



Version 1.1
English

HDS7000

User Manual

- when it has to be **right**

Leica
Geosystems

Introduction

Purchase



Congratulations on the purchase of a HDS7000 instrument.

This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "6 Safety Directions" for further information.

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

Product identification

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

Type: _____

Serial No.: _____

Symbols

The symbols used in this manual have the following meanings:

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 and/or 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.

Trademarks

- Windows is a registered trademark of Microsoft Corporation
- All other trademarks are the property of their respective owners.

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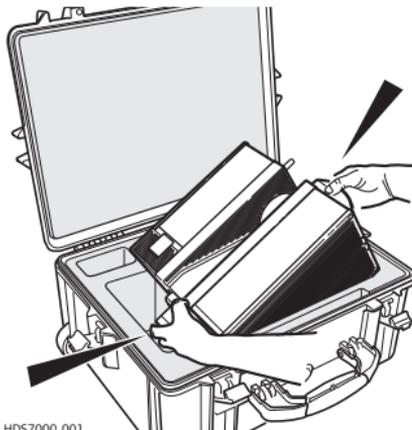
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1 Description of the System

1.1 Packing / Unpacking

Unpacking

When in its transport container, the HDS7000 sits in with the Wi-Fi antenna in face-up 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 (9.8 kg).

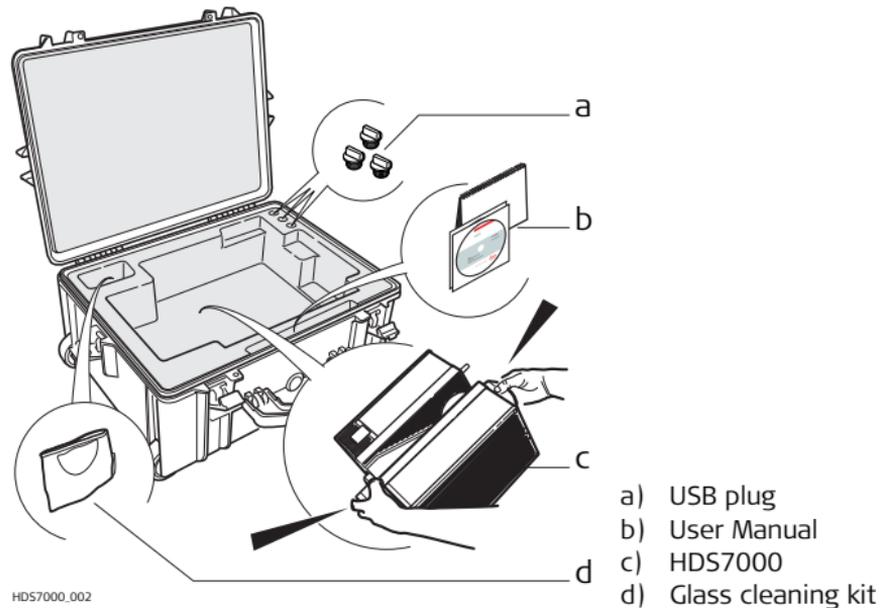


Pack the instrument the same way it is delivered.

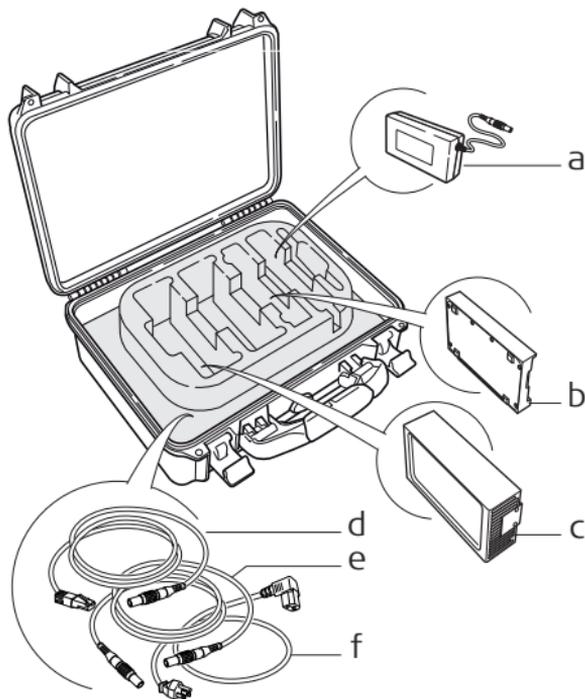
1.2

Container Contents

Transport
container for
HDS7000



Transport container for HDS7000 accessories



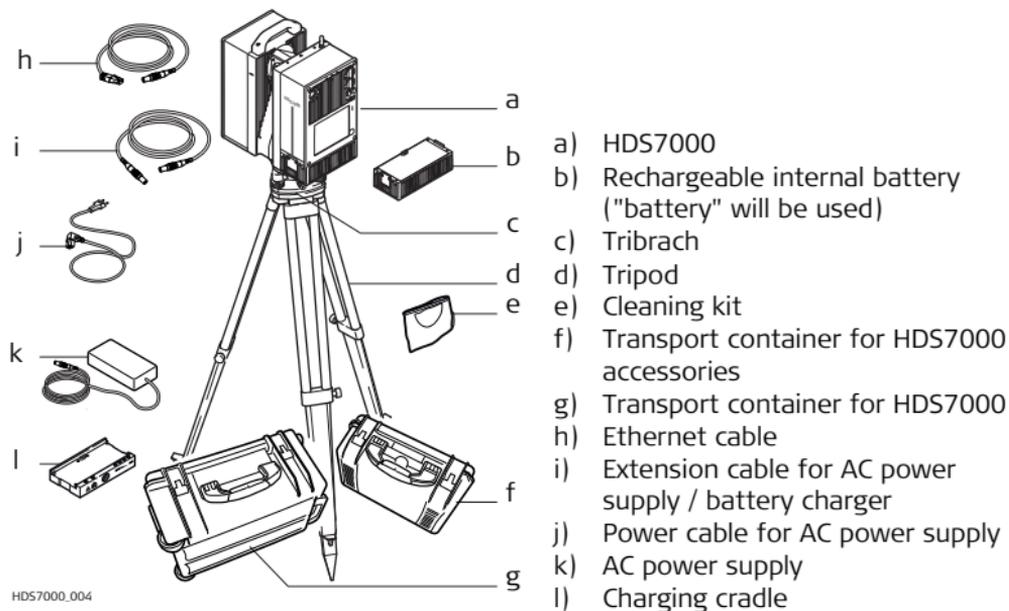
- a) AC power supply / battery charger
- b) Charging cradle
- c) HDS7000 battery
- d) Ethernet cable
- e) Extension cable for AC power supply
- f) Power cable for AC power supply

HDS7000_003

1.3

Instrument Components

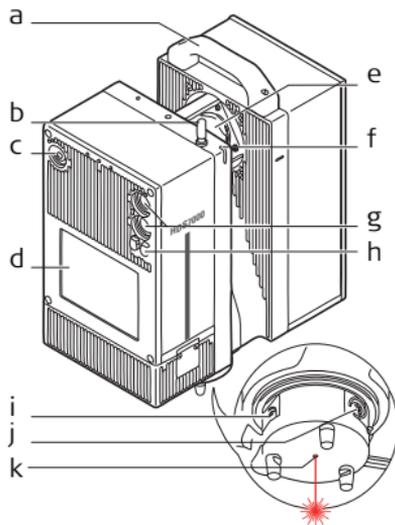
Overall system



Hardware options

- USB plug (32 GB)
- HDS7000 scan targets and target accessories
- Dolly

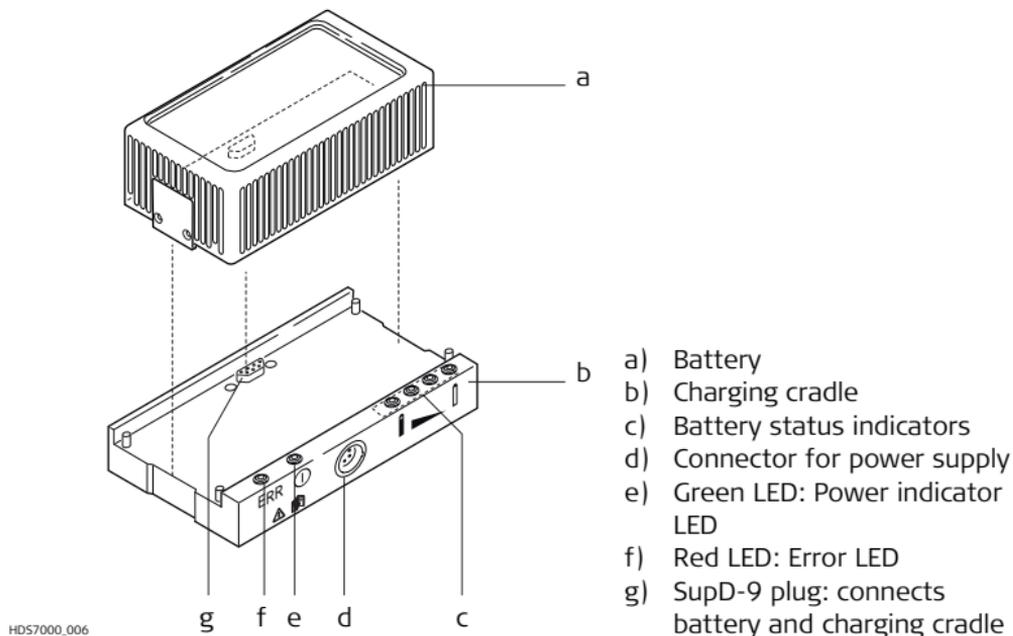
HDS7000



HDS7000_005

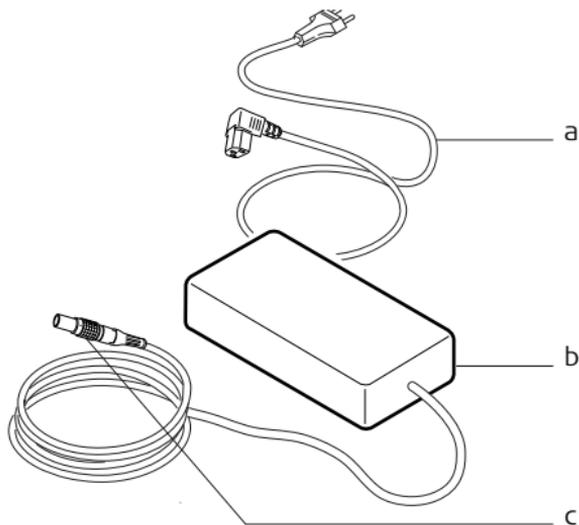
- a) Handle
- b) Wi-Fi antenna
- c) ON/OFF button
- d) Touch screen / Display
- e) Rotating mirror (Laser exit)
- f) Designated slot for stylus-pen
- g) USB Connectors, P1, P2
- h) Lemo Connectors, P3, P4
- i) Ethernet connector
- j) Connector for power supply
- k) Laser plummet

Battery and charging cradle



Use the SupD-9 plug only for connecting to the battery.

