Operation and Maintenance Manual
for
AL-4016-1EPRS

ELEVATION-OVER-AZIMUTH ANTENNA POSITIONER

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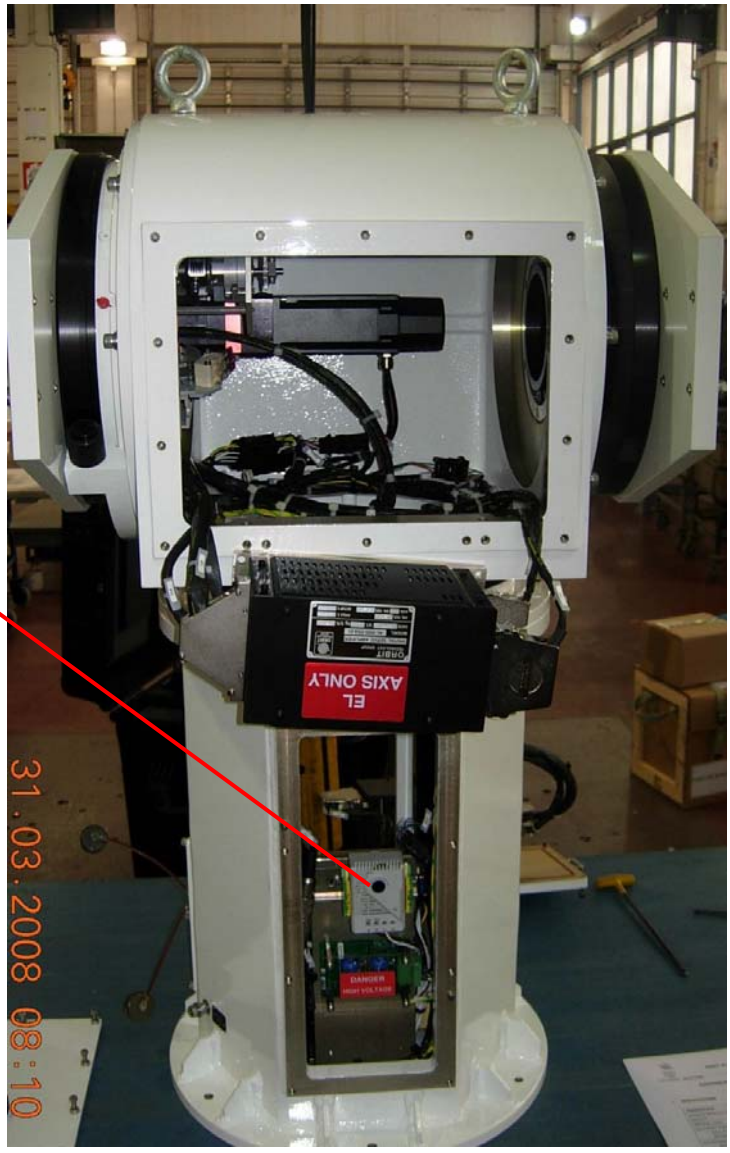
TECHNICAL PUBLICATIONS AND SERVICES

Item	Description	Qty.
1.	EL/AZ Tracking Antenna Positioner AL-4016-1EPRS, including Digital Servo Amplifiers .	1
2.	Counterweights (7 Kg)	8 Pcs.
3.	Operation and Maintenance Manual for EL/AZ Positioner, AL-4016-1EPRS	1
4.	Orbit control protocol for AL-4016.	1
5.	WINDOWS host application+ operation manual for AL-4016.	1

AL-4016-1EPRS

ELEVATION OVER AZIMUTH PEDESTAL



AL-4016-1EPRS

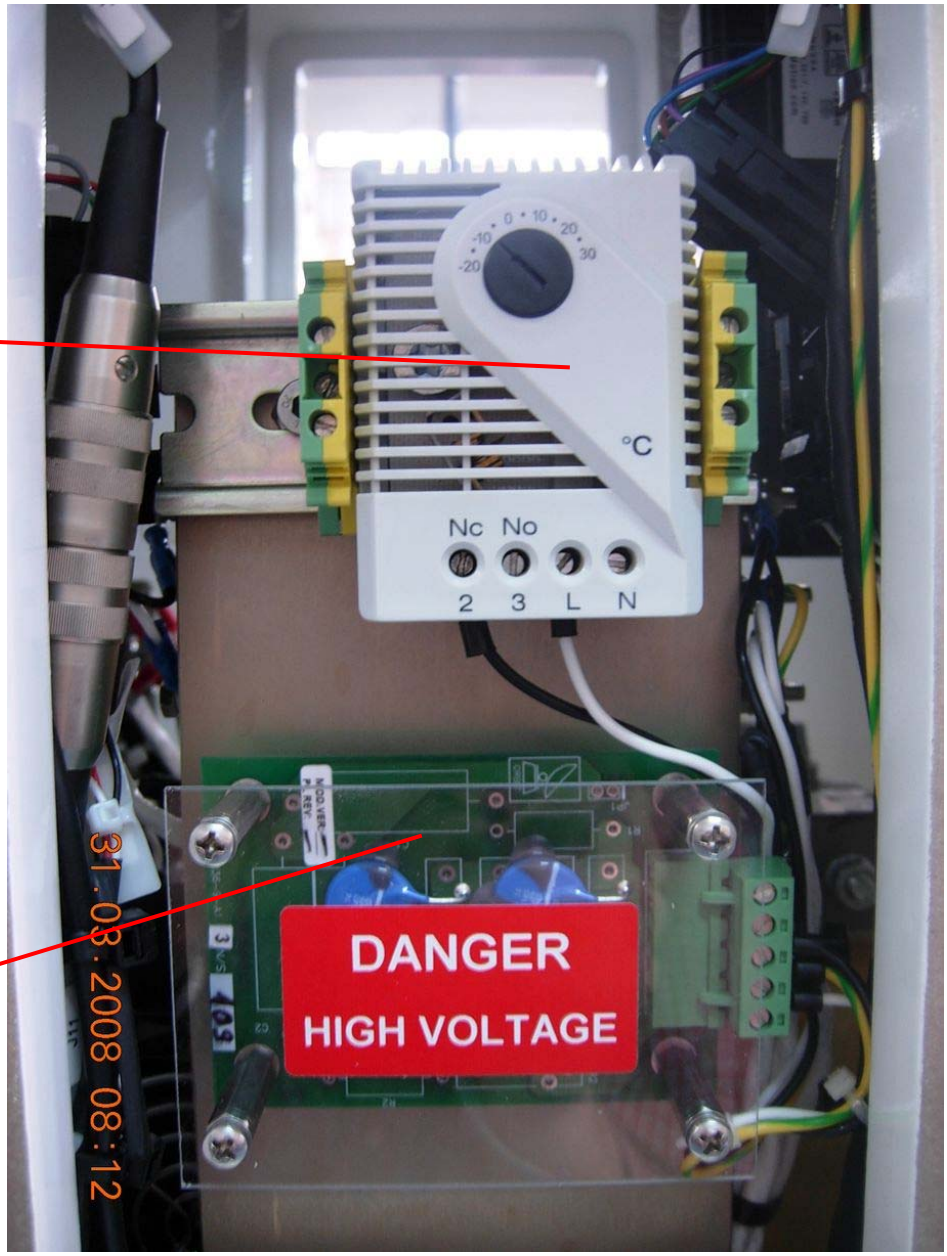
BASE RISER, EL INSIDE VIEW

AL-4016-1EPRS

PANEL CONNECTORS VIEW

THERMOSTAT

SUPRESSOR CARD



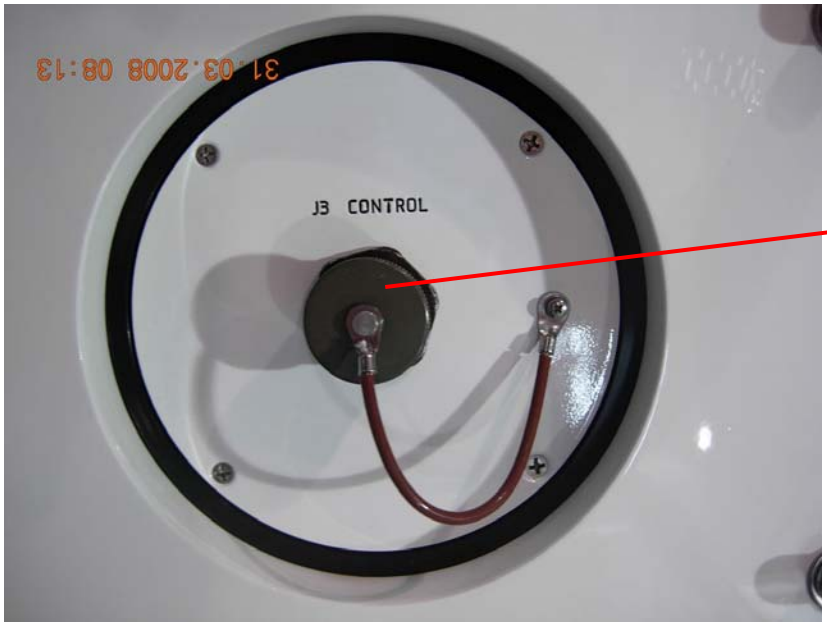
AL-4016-1EPRS

HEATER THERMOSTAT AND SUPRESSOR PROTECTION CARD VIEW

HEATER

AL-4016-1EPRS

TRANSFORMER AND HEATER VIEW



SERVICES CONNECTOR

AL-4016-1EPRS

EL SERVICES CONNECTOR VIEW

SECTION 1 - GENERAL DESCRIPTION

1.1 Introduction

The **AL-4016-1EPRS** Elevation over Azimuth Antenna Positioner series is designed for medium-load operation. This medium-load model is capable of supporting many types of loads and provides the ability to control an antenna or similar equipment motion about the elevation and azimuth axes. The **AL-4016-1EPRS** is a positioning system, which can be configured for either fixed land operation or, for mobile road, rail, or sea operation.

According to specified loads and environmental requirements, the pedestal can operate in OUTDOOR applications, without or under an adequate RADOME.

The **AL-4016-1EPRS** Elevation over Azimuth Antenna Positioner is designed to support and moving a customer antenna and the suitable electronic equipment.

The **AL-4016-1EPRS** features remarkably precision that are reflected in the low backlash, high orthogonality and encoder accuracy values.

The pedestal tracking functions are implemented using Orbit's **AL-2005-DSA-01** Digital Servo Amplifier, which is mounted inside the positioner axes.

In order to control and monitor the tracking system, a host computer (CFE) must be connected to the **AL-4016-1EPRS** Positioner. The connection between **AL-4016-1EPRS** and the host computer can be established via RS422.

This manual provides a technical description and instructions for installation, operation and maintenance of the **AL-4016-1EPRS** Elevation over Azimuth Tracking Antenna Positioner.

The main components of the **AL-4016-1EPRS** Positioner are shown in figure 1.

For more details regarding sub-assemblies identification and location, refer to Interface Control Drawings DCD27-1500, in Appendix B.

