

Leica AT500



User Manual
Version 1.2
English

- when it has to be **right**

leica
Geosystems



Introduction

Purchase

Congratulations on the purchase of the Leica AT500.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to [1 Safety Directions](#) for further information.

Read carefully through the User Manual before you switch on the product.

The content of this document is subject to change without prior notice. Ensure that the product is used in accordance with the latest version of this document.

To ensure safety when using the system, please also observe the directions and instructions contained in the User Manual and Safety Handbook issued by the:

- *Charger manufacturer*

Product identification

The model and serial number of your product are indicated on the type label.

Always refer to this information when contacting your agency or Leica Geo-systems authorised service centre.

Trademarks

- *Bluetooth®* is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to all product series instruments. Where there are differences between the various models they are clearly described.

Available Documentation

Name	Description/Format		
User Manual	All instructions required in order to operate the instrument to a basic level are contained in the User Manual. Provides an overview of the instrument together with technical data and safety directions.	-	✓
Quick Guide	Provides an overview of the instrument together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
Tracker Pilot Reference Manual	Describes the specific software for field checks, compensations and system maintenance.	-	✓
Programmers Manual	Describes the usage and commands of the Leica Metrology Foundation (LMF).	-	✓

Refer to the following resources for Absolute Tracker documentation/software:

- <https://www.hexagonmi.com/at500>

DRAFT

Feedback

Your feedback is important as we strive to improve the quality of our documentation. We request you to make specific comments as to where you envisage scope for improvement.

Use the following e-mail address to send your suggestions:
support.tracker-pl.mi@hexagon.com

Contact

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1.1**General Introduction****Description**

The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

About warning messages

Warning messages are an essential part of the safety concept of the instrument. They appear wherever hazards or hazardous situations can occur.

Warning messages...

- make the user alert about direct and indirect hazards concerning the use of the product.
- contain general rules of behaviour.

For the users' safety, all safety instructions and safety messages shall be strictly observed and followed! Therefore, the manual must always be available to all persons performing any tasks described here.

DANGER, WARNING, CAUTION and **NOTICE** are standardised signal words for identifying levels of hazards and risks related to personal injury and property damage. For your safety, it is important to read and fully understand the following table with the different signal words and their definitions! Supplementary safety information symbols may be placed within a warning message as well as supplementary text.

Type	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Additional symbols



Warning against explosive material.



Warning against flammable substances.



Product must not be opened or modified or tampered with.



Indicates the temperature limits at which the product may be stored, transported or used.

1.2

Definition of Use

Intended use

- Measuring coordinates
- Recording measurements
- Computing with software
- Automatic target search, recognition and tracking
- Remote control of product
- Data communication with external appliances

Reasonably foreseeable misuse

- Use of the product without instructions
- Use outside of the intended use and limits
- Disabling of safety systems
- Removal of hazard notices
- Opening the product using tools, for example a screwdriver, unless this is permitted for certain functions
- Modification or conversion of the product
- Use after misappropriation
- Use of products with recognisable damage or defects
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems
- Inadequate safeguards at the working site
- Deliberate dazzling of third parties
- Controlling of machines, moving objects or similar monitoring applications without additional control and safety installations

1.3

Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation. Not suitable for use in aggressive or explosive environments.

WARNING

Working in hazardous areas or close to electrical installations or similar situations

Life Risk.

Precautions:

- Local safety authorities and safety experts must be contacted by the person responsible for the product before working in such conditions.

Environment

For AC power supplies:

Suitable for use in dry environments only and not under adverse conditions.



1.4

Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the User Manual and original accessories, in a safe condition.

Person responsible for the product

The person responsible for the product has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual
- To ensure that the product is used in accordance with the instructions
- To be familiar with local regulations relating to safety and accident prevention
- To stop operating the system and inform Leica Geosystems immediately if the product and the application become unsafe
- To ensure that the national laws, regulations and conditions for the operation of the products are respected

1.5

Hazards of Use

NOTICE

Dropping, misusing, modifying, storing the product for long periods or transporting the product

Watch out for erroneous measurement results.

Precautions:

- Periodically carry out test measurements and perform the field adjustments indicated in the User Manual, particularly after the product has been subjected to abnormal use as well as before and after important measurements.



CAUTION

Mounting the sensor on unstable or uneven ground

This may cause the sensor to tip over or cause unreliable measurement results.

Precautions:

- ▶ Ensure the ground is stable and even. Do not place the sensor over cracks in the floor.



WARNING

Inadequate securing of the working site

This can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

- ▶ Always ensure that the working site is adequately secured.
- ▶ Adhere to the regulations governing safety, accident prevention and road traffic.



NOTICE

Risk of damage by overheating

If the product is covered by the protective cover while being switched on, the product may be damaged by overheating.

Precautions:

- ▶ Ensure that the product is switched off before covering it with the protective cover.



CAUTION

Moving the AT500 with attached cables

The Laser Tracker may tip over.

Precautions:

- ▶ Ensure that cables are always loose when moving the AT500 over short distances.
- ▶ Disconnect the cable(s) in advance when moving the AT500 over a distance longer than the Ethernet or/and power supply cable.

CAUTION

If the product is hit by a lateral push or moved without taking caution, it can topple over and cause property damage or injury.



Precautions:

- ▶ Use caution when working close to the product and when moving the product around the working site.
- ▶ Ensure that the working site is level and free of obstruction.
- ▶ Detach any accessories from the stand or tripod before moving it.
- ▶ Move the stand or tripod slowly and ensure that you do not jam on such things as hoses, cords or open grates.

NOTICE

Remote control of product

With the remote control of products, it is possible that extraneous targets will be picked out and measured.

Precautions:

- ▶ When measuring in remote control mode, always check your results for plausibility.

WARNING

Distraction or loss of attention

During dynamic applications there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:

- ▶ The person responsible for the product must make all users fully aware of the existing dangers.

WARNING

Cables deployed on the ground

These cables can be a hazard to pedestrians or vehicular traffic.

Precautions:

- ▶ Ensure the power cable, LAN cable or any other cables do not lie in the path of pedestrian/vehicular traffic.
- ▶ Use appropriate cable cover and/or warning signs.



Adverse use of handles

Serious injuries due to falling parts of the product.

Precautions:

- ▶ Do not lift the product with a crane!
The handles of the product are not designed for crane transport!



Not properly secured accessories

If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people can sustain injury.

Precautions:

- ▶ When setting up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
- ▶ Avoid subjecting the product to mechanical stress.



The instrument may fall off the Quick Release when the locking lever is removed.

Precautions:

- ▶ Do not remove the locking lever of the Quick Release while the instrument is attached and the Quick Release is locked.
Safeguard the instrument from falling when mounted in an upside-down or tilted position, for example by attaching a suitable lanyard or fall limiter to the handle on the socket of the AT500 instrument.
Contact your local Hexagon or distributor representative for further details on health and safety regulations.



Moving parts at the product during operation

Risk of squeezing extremities or entanglement of hair and/or clothes.

Precautions:

- ▶ Keep a safe distance to the moving parts.



If the instrument moves unexpectedly during operation, stop the instrument or alternatively, disconnect the battery or main power source to prevent further movements.

CAUTION

Before any cleaning procedure, ensure that the instrument is switched off and the battery has been removed.

WARNING

Inappropriate mechanical influences to batteries

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:

- ▶ Before shipping the product or disposing it, discharge the batteries by the product until they are flat.
- ▶ When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed.
- ▶ Before transportation or shipping, contact your local passenger or freight transport company.

WARNING

Exposure of batteries to high mechanical stress, high ambient temperatures or immersion into fluids

This can cause leakage, fire or explosion of the batteries.

Precautions:

- ▶ Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

WARNING

Short circuit of battery terminals

If battery terminals are short circuited e.g. by coming in contact with jewellery, keys, metallised paper or other metals, the battery can overheat and cause injury or fire, for example by storing or transporting in pockets.

Precautions:

- ▶ Make sure that the battery terminals do not come into contact with metallic/conductive objects.



Unsuitable installation location

Installing near mechanically moving machine components may damage the product.

Precautions:

- Deflect the mechanically moving machine components as far as possible and define a safe installation zone.



If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- The product includes parts of Beryllium inside. Any modification of some internal parts can release dust or fragments, creating health hazard.

Precautions:

-  The product must not be disposed with household waste.
Dispose of the product appropriately in accordance with the national regulations in force in your country. Always prevent access to the product by unauthorised personnel.

Product-specific treatment and waste management information can be received from your Leica Geosystems distributor.



Applies only for California. The product contains CR Lithium Cell(s) with perchlorate material inside – special handling may apply.

Refer to [Department of Toxic Substances Control - Perchlorate](#) for more details.



Improperly repaired equipment

Risk of injuries to users and equipment destruction due to lack of repair knowledge.

Precautions:

- ▶ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

1.5.1

For AC Power Supplies



Electric shock due to missing ground connection

If unit is not connected to ground, death or serious injury can occur.

Precautions:

- ▶ The power cable and power outlet must be grounded!



Electric shock due to use under wet and severe conditions

If unit becomes wet, it may cause you to receive an electric shock.