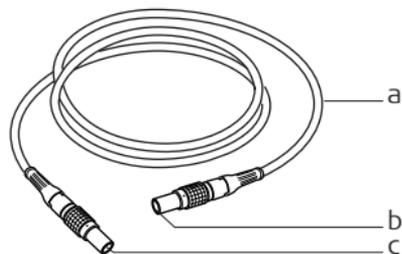
**AC power supply /
Battery charger**



- a) Power cable for AC power supply
- b) AC power supply
- c) Lemo plug (3 pin, female)

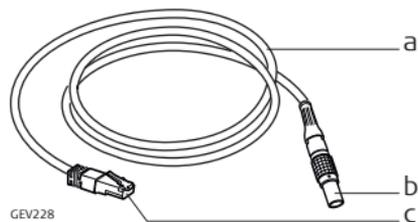
HDS7000_007

Extension cable for AC power supply



- a) Cable
- b) Connector 3 pin, female
- c) Connector 3 pin, male

Ethernet cable

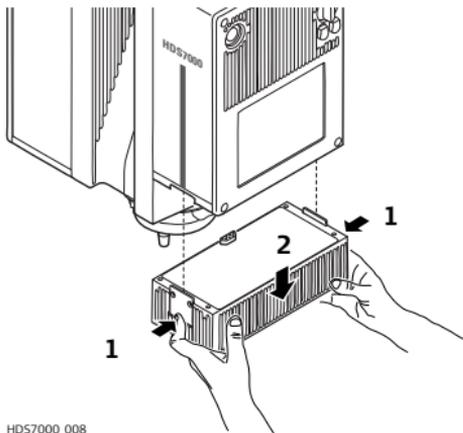


- a) Cable
- b) Connector, 8 pin male
- c) Ethernet connector

1.4 Cabling

1.4.1 Operate the HDS7000 with the Battery

Change the battery



HDS7000_008

1. Hold the battery with both hands and press the fixing clips.
2. Pull the battery carefully downwards.



A battery should always be attached to ensure the optimum weight balance for the HDS7000. If there is no removable battery connected, a warning message appears.



Never remove the battery while the HDS7000 is switched on.

Precautions:

- Switch off the HDS7000 beforehand or
 - use the external power supply
-



If the HDS7000 is operated until the battery is completely empty, it has to be recharged immediately. Failure to do this can result in battery damage.



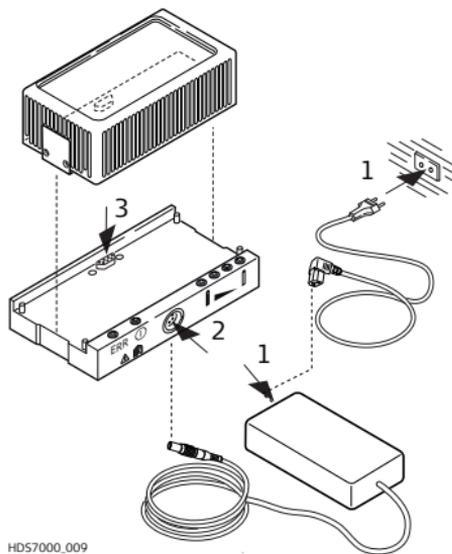
Primary use/charging

- The batteries must be charged prior to using for the first time because it is delivered with an energy content as low as possible.
- 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.
- The permissible temperature range for charging is between 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 if the temperature is too high.

Operation/Discharging

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

Charging the battery



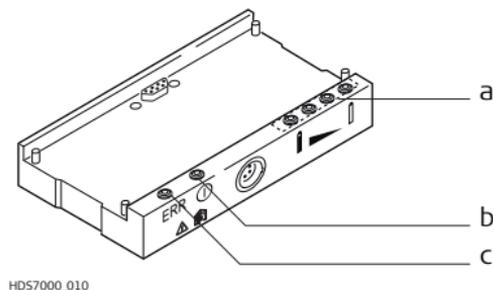
HDS7000_009

1. Plug the power cable into the battery charger and into an AC plug.
2. Using the HDS7000 power supply cable connect the charging cradle and the battery charger.
3. Place the battery onto the charging cradle.
4. After 30sec initialization, the charging cradle's battery status indicators will indicate the current battery charging status.
5. Disconnect the cables.



Charging of the battery takes approximately 1.5 hours.

Understand the charging cradle's LEDs:



HDS7000_010

- a) Battery status indicators
- b) Power indicator LED (green)
- c) Error LED (red)

Battery status indicators	<ul style="list-style-type: none">• If all four LEDs flash continuously then there is no battery in the charging cradle.• The overall charging capacity of the battery is divided into quarters. Each LED corresponds to a quarter:<ul style="list-style-type: none">• If the battery charge state is low the appropriate LED flashes slowly.• The LED flashes faster as the charge state improves.• If an LED illuminates constantly the battery has reached the appropriate level of charge.• When all four LEDs illuminate constantly the battery is 100% charged.
Error LED	The red LED illuminates if there is a fault in the electricity supply. Please refer to "HDS7000 Battery" in "4 Troubleshooting".
Power indicator LED	The green power indicator LED illuminates if the charging cradle is under voltage.



Danger

For AC power supply:

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!



Danger

Death or serious injury can occur if unit is not connected to ground.

Precautions:

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



Warning

Batteries not recommended by Leica Geosystems may be damaged if charged or discharged. They may burn and explode.

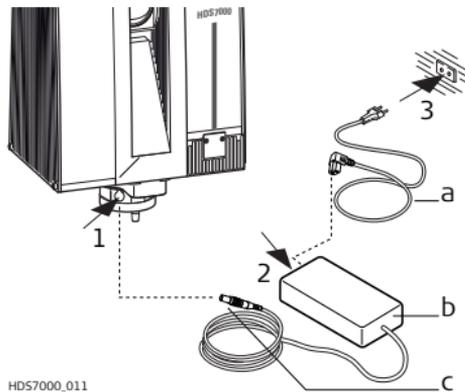
Precautions:

Only charge and discharge batteries recommended by Leica Geosystems.

1.4.2

Operate the HDS7000 with the Battery Charger (AC Power Supply)

Operate the HDS7000 with the battery charger



HDS7000_011

- a) Power cable for AC power supply
- b) AC power supply
- c) Power cable to the HDS7000

1. Connect the power cable to the HDS7000.
2. Connect the AC power supply with the power cable.
3. Connect the power cable to the main supply.
4. Switch on the HDS7000.

**For AC power supply:**

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!



Death or serious injury can occur if unit is not connected to ground.

Precautions:

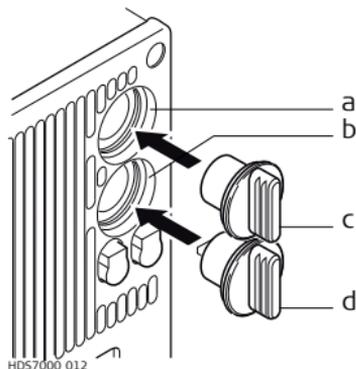
To avoid electric shock power cable and power outlet must be grounded.



1.4.3

USB Ports

USB ports



- a) USB port P1
- b) USB port P2
- c) USB plug
- d) USB memory stick



USB memory sticks and USB plugs that belong to the HDS7000 should always be attached to the respective USB ports P1 and P2 to prevent dirt and moisture to enter the scanner.



The scanner can be set in the menu to directly store current scans to the USB memory stick.



The file format on the external USB sticks must be FAT32. NTFS is not supported.

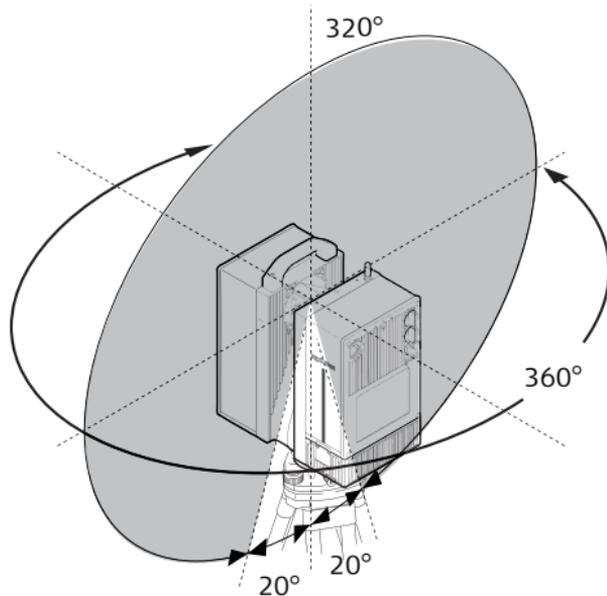
 **Caution**

Eject the USB memory sticks by pushing the corresponding buttons  before removing them. Do not remove the USB memory sticks as long as the symbols  are displayed.

1.5 Field of View (FOV)

Field of view

The HDS7000 has a rotating mirror system that covers a 360 x 320 degree field of view.



HDS7000_013

1.6

HDS *Cyclone* Software Suite

General

Leica Geosystems HDS *Cyclone* software modules provide point cloud users with the widest set of work process options for 3D laser scanning projects in engineering, surveying, construction and related applications.

The Software consist of five packages:

- *Cyclone* Scan:
allows the user to control the Scanner.
 - *Cyclone* Register:
allows the user to register multiple Scans together or to Geo-reference the point cloud.
 - *Cyclone* Survey:
gives the user basic functionality to extract and measure information from point clouds.
 - *Cyclone* Model:
gives the user the full functionality of *Cyclone*. The user is able to extract and measure features and to create a 3D Model out of the point clouds.
 - *Cyclone* Publisher:
allows users to publish point cloud data to a panoramic viewing format which can be posted to the Web. Users can then view this data using the Internet Explorer plug-in Leica TruView.
-



- For more information on *Cyclone* Software Suite, please visit: <http://www.leica-geosystems.com/hds>
 - *Cyclone* Software has also an online help available which can be accessed through the F1 key on your keyboard.
-

General Operating Principles

- **Download:**
Cyclone Software, as well as important Support documentation, can be downloaded from the Leica Geosystems HDS Website (<http://www.leica-geosystems.com/hds/en/27054.htm>).
The User must create an account before the download section is accessible.
 - **Installation:**
You must use a Windows account with administrator privileges to install or upgrade *Cyclone*, CloudWorx for AutoCAD, CloudWorx for MicroStation, CloudWorx for PDMS or CloudWorx for Intergraph SmartPlant® Review.
 1. Download the *Cyclone* Installshield from the website specified above.
 2. Run the Installation file.
 3. Follow the onscreen instructions and select the software you wish to install.
 4. Go to the License Request Page.
 - **Language:**
Cyclone's operating Language is English.
-

2 Setting Up the Instrument

2.1 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.

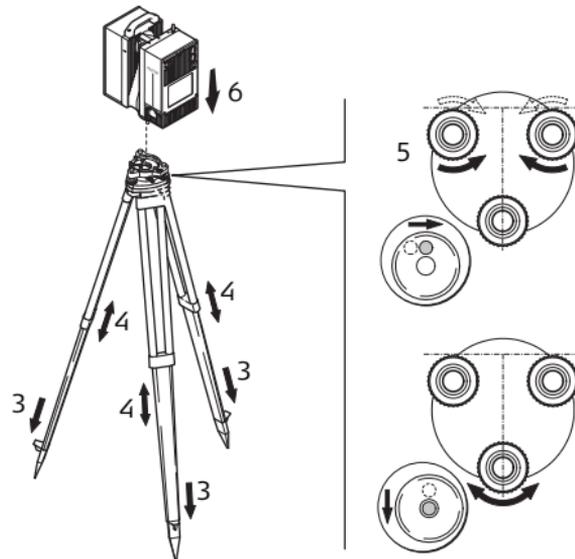
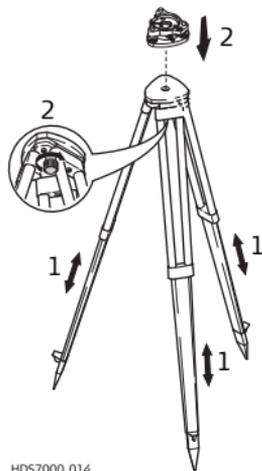


It is always recommended to shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.