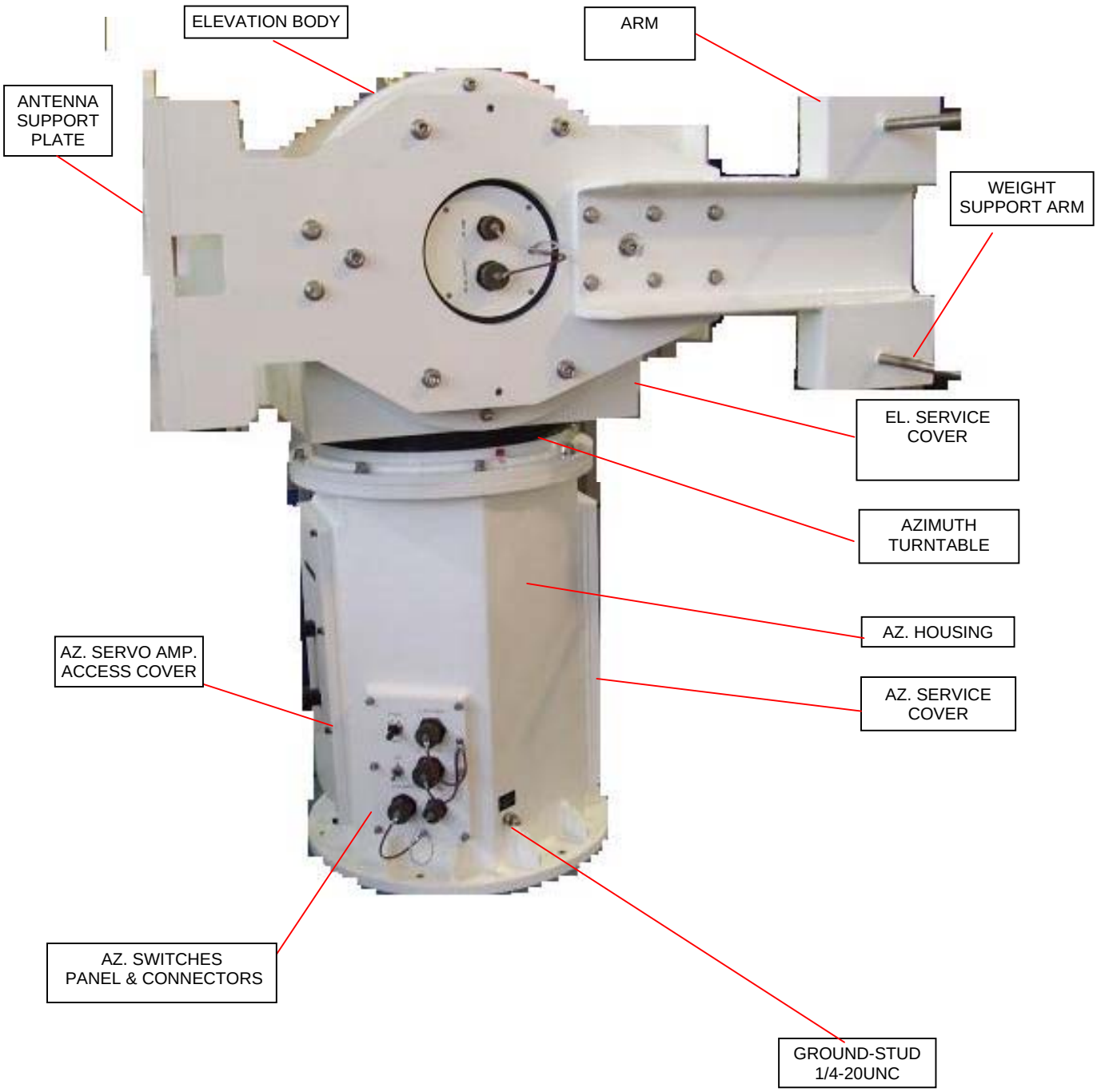


Figure 1.a

General View of AL-4016-1EPRS Pedestal

1.2 ANTENNA POSITIONER SPECIFICATIONS

*1.2.1 **Performance Specifications***

ITEM No.	PARAMETERS			UNITS	VALUES	
					ELEVATION	AZIMUTH
1	Azimuth bearing moment capacity (static)			Lb-Ft	800	
2	Maximum Payload (antenna & counterweights)			Lbs	260	
3	Delivered torque			Lb-Ft	150	150
4	Peak torque			Lb-Ft	200	
5	Peak velocity			Deg/sec	20	20
6	Peak acceleration			Deg/sec^2	36 max.	36 max.
7	Power gearing backlash			Deg.	0.07 Max.	
8	Data take-off accuracy			Deg.	± 0.03	± 0.03
9	Compliance			Rad/Lb.Ft	4 x 10^{-5}	
10	Positioner axes orthogonality			Deg.	0.04 Max.	
11	Software limit	*Elevation*	Down	Deg.	Between –5 to –5.5	
			Up	Deg.	Between +185 to +185.5	
12	Electrical Limit-to-limit Travel	*Elevation*	Down	Deg.	Between -6.5 to -7	
			Up	Deg.	Between +185.5. to +186	
13	Mechanical stops (Shock absorber)	*Elevation*	Down	Deg.	Between -7 to -9	
			Up	Deg.	Between +187 to +189	
14	Software limit	*Azimuth*	ccw	Deg.	Between –200 to –200.5	
			cw	Deg.	Between +200 to +200.5	
15	Electrical Limit-to-limit Travel	*Azimuth*	ccw	Deg.	Between -201 to -208	
			cw	Deg.	Between +201 to +208	
16	Mechanical stops (Shock absorber)	*Azimuth*	ccw	Deg.	Between -208 to -210	
			cw	Deg.	Between +208 to +210	
17	Motor type [With integral Encoder and FAIL-SAFE brake]				DC Brushless	

1.2.2 Dimensions and Weight

The Pedestal outline dimensions and interface information are shown on the Interface Control Drawing No: DCD27-1500*,* in Appendix B.
The maximum **weight** of the **AL-4016-1EPRS** Positioner, including digital servo amplifiers, antenna support plate, slip ring and two counterweight support arms, is **up to 150 Kg** (This weight not include antenna, and additional counterweights required for antenna balance).

1.2.3 Power Requirements

- AC Input Voltage: 1 phase, 115VAC-50/60Hz

1.2.4 Environmental Specifications

The Pedestal is capable of withstanding the natural environmental conditions specified below (adequate for OUTDOOR ground mobile applications, in salt sea conditions), without sustaining any damage or degradation in performance.

Item No.	PARAMETERS		UNITS	VALUES
1	Temperature Range	Operating	°C	-20 to +60
		Survival	°C	-30 to +70
2	Relative humidity (including condensation)	Operating	%	up to 95
		Survival	%	From 3 to 100
3	Rain		mm/hour	130
4	Altitude	Operating	Feet	10,000
		Transportation	Feet	33,000
5	Insects and fungi			For tropical regions
6	Salt sea atmosphere, sand, dust, solar radiation, vibration and shock.)		According to requirements for a ground mobile Pedestal, operate in outdoor conditions, near the sea	

1.3 Principles of Operation

The principles of operation for the azimuth and elevation units are similar. Each unit provides a single-axis motion. The both azimuth and elevation units motion are in a pre-determined angular range. The combined motions of the axes drive units results in a dual-axis antenna movement.

Each drive unit consists of the following sub-assemblies:

- DC Brushless motor with integral encoder and FAIL-SAFE brake.
- Modular planetary reduction gear, which together with the motor forms the Servo Drive unit.
- Large turntable slewing ring bearing with integral internal gear.
- Data take-off unit, encoder assembly (1:36 ratio).
- Elevation Electrical limit switch unit.
- Digital Servo Amplifier unit.
- Slip ring.

The DC brushless motor, which is driven by the Digital Servo Amplifier Unit (DSA), transmits motion, directly to the reduction gear. The planetary gear reduces the rate of this motion and then, transmits it to the turntable by means of an output pinion that in turn, drives the turntable internal gear. The internal gear is an integral part of the inner race of the slewing ring bearing and is directly coupled to the turntable.

In all operation modes, the Digital Servo Amplifier provides drive power to the positioner servomotors. This magnitude of the DC drive current and power, delivered to the motors, depends on the velocity and torque required from the positioner to moving the load.

A slip ring assembly is used to provide electrical connections between the elevation and azimuth pedestal sections.

Safety switch and a circuit breaker (combine power switching and circuit protection) are mounted on an azimuth base panel.

Power and communication cables enter the positioner through connectors mounted on azimuth panel connector, located on the side of the base riser. Electrical Limit Switch assemblies are used to limit the axis travel range, in case of controller failure (malfunction of software limits).

The elevation axis is equipped with two mechanical stop strikers and a shock-absorbing unit, which arrest axis motion and prevent physical damage to the antenna array in case of software or electrical limits malfunction.

Each unit can be disassembled, serviced and tested separately. All internal components can be accessed and reached through service covers, sealed with o-ring gaskets and secured with stainless steel captive fasteners.

The positioner itself is environmentally protected at a protection grade “IP56” (per European Standard IEC 529) and all rotating components are sealed and protected against sand, dust and water.

SECTION 2 - TECHNICAL DESCRIPTION

2.1 General

The **AL-4016-1EPRS** is a Dual-Axis Antenna Positioner that provides elevation-over-azimuth motion, under medium loads and harsh environmental conditions and guarantees good performance and reliability for tracking requirements.

The Positioner structure includes the following major sub-assemblies (refer to Figures 2):

a. Azimuth structure including azimuth housing;
b. Elevation body, elevation arms, antenna support plate and counterweights;
c. Azimuth drive unit;
d. Elevation drive unit;
e. Data take-off units (azimuth and elevation);
f. Elevation Electrical limit switch units;
h. Digital Servo Amplifier model **AL-2005-DSA-01A (AZIMUTH)**
AL-2005-DSA-01B (ELEVATION)

Each section (azimuth and elevation) is driven by a DC Brushless motor, which drives the turntable through a reduction gearbox and a pair of spur gears.

Motor with integral encoder and electromechanical Fail-Safe brake, data take-off units and limit switches are connected at appropriate points in the drive train of each section

Stop strikers and shock absorber mechanism arrest elevation motion, in case of software and electrical limits malfunction.

Safety switch and a circuit breaker are mounted externally on an azimuth panel.

Cables from the power and control equipment, enter the positioner through connectors mounted on a separate azimuth panel, located in the bottom side of the base riser.

Each unit can be disassembled, serviced and tested separately.

The Positioner itself is “IP65” (per European Standard IEC529) environmentally protected and all rotating components are sealed for protection against sand, dust and water.

The following paragraphs describe the positioner assemblies and sub-assemblies.

2.2 Description of Mechanical Units

2.2.1. Azimuth Body.

On the side of the base riser are placed, three access covers, a switch and connector panel. The connector's panel makes possible the interface between positioner units and the in / out power and control cables.

One of the side access covers function as a support for the positioner power supply and azimuth Digital Servo Amplifier (DSA) units.

The base riser, in its bottom side, is a housing for the slip ring, and azimuth Digital Servo Amplifier.

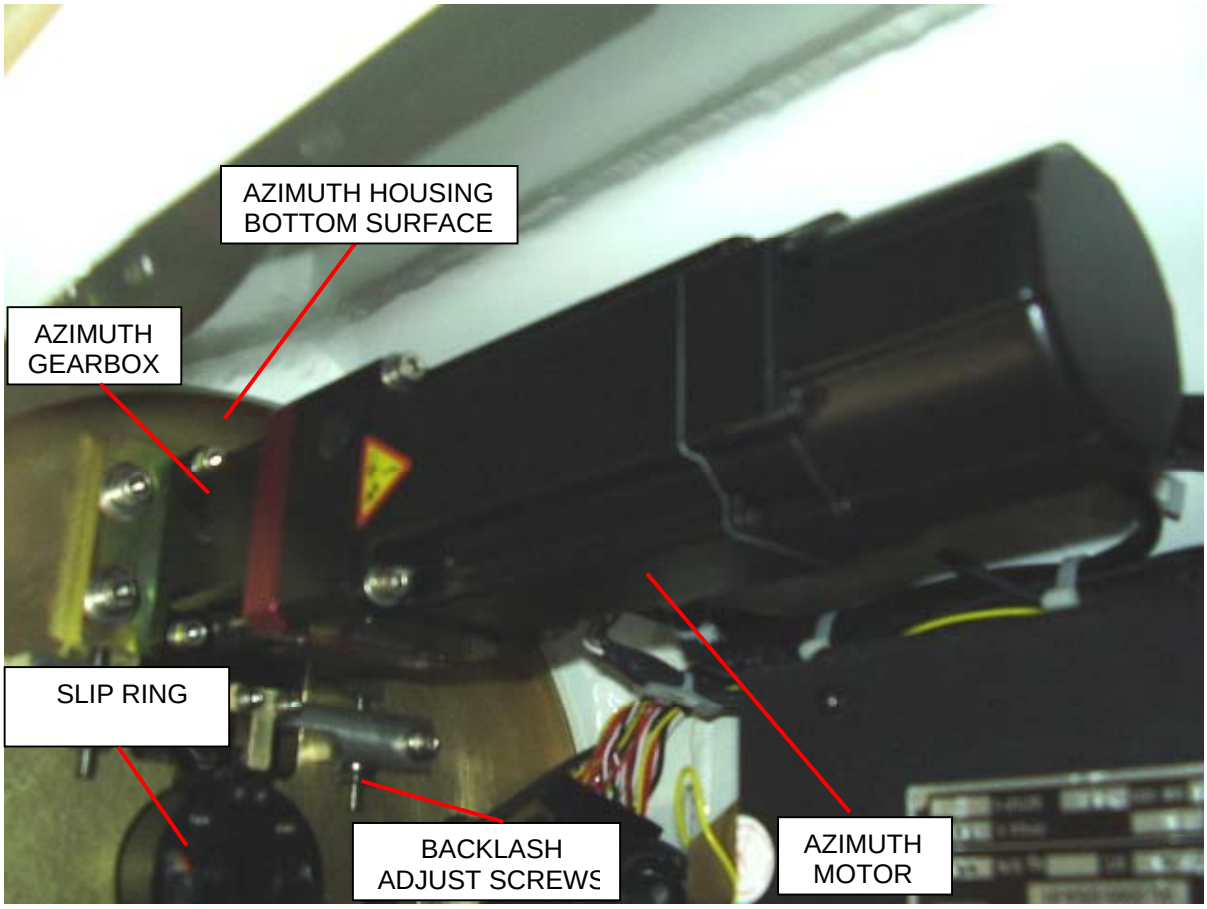
Inside the upper side of the base extension, supported by the azimuth housing, the following units are placed:

- Azimuth drive unit
- Azimuth data take-off unit (encoder assembly)

All access covers are sealed with O-Ring gaskets against harsh environmental conditions and are secured with captive fasteners.

Protection of the base extension parts against corrosion are ensured, on all internal and external surface, by chemical conversion (alodine), a primer layer of epoxy paint and a top coat of polyurethane paint, gloss white color #17925, per FED-STD-595.

Internal views of the azimuth lower and upper base extension are shown in figures 2.a and 2.b, on next pages.



