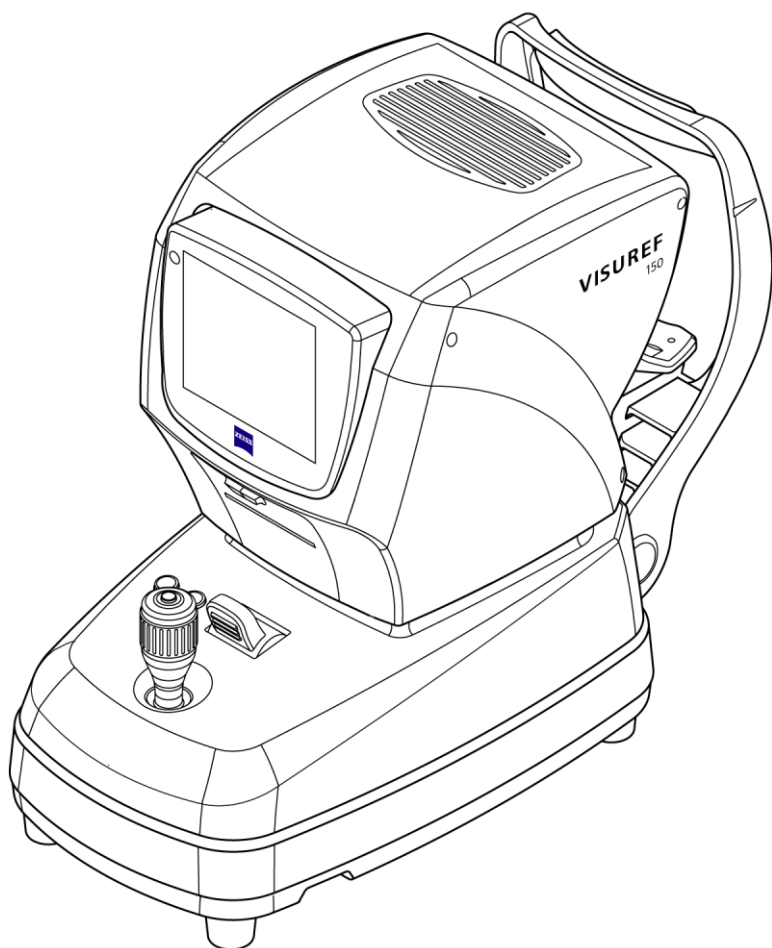


ZEISS VISUREF 150

Autorefractor/Keratometer

Documentation set



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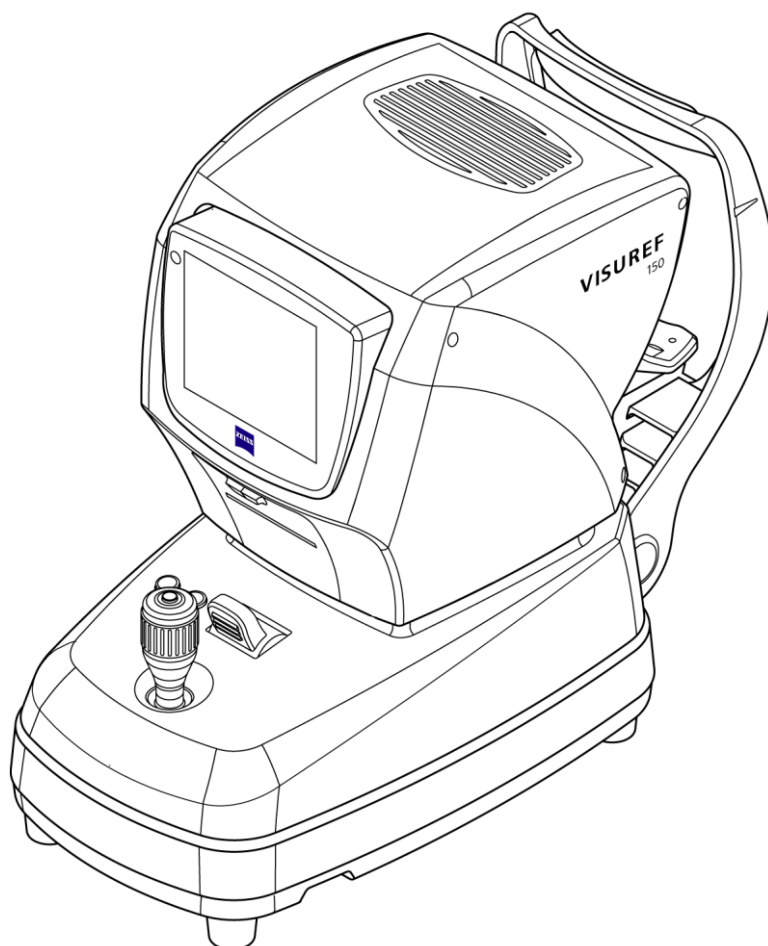
Contents

User manual
ZEISS VISUREF 150 Autorefractor/Keratometer
[000000-2227-967-GA-GB-250520]

ZEISS VISUREF 150

Autorefractor/Keratometer

User manual



Contents

Contents	1
Notes on the user manual	4
Purpose and availability of the documentation	4
Questions and comments.....	4
Explanation of symbols used	5
Package check list	6
Country-specific information and labels	7
Classification/Manufacturer's declaration	7
Intended use	8
Intended user profile.....	9
Disposal of the product	10
External labels.....	11
Performance specifications	14
Functional description.....	14
Service life.....	15
Description of the device.....	16
Installation	19
Notes on installation and use	19
Unpacking the device.....	19
Installing the device	20
Connecting the device.....	21
Connecting the device with other devices	22
Patient environment	24
Network configuration	25
Data exchange.....	26
Initial start-up.....	27
Switching on	27
Device initialization	28
Connection to the EMR/PMS system	29
Using the serial interface	29
File-based data exchange	30