2.2

Scanner Setup on Tripod

Setup step-by-step





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. 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. Level up the tribrach using the 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.
6. Place the instrument on the tribrach and secure it with the tribrach's locking knob. Make sure that the instrument is levelled by checking the built-in circular level.



When placing the instrument on the tribrach, align the legs of the scanner's table stand with the foot screws of the tribrach.



It is recommended to setup the HDS7000 horizontally by using the tripod screws. Subsequently the established horizontation can be refined using the integrated electronic level. If the incline is more than 0.5° , a warning appears before scanning.

2.3 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. Geo-referencing of the HDS7000 is established by setting up over a known or assumed control point, with optional reference target measurement to set the azimuth direction, and establishing a local or global coordinate system. The HDS7000 allows you to traverse, resect or free-station. Known azimuth or known backsight measurements can be observed.



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

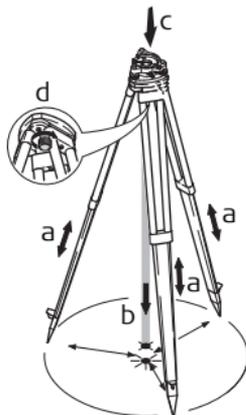


The data scanned with HDS7000 is corrected by an internal dual-axis compensator, when the dual-axis compensator is enabled.

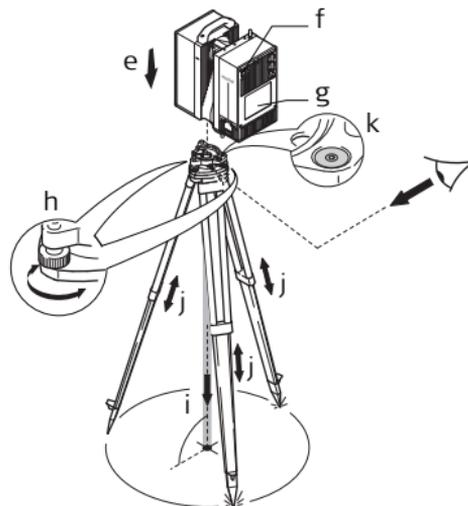


- The laser plummet described in this topic is built into the vertical axis of the instrument. It projects a red spot onto the ground, making it much easier to centre the instrument.
 - The laser plummet cannot be used in conjunction with a tribrach equipped with an optical plummet.
-

Setup step-by-step



HDS7000_015



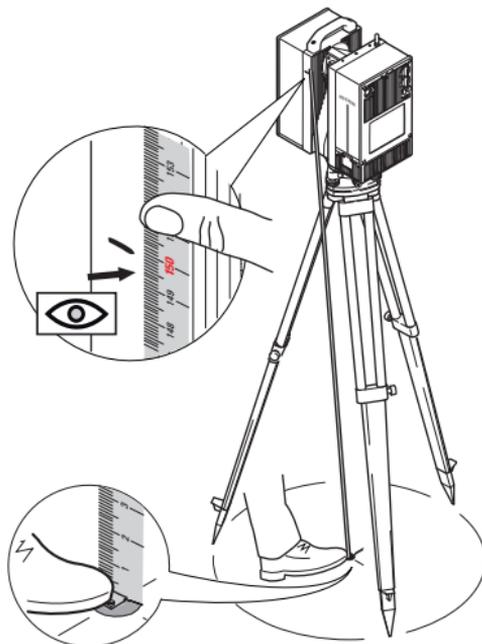
Shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.

1. Extend the tripod legs to allow for a comfortable working posture (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 **Level, Laser 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 (**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.
-

2.4 Instrument Height

Measure instrument height



HDS7000_016

To get an accurate measurement, hold the end of measurement tape with your foot on benchmark. Now expand the measurement tape and read height using bottom line on unit as shown.



Take care to use a 1:1 measure, not a special tape that is scaled differently (used for common surveying instruments).

2.5

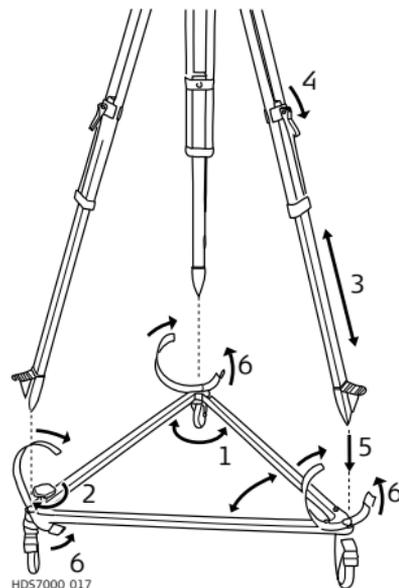
Setting Up the Instrument with the Dolly

Set up the tripod with the dolly

1. Fold the dolly apart.
2. Assemble the dolly triangle and secure it with the screw.
3. Extend the tripod legs to an even length.
4. Fix the tripod legs.
5. Position the legs into the respective seats on the dolly triangle.
6. Secure the tripod legs with the respective securing strap of each set



The dolly is available as an optional accessory and is not part of the standard scope of delivery.



3 Scanning

3.1 Switching the System On/Off

Switch on procedure

1. Setup the instrument as desired. Refer to chapter "2 Setting Up the Instrument" for more information.
 2. Check that the lens is clean.
 3. Press and hold the ON/OFF button for a minimum of 0.3 seconds.
 4. The power-up process starts and requires approximately 20 seconds to complete. During the power-up process the vertical mirror will spin.
 5. The system menu is shown on the display.
 6. An audible signal sounds.
-

Switch off procedure

- Press and hold the ON/OFF button for a minimum 0.5 seconds.
 - The display shows **Shut down system. Please wait.**
-



In the event of a system crash, press the ON / OFF button for at least 5 seconds. The system switches itself off.

3.2

Preparations

Targets

- Checkerboard pattern
 - Use non-reflective targets
 - Use non-reflective target mounting and devices (such as adhesive strips or holders)
 - Good recognizable labeling
 - Distribute the targets over the scanning area at different elevations
 - Have at least three targets per scan
 - For best results use the 6" Leica grey and white tilt-and-turn targets.
 - For printed paper targets use white paper and laser printers only. Test your print-outs prior to using them in the field.
-

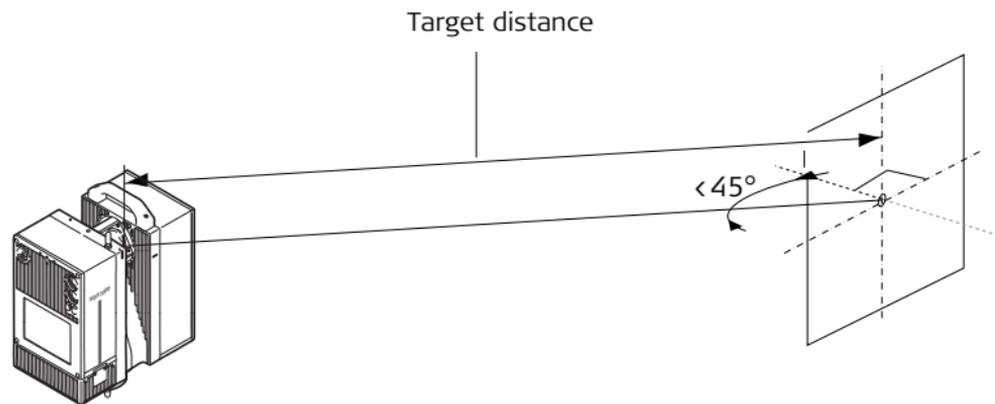
**Position the
HDS7000**

- Position the HDS7000 in the center of the target field.
- The "angle of incidence" is smaller the more perpendicular the surface is to you, so the angle of incidence should be smaller than 45 degrees (see following illustration).
- The recommended distance of the targets to the scanner depends on the scan resolution.
- Ensure that the HDS7000 is within the recommended distance to the targets.

Resolution	Recommended target distance at angle of incident approx. 90°
Low	1 - 10 m
Middle	1 - 15 m
High	1 - 20 m
Super High	1 - 25 m
Ultra High	1 - 30 m
Extreme High	1 - 35 m



With smaller angle the possible target distance is reduced.



HDS7000_018

3.3

Ambient Conditions

Unfavorable surfaces

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



Color or powder these surfaces before scanning.

Unfavourable weather conditions



- Rain, snow or fog cause poor measurements, so it is not possible to survey during these conditions!
 - Surfaces that are directly illuminated by the sun have 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 too low or too high



- If the temperature is outside the specified range, an error message is displayed. Scanning is still possible, but the measuring accuracy is no longer within specification.
Precaution: Warm up / cool down the instrument.
 - To avoid damages of the electronics, the instrument switches off when the upper temperature limit is exceeded.
Precaution: Cool down the instrument in a cold place.
 - If the instrument is brought from a cold environment (e.g., from storage) into a warm and humid environment, the glass window at the mirror or in extreme case even the interior optics can fog up. This causes measurement errors.
Precaution: Avoid large temperature differences; give the instrument time to acclimate.
-

Mirror



Soiling at the glass pane of the mirror, such as a layer of dust, condensed water or fingerprints, causes considerable measuring errors.

Memory capacity



Before initiating the scanning process check if there is enough space on the internal flash disk (30 – 60 GB per day, depending on your planning).

Others

Keep field notes containing:

- Target positions relative to the instrument.
 - Position of the instrument within the measured area (such as the factory or shed plan).
-

Cyclone-SCAN

The *Cyclone* SCAN software controls scanning operations with the instrument and allows point cloud visualization and measurement.

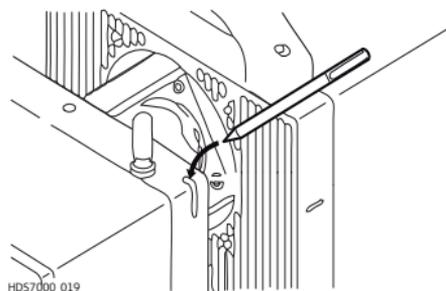


Refer to the *Cyclone* help system for information about the connection of the instrument to *Cyclone* and further scanning operations.

3.4

Onboard Controls

Stylus for touch screen



To control the HDS7000 via the touch screen a special stylus is required which is located directly at the scanner in the designated slot and can be removed for operation.

- Clicking on a symbol or button opens a menu or executes a command.
- Keep the pen on a symbol for more than 0.5 seconds to show a tooltip with further information on the respective button or parameter.
- The horizontal motor of the instrument can be arrested to enable data input with the stylus without instrument rotation. The motor is released automatically after 5 seconds without any further user interaction or with a scan start.
- By clicking the release symbol in the status bar the motor can be released immediately.
- The most important scanning menus can also be operated with a finger touch. The resistive touch screen reacts on pressure, therefore you can also operate the scanner wearing gloves.

Overview display



HDS7000_020

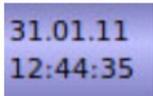
- a) Status bar
- b) Screen area
- c) Command bar

Element	Description
Status bar	Shows current status information for the instrument.
Screen area	Working area of the screen.
Command bar	Shows available commands of the current screen.

Overview status bar icons



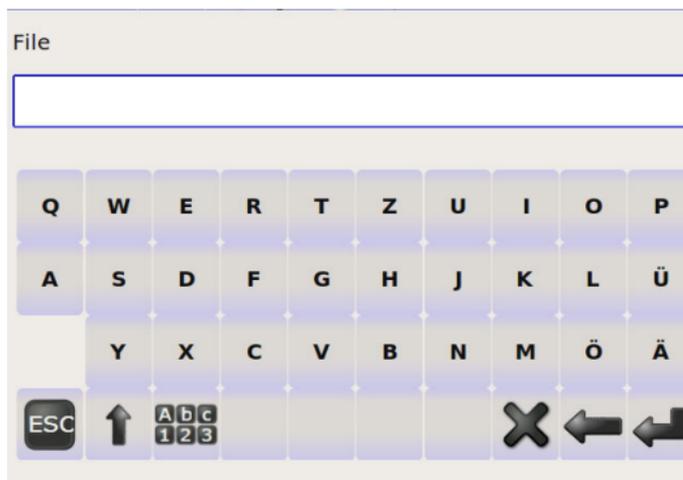
The icons in the status bar display the current status information of the instrument. Clicking a status icon opens a tooltip with a detailed status description.