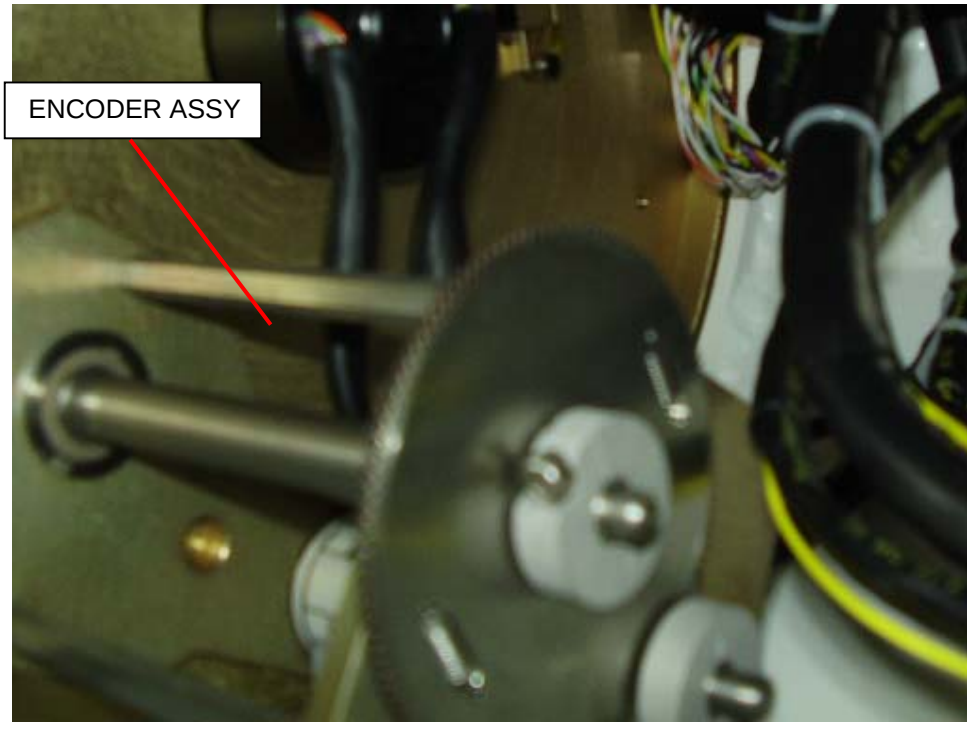


Figure 2.a: AL-4016-1EPRS Positioner Azimuth Base Interior Configuration

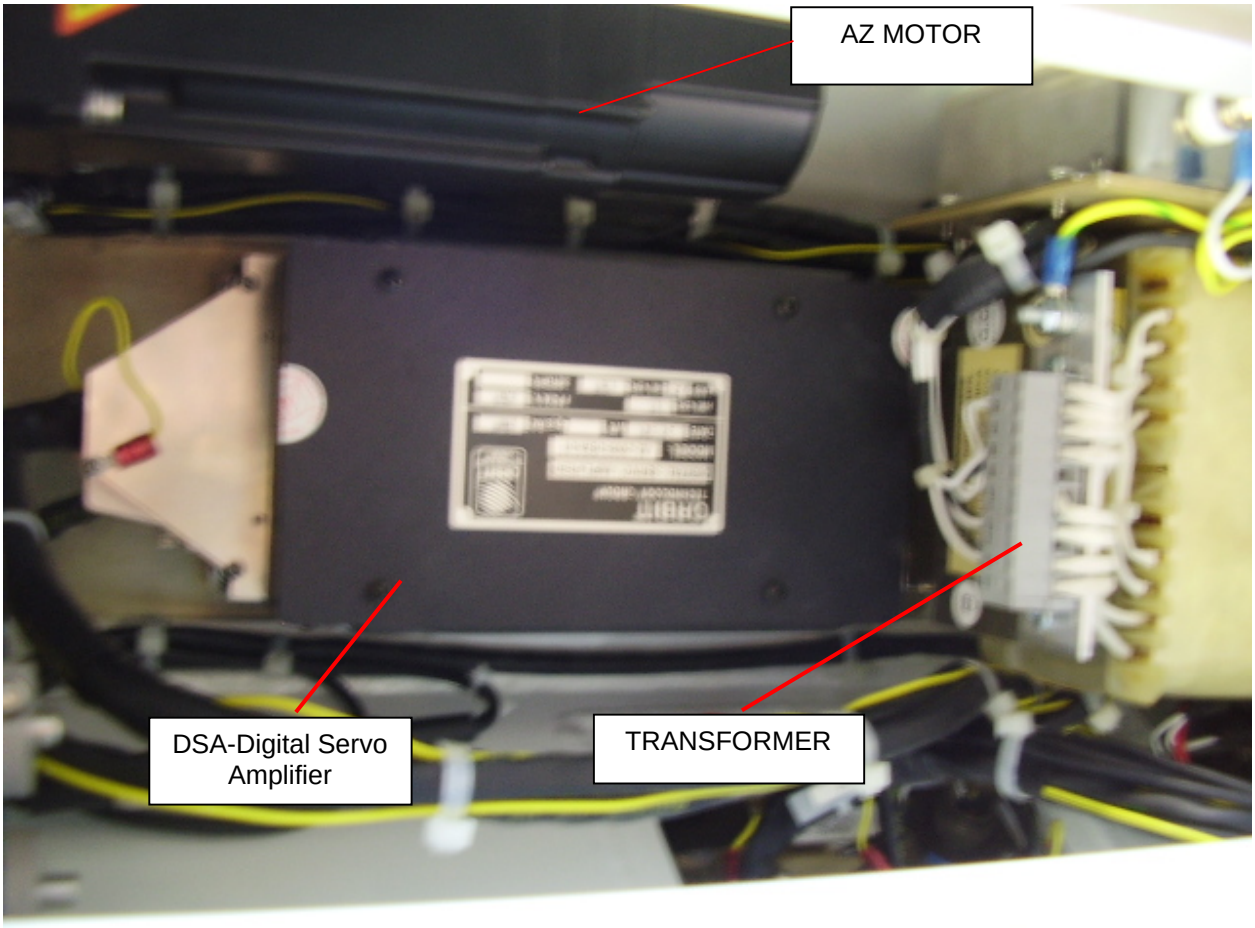


Figure 2.b: AL-4016-1EPRS Positioner

General View of Electrical Equipment located inside the Azimuth Base

2.2.2 Side Arms and Counterweights

The elevation mounting structure, arms and antenna support plate.
The counterweight support arms and the weights (8 pieces, 4 on each side), installed on each elevation arm, are provided to counterbalance the moment that is generated by the antenna assembly about the Elevation axis.
The supplementary weights are provided as modular elements and the customer must to install the exact weight necessary to counterbalance the antenna array.

2.2.3 AxIs Units

2.2.3.1 Azimuth Section Description (Refer to figures 1, 2.a, and 2.b)

The Azimuth section is built in a shape of a rigid plate, with all of its sub-assemblies mounted in the internal space of the upper base extension. The unit is rigidly fixed on top of the azimuth base riser.
The upper side of the Azimuth unit includes a driving plate (turntable), which supports and rotates the elevation unit.
The azimuth housing and drive mechanism are designed around a four-point contact large bearing with an integral internal gear. The outer race of the AZ. large bearing is directly mounted in a machined seat, located at the upper end of the azimuth housing.
The bottom surface of the azimuth housing provides an accurate mounting surface for the servo-drive unit (gear-motor), encoder package and slip ring, all of which have gears meshing with the large internal gear.
The azimuth slip ring support is also installed on the center of azimuth turntable.
The azimuth turntable is supported by the inner race of the large bearing with the main drive gear cut on the inner ring of the bearing.
A planetary gearbox provides the necessary reduction from the main drive gear to the drive motor and its output pinion mates with the internal ring gear. The precision gears of the gearbox are total enclosed and grease lubricated for life.
Backlash adjustment capability is provided between the gearbox output pinion and the internal gear of the large slewing bearing.
The motor selected is of the DC brushless servomotor type. It uses rare earth magnets for high torque capability, for both continuous and intermittent duty cycles.
Its brushless design leads to high reliability since there are no brushes to wear out.
This type of motors is characterized by a superior dynamic performance.

A low noise, high sensitive encoder is integrated into the motor housing. The directly coupled rotational elements provide a high resonant frequency connection, which is required to ensure optimum servo performance.
A FAIL/SAFE electromechanical brake, which is an integral part of the motor, provides protection and stability during both operational and non-operational modes.
An Anti-backlash gear, mounted on the output shaft of the data take-off unit, meshes with the large drive gear of the turntable bearing and drive, through a gear train, the shafts of the encoder units.

For the stable work of pedestal in low temperature used Heater and Thermostat with wide range .

All sub-assemblies are accessible and removable through the azimuth service panels, sealed with o-ring gaskets and secured with captive fasteners.

2.2.3.2 Elevation Section Description (Refer to figures 3 and 4)

The Elevation section is built in a machined casting body. The unit is supported by the Azimuth turntable and drives the antenna in the elevation axis.
Similar to the Azimuth unit, the Elevation unit contains a driving unit (consisting of a DC brushless motor and a planetary gearhead), encoder assembly and a limit switch assembly, and all of these units are mounted in the internal space of the elevation body.
The elevation-driving turntable is mounted on a four-point contact large bearing, which has the main drive gear as an “integral-cut” internal gear and the ring gear bolted directly to the turntable in a “pilot” seat. The outer race of the elevation large bearing is directly mounted in a machined seat, located in the right side of the elevation body casting. The elevation-driven turntable is mounted on a sealed four-point contact ball bearing enclosure, which is directly assembled in a machined seat, located at the opposite side of the body.
The antenna support plate connects between the two elevation arms and ensures turntable alignment.
For antenna counterbalance, ten weights of 7Kg are supplied to add to the counterweight support arms.
Electromechanical limit switch assembly is mounted in mesh with the elevation main drive gear and is used to limit the elevation axis travel in case of controller failure and software limits malfunction. The ***software limits*** activate at **-5º DOWN** and **+185º UP**.
The elevation ***electrical limit*** switches activate between **–6.5º up to –7.0º DOWN** and between **+185.5º up to +186.0º UP**.

Shock-absorbing unit, mounted on the elevation body, arrest elevation motion and prevent antenna physical damage, in case of software and electrical limit malfunction. The ***stop strikers*** are installed on the outer diameter of the driving turntable and are set to ***contact*** the shock absorber **at -9° DOWN and +189° UP** and to ***stop the travel*** at maximum **-8° DOWN** and **+189° UP**.

An Anti-backlash gear, mounted on the output shaft of the data take-off unit, meshes with the large drive gear of the turntable bearing and drive, through a gear train, the shafts of one, encoder motors.

The elevation section has essentially the same drive unit configuration used in the azimuth section (brush-less motor with integral encoder and fail-safe brake, gearbox, encoder assembly, Digital Servo Amplifier unit and an electrical limit switch assembly. The drive unit is installed on the left diaphragm of the elevation body.

The gearbox, motor, limit switches, encoder and elevation Digital Servo Amplifier unit, are all accessible and removable through an access cover sealed with O-ring gasket and secured with captive fasteners.

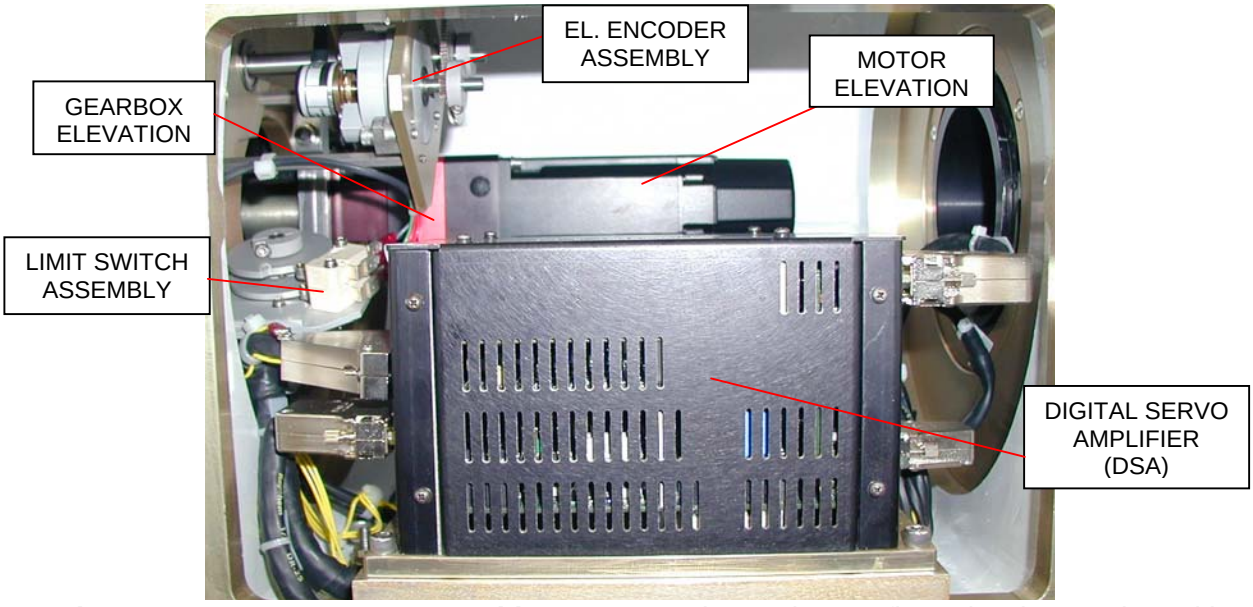


Figure 3a: AL-4016-1EPRS Positioner - EL. Unit, Interior Configuration (Front View with DSA)