Direct data transmission via network.....	30
Connection to ZEISS FORUM	31
Connection to ZEISS VISUCONSULT/i.Com mobile.....	33
Provision of data to be collected via the network (web service)	34
Daily startup	35
Switching on	36
Operation of the device	37
Warning and information messages	38
Operating concept.....	38
Screen layout.....	39
Measurement screens.....	40
Review screens.....	41
Device settings	42
On-screen keyboard	44
Full measurement procedure.....	46
Patient selection	47
Patient selection prior to measurement procedure	47
Subsequent patient allocation	49
Measurement of refraction and keratometry	51
Preparation of the device for measurement.....	51
Positioning the patient and explaining the procedure to the patient.....	57
Performing a measurement	58
Data display in the review screen.....	61
Measurement of pupil and corneal diameters	64
Preparation of the device for measurement.....	64
Review screen displays.....	70
Image captures	71
Preparation of the device for measurement.....	71
Capturing images.....	73
Image display in review screen	75
Measurement of contact lenses	77
Preparation of measurement	77
Performing contact lens measurement	78
Data display in the review screen.....	81
Delete measurement data	82
Review of completed measurements	84
Output of measurement results	84
Device settings	87
General submenu.....	88
Measurement submenu	91
Output submenu.....	92
Interface submenu	95

Web server interface.....	101
Shutting down.....	103
Switching off the device	103
Maintenance and care.....	104
Troubleshooting.....	104
Update device software	105
Replacing the fuses	106
Maintenance	107
Replacing the printer paper roll	107
Care and cleaning	108
Cleaning and disinfection of painted surfaces	109
Safety inspections	110
Transport.....	111
Transport without packaging	111
Transport with packaging.....	111
Technical data	113
Electromagnetic compatibility.....	115
Ambient conditions for intended use	115
Limitations on essential performance features.....	115
Electromagnetic emission	117
Electromagnetic immunity	117
Abbreviations/Glossary.....	119
Figures.....	120
Tables	122
Index	123

Notes on the user manual

Purpose and availability of the documentation

This user manual describes the safety precautions, functions, usage and performance parameters, as well as care and maintenance measures for the ZEISS VISUREF® 150 Autorefractor/Keratometer.

Correct operation of the device is imperative for safe and effective functioning. You should therefore ensure that you are thoroughly familiar with this user manual before setting up and using the device for the first time.

The user manuals and other documentation enclosed with the device should be kept accessible to users at all times, to ensure that the information required for using the device is readily available.

Questions and comments

If you have any questions or comments concerning this user manual or the device, please contact ZEISS service or your local dealer. (Contact details see reverse.)

Explanation of symbols used

The symbols used in this user manual refer to important safety information which may warn against possible health risks or fatal injuries and contain useful notes. Whenever you see these symbols, read the accompanying information carefully and observe all safety notes and information in this user manual and on device labels.

WARNING

Indicates a hazardous situation which may result in death or serious bodily injury if the appropriate safety precautions are not heeded.



CAUTION

Indicates a hazardous situation which may result in minor or moderate injury if the appropriate safety precautions are not heeded.



CAUTION - PROPERTY DAMAGE

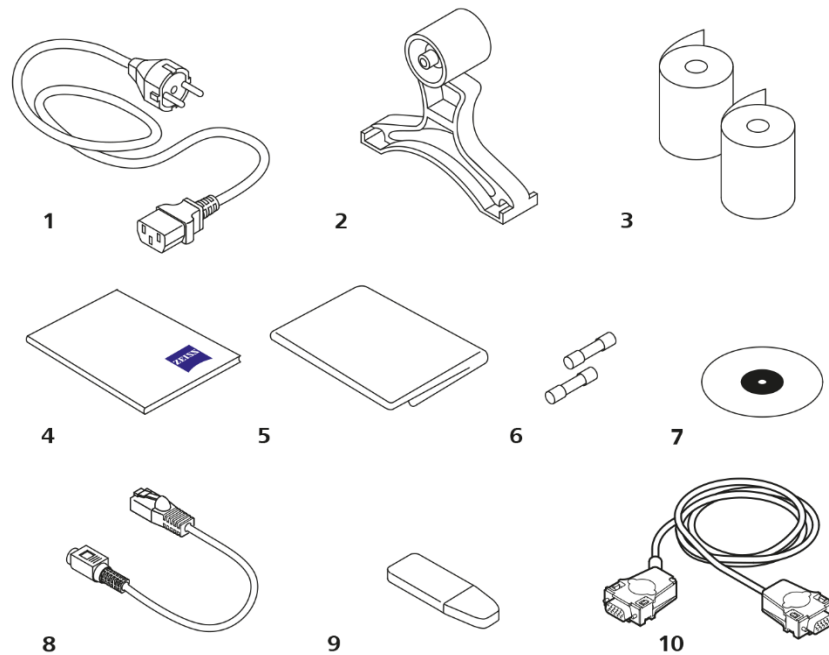
Indicates possible device damage if the appropriate safety precautions are not heeded.



Information, hints and advice for better understanding of the instructions to be observed in the operation of the device.

Package check list

The ZEISS VISUREF 150 basic device is supplied with the parts shown in the following figure.



- 1 Power supply cable
- 2 Test eye (also used as contact lens holder)
- 3 Printer paper (1 roll installed when delivered)
- 4 Documentation set
- 5 Dust cover
- 6 2 fuses (see Section *Technical data*, page 113)
- 7 Data carrier with source data of free software components (optional)
- 8 Network cable
- 9 USB storage device
- 10 Serial Interface cable (optional)

Fig. 1 Package check list



This device contains free software. The data carrier (7, Fig. 1) is provided as an option for licensing reasons, but does not include any installation-ready software necessary for the operation of the device.

Country-specific information and labels

Classification/Manufacturer's declaration

WARNING - GENERAL HAZARD

This device may be set up, operated and used only for the intended use and in accordance with local country-specific regulations, generally accepted engineering standards and occupational safety and accident prevention regulations. Further notes on classification are to be found in Section *Technical data*, page 113 and following.



Device group:	1 in accordance with ISO 15004-2 (max. radiation intensity < 117.1 $\mu\text{W}/\text{cm}^2$)
UMDNS No.	13-313 (Refractometer, ophthalmic) 12-811 (Ophthalmometer)

This declaration shall be rendered invalid if changes are made to the product without the manufacturer's authorization.

Further notes on electromagnetic compatibility are to be found in Section *Electromagnetic compatibility*, page 115 and following.

The product is RoHS-compliant according to Directive 2011/65/EU.

Intended use

The ZEISS VISUREF 150 Autorefractor/Keratometer is a diagnostic device used to determine the objective refractive values and keratometric characteristics of the human eye. The results are used to assist the process of prescribing optical aids such as eyeglasses and contact lenses.