Element	Description
	Shows scanner status and IP address. In the tooltip information about firmware version, DHCP status and remaining time until next calibration is listed.
	Shows current date and time.
	Status of the battery, tooltip shows exact capacity.
	Scanner is connected to external power.

Element	Description
	Internal flash disk capacity, tooltip shows used and free disk space.
	A USB memory stick is connected to upper USB port P1 or bottom USB port P2. It can be ejected by clicking the respective icon.  Eject the USB memory stick before removing it. Do not remove it as long as the icon is visible.
	Wi-Fi is activated and can be used.
	The DHCP server is active.
	Laser plummet is activated.
	Horizontal motor is locked. Press icon to release.

Element	Description
	Shows the current menu, for example "Home".

Overview user input



When an numeric or alphanumeric input field is selected with the stylus, a virtual keyboard opens offering letters, numbers and special characters.

Element	Description
	Quit keyboard mode and return to previous menu.
	Toggle between upper and lower case.
	Toggle between alphanumeric and numeric/special characters.
	Delete all in the input field.
	Backspace.
	Confirm and return to previous menu.

3.5

Main Menu

Description

The main menu is displayed after the system boot process.

Icon	Description
Scanning 	Offers access to all commands for scanner operation control.

Icon	Description
Scans  Scans	Offers access to all commands for scan management.
Help  Help	Offers access to the online help menu.
Brightness 	Decrease or increase the brightness of the screen.
Status  Status	Show current scanner status.
Settings  Settings	Offers access to the scanner settings.
Hardware  Hardware	Offers access to hardware settings.

3.6

Scanning

Access

Select **Main Menu, Scanning** .



Description

In the **Scanning** menu all commands for scanner setup and scan parameters are available.

Scanning screen



Icon	Description
	Open the Level menu to control the digital bubble and the laser plummet.

Icon	Description
Scan predefined 	Quick-Scan button to start a scan with predefined parameters.
Scan 	Open the setup menu for scan parameters.
Profiler 	Open the setup menu for scanning in 2D profiling mode.
Panorama 	Open the menu for panoramic image acquisition with an external camera.
1-TO 	Open the One Target Orientation menu for scanner setup and orientation by known points.
Exit 	Close and return to previous menu.

Icon	Description
Setup 	Setup the parameters for a predefined scanning.

3.6.1

Level

Access

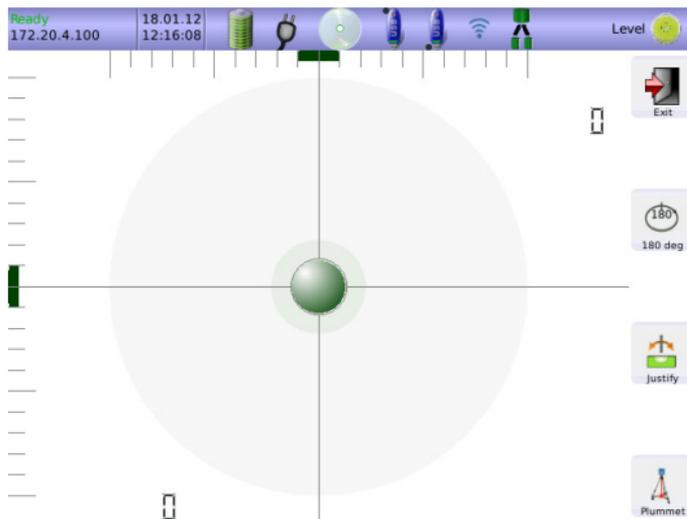
Select **Main Menu, Level**



Description

In the **Level** menu the digital bubble and the laser plummet can be controlled.

Level screen



Icon	Description
Rotate 180° 	Rotate the scanner horizontally by 180°.
Justify 	Turn the scanner horizontally to 0° and 180° and then calculate the tilt sensor's zero point (X0,Y0).
Plummet 	Turn the laser plummet on/off. By default the laser plummet is off after system boot.

Bubble colour	Description
Green	Tilt < 0.1°
Blue	Tilt < 0.5°
Blue	Tilt < 1.0°
Red	Tilt ≥ 1.0°



The digital bubble has to be turned off if the scanner is used in upside-down mode or if tilted more than 10°.

3.6.2

Start Predefined Scan

Access

Select **Main Menu, Scan predefined**



Description

In the menu **Scan predefined** a scan is started with predefined settings as defined in the menu **Setup** (refer to "3.6.7 Setup a Predefined Scan"). The button works like a quick-scan-button without any further configuration needed.

3.6.3 Scan with User Defined Settings

Access

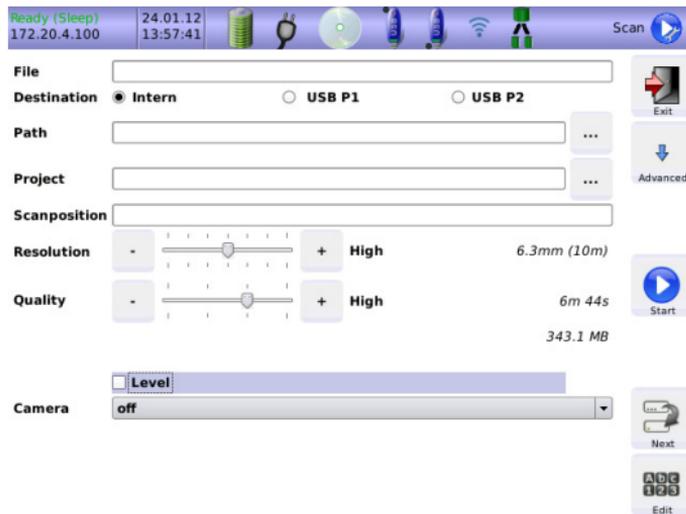
Select **Main Menu**, **Scan**



Description

In the **Scan** menu all parameters for a user defined scan can be set.

Scan screen



Field	Description
File	Enter file name of current scan. If file name is not changed, then next scan is named identically with the appendix increased by 1.
Destination	Select internal flash drive or external USB memory stick as storage medium for next scan.
Path	Create a folder on the chosen storage medium where to save the scan.
Project	Enter project name. Scans will be collected in one .PRJ project file.
Scanposition	Define a scan position. Mark scans from an equal scan position with the equal scan position name.
Resolution	Select the scan resolution by pressing the +/- buttons or the slider.
Quality	Select the scan quality by pressing the +/- buttons or the slider.
Level	Enable or disable the electronic level to monitor scanner movement during the scan process and overall inclination of the instrument.
Camera	Select optional camera. Setting is off by default.

Scanning resolution

Resolution level	Increments (Hz / V)	Point spacing at 10 m	Pixel/360°	ZFS file size (compressed) ²	Ideal object distance ³
Preview ¹	0.288° / 0.288°	50.3 mm	1250	ca. 4 MB	> 0.5 m
Low	0.144° / 0.144°	25.1 mm	2500	ca. 15 MB	> 1 m
Middle	0.072° / 0.072°	12.6 mm	5000	ca. 60 MB	> 2 m
High	0.036° / 0.036°	6.3 mm	10000	ca. 240 MB	> 5 m
Super High ³	0.018° / 0.018°	3.1 mm	20000	ca. 960 MB	> 20 m
Ultra High ³	0.009° / 0.009°	1.6 mm	40000	ca. 5 GB	> 40 m
Extreme High ^{3, 4}	0.004° / 0.004°	0.6 mm	100000	ca. 34 GB	> 100 m

- 1 Preview should not be used for measurement. It is intended for a fast preview only.
- 2 The file size depends on the compression rate.

- 3 Low distances to the object and high resolutions result in considerable overlapping of neighboring points, hence high resolutions do not improve image sharpness. Therefore high resolutions are only recommended for long distances to the object.
- 4 The resolution level "Extreme High" should only be chosen for selection scans. A complete scan with this resolution would require an enormous storage capacity and could not be loaded as one entity into the computer's memory.

Scan quality and speed

Resolution level	Pixel/360°	Low quality ²	Normal quality ²	High quality ²	Premium quality ²
Preview¹	1250	---	25 rps 31.75 KHz 0:26 min	---	---
Low	2500	50 rps 127 KHz 0:26 min	25 rps 63.5 KHz 0:52 min	12.5 rps 31.75 KHz 1:44 min	---
Middle	5000	50 rps 254 KHz 0:52 min	25 rps 127 KHz 1:44 min	12.5 rps 63.5 KHz 3:22 min	6.25 rps 31.75 KHz 6:44 min
High	10000	50 rps 508 KHz 1:44 min	25 rps 254 KHz 3:22 min	12.5 rps 127 KHz 6:44 min	6.25 rps 63.5 KHz 13:28 min

Resolution level	Pixel/360°	Low quality ²	Normal quality ²	High quality ²	Premium quality ²
Super High³	20000	50 rps 1.016 MHz 3:28 min	25 rps 508 KHz 6:44 min	12.5 rps 254 KHz 13:28 min	6.25 rps 127 KHz 26:56 min
Ultra High³	40000	---	25 rps 1.016 MHz 13:28 min	12.5 rps 508 KHz 26:56 min	6.25 rps 254 KHz 53:20 min
Extreme High^{3, 4}	100000	---	10 rps 1.016 MHz 1:21 h	5 rps 1.016 MHz 2:42 h	---

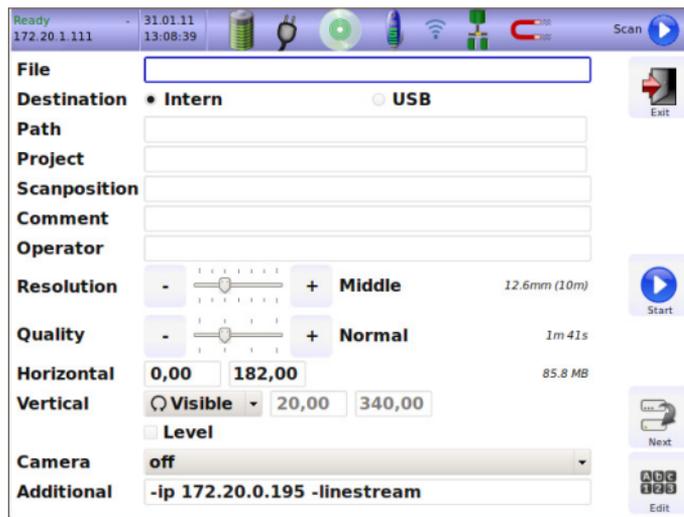
- 1 Preview should not be used for measurement. It is intended for a fast preview only.
- 2 Doubling ("low quality") and halving ("high quality") the data rate (pixel/sec.) theoretically increases the range noise on each pixel by 40% ("low quality") or decreases it by 40% ("high quality") compared to "normal quality". Depending on the roughness of the surface measured, in reality this difference could be less, especially when scanning objects with a bright surface at short distances, for example indoors.
- 3 Low distances to the object and high resolutions result in considerable overlapping of neighboring points, hence high resolutions do not improve image sharp-

ness. Therefore high resolutions are only recommended for long distances to the object.

- 4 The resolution level “Extreme High” should only be chosen for selection scans. A complete scan with this resolution would require an enormous storage capacity and could not be loaded as one entity into the computer’s memory.

