Seconds
DA	Department of Army
DAPAM	Department of the Army Pamphlet
DC	Direct Current
DEL	Delete Key
DGR	Degraded Operations Indicator
DISREP	Discrepancy in Shipment Report
DMS	Degrees Minutes Seconds
DOORS	Dynamic Object Oriented Requirements System
DVP	Design Verification Plan
EIR	Equipment Improvement Recommendation
EL	Elevation
ELLIP	Ellipsoid
EMI	Electromagnetic Interference
EMP	Electro-Magnetic Pulse
EOL	End of Orienting Line
ESC	Equipment Service Criteria
ESOH	Environmental, Safety, and Occupational Health
ETI	Elapsed Time Indicator
F	Degrees Fahrenheit
FI	Fault Isolation
FL	Filter
FNC	CDU FNC Key
FOS	Forward Observer System
GEOTRANS	Geographic Translator (software developed by NIMA - v2.2.3, Feb 21, 2003)
GZ	UTM Grid Zone

### Acronyms and Abbreviations

HDNG	Heading
hh:mm:ss	Hours:Minutes:Seconds
HMMWV	High Mobility Multi-Wheeled Vehicle
HORIZ	Horizontal
in	Inch
INIT	CPNU Initialization Mode
IP	Internet Protocol
IPADS	Improved PADS
JTA	
KBD	CDU Keyboard
kg	Kilograms
KM	Kilometers
km	Kilometers
LAN	Local Area Network
LAT	Latitude
lb	Pound
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEN OL	Length of Orienting Line
LONG	Longitude
LRU	Line Replaceable Unit
m	Meters
MHz	Megahertz
MISN	Point Filter set to Current Mission
mm	Millimeters
mm:ss	Minutes:Seconds
MRK	Mark
MTBF	Mean Time Between Failure
MTOE	Modified TOE
MWO	Modification Work Order
N	Northern Hemisphere Indicator
NATO	North Atlantic Treaty Organization
NAV	Navigation Aid
NGA	National Geospatial- Intelligence Agency (formerly NIMA)
NIMA	National Imagery and Mapping Agency
NIMA TR	National Imagery and Mapping Agency
NSN	National Stock Number
NXT ZPT	Next ZUPT (Time remaining till ZUPT is required)
OD	Outside Diameter
OL	Orienting Line
OS	Orienting Station
OS	Orienting Station
PADS	Position and Azimuth Determining System
PAE	Position Azimuth Elevation
PE	Probable Error
PERF	Performance



### Acronyms and Abbreviations

PMCS	Preventative Maintenance
PN	Part Number
POS	Position
POS UPD	Position Update Required Indicator
REQ	
PPA	Porro-Prism Assembly
PT SEL	Point Select
RAD DIST	Radial Distance from Update Point
RAD ERR	Radial Error
ROD	Report of Discrepancy
S	Southern Hemisphere Indicator
SB	Supply Bulletin
SCP	Survey Control Point
SCP	Survey Control Point
SF	Standard Form
SHUTDN	Shut Down
SND PNT	Sent Point to FOS
SS	Stainless Steel
STLTH	CDU Stealth Mode
SUSPND	CDU Suspend Mode
SUSV	Small Utility Support Vehicle
SW VER	Software Version
TAMMS	The Army Maintenance Management System
TBD	To Be Determined
TDA	Table of Distribution Allowances
TM	Technical Manual
TO&E	Table of Organization and Equipment
TOE	Table of Equipment
TOT DIST	Total Distance from Update Point
U/I	Unit of Issue
UH	Utility Helicopter
UPDT-PB	Update Plumb Bob
UPDT-T	Update Theodolite
USERDEF	User Defined Point Type
UTM	Universal Transverse Mercator
VDC	Volts Direct Current
VERT	Vertical
WAY	Waypoint
WGS	World Geodetic System
WP	Waypoint
X-SHIFT	X Datum transformation Parameter
Y-SHIFT	Y Datum transformation Parameter
Z-SHIFT	Z Datum transformation Parameter
ZUPT	Zero Velocity Update
ZUPT IN	Zupt is in Process Indicator
PROC	
∧	Theodolite



By Order of the Secretary of the Army and the Commandant of the Marine Corps:

PETER J. SCHOOMAKER  
*General, United States Army*  
*Chief of Staff*

Official:



JOEL B. HUDSON  
*Administrative Assistant to the*  
*Secretary of the Army*  
0425102

DISTRIBUTION: To be distributed in accordance with the Initial Distribution Number (IDN) 401214, requirements for Army TM 9-6675-349-12&P.



<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b>  For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II ( <i>reverse</i> ) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
---	--	------

<b>TO:</b> ( <i>Forward to proponent of publication or form</i> ) ( <i>Include ZIP Code</i> )	<b>FROM:</b> ( <i>Activity and location</i> ) ( <i>Include ZIP Code</i> )
---	---

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

PUBLICATION/FORM NUMBER	DATE	TITLE
-------------------------	------	-------

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

*\* Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
----------------------------	---	-----------

<b>TO:</b> <i>(Forward direct to addressee listed in publication)</i>	<b>FROM:</b> <i>(Activity and location) (Include ZIP Code)</i>	<b>DATE</b>
---	--	-------------

**PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

PUBLICATION NUMBER			DATE		TITLE			
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

**PART III - REMARKS** *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
----------------------------	--	-----------



