



Version 5.0
English

Leica ScanStation P16 User Manual

- when it has to be **right**

Leica
Geosystems

Introduction

Purchase

Congratulations on the purchase of a ScanStation P16 series instrument.



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.

Product Identification

The model and serial number of your product are indicated on the type plate. Always refer to this information when you need to contact your agency or Leica Geosystems authorised service centre.

Leica Geosystems Address Book

On the last page of this manual, you can find the address of Leica Geosystems headquarters. For a list of regional contacts, please visit **http://leica-geosystems.com/contact-us/sales_support**.

Trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and other countries
- Bluetooth® is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Table of Contents

| In this manual | Chapter | Page |
|----------------|--|-----------|
| | 1 Safety Directions | 7 |
| | 1.1 General Introduction | 7 |
| | 1.2 Definition of Use | 10 |
| | 1.3 Limits of Use | 12 |
| | 1.4 Responsibilities | 13 |
| | 1.5 Hazards of Use | 14 |
| | 1.5.1 For Power Supplies | 18 |
| | 1.6 Laser Classification | 20 |
| | 1.6.1 General | 20 |
| | 1.6.2 Scanning Laser | 22 |
| | 1.6.3 Laser Plummet | 25 |
| | 1.7 Electromagnetic Compatibility EMC | 28 |
| | 1.8 FCC Statement, Applicable in U.S. | 31 |
| | 2 Description of the System | 37 |
| | 2.1 Packing / Unpacking the Instrument | 37 |
| | 2.2 Container Contents | 38 |
| | 2.3 System Components | 40 |

| | | |
|----------|---|-----------|
| 2.4 | Power Concept | 42 |
| 2.4.1 | Batteries | 42 |
| 2.4.2 | Chargers and Power Supplies | 44 |
| 2.5 | Other Components | 49 |
| 2.6 | Cabling | 50 |
| 2.6.1 | About Chargers and Power Supply | 52 |
| 2.7 | Field of View (FoV) | 54 |
| 2.8 | User Interface | 55 |
| 2.8.1 | Face Plate | 55 |
| 2.8.2 | Screen | 56 |
| 2.8.3 | Icons | 58 |
| 2.8.4 | Operating Principles | 60 |
| 3 | Operation | 61 |
| <hr/> | | |
| 3.1 | Instrument Setup | 61 |
| 3.1.1 | General Information | 61 |
| 3.1.2 | Tripod Setup | 62 |
| 3.1.3 | Setup Over a Benchmark with the Internal Laser Plummet | 64 |
| 3.2 | Power Supply | 68 |
| 3.2.1 | Operating Principles | 68 |
| 3.2.2 | Battery and Charger Safety | 69 |

| | | |
|----------|---|------------|
| 3.2.3 | Charging Station | 72 |
| 3.2.4 | Internal Battery | 78 |
| 3.2.5 | External Battery | 80 |
| 3.3 | Scanning | 82 |
| 3.3.1 | Switching the System On/Off | 82 |
| 3.3.2 | Ambient Conditions | 84 |
| 3.3.3 | Onboard Controls | 86 |
| 3.3.4 | Troubleshooting | 89 |
| 4 | Care and Transport | 93 |
| 4.1 | Check & Adjust | 93 |
| 4.2 | Transport | 94 |
| 4.3 | Storage | 95 |
| 4.4 | Cleaning and Drying | 96 |
| 4.5 | Glass Cleaning Procedure | 98 |
| 4.6 | Checking and Adjusting the Circular Level of the Tribrach | 100 |
| 4.7 | Servicing the Tripod | 102 |
| 4.8 | Inspecting the Laser Plummet of the Instrument | 103 |
| 5 | Technical Data | 105 |
| 5.1 | General Technical Data of the Instrument | 105 |
| 5.2 | System Performance | 108 |

| | | |
|----------|------------------------------------|------------|
| 5.3 | Laser System Performance | 109 |
| 5.4 | Electrical Data | 113 |
| 5.4.1 | Pin Assignment of Lemo Ports | 116 |
| 5.5 | Environmental Specifications | 120 |
| 5.5.1 | ScanStation | 120 |
| 5.5.2 | Charger and Batteries | 122 |
| 5.6 | Dimensions | 124 |
| 5.7 | Weight | 126 |
| 5.8 | Accessories | 127 |
| 5.9 | Conformity to National Regulations | 128 |
| 5.9.1 | ScanStation P16 | 128 |
| 5.9.2 | Dangerous Goods Regulations | 130 |
| 6 | Software Licence Agreement | 131 |

| | | |
|-----|---------------------------------|-----|
| 6.1 | End User Licence Agreement EULA | 132 |
|-----|---------------------------------|-----|

1

Safety Directions

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. |

| Type | Description |
|---|--|
|  | Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner. |

1.2

Definition of Use

Intended use

- Measuring horizontal and vertical angles.
 - Measuring distances.
 - Scanning objects.
 - Capturing and recording images.
 - Recording measurements.
 - Computing with software.
 - Remote control of product.
 - Data communication with external appliances.
-

Reasonably foreseeable misuse

- Use of the product without instruction.
 - Use outside of the intended use and limits.
 - Disabling safety systems.
 - Removal of hazard notices.
 - Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
 - Modification or conversion of the product.
 - Use after misappropriation.
 - Use of products with obvious damages 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.
-

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.



DANGER

Local safety authorities and safety experts must be contacted before working in hazardous areas, or close to electrical installations or similar situations by the person in charge of the product.

Environmental conditions for indoor chargers

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 it is used in accordance with the instructions.
 - To be familiar with local regulations relating to safety and accident prevention.
 - To inform Leica Geosystems immediately if the product and the application becomes unsafe.
 - To ensure that the national laws, regulations and conditions for the operation of the product are respected.
-

1.5

Hazards of Use

**DANGER**

Because of the risk of electrocution, it is dangerous to use poles, levelling staffs and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:

Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.

**WARNING**

If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.

Precautions:

Do not use the product in a thunderstorm.

-  **WARNING** During dynamic applications, for example stakeout procedures 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** Inadequate securing of the working site 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.
-
-  **WARNING** Only Leica Geosystems authorised service centres are entitled to repair these products.
-
-  **WARNING** High mechanical stress, high ambient temperatures or immersion into fluids can cause leakage, fire or explosions of the batteries.
Precautions:
Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.
-

**WARNING**

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:

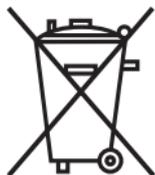
Make sure that the battery terminals do not come into contact with metallic objects.

**WARNING**

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.

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.



CAUTION

Watch out for erroneous measurement results if the product has been dropped or has been misused, modified, stored for long periods or transported.

Precautions:

Periodically carry out test measurements, particularly after the product has been subjected to abnormal use and before and after important measurements.



CAUTION

During the operation of the product, there is a hazard of squeezing extremities or entanglement of hair and/or clothes by moving parts.

Precautions:

Keep a safe distance of the moving parts.

-
-  **CAUTION** 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.
-
-  **CAUTION** 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 of it, discharge the batteries by running 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.
-

1.5.1

For Power Supplies



WARNING

If charged or discharged, batteries not recommended by Leica Geosystems may be damaged. They may burn and explode.

Precautions:

Only charge and discharge batteries recommended by Leica Geosystems.



WARNING

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

Precautions:

To avoid electric shock power cable and power outlet must be grounded.



WARNING

The product is not designed for use under wet and severe conditions. If unit becomes wet it may cause you to receive an electric shock.

Precautions:

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



1.6

1.6.1

Laser Classification

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:

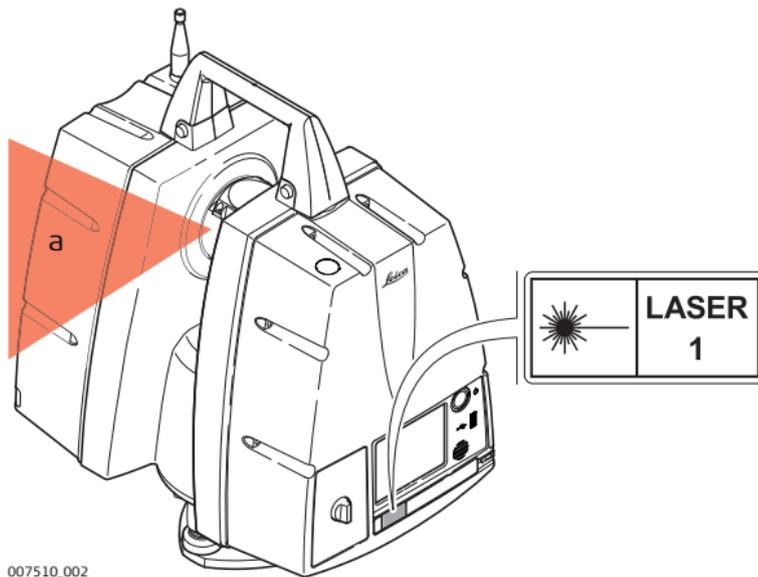
- laser safety officer involvement,
- protective clothes and eyewear,
- special warning signs in the laser working area

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).

Labelling



007510.002

a) Laser beam

1.6.2

Scanning Laser

General

The laser incorporated in the product produces a laser beam which emerges from the rotating mirror.

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.

Visible Laser:

| Description | Value |
|-----------------------|------------|
| Wavelength | 658 nm |
| Maximum radiant power | 0.23 mW cw |
| Beam divergence (1/e) | < 1.5 mrad |

Invisible Laser:

| Description | Value |
|------------------------------------|--------------|
| Wavelength | 1550 nm |
| Maximum pulse energy | 135 nJ |
| Pulse duration | 0.75 ns |
| Pulse repetition frequency (PRF) | 1 MHz |
| Beam divergence (FWHM, full angle) | < 0.23 mrad |
| Mirror rotation | 4 Hz |
| Base rotation | 16 μ Hz |

1.6.3

Laser Plummet

General

The laser incorporated in the product produces a visible red laser beam which emerges from the bottom of the product.

