

Leica TS16



User Manual
Version 5.0
English

- when it has to be **right**

Leica
Geosystems

PART OF
HEXAGON

Introduction

Purchase

Congratulations on the purchase of the Leica TS16.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to [9 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.



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.

Updated versions are available for download at the following Internet address:
<https://myworld.leica-geosystems.com> > myProducts.

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 Geosystems authorised service centre.

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.
- SD Logo is a trademark of SD-3C, LLC.



All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to the TS16.

Available documentation

Name	Description/Format		
TS16 Quick Guide	Provides an overview of the product together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
TS16 User Manual	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	-	✓

Name	Description/Format		
Captivate Technical Reference Manual	Overall comprehensive guide to the product and apps. Included are detailed descriptions of special software/hardware settings and software/hardware functions intended for technical specialists.	-	✓

Refer to the following resources for documentation/software:

- the Leica Captivate USB documentation card
- <https://myworld.leica-geosystems.com>



Leica Geosystems address book

Video tutorials are available on:

<http://www.leica-geosystems.com/captivate-howto>

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.



<https://myworld.leica-geosystems.com> offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

The availability of services depends on the instrument model.

Service	Description
myProducts	Add all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep up-to-date with the latest documentation.
myService	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your support requests and view detailed information on each request in case you want to refer to previous support requests.
myLearning	Welcome to the home of Leica Geosystems online learning! There are numerous online courses – available to all customers with products that have valid CCPs (Customer Care Packages).
myTrustedServices	Add your subscriptions and manage users for Leica Geosystems Trusted Services, the secure software services, that assist you to optimise your workflow and increase your efficiency.

Service	Description
mySmartNet	Exclusive to GS systems, HxGN SmartNet Global is a family of trustworthy correction services that are easily accessible, and they automatically enable the best possible accuracy everywhere. HxGN SmartNet Global family consists of three services: HxGN SmartNet Pro, HxGN SmartNet+ and HxGN SmartNet PPP.
myDownloads	Downloads of software, manuals, tools, training material and news for Leica Geosystems products.

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PART 1

TS16

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.
	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 horizontal and vertical angles
- Measuring distances
- Recording measurements
- Capturing and recording images
- Automatic target search, recognition and tracking
- Visualising the aiming direction and vertical axis
- Remote control of product
- Data communication with external appliances
- Measuring raw data and computing coordinates using carrier phase and code signal from GNSS satellites (GNSS systems)
- Recording GNSS and point related data
- Computing with software

Reasonably foreseeable misuse

- Use of the product without instruction
- 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
- Aiming directly into the sun

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.

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 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.

DANGER

Risk of electrocution

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.



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

Lightning strike

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

Distraction/loss of attention

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

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.
-

CAUTION

Pointing product toward the sun

Be careful when pointing the product toward the sun, because the telescope functions as a magnifying glass and can injure your eyes and/or cause damage inside the product.

Precautions:

- ▶ Do not point the product directly at the sun.
-

CAUTION

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.
-

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 objects.

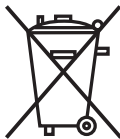
WARNING

Improper disposal

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.

WARNING

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.


1.6 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 areaif 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).
-

1.6.2 Distancer, Measurements with Reflectors

General

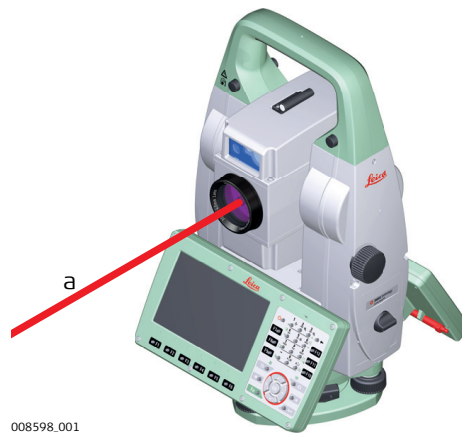
The EDM module built into the product produces a visible laser beam which emerges from the telescope objective.

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	658 nm
Pulse duration	800 ps
Pulse repetition frequency (PRF)	100 MHz
Maximum average radiant power	0.33 mW
Beam divergence	1.5 mrad × 3 mrad



008598.001

a Laser beam

1.6.3

Distancer, Measurements without Reflectors

General

The EDM module built into the product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 3R in accordance with:

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

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

- unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
- inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
- natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value
	R30 R500 R1000
Wavelength	658 nm
Maximum average radiant power	4.8 mW
Pulse duration	800 ps
Pulse repetition frequency (PRF)	100 MHz
Beam divergence	0.2 mrad x 0.3 mrad
NOHD (Nominal Ocular Hazard Distance) @ 0.25 s	44 m / 144 ft

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- ▶ Prevent direct eye exposure to the beam.
- ▶ Do not direct the beam at other people.

⚠ CAUTION

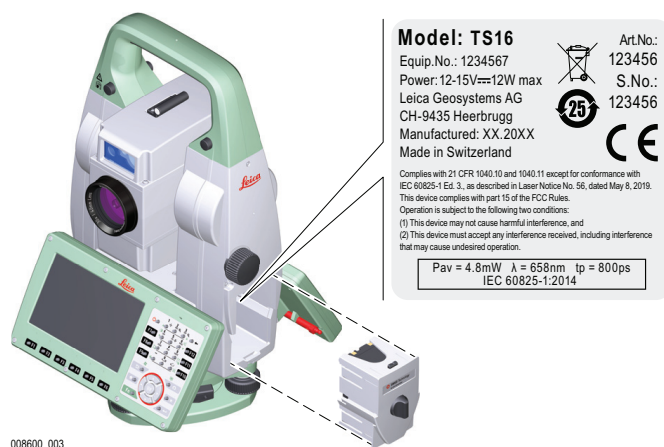
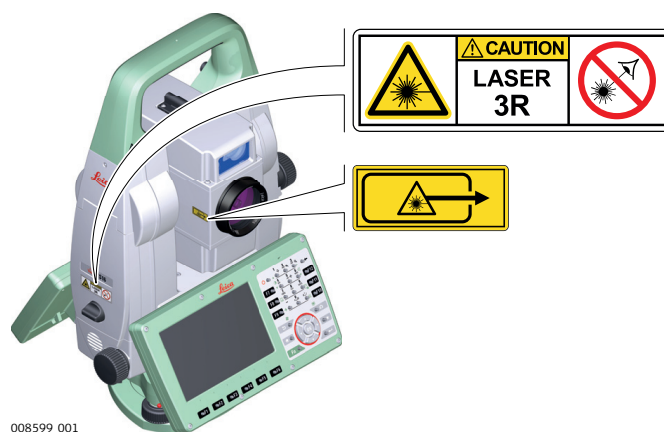
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- ▶ Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- ▶ Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



General

The laser pointer built into the product produces a visible red laser beam which emerges from the telescope objective.