Precautions:

- ▶ If the product becomes humid, it must not be used!
- ▶ Use the product only in dry environments, for example in buildings or vehicles.



- ▶ Protect the product against humidity.

WARNING

Unauthorised opening of the product

Either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs

Precautions:

- ▶ Do not open the product!
- ▶ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

1.6

Laser Classification

1.6.1

General

General

The following chapters provide instructions and training information about laser safety according to international standard IEC 60825-1 (2014-05) and technical report IEC TR 60825-14 (2004-02). The information enables the person responsible for the product and the person who actually uses the equipment, to anticipate and avoid operational hazards.

 According to IEC TR 60825-14 (2004-02), products classified as laser class 1, class 2 and class 3R do not require:

- laser safety officer involvement
- protective clothes and eyewear
- special warning signs in the laser working area

if used and operated as defined in this User Manual due to the low eye hazard level.

 National laws and local regulations could impose more stringent instructions for the safe use of lasers than IEC 60825-1 (2014-05) and IEC TR 60825-14 (2004-02).

The AT500 is classified as laser class 2 in accordance with:

- IEC 60825-1 (2014-05): "Safety of laser products"

These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam. The beam may cause dazzle, flash-blindness and afterimages, particularly under low ambient light conditions.

⚠ CAUTION

Class 2 laser product

From a safety perspective, class 2 laser products are not inherently safe for the eyes.

Precautions:

- Avoid staring into the beam or viewing it through optical instruments.
- Avoid pointing the beam at other people or at animals.

Labelling



The AT500 is classified as a laser class 2 system although some individual laser sources are classified differently. The possibility of simultaneous emission of the individual laser sources results in an overall classification as laser class 2.

1.6.2

Absolute Distance Meter (ADM) and Laser Pointer

General

The Absolute Distance Meter built into this product produces an invisible laser beam which emerges from the telescope objective. The laser pointer

built into this product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 2 in accordance with:

- IEC 60825-1 (2014-05): "Safety of laser products"

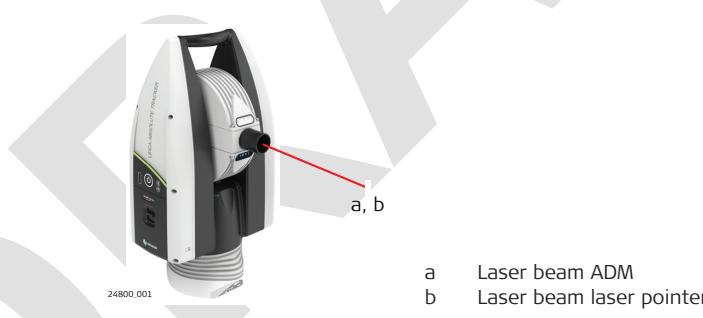
These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions.

ADM:

Description	Value
Emission wavelength	795 nm (range 785 nm-800 nm)
Maximum average radiant power	< 0.35 mW cw
Beam divergence (full angle)	0.1 mrad

Laser Pointer:

Description	Value
Emission wavelength	640 nm
Maximum average radiant power	0.35 mW cw
Beam divergence (full angle)	0.2 mrad



a Laser beam ADM
b Laser beam laser pointer

1.6.3

Automatic Target Recognition

General

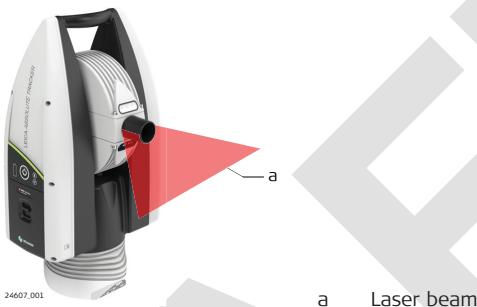
The Automatic Target Recognition built into the product produces an invisible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 1 in accordance with:

- IEC 60825-1 (2014-05): "Safety of laser products"

These products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with this user manual.

Description	Value
Wavelength	905 nm
Maximum average radiant power	1.5 mW
Beam divergence (full angle)	11 mrad
Pulse duration	≤ 2.56 ms
Pulse repetition frequency	≤ 500 Hz



1.6.4

PowerLock

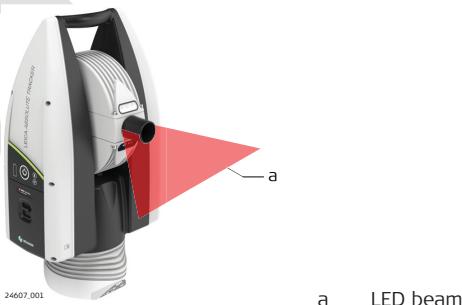
General

The PowerLock vision system built into the product produces an invisible LED beam which emerges from the front side of the telescope.



The product described in this section, is excluded from the scope of IEC 60825-1 (2014-05): "Safety of laser products".

The product described in this section, is classified as exempt group in accordance with IEC 62471 (2006-07) and does not pose any hazard provided that the product is used and maintained in accordance with this user manual.



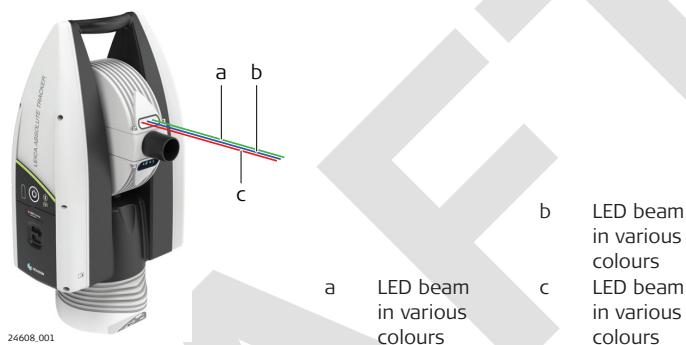
General

The status LEDs built into the product produces a visible LED beam which emerges from the front side of the telescope.



The product described in this section, is excluded from the scope of IEC 60825-1 (2014-05): "Safety of laser products".

The product described in this section, is classified as exempt group in accordance with IEC 62471 (2006-07) and does not pose any hazard provided that the product is used and maintained in accordance with this user manual.



1.7

Electromagnetic Compatibility (EMC)**Description**

The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

**Electromagnetic radiation**

Electromagnetic radiation can cause disturbances in other equipment.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

CAUTION

Use of the product with accessories from other manufacturers. For example, field computers, personal computers or other electronic equipment, non-standard cables or external batteries

This may cause disturbances in other equipment.

Precautions:

- ▶ Use only the equipment and accessories recommended by Leica Geosystems.
- ▶ When combined with the product, other accessories must meet the strict requirements stipulated by the guidelines and standards.
- ▶ When using computers, two-way radios or other electronic equipment, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

CAUTION

Intense electromagnetic radiation. For example, near radio transmitters, transponders, two-way radios or diesel generators

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that the function of the product may be disturbed in such an electromagnetic environment.

Precautions:

- ▶ Check the plausibility of results obtained under these conditions.

CAUTION

Electromagnetic radiation due to improper connection of cables

If the product is operated with connecting cables, attached at only one of their two ends, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired. For example, external supply cables or interface cables.

Precautions:

- ▶ While the product is in use, connecting cables, for example product to external battery or product to computer, must be connected at both ends.



Use of product with radio or digital cellular phone devices

Electromagnetic fields can cause disturbances in other equipment, installations, medical devices, for example pacemakers or hearing aids, and aircrafts. Electromagnetic fields can also affect humans and animals.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.
- ▶ Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
- ▶ Do not operate the product with radio or digital cellular phone devices near medical equipment.
- ▶ Do not operate the product with radio or digital cellular phone devices in aircrafts.
- ▶ Do not operate the product with radio or digital cellular phone devices for long periods with the product immediately next to your body.

2.1 System Components

Introduction

The Leica Absolute Tracker system consists of:

- AT500 instrument with built-in Meteo Station
- Quick Release with 3 1/2" x 8 thread (Brunson compatible)
- Stand Tube (optional)
- Universal Stand Fixture
- AC/DC adapter
- LAN cable
- 2 x GEB364 batteries

The terms "Absolute Tracker" and "Laser Tracker" are used as synonyms for all types of the Leica Geosystems Absolute Tracker.

System Components



Component	Description
AT500 instrument	Absolute Tracker of highest accuracy for measuring, calculating and capturing data.
Application Software	Third-party metrology software with an interface to the Absolute Tracker for acquisition, analysis, management, automation and reporting of measurement data.
Tracker Pilot	System software to <ul style="list-style-type: none">• check the system accuracy and adjust (compensate) instrument parameters.• maintain and update the system software/firmware.

Component	Description
AT500 Connect App	<p>Mobile application to</p> <ul style="list-style-type: none"> enable basic connectivity to the system to configure individual connection parameters. provide basic MMI functions via the app, e. g. electronic levelling bubble.

2.2

Software Concept

General

The Absolute Tracker supports the following types of software applications.