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

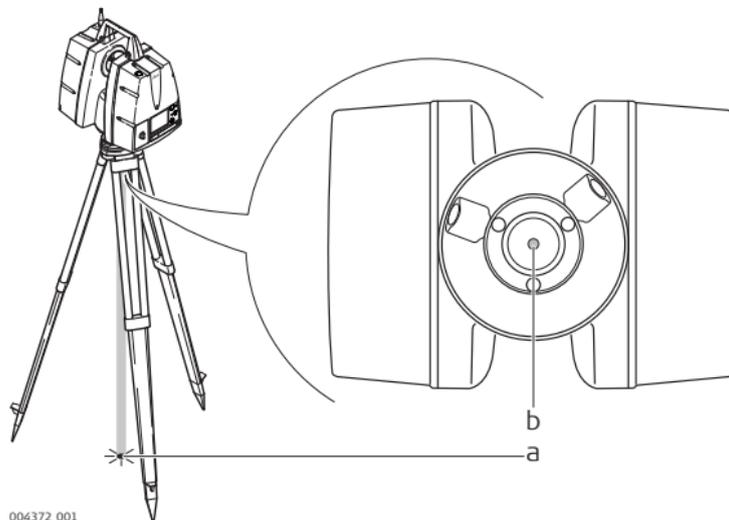
- IEC 60825-1 (2014-05): "Safety of laser products".

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 |
|-------------------------------|------------------|
| Maximum average radiant power | < 0.39 mW |
| Pulse duration | 714 ns |
| Pulse repetition frequency | 700 kHz |
| Wavelength | 640 nm |
| Pulse package duration | max. 475 μ s |
| Pulse package PRF | 1 kHz |

| Description | Value |
|-----------------|------------|
| Beam divergence | < 1.5 mrad |

Laser plummet beam



- a) Plummet laser beam
- b) Laser exit window

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.



WARNING

Electromagnetic radiation can cause disturbances in other equipment.

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.

Radios or Digital Cellular Phones



WARNING

Use of product with radio or digital cellular phone devices:

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in aircraft. It 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 to medical equipment.
- Do not operate the product with radio or digital cellular phone devices in aircraft.

**CAUTION**

There is a risk that disturbances may be caused in other equipment if the product is used with accessories from other manufacturers, for example field computers, personal computers or other electronic equipment, non-standard cables or external batteries.

Precautions:

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

 **CAUTION** Disturbances caused by electromagnetic radiation can result in erroneous measurements. 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 product may be disturbed by intense electromagnetic radiation, for example, near radio transmitters, two-way radios or diesel generators.

Precautions:

Check the plausibility of results obtained under these conditions.

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

Precautions:

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

1.8

FCC Statement, Applicable in U.S.



WARNING

The greyed paragraph below is only applicable for products without radio.

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.

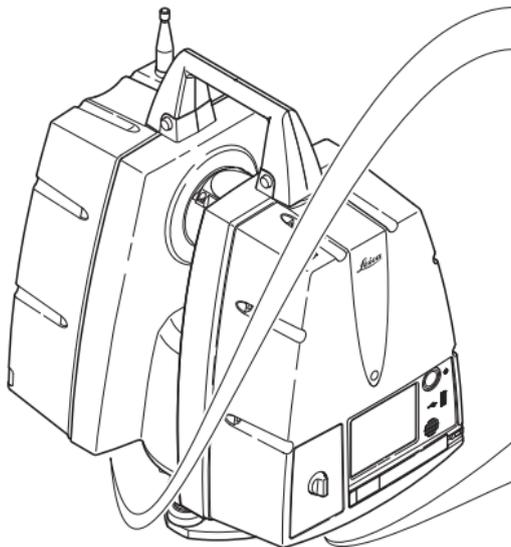
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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:

- 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.
-

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

FCC Labelling Scan-Station P16



007888_003

This device contains:

WLAN 802.11 b/g/n module
 FCC-ID:TK4-10-WLE200NX
 IC-ID:7849A-WLE200NX

Bluetooth radio module
 FCC-ID:PVH0946
 IC-ID:5325A-0946



Type: ScanStation ... Art.No.:

Equip.No.: S.No.:

Power:

Leica Geosystems AG
 CH-9435 Heerbrugg
 Manufactured: 20XX
 Made in Switzerland



Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

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.

FCC Labelling GEB242



008682_001

Leica Type: **GEB242** Art.No.: 793975
Li-Ion Battery: 14.8V \equiv /5.8Ah
 \equiv 15A \equiv 5A/130°C 85.8Wh
Leica Geosystems AG, CH-9435 Heerbrugg
S.No.: 10142
Made in China



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.

C **RU** **US**
11WE
MH29443

Type Plate Label- ling GKL311



009194_001

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.

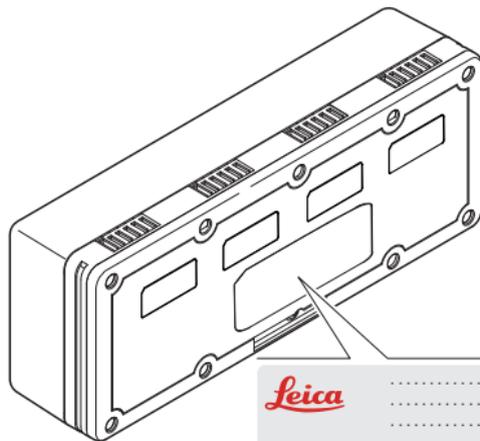
Type Plate Label-
ling GKL341



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.

009195_001

FCC Labelling GEB271

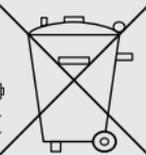


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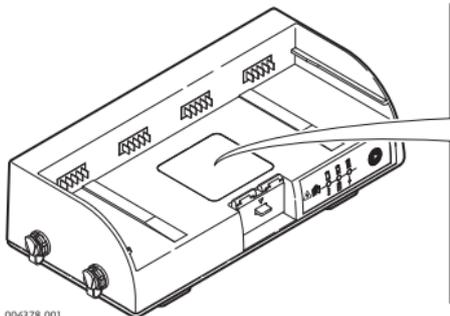
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

 **UL US LISTED**
ITS Accessories
E175076 .70YL

004377_001

FCC Labelling GKL271



00-4378_001

..... Art.No:
.....
..... S.No:xxxx
.....
.....
.....
.....
.....

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 interferences, and
2) This device must accept any interference received,
including interference that may cause undesired operation.

2

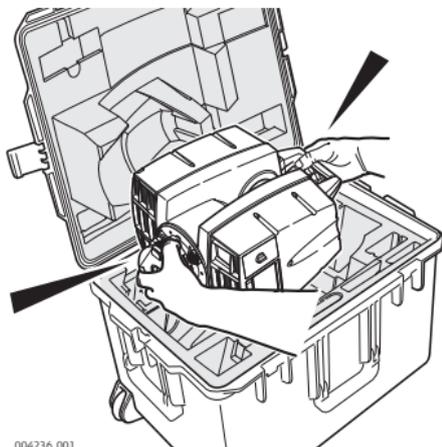
Description of the System

2.1

Packing / Unpacking the Instrument

Packing and Unpacking

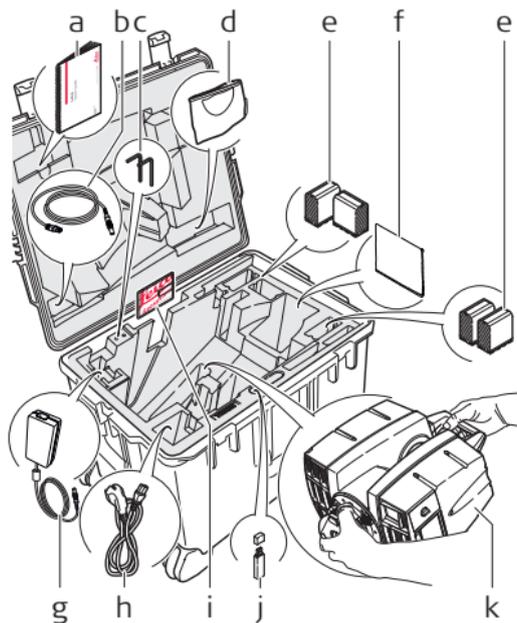
When in its transport container, the ScanStation P16 can sit in either a face-up or face-down position.



To take the instrument out of its container, grasp the handle and the base of the instrument, and lift. Use caution due to the weight of the instrument (12 kg).

2.2 Container Contents

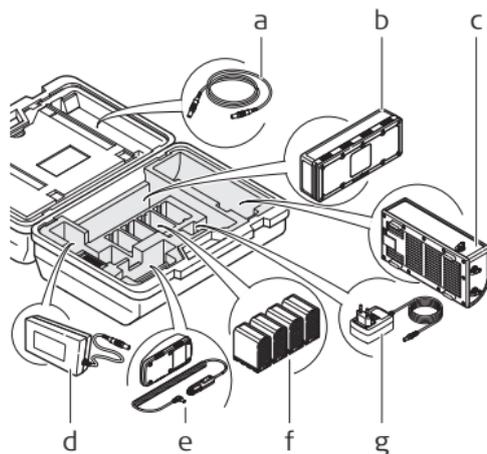
Transport Container for ScanStation P16



007889_001

- a) ScanStation P16 Quick Guide
- b) GEV228 Ethernet cable
- c) Allen keys
- d) Protection cover
- e) GEB242 internal batteries
- f) Cleaning tissue
- g) GKL123 AC power supply (not supplied with the system)
- h) Power cable, country specific
- i) ScanStation P16 System USB Swing Card
- j) USB memory stick, not supplied with the system
- k) ScanStation P16