Advanced scan screen

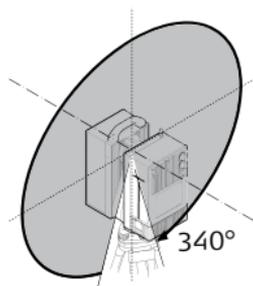
By clicking **Advanced** an advanced scan menu with additional settings can be accessed.



Field	Description
Comment	Enter additional information to be stored in the scan header.
Operator	Enter operator details to be stored in the scan header.
Horizontal	Define the left and right limit of the horizontal scan area.
Vertical	Define the bottom and top limit of the vertical scan area or select a predefined scan area.

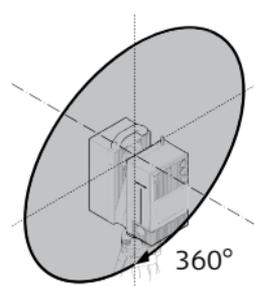
Predefined vertical scan range

Visible 20° - 340°



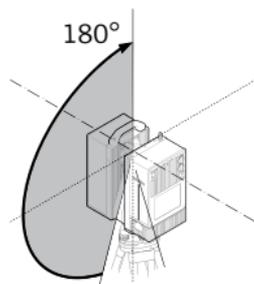
HDS7000_020

Full 0° - 360°



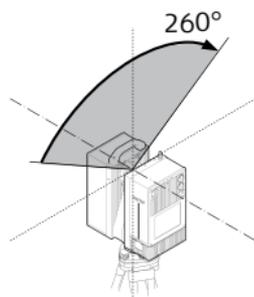
HDS7000_021

Left 20° - 180°



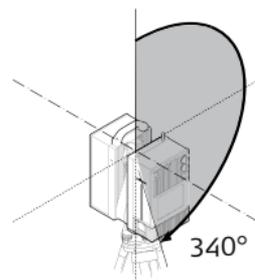
HDS7000_022

Top 100° - 260°



HDS7000_024

Right 180° - 340°



HDS7000_023

User

With this option selected, the user can enter the bottom and top limit in the designated fields.

3.6.4 Profile Scanning

Access

Select **Main Menu, Profiler**



Description

In the menu **Profiler** the settings for the 2D profiling mode can be controlled. In profile scanning the horizontal motor is blocked and only the vertical mirror rotates. In this mode the scanner typically is mounted on a moving vehicle and the horizontal rotation is replaced by a forward motion. To determine the trajectory of the motion additional sensors are required. A special manual is available for this operation mode.

3.6.5

Panorama

Access

Select **Main Menu, Panorama**



Description

In the menu **Panorama** panoramic images with an external camera can be created.

Panorama screen





Requires external software (e.g. PTGui) to stitch single images to a full panoramic image.

3.6.6

One Target Orientation (1-TO)

Access

Select **Main Menu, 1-TO**



Description

In the **1-TO** menu the settings of the One Target Orientation can be made. The user can enter coordinates, heights and names of a known scanner position and a known target position for an offline calculation of scanner setup and orientation by known points.

1-TO screen

Ready 23.01.12 172.20.4.100 18:19:22       1-TargetOrientation 

Scanposition

Name

Height (optional) m

XYZ (optional) m

Connection point

Name

Height m

XYZ (optional) m

 Exit

 Next

 Next

 Edit

3.6.7

Setup a Predefined Scan

Access

Select **Main Menu, Setup**



Description

In the **Setup** menu the settings for the quick-scan-button (refer to "3.6.2 Start Predefined Scan") can be defined. The settings are the same as for a user-defined scan (refer to "3.6.3 Scan with User Defined Settings"). In addition the parameters for the quick-scan-button can be protected by a password here.

3.7

Scans

Access

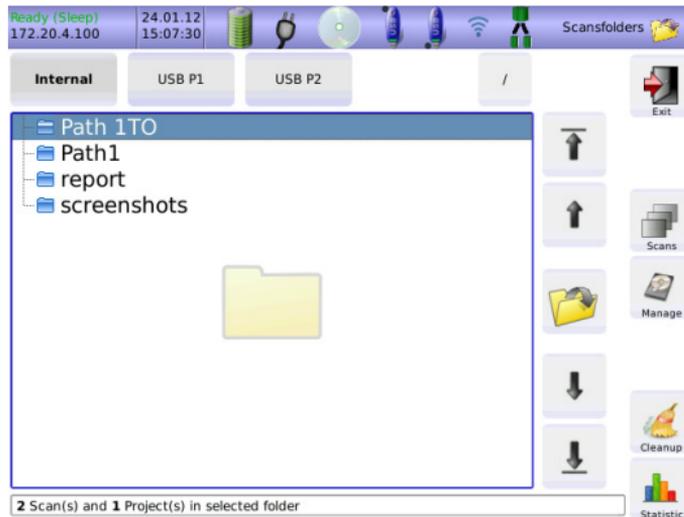
Select **Main Menu, Scans**



Description

In the **Scans** menu all commands for scan management are available such as copy, move, delete and display scans.

Scan folder screen

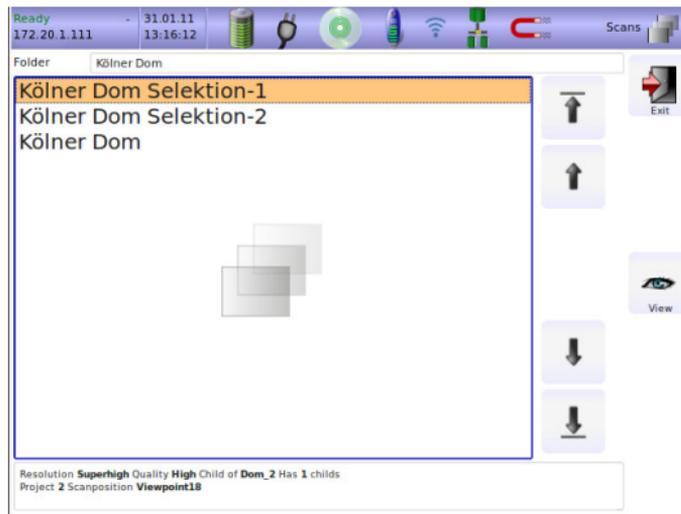


Icon	Function
<p data-bbox="368 707 700 733">Internal / USB P1/ USB P2</p> <div data-bbox="368 749 827 819"> Internal USB P1 USB P2 </div>	<p data-bbox="856 707 1362 767">Select access to internal flash drive or to external USB memory stick.</p>

Icon	Function
Root folder 	Go to root folder of selected drive.
Up / Down  	Navigate up or down in the folder list.
Go to first / last  	Navigate to the first or last folder in the list.
Expand 	Expand selected folder.
Scans 	List all scans of the selected folder.
Manage 	Switch to scan management to copy, move or delete scans.

Icon	Function
Cleanup 	Switch to disk management to clean up unlinked files and empty folders or to start Check Disk for fixing of logical file system errors.
Statistic 	Switch to the Statistics menu to display the number of scans per day in a selected month.

Scans screen

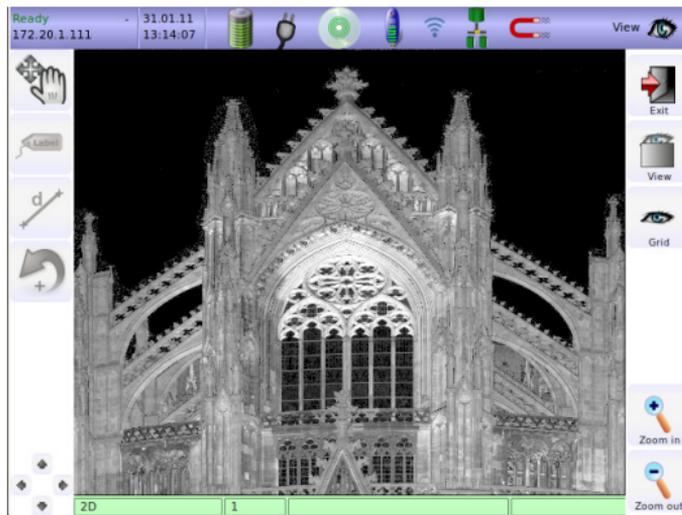


Icon	Function
Folder	Shows the selected folder.
Up / Down	Navigate up or down in the scan list.



Icon	Function
Go to first / last  	Navigate to the first or last scan in the list.
View	 View

View screen



Icon	Function
Mode 	Toggle between movement, selection and measurement mode.

Icon	Function
Label 	In selection mode create a text label at cursor position.
Distance 	In measurement mode get the distance between two points.
Undo 	Undo the last user command for movement, labeling or selection.
View 	Toggle between 2D, bubble and info view.
Grid 	In movement mode display/hide a grid.
Zoom in 	Zoom in to see details of the selected scan.

Icon	Function
Zoom out  Zoom out	Zoom out to get a better overview of the selected scan.

3.8

Help

Access

Select **Main Menu, Help**



Description

In the **Help** menu online help files and support contacts can be found.

3.9

Status

Access

Select **Main Menu**, **Status**



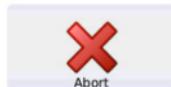
Description

In the **Status** menu the current scanner status and potential errors are displayed.

Status screen



No error



Icon	Function
Ignore 	Confirm error and proceed.
Abort 	Confirm error and abort.
Help 	Open help menu with support contacts.
Report 	Create a report file and store it on USB memory stick if connected.

3.10

Settings

Access

Select **Main Menu, Settings** .



Description

In the **Settings** menu the instrument can be configured by changing settings for language, units, date/time or the IP address.

Settings screen

Ready 172.20.1.111 31.01.11 13:18:19 Settings

Language English

Unit foot

Date / Time 31.01.11 13:17 Apply+switchoff

DHCP Client *1

DHCP Server *1

IP 172.20.1.111 *1

Wireless *1

Key (WPA2) nokey *1

m-cam Use graycard

*1 You have to reboot to take affect.

Exit

More

Next

Edit



Settings marked with “*1” require a scanner restart to take effect.

Field	Description
Language	Select operating language (English, German, Spanish, French, Italian, Japanese, Dutch, Russian, Portuguese, Chinese).
Unit	Select unit for distances (meter, foot, foot + inch, yard).
Date/Time	Set local date and time and confirm with "Apply+switchoff". After confirmation the scanner switches off and must be rebooted.
DHCP Client	Choose if a DHCP client is used.
DHCP server	Choose if a DHCP server is used.
IP	Change the scanner's IP address.
Wireless	Select for Wi-Fi operation.
Key (WPA2)	Enter password for WPA2 protection of Wi-Fi communication.
m-cam	Enable the graycard function of the m-cam.

3.11

Hardware

Access

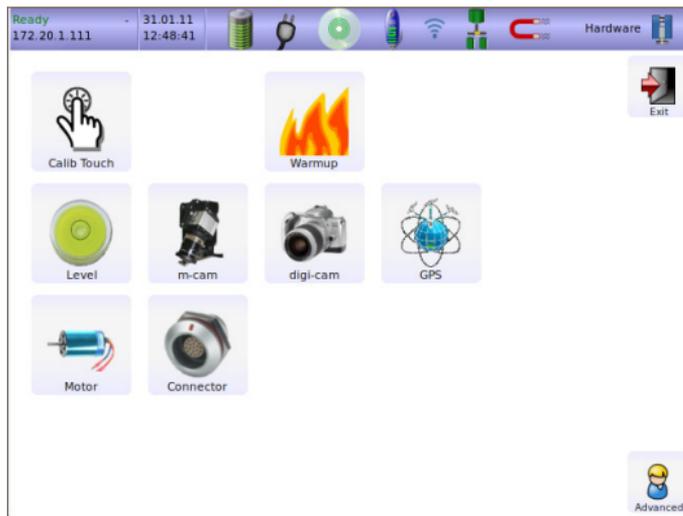
Select **Main Menu, Hardware** .