The laser product described in this section is classified as laser class 3R in accordance with:

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

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

- unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
- inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
- natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value R30 R500 R1000
Wavelength	658 nm
Maximum average radiant power	4.8 mW
Pulse duration	800 ps
Pulse repetition frequency (PRF)	100 MHz
Beam divergence	0.2 mrad x 0.3 mrad
NOHD (Nominal Ocular Hazard Distance) @ 0.25 s	44 m / 144 ft

 R30 is only available for TS16G.

 CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- ▶ Prevent direct eye exposure to the beam.
- ▶ Do not direct the beam at other people.

⚠ CAUTION

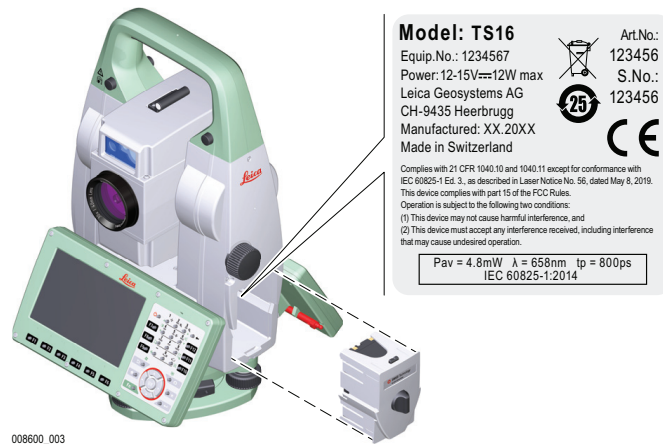
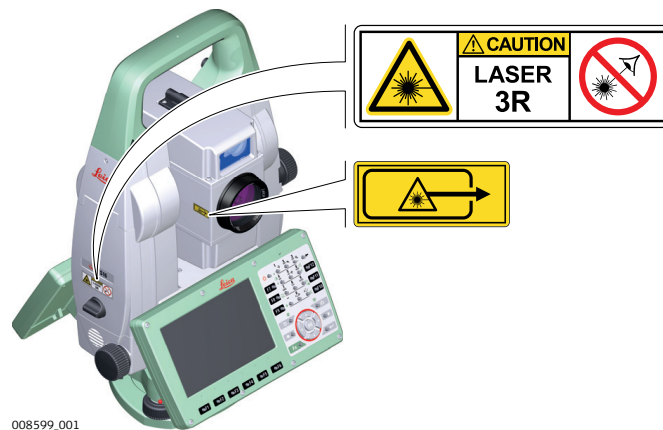
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- ▶ Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- ▶ Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



1.6.5

Automatic Target Aiming (ATRplus)

General

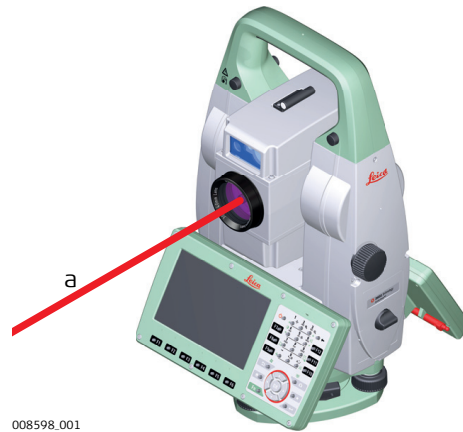
The Automatic Target Aiming built into the product produces an invisible laser beam which emerges from the telescope objective.

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	785 nm
Maximum radiant peak power per pulse	10 mW
Pulse duration	≤ 15 ms
Pulse repetition frequency (PRF)	≤ 213 Hz
Beam divergence	25 mrad



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a Laser beam

1.6.6

PowerSearch (PS)

General

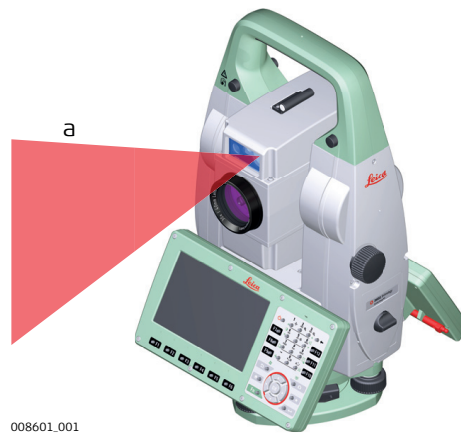
The PowerSearch built into the product produces an invisible laser beam which emerges from the front side of the telescope.

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	850 nm
Maximum average radiant power	11 mW
Pulse duration	20 ns, 40 ns
Pulse repetition frequency (PRF)	24.4 kHz
Beam divergence	0.4 mrad × 700 mrad



008601_001

a Laser beam

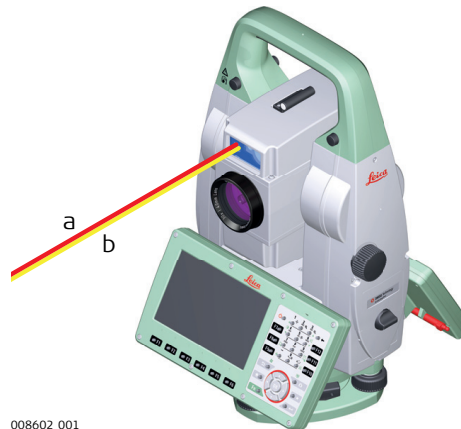
1.6.7 Electronic Guide Light (EGL)

General

The Electronic Guide Light 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.



008602_001

a LED beam red
b LED beam yellow

1.6.8 Laser Plummet

General

The laser plummet built into 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 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.