Measurement errors may occur when using the device on patients in the following categories:

- Patients who are unable to steadily fixate the fixation image with the eye under examination (e.g. in the case of nystagmus, extremely poor visual acuity, lack of concentration).
- Patients who are unable to follow the instructions of the user.
- Patients who are unable to sit upright in front of the device.
- Patients who have forehead or chin injuries that prevent the head from being supported on the forehead/chin rest
- Patients whose eyes exhibit an optical media transparency that is too low for refraction measurements (such as cataract with dense lens clouding).
- Patients whose eyes have an insufficient corneal reflection for keratometry or refraction measurements (e.g. due to distortion of the tear film, corneal scarring or caustic burns of the cornea).
- Patients with significantly changed cornea (e.g. keratoconus).
- Patients whose pupil opening is too small (< 2 mm) for refraction measurements.
- Patients whose closed or partially closed palpebral fissure causes complete or partial obstruction of the pupil.
- Patients with morphological changes of the retinal anatomy in the region of the fovea for refraction measurements (e.g. retinal detachment, edema, ulcer).

Intended user profile

CAUTION - RISK ARISING FROM OPERATING ERRORS

This device may only be installed, operated, used and maintained by persons who have been properly trained or who have the required knowledge and experience to do so. Please also adhere to the national qualification guidelines applicable in your country.

Persons using the device must belong to the following occupational groups or their national equivalents:

- Ophthalmologists or assistants
- Opticians or assistants
- Optometrists or assistants



Disposal of the product



CAUTION - RISK OF ENVIRONMENTAL POLLUTION

The packing material should be kept to be used for a future move or for repairs.

If you want to dispose of the packing material, please use a recognized collection system for recycling.

The device contains electronic components. At the end of the service life, the device and the batteries installed in it have to be disposed of properly according to the national laws.



Disposal of the product within the EU

In accordance with applicable EU guidelines and national regulations at the time at which the product was brought onto the market, the product specified on the consignment note is not to be disposed of via the domestic waste disposal system or communal waste disposal facilities.

For detailed information on the disposal of the product, please contact your local dealer or the device manufacturer or its legal successor company. Please read latest Internet information provided by the manufacturer.

Where the product or its components are resold, the seller must inform the buyer that the product must be disposed of in accordance with the currently applicable national regulations.

External labels

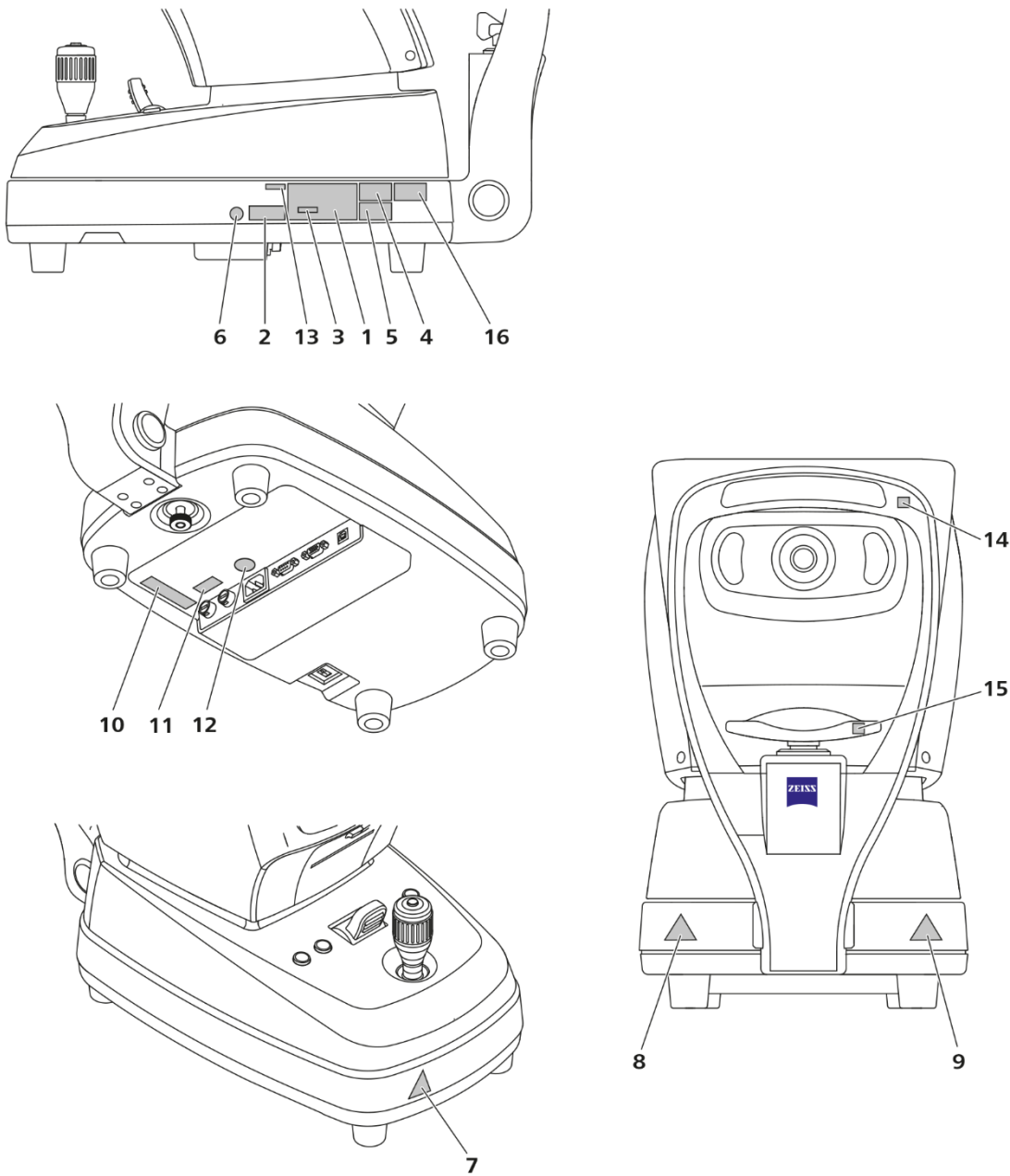
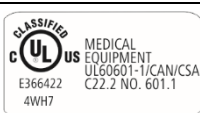
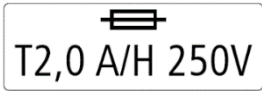


