

# 2006 Precision Azimuth Positioner

## User Manual





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## NOTES, CAUTIONS AND WARNINGS

	<p><b>Note:</b> Denotes helpful information intended to provide tips for better use of the product.</p>
<div style="border: 2px solid black; padding: 5px; text-align: center;"><b>CAUTION</b></div>	<p><b>Caution:</b> Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.</p>
<div style="border: 2px solid black; padding: 5px; text-align: center;"><b>WARNING</b></div>	<p><b>Warning:</b> Denotes a hazard. Failure to follow instructions could result in <b>SEVERE</b> personal injury and/or property damage. Included text gives proper procedures.</p>





## SAFETY INFORMATION

	<p><b>Refer to Manual:</b> When product is marked with this symbol, see the instruction manual for additional information. If the instruction manual has been misplaced, download it from <a href="http://ets-lindgren.com">ets-lindgren.com</a>, or contact ETS-Lindgren Customer Service.</p>
	<p><b>High Voltage:</b> Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.</p>
	<p><b>High Voltage:</b> Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.</p>
	<p><b>Protective Earth Ground (Safety Ground):</b> Indicates protective earth terminal. You should provide uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord, or supplied power cord set.</p>



See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

## GENERAL SAFETY CONSIDERATIONS

	<p>Before power is applied to this instrument, ground it properly through the protective conductor of the AC power cable to a power source provided with the protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal could result in personal injury.</p>
 	<p>Before servicing: contact ETS-Lindgren – servicing (or modifying) the unit by yourself may void your warranty. If you attempt to service the unit by yourself, disconnect all electrical power before starting. There are voltages at many points in the instrument which could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. Capacitors inside this instrument may still be CHARGED even when instrument is disconnected from its power source.</p>
	<p>Only qualified personnel should operate (or service) this equipment.</p>



# INTRODUCTION

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ETS-Lindgren's 2006 Precision Azimuth Positioner is designed to perform two-dimensional measurements (or manual three-dimensional measurements) of spherical antenna patterns. The positioner includes a vertical support column that will accommodate EUTs up to 25 kg (55 lb).

The height of the vertical support column is 87.6 cm (34.5 in). Custom heights are available. Contact ETS-Lindgren to request a custom height. In order to minimize any potential RF obstruction or distortion of RF signals from low directive wireless transmit antennas, the positioner vertical support column is constructed of low dielectric materials.

The positioner is equipped with one motor, 208/220 VAC 50 or 60 Hz single phase. An IEC receptacle is the standard power input. Current draw is fused at 6.3 A maximum. The motor drive, in conjunction with the provided command set, controls the movement of the unit. Optional EMQuest™ EMQ-1xx drivers are available with the purchase of EMQuest software. 10 M (32.8 ft) fiber-optic cable provided.

The optional RS-232 shield room filter includes integrated D sub-miniature connectors. The LMF-3995 RFI/EMI filter is a device used in a wide variety of applications mainly as a means of protecting other equipment from unwanted RFI and EMI. The filter may not protect against voltage transients and current short circuits. Access to terminals for the filter can only be accomplished by the removal of input and output covers. The covers are secured with screws. The filter is provided with male (output) and female (input) DB-9 connectors.

## Standard Configuration

- 125460 Model 2006 Turntable Assembly
- 126228 Expanded Polystyrene Column, Height 87.6 cm (34.5 in)
- SMA RF Rotary Joint for Continuous Rotation, Rated at 26.5 GHz
- 708043 Ethernet to Fiber Converter
- 705641-10 10 M (32.8 ft) Fiber-Optic Cable
- SYS100230 3 M (10 ft) Ethernet Cable
- Slip Ring for EUT power 115/230 VAC, 10 A and for USB 2.0 Data/Control Interface
- 2 Year Warranty
- 399410 User Manual

## Optional Items

- EMQuest EMQ-100 Antenna Measurement Software (Standard Version)
- EMQuest EMQ-100 Lite Antenna Pattern Measurement Software
- Additional EUT Columns, Custom Heights
- Custom EUT Mounts on Top of the EUT Support Column

## ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment

- Steps to return a component for service
- ETS-Lindgren calibration service
- ETS-Lindgren contact information

## MAINTENANCE

### CAUTION

Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

### CAUTION

Disconnect the power before proceeding with recommended maintenance. Do not perform maintenance while the positioner is operating.