Description	Value
Wavelength	640 nm
Maximum average radiant power	0.95 mW
Pulse duration	0.1 ms - cw
Pulse repetition frequency (PRF)	1 kHz
Beam divergence	<1.5 mrad

CAUTION

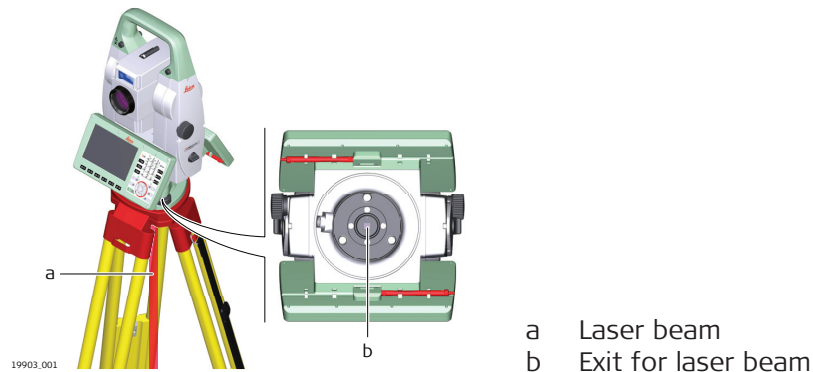
Class 2 laser product

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



1.6.9

AutoHeight Laser Plummet

General

The laser plummet built into 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 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.

Description	Value
Wavelength	640 nm
Maximum average radiant power	0.95 mW
Pulse duration	<1 ns
Pulse repetition frequency (PRF)	320 MHz
Beam divergence	<1.5 mrad

⚠ CAUTION

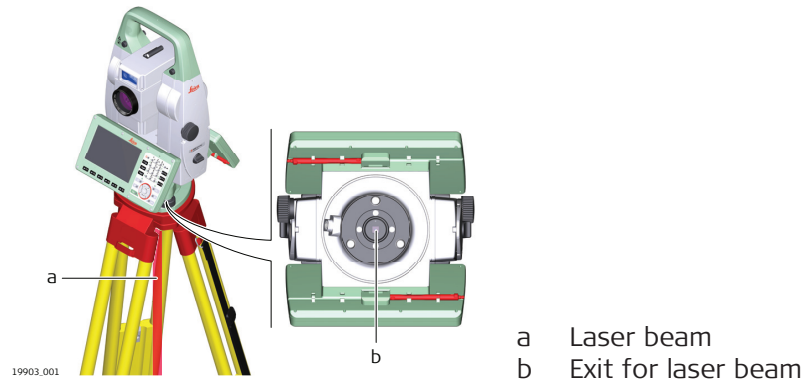
Class 2 laser product

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



1.6.10

Laser Guide

General

The Laser Guide built into the TS16 G instrument produces a visible red laser beam which emerges from the front side of the telescope.

The laser product described in this section is classified as laser class 3R in accordance with:

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

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

- unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
- inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
- natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value R30 R1000
Maximum radiant power	4.8 mW c.w.
Wavelength	658 nm
Beam divergence	0.1 mrad
NOHD (Nominal Ocular Hazard Distance) @ 0.25s	120 m

⚠ CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- ▶ Prevent direct eye exposure to the beam.
- ▶ Do not direct the beam at other people.

⚠ CAUTION

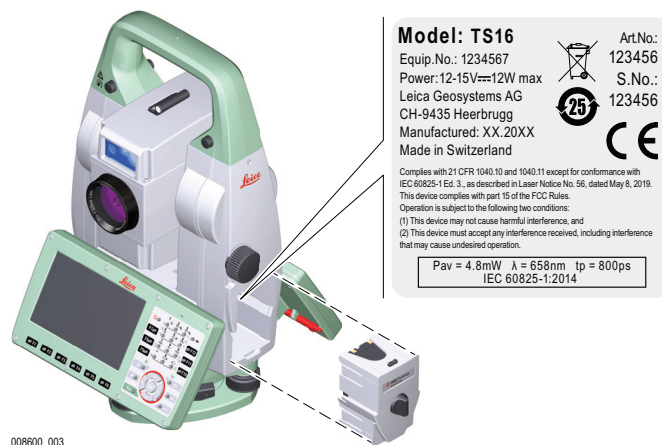
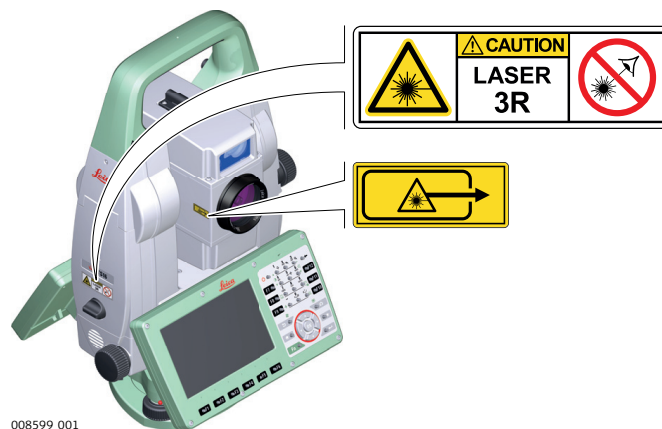
Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- ▶ Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- ▶ Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



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.