Software Types

Software type	Description
System firmware	This software comprises the central functions of the Absolute Tracker.
Tracker Pilot	The Tracker Pilot software provides functionality to check and adjust the Absolute Tracker system as well as maintaining and updating the system.
Third-party application software	There are various computer-based third-party applications available for the Absolute Tracker. Contact your Hexagon or distributor representative for details.
Customised application programs	Customised software specific to user requirements can be developed using the Leica Metrology Foundation (LMF). Contact your Hexagon or distributor representative for further information.

Firmware upload

A firmware update of the Absolute Tracker can be done through the provided Tracker Pilot software.

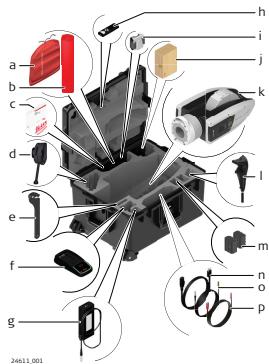


Refer to Tracker Pilot Reference Manual for details on updating the Absolute Tracker system.

2.3

Container Contents

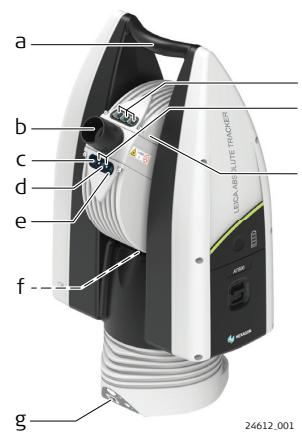
Container for Instrument and Delivered Accessories



Instrument Components

AT500 Instrument components

Front/side view – right

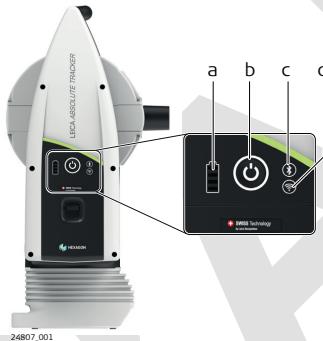


Front/side view – right



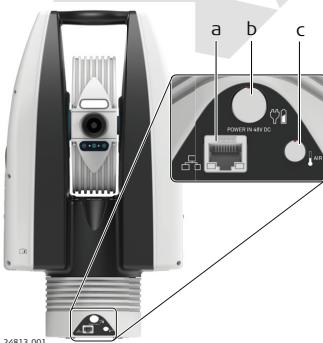
- a RESET button – placed inside the battery compartment

Side view – left



- a Battery level LEDs
- b Power Button and Status LED
- c Bluetooth Status LED and Pairing Button
- d WLAN Status LED

Front view



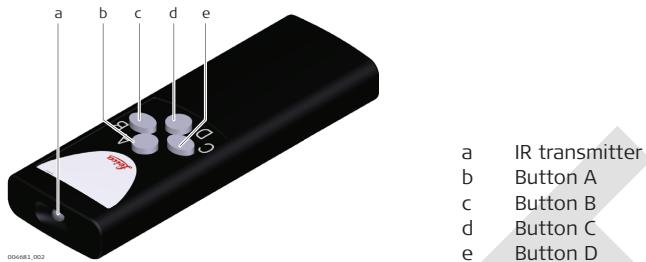
- a Connector for Ethernet (LAN) RJ45 (TCP/IP)
- b Connector for AC power supply unit or external battery
- c Connector for external ambient temperature sensor

2.4.1

AT Remote Control 400

Description

The AT Remote Control 400 allows to control specific instrument functions remotely.



Button assignments

The Tracker Pilot software has the following functions assigned to the AT Remote Control 400.

Button	Function
A	Start Measurement
B	Next (on Tracker Pilot wizard pages)
C	Back (on Tracker Pilot wizard pages)
D	Toggle between full sketch view, full DRO view and shared view

Battery replacement

The AT Remote Control 400 is powered by two 1.5 V AAA batteries.

 The battery compartment is located on the back of the AT Remote Control 400.

1. Press the fluted part of the cover of the battery compartment and slide the cover open.
2. Insert two AAA batteries as indicated on the bottom of the battery compartment.
3. Close the cover of the battery compartment. A click indicates when the battery compartment cover is fully closed.

Battery level LEDs



a Battery level LEDs

Battery Capacity Status Icon	Description	Troubleshooting Status Icon	Description
	100%-76%		Battery over-heating system will immediately shut down - >72 °C Quick flashing
	75%-51%		Charging not allowed, temperature outside the permissible range Quick flashing
	50%-21%		
	20%-6%		
	5% - near critically low %		
	Critically low - 0%		
	Quick flashing		

Status power button



a Status power button

LED Indicator	Status	Description
	Off	No activity.
	Fast flashing blue	Booting up/initialising.
	Solid blue	System booted up, ready to connect.
	Slow flashing green	Connected to network.
	Solid green	LMF connection established.
	Fast flashing blue	Shutting down.

LED Indicator	Status	Description
	Solid orange	Update running.
	Solid red	Impediment: Firmware problem.
	Fast flashing red	General impediment: Laser failure.

Power button functionalities

Event	Action	Visual Feedback
Long press.	Turn sensor ON/OFF.	Yes - see table above Status power button .
Short press with sensor OFF.	Shows battery charge status for five seconds.	Battery indicators show charge level.

Bluetooth pairing button functionalities

Event	Action	Visual Feedback
Press and hold button for 1-2 seconds.	Initiate the pairing and bonding process with a new device.	Slow flashing white

Reset button functionalities

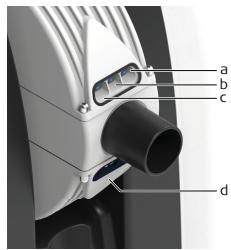
Event	Action	Visual Feedback
Press and hold reset button longer than 3 seconds.	Restart the Tracker: Reset all connections to factory default (LAN to Automatic and WLAN/WiFi to Access Point Mode).	Power button is fast flashing red.

Status LEDs

Description

The AT500 has Light Emitting Diode indicators at the front side and back side of the telescope. They indicate the following states.

Diagram of the Status LEDs



a LED with various colours
b LED with various colours

c LED with various colours
d Front side

Description of the Status LEDs

Symbol	Description	Symbol	Description
	Status indicator, red continuous ON		Status indicator, red flashing
	Status indicator, green continuous ON		Status indicator, green flashing
	Status indicator, blue continuous ON		Status indicator, blue flashing
	Status indicator, OFF		

	LED State			Status Information
	A	B	C	
LEDs				The AT500 instrument is off.
Pattern	None	None	None	
LEDs				The system is booted and no reflector is locked. PowerLock is active.
Pattern				
LEDs				The system is booted and no reflector is locked. PowerLock is inactive.
Pattern	None		None	
LEDs				Target is out of range.
Pattern	None		None	
LEDs				Laser off: Stand-by mode
Pattern	None		None	
LEDs				Target locked. Ready to measure.
Pattern				
LEDs				Measurement is in progress.
Pattern				
LEDs				PowerLock is temporarily suspended while laser is pointing
Pattern				

2.5

AT500 Instrument Measurement System

2.5.1

Angular System

Description

The angle measurement system mainly consists of a coded glass circle and four angular encoders using quadruple angle reading. The quadruple angle reading system eliminates systematic and periodical errors of the angle measurement which results in increased measurement accuracy.

2.5.2

Inclination Sensor

Orient-to-Gravity Sensor

The Absolute Tracker AT500 features a dual-axis Orient-to-Gravity sensor. This inclination sensor is located within the rotating head of the AT500 instrument. The Orient-to-Gravity sensor can operate in different modes depending on the stability of the ground:

- Orient-to-gravity
- Monitoring
- Inclination sensor off



Refer to Tracker Pilot Reference Manual or the relevant third-party software application manual for details on setting the desired operation mode.

2.5.3

Motorisation

Description

The AT500 instrument has two orthogonal, rotating axes. The motorisation of the axes uses direct drives that provide highest tracking speed and acceleration for high-dynamic measurements, for example in automation applications.

2.5.4

Absolute Distance Meter (ADM)

Description

The Absolute Distance Meter module of the AT500 uses a modulated and polarised infrared light beam, which allows a dynamic lock-on to a moving reflector while still ensuring the highest accuracy. The ADM supports measuring stationary points, as well as continuous measurements of a moving reflector at speeds of up to 100 Hz.

Measurement modes

The following measurement and modes are available:

Target	Measurement Mode	Measurement Profile
Reflector	Stationary	Fast Standard Precise
	Continuous	Continuous time Continuous distance
B-Probe	Stationary	Standard

Atmospheric influence

The accuracy of the measured distance is primarily dependent on the accuracy of the determination of:

- The ambient air temperature
- The air pressure

A change or a deviation in the atmospheric parameters affects the distance measurement accuracy as follows:

- $\pm 1^\circ\text{C}$ results in a change in distance of approximately 1 ppm.
- $\pm 4 \text{ hPa}$ result in a change in distance of approximately 1 ppm.
- The air humidity influences the distance measurement if the climate is hot and damp, therefore $\pm 30\%$ relative humidity results in a change in distance of approximately 1 ppm at 40°C , approximately 0.3 ppm at 20°C and approximately 0.1 ppm at 0°C ambient temperature.