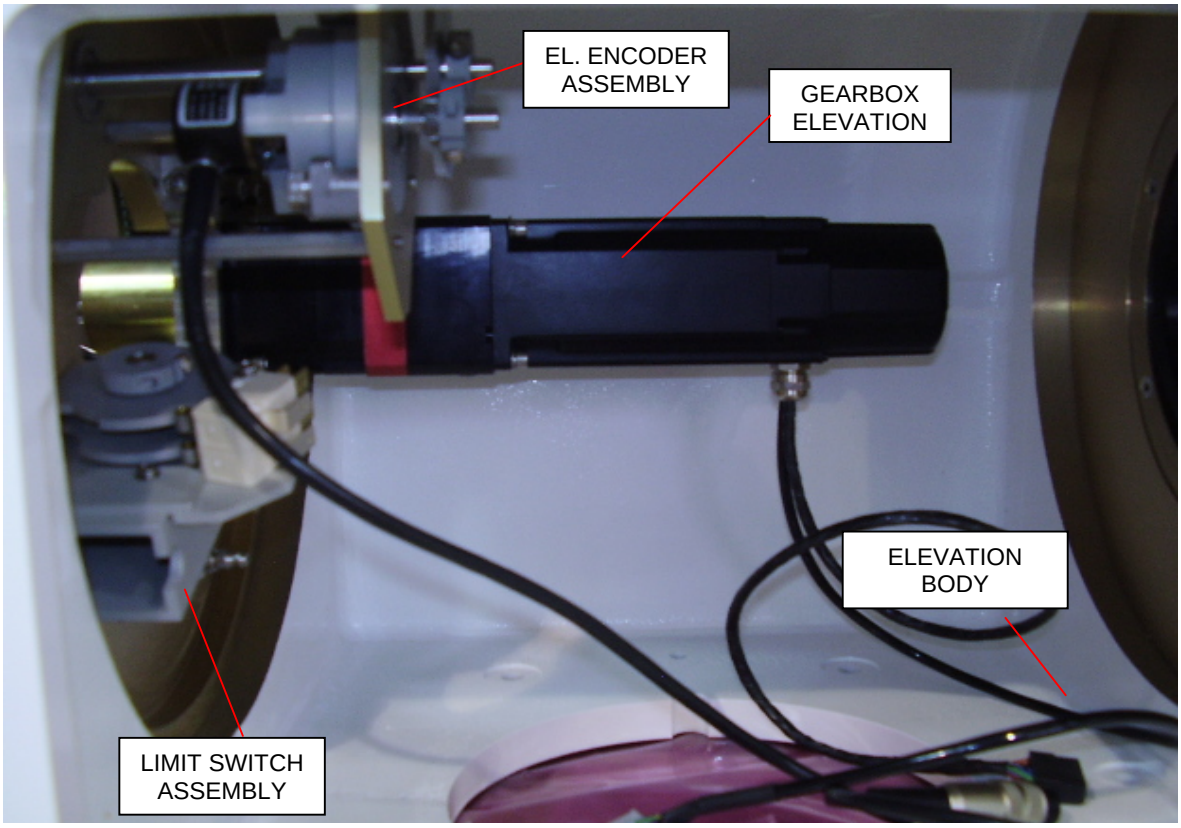


Figure 3b: AL-4016-1EPRS Positioner - EL. Unit, Interior Configuration (Front View)

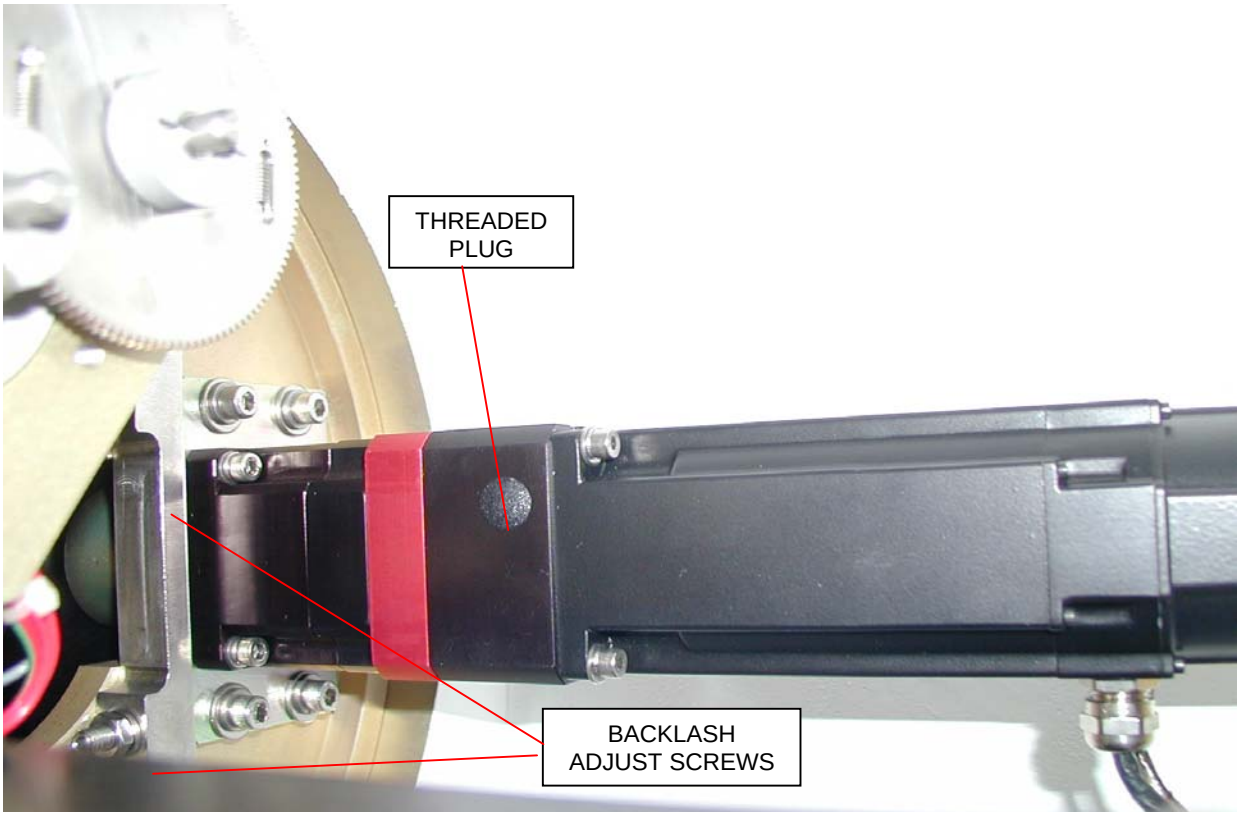


Figure 4: AL-4016-1EPRS Positioner – Elevation Unit, Interior Configuration (Side View)

2.2.4 Mechanical Stops (refer to Figure 9)

Mechanical stops and a shock absorber unit are mounted on the elevation axis.
The mechanical stops are mounted to prevent physical damage to the antenna or to equipment due to malfunction of the software or electrical limit switches.
The shock-absorbing unit, mounted on the elevation body, arrest axis motion and protect the antenna. The stop strikers are installed on the outer diameter of the elevation-driving turntable.

2.2.5 Encoder Assemblies

The term "Encoder" is a generic term covering a wide range of electromechanical devices, which are used in data transmissions and computing systems.
The encoder provides a mechanical indication of its position as a result of an electrical input or output which represents some functions of the angular displacement of its shaft.
The data take-off package of each axis is a single (1:36) encoder assembly.
The encoder assemblies are directly integrated with the internal gears through a precision anti-backlash gear, to obtain high accuracy of pointing data.

Encoder transmitters are used in the positioner as data take-off units. The package assembly is a modular design which can be easily removed and replaced and is identical at both axes.
The encoder transmitters are also connected to the final drive gear by means of anti-backlash gears.
The encoder assembly is shown in figure 2a.

2.2.6 Limit Switch Assemblies

Limit switches are mounted on both the azimuth and elevation axes.
The limit switch assembly is mounted in mesh with the end of the main drive gear through a spur gear.
The limit switches are factory adjusted prior to shipment. However, when Positioner readjustment or change of rotation limits is necessary, the limit switches must be re-adjusted. Refer to figure 3, for the location of the limit switch assemblies and to Figure 10.a and 10.b for details of the limit switch assembly.

2.2.7 Access Panels

Removable access panels are located on the various sections of the positioner structure in order to facilitate maintenance operations.

The Azimuth section contains the following access panels:

1. Two service covers on the side the azimuth base that provide easy access to the azimuth encoder assembly, gear-motor unit, limit switch assembly, Power Supply and azimuth Digital Servo Amplifier.
2. One switches and connector panel on the lower side of the azimuth base riser,

The Elevation section contains the following access panels:

1. One large service cover, which allows access to all internal components of the Elevation body.

2.3 Description of Electrical Units

2.3.1 Azimuth Connectors and Switch Panels (refer to Figure 5 and Table 1)

The panels are located on the bottom side of the azimuth base extension. The switch panel contains a SAFE / OPERATE switch, and a circuit breaker switch. The connector panel contains power and communication cables.
The part numbers of the switches, circuit breaker and connectors are listed in Table 1.

2.3.1.1 SAFE / OPERATE Switch

The SAFE / OPERATE switch – S1 – is located on the azimuth bottom panel.
The SAFE / OPERATE switch allows maintenance personnel to prevent positioner movement while repairs are being made, by setting it to the “SAFE” position.
The switch is a two-position, hermetically sealed toggle switch, operating in a PULL-TO-UNLOCK fashion. The PULL-TO-UNLOCK feature prevents accidental toggle movement. The “knobbed” toggle lever must be pulled-out approximately 2.5mm in order to change switch positions.

*The SAFE / OPERATE switch should be in the **SAFE** position during all of the positioner non-operation periods or installation works.*

2.3.1.2 *Circuit Breaker (Main ON / OFF Switch and Circuit Protection)*

The one-pole, hermetically sealed, magnetic circuit breaker, which is located on the azimuth panel, combines power switching and accurate, reliable circuit protection with inverse time delays and trip-free features.
The dual-purpose breaker replaces a fuse assembly and an ON / OFF switch.
Two of the basic units are contained in the hermetically sealed case in order to provide protection for two independent circuits. A single-toggle handle actuates the internal trip mechanisms. An overload in either circuit trips both protection mechanisms simultaneously, even if the toggle handle is forcibly held up. This feature insures that the circuits cannot be damaged, even if the breaker is forcibly held on during an overload. The handle of the breaker moves forcibly and positively to the OFF position during an overload. It is not necessary to manually "RESET" to full "OFF" in order to turn the breaker on again.

2.3.2 Digital Servo Amplifier Unit (Azimuth and Elevation), AL-2005-DSA-01

Both the azimuth and elevation axes are equipped with Digital Servo Amplifier units - one in each axis. Each Digital Servo Amplifier, model AL-2005-DSA-01, is attached to its place by four 1/4-20UNC-socket head cap screws and can be easily removed and replaced in case of malfunction. Label marks the service cover for access to the unit.

Figure 5: AL-4016-1EPRS Positioner Connector and Switch panel configuration

Table 1

AL-4016-1EPRS Positioner - Connector and Switch parts list specification

Item No.	PART NUMBER	DESTINATION
AZIMUTH CONNECTORS		
J1	D38999/24WC04PN	MAIN / AC POWER
J2	D38999/24WD19SN	PEDESTAL COMMUNICATION
AZIMUTH SWITCHES		
S1	MS24660-23D	PEDESTAL SAFE / OPERATE
S2	AP1-1-65F-602	MAIN POWER ON / OFF ONE POLE CIRCUIT BREAKER, 6 Amp.
ELEVATION CONNECTORS		
J5	D38999/24WD19PN	MAINTAN. USE

SECTION 3

INSTALLATION

(Refer to Interface Control Drawing No. ***DCD27-1500*** in Appendix B)

3.1 General Outline of Installation

Carefully unpack the pedestal from its shipping container and inspect the following units for evidence of shipping damage: body, base, arms, connectors, switches, and all Pedestal interfaces with customer equipment.

If a claim for damage is to be made, file the claim with the carrier and also notify an ORBIT sales representative, immediately.

The Positioner is shipped ready for installation and operation.

Prepare the Positioner for use by performing the following steps:

a. Use the equipment required for installation:
   - Two lifting eyes of 1/2 - 13 UNC, mounted on the elevation body upper surface, a mobile crane of 500 Kg. minimum lift capability, belts, all applicable hand tools and a suitable torque wrench.

b. Install the pedestal and all of its accessory equipment.

c. Perform a routine inspection and an operational checkout.

3.1.1 Pedestal removing procedure from the shipment package

- Cut the tie-wraps to release the envelope including the manuals, drawings and the test results.
- Cut the tie-wraps to release the boxes containing the accessories and the set of cables.
- Using Allen wrench and open-end wrenches, Release the Pedestal from the wood platform and counterweights.

Attach the two lifting belts to elevation body upper surface (antenna support plate) and lift the pedestal in vertical position, as shown in picture 3. If a lifting chain is attached, use a protective sponged material between the chain and antenna support plate.

For repacking, perform the previous procedure in a logical reverse sequence.

Picture 3: lifting eyebolts option.

3.2 Installation Summary

The pedestal installation requires preparation of the mounting site, mounting the pedestal, installation of antenna array, video camera assembly and connection of all the power, control, RF and grounding cables.

3.3 Pedestal Mounting Location

A suitable base structure, provided with a horizontal mounting surface of 400mm (15.7”) diameter minimum, leveled within 2 mm / ∅ 1000 mm flatness, must be prepared to withstanding the dynamic accuracy performance, under maximum pedestal operating loads and moments (severally or together). On the designed mounting surface, six threaded holes 5/16 or M8 anchor bolts must be installed, equally spaced, on a *base circle diameter of 360 mm*.
If anchor bolts are used, the height of the anchor bolts above the mounting surface has to be at least 65 mm.
The pedestal outline dimensions and interface information’s are shown on the drawing No. DCD27-1500.

3.4 Pedestal Installation

The installation procedure including the following steps:

a. Pedestal installation and leveling.
b. Installation of antenna array, feeds and counterweights.
c. Cables connection and installation.
d. Lightning and grounding protection.
e. Pedestal operation.

3.5 Positioner Installation (Refer to ICD No. DCD27-1500 in Appendix B)

Use the following procedure to install the positioner unit on the base structure:

a. Use a level with an accuracy of 0.02 deg. mounted on the upper surface of the Antenna support plate.

b. Verify that the threaded holes and/or anchor bolts prepared for installation are according to the referenced Interface Control Drawing.