Warranty may be void if the housing is opened.

If you have any questions concerning maintenance, contact ETS-Lindgren Customer Service.

## Positioner Maintenance Recommendations

### Annual Calibration

See the *Product Information Bulletin* included with your shipment for information on ETS-Lindgren calibration services.

### Periodic Maintenance

Check cables for wear. Ensure they are clear of potential damage from moving parts.

### Replacement and Optional Parts

Following are the part numbers for ordering replacement or optional parts for the 2006 Precision Azimuth Positioner.

Possible Replacement Parts	
Part Description	Part Number
Fiber-Optic Cable	705641-10
Rotary Joint	890817
Support Column, 87.6 cm (34.5 in) (Contact ETS-Lindgren to request a custom height.)	126228
Tabletop Absorber	126260
Housing Absorber	126259
Gears	126229
Adapter, Speag Head, 2006 Column	126278
Leveling Feet	891344
User Manual	399410

## Service Procedures

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

## Safety Precautions

- Removing top panel will expose AC power
- Do not use damaged or crimped AC power cords

## PRE-INSTALLATION TASKS

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### CAUTION

Before installing any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

### CAUTION

Ensure power is off and base is secured before proceeding with installation.

Pre-planning is essential for successful installation. Discuss requirements with your sales representative and request dimensional drawings prior to construction of your site.

## Tools Required

- Flat-head screws for floor flange (not included)
- #2 Phillips screwdriver

## ASSEMBLY AND INSTALLATION

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### CAUTION

Before installing any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

## Positioner Installation

Proper installation of the 2006 Precision Azimuth Positioner unit directly affects performance of the positioning system as well as the accuracy of the test results.

1. Uncrate all parts. Check all parts for any shipping damage. Ensure a clear area is available to assemble the positioner unit safely.



Do not discard packing material until the Turntable is fully assembled and correct operation is verified.

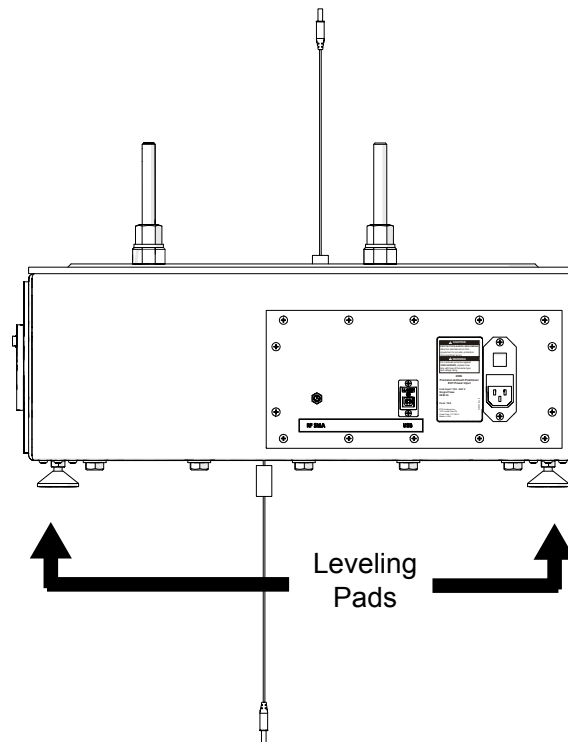
The 2006 Precision Azimuth Positioner consists of:

- Variable speed turntable
- Lossy foam absorber to cover the top of the turntable and enclosure
- Vertical column



Customer provides RF and USB cabling to the top of the unit and to the EUT.

2. The center of rotation for the unit must intersect the line through the bore sight of the measurement antenna. It is recommended that a 5-beam laser level be utilized to verify the alignment and location.
3. Position the unit so that the connections on the positioner are easily accessible and located closest to available feed through panels and power supply connections. Verify that the supplied serial cable, as well as any user-supplied RF cable(s), is long enough to reach from the unit to the feed through panel that will include the RS232 filter before settling on an orientation.
4. Ensure that any power supply feed or other conduits or connector panels installed on the floor near the unit are located outside the perimeter of the unit motor base. When working around the table, avoid stepping on any cables or their connectors. The cables will be installed in a later step.