Additive constant

For an absolute distance measurement the following values must be known:

- The additive constant (ADM Offset)
- The scale factor

These values are precisely determined in the factory. In the field the additive constant can be verified through a sensor check or compensation process.



Refer to the Tracker Pilot Reference Manual on details of the ADM check and compensation process.

Reflector constant

Glass prism reflectors like the Tooling Ball (TBR) have an internal reflector constant, which causes an apparent increase in the distance measurement. This reflector constant is indicated on the accompanying Producer Certificate.

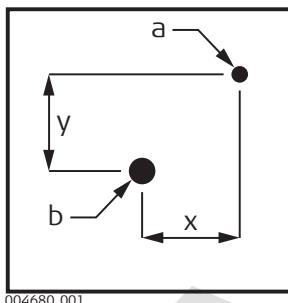
Please note: Hollow Corner Cube Reflectors (RRR) do not have a reflector constant.

2.5.5

Automatic Target Recognition

Description

The Automatic Target Recognition (ATR) is a sensor which recognises the position of a reflector by means of a CMOS image sensor. The light beam of the ATR represents the collimation axis of the Laser Tracker, the reflected beam is received by the CMOS image sensor. The position of the reflected spot in relation to the centre of the CMOS image sensor is computed. These ATR offsets are used to correct the horizontal and vertical angles. The ATR offsets are also used to control the motors which turn the instrument to centre the reflected spot closely to the centre of the CMOS image sensor.



- a) Centre of reflected spot
- b) Zero pixel of the ATR
- x, y) ATR offsets

Tracking

The Automatic Target Recognition (ATR) is capable of tracking a moving reflector. When a target is within the field of view, the ATR will constantly measure and apply the offsets to the angular measurements and provide them to the motors of the Absolute Tracker to track the movements of the reflector.

Field of view

The field of view of the Automatic Target Recognition (ATR) is 0.6° , which corresponds to a spot size of 105×105 mm at a distance of 10 meters.

2.5.6

PowerLock

Description

To determine the location of a target, the Absolute Tracker uses an additional off-axis vision system, which is built into the sensor. As soon as the target is in the field of view of the sensor, the Absolute Tracker locks on to the target and steers the laser beam back onto the ATR without operator intervention.

This revolutionary vision system works with all standard reflectors.

Field of View

The field of view of the PowerLock vision system is 10° , which corresponds to a covered area of $1.75 \text{ m} \times 1.75 \text{ m}$ at a distance of 10 meters.

2.5.7

Overview Camera

Description

The Overview Camera enables the visualisation of reflectors. This camera is at the front of the telescope below the aperture of the measurement

beam, the focus and aperture are fixed. Targets that are recognised by the PowerLock vision system are visualised within the image of the Overview Camera. By this, you can identify and select reflectors to lock on and take measurements.

2.5.8

Meteo Station

Description

The air temperature, air pressure and humidity affect the refraction index of the air, which causes a change in velocity of propagation and wavelength of the measurement beam. These changes can influence the values of the distance measurements. The built-in Meteo Station provides environmental information on air temperature, air pressure and relative humidity, which is used to calculate the current refraction index of the surrounding atmosphere. The internal Meteo Station reads the information from an internal probe, optionally two additional external temperature sensors can be connected, one for the ambient air temperature and one for the object temperature.



To achieve the highest possible measurement accuracy it is strongly recommended to determine the ambient temperature using the provided external temperature sensor.

2.6

AT500 Connect App

Description

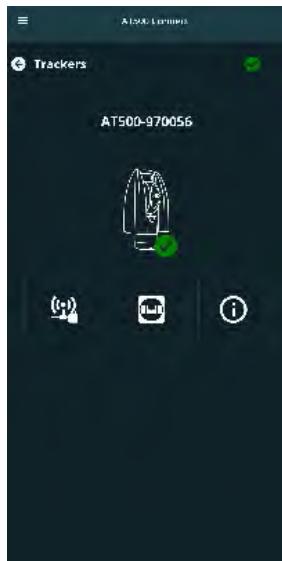
The AT500 Connect App runs on iOS and Android mobile devices. The app can be downloaded from the respective app store:

iOS

Android



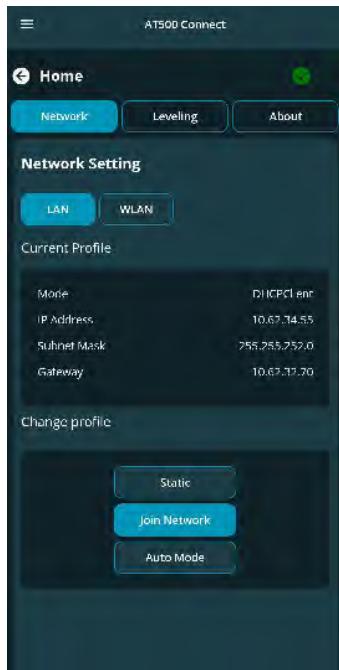
Home Screen



The app connects to the AT500 through the Bluetooth interface and provides basic functionality such as:

- Configure a TCP/IP connection between the system and the application computer.
- Basic MMI functions like the electronic levelling bubble to assist the user when levelling the instrument to perform an orient-to-gravity (OTG) alignment.

Network Screen



2.7

Application Processor

Description

An application processor which runs the actual application software is required to operate the AT500. The Leica Metrology Foundation (LMF) provides an open and flexible interface to third-party application programs. The use of an Application Processor distributes the workload such as:

- The system software runs on the AT500 Processor, the application software runs on the Application Processor. The resources of the Application processor are fully available for data acquisition, handling, calculation and graphical display to support all user needs. The hardware requirements for the Application Processor depend on the specifications of the supplier of the application software.
- The interface between the system software and the application software is clearly defined, making it easier to maintain both, embedded and application software.

2.8

Accuracy

Description

The accuracy of measurements with the Absolute Tracker depends on the individual accuracy of the following components:

- Angle measurements
- Distance measurements
- Reflectors

2.8.1

Maximum Permissible Error (MPE)

Description

Accuracy specifications in the technical data of this manual are stated with the Maximum Permissible Error (MPE). The Maximum Permissible Error (MPE) is defined by the ISO 10360-10:2021 as the extreme value of the measurement error permitted by specification for the relevant test, i.e. length measurement. An acceptance test is verified if all measurement errors according to the relevant test item are smaller than the corresponding MPE specifications. The ISO 10360-10:2021 defines criteria for the repetition of measurements that exceed the MPE values. Typical measurement results of the Absolute Tracker are half of the relevant MPE values.

2.8.2

Laser Tracker Subsystem Specifications

The following specifications represent the Laser Tracker subsystem specification in accordance with ISO 10360-10:2021, Annex D.

Laser Tracker Subsystem	Symbol	Maximum Permissible Error (MPE)
Absolute Distance Meter (ADM)	e_{ADM}	$\pm 10 \mu\text{m} + 0.3 \mu\text{m}/\text{m}$
R0 Parameter (R0)	e_{R0}	$\pm 5 \mu\text{m}$
Transverse	e_T	$\pm 15 \mu\text{m} + 6 \mu\text{m}/\text{m}$

2.8.3

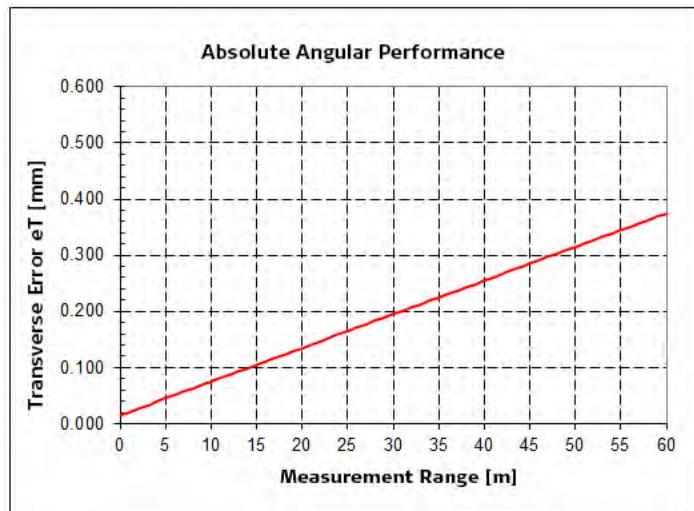
Measurement Uncertainty

Description

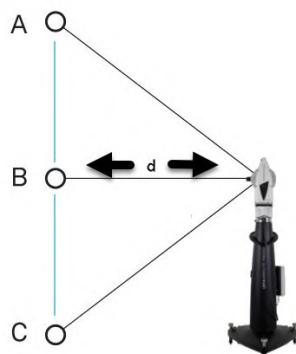
The table below shows the Maximum Permissible Error (MPE) specifications for the test items defined in ISO 10360-10:2021 using Leica 1.5" Red Ring Reflectors (RRR) and standard measurement mode unless otherwise noted.