 CAUTION**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.
-

WARNING

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.
-

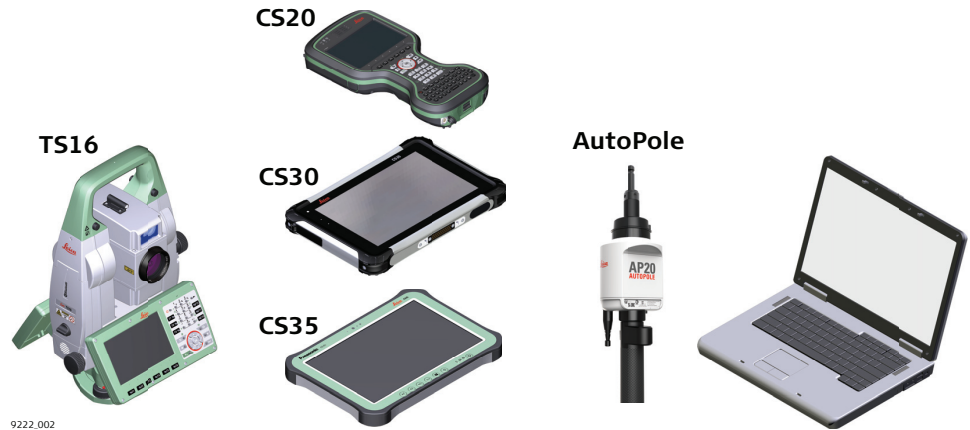
2

Description of the System

2.1

System Components

Main components



Component	Description
TS16 instrument	<ul style="list-style-type: none">• a total station for measuring, calculating and capturing data.• consisting of various models with a range of accuracy classes.• integrated with an add-on GNSS system to form SmartStation.• combined with the multi-purpose CS20 field controller, the CS30 tablet or the CS35 tablet to conduct remote control surveys.• connected with Infinity to view, exchange and manage data.
CS20 field controller	A multipurpose 5" screen field controller allowing the remote control of the TS16 instrument.
CS30 tablet	A 7" tablet allowing the remote control of the TS16 instrument.
CS35 tablet	A 10.1" tablet allowing the remote control of the TS16 instrument.
AutoPole (AP)	A product group with active sensor components which can be attached to AP Reflector Poles. The AP can communicate with total station, field controller or tablet.
AP Reflector Pole	A dedicated group of reflector poles with passive sensing elements inside, capable to carry an AutoPole. Without AutoPole, an AP Reflector Pole can also be used as conventional pole.
Infinity	The office software including a series of help programs which support working with Leica instruments.

Terms and abbreviations

The following terms and abbreviations can be found in this manual:

Term	Description
Remote Mode	The instrument is remote controlled by the field controller or tablet using radio.
EDM	<p>Electronic Distance Measurement</p> <p>EDM refers to the laser distancer incorporated into the instrument which enables distance measurement.</p> <p>Two measuring modes are available:</p> <ul style="list-style-type: none"> • Prism mode. This mode refers to the ability to measure distances to prisms. It incorporates the long range mode to measure extended distances to prisms. • Any surface mode. This mode refers to the ability to measure distances without prisms.
PinPoint	PinPoint refers to the Reflectorless EDM technology which enables an increased measuring range with a smaller laser spot size. Two options are available: R500 and R1000.
EGL	<p>Electronic Guide Light</p> <p>An EGL fitted to an instrument assists with prism targeting. It consists of two differently coloured flashing lights located in the instrument telescope housing. The person holding the prism can align themselves into the line-of-sight of the instrument.</p>
Laser Guide	<ul style="list-style-type: none"> • A variant of the TS16 instrument equipped with Automatic Target Aiming. Instruments equipped with the Laser Guide cannot be equipped with PowerSearch (PS) or Guide Light (EGL). • Included in a special compartment in the upper telescope section. • Emits a visible red laser beam used for visualising the line of sight. • Used for guiding tunnel boring machines, monitoring tunnelling progress or visualising bore holes for rock blasting; targeting of inaccessible objects or prohibited surfaces; positioning of objects and inspecting marks on surfaces.
Motorised	Instruments fitted with internal motors, enabling automatic horizontal and vertical turning are referred to as Motorised.
ATRplus	<p>Automatic Target Aiming.</p> <p>ATRplus refers to the instrument sensor which enables the automatic target aiming and locking.</p>
Automated	<p>Instruments fitted with ATRplus are referred to as Automated.</p> <p>ATRplus refers to the instrument sensor which enables the automatic target aiming to a prism.</p> <p>Three automation modes are available with Aim at target:</p> <ul style="list-style-type: none"> • Manual: no automation and no lock. • Automatic: automatic target aiming to a prism. • LOCK: an already targeted prism is followed automatically.
Overview camera	Overview camera is located in the upper part of the telescope housing and has a fixed focus.

Term	Description
PowerSearch	PowerSearch refers to the instrument sensor which enables the automatic rapid finding of a prism.
SmartStation	A Leica Viva TS instrument integrated with an add-on GNSS system, comprising hardware and software components, forms a SmartStation. Components of a SmartStation include a SmartAntenna and a SmartAntenna Adapter. A SmartStation provides an additional instrument setup method for determining instrument station coordinates. The GNSS principles and functionality of a SmartStation derive from the principles and functionality of Leica VivaGNSS instruments.
SmartAntenna	SmartAntenna with integrated Bluetooth is a component of a SmartStation. It can also be used independently on a pole with a CS20 field controller. Models compatible with a TS16 instrument are GS16/GS15. Where there are differences between the various models they are clearly described.
RadioHandle	A component of remote mode is the RH17/RH18 RadioHandle. It is an instrument carry handle with one or more integrated long range Bluetooth modules with attached antenna.
Communication side cover	Communication side cover with integrated Bluetooth, SD card slot, USB port, WLAN and RadioHandle is standard for a TS16 instrument and a component of a SmartStation. In combination with the RH17/RH18 RadioHandle, it is also a component of remote mode.

Available models

Model	TS16 M	TS16 A	TS16 G	TS16 P	TS16 I
Angle measurement	✓	✓	✓	✓	✓
Distance measurement to prism	✓	✓	✓	✓	✓
Distance measurement to any surface (reflectorless)	✓	✓	✓	✓	✓
Motorised	✓	✓	✓	✓	✓
Automatic Target Aiming	-	✓	✓	✓	✓
PowerSearch (PS)	-	-	-	✓	✓
Overview Camera	-	-	-	-	✓
Laser Guide	-	-	✓	-	-
RS232, USB and SD card interface	✓	✓	✓	✓	✓
Bluetooth	✓	✓	✓	✓	✓
Internal Flash Memory (2 GB)	✓	✓	✓	✓	✓
Hotshoe interface for RadioHandle	✓	✓	✓	✓	✓

Model	TS16 M	TS16 A	TS16 G	TS16 P	TS16 I
Guide Light (EGL)	✓	✓	-	✓	✓
WLAN	✓	✓	✓	✓	✓

✓Standard - Not available

2.2 System Concept

2.2.1 Software Concept

Description

All instruments use the same software concept.

Software for TS models

Software type	Description
TS firmware (xx.fw)	<p>The Leica Captivate software is running on the TS instrument and covers all functions of the instrument.</p> <p>The main applications and languages are integrated into the firmware and cannot be deleted.</p> <p>The languages released with Leica Captivate are included in the firmware file.</p>
Applications (xx.axx)	<p>Many optional survey-specific applications are available for the TS instruments. All applications are included in the Leica Captivate firmware file and can be loaded separately.</p> <p>Some of the applications are activated freely and require no licence key; others require purchasing and are only activated with a licence key.</p> <p>If the licence is not loaded to the instrument, applications requiring a licence key run for a trial period. For a trial run, the Measure&Stakeout licence must be available on the TS.</p>
Customised applications (xx.axx)	<p>Customised software, specific to user requirements, can be developed using the GeoC++ development kit. Information on the GeoC++ development environment is available on request from a Leica Geosystems representative.</p>

Software upload



Uploading software can take some time. Ensure that the battery is at least 80% full before you start the upload. Do not remove the battery during the upload process.