5. Use a marker, with the unit in the desired position, to mark around the perimeter of the table base. These marks will be used for reference if the assembly moves.
6. Once the position of the unit has been determined, the table must be leveled. Using a leveling instrument (torpedo laser level or some other device) level the unit by turning the level mount pads on the bottom of the motor base. When the positioner is level, tighten all lock nuts on the leveling pads to lock the height of the unit into place.
7. Next, place the center circular absorber piece over the support pegs.
8. Finally, place the remaining two absorber pieces on the outer portion of the motor base.
9. Install the vertical support column onto the motor drive mount by placing it over the column supports on top of the motor base.
10. Using gauge 126183, rotate the unit under power and indicate the gauge until it runs true. This can be adjusted using the lock-nuts and column supports which are threaded. There are located at the base of the column.

11. Finally, floor absorber (ordered separately) may be placed around the motor base to prevent RF interference from the positioner itself.

## Electrical Installation

### CAUTION

Electrical connection should only be performed by a qualified electrician and subject to location electrical codes.

The 2006 Precision Azimuth Positioner is designed to operate using 208/230 VAC single phase 50 or 60 Hz power. The branch circuit supplying power to the motor base must be protected from excess current according to local electrical codes. ETS-Lindgren has provided integral circuit protection in the motor base assembly.

Check that the conductor size is adequate for the motor load and the distance from the mains source is appropriate. Improperly sized conductors will lead to a high voltage drop in the power conductors and cause reduced starting torque and premature motor failure.

### CAUTION

Prior to servicing the turntable, remove the power connection.

## OPERATION

### CAUTION

Before operating any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

## 2006 Precision Azimuth Positioner Command Set

### System Commands

Device Identification Query	
<b>Command:</b>	*IDN?
<b>Description:</b>	Identification query. Determines the nature of device located at a given address on the network. The string returned ("ETS-Lindgren Inc.,2006 Precision Azimuth Positioner,<Module Name>,PCA120518 FW N.NN") identifies this device as a 2006 Precision Azimuth Positioner. The <Module Name> parameter is a place holder to identify a specific module. The N.NN parameter is a place holder for the firmware version identification.
<b>Query:</b>	*IDN?
<b>Returns:</b>	ETS-Lindgren Inc.,2006 Precision Azimuth Positioner,<Module Name>,PCA120518 FW n.nn
<b>Example:</b>	*IDN? ETS-Lindgren Inc.,2006 Precision Azimuth Positioner,Comm,PCA120518 FW 4.14

Module IP Address	
<b>Command:</b>	MOD:IP <nnn.nnn.nnn.nnn>
<b>Description:</b>	The device default IP address and subnet mask is 192.168.0.100, 255.255.255.0. The default address and subnet mask are assigned to the device by ETS-Lindgren and do not change even if your computer reboots. The IP address can be changed using the MOD:IP command. The new address will not change even if your computer reboots. The port number is 1206.
<b>Query:</b>	MOD:IP?
<b>Returns:</b>	nnn.nnn.nnn.nnn
<b>Example:</b>	MOD:IP 192.168.0.55

Module Name	
<b>Command:</b>	MOD:NAME <Module Name>
<b>Description:</b>	The <Module Name> parameter in the *IDN? query response is a place holder to identify a specific device in a network. If you have more than one device you might want to identify them with different module names. For instance, "EMC LAB1" and "EMC CHAMBER".
<b>Query:</b>	MOD:NAME?
<b>Example:</b>	MOD:NAME EMC LAB1

Module Subnet Mask	
<b>Command:</b>	MOD:NETMASK <nnn.nnn.nnn.nnn>
<b>Description:</b>	The device default IP address and subnet mask is 192.168.0.100, 255.255.255.0. This address and mask are assigned to the device by ETS-Lindgren and does not change even if your computer reboots. The subnet mask can be changed using the MOD:NETMASK command. The new subnet mask will not change even if your computer reboots.
<b>Query:</b>	MOD:NETMASK?
<b>Returns:</b>	nnn.nnn.nnn.nnn
<b>Example:</b>	MOD:NETMASK 255.255.0.0

## Control Commands

Acceleration in Milliseconds	
<b>Command:</b>	A <nnnn>
<b>Description:</b>	This is the acceleration setting for variable speed devices. The number nnnn represents the time in milliseconds for the positioner to reach max speed. For high inertial loads a longer acceleration time might be required.
<b>Query:</b>	A?
<b>Returns:</b>	The time in milliseconds for the positioner to reach max speed.
<b>Example:</b>	A 3000