Two-Face Measurement	Position	Tolerance (MPE)	General Formula
Absolute Angular Performance e_T ¹⁾	Pos. 1 to 9 (1.5 m distance)	$\pm 24 \mu\text{m}$	$\pm 15 \mu\text{m} + 6 \mu\text{m}/\text{m}$
	Pos. 10 to 18 (6 m distance)	$\pm 51 \mu\text{m}$	

¹⁾ Angular Performance Transverse e_T according to ISO 10360-10:2021, this respects to a MPE for the Location Error (LDia.2x1:P&R:LT,MPE) in accordance with chapter 6.3 of ISO 10360-10:2021 of $30 \mu\text{m} + 12 \mu\text{m}/\text{m}$



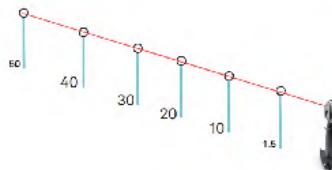
ISO Two-Face Measurement



Length Measurement	Position	Tolerance (MPE)	General Formula
Length Measurement EUni:0:LT,MPE 2)	Pos. 1 to 2 (1.5 m distance)	$\pm 32 \mu\text{m}$	$\pm 21 \mu\text{m} + 8.5 \mu\text{m}/\text{m}$
	Pos. 3 to 15 (3 m distance)	$\pm 46 \mu\text{m}$	
	Pos. 16 to 19 (6 m distance)	$\pm 72 \mu\text{m}$	
	Pos. 20 to 29 (1.5 m distance)	$\pm 32 \mu\text{m}$	
	Pos. 30 to 35 (9 m distance)	$\pm 97 \mu\text{m}$	
	Pos. 36 (1.5 m to 10 m)	$\pm 14 \mu\text{m}$ (ADM)	$\pm 14 \mu\text{m}$ (ADM)
	Pos. 37 (1.5 m to 20 m)	$\pm 14 \mu\text{m}$ (ADM)	
	Pos. 38 (1.5 m to 30 m)	$\pm 14 \mu\text{m}$ (ADM)	
	Pos. 39 (1.5 m to 40 m)	$\pm 14 \mu\text{m}$ (ADM)	
	Pos. 40 (1.5 m to 50 m)	$\pm 14 \mu\text{m}$ (ADM)	

2) in accordance with ISO 10360-10:2021, chapter 6.4

ISO length measurement – in-line



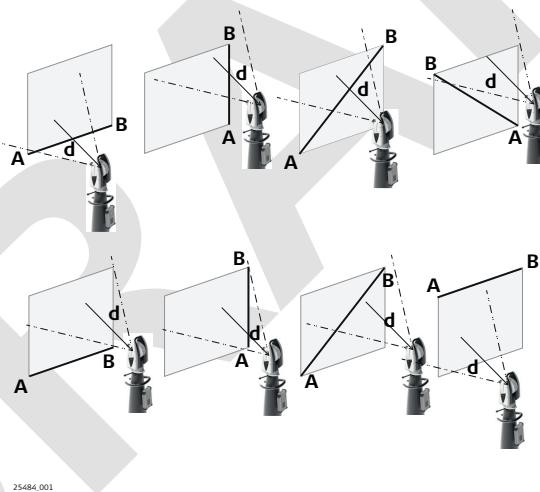
Probing Size and Probing Form

PSize.Sph.1x25:SMR:LT,MPE $\pm 20 \mu\text{m}$

PForm.Sph.1x25:SMR:LT,MPE $50 \mu\text{m}$

2) in accordance with ISO 10360-10:2021, chapter 6.2

ISO Probing Measurement – traversal



25484.001

2.8.4

Reflector

Reflectors

Hollow Corner Cube Reflectors (RRR and BRR) and glass prisms (TBR) are available with the following tolerances:

Roundness (Ball)	Value
Red-Ring Reflector (RRR)	$\triangle \pm 3 \mu\text{m}$
Break Resistant Reflector (BRR)	$\triangle \pm 3 \mu\text{m}$
Tooling Ball Reflector (TBR)	$\triangle \pm 6 \mu\text{m}$

Centring of optics	Value
Red-Ring Reflector (RRR)	< $\pm 3\mu\text{m}$
Break Resistant Reflector (BRR)	$\leq \pm 10 \mu\text{m}$
Tooling Ball Reflector (TBR)	< $\pm 10 \mu\text{m}$
Reflector constant (ADM)	Value
Red-Ring Reflector (RRR)	0.000 mm ± 0.003 mm
Break Resistant Reflector (BRR)	0.00 mm ± 0.01 mm
Tooling Ball Reflector (TBR)	5.30 mm ± 0.03 mm



If repeatability of measurements is important, the reflector should always be used with the same orientation. The serial number and Leica logo on the reflector housing helps to maintain the orientation.

Description

This chapter describes the following accessories for the Laser Tracker systems:

- Reflectors
- Measurement Cart

This list of accessories is not exhaustive, various other products are available for different measurement tasks.



Refer to the brochure "Hexagon MI Laser Tracker and Accessories Catalog" for detailed information on additional accessories.



The use of accessories from third-party manufacturers without prior approval of Leica Geosystems is not permitted. Unauthorised modifications to the system make the warranty null and void.

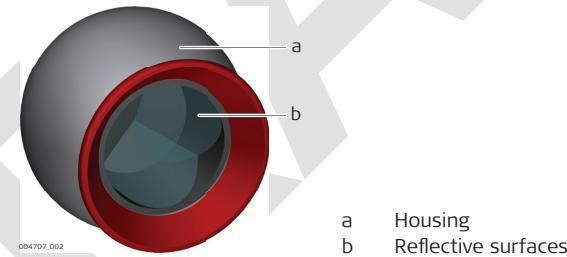
3.1

Reflectors

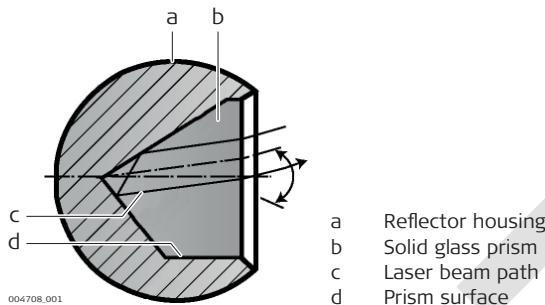
Reflector Types

Leica Geosystems recommends using the following reflector types:

- Hollow corner cube (air path) reflector (Red Ring Reflector (RRR), Break Resistant Reflector (BRR)), consisting of three orthogonal mirrors. The mirrors are centred in a metal sphere and their reflective surfaces have a optimized coating.



- Small size glass prism (Tooling Ball Reflector (TBR)). For a small size glass prism, the influence of refraction for small entry angles ($\pm 15^\circ$) can be neglected. Glass prism reflectors are recommended for static points, where it can be pointed towards the sensor unit during the actual measurement. To impede measurements with large entry angles of the laser beam, a collar can be mounted on the aperture of the TBR.



- Glass sphere prism (Supercateye SCE 1.5"). The SCE 1.5" is a target with a very large acceptance angle. The glass ball is centered in a metal sphere and can be used with the same reflector nest as other 1.5" reflectors.

Maximum entry angle of laser beam

Reflector Type	Maximum Entry Angle
RRR/BRR	$\pm 30^\circ$
TBR	$\pm 22^\circ$
SCE 1.5"	$\pm 75^\circ$ vertical $\pm 360^\circ$ horizontal

Housing

Most reflectors are housed in a metal ball (Spherically mounted reflector, SMR), with the advantage of a constant offset when measuring surfaces. A three-point reflector support ensures reliable centering of the sphere.

Reflector support

A reflector support is used, when the reflector needs to be fixed in a particular stable position. A magnet in the reflector support holds the reflector in the same position. Various kinds of reflector supports are available.



Refer to the brochure "Hexagon MI Laser Tracker and Accessories Catalog" for detailed information.

Damaged reflectors

A dropped reflector may be damaged, which will affect the measuring accuracy (trueness of the optics and centering). Damages may not be immediately apparent. Dropped reflectors should be sent to your authorised Hexagon representative or distributor for inspection.



Secure the reflector with a lanyard when moving the reflector.

3.2

Measurement Cart

Description

A mobile, lockable cart offers flexibility in assembly and portability of the Absolute Tracker system. All components, apart from the Tracker Stand, can be installed or stored inside the cart. The complete system can be lifted onto rails on the side of the cart.

The cart has drawers to store reflectors and smaller accessories, and a provision for a power panel.

Height adjustable shelves enable the installation of an Application and an uninterruptable power supply (UPS) module.

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4.1

Setup

General

The first installation of the product should be done by authorised Hexagon personnel. Installation by unauthorised personnel may cause damage and will make the warranty null and void.

Setup Step-by-step



1. Screw the Quick Release onto the Tracker Stand and tighten it using the hinged hook wrench.
2. Ensure that the locking lever of the Quick Release is in unlocked position.
Set the AT500 instrument onto the Quick Release.
3. Do not remove the locking lever of the Quick Release while the sensor is attached to the Quick Release.
Close the locking lever to lock the Absolute Tracker on the Quick Release.
4. Connect the external temperature sensor to the connector of the socket, that is labelled with "Air". This ensures that you achieve the highest possible measurement accuracy.
5. Connect a LAN cable (if applicable).
6. Connect the AC power supply to the connector on the socket and to a grounded mains socket outlet.
7. To turn on the Absolute Tracker, press the power switch on the frontpanel of the side cover.
8. The system automatically detects when the start-up cycle has finished. The system will initialise automatically once the start-up cycle has finished.
9. Start the application.