Software update instructions for all TS models:

1. Download the most recent firmware file from <https://myworld.leica-geosystems.com>. Refer to [Introduction](#).

2. Copy the firmware file into the **System** folder on the memory device.
3. Start the instrument. Select **Settings\Tools\Update software**. Select the firmware file and start the update.
4. When the update is complete, a message appears.

2.2.2

Power Concept

General

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

Power options

Model	Power supply
all TS models	Internally by GEB222 battery, OR Externally by GEV52 cable and GEB373 battery. If an external power supply is connected and the internal battery is inserted, then the external power is used.
SmartAntenna	Internally via GEB212 battery fitted into the antenna.

2.2.3


Data Storage Concept

Description

Data is stored on a memory device. The memory device can be an SD card or internal memory. For data transfer an USB stick can also be used.

Memory device

Device	Description
SD card	All instruments have an SD card slot fitted as standard. An SD card can be inserted and removed. Available capacity: 1 GB and 8 GB.
USB stick	All instruments have a USB port fitted as standard.
Internal memory	All instruments have an internal memory fitted as standard. Available capacity: 2 GB.

 While other SD cards/USB sticks can be used, Leica Geosystems recommends to only use Leica SD cards/USB sticks and is not responsible for data loss or any other error that can occur while using a non-Leica SD card/USB stick.



Unplugging connecting cables or removing the SD card or USB stick during the measurement can cause loss of data. Only remove the SD card or USB stick or unplug connecting cables when the TS instrument is switched off.

Transfer data

Data can be transferred in various ways.

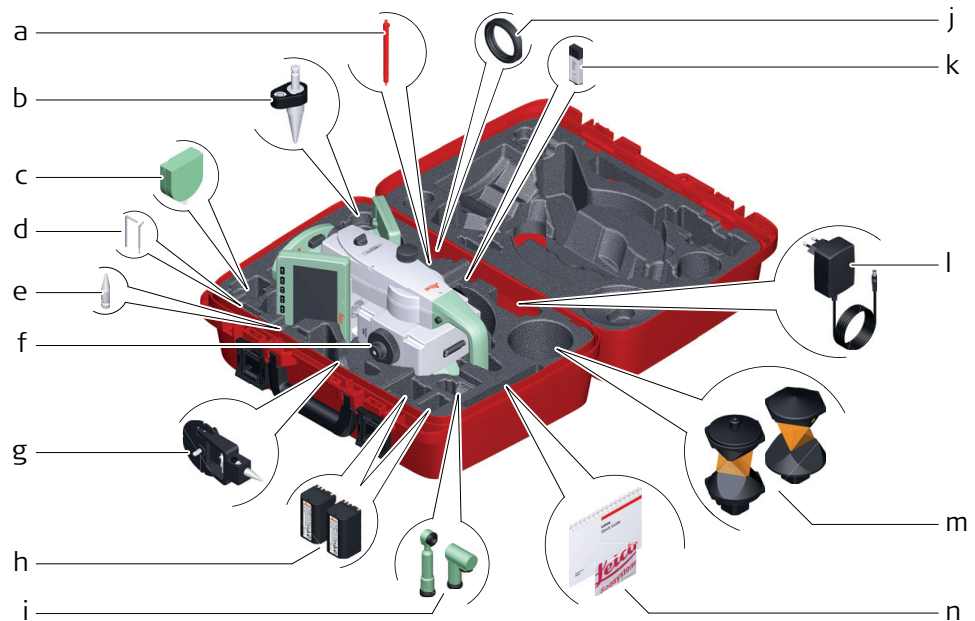


SD cards can directly be used in an OMNI drive as supplied by Leica Geosystems. Other PC card drives can require an adaptor.

2.3

Container Contents

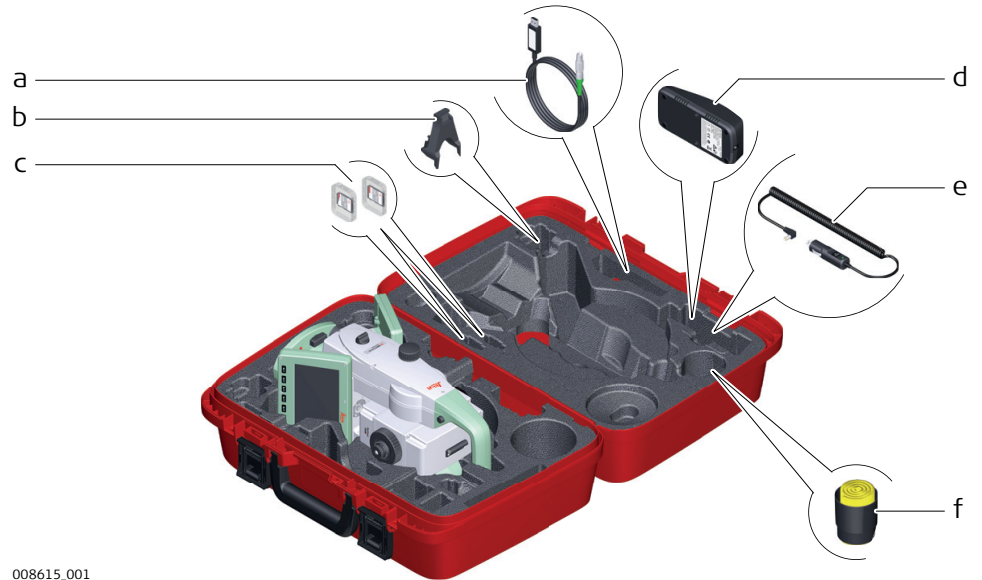
Container for instrument and accessories - part 1 of 2



008614_001

- a Stylus
- b GLS14 mini pole
- c GHM007 Instrument height meter
- d Allen key and adjustment tool
- e Tip for GMP101 mini prism
- f Instrument with tribrach and standard handle or RadioHandle
- g GMP101 mini prism
- h GEB222 batteries
- i GFZ3 or GOK6 diagonal eyepiece
- j Counterweight for diagonal eyepiece
- k MS1, 1 GB USB memory stick
- l GEV192 AC power supply for battery charger
- m GRZ4 or GRZ122 prism
- n Manuals and USB documentation card