Acceleration in Seconds	
<b>Command:</b>	ACC nn.n
<b>Description:</b>	This is the acceleration setting for variable speed devices. The number N.N represents the time in seconds for the positioner to reach max speed. For high inertial loads a longer acceleration time might be required.
<b>Query:</b>	ACC?
<b>Returns:</b>	The time in seconds for the positioner to reach max speed.
<b>Example:</b>	ACC 3.0

Continuous Rotation Mode	
<b>Command:</b>	CR
<b>Description:</b>	Set the positioner in continuous rotation mode. In the continuous mode of operation the positioner is allowed infinite movement. The turntable travels from 0 – 359.9 and the limits are ignored. Also, in continuous rotation mode, the device will seek the target value by the shortest possible path. Thus, a seek from 350.0 to 10.0 will rotate clockwise, not counterclockwise.
<b>Query:</b>	CR?
<b>Returns:</b>	1 when in continuous rotation mode, 0 otherwise
<b>Example:</b>	CR

Homing Procedure	
<b>Command:</b>	HOME
<b>Description:</b>	<p>The device has a mechanical home sensor. Every time the positioner is turned on, a home procedure must be performed so the current position is known by the firmware.</p> <p>To home the positioner, send the following commands:</p> <p>HOME *OPC?</p> <p>Keep querying the positioner by sending the *OPC? until it returns 1. *OPC? Will return 0 if the turntable is still being homed. *OPC? will return 1 if the home procedure is done.</p> <p>After *OPC returns 1, send the query HOME? to confirm that the positioner found the mechanical home sensor. HOME? returns 0 if the home procedure was not successful; the reason could be a faulty sensor.</p>
<b>Query:</b>	HOME?
<b>Returns:</b>	1 if the positioner has been homed, 0 otherwise

Lower Limit	
<b>Command:</b>	LL nnn.n
<b>Description:</b>	Sets the lower/counterclockwise limit of the device. The specified value nnn.n must be less than the upper/clockwise limit.
<b>Query:</b>	LL?
<b>Returns:</b>	Lower or counterclockwise limit of the device in degrees.
<b>Example:</b>	LL 0.0

Motion Direction	
<b>Command:</b>	DIR?
<b>Description:</b>	Queries the motion direction for the device.
<b>Query:</b>	DIR?
<b>Returns:</b>	<direction> Value indicating the current motion of the queried device. +1            Device is moving up/clockwise. 0             Device is stopped. -1            Device is moving down/counterclockwise

Move Clockwise	
<b>Command:</b>	CW
<b>Description:</b>	Instructs the positioner to move in the clockwise direction. In non-continuous mode this movement is limited by the clockwise (upper) limit.
<b>Example:</b>	CW

Move Counterclockwise	
<b>Command:</b>	CCW
<b>Description:</b>	Instructs the positioner to move in the counterclockwise direction. This movement is limited by the counterclockwise (lower) limit.
<b>Example:</b>	CCW

Non-Continuous Rotation Mode	
<b>Command:</b>	NCR
<b>Description:</b>	Set the positioner in non-continuous rotation mode. In the non-continuous mode the positioner motion is restricted between the upper and lower limits. A seek from 350.0 to 10.0 will rotate Counterclockwise.
<b>Example:</b>	NCR

Scan	
<b>Command:</b>	SCAN
<b>Description:</b>	Instructs the positioner to begin scanning between preset lower and upper limits.
<b>Example:</b>	SCAN

Seek Negative	
<b>Command:</b>	SKN <nnn.n>
<b>Description:</b>	Instructs the device to begin seeking the specified target value in the negative (down/counterclockwise) direction only. This command is provided primarily to support continuous rotation mode. It allows forcing seeking a position from a particular direction. Thus, a SKN from 180.0 to 181.0 will rotate counterclockwise to reach the target value. In non-continuous rotation mode if the target is up/clockwise from the current position, no motion occurs. The target must be located between the current upper/clockwise and lower/counterclockwise limits.
<b>Example:</b>	SKP 180.0



Seek Position	
<b>Command:</b>	SK nnn.n
<b>Description:</b>	Instructs the device to begin seeking for a target position. In continuous rotation mode, the device will seek the target value by the shortest possible path. Thus, a seek from 350.0 to 10.0 will rotate clockwise, not direction. If the target is not located between the current upper/clockwise and lower/counterclockwise limits, motion will continue in the target direction until a limit is hit.
<b>Example:</b>	SK 60.0