Transport Container for Scan-Station P16 accessories

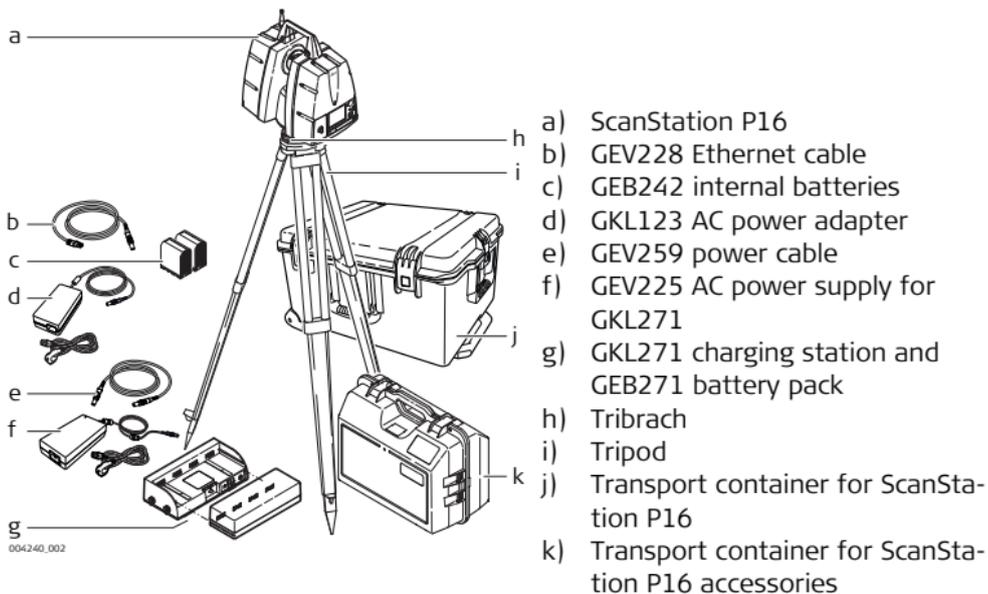


004239_003

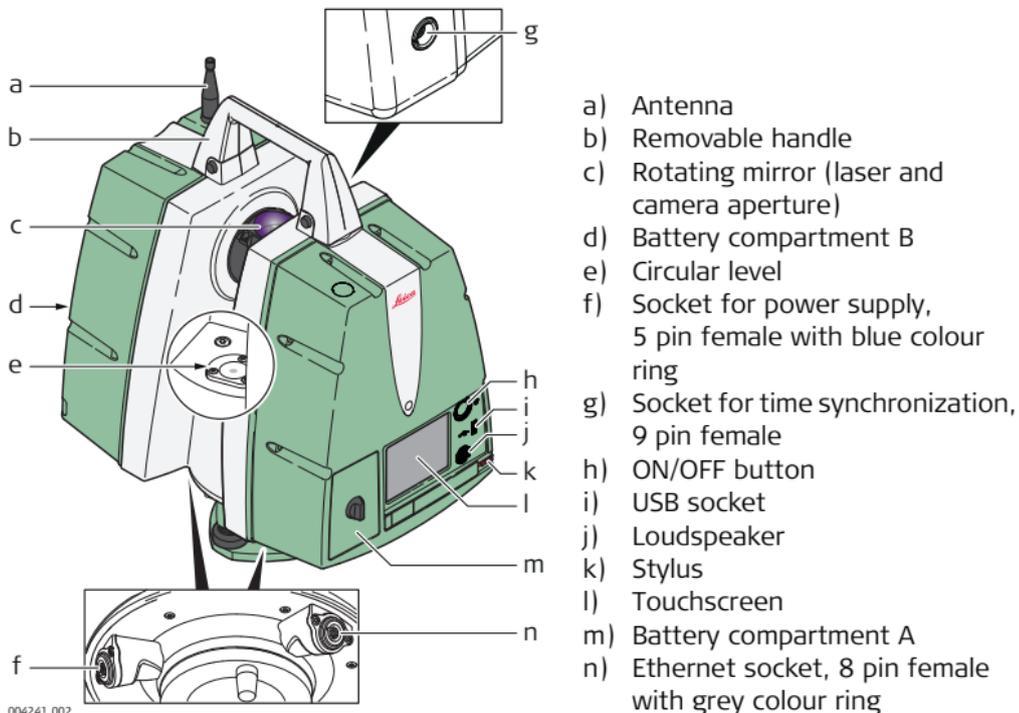
- a) GEV259 power cable
- b) GEB271 external battery pack
- c) GKL271 charging station
- d) GEV225 AC power supply for GKL271 charging station
- e) GKL311 Single-bay Charger Professional 3000
- f) GEB242 internal batteries
- g) AC/DC adapter for charger

2.3 System Components

System components ScanStation P16



Components of the ScanStation P16



2.4 Power Concept

2.4.1 Batteries

GEB242 Li-Ion
internal battery

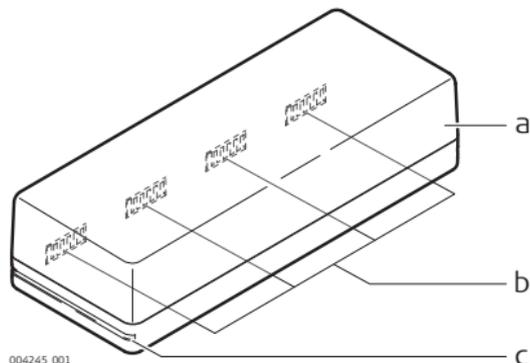


- a) GEB242 internal battery
- b) Electrical contacts

GEB271 battery pack



The GEB271 battery pack can only be used together with the GKL271 charging station.



- a) Battery pack
- b) Battery connector interface, female
- c) Guide rail for fitting with charging station

2.4.2

Chargers and Power Supplies

GKL311 Single-bay
Charger Profes-
sional 3000



009201_001



For more details refer to the GKL311 User Manual.

**GKL341 Multi-bay
Charger Profes-
sional 5000**



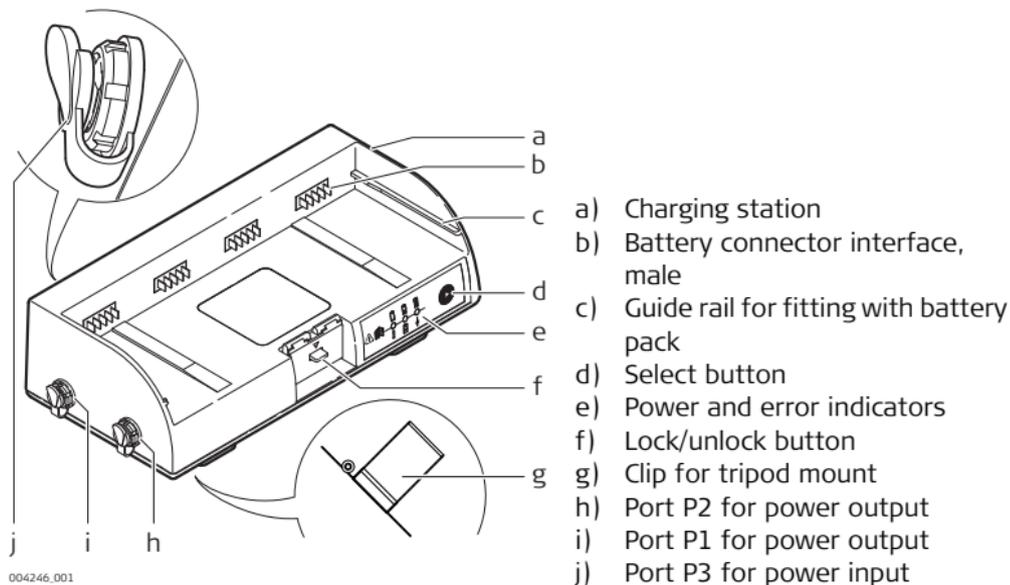
009202_001



For more details refer to the GKL341 User Manual.

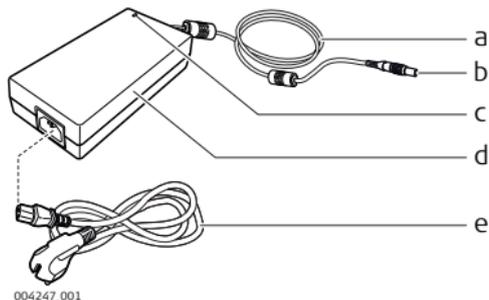
**GKL271 charging
station**

GKL271 charging station for the GEB271 battery pack.



GEV225 AC power supply

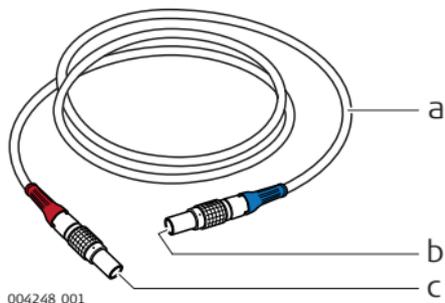
GEV225 AC power supply for the GKL271 charging station.



- a) AC power supply cable
- b) Connector 3pin, male with blue bend protection
- c) Power indicator LED
- d) AC power supply
- e) Mains power cable, country specific

GEV259 power cable for ScanStation P16

Connects ScanStation P16 to GKL271 charging station.



- a) Cable
- b) Connector 5-pin, male with blue bend protection
- c) Connector 4-pin, male with red bend protection

GKL123 AC power supply

AC power supply for the ScanStation P16.



004249_002

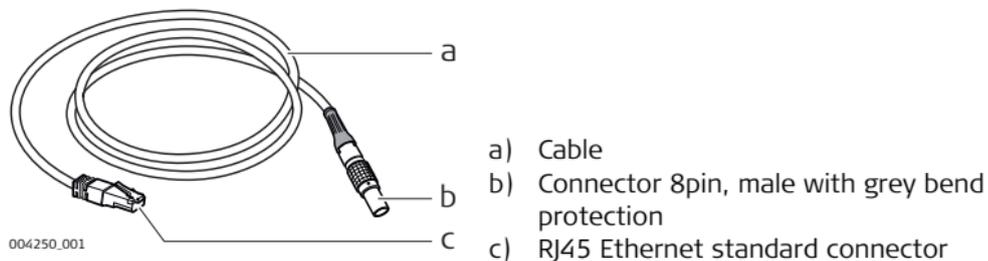
- a) Cable and connector 5 pin, male with blue bend protection
- b) Power indicator LED
- c) GKL123 AC power supply unit
- d) Mains power cable, country specific

2.5

Other Components

GEV228 Ethernet cable

Connects the ScanStation P16 to an Ethernet network or directly to a computer.

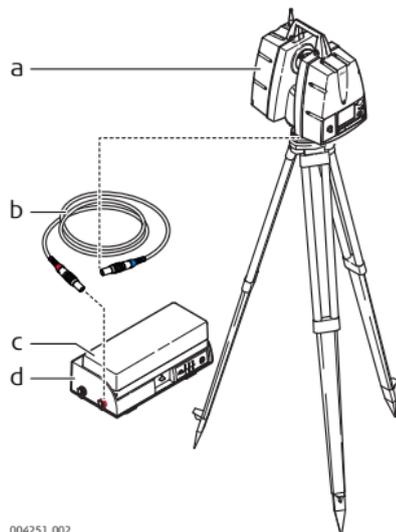


2.6

Cabling

Cabling for Scan-Station P16 with GEB271 battery pack

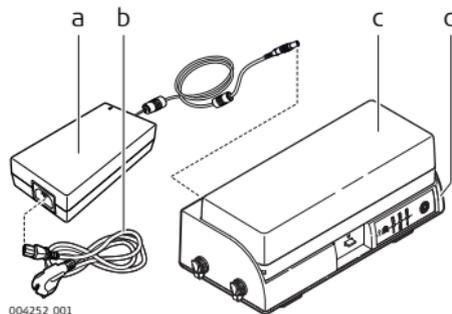
The following illustration shows the correct cabling to connect the ScanStation P16 to a GEB271 battery pack.