Description

In the **Hardware** menu information about internal and external hardware components is displayed.

Hardware screen



Icon	Function
Calib Touch 	Open touch screen calibration.
Level 	Open the Level menu to control the digital bubble and the laser plummet.

Icon	Function
Warmup 	Warm up the scanner by powering up (lubrication solvent liquefies) the motors and electronic parts.
M-Cam 	Check status and upload calibration parameters of an optional m-cam camera.
Digi-Cam 	Detect and check status of an optional digital camera.
GPS 	Check functionality of an optional attached GPS.
Motor 	Check functionality of horizontal and vertical motors.
Connector 	Test input and output signals of lemo connectors P3 and P4.

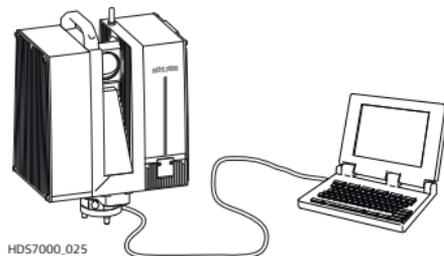
3.12

Connections

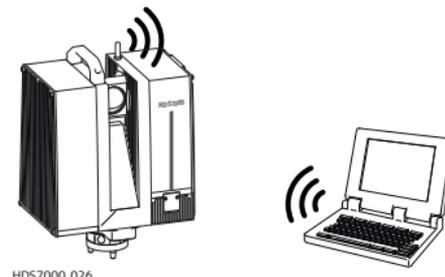
Description

The HDS7000 is equipped with an a network interface and a Wi-Fi interface to allow external control.

Cable connection



Wi-Fi connection



In order for a notebook/PC and the HDS7000 to communicate with one another, each of the devices must be able to send data to the other (network). So that this data arrives at the right station, the station must have a unique address. In an IP network this is achieved with an IP address.

The HDS7000 supports DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol). If the automatic reference to an IP address is set at the client (DHCP client), the HDS7000 can be included in any network without further configuration.

A DHCP server on the network automatically assigns an IP address to the DHCP client (HDS7000).

If the HDS7000 is connected by an Ethernet cable only to a notebook, without a wider network structure, then the HDS7000 is a DHCP server. The HDS7000 assigns a dynamic IP address to the notebook/PC on start-up.



If there is no DHCP the user must enter the IP address and netmask.

3.12.1 Connecting the HDS7000 to a Network by Cable

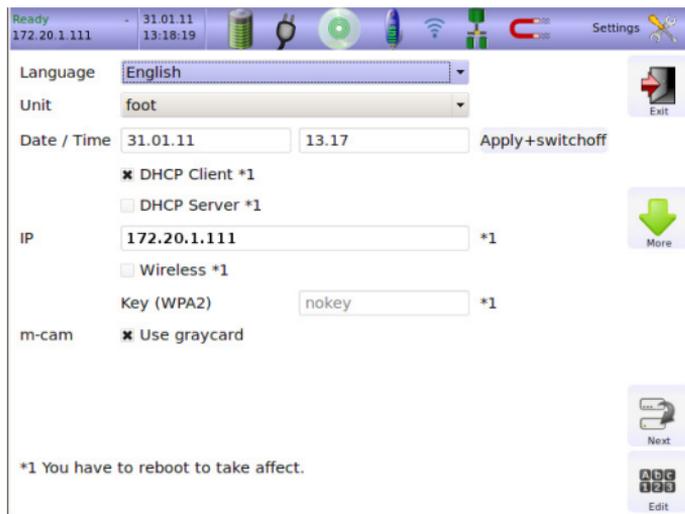
Access

Select **Main Menu, Settings**



Description

In the **Settings** menu enable the **DHCP Client** option for a connection to a network.



Connecting by cable

1. Connect the HDS7000 with the attached Ethernet cable to a hub/switch on the desired network.
 2. Settings on the HDS7000:
 - Switch on the HDS7000 (press the ON/OFF button for 0.3 sec).
 - Go to **Main Menu, Settings** and enable **DHCP Client**.
 - Reboot the HDS7000.
 3. Settings on your browser:
 - Open the web browser on your notebook/PC.
 - Select **Tools/Internet Options/Connections/LAN Settings/Advanced**.
 - Select under exceptions **Do not use a proxy server**.
 - Confirm all changes in your web browser.
 - Enter the IP of the HDS7000 into your web browser.
For example 172.20.0.100
-

3.12.2 Connecting the HDS7000 to a Notebook by Cable

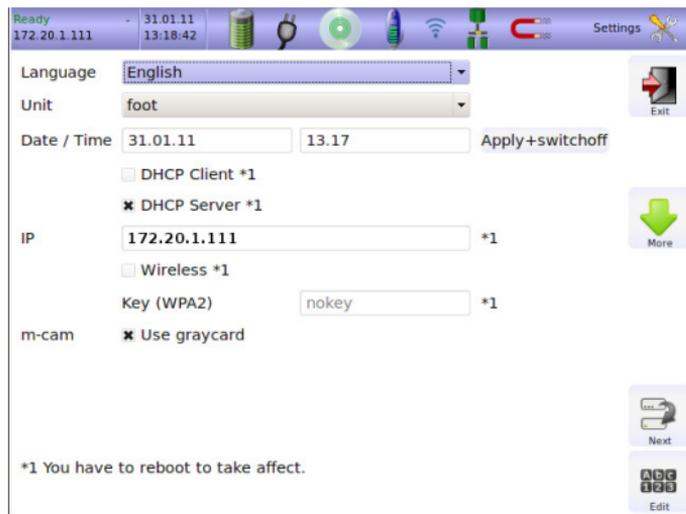
Access

Select **Main Menu, Settings**



Description

In the **Settings** menu enable the **DHCP Server** option for a connection to a notebook.



Connecting to the notebook

1. Connect the HDS7000 to the notebook with the attached Ethernet cable. The LAN connection should be automatically activated in the PC otherwise the attributes of the LAN connection could be shown by choosing network connections. Set a check mark at Internet Protocol (TCP/IP) and open the attributes. In attributes the field **Source IP address automatically** and **Source DNS address automatically** should be checked.
2. Settings on the HDS7000:
 - Switch on the HDS7000 (press the ON/OFF button for 0.3 sec).
 - Go to **Main Menu, Settings** and enable **DHCP Server**.
 - Reboot the HDS7000.
3. Settings on the notebook:

On the notebook you can access the data on the HDS7000 using the web browser or an FTP client:

 - Enter the IP address of the HDS7000 into your web browser: http://<IP>
or
 - Enter the IP address directly at the FTP client.

The scan files on the HDS7000's hard disk are listed in their subfolders in the web browser/FTP client. When using the web browser a preview of every scan is shown. You can open the scan files or download them to your notebook.



- The firewall of the notebook should be deactivated to avoid disturbing the connection to the scanner.
 - The proxy settings of the web browser should be deactivated or an exception for the web page must be declared.
 - Enter user name "scans" for establishing an FTP connection to be able to delete scans. Backup all important files before deleting. Deleted files cannot be restored.
-

3.12.3

Connecting the HDS7000 by Wi-Fi

Access

Select **Main Menu, Settings**



Description

In the **Settings** menu enable the **Wireless** option for a Wi-Fi connection.

Configuration of the laptop

1. Go to **Start, Settings, Network Connections**.
 2. Select **Wireless Network Connections**.
 3. In the **Wireless Network Connections** list the HDS7000 is listed as **hds7000-xxxx** with xxx = serial number. If scanner is not listed select **Refresh network list**, after some seconds the system automatically will find the HDS7000.
 4. Press **Connect** to connect the HDS7000.
-

Web browser settings

Open your web browser and in the address field enter the Wi-Fi IP address `http://192.168.3.1`

In Wi-Fi mode the general IP address 192.168.3.1 is used instead of the unique scanner IP address.

3.13 Operating the HDS7000 using a Web Browser

Start page

The HDS7000 can be operated via Ethernet connection or via Wi-Fi in a local network directly using a web browser.

Enter the IP address of the HDS7000 into the address field of your web browser. Refer to IP address under "3.10 Settings". The functions of the main menu are displayed.

For example: `http://172.20.0.100`

Fixed address for Wi-Fi:

`http://192.168.3.1`



The buttons on the left side of the screen guide directly to the following menu items:

- Info
- Status
- Scan predefined
- Scan
- Scanmanagement
- Help

If the IP address is extended to show the menu's shortcut commands, you can go directly to the desired page.

For example: <http://172.20.0.100/info>



Further shortcuts for menu points include:

- **/home**
- **/info**
- **/scan**
- **/scan/predefined**
- **/scanmanagement**
- **/status**
- **/config**
(password protected)
- **/debug**
- **/firmware**
- **/camera**
- **/systemtest**
- **/report**
- **/backlight**
- **/profiler**
- **/statistic**
- **/error**
- **/error/help**

Scan menu in web browserFor example: <http://172.20.0.100/info>

Leica
Geosystems
HDS7000 3016 - Scan

Start scan Restart

Filename	2				
Destination	intern				
Path	Test profile				
Project					
Scanposition				Prev	Next
Resolution	High				
Quality	Normal				
Tilt Sensor	off			Level	
Camera	do not use				
Comment					
Operator					
H Selection	0	182	deg		
V Selection	Visible 20-340	25	335	deg	



The settings for the web browser scan interface are the same as for the interface of the onboard display. Refer to chapter "3.6.3 Scan with User Defined Settings" for details.

4 Troubleshooting

HDS7000

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.
Missing points in scans.	Dust, debris or fingerprints on optics of rotating mirror.	Use glass cleaning kit to clean the specific areas.
Instrument too cold.	The instrument is operated at a temperature lower than -10°C .	Start scanning, for example perform some preview scans, as the activity helps warm the HDS7000.
Instrument too warm.	The instrument is operated at a temperature higher than $+45^{\circ}\text{C}$.	Put the HDS7000 in a cool and shady place, leave it powered in standby mode only.

Problem	Possible Cause(s)	Suggested Remedies
Control panel does not work correctly.	Dirt on the touch screen.	Turn off the instrument and clean control panel with mild cleaning supplies and a soft tissue.

HDS7000 Battery

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. Damaged cable.	Check the function of the battery charger. Examine the cabling and pay attention to damages, which for example can cause loose contacts or short circuits. Defective circuits need to be replaced. Only use supplied power cables.

Problem	Possible Cause(s)	Suggested Remedies
	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.

HDS7000 battery charging process

Problem	Possible Cause(s)	Suggested Remedies
Charging status on charging cradle is not shown and running light is active.	Battery is depth-discharged and the charger cannot initialize.	Turn off power supply and turn it on again without changing any configuration.
	Battery is defect.	Test with another battery. If needed replace defect battery.
Red LED flashing rapidly on the charging cradle.	Charging cradle and battery operated outside the operation temperature (0°C to +40°C).	Use the charging cradle and the battery for charging only at temperature from 0°C to 40°C.
Red LED flashing slowly on the charging cradle.	Charging process too slow. Charger cannot load battery in given time.	Check with another battery.

Report file procedure

The report file procedure explains how to create a report file with the user interface of your HDS7000 instrument in case of problems with the scanner. To create a report file, follow the steps described below:

1. Go to Main Menu, Status, Report to create a report file.
 2. Copy the report file from the internal or external disk.
 3. Send the report file together with details about scanner type, scanner serial number and a short description of the problem to your local support team.
-

Summary

If you experience problems with your instrument email the scanner's report file to your local support:

- For Americas support:
us-support@hds.leica-geosystems.com
 - For Europe, Middle East and Africa support:
euro-support@hds.leica-geosystems.com
 - For Asia support:
asia-support@hds.leica-geosystems.com
-

5 Care and Transport

5.1 Check & Adjust

**Caution**

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 twice a year by the manufacturer respectively just after such a high stress exposure.