Note:

An azimuth zero reference point should be marked on the foundation to provide the desired zero degree orientation (azimuth and elevation). The foundation fasteners (threaded holes, anchor bolts or studs) must be arranged to allow this reference point to line up with the holes in the base of the pedestal (or base extension). Note the positional relationship between the foundation mounting bolt circle and the zero azimuth reference point. Maintain this relationship when placing the pedestal (or base extension) on the foundation.

c. For lifting belts using: Verify that the Positioner is ready for installation and operation, with the Elevation arms rotated at 90° Position, Without antenna, electronic equipment and counterweights installed.

d. Verify the correct installation of the two lifting belts on the elevation body upper surface (antenna support plate).

e. For lifting eyes using: Verify that the Positioner is ready for installation and operation, with the Elevation arms rotated at 0º, without antenna, electronic equipment and counterweights installed.

f. Verify the correct installation of the two lifting eyes (1/2"-13 UNC) on the elevation body upper surface.

g. By means of a crane, slowly lift the Positioner unit above the base structure, *line up the foundation and pedestal zero azimuth reference* and place the complete assembly on the mounting surface.

CAUTION

Before lifting the positioner, verify that it is detached from the maintenance-mounting surface and that the lifting devices are correctly installed.

h. Insert shims between the Positioner's base and the mounting surface. Insert the shims on both sides of each mounting bolt and level the positioner to 0.1 deg. or better. As an alternative to employing shims, leveling feet may be used.

i. If installing the Positioner by means of screws, verify that the depth of screw penetration is at least 1.5 times the diameter of the screw. Tighten the screws with washers in a cross-wise sequence to the prescribed value, using a torque wrench.

j. If installing the Positioner by means of anchor bolts and nuts, verify that the bolt ends protrude from the nuts by at least 15mm (0.6inch). Tighten the nuts with washers in a cross-wise sequence to the prescribed value, using a torque wrench.

NOTE:
Use bolts grade 5 or higher.

k. Connect the power and control cables and rotate each axis slowly through its entire travel range. Check each axis for smooth mechanical operation.

l. Verify that the Positioner's platform is still level per step (g) after the positioner was rotated in both axis (if necessary).

3.6 Antenna array and Counterweights Installation

(Refer to Interface Control Drawing No. DCD27-1500 in Appendix B).

The installation procedure of Antenna assembly and counterweights will be performed only with the elevation axis rotated to 90º (vertical arms) and the positioner in SAFE mode.

CAUTION

Install the antenna array and counterweights only when the positioner is rotated at 90º elevation (antenna to zenith and arms in vertical position) and the safe-operate switch is set to SAFE.

a. Attach a lifting belt or chain to the antenna assembly and install the antenna on the positioner, Use suitable stainless steel screws, with flat and spring washers.
The exact interface dimensions of the antenna support plate and the pedestal-mounting surface (base flange) are shown on Figure 8 and on Interface Control Drawing No. DCD27-1500.

b. Detach the counterweight support arms from the package platform and install them on the elevation arms.
Fasten the nuts and washers securing the weights to the counterweight support arms.

c. Slowly rotate each axis through its complete travel range and check for smooth mechanical operation.

d. Verify that for the complete travel range for each axis, no section of the antenna array comes in contact with the pedestal or any other structure.

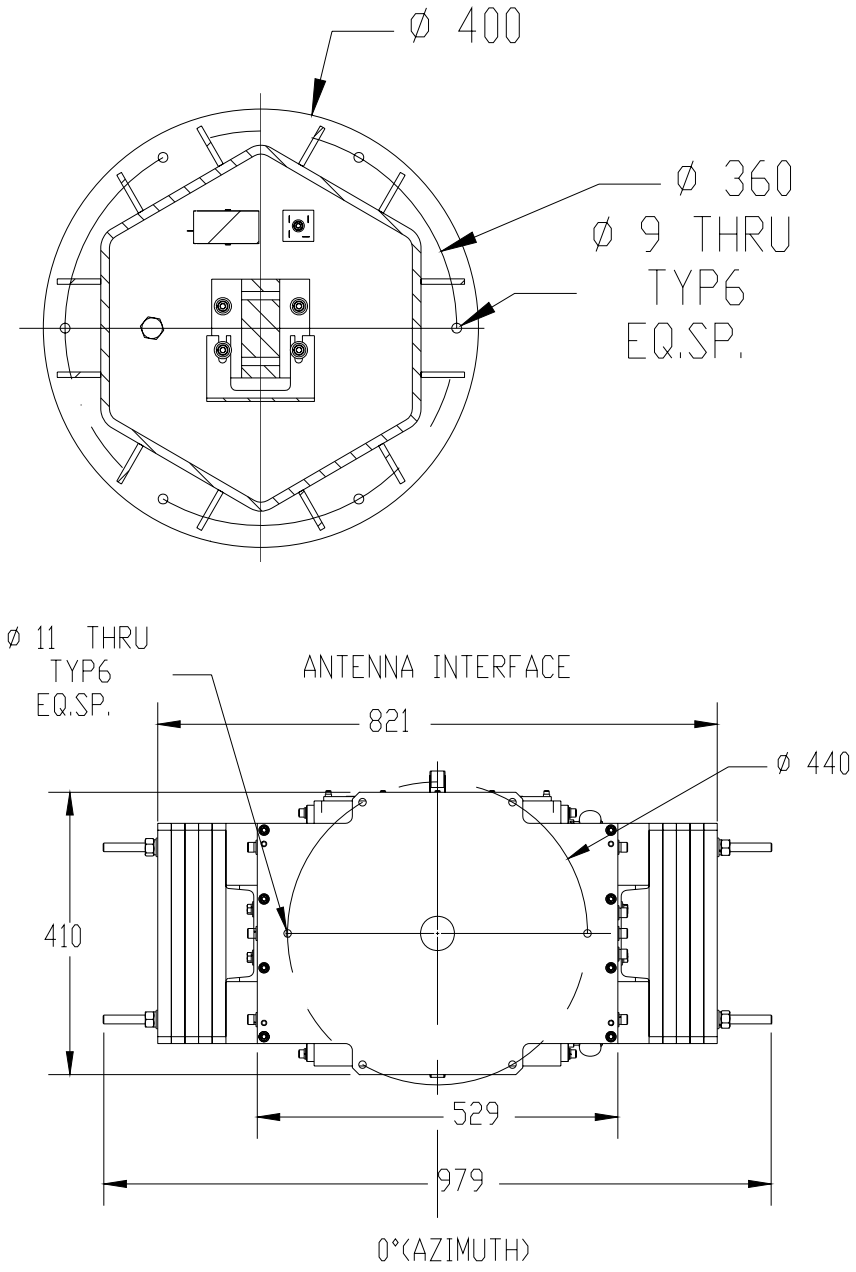


Figure 8: AL-4016-1EPRS Positioner Interfaces

3.7 Pedestal Leveling

Final pedestal leveling should be performed after all the antenna, feeds and supplementary equipment, have been properly installed.
The pedestal-leveling method is described in Para. 3.5, steps (a) & (g), and the mounting screws / bolts should be tightened as described in Para. 3.5, step (h) and (i), respectively.
After the pedestal is leveled within the required tolerance, it should not require re-leveling unless it is moved to a new location. The pedestal leveling should be rechecked if significant additional weight (load) is added.

3.8 Pedestal Cables

Control, and power cables must be connected to the pedestal. The cables are connected to the interface panel located on the bottom side of the azimuth base extension. (Refer to figures 1 and 6 and to the Interface Control Drawing #DCD27-1500).

3.9 Lightning Protection

For protection from damage due to lightning strikes on the pedestal, a ground strap of sufficient size should be connected between the antenna and the grounding-stud that on the pedestal base grounding stud (shown in figures 2.b and 6) to the nearest good earth ground. When routing the ground strap; use the shortest, most direct route possible and avoid making sharp bends in the strap.

3.10 Positioner operation

The AL-4016-1EPRS positioner operates by means of ORBIT WinDsaHost application using host PC.

For a full description of System operation, refer to the WinDsaHost Operation Manual.

3.11 Pedestal Relocation

Disassembly of the pedestal and preparation for reshipment is essentially the reverse of the installation procedure. However, the following precautions should be observed during disassembly and shipment.

a. Remove all cables and additional equipment from the pedestal.

b. When removing the antenna and counterbalance assembly, observe the precautions listed in the assembly procedure (elevation axis must by rotated to 90º or 0º before mounting or removing operations).

h. Before shipment, make sure that all pedestal components are properly protected for shipment.

d. Construct wooden skids to protect the assemblies during shipment. Seal any existing openings in the units to keep out dirt, moisture and insects.

SECTION 4 - MAINTENANCE

4.1 General

This section contains maintenance information for the Positioner **AL-4016-1EPRS**. This information includes inspection procedures, cleaning, test procedures, adjustment procedures, lubrication and replacement procedures for defective subassemblies.

GENERAL PRECAUTIONS

Observe the following list of general precautions when installing, operating and maintaining the system.

- **During all assembly operations, apply "anti-seize" grease on all of the stainless steel screws in order to prevent screw "lock-up" and to facilitate easy removal of the screws during future disassembly/assembly operations. Accord the tightening torque value for lubricated bolts.**
- ***Pay attention, the prescribed tightening torque values are for stiff metal to metal joints. Do not use for gasketed joints or joints of soft materials.***

WARNING

It is particularly important to check that the required preload level of the bolts is still maintained while the fasteners are essentially working in fatigue and not in shearing.

ORBIT RECOMMENDS TO RETIGHTENING THE FASTENERS OF THE GEAR-MOTOR UNITS AFTER THE FIRST TWO OR FOUR MONTHS OF UTILIZATION (OR EVERY 1800 WORKING HOURS) AND THEN PROCEED TO A SYSTEMATIC YEARLY CHECK.

CHECK AND RETIGHTEN THE FASTENERS ALSO AFTER EACH SYSTEM FAILURE THAT CAUSES SHOCKS (VIBRATIONS) TO THE POSITIONER DRIVE UNITS.

If any bolt is found loose, a further in deep examination is essential.

Some regulations impose the replacement of the main fasteners every seven years overhaul.

- **When reassembling the various parts of the Positioner, use the same size of screws, together with the correct associated flat and spring washers, as used originally at the same location.**
- ***Install the antenna dish and the counterweights, only when the positioner is rotated at 90 degrees elevation (arms in vertical position, antenna to Zenith).***
- ***If are used swivel hoist rings instead the eyebolts, remove them from the elevation body upper surface, before operating the positioner.***
  Use the swivel hoist rings for installation procedure only!
- **This equipment contains potentially harmful voltage when connected to the designated power source. Never disconnect any cables from the equipment while power is applied to the system!!**
- **Before lubricating the gears with an equivalent type of grease; first, remove all of the old grease.**
- **Periodically, check the smooth operation of Positioner's principal units.**
- **Periodically, check the interior of the Positioner for excessive moisture and/or corrosion, by opening one of the service panels.**
  (Note: It is only necessary to open one service panel in order to observe the interior condition of the Positioner. If more than one service panel is opened, excessive moisture may enter the interior of the Positioner).

WARNING

TO PREVENT INJURY TO MAINTENANCE PERSONNEL OR DAMAGE TO EQUIPMENT, PRIOR TO PERFORMING ANY MAINTENANCE OPERATION, ALWAYS VERIFY THAT NO EXTERNAL VOLTAGE IS SUPPLIED TO POSITIONER AND THAT THE SAFE / OPERATE SWITCH IN THE SAFE POSITION.

IF POWER MUST BE APPLIED FOR TEST PURPOSES, TAKE ALL THE STEPS THAT ARE NECESSARY IN ORDER TO AVOID INJURIES AS A

RESULT OF ELECTRICAL SHOCKS AND MOVEMENT OF MECHANICAL UNITS.

4.1.1 Tools and Applicable Materials

a. Allen wrench inch set and millimetric set.
b. Open-end wrench inch set.
c. Socket driver and ratchet wrench with socket.
d. PHILLIPS screwdriver, sizes #0, #1 and #2.
e. Flat screwdriver, medium-size.
f. Torque handle for Allen wrench.
g. Adjustable wrench, small size (6”).
h. A-N connector pliers.
i. Multi-Meter (voltage / current).
j. Grease gun with flexible hose.
k. MIL-G-23827 or equivalent grease (see para. 4.3.3.1) for bearing lubrication.
l. MOLYKOTE #165 or equivalent (see para. 4.3.3.2) grease for gears lubrication.
m. Flashlight.
n. Conductive silicon O-ring cord, sizes: 1.78mm, 2.62mm and 3.53mm diameter.
o. Screw locking compound, LOCTITE #241 or equivalent.
p. Adhesive compound for silicon gaskets (per MIL-A-46050): LOCTITE PBK or equivalent, for conductive o-ring cords.
r. RTV adhesive sealant (per MIL-A-46146): RTV-3145.
s. Cable ties (Tie-wraps)

4.2 MAINTENANCE POLICY

The AL-4016-1EPRS Positioner is kept in operating condition according to two maintenance categories:

Preventive maintenance

The purpose of preventive maintenance is to keep the AL-4016-1EPRS assemblies and sub assemblies in good and accurate operating condition as well as to reduce wear and corrosion.

Preventive maintenance includes inspections, cleaning and lubrication operations.

Corrective maintenance

The purpose of corrective maintenance is to locate and repair any malfunction or abnormality in the AL-4016-1EPRS operation.

Corrective maintenance includes calibration, alignment and replacement of defective assemblies**.**

4.3 PREVENTIVE MAINTENANCE PROCEDURES

4.3.1 Visual Inspection

The following visual inspection procedures should be performed during the course of maintenance operations:

a. Inspect all wiring for frayed, loose or burned wires.
b. Check cable connections, making sure the plugs are free from corrosion and are properly secured.
c. Check all components (motor, gearbox, slip-ring, rotary joints, encoders, bearings and waveguide components) for evidence of overheating, breakage, vibration, corrosion or loose connections (loose bolts, nuts and screws).