- a) ScanStation P16
- b) GEV259 power cable
- c) GEB271 battery pack
- d) GKL271 charging station

Power supply for GKL271 charging station

The following illustration shows the charging station setup.
See "Hazards of Use" for additional safety information.



- a) GEV225 AC power supply
- b) Mains power cable, country specific
- c) GEB271 battery pack
- d) GKL271 charging station

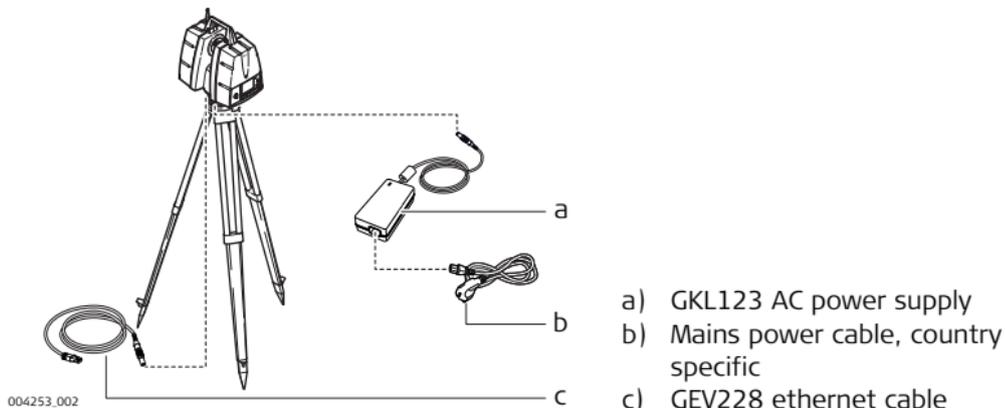
-  The GEV225 AC power supply cannot be used as an AC power supply for the scanner. It is designed exclusively for powering the charging station and must not be connected to the instrument.
 -  The GEB271 battery pack can only be used together with the GKL271 charging station.
-

Cabling for ScanStation P16 with GKL123 AC power supply

The following illustration shows the correct cabling to connect the ScanStation P16 to a GKL123 AC power supply.



See "Hazards of Use" for additional safety information.



The GKL123 AC power supply cannot be used as an AC power supply for the battery charging station. It is designed exclusively for powering the ScanStation P16 and must not be connected to any other device.

2.6.1

About Chargers and Power Supply



WARNING

The product is not designed for use under wet and severe conditions. If unit becomes wet it may cause you to receive an electric shock.

Precautions:

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



WARNING

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

Precautions:

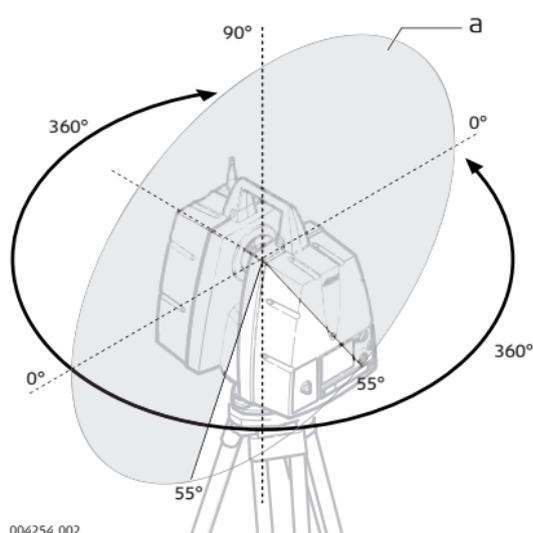
To avoid electric shock power cable and power outlet must be grounded.



2.7 Field of View (FoV)

Field of View

The instrument has a rotating scan-head and a rotating mirror that covers a $360^\circ \times 290^\circ$ field of view (FoV).



a) Scanning laser beam

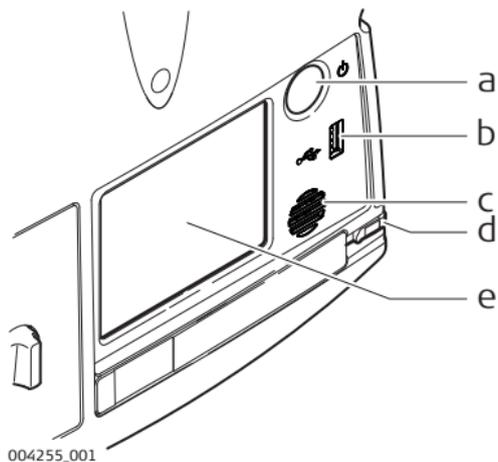
2.8

User Interface

2.8.1

Face Plate

Overview of face plate

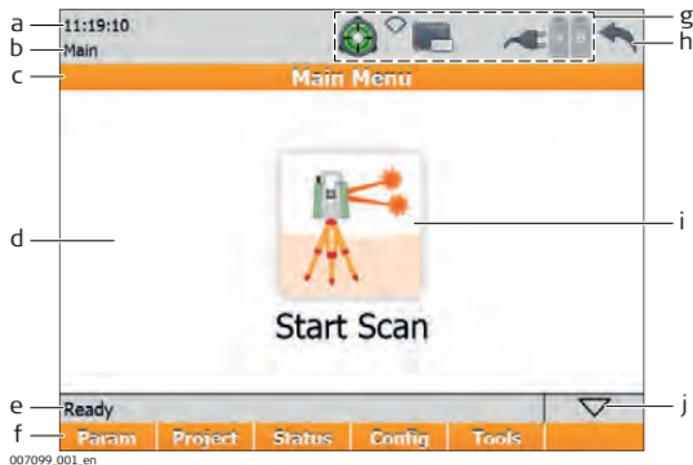


- a) ON/OFF button
- b) USB socket
- c) Loudspeaker
- d) Stylus
- e) Touchscreen user interface

2.8.2

Screen

Screen overview



007099_001_en

| Element | Description |
|-----------|----------------------------------|
| Time | The current local time is shown. |
| Caption | Shows location in menu system. |
| Title bar | Shows name of current screen. |

| Element | Description |
|----------------|---|
| Screen area | Working area of the screen. |
| Message bar | Shows messages. |
| Soft keys | Commands can be executed with the soft keys. |
| Status bar | Shows current status information of the instrument. |
| Escape button | Returns to the previous screen. |
| Menu icon | Selecting menu icons opens submenus. |
| SHIFT button | Displays the second level of soft keys. |

2.8.3

Icons

Status bar icons

Status bar icons display status information of the instrument. Their appearance changes accordingly to the system status.

Overview of status bar icons



Clicking a status icon gives direct access to a detailed status description.



009219_003

- a) Range filter
- b) Wake up mode
- c) Dual-axis compensator
- d) WiFi status
- e) Bluetooth status
- f) Internal hard disc
- g) External memory
- h) Status of external memory
- i) External camera
- j) External battery / AC power supply
- k) Internal battery **A**
- l) Internal battery **B**



Internal battery A indicates the status of the battery in compartment **A** which is located at the same side cover as the touchscreen.



Internal battery B indicates the status of the battery in compartment **B** at the opposite side cover without a screen.



For a complete description of all status bar icons refer to the Leica ScanStation P16 System Field Manual.

2.8.4

Operating Principles

Keyboards on touchscreen

The system offers two different virtual keyboard layouts for user input:

- When an **alphanumeric input field** is selected with the stylus, the keyboard will appear in alphanumeric layout. This layout offers letters, numbers and special characters.
- When an **numeric input field** is selected with the stylus, the keyboard will appear in numeric layout. This layout offers numbers and some special characters.



For a complete description of the virtual keyboards refer to the Leica ScanStation P16 System Field Manual.

3

3.1

3.1.1

Operation

Instrument Setup

General Information

Use the tripod

The instrument should always be set up on its tripod. Using the tripod specified for the scanning system guarantees maximum stability during scanning operations.



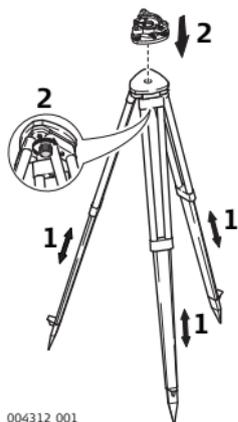
Always set up the instrument on its tripod. Do not set up the instrument directly on the ground for scanning operations.



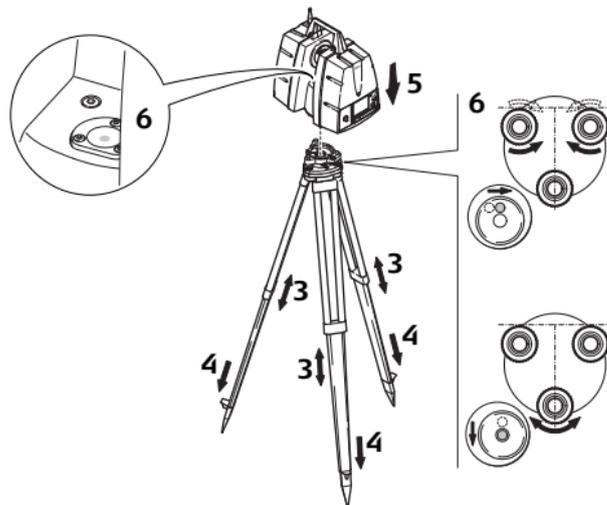
It is always recommended to shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.

3.1.2 Tripod Setup

ScanStation setup
step-by-step



004312_001





Shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.

| Step | Description |
|------|---|
| 1. | Extend the tripod legs to allow for a comfortable working posture. Tighten the screws at the bottom of the legs. |
| 2. | Place the tribrach on the tripod and secure it with the central fixing screw. |
| 3. | Set up the tripod so that the tripod plate is as horizontal as possible. |
| 4. | Push the tripod legs firmly into the ground. |
| 5. | Place the instrument on the tribrach and secure it with the locking knob of the tribrach. |
| 6. | Level up the instrument using the instrument's circular level. Turn two of the foot screws together in opposite directions. The index finger of your right hand indicates the direction in which the bubble should move. Now use the third foot screw to centre the bubble. |

3.1.3 Setup Over a Benchmark with the Internal Laser Plummet

Description

This topic describes an instrument setup over a marked ground point using the laser plummet.



It is always possible to set up the instrument without the need for a marked ground point.