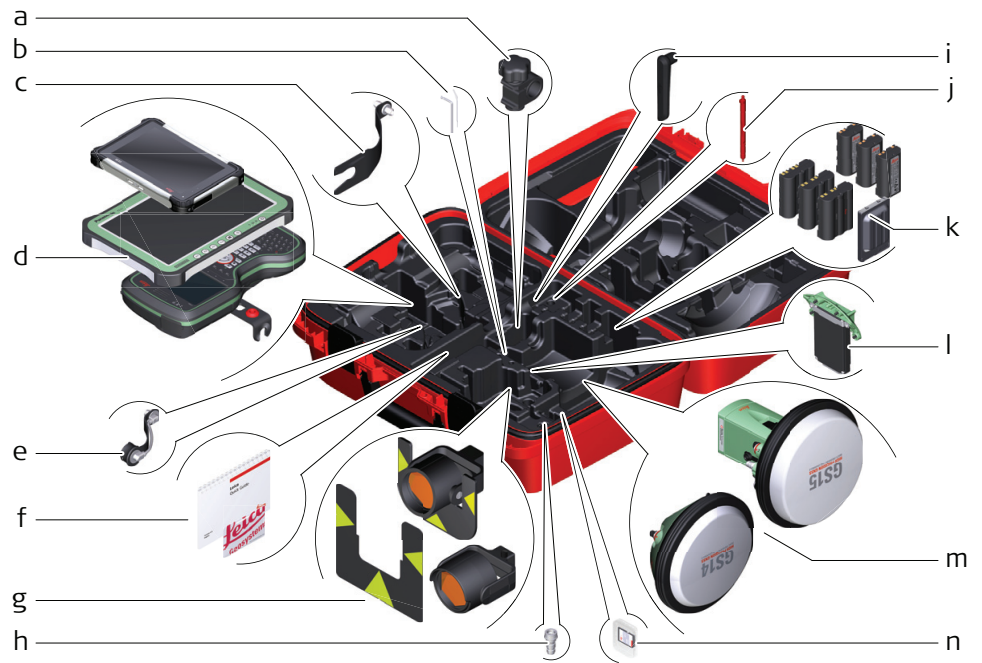
Container for instrument and accessories - part 2 of 2



008615.001

- a Cables
- b GHT196 tribrach bracket for height meter
- c SD cards and covers
- d GKL311 battery charger
- e Car adapter power plug for battery charger (stored under battery charger)
- f Protective cover for instrument, sunshade for objective lens and cleaning cloth

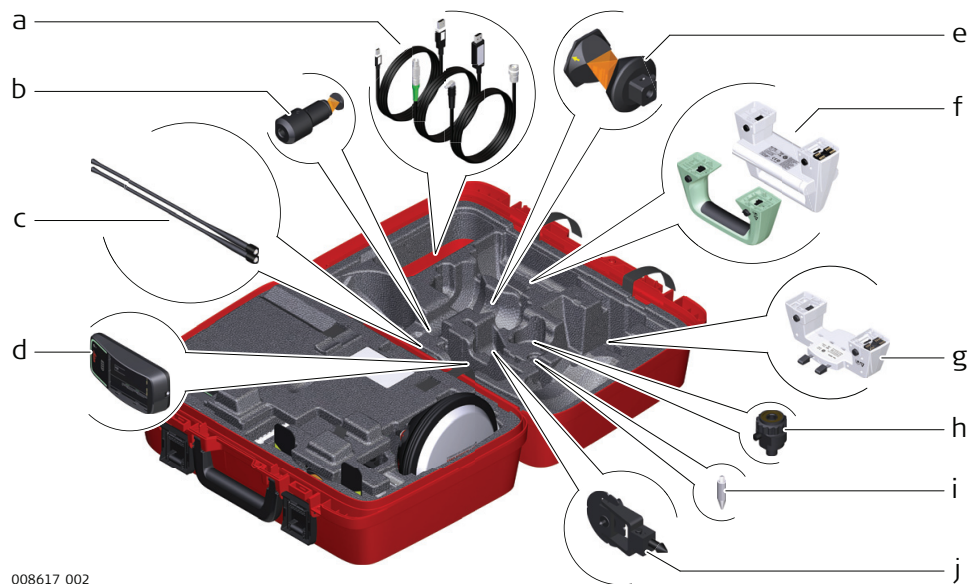
Container for GS SmartPole/ SmartStation and accessories - part 1 of 2



008616.004

- a GHT63 pole holder clamp
- b Allen key and adjustment tool
- c GAD33 antenna arm
- d CS35/CS30 tablet or CS20 field controller with GHT62 holder
- e GAD108 antenna arm
- f Manuals and USB documentation card
- g GPR121 circular prism PRO or GZT4 target plate for GPH1 and GPH1 prism holder with GPR1 circular prism
- h GAD109 QN-TNC Adapter
- i GAT25 radio antenna
- j Stylus
- k GEB212 or GEB331 batteries
- l SLXX RTK modem
- m Antenna
- n SD card and cover

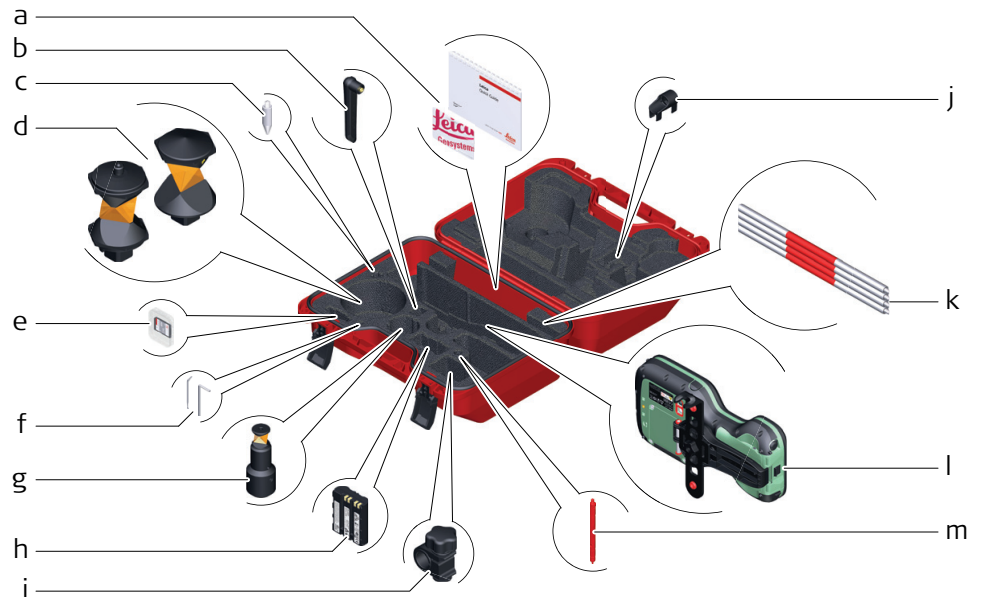
**Container for
GS SmartPole/
SmartStation and
accessories -
part 2 of 2**