4.3.2 Cleaning

a. Clean the positioner exterior with a low-pressure water hose and mild soap solution. Clean the positioner interior with a damp, clean, lint-free cloth. Wipe the positioner. Dry by using a clean, dry, lint-free cloth. If available, use a vacuum cleaner to remove all accumulated dust from the positioner interior.
b. Use a hand-controlled dry air jet (not more than 1 atm) to blow the dust from inaccessible areas of the positioner. Exercise care to avoid damage by the air blast.
c. Clean electrical connector contacts with a burnishing tool or clean, lint-free cloth lightly moistened with an approved contact cleaner.
d. Clean the receptacles and plugs with a hand-controlled dry-air jet (not higher than 2 atm. pressure) and a clean, lint-free, lightly moistened cloth. Wipe dry with a clean, dry, lint-free cloth.

4.3.3 *Lubrication* (Refer to Figures 8 and 9)

Lubricate the Elevation-over-Azimuth Positioner assemblies according to the following instructions.

4.3.3.1 *Turntable's Bearing Lubrication*

At least twice a year, lubricate the Azimuth and Elevation large (main) bearings by injecting grease through the respective grease fittings. Labels mark locations of the lubrication fittings. To lubricate the bearing raceway, clean lubrication fittings and slowly rotate each positioner axis through its entire travel range. Using a grease gun, inject approximately 2cc of grease at each 30 deg. increment of turntable rotation in the azimuth axis and at each 20-to 25 deg. rotation of the elevation axis. **MIL-G-23827**, or equivalent type of grease: ROYCO 27 (Royal Lubricants Inc.), AEROSHELL 7 (SHELL OIL Co.), ISOFLEX LDS 18 SP. A (KLUBER Co.) , is recommended for lubricating the large ring bearings (raceway system).

For Systems operating with continuous rotation, severe sector scan or under adverse environmental conditions, the azimuth bearing should be lubricated every 90 days.

Slewing ring bearings should always be re-lubricated in the following instances:

- After each cleaning, spraying with water, steam, etc.
- Before and after long stationary periods (i.e., storage periods, etc.)
- If high levels of moisture occur.

The lubrication fitting of the azimuth slewing ring bearings is located on the external periphery surface of the azimuth turntable *(refer to Figure 8)*.
The lubrication fitting of the elevation slewing ring bearings is located on the front surface of the elevation right arm *(refer to Figure 9)*.
The location of the lubrication fitting of the main bearings and recommended grease type are marked with labels.

4.3.3.2 *Main Drive Gears Lubrication*

At least twice a year, through the grease fittings located on the azimuth or elevation housings, lubricate the large ring gear of the azimuth and elevation bearings and the output pinion of the planetary gears, with grease **MOLYKOTE #165LT** (DOW CORNING CORPORATION) or an equivalent type of grease, OKS 495 (OKS Spezialschmierstoffe GmbH-Germany)
Through the grease fitting located on the external periphery of the azimuth housing, lubricate the large ring gear and pinion of the azimuth bearing.
Slowly rotate the positioner (azimuth axis) through the full travel range and using a grease gun, inject approx. 2cc of grease at each 30º increment of the turntable rotation (*refer to Figure 8*).
Repeat the lubrication procedure used to lubricate the azimuth main gear and pinion for the Elevation axis large ring gear and pinion. Through the grease fitting located on the rear side of the elevation body, inject approx. 2cc of grease at each 20º increment of the elevation turntable rotation (*refer to Figure 9*).
The location of the gear lubrication fittings and recommended type of grease are marked with labels.

For systems operating under continuous rotation, severe sector scan or under adverse environmental conditions, the elevation main gear should be lubricated every 90 days.

Re-lubrication is required before and after long stationary periods (i.e., storage periods) or if a high level of moisture occurs.

4.3.3.3 *Gearbox Reducer*

The planetary gearbox is completely sealed and lubricated for life. It does not require any periodic lubrication.

4.3.3.4 *Drive Motors Lubrication*

The DC brush-less motors should be external inspected and cleaned at least once a year.

The motor bearings are permanently lubricated, sealed bearings and not requiring maintenance operations.

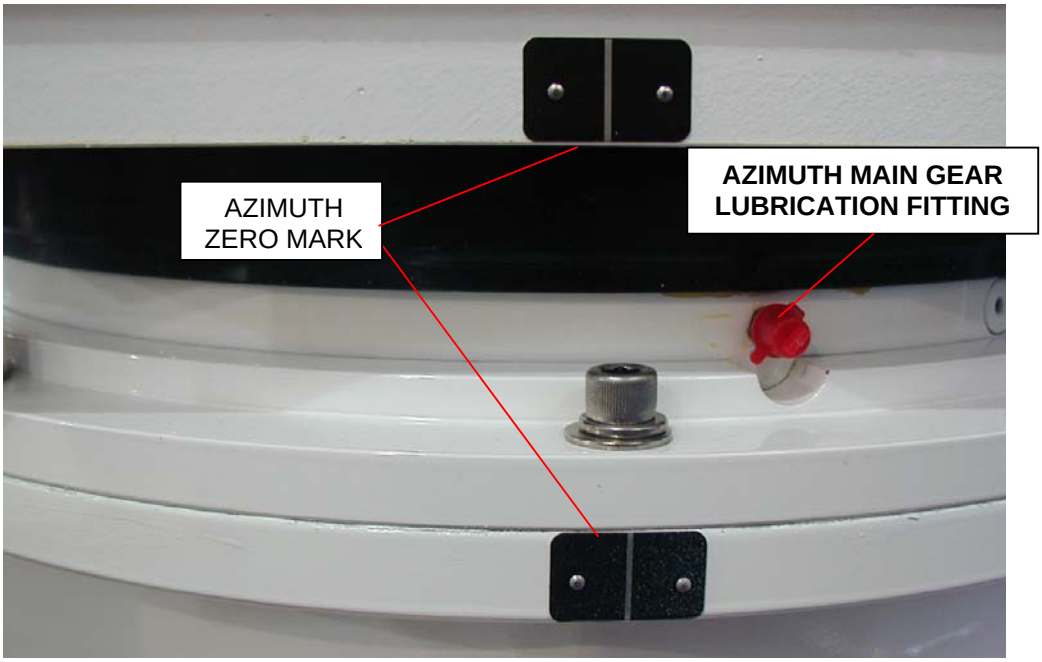


Figure 8: AL-4016-1EPRS Positioner
Location of Azimuth Lubrication Fittings

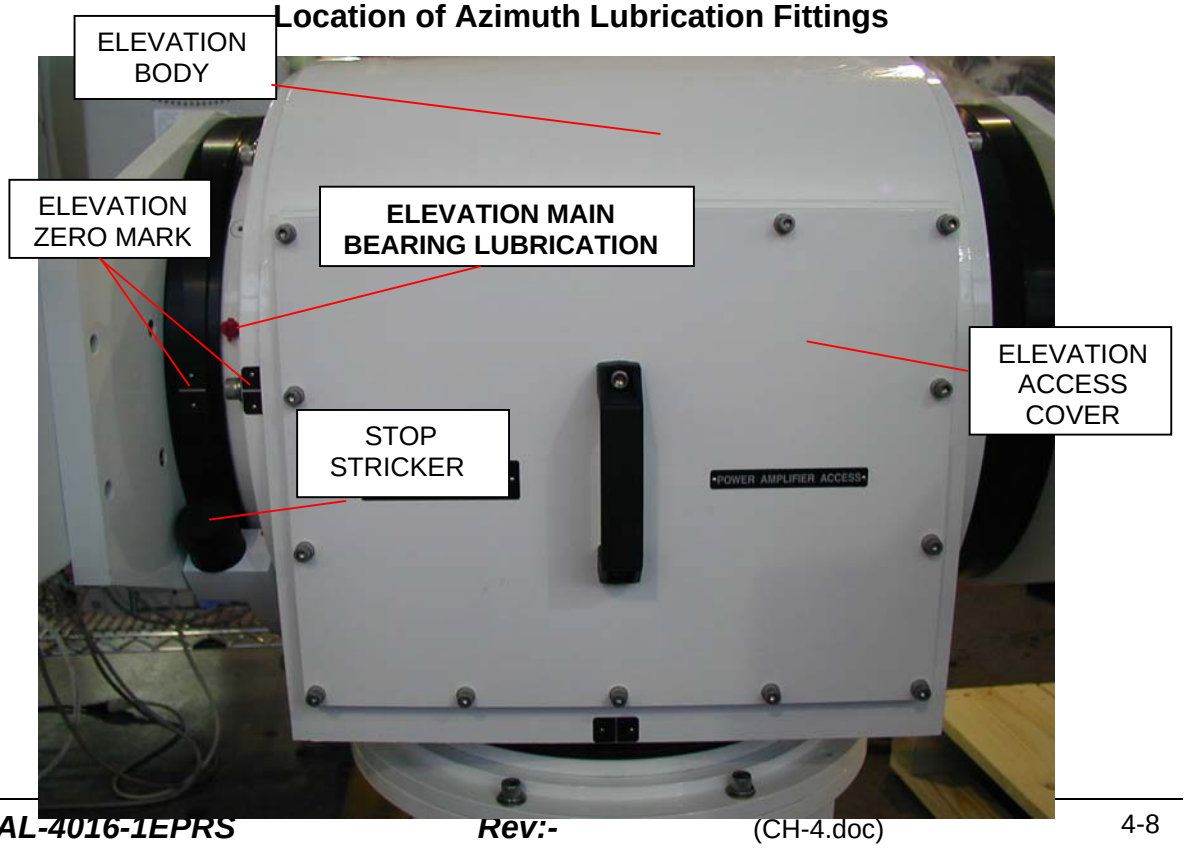


Figure 9: AL-4016-1EPRS Positioner
Location of Elevation Lubrication Fittings

4.4 CORRECTIVE MAINTENANCE PROCEDURES

4.4.1 Adjustment Procedures

The adjustments described in the following paragraphs are initial factory adjustments. Readjustment should be required only if reorientation of either positioner axis is necessary or upon replacement of faulty components.

4.4.1.1 Limit Switch Adjustment Procedure (Refer to Figures 10.a and 10.b)

To adjust the elevation or azimuth axis travel limits, perform the following steps:

a. Using a 5/32" Allen wrench, remove the azimuth or elevation service cover that allows access to the limit switch assemblies.
b. Turn Positioner axis to the desired electrical limit angle (elevation UP or DOWN, azimuth CW or CCW).
c. Set the pedestal to SHUTDOWN Mode.
d. Using a 7/64*"* Allen wrench, release the appropriate limit switch cam fastening screw.
e. Rotate the appropriate switch cam until Positioner operation is inhibited in the desired direction and re-tight the cam screw. Refer to figures 10.a and 10.b to identify the came function.
f. Set the pedestal to SLEW Mode.
g. Turn the Positioner in opposite direction and then return it in the limit direction.
   Verify that the axis movement is stopped at the desired angle (±1°), by turning the axis, at low speed, in the opposite direction and then back to the limit position. Should this not be the case, repeat the adjustment procedure (steps a thru g).

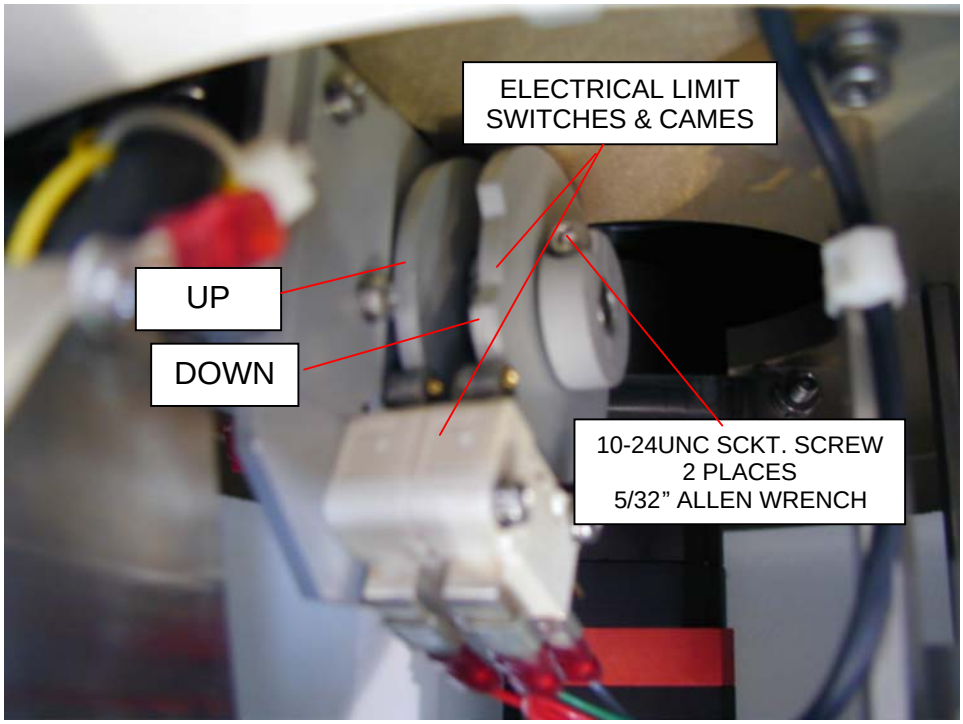


Figure 10.b: Elevation Limit Switch Assembly

4.4.2 Replacement of Positioner Subassemblies

4.4.2.1 General

This section provides instructions for removal and replacement of the Positioner main sub-assemblies.
The positioner is conservatively rated, and frequent replacement of gears, bearings and other internal parts due to normal wear should not be required. For a general overhaul, the equipment should be returned to the factory or special overhaul instructions should be obtained from the manufacturer.