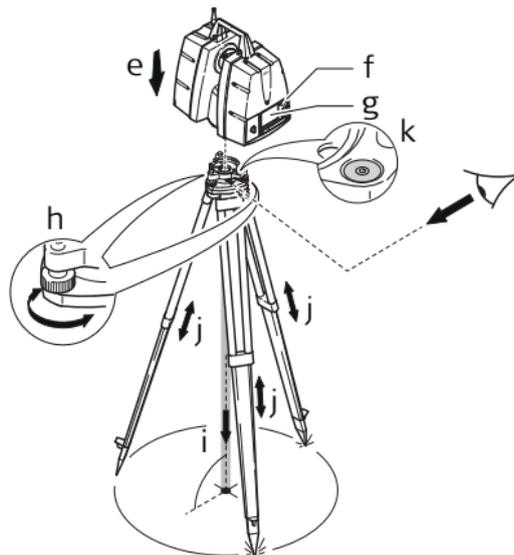
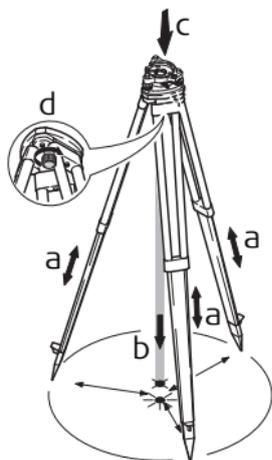


With the dual-axis compensator enabled, the data scanned with ScanStation P16 is corrected automatically.

About the plummet:

- The laser plummet described in this topic is built into the vertical axis of the instrument. It projects a red spot onto the ground, making it much easier to centre the instrument.
 - The laser plummet cannot be used in conjunction with a tribrach equipped with an optical plummet.
-

Setup with Laser Plummet step-by-step





Shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.

| Step | Description |
|------|---|
| 1. | Extend the tripod legs to allow for a comfortable working posture (a). Position the tripod approximately over the marked ground point, centring it as well as possible (b). |
| 2. | Place the tribrach on the tripod (c) and secure it with the central fixing screw (d). |
| 3. | Place the instrument on the tribrach (e) and secure it with the tribrach's locking knob. |
| 4. | Turn on the instrument by pressing the ON/OFF button (f). Go to Status, Level and Laser Plummet, Plummet and activate the laser plummet (g). |
| 5. | Move the tripod legs (a) and use the tribrach footscrews (h) to centre the plummet (i) over the ground point. |
| 6. | Adjust the tripod legs (j) to level the circular level (k). |
| 7. | By using the electronic level (Status, Level and Laser plummet, Level) turn the tribrach footscrews (h) to precisely level the instrument. |
| 8. | Centre the instrument precisely over the ground point (i) by shifting the tribrach on the tripod plate. |
| 9. | Repeat steps 7. and 8. until the required accuracy is achieved. |

3.2

Power Supply

3.2.1

Operating Principles

About the battery pack

As the battery pack contains rechargeable cells it is always recommended to handle the battery and charging station with care.



Observe the LEDs on the charging station before and after the charging process, as well as during operation. For details please refer to section "About the Charger".



When port P3 is connected for charging, both ports P1 and P2 cannot be used for operation: no simultaneous charging and discharging.



When port P1 is connected for operation, port P2 cannot be used for operation and vice versa: no simultaneous operation of two ports.



The ScanStation P16 can only be powered via P2.

3.2.2 Battery and Charger Safety

General

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



WARNING

The product is not designed for use under wet and severe conditions. If unit becomes wet it may cause you to receive an electric shock.

Precautions:

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



First-time Use/Charging Batteries

- The battery must be charged before using it for the first time because it is delivered with an energy content as low as possible.
- 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 only one charge/discharge cycle.
- For Li-Ion batteries, a single discharging and charging 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 / Discharging

- 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.
-

**Cold temperature
battery manage-
ment**

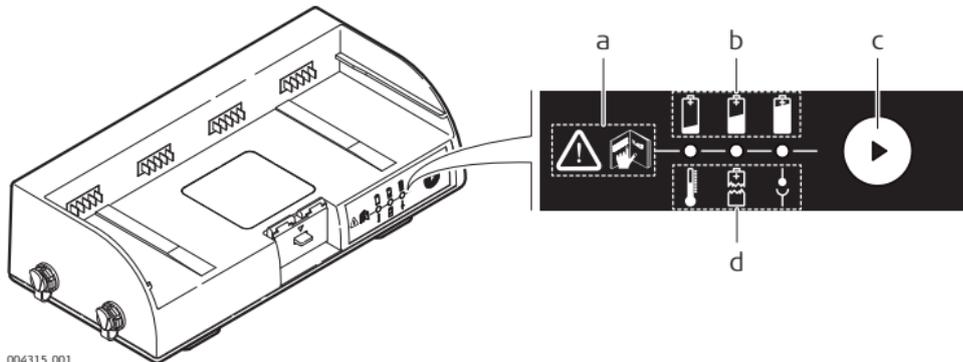
- It is recommended to use two warm internal batteries when powering the instrument with internal batteries.
 - Keep batteries warm before inserting into the instrument's battery compartments (e.g. warm up in container, wear under your clothing).
 - If the temperature of one internal battery is detected to be lower than 5 °C/41 °F, the maximum vertical rotational speed of the instrument's rotating prism will be reduced from 50 Hz to 32 Hz.
 - To switch the maximum vertical rotational speed back to 50 Hz the temperature of both internal batteries must be detected to be higher than 10 °C/50 °F.
 - If the temperature of one internal battery is detected to be lower than 5 °C/41 °F, both batteries will be discharged simultaneously.
 - Once the temperature of both internal batteries is detected to be higher than 10 °C/50 °F again, the battery with the lower capacity will be used.
-

3.2.3

Charging Station

About the Charger

On the charging station's front side are the Select button and LEDs for capacity and error indication.

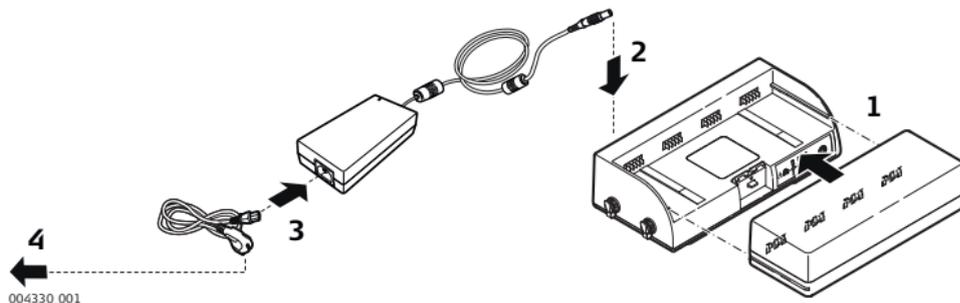


- 004315_001
- a) Safety directions to read this manual
 - b) Capacity indication
 - c) Select button
 - d) Error indication

The LEDs show the actual charge/discharge status or indicate an error status. During charging, the LEDs always show the current status.

While discharging or in standby, the status will only be shown for about 10 seconds after pressing the select button.

Charging the battery



- 1) Slide the battery pack into the charging station. When connected, the three LEDs light up for 1 sec.
- 2) Plug the AC power supply cable of the AC power supply into port P3 of the charging station.
- 3) Plug the power cable into the AC port of the AC power supply.
- 4) Plug the power cable into a socket outlet. The charging process starts automatically when all parts are plugged in. The battery is fully charged when all three LEDs are flashing green.
- 5) After charging is completed, remove the power cable from the socket outlet.
- 6) Remove the battery pack from the charging station by moving the lock/unlock-button.

Charger handling advice

- After a maximum of six hours the charging process is terminated.
- Properly remove the wall plug first, before removing the Lemo connector.
- Do not tamper with the power supply or charger during charging or usage.
- Do not put flammable objects near the power supply during charging or usage.

Explanation of the symbols used in this chapter

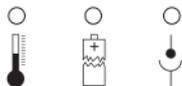
| Symbol | Description |
|---|---------------------|
|  | LED off. |
|  | LED permanently on. |
|  | LED flashing. |

Capacity indicators, green LEDs



| Symbol | Description |
|--------|-------------------------|
| | Battery fully charged. |
| | Battery capacity > 80%. |
| | Battery capacity > 50%. |
| | Battery capacity > 10%. |
| | Battery capacity < 10%. |

Error indicators, red LEDs



| LED | Description | Measure to take |
|-----|--|--|
| | Charging outside temperature range 0°C to 45°C | Use within specified temperature range only. LED keeps flashing until problem is resolved. |

| LED | Description | Measure to take |
|---|--|--|
|  | Discharging outside temperature range -20°C to +55°C | Use within specified temperature range only. |
|  | Battery defect | Disconnect all cables and other equipment, check contacts and reconnect. If problem persists, contact Leica Geosystems or your local agency. |
|  | Charging error | Disconnect all cables and other equipment, check contacts and reconnect. If problem persists, contact Leica Geosystems or your local agency. |

Additional status indicators

- When the GEB271 battery pack is inserted into the GKL271 charging station, the three LEDs light green for one second.
- When the GEV225 AC adapter is connected to the GKL271 charging station for charging, the three LEDs light green for one second and then show the actual battery level.

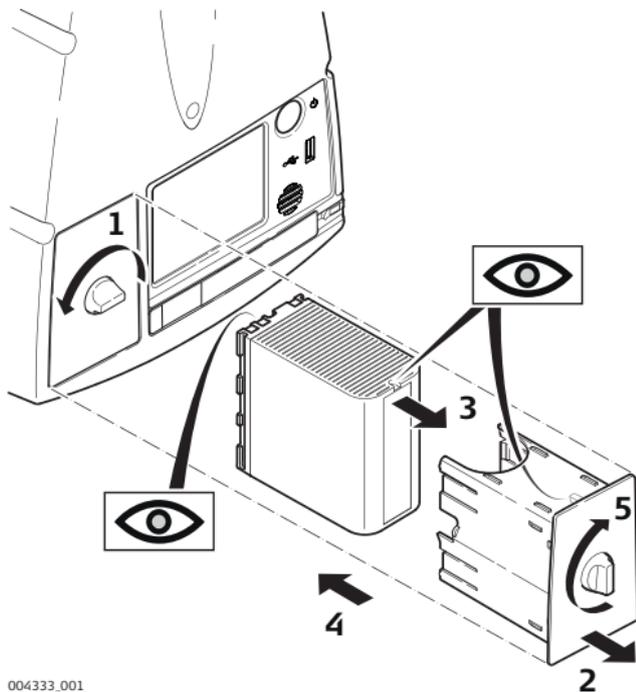


If the charger indicates an error when the battery is connected, try connecting a different battery to find out whether the fault lies with the battery or with the charging station. If the problem persists, contact Leica Geosystems or your local agency.