008617.002

- a Cables
- b GRZ101 mini prism and GAD103 adapter
- c GAT1 or GAT2 radio antennas
- d GKL311 charger
- e GRZ4 or GRZ122 prism
- f Standard handle or RadioHandle
- g GAD110 adapter for antenna
- h GAD31 screw to stub adapter
- i Mini prism spike
- j GMP101 mini prism

**Container for TS
robotic pole setup,
Small-Size**



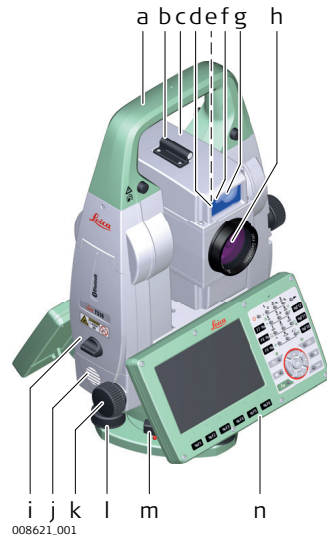
008620.001

- a Manuals and USB documentation card
- b GAT25 radio antenna
- c Mini prism spike
- d GRZ4 or GRZ122 prism
- e SD card and cover
- f Adjustment tool and allen key
- g GRZ101 mini prism and GAD103 adapter
- h GEB331 battery
- i GHT63 pole holder clamp
- j Tip for mini pole
- k GLI115 clip-on bubble for GLS115 mini prism pole
- l CS20 field controller and GHT66 holder
- m Stylus

2.4

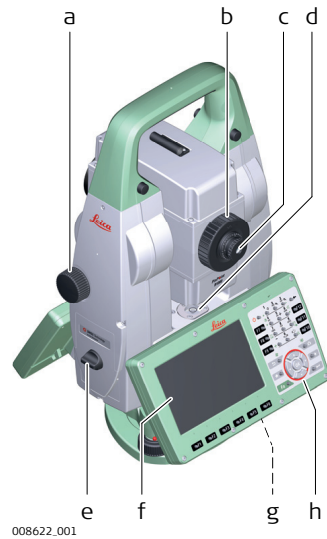
Instrument Components

Instrument components part 1 of 2



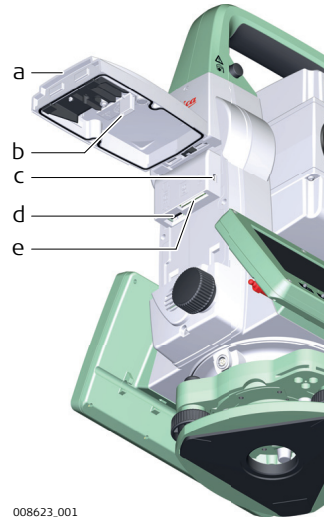
- a Carry handle
- b Optical sight
- c Telescope, integrating EDM, ATRplus, EGL, PS, overview camera
- d EGL flashing diode - yellow and red
- e Overview camera
- f PowerSearch, transmitter
- g PowerSearch, receiver
- h Coaxial optics for angle and distance measurement, and exit port of visible laser beam for distance measurements
- i SD Card and USB stick
- j Loudspeaker
- k Horizontal drive
- l Tribach footscrew
- m Tribach securing screw
- n Second keyboard (optional)

Instrument components part 2 of 2



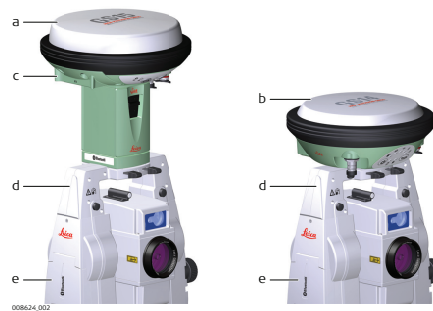
- a Vertical drive
- b Focusing ring
- c Interchangeable eyepiece
- d Circular level
- e Battery compartment
- f Touch screen
- g Stylus for touch screen
- h Keyboard

Communication Side Cover



- a Compartment lid
- b USB stick cap storage
- c USB device port (mini AB OTG)
- d USB host port for USB stick
- e SD card port

Instrument components for SmartStation



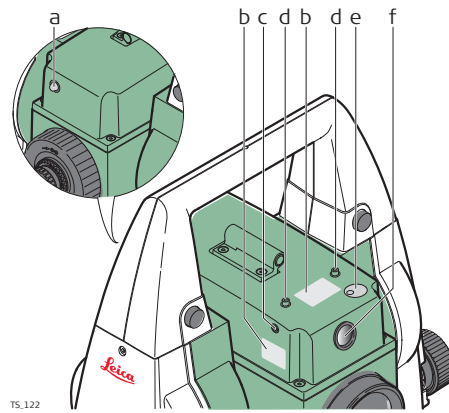
- a GS15 SmartAntenna
- b GS16 SmartAntenna
- c RTK slot-in device
- d GAD110 SmartAntenna Adapter
- e Communication side cover

Instrument components for remote mode



- a RadioHandle
- b Communication side cover

Laser guide components



TS_122

- a Operation indicator LED, orange
- b Labelling
- c Horizontal adjustment screws
- d Fixing screws
- e Safety cover for vertical adjustment screws
- f Laser aperture

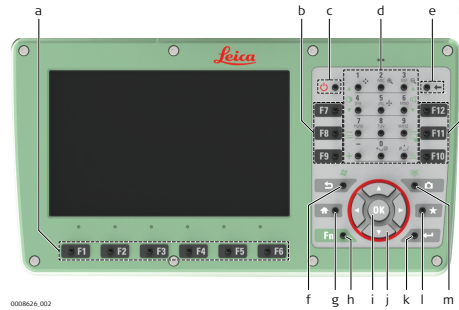
3

User Interface

3.1

Keyboard



Keyboard


























- a Function keys F1-F6
- b Function keys F7-F12
- c ON/OFF
- d Alphanumeric keys
- e Backspace
- f Esc
- g Home
- h Fn
- i OK
- j Arrow keys
- k Enter
- l Favourites
- m Camera