Refer to the relevant application manual for further details on carrying out measurements.



Mounting the sensor on unstable or uneven ground

This may cause the sensor to tip over or cause unreliable measurement results.

Precautions:

- ▶ Ensure the ground is stable and even. Do not place the sensor over cracks in the floor.

4.2

Connecting to an Application Computer

Connection types

There are two basic connection types available:

- Point-to-point configuration (TCP/IP), Static IP
- Network configuration (TCP/IP), Connect to Network

4.2.1

Wired Connection

Automatic Mode

The network module of the AT500 can automatically detect whether it is connected to the application computer through a point-to-point or a network connection.

Changes between connection types are detected automatic and do not require manual configuration.

Nevertheless the network settings can still be configured manually through Tracker Pilot, if necessary.



In Automatic mode the network module will search for a server and join the network by asking the network DHCP server for an IP address. If no server is found within reasonable time the AT500 will stop searching, create a new network and distribute IP addresses so that an application computer can join this network.

Within a company computer network it is recommended to use the "Connect to Network" option instead, as the Automatic mode can potentially cause disturbances and should be only be used with advice from local IT administration.

Static IP (point-to-point)

The Static IP connection connects the Application Processor (AP) to the AT500 through point-to-point configuration. Third-party application software is using the Leica Metrology Foundation (LMF) as low-level interface to the AT500. The connection requires the following component:

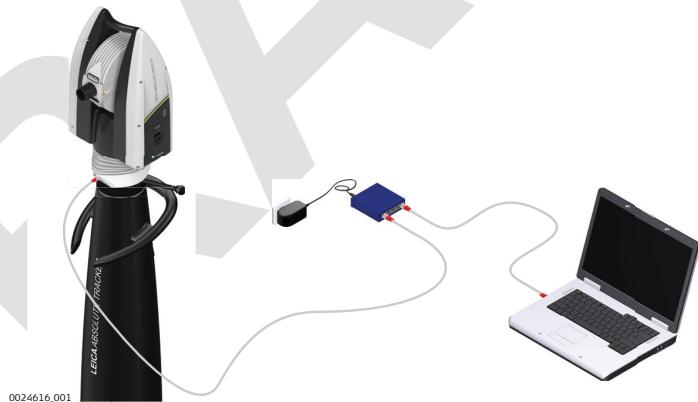
- CAT5 LAN Cable RJ45



Network configuration

The LAN configuration provides a network-based access from the Application Processor to the AT500. The connection requires the following components:

- CAT5 LAN Cable RJ45 for the connection between the AT500 and the network hub.
- CAT5 LAN Cable RJ45 for the connection between the Application Processor and the network hub.
- Hub for LAN connection to AT500, Application Processor and network.



4.2.2

WLAN Connection

WLAN Configuration

As alternative to the wired connection the AT500 and the Application Processor can be operated in a wireless LAN (WLAN) network.

The AT500 supports the wireless topologies:

- Access Point Mode: The AT500 serves as Access Point to allow multiple clients to establish a connection. For example, to an application computer, a remote control or multiple Absolute Tracker setups.
- Connection to an external Access Point: The AT500 connects as client to an external Access Point. For example, to a company network or as a client to different Absolute Tracker in the same network.



The setup is similar to the wired configuration. For the Application Processor, install and configure the WLAN module.



Refer to Tracker Pilot Reference Manual for detailed instructions on setting up a WLAN connection.



For certain countries with special regulations for operating wireless networks the WLAN module will be decommissioned by the factory. The user of the product will not be able to activate the WLAN module in this case. Please contact your local Hexagon representative or distributor for further details on wireless network regulations.

4.3

Application Processor

Description

The Application Processor runs the application software. The application software must be installed beforehand.



Refer to the manual of the application software for further details.

4.4.1

Operating Principles

First-time use/
charging batteries

- The battery must be charged before using it the first time, because it is delivered with an energy content as low as possible or might be in sleep mode.
- The permissible temperature range for charging is from 0 °C to +40 °C/+32 °F to +104 °F. For optimal charging, we recommend charging the batteries at a low ambient temperature of +10 °C to +20 °C/+50 °F to +68 °F if possible
- It is normal for the battery to become warm during charging. Using the chargers recommended by Leica Geosystems, it is not possible to charge the battery once the temperature is too high
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make a discharge/charge cycle
- For Li-Ion batteries, a single discharge/charge cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a Leica Geosystems product deviates significantly from the actual battery capacity available.

Operation/dischar-
ging

- The batteries can be operated from -20 °C to +55 °C/-4 °F to +131 °F. Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery.

4.4.1.1

Power Concept

General

Use the batteries, chargers and accessories recommended by Leica Geosystems to ensure the correct functionality of the instrument.

Power options

Power for the instrument can be supplied either internally or externally.

AT500 instrument

Internally by 2 x GEB364 batteries fitted into the battery compartment, or externally by the AC power supply. The AC power supply can be also used to charge the two internal batteries while the instrument is powered off.

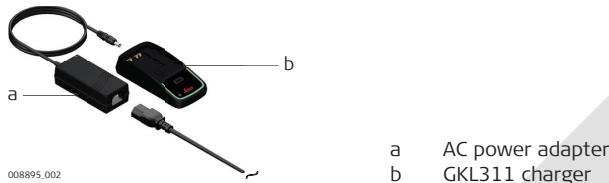
GEB364 Li-Ion
internal battery

a GEB364 internal battery
b Electrical contacts

GKL311 Single-bay
Charger

The optional GKL311 Single-bay Charger can be used in the following ways:

Charging of one GEB364 battery



4.4.1.2

Battery for the AT500 Instrument

Change battery step-by-step



1. Push down the lock on the lid of the battery compartment to open the battery housing.
2. Pull out the battery housing.
3. Pull the battery from the battery housing.
4. A pictogram of the battery is displayed inside the battery housing. This pictogram is a visual aid to assist in placing the battery correctly.
5. Place the battery into the battery housing, ensuring that the contacts are facing outward. Click the battery into position.
6. Place the battery housing into the battery compartment. Push the battery housing in until it fits completely into the battery compartment.

7. Push up the lock on the lid of the battery compartment to lock the battery housing.

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Description

Leica Geosystems products are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, frequent movements of the product, shock or stress can cause deviations and decrease the measurement accuracy.

It is therefore recommended to check and adjust (compensate) the product from time to time. This can be done onsite by running through specific sensor check or compensation measurements. If the sensor checks do not provide satisfying results repeatedly, a full compensation of the product is recommended.

The following product parameters can be checked and adjusted electronically to a product specific parameter file:

- Axis offsets (O_x, O_y, e)
- Vertical index, related to the standing axis (j)
- Hz collimation correction (c)
- Tilting axis correction (i)
- Scan axis correction (c, j, O_x, O_y)
- ADM Offset for reflector and for non-contact measurement (AC)



Please refer to "Compensation" or "Sensor Check" in the Tracker Pilot Reference Manual for details on the Sensor Check and Compensation process.

Measurement precision

To achieve precise measurement results in the daily work, it is important to check and adjust (compensate) the product from time to time. During the manufacturing process, the product parameters are carefully determined. As previously mentioned, these values can change and it is highly recommended to check or adjust the product in the following situations:

- Before the first use of the product
- Before taking high precision measurements
- After long transportations
- After long working periods
- After long storage periods
- After mechanical shock of the product, for example drop
- In a high or low temperature environment



Before starting to work the product has to become acclimatised the ambient temperature, especially if the product has been stored under different temperature conditions. Ensure sufficient acclimatisation to the environment before taking precision measurements.

Adjusting the Circular Level Step-by-step

1. Place and secure the instrument into the Quick Release on the Stand Tube.
2. Level the instrument precisely with the electronic level on the display of the AT500 Connect App using the footscrews.
3. Check the position of the circular level on the instrument.
4. a) If the circular level is centred, no adjustments are necessary.
b) If the circular level is not centred, adjust as follows:
 - If the bubble extends beyond the engraved circle, use a 2-mm allen key to centre it with the adjustment screws.
 - Turn the sensor unit by 180°. If the bubble of the circular level does not stay centred, repeat the adjustment procedure.

 After the adjustments, all adjusting screws must have the same tightening tension and no adjusting screw should be loose.

6.1

Transport

General

The equipment is sensitive to shock, vibration, temperature, humidity and air pressure.

6.1.1

Transport On-site

On-site transport

When transporting the equipment on site, always make sure that you carry the product

- in its original container,
- or attached to the Tracker Stand.



Ensure that the working site is level and free of obstruction.



Detach any accessories from the stand or tripod and carry them in their original container.



Move the stand or tripod slowly and ensure that you do not jam on such things as hoses, cords or open grates.