3.2.4

Internal Battery

Insert and remove
the internal
battery
step-by-step



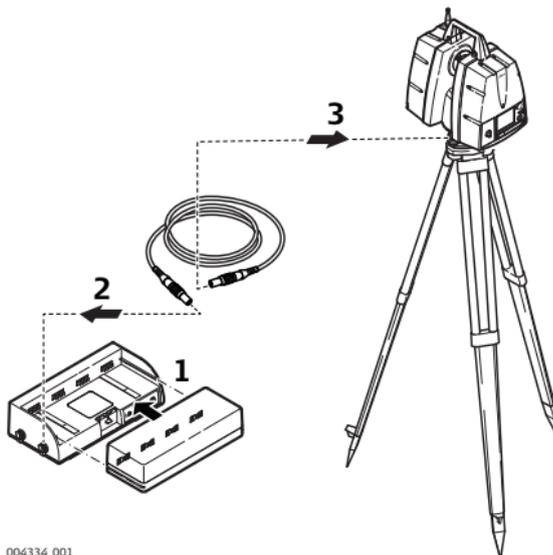
004333_001

| Step | Description |
|------|---|
| 1. | Unlock and open the battery compartment. |
| 2. | Remove the battery holder. |
| 3. | Remove the battery from the battery holder. Insert the new battery into the battery holder, ensuring that the contacts are facing outward and that the tip on the holder fits into the slot of the battery. The battery should click into position. |
| 4. | Insert the battery holder back into the battery compartment. |
| 5. | Turn the knob to lock the battery holder in place. |
| 6. | Switch on the instrument to start the boot process. |

3.2.5

External Battery

Using the external
battery pack
GEB271
step-by-step



004334_001

| Step | Description |
|------|--|
| 1. | Slide the battery pack into the charging station. When connected, the three LEDs on the charging station light up for 1 sec. |
| 2. | Connect the GEV259 power cable to port P2 of the charging station. Use the plug with the red bend protection. |
| 3. | Connect the other end of the GEV259 power cable to the power port of the instrument. Use the plug with the blue bend protection. |
| 4. | Press the On/Off button on the instrument to start the boot process. |



Check the battery capacity indicator LEDs to ensure that remaining power is enough to operate the instrument and finish the scheduled scan process.

3.3

Scanning

3.3.1

Switching the System On/Off

Switch On procedure

- 1) Set up the instrument as desired. Refer to chapter "Instrument Setup" for more information.
 - 2) Press and hold the On/Off button for 2 seconds until a beep is audible.
 - 3) The instrument starts with several subsequent beeps and a short melody.
 - 4) The **Leica Geosystems** welcome screen appears.
 - 5) Wait until the **Main Menu** appears on the display.
-

Switch Off procedures

Shutdown via **Main Menu**:

- 1) From the current menu return to the **Main Menu**.
- 2) In the **Main Menu** press the  button.
- 3) In the popup window confirm the question **Do you want to shutdown?** with **Yes**.
- 4) Wait for the scanner to shut down.

Shutdown via **On/Off button**:

- 1) Press and hold the **On/Off button** for 1 second until a single beep is audible.
- 2) Wait for the scanner to shut down.

In case of a system crash (forced shutdown):

- 1) Press and hold the On/Off button for 6 seconds until a **double beep** is audible.
 - 2) Wait for the scanner to shut down.
-

3.3.2

Ambient Conditions

Unfavourable surfaces for scanning

- Highly reflective (polished metal, gloss paint)
- Highly absorbent (black)
- Translucent (clear glass)



Colour, powder or tape these surfaces before scanning if necessary.

Unfavourable weather conditions for scanning

- Rain, snow or fog may adversely affect measurement quality. Always use care when surveying in these conditions.
 - Surfaces that are directly illuminated by the sun cause an increased range noise and therefore a larger measurement uncertainty.
 - If some objects are scanned against the sunlight or a bright spotlight, the optical receiver of the instrument can be dazzled so heavily that in this area no measured data is recorded. A "black hole" appears in the reflectance image.
-

Temperature changes during scanning

If the instrument is brought from a cold environment, for example from storage, into a warm and humid environment, the glass window at the mirror or in extreme cases even the interior optics can condensate. This may cause measurement errors.



Precaution: Avoid rapid temperature changes and give the instrument time to acclimatise.

Dirt on the glass pane

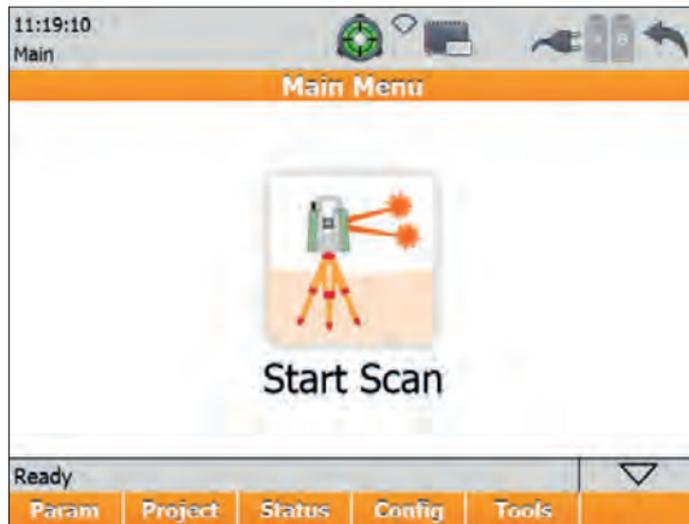
Dirt on the glass pane of the mirror such as a layer of dust, condensation or fingerprints may cause considerable measuring errors.

3.3.3

Onboard Controls

About the Main Menu

The **Main Menu** will be displayed after the system boot process. **Ready** in the message bar indicates that the instrument is ready for scanning.





For a complete description of all menus and commands refer to the Leica ScanStation P16 System Field Manual.

| Command | Function |
|----------------|---|
| Param | Offers access to all commands for scanner control. |
| Project | Offers access to all commands for project management. |
| Status | Offers access to all commands for the scanner's status information. |
| Config | Offers access to all commands for the configuration of the system. |
| Tools | Offers access to all commands for disk formatting, data transfer, license management and display calibration. |

Menu independent commands:

| Command | Function |
|---|--|
| Escape  | Return to previous menu in menu hierarchy. |
| Shift → Quit   | Return to main menu. |
| Page  | Switch between pages in a menu. |

3.3.4

Troubleshooting

Basic troubleshooting

| Problem | Possible Cause(s) | Suggested Remedies |
|---|--|--|
| Instrument does not boot. | | Disconnect from AC power supply or external battery. Disconnect all cables and remove all internal batteries. Wait for 1 minute. Reconnect cables and external power sources, insert all internal batteries and switch on again. |
| Black gap of missing points in overhead scans. | Handle not removed. | Remove handle and scan area again. |
| Display elements cannot be hit exactly with the stylus. | Touchscreen not calibrated. | Recalibrate touchscreen via Tools>Screen Calibration . |
| Missing points in scan. | Dust, debris or fingerprints on optics of rotating mirror. | Use glass cleaning tissue to clean the specific areas. |

Advanced trouble-shooting

| Problem | Possible Cause(s) | Suggested Remedies |
|--|---|---|
| When switching on the instrument or starting a scan, the system switches off automatically. | Capacity of battery is too low. | Recharge or change battery. |
| When switching on the instrument or starting a scan, the system switches off automatically even though it was totally recharged. | Battery charger is defective. | Check the function of the battery charger. Please note the charging status displayed on the battery charger. |
| | Damaged cable. | Examine the cabling and pay attention to damages, which for example can cause loose contacts or short circuits. Defective cables need to be replaced. Only use supplied power cables. |
| | Internal battery is no longer charging. | At the end of its life time the internal battery has lost most of its capacity. The battery needs to be replaced. |
| | External battery no longer charging. | At the end of its life time the external battery has lost most of its capacity. The battery needs to be replaced. |

Diagnostic procedure

The diagnostic procedure explains how to create log files with the user interface of your ScanStation P16 instrument in case of problems with the scanner. To create log files, follow the steps described below:

- 1) From the **Main Menu** go to **Tools, Transfer, Transfer Project**.
 - 2) Connect an external USB memory device to the scanner's USB connector.
 - 3) Press the **Logs** button.
 - 4) In the USB memory devices's main directory a folder named Logs will be created containing log files:
 - Pxx_1851234_20140805.log: log file with scanner serial number (e.g. 1851234) and scan date (year, month, day) embedded in the file name,
 - Pxx_1851234_20140805.log.gz: archived log file with scanner serial number (e.g. 1851234) and scan date (year, month, day) embedded in the file name,
 - UpgraderLog.txt,
 - POSTLog.txt.
 - 5) Send the content of the Logs folder together with details about scanner type, scanner serial number and a short description of the problem to your local support team.
-

**Troubleshooting -
support contacts**

If you experience problems with your instrument:

- Email the scanner's log files to your local support:
 - For **America**: us-support@hds.leica-geosystems.com
 - For **South America**: suporte@leica-geosystems.com.br
 - For **Europe, Middle East and Africa**: euro-support@hds.leica-geosystems.com
 - For **Asia**: asia-support@hds.leica-geosystems.com
- Log files are stored on the USB memory stick in the folder Logs.

4**4.1****Care and Transport****Check & Adjust**

Units that are exposed to high mechanical forces, e.g. through frequent transport or rough handling, it is recommended to carry out a check and adjust once a year by the manufacturer respectively just after such a high stress exposure.

4.2

Transport

Transport in the field

When transporting the equipment in the field, always make sure that you

- either carry the product in its original transport container,
 - or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.
 - or remove product from tripod and carry it by its handle.
-

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, original packaging or equivalent and secure it.

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.

4.3

Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "5 Technical Data" for information about temperature limits.

Storing

Long-term battery storage is not recommended. If storage is necessary:

- Refer to "Environmental Specifications" for information about storage temperature range.
 - Remove batteries from the product and the charger before storing.
 - After storage recharge batteries before using.
 - Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.
 - A storage temperature range of 0°C to +30°C/+32°F to 86°F in a dry environment is recommended to minimise self-discharging of the battery.
 - At 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.
 - Always try to use a 'first-in first-out' approach to minimise storage time.
-

4.4

Cleaning and Drying

Product and accessories

- Blow dust off lenses and prisms.
- Never touch the glass with your fingers.

Cleaning the touchscreen:

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



The touchscreen is covered by a thin, touch resistive foil. This foil can easily be damaged during cleaning e.g. by detergents.

Damp products

Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater 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.



Cables and plugs

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

Connectors with dust caps

Wet connectors must be dry before attaching the dust cap.