NOTE

Use only ORBIT authorized parts for repair as listed in the Parts List Table (refer to Appendix A).

If positioner parts are damaged by accident or misuse, field repair should be limited to replacement of major sub-assemblies that can be returned to the factory for repair.

This paragraph provides the replacement instructions for the following Subassemblies:

- Limit Switch Assembly
- Digital Servo Amplifier Unit, AL-2005-DSA-01A
- Digital Servo Amplifier Unit, AL-2005-DSA-01B
- DC Brushless Motor Assembly
- Reduction Gearbox Assembly

4.4.2.2 Replacement of Limit Switch Assembly (Refer to Figures 10.a and 10.b)

4.4.2.2.1 Required Tools

Allen wrench, size 5/32**"**.

4.4.2.2.2 Removal of Limit Switch Assembly

Use the following procedure to remove the Limit Switch Assembly, mounted inside the Azimuth or Elevation Units:

a. Using a 5/32**"** Allen wrench, remove the service cover, to gain access to the relevant limit switch assembly.
b. Disconnect wires from the electrical switches.
c. Using a 5/32**"** Allen wrench, remove the two #10 mounting screws fastening the limit switch assembly to the elevation body.
d. Remove the limit switch assembly from the elevation body.

4.4.2.2.3 Installation of Limit Switch Assembly

For new limit switch installation, perform the removal procedure in paragraph 4.4.2.2.2 in a logical reverse sequence.

NOTE

After the installation procedure is completed, the new limit switch must be adjusted according to paragraph 4.4.1.2, above.

4.4.2.3 Replacement of Encoder Assembly

4.4.2.3.1 Required Tools

- Allen wrench, size 7/64” and 5/32”

4.4.2.3.2 Removal of Encoder Assembly

Use the following procedure to remove either the Azimuth or the Elevation Encoder Assembly:

a. Using a 5/32" Allen wrench, remove the 8 screws #10, securing the access cover, marked “ENCODER ACCESS” and the 12 screws #10, securing the azimuth large service cover, located under this cover, on the azimuth base riser.

b. Detach the encoder connector, located on a suitable bracket support.

c. Using a 5/32" Allen wrench, remove the four 10-24 UNC screws fastening the encoder assembly to the azimuth housing and carefully extract the encoder assembly from the base.

NOTE

To remove the elevation encoder assembly, use a 5/32" Allen wrench, remove the elevation central access cover and repeat steps (b) and (c), above.

4.4.2.3.3 Installation of Encoder Assembly.

Use the following procedure to install either the Azimuth or the Elevation Speed Encoder Assembly:

a. Attach the Encoder assembly, including the anti-backlash main gear, to the Azimuth or Elevation body. When insert the anti-backlash main gear of the encoder unit, between the teeth of the bearing internal gear, you must to verify, that the teeth mesh properly and **that the anti-backlash gear springs remain tight after installation**.

b. Using a 5/32" Allen wrench, securely fasten the four 10-24UNC screws securing the Encoder assembly to the Azimuth or Elevation body.

c. Using a Philips screwdriver #1, remove the four #6 screws securing the encoder cover and remove the cover (refer to Figure 11).

d. Attach the connector (MOLEX) to its bracket support.

e. Bring the applicable Positioner's turntable to its zero position.

NOTE

After the installation procedure is completed, the new Encoder Assembly must be adjusted.

f. Replace the access covers on the Azimuth base riser or the central access cover on the elevation body. Check the conditions of the conductive O-Ring gaskets on each service cover and using a 5/32" Allen wrench, fasten securely the captive screws of the access cover.

4.4.2.4 *Replacement of Brushless Motor Assembly*

(Refer to Figures 3.a, 4, 12 and 13)

4.4.2.4.1 *Removal of DC Brushless Motor Assembly*

Use the following procedures to remove the Azimuth and the Elevation Brushless Motor Assemblies:

❖ To remove the Azimuth Brushless Motor Assembly, perform the following steps (Refer to Figures 3.a, 12 and 13):

a. Using Allen wrench, release the captive screws securing the azimuth access covers of the base extension and carefully remove the covers.

b. Detach the two azimuth motor connectors (MOLEX).

CAUTION

To avoid injury and damage to the Positioner units, be careful when removing the azimuth gearbox-motor assembly from the base extension, since this assembly is heavy!

c. Using Allen Wrench and an open-end wrench, release the two socket set screws and nuts (backlash adjusters), securing the azimuth gearbox.

d. Using Allen Wrench, remove the four socket-head screws securing the azimuth gearbox-motor support to the azimuth housing.

e. Carefully, remove the azimuth gearbox-motor assembly from the azimuth base extension.

f. Using Allen wrench, remove the threaded plug from the gearbox rear housing, in order to access the "pinion-locking" screw (refer to figure 13).

g. Rotate the pinion until the head of the "pinion-locking" screw is aligned with the pinion screw access hole (use a flashlight to see better). In order to rotate the pinion, first of all, the brake should be released. Use an external source of 24 VDC and connect two wires

between the source and the MOLEX 6 pins of the motor. The plus (+) lead to pin #5 (gray) and the minus (-) lead to pin #6 (violet)

h. Insert a 3mm Allen wrench through the pinion screw access hole into the head of the "pinion-locking" screw and release the screw. This screw should be loose, do not remove it!

NOTE

The 3 mm Allen wrench should stay inserted in the "pinion-locking" screw, to ensure that the pinion remains in proper alignment during the motor installation procedure.

i. Using a 4mm Allen wrench, remove the four M6 socket-head screws attaching the motor assembly to the gearbox assembly.

j. Carefully, extract the motor shaft from the gearbox input pinion and detach the motor assembly.

❖ To remove the Elevation Brushless Motor Assembly, perform the following steps (Refer to Figures 2.b, 4, 5, 12 and 13):

a. Using Allen wrench, remove the captive screws securing the central access cover to the elevation body and carefully remove the cover.

b. Detach the two azimuth motor connectors (MOLEX).

c. Using Allen Wrench, remove the four socket head screws, securing the removable gear-tightening screws support plate and extract the plate from the body.

d. Using Allen wrench, release and remove the four socket-head screws securing the elevation gearbox-motor support housing to the elevation body and carefully remove the gearbox-motor assembly from the elevation body.

e. To detach the reduction gearbox assembly from the motor assembly, repeat steps (f) thru (j), paragraph 4.4.2.4.1 above.

4.4.2.4.2 Installation of DC Brushless Motor Assembly (Refer to fig. 2.b, 13 and 14)

Use the following procedure to install either the Azimuth or the Elevation DC Brushless Motor Assembly:

a. Since the removing procedure, the 3 mm Allen wrench was kept inserted through the access hole, into the head of the "Pinion-Locking" screw. Verify that the screw is not tightened.

b. To facilitate the gearbox mounting process, the gearbox unit should be positioned vertically with the input shaft pointing in the upward direction.

c. Insert the motor shaft into the gearbox input clamp-on pinion. Align the motor flange mounting holes with the mounting threads on the gearbox rear housing and, using the 4mm Allen wrench, fasten the four M6 socket-head cap screws and lock washers securing the motor to the gearbox.

d. Using the torque handle and inserted 3mm Allen wrench, fasten the "pinion-locking", clamp-on screw to a final torque rating of 4.5 ±0.3 Nm.

e. Remove the 3mm Allen wrench from the pinion screw access hole in the gearbox housing.

f. Insert the threaded plug in the pinion screw access hole in the gearbox housing and, using a #3/16" Allen wrench, securely tighten the plug.

CAUTION

To avoid injury and damage to the Positioner units, be careful when lifting and mounting the gearbox-motor assembly to the azimuth / elevation housing.

g. Replace the gearbox-motor assembly on its azimuth / elevation body and check the backlash (not more than 0.05º). Using a torque handle and Allen wrench, tighten the four Allen screws securing the gearbox-motor assembly to the azimuth / elevation body (torque rating value - 25 lb.ft / 34 Nm).

h. Re-tightening the two socket set screws and nuts (backlash adjusters) securing the azimuth gearbox or, replace the removable gear-tightening screws support plate on the elevation body and fasten the four socket head screws securing the plate.

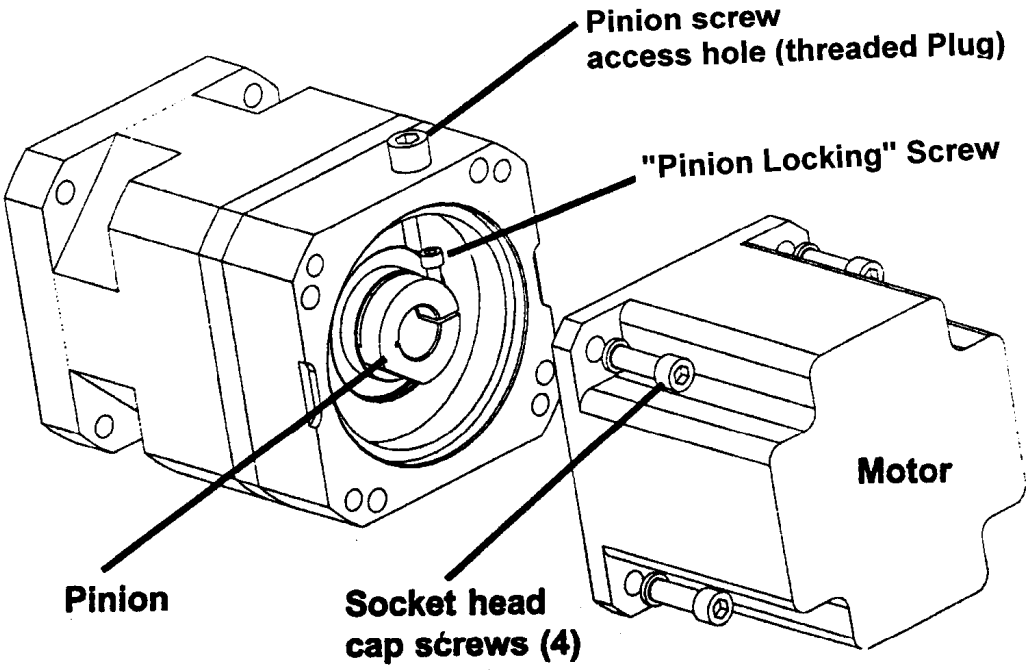
i. Attach the two motor connectors (MOLEX).

j. Rotate the azimuth / elevation axis and verify that the backlash does not exceed the value specified in Para. 1.2.1 (max. 0.05º).

k. Carefully, replace the two service covers on the azimuth base extension, or the central access cover on the elevation body.

l. Check the condition of the access cover O-Ring gaskets and, using a 5/32" Allen wrench, securely fasten the applicable access cover mounting screws.

Figure 12: Gearbox-Motor Assembly



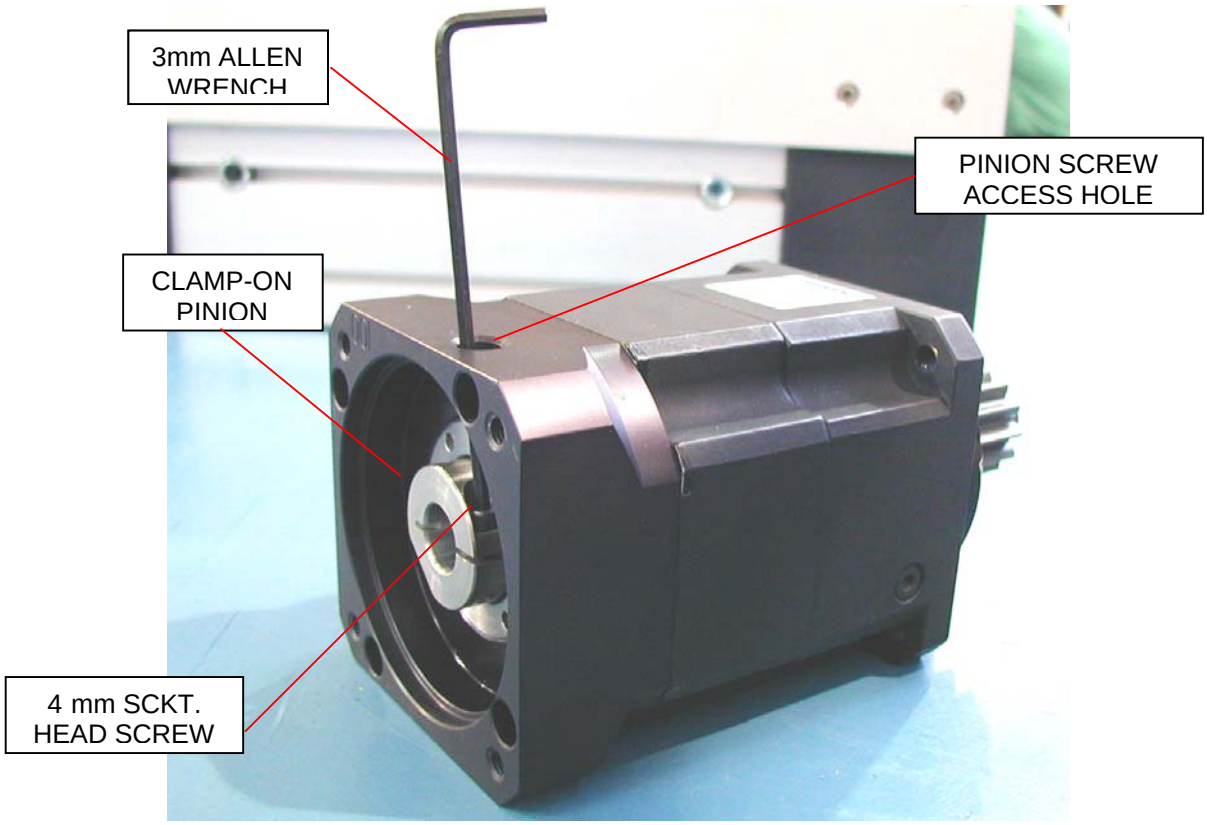


Figure 13: "SERVOMOUNT" Gearbox to Motor Mounting System

4.4.2.5 *Replacement of Reduction Gearbox Assembly* *(Refer to Figures* 2.b, 3.a, 4, 5, 12 and 13*)*

4.4.2.5.1 *Removal of Reduction Gearbox Assembly*

Use the following procedures to remove the Azimuth and the Elevation Reduction Gearbox Assemblies:

❖ To remove the Azimuth Reduction Gearbox Assembly, perform the following steps (refer to figures 3.a, 12 and 13):

a. To remove the azimuth gear-motor assembly from the upper base extension, perform the "Removal of Azimuth DC Brushless Motor Assembly" procedure, Para. 4.4.2.4.2, steps (a) thru (e).

b. To detach the motor assembly from the reduction gearbox assembly, perform the "Removal of Azimuth DC Brushless Motor Assembly" procedure, Para. 4.4.2.4.2, steps (f) thru (j).

c. To remove the gear-motor support housing from the reduction gearbox, use Allen wrench to remove the four socket-head screws and carefully remove the housing.