Fig. 2 External labels

Pos.	Label	Explanation
1	 Carl Zeiss Meditec AG Goeschwitzer Strasse 51-52 07745 Jena, Germany VISUREF150  100 V-240 V~  YYYY-MM-DD 50/60 Hz 90 VA	ZEISS VISUREF 150 type label  Manufacturer  Date of manufacture  Applied part type B
2	 REF 2227-967 SN XXXXXXXXXXXX	ZEISS VISUREF 150 identification label REF Catalogue number/part number SN Serial number
3	 YYYY-MM-DD	Label with manufacturing date
4	 CE 0297 	CE approval label and disposal advice for EU
5	 CLASSIFIED c UL US MEDICAL EQUIPMENT UL60601-1/CAN/CSA E366422 C22.2 NO. 601.1 4WH7	Sign with UL approval for USA and Canada
6	 	Information label "Observe user manual"
7	 	Warning label "Risk of pinching fingers"
8	 	Warning label "Avoid contact with the hand"
9	 	Warning label "Avoid contact with the hand"
10	 Made in Korea	Country of origin label
11	  T2,0 A/H 250V	Label with fuse specifications

Pos.	Label	Explanation
12		Information label "Disconnect device from the power supply before opening"
13	Not applicable	Not applicable
14		Applied part type B
15		Applied part type B
16	Not applicable	Not applicable

Performance specifications

Functional description

ZEISS VISUREF 150 is an autorefractor/keratometer. It allows the measurement of objective refraction including sphere, cylinder, axis. The VISUREF 150 covers the refractive measurement range from -25 D to +22 D so that even patients with severe refractive errors can be measured. Furthermore, the device determines the central keratometry values of the eye, consisting of corneal radii and the axis. Data on pupil distance and pupil diameter is also recorded. In contact lens mode, the device can measure the base curve of contact lenses.

The user can take up to seven measurements per eye, either manually or automatically. The device calculates the average value from these measurements. Results of intermediate measurements can also be retrieved.

Various illumination parameters can be adapted for the purpose of enhancing the visual inspection of the measured object and optimizing the measurement. These include the intensity of the ambient light on the measured object, reference illumination and illumination of the optical fixation target. Special illumination parameters in IOL mode can be preselected when measuring patients with implanted intraocular lenses (IOL). By adapting the illumination parameters, it is also possible to measure eyes with a slight cataract.

The device can capture, save and output images of the eye to be measured. Space is provided for up to two images per eye. Abnormalities or pathological details of the eye can be enlarged using the zoom function. Furthermore, the device can be used to manually measure any distance in these captured images, e.g. corneal or pupil diameters.

The device has a motorized chin rest for comfortable positioning of the patient's eye at the level of the Canthus mark. The device is operated via an adjustable touchscreen display with an intuitive user interface, control buttons for the chin rest and a joystick for alignment of the measuring head.

The device incorporates state-of-the-art interface and communication technology (e.g. LAN, USB, RS 232). The device can be connected to a patient database or a practice management system in the user's network. By default, the device supports the ZEISS VISUCONSULT/i.Com mobile application and ZEISS FORUM. Thus, the data of the patient to be measured can be retrieved from a worklist and his/her measurement data transferred back to the patient database after measurement. The device can also generate several PDF and XML formats as well as the standard published by JOIA. This data can be copied to a directory on a network folder and/or USB drive. Furthermore, the measured data can be sent to a network printer for printing, or to the ZEISS subjective refraction system comprising the VISUSCREEN 100/500 visual acuity chart projector and the VISUPHOR 500 digital phoropter.

Service life

WARNING - GENERAL HAZARD

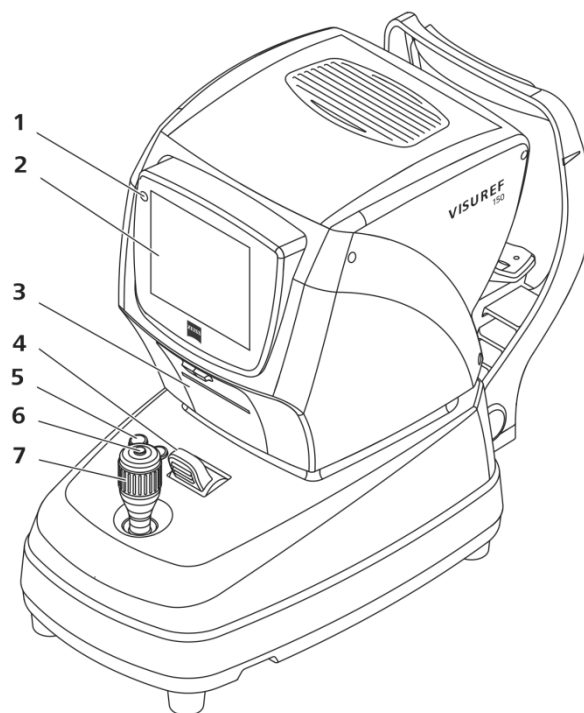
The development, production and maintenance of this device, together with the associated risks, are based on an expected service life of seven years.

Modifications to the product or failure to follow the manufacturer's instructions may substantially reduce the expected service life and significantly increase the risks associated with the use of this device.

It is the responsibility of the institution operating this product to follow the manufacturer's instructions and, upon reaching the expected service life, to weigh up the risks and benefits.