4.5

Glass Cleaning Procedure

General cleaning information

The scanning mirror must be kept clean. The instructions must be followed as described in this chapter to clean the scanner mirror.



Before any cleaning procedure, ensure the instrument is switched off.

Dust and debris on optical surfaces

Using a compressed gas duster (e.g., UltraJet® 2000 Gas Duster or UltraJet® Compressed CO2 Duster), remove dust and debris from surface of scanner glass.



Never rub off dust or debris as this will scratch the glass and so possibly cause permanent damage to the special optical coatings.

Cleaning of optical surfaces

Soiling of the glass pane can cause extreme measurement errors and therefore useless data!



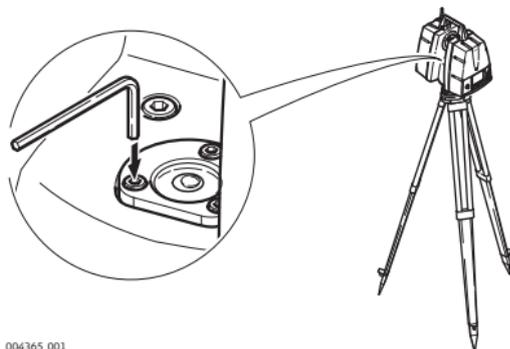
All soiling that is visible on the glass pane has to be removed, except for single small dust particles that adhere inevitably.

Clean the glass pane regularly with the provided cleaning tissue:

- Switch off instrument.
 - Washing hands is necessary in order to avoid grease on the cleaning tissue.
 - Better, use gloves to avoid finger oil on the glass.
 - Then use the lens tissue for wiping circularly from the centre to the edge until there is only a thin film of detergent visible.
 - If any smears from cleaning are visible against back light, repeat the procedure.
 - Do not use air from the pneumatic power system as this is always slightly oily!
-

4.6 Checking and Adjusting the Circular Level of the Tribrach

Levelling the instrument step-by-step

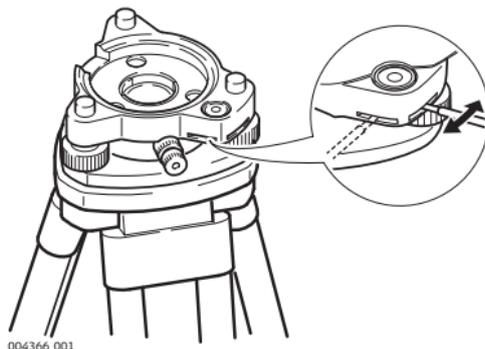


- 1) Level up the instrument in advance with the electronic level, assuming that the instrument is correctly adjusted. In the **Main Menu** go to **Status, Level and Laser plummet, Level** to access the electronic bubble.
- 2) The bubble must be centred. If it extends beyond the circle, use an allen key to centre it with the adjustment screws. Turn the instrument slowly 200 gon (180°). Repeat the adjustment procedure if the bubble does not stay centred.



After the adjustment, no screw shall be loose.

Levelling the tribrach step-by-step



- 1) Level up the instrument in advance with the electronic level, assuming that the instrument is correctly adjusted. In the **Main Menu** go to **Status, Level and Laser plummet, Level** to access the electronic bubble.
- 2) The bubble of the tribrach must be within the centring circle. If the bubble is outside the circle, use the adjusting pin and the two cross-headed adjustment screws to centre it.



After the adjustment, no screw shall be loose.

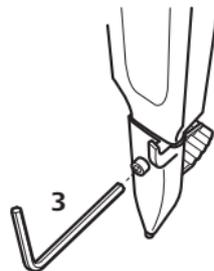
4.7

Servicing the Tripod

Service the tripod step-by-step



T50K_122



The connections between metal and timber components must always be firm and tight.

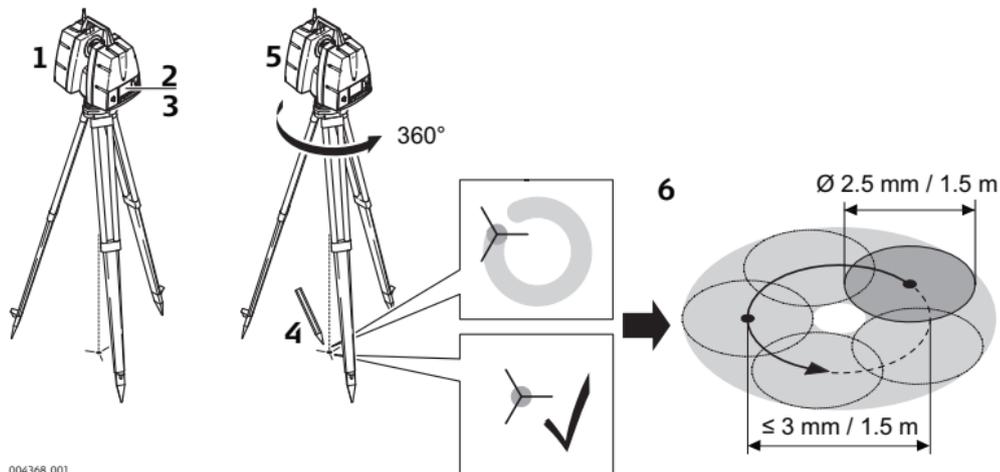
- 1) Tighten the leg cap screws moderately with the allen key supplied.
 - 2) Tighten the articulated joints on the tripod head just enough to keep the tripod legs open when lifting the tripod off the ground.
 - 3) Tighten the screws of the tripod legs.
-

4.8 Inspecting the Laser Plummet of the Instrument



The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, return the instrument to any Leica Geosystems authorised service workshop.

Inspecting the laser plummet



The following table explains the most common settings.

| Step | Description |
|---|---|
| 1. | Place and secure the instrument into the tribrach and onto a tripod. |
| 2. | Using the tribrach footscrews, level the instrument with the electronic level. In the Main Menu go to Status, Level and Laser plummet, Level . |
| 3. | To enter the laser plummet page, press Page . Switch on the laser plummet. Inspection of the laser plummet must be carried out on a bright, smooth and horizontal surface, like a sheet of paper. |
| 4. | Mark the centre of the red dot on the ground. |
| 5. | Turn the instrument through 360° slowly, carefully observing the movement of the red laser dot. |
|  | The maximum diameter of the circular movement described by the centre of the laser point must not exceed 3 mm at a distance of 1.5 m. |
| 6. | If the centre of the laser dot describes a perceptible circular movement or moves more than 3 mm away from the point which was first marked, an adjustment might be required. Inform your nearest Leica Geosystems authorised service workshop. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m it is about 2.5 mm. |

5 Technical Data

5.1 General Technical Data of the Instrument

Instrument features

The ScanStation P16 has the following features:

- Compact design
- Ultra high-speed laser scanner with pulsed, dual-axis compensated scanning unit
- Survey-grade scanning accuracy
- Long range and wide field of view
- Integrated high-resolution camera
- Built-in laser plummet
- Built-in electronic and external circular bubble for level indication

User interface

Built-in control:

- Touchscreen control with stylus
- Full colour graphic display, VGA (640 x 480 pixels)

Optional external control:

- Notebook
 - Tablet PC
 - Remote controller
-

Storage and Communication

Internal Storage:

Integrated 256 GB solid state drive. Additional storage on external USB device or external PC.

Communication:

Gigabit Ethernet or integrated wireless LAN (WLAN).

Internal Camera

The ScanStation P16 has an integrated high-resolution digital camera with zoom video.

| Camera data | Value |
|------------------------|---|
| Type | Colour sensor, auto-adjusting, parallax-free integration |
| Full 360° x 290° dome | Streaming video with zoom, auto-adjusts to ambient lighting |
| Single 17° x 17° image | 1920 x 1920 pixels (4 megapixel) |
| Full 360° x 290° dome | 274 images, automatically spatially rectified |
| White balancing | Sunny, cloudy, warm light, cold light, custom |
| HDR | Tone mapped / full range |

**External SLR
camera (optional)**

- Canon EOS 60D/70D/80D camera with Sigma 8 mm F3.5 EX DG fisheye lense
- Single image: 3456 x 5184 pixels (18 megapixel)
- Full 360° x 290° dome: 6 images, automatically spatially rectified

For details refer to the external camera manual.

5.2

System Performance

System performance and accuracy



All \pm accuracy specifications are one sigma (1σ) unless otherwise noted.

| Accuracy of single measurement (at 78% albedo) | Value |
|--|---------------------------------------|
| 3D position accuracy | 5 mm at 80 m |
| Range | 1.2 mm + 10 ppm over full range |
| Angle (horizontal/vertical) | 8" / 8" (40 μ rad / 40 μ rad) |

| Dual-axis compensator | Value |
|-----------------------|---|
| Selectable | on/off |
| Setting accuracy | 1.5" / 7.275 μ rad, resolution 1", dynamic range $\pm 5'$ |

5.3

Laser System Performance

Laser scanning system data



The scanning system is an ultra-high speed time-of-flight unit, enhanced by Waveform Digitising (WFD) technology.

Laser unit:

| Scanning laser | Value |
|----------------|--|
| Classification | Laser Class 1 (in accordance with IEC 60825-1 (2014-05)) |
| Wavelength | 1550 nm (invisible) / 658 nm (visible) |

Range:

| Scanning data | Value |
|-------------------------------|---|
| Beam divergence | < 0.23 mrad (FWHM, full angle) |
| Beam diameter at front window | < 3.5 mm (FWHM) |
| Minimum range | 0.4 m |
| Maximum range | 80 m @ 18% albedo |
| Range noise | 0.4 mm rms at 10 m and 0.5 mm rms at 50 m |

Field-of-View (per scan):

| Field-of-View | Value |
|-----------------|---|
| Aiming/Sighting | Parallax-free, integrated zoom video |
| Horizontal | 360° (maximum) |
| Vertical | 290° (maximum) |
| Scan motors | Direct drive, brushless |
| Scanning optics | Vertically rotating mirror on horizontally rotating base: <ul style="list-style-type: none">• Up to 50 Hz with internal battery.• Up to 100 Hz with external power supply. |

Scan duration:

| Resolution [mm @ 10 m] | Estimated scan duration [HH:MM:SS] for a full dome scan |
|------------------------|---|
| 50 | 00:00:20* |
| 25 | 00:00:33* |
| 12.5 | 00:00:58* |

| Resolution [mm @ 10 m] | Estimated scan duration [HH:MM:SS] for a full dome scan |
|---------------------------|---|
| 6.3 | 00:01:49* |
| 3.1 | 00:03:30* |
| 1.6 | 00:13:33 |
| 0.8 | 00:54:07 |

* Reduced speed when in cold temperature battery management mode.