5.2

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.
-

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 transport container and secure it.

Shipping

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

Shipping, transport of batteries

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.

5.3	Storage
Product	Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "7 Technical Data" for information about temperature limits.
Field adjustment	After long periods of storage, inspect the field adjustment parameters given in this user manual before using the product.
Batteries	<ul style="list-style-type: none">• Refer to "7.4 Environmental" for information about storage temperature range.• A storage temperature range of -20°C to +30C / -4°F to +86°F in a dry environment is recommended to minimize self-discharging of the battery.• At the recommended storage temperature range, batteries containing a 10% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged. The batteries have to be recharged after maximum 6 month.• 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.

5.4

Cleaning and Drying

Product and accessories

- Use only a clean, soft, lint-free cloth for cleaning or use lens paper (e.g. for cleaning camera lenses). If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.
 - Blow dust off glass windows.
 - Never touch the glass with your fingers.
 - Never clean glass with paper towels or similar, as they will scratch the coating on the windows.
-

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. 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.

5.5 Window Cleaning Procedure

General

The HDS7000 scanning window must be kept clean. The instructions must be followed as described in this chapter to clean the scanner mirror.

Warning

Direct intrabeam viewing is always hazardous.

Precautions:

Before cleaning windows, ensure the instrument is switched off.



Window Cleaning Kit can be ordered through your local Leica Geosystems dealer.

Dust and debris removal

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



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

Cleaning of the optics



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

Precautions:

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

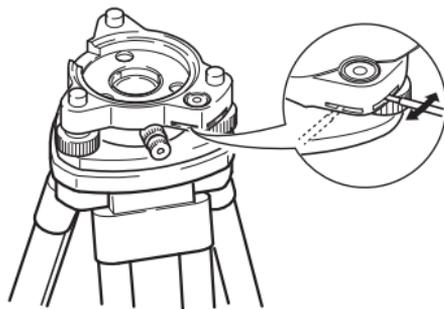


Clean the glass pane regularly with the provided cleaning kit:

- 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 center to the edge until there is only a thin film of detergent visible.
- Use a new lens tissue for drying the pane, wipe circularly.
- If any smears from cleaning are visible against back light, repeat the procedure.
- Do not touch the side of the paper that is used for cleaning with your fingers.
- Do not reuse tissues that have been used before.
- Only use non-fuzzy lens tissues.
- Do not use air from the pneumatic power system as this is always slightly oily!

5.6 Adjustment of the Circular Level

On the tribrach
step-by-step



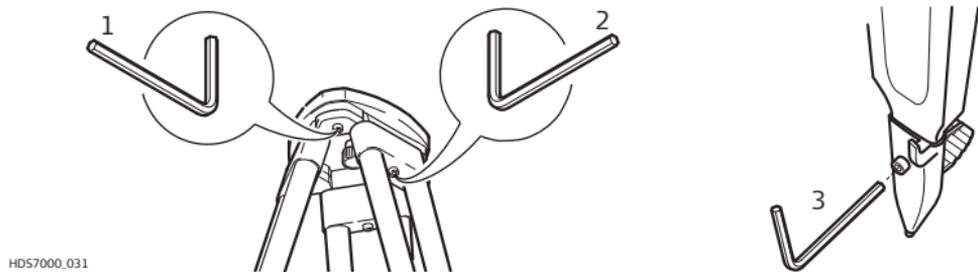
HDS7000_027

Step	Description
1.	Level up the tribrach together with the instrument in advance using the electronic level, assuming that the instrument is correctly adjusted. Remove the instrument from the tribrach.
2.	The bubble of the tribrach must be centered. If it extends beyond the circle, use the adjusting pin in conjunction with the two cross-headed adjustment screws to centre it.
	After the adjustment, no screw shall be loose.

5.7

Service of the Tripod

Service tripod step-by-step



HDS7000_031

Step	Description
	The connections between timber and metal must be firm and tight.
1.	Moderately tighten the allen screws (1) with the allen key supplied with the tripod.
2.	Tighten articulated joints just enough to keep the tripod legs open when lifting the tripod off the ground (2).
3.	Tighten the allen screws of the tripod legs (3).

6 Safety Directions

6.1 General Description

Description

The following directions should 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.

6.2

Intended Use

Permitted use

- Measuring horizontal and vertical angles.
 - Measuring distances.
 - Recording measurements.
 - Computing by means of software.
 - Target search, recognition.
 - Visualizing the aiming direction and vertical axis.
 - Recording point related data.
 - Remote control of product.
 - Data communication with external appliances.
-

Adverse use

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

- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
- Inadequate safeguards at the surveying site, for example when measuring on roads.
- Deliberate dazzling of third parties.
- Controlling of machines, moving objects or similar monitoring application without additional control- and safety installations.

 **Warning**

Adverse use can lead to injury, malfunction and damage.

It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. The product is not to be operated until the user has been instructed on how to work with it.

6.3

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 in close proximity to electrical installations or similar situations by the person in charge of the product.

6.4

Responsibilities



Leica Geosystems AG, Heinrich-Wild-Strasse, CH-9435 Heerbrugg, Switzerland, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the user manual and original accessories, in a completely safe condition.

Manufacturers of non Leica Geosystems accessories

The manufacturers of non Leica Geosystems accessories for the product are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Person in charge of the product

The person in charge of the product has the following duties:

- To understand the safety instructions on the product and the instructions in the user manual.
 - 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 radio transmitters are respected
-



Warning

The person responsible for the product must ensure that it is used in accordance with the instructions. This person is also accountable for the training and the deployment of personnel who use the product and for the safety of the equipment in use.

6.5

Hazards of Use

Warning

The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial and environmental consequences.

Precautions:

All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the product.

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 and perform the field adjustments indicated in the user manual, 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 hairs and/or clothes by rotating parts.

Precautions:

Keep a safe distance of the rotating parts.

 **Caution**

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.

 **Danger**

Because of the risk of electrocution, it is very dangerous to use poles 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**

By working during a thunderstorm you are at risk from lightning.

Precautions:

Do not carry out field surveys during thunderstorms.

 **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 and accident prevention and road traffic.

 **Warning**

If computers intended for use indoors are used in the field there is a danger of electric shock.

Precautions:

Adhere to the instructions given by the computer manufacturer with regard to field use in conjunction with Leica Geosystems products.

-
-  **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 may sustain injury.
- Precautions:**
When setting-up the product, make sure that the accessories, for example tripod, tribrach, connecting cables, are correctly adapted, fitted, secured, and locked in position.
Avoid subjecting the product to mechanical stress.
-
-  **Warning** Only Leica Geosystems authorised service workshops are entitled to repair these products.
-
-  **Warning** Using a battery charger not recommended by Leica Geosystems can destroy the batteries. This can cause fire or explosions.
- Precautions:**
Only use chargers recommended by Leica Geosystems to charge the batteries.
-

 **Danger**

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 you open the product, either of the following actions may cause you to receive an electric shock.

Touching live components

Using the product after incorrect attempts were made to carry out repairs.

Precautions:

Do not open the product. Only Leica Geosystems authorised service workshops are entitled to repair these products.

 **Warning**

Batteries not recommended by Leica Geosystems may be damaged if charged or discharged. They may burn and explode.

Precautions:

Only charge and discharge batteries recommended by Leica Geosystems.

-
-  **Danger** If unit is not connected to ground, death or serious injury can occur.
Precautions:
To avoid electric shock power cable and outlet must be grounded.
-  
-
-  **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** Short circuited battery terminals can overheat and cause injury or fire, for example by storing or transporting in pockets if battery terminals come in contact with jewelry, keys, metallized paper or other metals.
Precautions:
Make sure that the battery terminals do not come into contact with metallic objects.
-
-  **Caution** Direct rain or water may damage and/or reduced lifetime on the battery.
Precautions:
During outdoor use keep the battery in an against rain protected place.
-



Caution

Long term storage may reduce lifetime or damage the battery.

Precautions:

During long term storage, maintain battery life by periodic re-charge.



Warning

During usage, charging and/or disposal one of the following can occur with impact to humans and environment:



Explosion hazard:

A highly-explosive oxyhydrogen gas mixture occurs when charging batteries.



Precautions:

Fires, sparks, naked lights and smoking are prohibited:
Avoid causing sparks when dealing with cables and electrical equipment, and beware of electrostatic discharges. Avoid short-circuits.



Corrosive hazard:

Battery acid is highly corrosive.

Precautions:

Wear protective gloves and eye protection. Do not tilt battery, acid can escape from the degassing openings or vents.

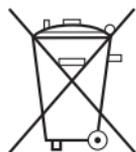
-
-  **Caution** During the transport, shipping or disposal of batteries, it is possible for inappropriate mechanical influences to constitute a fire hazard.
- Precautions:**
When transporting shipping, or disposing batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping contact your local passenger or freight transport company.
-
-  **Warning** Charging the battery at temperatures below 0°C or above 40°C or operating it at temperatures below -10°C or above 45°C is not allowed since it may damage the battery.
- Precautions:**
Only charge the battery in well-ventilated areas because it can produce explosive gases. Connect the battery to the battery charger only when the charger is turned off. Fire, smoking, and sparking near the battery are not allowed.
-
-  **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 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.
- Improper disposal of silicone oil may cause environmental contamination.

Precautions:



The product must not be disposed of 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 downloaded from the Leica Geosystems home page at <http://www.leica-geosystems.com/treatment> or received from your Leica Geosystems dealer.

6.6 Laser Classification Scanner, Invisible Laser

General

The EDM module incorporated into the product produces an invisible laser beam which emerges from the windows.

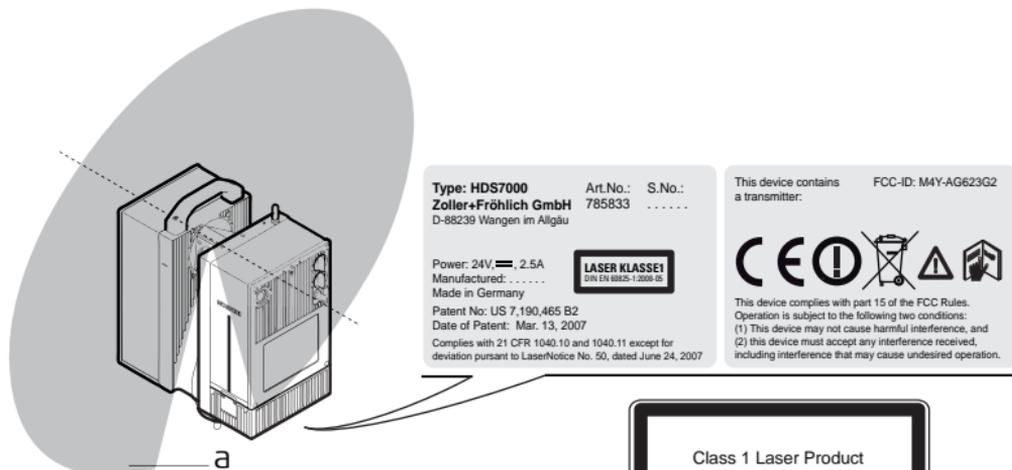
The laser product described in this section is classified as laser class 1 in accordance with:

- IEC 60825-1 (2007-03): "Safety of laser products"
- EN 60825-1 (2007-10): "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	1.5 μm
Beam divergence	< 0.3 mrad

Labelling



HDS7000_028

a) Laser beam

6.7 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.