Keys

Key	Function
Function keys F1 to F6	Correspond to six softkeys that appear on the bottom of the screen when the screen is activated.
Function keys F7 to F12	User definable keys to execute chosen commands or access chosen screens.
Alphanumeric keys	To type letters and numbers.
Camera	To capture an image with the camera.
Esc	Leaves the current screen without storing any changes.
Fn	Switches between first and second level of any key on the keyboard.
Enter	Selects the highlighted line and leads to the next logical menu / dialog. Starts the edit mode for editable fields. Opens a selectable list.
ON/OFF	If the instrument is already off: Turns on the instrument when held for 2 s. If the instrument is already on: Turns to Power Options menu when held for 2 s.
Favourites	Goes to a favourites menu.
Home	Switches to the Home Menu.
Arrow keys	Move the focus on the screen.

Key		Function
OK		Selects the highlighted line and leads to the next logical menu / dialog. Starts the edit mode for editable fields. Opens a selectable list.
Backspace		Deletes the job in the centre of the job carousel.

Key combinations

Key		Function
	+ 	Hold Fn while pressing  . Switch to Windows.
	+ 	Hold Fn while pressing  . Take a screenshot of the current screen.
	+ 1 	Hold Fn while pressing 1 . Increase the screen brightness.
	+ 4 	Hold Fn while pressing 4 . Decrease the screen brightness.
	+ 3 	Hold Fn while pressing 3 . Increase the volume for acoustic warning signals, beeps and keypresses on the instrument.
	+ 6 	Hold Fn while pressing 6 . Decrease the volume for acoustic warning signals, beeps and keypresses on the instrument.
	+ 7 	Hold Fn while pressing 7 . Lock/unlock the keyboard.
	+ 9 	Hold Fn while pressing 9 . Lock/unlock the touch screen.
	+ - 	Hold Fn while pressing - . Enter a plus sign instead of a minus sign.
	+ 	Hold Fn while pressing  . Turn the keyboard illumination on/off.

3.2

Keyboard and touch screen

Operating Principles

The user interface is operated either by the keyboard or by the touch screen with supplied stylus. The workflow is the same for keyboard and touch screen entry, the only difference lies in the way information is selected and entered.



Operation by keyboard

Information is selected and entered using the keys.





Operation by touch screen

Information is selected and entered on the screen using the supplied stylus.

Operation	Description
To select an item	Tap on the item.

Operation	Description
To start the edit mode in editable fields	Tap on the editable field.
To highlight an item or parts of it for editing	Drag the supplied stylus from the left to the right.
To accept data entered into an editable field and exit the edit mode	Tap on the screen outside of the editable field.
To open a context-sensitive menu	Tap on the item and hold for 2 s.
To zoom in	Available on CS35/CS30 and win32 tablets. Tap in the 3D viewer area using two fingers and move them apart. 
To zoom out	Available on CS35/CS30 and win32 tablets. Tap in the 3D viewer area using two fingers and bring them closer together. 

Operation on CS35/CS30 and win32 tablets for quick text deletion

Operation	Description
To highlight a whole text for editing	Two options are available: <ul style="list-style-type: none"> • Double-click the text. • Long-press (press-and-hold) on the text.
To delete a whole text	Highlight a whole text for editing. Press the  key on the virtual keyboard.
To delete a whole text and enter new text at the same time	Highlight a whole text for editing. Type the characters for the new text on the virtual board.
To set the cursor at the beginning of a text	Highlight a whole text for editing. Press the  key on the virtual keyboard.
To set the cursor at the end of a text	Highlight a whole text for editing. Press the  key on the virtual keyboard.
To delete the text in the code editable field	Highlight a whole text for editing. Press Ctrl plus  on the virtual keyboard at the same time.

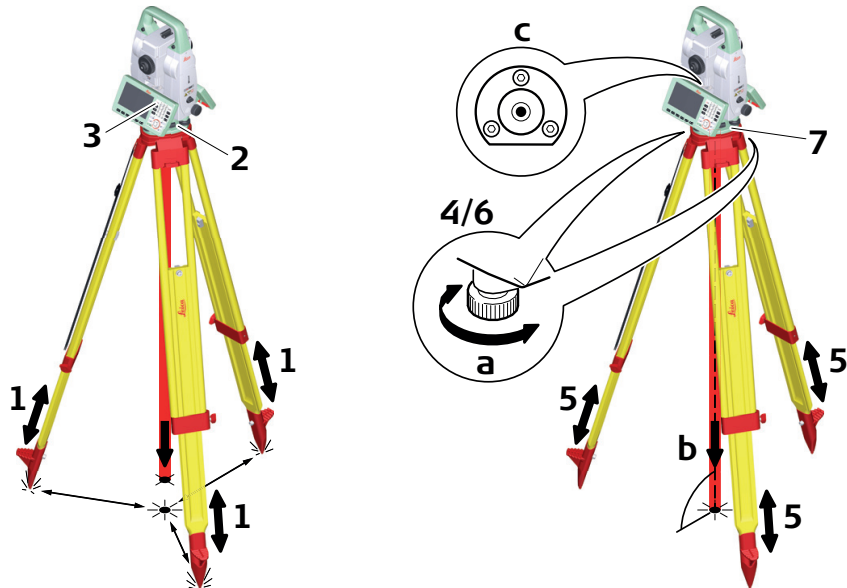
4

Operation

4.1

Setting Up the TS Instrument

Instrument setup step-by-step



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

1. Extend the tripod legs to allow for a comfortable working posture. Position the tripod above the marked ground point, centring it as good as possible. Ensure that the tripod plate is roughly horizontal.
2. Fasten the tribrach and instrument onto the tripod.
3. Turn on the instrument by pressing . Select **Settings/TS instrument/Level & compensator** to activate the laser plummet and electronic level.
4. Use the tribrach footscrews (a) to centre the plummet (b) above the ground point.
5. Adjust the tripod legs to level the circular level (c).
6. By using the electronic level, turn the tribrach footscrews (a) to level the instrument precisely.
7. Centre the instrument precisely over the ground point (b) by shifting the tribrach on the tripod plate.
8. Repeat steps 6. and 7. until the required accuracy is achieved.



Use the AutoHeight laser plummet for vertically setting up the instrument over a ground point and for measuring the instrument height when setting up the station.