Scan size:

| Resolution [mm @ 10 m] | Angular increment [°] | Points/360° | Project size [MB] |
|---------------------------|-----------------------|-------------|----------------------|
| 50 | 0.286 | 1258 | ~ 5.5 |
| 25 | 0.143 | 2514 | ~ 19 |
| 12.5 | 0.072 | 5028 | ~ 74 |
| 6.3 | 0.036 | 10054 | ~ 294 |
| 3.1 | 0.018 | 20107 | ~ 1170 |
| 1.6 | 0.009 | 40278 | ~ 4700 |

**Laser Plummet
data**

Plummet laser:

| Plummet | Value |
|----------------|--|
| Classification | Laser Class 1 (visible red) |
| Location | In standing axis of instrument |
| Accuracy | 1.5 mm at 1.5 m instrument height (deviation from plumb line) |

5.4

Electrical Data

ScanStation power supply and consumption

Power ports:

| Ports |
|--|
| Internal: 2, External: 1 (simultaneous use, hot swappable) |

Power supply:

| Internal |
|--|
| 12 - 16.6V DC; four internal batteries provided with system. |

| External |
|-------------|
| 24 - 36V DC |

Power consumption:

| Instrument |
|-------------------------|
| 60 W typical; 95 W max. |

External GKL123 AC power supply:

| Supply | Value |
|----------------|------------------------|
| Input voltage | 100-240 V AC, 50-60 Hz |
| Output voltage | 24 V, 7.5A max. |

GEV225 AC power supply for GKL271

| Supply | Value |
|----------------|------------------------|
| Input voltage | 100-240 V AC, 50-60 Hz |
| Output voltage | 24 V |

GKL271 charging station

| Supply | Value |
|----------------|------------------------------|
| Input voltage | 24 V DC (port: P3) |
| Output voltage | 14.4 V DC (port: P1) |
| | 24 V DC / 36 V DC (port: P2) |

**GEB271 external
battery pack**

| Supply | Value |
|---------------|--------------|
| Type | Li-Ion |
| Voltage | 14.4 V |
| Capacity | 19.6 Ah |

**GEB242 internal
battery**

| Supply | Value |
|---------------|--------------|
| Type | Li-Ion |
| Voltage | 14.8 V |
| Capacity | 5.8 Ah |

**Battery operating
and charging times**

| Internal battery | Value |
|-------------------------|---|
| Operating time | 5.5 hours, typical continuous use (room temperature), using both batteries simultaneously. |
| Charging time | Typical charging time with Charger GKL311 is < 3.5 hours at room temperature (2 batteries). |

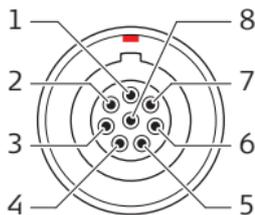
| External battery pack | Value |
|-----------------------|---|
| Operating time | 7.5 hours, typical continuous use (room temperature). |
| Charging time | Typical charging time is 3.5 hours at room temperature. |

5.4.1

Pin Assignment of Lemo Ports

Ethernet port

Lemo1, 8 pin female with grey colour ring



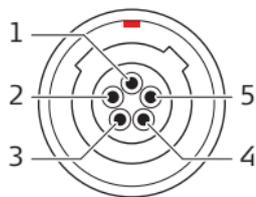
010743_001

| Pin | Name |
|-----|------|
| 1 | D1+ |
| 2 | D1- |
| 3 | D2+ |

| Pin | Name |
|-----|------|
| 4 | D2- |
| 5 | D3+ |
| 6 | D3- |
| 7 | D4+ |
| 8 | D4- |

Power supply port

Lemo1, 5 pin female with blue colour ring



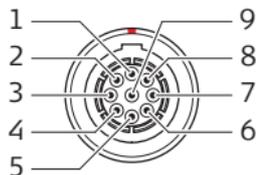
010744_001

| Pin | Name | Function |
|-----|--------|--------------------------|
| 1 | PWR_IN | Power-In, 10.5 V to 40 V |
| 2 | NC | Do not connect |

| Pin | Name | Function |
|-----|--------|--------------------------|
| 3 | GND | Ground |
| 4 | GND | Ground |
| 5 | PWR_IN | Power-In, 10.5 V to 40 V |

Synchronization port

Lemo0, 9 pin female



010745_001

| Pin | Name | Function |
|-----|---------------------|----------------------------------|
| 1 | PPS_in_record IN | Reserved for future use |
| 2 | PPS_in_trigger IN | Trigger for time synchronization |
| 3 | PPS_in_reset IN | Reserved for future use |
| 4 | PPS_out_record OUT | Reserved for future use |
| 5 | PPS_out_trigger OUT | Nadir passed event |

| Pin | Name | Function |
|-----|------------------|----------------------------------|
| 6 | PPS_out_reset IN | Reserved for future use |
| 7 | TxD_RS232 OUT | Reserved for future use |
| 8 | GND | Common ground |
| 9 | RxD_RS232 IN | Received data of RS232 interface |

5.5

5.5.1

Environmental specifications ScanStation P16

Environmental Specifications

ScanStation

Temperature range:

| Type | Operating temperature [°C] | Storage temperature [°C] |
|-----------------|----------------------------|--------------------------|
| Instrument | -20 to +50 | -40 to +70 |
| AC-power supply | 0 to +40 | -25 to +65 |

Protection against water, dust and sand:

| Type | Protection |
|------------|--|
| Instrument | IP54 (IEC 60529), upright or upside down setup with water cover installed Dust protected Protection against splashing water from any direction |

Humidity:

| Type | Protection |
|------------|-------------------------|
| Instrument | Max 95 % non condensing |

Lighting:

| Type | Protection |
|------------|--|
| Instrument | Fully operational from bright sunlight to complete darkness. |

Sound emission:

| Type | Level |
|------------|-----------|
| Instrument | ≤75 dB(A) |

5.5.2

Charger and Batteries

Charger and battery specifications

Temperature range for GEB271, GKL271, GKL123 and GEB242

| Operating temperature [°C] | Mode |
|----------------------------|-------------|
| 0 to +45 | Charging |
| -20 to +55 | Discharging |

| Storage temperature [°C] | Mode | Recharging interval |
|--------------------------|----------|---------------------|
| -40 to +70 | Standard | 6 months |

Protection against water, dust and sand

| Type | Protection |
|------------|---|
| Instrument | IP54 (IEC 60529) Dust protected Protection against splashing water from any direction |

Humidity

| Type | Protection |
|------------|-------------------------|
| Instrument | Max 95 % non condensing |

5.6

Dimensions

Dimensions

| Instrument | Dimensions [mm] (D x W x H) | Dimensions ["] (D x W x H) |
|--|--|---------------------------------------|
| ScanStation P16 | 238 x 358 x 395 | 9.4 x 14.1 x 15.6 |
| GKL123 power supply for ScanStation P16 | 85 x 170 x 42 / cable length: 1700 | 3.4 x 6.7 x 1.7 / cable length: 66 |
| GEV225 AC power supply for charging station GKL271 | 85 x 170 x 41 / cable length: 1800 | 3.4 x 6.7 x 1.6 / cable length: 70 |
| GKL271 charging station | 127 x 264 x 82 | 5 x 10.4 x 3.2 |
| GEB271 battery pack | 95 x 248 x 60 | 3.7 x 9.8 x 2.4 |
| GEB242 battery | 40 x 72 x 77 | 1.6 x 2.8 x 3.0 |
| GVP645 transport container | 500 x 625 x 366 | 19.7 x 24.6 x 14.4 |

5.7**Weight****Weight**

| Instrument | Weight [kg] | Weight [lbs] |
|--|--------------------|---------------------|
| ScanStation P16 | 12.25 nominal | 27 nominal |
| GKL123 AC power supply for ScanStation P16 | 0.9 | 1.9 |
| GEV225 AC power supply for GKL271 | 0.860 | 1.9 |
| GKL271 charging station | 1 | 2.2 |
| GKL271 battery pack | 1.9 | 4.2 |
| GEB242 battery | 0.4 | 0.9 |
| GVP645 ScanStation P16 transport container (without scanner and accessories) | 10.4 | 22.9 |
| GVP645 ScanStation P16 transport container (with scanner and standard accessories) | 28 | 61.7 |

5.8

Accessories

Scope of delivery

Included standard accessories:

- Transport container for scanner
 - Tribrach (Leica Professional Series)
 - Internal battery (4x)
 - Battery charger with AC power cable, car adapter, daisy chain cable
 - Ethernet cable
 - Cleaning tissue
 - 1 year CCP Basic support agreement
-

Additional accessories

- B&W scan targets and target accessories
 - Range of Customer Care Products (CCP) that include support, hardware & software maintenance and extended warranty
 - External battery with charging station, AC power supply and power cable
 - Professional charger for internal batteries
 - AC power supply for scanner
 - Tripod, tripod star, rolling base
 - Adapter for upside down mounting
-

5.9 Conformity to National Regulations

5.9.1 ScanStation P16

Conformity to national regulations

- FCC Part 15 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the product ScanStation P16 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity can be consulted at <http://www.leica-geosystems.com/ce>.



Class 1 equipment according European Directive 1999/5/EC (R&TTE) can be placed on the market and be put into service without restrictions in any EEA member state.

- The conformity for countries with other national regulations not covered by the FCC part 15 or European directive 1999/5/EC has to be approved prior to use and operation.
 - Japanese Radio Law and Japanese Telecommunications Business Law Compliance.
 - This device is granted pursuant to the Japanese Radio Law (電波法) and the Japanese Telecommunications Business Law (電気通信事業法).
 - This device should not be modified (otherwise the granted designation number will become invalid).
-

Frequency band

| Type | Frequency band [MHz] |
|----------------------|----------------------|
| Integrated Bluetooth | 2402 - 2480 |
| Integrated WiFi | 2412 - 2462 |

Output power

| Type | Output power [mW] |
|----------------------|-------------------|
| Integrated Bluetooth | 20 max. |
| Integrated WiFi | 63 max. |

Antenna

| Type | Antenna | Gain [dBi] |
|----------------------|-------------------------|------------|
| Integrated Bluetooth | Internal PIF antenna | 0 |
| Integrated WiFi | External dipole antenna | ± 2 |

5.9.2

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 (<http://www.leica-geosystems.com/dgr>) 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.

6

Software Licence Agreement

Software Licence Agreement

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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).

6.1

End User Licence Agreement EULA

EULA terms

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- when it has to be **right**

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827810-5.0.0en

Original text

Printed in Switzerland

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