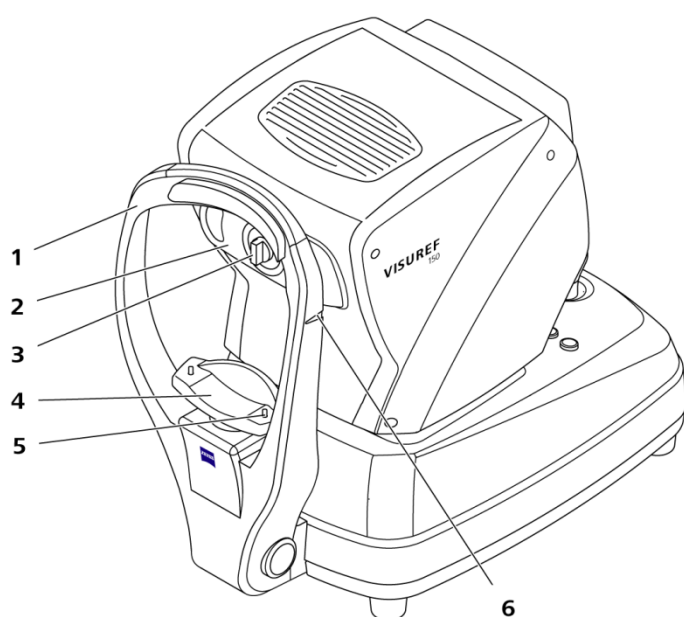


Description of the device



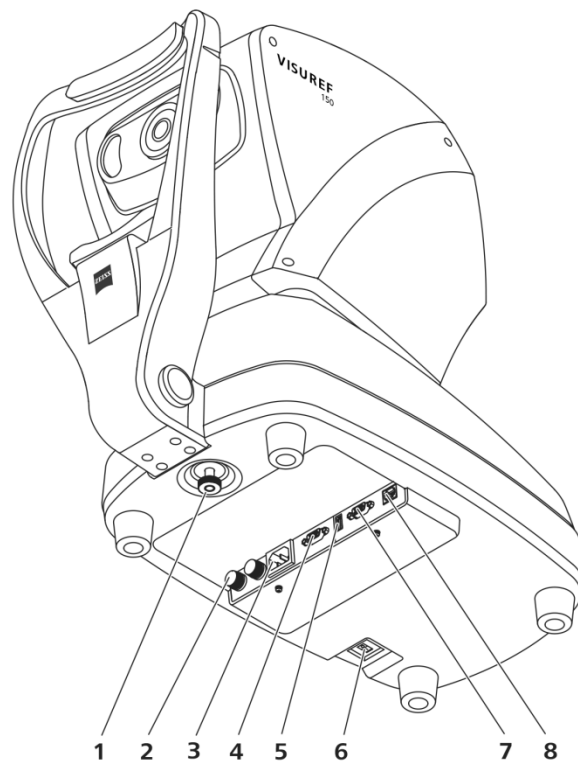
- 1 Status LED (illuminated: device switched on; flashing: screen saver activated)
- 2 LCD monitor
- 3 Printer cover
- 4 Stage locking lever
- 5 Buttons for chin rest height adjustment
- 6 Measuring button to trigger the measurement
- 7 Joystick

Fig. 3 Operator's side of the device



- 1 Forehead rest
- 2 Measurement window
- 3 Dust cap
- 4 Chin rest
- 5 Fixing pins for chin rest paper
- 6 Canthus markers
(Reference mark for optimum eye level of patient)

Fig. 4 Patient's side of the device



- 1 Clamping screw to lock the stage for transportation
- 2 Fuses
- 3 Power input socket
- 4 Monitor output
- 5 USB port with cover
- 6 Power switch
- 7 RS232 interface
- 8 Network connection (LAN)

Fig. 5 Bottom side view

Installation

Notes on installation and use

WARNING - GENERAL HAZARD

Do not store or operate the device in ambient conditions other than those specified (see Section *Technical data* on page 113 and following).

The device should be set up so that the power cable can be disconnected from the power supply quickly and easily without any tools.



WARNING - FIRE HAZARD

The device is not suitable for operation in explosion risk areas (e.g. combustible mixture of anesthetic, cleaning or disinfecting agents with air, oxygen or nitrous oxide).

Do not store alcohol and other flammable vapors and liquids in the vicinity of this equipment.



CAUTION - DANGER FROM FALLING PARTS

When selecting a suitable table, ensure that the combination of table and device is stable up to a 10° angle of tilt. Furthermore, the table must be designed for four times the weight of the device configuration. If the table is on casters, these must have a locking device.



CAUTION - PROPERTY DAMAGE

Do not store or use this device in damp rooms. Do not expose the device to water splashes, dripping water or sprayed water.

Unpacking the device

- Open the box and make sure that all the accessories (Fig. 1) are included in it.



Handle the device with care. Do not drop the device and protect it from any impact.



Packaging materials should be retained for possible return.

Installing the device



CAUTION - DANGER FROM FALLING PARTS

Install the device on a suitable, level, steady table that is not exposed to vibration.



When transporting outside the premises, always use the transport packaging.



Set up the device so that no light sources (ceiling lamps, spots, etc.) are directed at it (head rest, measuring head) or the patient.

We recommend the use of a height-adjustable instrument table. This facilitates the positioning of the patient in front of the device for achieving good measuring results.



Do not use outdoors. The device is designed to be used indoors only.



Do not use the device in humid or dusty environments.

- Release the stage locking by turning the clamping screw (1, Fig. 5) on the bottom of the device counterclockwise (A, Fig. 6).
- Now press the stage locking lever (4, Fig. 3) to the front (B, Fig. 6).

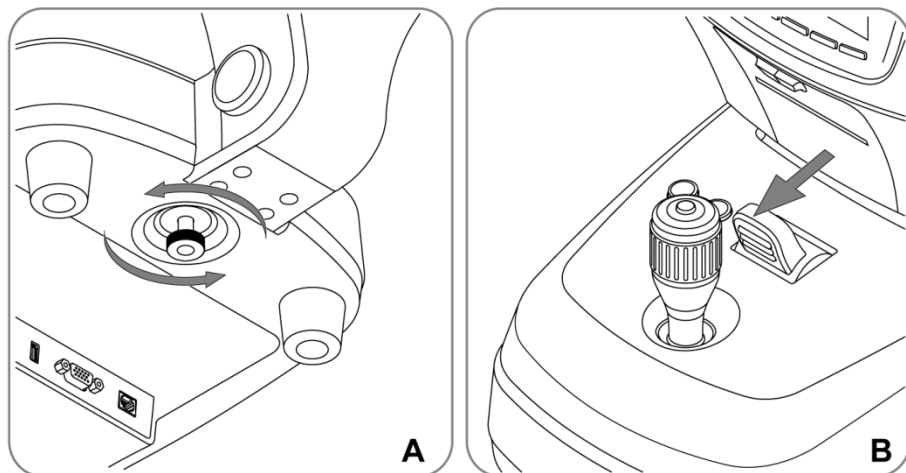


Fig. 6 Releasing the stage locking

- Remove the protective film from the display.

Connecting the device

WARNING - GENERAL HAZARD

When connecting the device to a power supply grid, pay attention to the data on the type label.