Properly set up the stand or tripod at the new position before reattaching the accessories.

 **WARNING****Adverse use of handles**

Serious injuries due to falling parts of the product.

Precautions:

- ▶ Do not lift the product with a crane!
The handles of the product are not designed for crane transport!

**Transport in a road vehicle**

Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its container and secure it.

For products for which no container is available use the original packaging or its equivalent.

Shipping

When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, container and cardboard box, or its equivalent, to protect against shock and vibration.

Shipping, transport of batteries	When transporting or shipping batteries, the person responsible for the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.
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Field adjustment	Exposing the product to high mechanical forces, for example through frequent transport or rough handling, or storing the product for a long time may cause deviations and a decrease in the measurement accuracy. Periodically carry out test measurements and perform the field adjustments indicated in the User Manual before using the product.
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6.2

Storage

Product	Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to 7 Technical Data for information about temperature limits.
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Protection Cover	The sensor unit and its external optical parts can be protected from dust with the Protection Cover. Use the Protection Cover whenever the Laser Tracker is not in use.
-------------------------	---

Li-Ion batteries	<ul style="list-style-type: none">Refer to 7 Technical Data for information about storage temperature rangeRemove batteries from the product and the charger before storingAfter storage recharge batteries before usingProtect batteries from damp and wetness. Wet or damp batteries must be dried before storing or useA storage temperature range of 0 °C to +30 °C / +32 °F to +86 °F in a dry environment is recommended to minimize self-discharging of the batteryAt the recommended storage temperature range, batteries containing a 40% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged
-------------------------	---

Charger and AC/DC power supply	<ul style="list-style-type: none">Keep chargers and AC/DC power supply away from excessive dirt, dust and contaminantsAfter unpacking the product, visually inspect the charger for possible damagesUnplug the product from the outlet before attempting any maintenance or cleaning
---------------------------------------	--

6.3

Cleaning and Drying

6.3.1 General

Product and accessories	<ul style="list-style-type: none">Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.
--------------------------------	--

For power supplies and chargers:

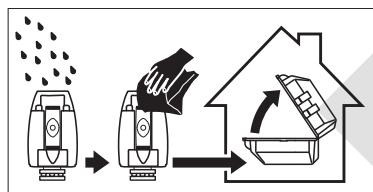
- Use only a clean, soft, lint-free cloth for cleaning.

Cables and plugs

Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Damp products

Dry the product, the transport container, the foam inserts and the accessories at a temperature not higher than 40°C /104°F and clean them. Remove the battery cover and dry the battery compartment. Do not repack until everything is completely dry. Always close the transport container when using in the field.



6.3.2

Cleaning Optical Parts

General

Optical elements, like the cover glass and reflectors, are sensitive to dirt moisture and mechanical damage, which influence the following factors:

- General functionality (loss of tracking)
- System accuracy (angular and distance accuracy)
- Intensity of laser beam (cover glass)

The cleaning intervals depend on the local conditions of use.

The following optical parts must be cleaned regularly:

- Cover Glass
- Retroreflectors



NOTICE

Improper cleaning

Improper cleaning can destroy optical surfaces which may lead to a malfunction.

Precautions:

- ▶ Cleaning of all optical parts requires great care.
- ▶ Only use appropriate cleaning material and follow the cleaning procedure described in this User Manual.

Cleaning Set

The cleaning set consists of the following articles:

- 1 Hand blower
- 1 Brush
- Cleaning swabs (large)
- Cleaning swabs (small)
- Cleaning cloth



Keep the cleaning set from soiling. Do not reuse swabs or tissues that are contaminated with dust or swarf particles.



If you need to replace cleaning materials, contact your local Leica Geosystems agency as source of supply.

Cleaning liquid

Use Isopropanol as cleaning liquid to soak tissues or cleaning swabs.



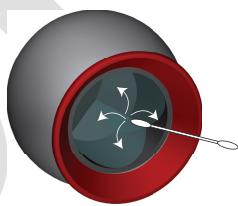
Keep the content of the liquid container clean. Do not dip the swabs into the liquid container, pour the liquid onto the swab or tissue.



Do not use common liquid cleaners or cleaning tissues for eyeglasses. They can damage or leave a residue on the optical surfaces.

Cleaning Optical Parts

To clean optical parts like cover glass, reflectors etc., use the following procedure:



1. Use hand blower to clear out dirt.

2. Never touch any glass surfaces with your fingers.

3. Use a hairbrush to loosen and remove remaining dirt.



Repeat procedure with the hand blower and brush until the residues of dirt have been removed.

4. Use the cotton swabs soaked in cleaning liquid to remove any remaining dirt.

BRR

A special procedure applies for the cleaning of Break Resistant Reflectors.

NOTICE**Improper cleaning by using mechanical force like brushes or cotton swabs**

Improper cleaning may destroy the coated surfaces of the Break Resistant Reflectors (BRR) and lead to a malfunction.

Precautions:

- For cleaning of Break Resistant Reflectors (BRR) follow the procedure described in the Product Information delivered with the product.

6.4**Maintenance****Service**

The product is a high-precision measuring instrument and to be handled with care. Maintenance of the equipment must be carried out by a Hexagon authorised Service Centre.

⚠ CAUTION

There are no user-serviceable parts inside the product.

Precautions:

- Do not open the product. Breaking the warranty seals will void the warranty.

Refer to [1 Safety Directions](#) for further details.

Service Intervals

The periodicity of service intervals is dependent on the conditions of use. We recommend a service contract with a yearly maintenance of the equipment. Please contact your local Hexagon representative or distributor for details.

Repairs

In case of visible damage, system failure or errors, contact your local Hexagon representative.

Physical Dimensions

AT500 Instrument	Dimensions
Size	261 mm x 239 mm x 477 mm
Transit Axis Height	1404 mm
Weight of AT500 Sensor	13.60 kg
Weight of GEB364 Battery	0.32 kg
Weight of Quick Release	1.25 kg
Quick Release Interface	3 ½" - 8 UNC

**Base Tube****Dimensions**

Size (Length)	862 mm effective length (875 mm overall length)
Weight	approximately 9.3 kg

Base Plate**Dimensions**

Size (Side Length)	615 mm overall length, 602 mm width
Weight	approximately 17.95 kg

Electrical Power**AT500 Instrument****Value**

Input Voltage at connector for external power	30 V - 48 V DC
Max. input current (over current protection)	4 A

AC/DC Adapter**Value**

Input Voltage	100 V to 240 V AC
Output Voltage	48 V DC

AC/DC Adapter	Value
Frequency	50/60 Hz
Power	180 W
Max. input AC current	1.7 A (115 V AC); 0.9 A (230 V AC)



Use only with Leica Geosystems provided power supply or power supplies approved by Leica Geosystems within LPS specification.

Battery GEB364

Internal Battery GEB364	Value
Type	Li-Ion
Nominal Voltage	10.8 V DC
Rated Capacity	6.9 Ah
Typical operating time	5 h to 6 h

Environmental Specifications

Temperature

Type	Operating temperature [°C]	Storage temperature [°C]
AT500 instrument	-15 to +50	-25 to +70

Humidity

Type	Protection
AT500 instrument	Max. 95%, non condensing. To avoid the effects of condensation, periodically dry out the instrument.

Elevation

Maximum Elevation	Range	
	[m]	[ft]
Operation	5500	18000
Storage	12000	39500

Protection against water, dust and sand

Type	Protection
AT500 instrument	IP54 (IEC 60529)

Noise Level

Type	Value
AT500 instrument	< 70 dB (A)

MeteoStation

Measurement range	Range	
Temperature (internal sensor)	-10 °C to +60 °C (14 °F to 158 °F)	
Temperature (external sensor)	-20 °C to +80 °C (14 °F to 158 °F)	
Pressure	500 hPa to 1100 hPa	
Humidity	0% to 95%	
Device	Measurement uncertainty	Applicable range
External Air/Object temperature	±0.3 °C	0 °C to 40 °C (32 °F to 104 °F)
Pressure	±1.0 hPa	0 °C to 40 °C (32 °F to 104 °F) 750 hPa to 1100 hPa
Humidity	±10% *	-

* Prerequisite: External air temperature sensor is connected.