Seek Positive	
<b>Command:</b>	SKP <nnn.n>
<b>Description:</b>	Instructs the device to begin seeking the specified target value in the position (up/clockwise) direction only. This command is provided primarily to support continuous rotation mode. It allows forcing seeking a position from a particular direction. Thus, a SKP from 181.0 to 180.0 will rotate clockwise to reach the target value. In non-continuous rotation mode if the target is down/ counterclockwise from the current position, no motion occurs. The target must be located between the current upper/clockwise and lower/counterclockwise limits.
<b>Example:</b>	SKP 180.0

Seek Relative	
<b>Command:</b>	SKR [+/-]nnn.n
<b>Description:</b>	Instructs the device to begin seeking the specified target value relative to the current position. The specified value is added to the current position to obtain the target position. Thus, a positive value will cause up/clockwise motion and a negative value will cause down/counterclockwise motion. If the calculated target is not located between the current upper/clockwise and lower/counterclockwise limits, motion will continue in the target direction until a limit is hit.
<b>Example:</b>	SKR -10.5

Speed	
<b>Command:</b>	Sn Where n is a number between 1 and 8. The factory speed settings configuration is: S   RPM 1   .25 2   .5 3   1.0 4   4.0 5   8.0 6   12.0 7   18.0 8   25.0
<b>Description:</b>	Changes the device speed
<b>Query:</b>	S?
<b>Returns:</b>	A number between 1 and 8
<b>Example:</b>	S3 Set current speed to 1 RPM

Speed Preset	
<b>Command:</b>	SS<n> <speed>
<b>Description:</b>	Assigns a preset speed setting 0-255 to n, where n is a number 1-8. <b>Warning:</b> There can be no white space between the command and the register number. However, there must be white space between the register number and the speed value.
<b>&lt;speed&gt;</b>	Value from 0-255 representing the desired speed setting for the specified speed selection. A value of 0 represents the minimum available speed of the device. A value of 255 represents the maximum speed of the device. The actual speed of the device is given approximately by the formula: Actual Speed = <speed> (MaxSpeed – MinSpeed) / 255 + MinSpeed The minimum speed for this device is 0.25 RPM. The maximum speed is 25 RPM.
<b>Query:</b>	SS#?
<b>Returns:</b>	Value between 0 (minimum) and 255 (maximum) speed.
<b>Example:</b>	SS2 127                      Set speed 2 to half speed SS5 63                        Set speed 5 to quarter speed

Stop Motion	
<b>Command:</b>	ST
<b>Description:</b>	Causes device motion to stop.

Trigger Configuration	
<b>Command:</b>	UL nnn.n
<b>Description:</b>	Sets the upper/clockwise limit of the device. The specified value nnn.n must be greater than the lower/counterclockwise limit.
<b>Query:</b>	UL?
<b>Returns:</b>	Upper or clockwise limit of the device in degrees.
<b>Example:</b>	UL 359.9

Upper Limit	
<b>Command:</b>	TRIGGER (<ON OFF>, <step size>, <reference>, <pre trigger delay>, <pulse length>, <post trigger delay>, <polarity>)
<b>Description:</b>	Use this command to configure the trigger. Where step size is the angular distance between trigger pulses in degrees, reference position is one of the positions where a trigger should occur (not necessarily a starting position), pre-trigger delay is the time between reaching the target encoder position and producing a trigger pulse, trigger pulse length is the active period of the trigger pulse, post trigger delay is the minimum inactive period after the trigger pulse before another trigger event can occur, and High/Low sets the polarity of the trigger signal. Time unit is milliseconds.
<b>Query:</b>	TRIGGER?
<b>Returns:</b>	Trigger configuration
<b>Example:</b>	TRIGGER (ON,15.00,0.00,0.10,1.00,0.00,LOW)

**WARNING**

Ensure the current travel limit settings will not cause damage to existing cables.

**WARNING**

Do not operate the 2006 Precision Azimuth Positioner in a stalled condition. Doing so can cause damage to the drive unit and will void the warranty. Ensure the positioner will continue to rotate under load at all speeds.

## APPENDIX A: WARRANTY

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See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your 2006 Precision Azimuth Positioner.

All product warranties, except the warranty of title, and all remedies for warranty failures are limited to the duration specified in the table.