**WARNING - RISK OF ELECTRIC SHOCK**

Be sure to turn off the power switch before connecting to or disconnecting the device from a power supply grid.



- Connect the power supply cable into the socket at the bottom of the body.
- Make sure that the power switch is turned off. Then plug the other end of the power supply cable into an electrical outlet.

Connecting the device with other devices



WARNING - HAZARD DUE TO ELECTROMAGNETIC INTERFERENCE RADIATION

When connecting external devices to the interfaces of the device, the responsible organization must ensure that the requirements defined in IEC 60601-1-2 are met.



WARNING - RISK OF ELECTRIC SHOCK

Additional equipment connected to medical electrical equipment must comply with the current IEC or ISO standards (e.g. IEC 62368-1 for data processing equipment). Furthermore all configurations must comply with the requirements for medical electrical systems in accordance with IEC 60601-1.

When connecting further equipment to medical device, you are configuring a medical system and are thus responsible for ensuring compliance with the requirements for medical electrical systems.

Please observe that local laws take priority over the above-mentioned requirements. If in doubt, consult your local representative or ZEISS Service.



WARNING - RISK OF ELECTRIC SHOCK

Equipment which is connected to the autorefractor/keratometer system and placed inside the patient environment must be powered from a medically-isolated power source or must be a medically-isolated device. Equipment powered from a non-isolated source can result in chassis leakage currents exceeding safe levels. Chassis leakage current generated by an accessory or device connected to a non-isolated outlet may add to the chassis leakage current of the autorefractor/keratometer system.

WARNING - RISK OF ELECTRIC SHOCK

If a non-medical grade LCD Monitor or PC is connected to the autorefractor/keratometer system, the autorefractor/keratometer system must not contact the patient. Relevant standards for non-medical electrical equipment may require chassis leakage current limits which are higher than that required by medical standards.

These higher limits are only acceptable outside the patient environment. It is essential to reduce chassis leakage currents when using non-medical electrical equipment within the patient environment. Measures for reducing leakage current include using a medically approved isolation transformer.

If a non-medical grade LCD monitor or PC is to be used with the autorefractor/keratometer system, then you must ensure appropriate mitigation to meet the safety requirements. It is the responsibility of the user to ensure that the autorefractor/keratometer system complies with safety requirements when combined with non-medical grade LCD monitors or PCs.

Always use a medically-approved isolation transformer when using a non-medical grade LCD monitor or PC.

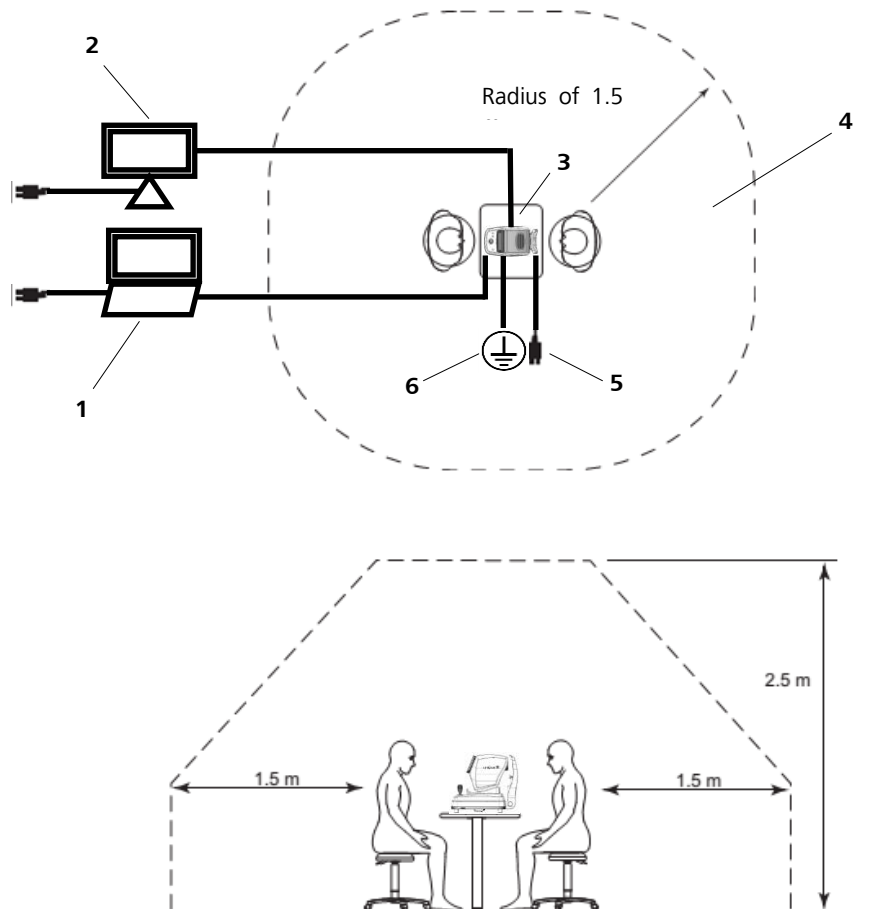
**CAUTION - PROPERTY DAMAGE**

When connecting an external monitor, ensure that the monitor supports a resolution of 800x480. Otherwise, the monitor may not display a suitable image. If required, contact the manufacturer of the monitor.

Patient environment

The patient environment is the space where direct contact of the patient or operator with third persons is possible.

When using a further device type in the patient environment, use a device that complies with IEC 60601-1. If devices are used which do not comply with IEC 60601-1, an isolating transformer is required to power the device or connect the devices to additional protective grounding.



- 1 Peripheral equipment (EN XXXXX and IEC XXXXX)
- 2 Peripheral equipment (EN XXXXX and IEC XXXXX)
- 3 ZEISS VISUREF 150 device
- 4 Patient environment (represented by dotted line, within a radius of 1.5 meter)
- 5 Power cable with protective grounding
- 6 Protective grounding

Fig. 7 Patient environment

Network configuration

WARNING - GENERAL HAZARD

Connecting ZEISS VISUREF 150 to an IT network may result in hazards for the patient, operator or a third person or may impair functioning of the device or other participants in the network due to coupling. These hazards or impairments are not within area of responsibility of ZEISS. The operator is responsible for appropriate risk assessment, implementation of measures to control risks and monitoring of the effectiveness of these measures. This analysis should be performed each time the network or essential characteristics are modified.