Overview Camera

Description	Value
Focal length	20.6 mm
Field of view	Approximately 10° (horizontally & vertically)
	At 10 m: Horizontal ~ 1.5 m, Vertical ~ 1.5 m
Focus	~ 17 m (56 ft)
Video Output	Live image: VGA (640 x 480) Still image: 2MP; 5MP
Update Rate	10 fps
Target Recognition	Supported by ATR Image Processing

PowerLock

Description	Value
Field of View	Approximately 10° (horizontally & vertically)
Operating Range	2 m to 60 m (with 1.5" RRR)
Operating Wavelength	850 nm

WLAN module

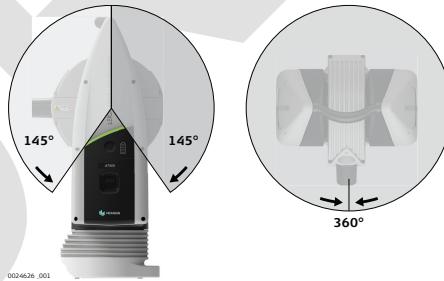
Standard	WLAN according to IEEE 802.11n, compatible with IEEE 802.11b/g
Channels	<ul style="list-style-type: none">1 to 11 (for Access Point Mode)1 to 13 (for Client Mode)
Frequencies	<ul style="list-style-type: none">2.412 to 2.462 (for Access Point Mode)2.412 to 2.4835 (for Client Mode)
Data Rate	Up to 150 Mbit/s

Operation Modes	<ul style="list-style-type: none"> Access Point Mode Client Mode (connect to external Access Point)
Encryption	<ul style="list-style-type: none"> WPA2 PSK None

Data output	Description	Value
	Measurement Data Output Rate	100 points/s

Motorisation	AT500 instrument	Value
	Maximum rotation speed	180°/s
	Acceleration lateral	675°/s ²
	Acceleration radial	180 m/s ²
	Tracking speed lateral	145°/s
	Tracking speed radial	6 m/s

Measurement Range	Angular measurement range	Value				
	Horizontal	endless				
	Vertical	<table> <tr> <td>Face 1</td> <td>+75°/-55°</td> </tr> <tr> <td>Face 2</td> <td>+85°/-55°</td> </tr> </table>	Face 1	+75°/-55°	Face 2	+85°/-55°
Face 1	+75°/-55°					
Face 2	+85°/-55°					
Distance measurement range	Value AT500					
		Reflector 1.5" RRR				
		0.8 m to 80 m (guaranteed range)				
		0.8 m to 160 m (typical range with selected 1.5" reflectors)				



Angular Measurement	Description	Value
	Resolution	0.07 arc sec
	Angular repeatability	±7.5 µm + 3 µm/m

Description		Value
Absolute Angular Performance, transverse eT		$\pm 15 \mu\text{m} + 6 \mu\text{m}/\text{m}$

Inclination Sensor

Description		Value
Setting accuracy		$\pm 1.0 \text{ arc sec} (2\sigma)$
Compensated measuring range for Orient to Gravity (OTG)		$\pm 227 \text{ arc sec}$
Measuring range		$\pm 616 \text{ arc sec}$
Compensation method		Lengthwise & crosswise

Orient to Gravity

Description		Value
Orient to Gravity Uncertainty $U_Z(\text{OTG})$		$\pm 15 \mu\text{m} + 8 \mu\text{m}/\text{m}$

7.1

Conformity to National Regulations

Labelling AT500 Instrument



Antennas

Type	Antenna	Gain [dBi]
WLAN	Flexible Planar Inverted F Antenna (Flex-PIFA)	2
Bluetooth	Flexible Planar Inverted F Antenna (Flex-PIFA)	2

Frequency bands, output power	Type	Frequency band [MHz]	Output power ¹⁾ [dBm]
	Bluetooth LE	2400-2480	+10
	WLAN 2.4 GHz	2400-2480	+20

Radiation Exposure Statement

The radiated output power of the instrument is below the radio frequency exposure limits. Nevertheless, the instrument should be used in such a manner that the potential for human contact during normal operation is minimised. To avoid the possibility of exceeding the radio frequency exposure limits, keep a distance of at least 5 cm between you (or any other person in the vicinity) and the instrument.

EU



Hereby, Leica Geosystems AG declares that the radio equipment type AT500 is in compliance with Directive 2014/53/EU and other applicable European Directives.

The full text of the EU declaration of conformity is available at the following Internet address: <http://www.leica-geo-systems.com/ce>.

USA

Contains FCC ID: 2AJY6MORIN01; SQQL654
FCC Part 15 B/C

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, it may cause harmful interference to radio communications.

However, there is no guarantee that interference does not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

¹⁾ Conducted power for mobile technologies and EIRP for other technologies.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

In order to comply with FCC RF Exposure requirements, this device must be installed to provide at least 5 cm separation from the human body at all times.

Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Canada

CAN ICES-003 B/NMB-003 B

Contains IC: 22172-MORIN01; 3147A-BL654

Canada Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference
2. This device must accept any interference, including interference that may cause undesired operation of the device

Canada Déclaration de Conformité

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

In order to comply with FCC / ISED RF Exposure requirements, this device must be installed to provide at least 5 cm separation from the human body at all times.

Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 5 cm de séparation du corps humain en tout temps.

Japan

- This device is granted pursuant to the Japanese Radio Law (電波法).
- This device should not be modified (otherwise the granted designation number will become invalid).

Others

The conformity for countries with other national regulations has to be approved prior to use and operation.

7.1.1

Dangerous Goods Regulations

Dangerous Goods Regulations

Many products of Leica Geosystems are powered by Lithium batteries.

Lithium batteries can be dangerous under certain conditions and can pose a safety hazard. In certain conditions, Lithium batteries can overheat and ignite.



When carrying or shipping your Leica product with Lithium batteries onboard a commercial aircraft, you must do so in accordance with the **IATA Dangerous Goods Regulations**.



Leica Geosystems has developed **Guidelines** on "How to carry Leica products" and "How to ship Leica products" with Lithium batteries. Before any transportation of a Leica product, we ask you to consult these guidelines on our web page ([IATA Lithium Batteries](#)) to ensure that you are in accordance with the IATA Dangerous Goods Regulations and that the Leica products can be transported correctly.



Damaged or defective batteries are prohibited from being carried or transported onboard any aircraft. Therefore, ensure that the condition of any battery is safe for transportation.

International Limited Warranty

This product is subject to the terms and conditions set out in the International Limited Warranty which you can download from the Leica Geosystems home page at [Leica Warranty](#) or collect from your Leica Geosystems distributor.

Software Licence Agreement

This product contains software that is preinstalled on the product, or that is supplied to you on a data carrier medium, or that can be downloaded by you online according to prior authorisation from Leica Geosystems. Such software is protected by copyright and other laws and its use is defined and regulated by the Leica Geosystems Software Licence Agreement, which covers aspects such as, but not limited to, Scope of the Licence, Warranty, Intellectual Property Rights, Limitation of Liability, Exclusion of other Assurances, Governing Law and Place of Jurisdiction. Please make sure, that at any time you fully comply with the terms and conditions of the Leica Geosystems Software Licence Agreement.

Such agreement is provided together with all products and can also be referred to and downloaded at the Leica Geosystems home page at [Hexagon – Legal Documents](#) or collected from your Leica Geosystems distributor.

You must not install or use the software unless you have read and accepted the terms and conditions of the Leica Geosystems Software Licence Agreement. Installation or use of the software or any part thereof, is deemed to be an acceptance of all the terms and conditions of such Licence Agreement. If you do not agree to all or some of the terms of such Licence Agreement, you must not download, install or use the software and you must return the unused software together with its accompanying documentation and the purchase receipt to the distributor from whom you purchased the product within ten (10) days of purchase to obtain a full refund of the purchase price.

Open source information

The software on the product may contain copyright-protected software that is licensed under various open source licences.

Copies of the corresponding licences:

- are provided together with the product (for example in the About panel of the software).
- can be downloaded on the Tracker website:
[/XX.XX.XX.XXX/OpenSourceTracker.html](http://XX.XX.XX.XXX/OpenSourceTracker.html)

Download open source licence:

1. Note the IP address of the Laser Tracker.



It is displayed on the AT500 Connect App screen on any of the network connection pages in defined digits:
XXX.XXX.XXX.XXX



Be sure that the application computer is connected within the same network as the Laser Tracker.

2. On the application computer:
Type **//XXX.XXX.XXX.XXX/OpenSourceTracker.html** into the address bar of the browser with the inserted real IP value for
XXX.XXX.XXX.XXX



//XXX.XXX.XXX.XXX/OpenSourceTracker.html

3. Press enter.
The open source licence website opens.

If foreseen in the corresponding open source licence, you may obtain the corresponding source code and other related data by email. Please contact therefore oss.tracker.mi@hexagon.com.

Appendix A Abbreviations

Abbreviations

The following abbreviations are used in this manual:

Term	Description
3D	three-dimensional
ADM	Absolute Distance Meter
AP	Application Processor
AT	Absolute Tracker
ATR	Automatic Target Recognition
BRR	Break Resistant Reflector
EMC	Electromagnetic Compatibility
EN	Standard of the European Committee for Standardization
IEC	International Electrotechnical Commission
ISO	International Standards Organisation
LED	Light Emitting Diode
LMF	Leica Metrology Foundation
LPS	Limited Power Source
MPE	Maximum Permissible Error
RJ45	Registered Jack 45, standardised physical interface for connecting telecommunication equipment.
RRR	Red Ring Reflector
SMR	Spherically Mounted Reflector
TBR	Tooling Ball Reflector
TCP/IP	Transmission Control Protocol/Internet Protocol
UNC	Unified National Coarse Thread

Appendix B Regional Contact Addresses

Regional Contact Addresses

Visit <https://www.hexagonmi.com/contact-us> to find the contact details of your local Hexagon distributor or representative.

DRAFT

958651-1.2.0en

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- when it has to be **right**

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