Caution

There is a risk that disturbances may be caused in other equipment if the product is used in conjunction with accessories from other manufacturers, for example field computers, personal computers, two-way radios, 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 and two-way radios, 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 very intense electromagnetic radiation, for example, near radio transmitters, two-way radios or diesel generators.

Precautions:

Check the plausibility of results obtained under these conditions.

 **Warning**

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.

 **Warning**

Electromagnetic radiation 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 in combination with radio or digital cellular phone devices recommended by Leica Geosystems 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 or that humans or animals may 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.
 - Do not operate the product with radio or digital cellular phone devices for long periods immediately next to your body.
-

6.8

FCC Statement, Applicable in U.S.

Applicability

The grayed paragraph below is only applicable for products of the HDS7000 System without radio, digital cellular phone devices or Bluetooth.

Warning

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.

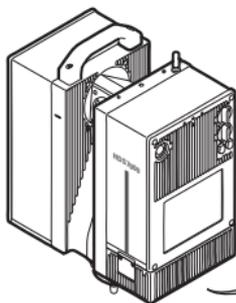
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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.

Labelling
HDS7000


Type: HDS7000 Art.No.: S.No.:
Zoller+Fröhlich GmbH 785833
 D-88239 Wangen im Allgäu

Power: 24V, , 2.5A
 Manufactured:
 Made in Germany
 Patent No: US 7,190,465 B2
 Date of Patent: Mar. 13, 2007

Complies with 21 CFR 1040.10 and 1040.11 except for deviation pursuant to LaserNotice No. 50, dated June 24, 2007



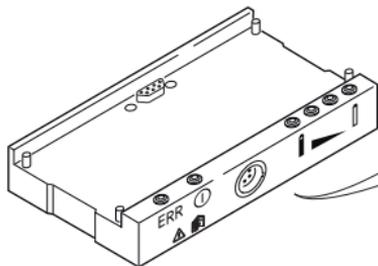
This device contains a transmitter: FCC-ID: M4Y-AG623G2



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.

HDS7000_032

Labelling Charging cradle



HDS7000_029

Type: Li-Ion Charger Art.No.: S.No.:
Zoller+Fröhlich GmbH 788153
D-88239 Wangen im Allgäu



INPUT: 24V, VDC, 5A

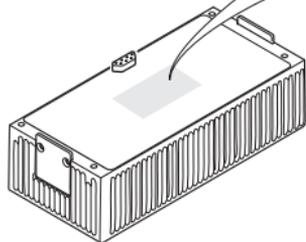
OUTPUT: 16.8 VDC, 2 x 2.4 A

Manufactured:, Made in Germany

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.

Labelling battery



Type: Li-Ion Battery Art.No.: S.No.:
Zoller+Fröhlich GmbH 785835
D-88239 Wangen im Allgäu

Nominal / Charge Voltage: 14.4V / 16.8A
Energy / Capacity: 2x70.56Wh, 4.9 Ah
Manufactured:
Made in Germany



7 Technical Data

7.1 General Technical Data of the Instrument

Instrument	Compact, phase-based, dual-axis compensated, ultra-high speed laser scanner, with survey-grade accuracy, range, field-of-view and laser plummet.
User interface	Onboard touch panel, notebook PC or PDA
Scanner drive	Servo motor

7.2

Laser Scanning System

Wavelength/Colour	1.5 μm , invisible																		
Laser Class	Class 1 (in accordance with IEC 60825-1 resp. EN 60825-1)																		
Range	Maximum range: 187 m ambiguity interval Minimum range: 0.3 m Range resolution: 0.1 mm																		
Linearity error	≤ 1 mm																		
Spot size	~ 3.5 mm @ 0.1 m distance (Gaussian based)																		
Beam divergence	< 0.3 mrad																		
Scan rate	Up to 1'016'000 points/sec, maximum instantaneous rate																		
Range noise	<table border="1"><thead><tr><th>Range</th><th>Black 14%</th><th>Gray 37%</th><th>White 80%</th></tr></thead><tbody><tr><td>10 m¹</td><td>0.5 mm rms</td><td>0.4 mm rms</td><td>0.3 mm rms</td></tr><tr><td>25 m¹</td><td>1.0 mm rms</td><td>0.6 mm rms</td><td>0.5 mm rms</td></tr><tr><td>50 m¹</td><td>2.7 mm rms</td><td>1.2 mm rms</td><td>0.8 mm rms</td></tr></tbody></table>	Range	Black 14%	Gray 37%	White 80%	10 m ¹	0.5 mm rms	0.4 mm rms	0.3 mm rms	25 m ¹	1.0 mm rms	0.6 mm rms	0.5 mm rms	50 m ¹	2.7 mm rms	1.2 mm rms	0.8 mm rms		
Range	Black 14%	Gray 37%	White 80%																
10 m ¹	0.5 mm rms	0.4 mm rms	0.3 mm rms																
25 m ¹	1.0 mm rms	0.6 mm rms	0.5 mm rms																
50 m ¹	2.7 mm rms	1.2 mm rms	0.8 mm rms																

Range	Black 14%	Gray 37%	White 80%
100 m ^{1, 2}	10 mm rms	3.8 mm rms	2.0 mm rms

- 1 Data rate 127000 pts/sec (equivalent to "high resolution, high quality scan), 1 sigma range noise, unfiltered raw data
- 2 All values extrapolated

Scan resolution and duration

7 pre-set spacings selectable per table

Setting	Pts/360° (vert./horiz.)	Low quality ³	Normal quality ³	High quality ³	Premium quality ³
Preview ¹	1250	---	0:26 min	---	---
Low	2500	0:26 min	0:52 min	1:44 min	---
Middle	5000	0:52 min	1:44 min	3:22 min	6:44 min
High	10000	1:44 min	3:22 min	6:44 min	13:28 min
Super High	20000	3:28 min	6:44 min	13:28 min	26:56 min
Ultra High ²	40000	---	13:28 min	26:56 min	53:20 min
Extreme High ²	100000	---	1:21 h	2:42 h	---

- 1 Resolution not recommended for exact measurements, only for positioning higher resolution scan selections.

- 2 Only recommended for scan selections because of enormous amount of data.
- 3 Doubling ("low quality") and halving ("high quality") the data rate (pixel/sec.) theoretically increases the range noise on each pixel by 40% ("low quality") or decreases it by 40% ("high quality") compared to "normal quality". Depending on the roughness of the surface measured, in reality this difference could be less, especially when scanning objects with a bright surface at short distances, for example indoors.

Field-of-View (per scan)

Horizontal: 360° (maximum)
 Vertical: 320° (maximum)

Scannings optics

Vertically rotating mirror on horizontally rotating base. User selectable vertical rotation speed (6.25 rps, 12.5 rps, 25 rps, 50 rps). Environmentally protected by shield.

Scan motors

Direct drive, brushless

Angular accuracy

125 μrad / 125 μrad (horizontal / vertical)

Angular resolution

3.5 μrad / 7 μrad (horizontal / vertical)

7.3	Miscellaneous
Onboard display	Touchscreen control with stylus, full colour graphic display, VGA (640 x 320 pixels)
Dual-axis compensator	<ul style="list-style-type: none">• Selectable on/off• Resolution 3.6"• Measurement range $\pm 30'$• Accuracy $< 25''$
Level indicator	Electronic bubble in onboard control and software
Laser plummet	<ul style="list-style-type: none">• Laser class 2 (in accordance with IEC 60825-1 resp. EN 60825-1)• Centering accuracy: 0.5 mm / 1 m• Laser dot diameter: < 1.5 mm @ 1.5m• Selectable on/off
Data transfer	Ethernet or USB 2.0 device (two ports)
Data storage	64 GB flash drive (integrated) and 2x 32 GB USB flash drive (external)
Data integrity monitoring	Self-check at startup

7.3.1

Electrical

Power supply

- Batteries: 14.4 V DC
- Battery charger: 100 -240 V AC

Power consumption

< 65 W (on average)

Battery type

- Type: Li-Ion (2 x Lithium-Ion pack with protective circuit, 4S2P)
- Voltage (pack): 14.4 V
- Capacity (pack): 4.9 Ah

Power ports

- Internal: 1
- External: 1

Duration

Integrated battery: > 2.5 h (at room temperature)

Charging cradle

- Output voltage: 16.8 V DC
- Power status: LEDs indicate charging status and capacity level

AC power supply

- Input voltage: 100 – 240 V AC, 50 - 60 Hz
 - Output voltage: 24 V DC
-

7.4 Environmental

Environmental specifications

Temperature

Type	Operating temperature [°C]	Storage temperature [°C]
HDS7000	-10 to +45	-20 to +50
AC power supply	-10 to +45	-20 to +50
Battery	-10 to +45	0 to +30
Charging cradle	0 to +40	-20 to +50

Protection against water, dust and sand

Type	Protection
HDS7000	IP53 (IEC 60529) with additional USB plugs at side cover
AC power supply	IP20 (IEC 60529)
Battery	IP53 (IEC 60529)
Charging cradle	IP20 (IEC 60529)

Humidity

Non-condensing

Lighting

Fully operational between bright sunlight and complete darkness.

7.5

Physical

Dimensions and Weight

Instrument	Dimensions [mm] (D x W x H)	Weight [kg]
HDS7000	286 x 170 x 395	9.8
AC power supply	167 x 67 x 35	0.54
Battery	88 x 170 x 61	1.2
Charging cradle	107 x 170 x 30	0.48

Tilt axis height

285 mm

7.6 Accessories

Standard Accessories

- Scanner and accessory transport case
 - 2x 32 GB memory stick, 1x USB memory plug
 - Additional rechargeable integrated battery
 - Charging/Power cable
 - Ethernet cable
 - AC cable
 - Battery charger/AC Power supply
 - Battery charging cradle for integrated battery
 - Cleaning kit
 - *Cyclone*TM-SCAN software
 - 1 year CCP Basic support agreement
-

Hardware Options

- Notebook PC, tablet PC or PDA
 - HDS scan targets and target accessories
 - Service agreement for HDS7000
 - Extended warranty for Leica HDS7000
 - External camera kit (third party product)
 - External battery
 - Tripod, Tripod star
 - Rolling base
-

**Notebook PC for
scanning with
Cyclone software**

Component	Minimum requirements
Processor	1.7 GHz Pentium M or greater
System memory RAM	1 GB or greater, 2 GB for Windows Vista
Network connection	Ethernet
Data connection	Ethernet, Wireless LAN
Display	SVGA or OpenGL accelerated graphics card (with latest drivers)
Operating system	Windows XP Professional (SP2 or higher), 32 or 64 Windows Vista (32 or 64) Windows 7 (32 or 64)
File System	NTFS



Minimum requirements for modeling are different. Please refer to *Cyclone* datasheet for specifications, available at your Leica Geosystems dealer. Notebook PC does not record any data! Data can be transferred automatically after scan process.

7.7**Wi-Fi**

Wi-Fi technical data

Standard:	IEEE 802.11b/g
Frequency band:	2412 MHz - 2462 MHz (channel 1 - 11)
Output:	< 20 dBm
FCC IC:	M4Y-AG623C

7.8

Conformity to National Regulations

Conformity to national regulations

- FCC Part 15 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the HDS7000 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at <http://www.leica-geosystems.com/ce>.



- Class 2 equipment according European Directive 1999/5/EC (R&TTE) for which following EEA Member States apply restrictions on the placing on the market or on the putting into service or require authorization for use:
- France
 - Italy
 - Norway (if used in the geographical area within a radius of 20km from the centre of Ny-Ålesund)
- 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.
-

8 International Limited Warranty, Software Licence Agreement

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- when it has to be **right**

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