In particular, a modification means the following (but not exclusive):

- Modifications in the logical or physical network configuration
- New integration or removal of other network participants or network accessories
- Updates or upgrades of network participants



CAUTION - PROPERTY DAMAGE

When connecting to an external IT network the operator is responsible for compliance with the legal requirements for data security. The IT network must be protected by anti-virus programs and a firewall from public networks (Internet).

Suitable measures must be taken to ensure that only authorized users gain access to the IT network.

To benefit from the full functionality of the device, it must be integrated into the responsible organisation's network. The following features are available only after the network connection has been made:

- Use of higher-level data storage and organization systems (ZEISS FORUM, ZEISS VISUCONSULT/i.Com mobile or other EMR/PMS systems)
- Data storage on network folders
- Printing to network printers



The use of a closed network is recommended, if necessary with a single point of access to connect to other networks. The exact specification of the network, including the required safety devices, depends on the specifications of the responsible organization. The device does not require any special network settings for proper functioning. If the network is incorrectly configured, the basic functioning of the device will not be impaired, although some of its network functions may not be available.

Data exchange

The device exchanges data with other network participants through standard TCP/IP ports.

This data includes:

- Patient data (biographical)
- Measurement results



The responsible organization is responsible for the integrity of the data exchange.

Initial start-up

Switching on

- Switch on the device using the power switch (6, Fig. 5).
- After the device has been started (booted), the start-up screen will be displayed.



Fig. 8 Start-up screen

During initial start-up of the device or after a reset to factory settings, an input mask will be displayed for **device initialization**.

In all other cases, the measurement screen with the pre-set measurement mode will be shown after the start-up screen.

Device initialization

During initial start-up of the device or after a reset to default values, an input mask will be displayed for device initialization. Here you can set basic settings of your device.



These settings can be displayed and modified at any time using the Device settings symbol.

- Select the desired language and tap on **Next**.

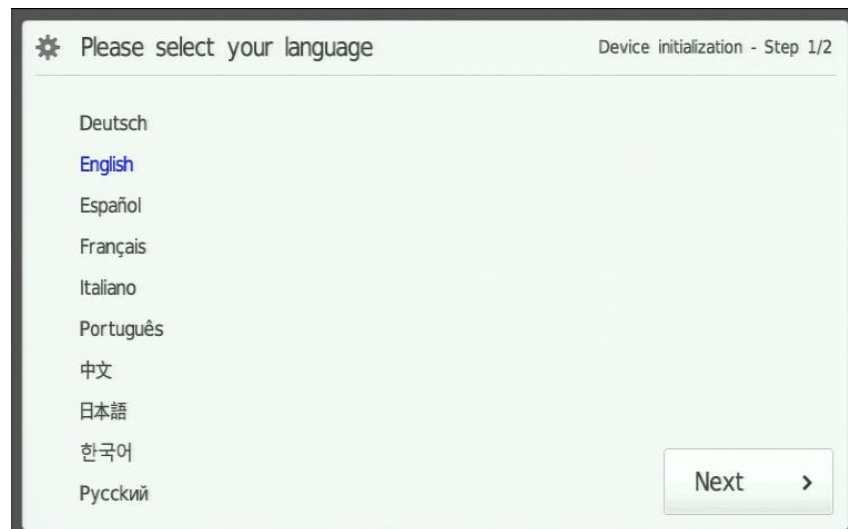


Fig. 9 Device initialization - Language selection

- Select the desired time zone by browsing to the left or right using the arrow buttons.
- Then tap on **Start**.

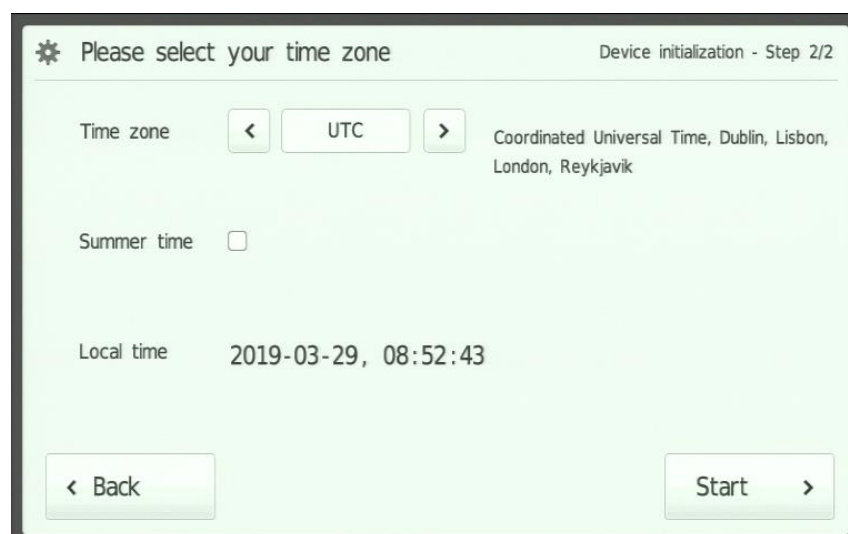


Fig. 10 Device initialization - Selecting a time zone

- The device will now start in **Refraction mode** (Fig. 16).
- If necessary, tap **Back** to return to the previous page for language selection.

Connection to the EMR/PMS system

For connecting the device to an EMR/PMS system, there are several options:

- Connecting via the serial interface
- File-based data exchange via a network folder
- Data output via network
- Provision of data to be collected via the network (web service)

Please check which of these options are supported by your EMR/PMS system. The current device interface specifications can be found at www.zeiss.com/essential-line/connectivity.

Using the serial interface

- Switch off both devices and plug the RS 232 cable into the corresponding connecting ports of the ZEISS VISUREF 150 (**7**, Fig. 5) and the receiving device, e.g. your i.Com server, PC or your VISUPHOR/VISUSCREEN Junction Box. Use the fixing screws provided.
- Switch on both devices.
- Set the configuration parameters for both devices.
- Switch to the device settings of ZEISS VISUREF 150 and open the **Interface/Serial** menu (see Section *Interface submenu*, page 95).
- Align the **Baud rate**, **Number of bits for Data and Stop**, **Parity** and **Handshaking** interface parameters with the corresponding settings of the receiving device.
- Select the desired output format and protocol.
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Exit the device settings and tap **Apply**.