❖ To remove the Elevation Reduction Gearbox Assembly, perform the following steps:

a. To remove the elevation gear-motor assembly from the upper base extension, perform the "Removal of Elevation DC Brushless Motor Assembly" procedure, Para. 4.4.2.4.2, steps (a) thru (e).

b. To detach the motor assembly from the reduction gearbox assembly, perform the "Removal of Azimuth DC Brushless Motor Assembly" procedure, Para. 4.4.2.5.2, steps (f) thru (j).

c. To remove the gear-motor support housing from the reduction gearbox, use Allen wrench to remove the four socket-head cap screws, securing the housing to the gearbox.

4.4.2.5.3 *Installation of Reduction Gearbox Assembly*

Use the following procedure to install either the Azimuth or the Elevation Reduction Gearbox Assembly:

NOTE:

The Reduction Gearbox and Motor are attached together and installed as one unit.

a. To attach the Motor Assembly to the Reduction Gearbox assembly, perform the "Installation of DC Brushless Motor Assembly" procedure, Para. 4.4.2.4.3, steps (a) thru (i).

b. Attach the gear-motor support housing to the reduction gearbox and use Allen wrench to fasten the four socket head screws.

c. Replace the gearbox-motor assembly on its azimuth / elevation body and check the backlash (not more than 0.05º). Using a torque handle and Allen wrench, tighten the four Allen screws securing the gearbox-motor assembly to the azimuth / elevation body (torque rating value - 25 lb.ft / 34 Nm).

d. Attach the two motor connectors.

e. Rotate the azimuth / elevation axis and verify that the backlash does not exceed the value specified in Para. 1.2.1 (max. 0.05º).

f. Carefully, replace the two access covers on the azimuth upper base extension, or the central access cover on the elevation body.

g. Check the condition of the access cover O-Ring gaskets and, using Allen wrench, securely fasten the applicable access cover(s) mounting screws.

4.4.2.6 Replacement of Azimuth Digital Servo Amplifier Unit AL-2005-DSA-01 (refer to Figure. 2.b)

The positioner power supply unit and the azmuth servo amplifier unit are installed inside the base extension, on a common access cover (suitable marked with “power amplifier access” and “power supply access”).

4.4.2.6.1 Required Tool

a. Allen Wrench, sizes: 5/32” and 3/16”
b. Flat screwdriver, small size

4.4.2.67.2 Removal of Positioner Power Supply or Azimuth Servo Amplifier Unit

Use the following procedure to remove the power supply or azimuth servo amplifier unit:

a. Using Allen wrench, remove the base access cover (refer to the marking labels for “power supply access” and “power amplifier access”) to gain access to the power supply or to the azimuth servo amplifier unit.

b. By means of a small flat screwdriver, detach the relevant connectors.

c. Using Allen wrench, remove the four socket-head screws securing the power supply and power ampliifer unit to the support plate.

4.4.2.6.3 *Installation of Power Supply or Servo Amplifier Unit*

For a new power supply or servo amplifier unit installation, perform the removal procedure detailed in paragraph 4.4.2.6.2 in a logical reverse sequence and verify that all wiring is properly routed and securely attached.

4.4.2.7 *Replacement of Elevation Servo Amplifier Unit, AL-2005-DSA-01*
(Refer to Figures 4 and 5)

4.4.2.7.1 *Required Tool*
Allen wrench, sizes: 5/32” and 3/16”

4.4.2.7.2 *Removal of Elevation Servo Amplifier Unit*

Use the following procedure to remove the Elevation Power Amplifier Unit:

a. Using a 5/32" Allen wrench, remove the Elevation access cover (Refer to marking label for “power amplifier access”) to gain access to the Elevation Servo Amplifier.

b. Detach the servo amplifier connectors using a small flat screwdriver.

c. Using a 3/16" Allen wrench, remove the four #1/4" mounting screws securing the servo amplifier to the Elevation body inner structure.

4.4.2.7.3 *Installation of Elevation Servo Amplifier Unit*

For installation of a new Elevation servo amplifier unit, perform the removal procedure in paragraph 4.4.2.7.2 in a logical reverse sequence.

SECTION 5 - STORAGE AND PREPARATION FOR USE

5.1 Storage

Storage conditions

Store the positioner in a closed place, and cover it with a tarpaulin to protect it from dust, rain and humidity.

Protect all protruding parts (connectors, switches) against damages.

At least twice a year, rotate each axis of the positioner for approx. 5 minutes in each direction.

NOTE

For transport or storage in the field, it is recommended to cover the Positioner (e.g., with a tarpaulin) in order to protect it from harsh environmental conditions.

5.2 Preparation for Use

Before using the positioner after a long storage period, re-lubricate the gears and bearings according to the instructions in paragraph 4.3.3.

SECTION 6 - CORROSION PROTECTION

6.1 General

ORBIT 's positioners are protected from corrosion, while operating in harsh environments, by the following four step protective finish process that is standard on all ORBIT positioner products:

1. All parts are pre-conditioned to remove mill scale, grease and oil from all machined surfaces.
2. All stainless-steel parts are passivated per QQ-P-35, all steel parts are zinc plated, 7 to 13 microns thickness, per ASTM-B-633, and all aluminum parts are chem-filmed per MIL-C-5541 or anodized per MIL-A-8625.
3. A coat of epoxy primer, which meets the requirements of MIL-P-53022, is applied to all parts.
4. The final step in the protective finish process is to apply a polyurethane weather-resistant topcoat per MIL-C-85285, white gloss color #17925 per FED-STD-595, to all parts. This paint has excellent resistance to sunlight and salt fog.

ORBIT utilizes corrosion resistant, stainless steel or plated alloy steel hardware throughout its assemblies. All access panels are sealed using RFI / EMI conductive silicone gaskets (o-rings), which ensure protection for interior pedestal units.

ORBIT includes "DESI-PACK" CLAY DESICCANT inside the base-extension and the elevation body, which protects the Positioner against corrosion caused by damp environmental conditions. DESI-PACK unit bags exceed the requirements of MIL-D-3464E, Types 1 and 2, and are an efficient desiccant with a high degree of moisture vapor absorption.

The access covers should not be removed unnecessarily. They should be removed only when maintenance and internal adjustments are required. Periodically, check the inside of the Positioner for excessive moisture or corrosion, by opening only one service panel. If the access covers are removed often, the DESI-PACK bags should be replaced or reactivated. Reactivation time per bag is 16 hours at 120°C (250°F).

NOTE

When the Positioner is non-operational, in storage or being transported, cover the Positioner with a tarpaulin in order to protect it from moisture and corrosion.

APPENDIX A

PARTS LIST

PARTS LIST

GENERAL

The various parts used in the AL-4016-1EPRS Positioner are listed in the following parts list table. The purpose of this parts list is for identification, requisition, and issuance of spare or replacement parts.

For part replacement, use only part numbers specified in this parts list.

The parts list table is divided into five columns which are described in the following paragraphs.

ITEM NUMBER (ITEM)
The first column in the parts list table contains the item numbers, assigned in numerical sequence.

DESCRIPTION
The second column contains brief descriptive information of each part.

PART NUMBER
The third column lists manufacturer's part numbers.

MANUFACTURER (MFR.)
The fourth column lists manufacturer's names and locations.

QUANTITY (QTY)
The fifth column lists quantity of each item used in the Positioner.

ORDERING INFORMATION FOR PARTS
When ordering spare or replacement parts, state the full description of part, part number, manufacturer's full name and location, and the desired quantity.

AL-4016-1EPRS REPLACEMENT PARTS LIST
(AZIMUTH AND ELEVATION)

ITEM	DESCRIPTION	PART NUMBER	MFR.	QUANTITY	
				AZIMUTH	ELEVATION
1	REDUCTION GEAR	25-0840	ORBIT *(ISRAEL)*	1	1
2	DC BRUSHLESS MOTOR	AKM23FCKM22-00	Kollmorgen (USA)	1	1
3	SLEWING RING BEARING	04-2233	ORBIT *(ISRAEL)*	1	1
4	ENCODER ASSEMBLY	25-0855	ORBIT *(ISRAEL)*	1	1
5	LIMIT SWITCH ASSEMBLY	03-0863-20-01	ORBIT *(ISRAEL)*	-	1
6	SUPPORT BERING	61824-2RS1	KAYDON *(USA)*	--	1
7	V-RING ∅ 125 - VITON	TWVL-01300	BUSAK *(GERMANY)*	1	2
8	CIRCUIT BREAKER	AP1-1-65F-602	AIRPAX *(USA)*	1	--
9	SAFE / OPERATE SWITCH	MS35059-22	Q.P.L.	1	–
10	DIGITAL SERVO AMPLIFIER	AL--2005-DSA-01 OPT 1A (AZ) AL-2005-DSA-01 OPT 1B (EL)	ORBIT *(ISRAEL)*	1	1
11	"DESI-PAK" CLAY DESICCANT BAGS	71036020	UNITED DESICCANTS/ HUMIDIAL *(USA)*	1	1

APPENDIX B

DRAWINGS

LIST OF DRAWINGS

No.	Drawing No.	Title
1.	DCD27-1500	INTERFACE CONTROL DRAWING (I.C.D.) AL-4016-1EPRS, ELEVATION OVER AZIMUTH TRACKING ANTENNA POSITIONER
2.	27-1641-9-1	WIRING DIAGRAM, AL-4016-1EPRS

APPENDIX C

ELECTRICAL INTERFACE

FOR

AL-4016-1EPRS

PEDESTAL PANEL CONNECTOR INTERFACE

AC POWER TO PEDESTAL - J1

UNIT:	PEDESTAL	**PIN TYPE:**	Crimped
UNIT DESIGN. :	J1		
MNEMONIC:	AC IN	**MATING CON. :**	**D38999/26WC04SN**
CONNECTOR:	**D38999/24WC04PN**	**SIGNAL TYPES:**	115VAC 50/60Hz

PIN	FUNCTION	MNEMONIC	DIR.	TYPE	DESTINATION	REMARK
B	PHASE 230VAC	PHASE	IN	Power		AWG 16
D	GND	GND				AWG 16
A	NEUTRAL	NEUTRAL	IN	Power		AWG 16
	Outer shield	SHIELD				

COMMUNICATION FROM/TO HOST – J2

UNIT:	PEDESTAL	**PIN TYPE:**	Crimped
UNIT DESIGN:	J2	**SPARE PINS:**	
MNEMONIC:	HOST	**MATING CON:**	D38999/26WD19PN
CONNECTOR:	D38999/24WD19SN	**SIGNAL TYPES:**	RS-422 ,VDC

PIN	FUNCTION	MNEMONIC	DIR.	TYPE	LEVEL	REMARK
A.	TXD+		OUT	RS-422		FOUR SHIELDED TWISTED CABLE
B.	TXD-		OUT	RS-422		
C.	RXD+		IN	RS-422		
D.	RXD-		IN	RS-422		
E	**24VDC**	LCU(OPT)	OUT	DC		DC(+)
F	GND	LCU(OPT)	OUT	DC		DC(-)
L	**+24VDC**	AZ BRAKE RELEASE	IN	DC		DC(+)
M	**GND**	AZ BRAKE RELEASE	IN	DC		DC(-)
V	SHIELD	GND		CGND	0	Note 2

SERVICE/MAINT. – J2

UNIT:	PEDESTAL	**PIN TYPE:**	Crimped
UNIT DESIGN:	J2	**SPARE PINS:**	
MNEMONIC:	HOST	**MATING CON:**	D38999/26WD19PN
CONNECTOR:	D38999/24WD19SN	**SIGNAL TYPES:**	RS-422 ,VDC

PIN	FUNCTION	MNEMONIC	DIR.	TYPE	LEVEL	REMARK
A.	TXD+		OUT	RS-422		FOUR SHIELDED TWISTED CABLE
B.	TXD-		OUT	RS-422		
C.	RXD+		IN	RS-422		
D.	RXD-		IN	RS-422		
E	**24VDC**	LCU(OPT)	OUT	DC		DC(+)
F	GND	LCU(OPT)	OUT	DC		DC(-)
L	**+24VDC**	EL BRAKE RELEASE	IN	DC		DC(+)
M	**GND**	EL BRAKE RELEASE	IN	DC		DC(-)
V	SHIELD	GND		CGND	0	Note 2