File-based data exchange

- Connect the device to your network. To do this, plug the network cable (8, Fig. 1) into the relevant socket (8, Fig. 5).
- Switch to device settings.
- Open the **Interface/LAN/Network folder** menu (see Section *Interface submenu*, page 95).
- Enter the required parameters (access data for file server etc.).
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Exit the device settings.



The SMB2 protocol is used for communication with the network server.

Direct data transmission via network

- Connect the device to your network. To do this, plug the network cable (8, Fig. 1) into the relevant socket (8, Fig. 5).
- Switch to device settings.
- Open the **Interface/LAN/Network socket** menu (see *Interface submenu*, page 95).
- Enter the required parameters (network address of your EMR/PMS system, etc.).
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Exit the device settings.

Connection to ZEISS FORUM

- Connect the device to your network. To do this, plug the network cable (8, Fig. 1) into the relevant socket (8, Fig. 5).
- Ensure that VISUREF 150 is connected to ZEISS FORUM and that the following configuration parameters are set (see Table 1).

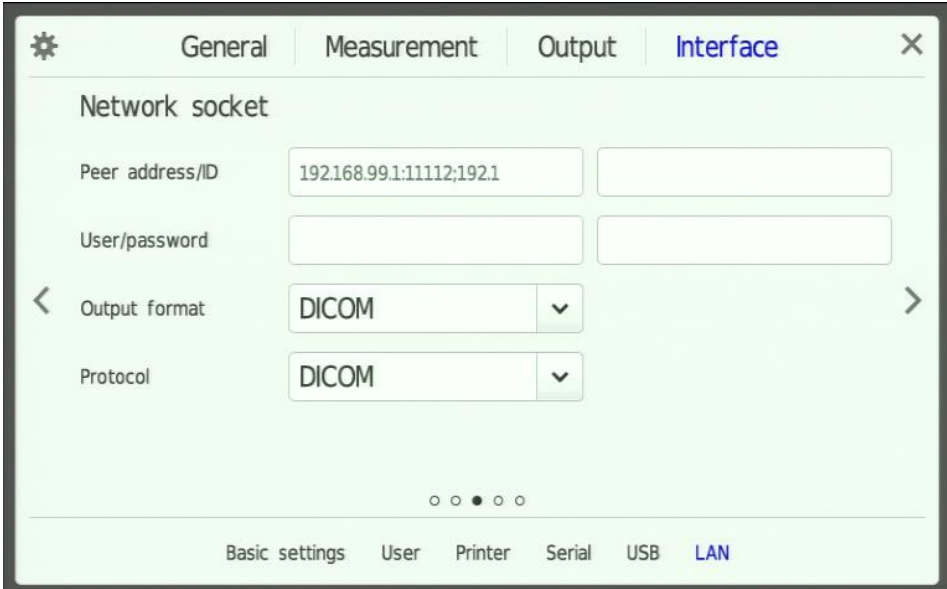
Parameter	Value
AE title of VISUREF 150	Device ID (see <i>Device settings</i> , page 87)
Modality	ARK

Table 1 Configuration parameters in ZEISS FORUM



For details on device connectivity to ZEISS FORUM see the FORUM user manual and the corresponding instructions.

- Switch to device settings.
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Open the **Interface/LAN/Network socket menu** (see *Interface submenu*, page 95).
- Enter the IP address and port of your FORUM server as peer address.
 - Use the format
<MWL server address>:<MWL server port>;<Archive server address>:<Archive server port>
 - Depending on the network environment, instead of the IP addresses, the host names may be entered.
 - If no port number is defined, the FORUM standard 11119 will be used.
- Select "DICOM" as output format and output protocol (see Fig. 11).
- Exit the device settings and tap **Apply**.
- VISUREF 150 is now enabled to exchange data with FORUM.



The screenshot shows a software configuration window titled "Interface" with a close button (X) in the top right corner. The window has four tabs: "General", "Measurement", "Output", and "Interface", with "Interface" being the active tab. Below the tabs, the section "Network socket" is visible. It contains four input fields: "Peer address/ID" with the value "192.168.99.1:11112;192.1", "User/password" which is empty, "Output format" with a dropdown menu showing "DICOM", and "Protocol" with a dropdown menu showing "DICOM". Navigation arrows (left and right) are positioned to the left and right of the "Output format" and "Protocol" dropdowns. At the bottom of the window, there is a row of five small circles, with the second circle from the left being filled. Below this row is a horizontal bar with six labels: "Basic settings", "User", "Printer", "Serial", "USB", and "LAN". The "LAN" label is highlighted in blue.

Fig. 11 Enter the peer address and select output format and protocol

Connection to ZEISS VISUCONSULT/i.Com mobile

- Connect the device to your network. To do this, plug the network cable (8, Fig. 1) into the relevant socket (8, Fig. 5).
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Open VISUCONSULT 500 and note the IP address of your i.Com server.
- Open the **Interface/LAN/Network socket menu** (see *Interface submenu*, page 95).
- Enter the IP address of your i.Com server into the "Peer address/ID" field.
- Select "XML ZEISS" as output format and "i.Com mobile" as output protocol (see Fig. 12).



Fig. 12 Settings for connection to ZEISS VISUCONSULT/i.Com mobile

- Exit the device settings and tap **Apply**.
- VISUREF 150 is now enabled to send data to ZEISS i.Com mobile or VISUCONSULT 500.

Provision of data to be collected via the network (web service)

The web service is an alternative option for EMR/PMS systems to integrated VISUREF 150, assign patient data to the device and actively collect measurement data.

Data provision via web server is only possible if your EMR/PMS system supports this data exchange service.

- Connect the device to your network. To do this, plug the network cable (**8**, Fig. 1) into the relevant socket (**8**, Fig. 5).
- Switch to device settings.
- Open the **Interface/LAN/Web service** menu (see Section *Interface submenu*, page 95).
- Align the **Port** parameter with your EMR/PMS system.
- Enable the interface in the **Interface/Interface enablement** menu (see Section *Interface submenu*, page 95).
- Exit the device settings.

Daily startup

WARNING - GENERAL HAZARD

Prior to using the device, the user must ensure that it is in a good condition and fully functioning. Furthermore, the user must follow the instructions in the user manual.

The following inspections must be carried out each working day prior to use:

- Visual inspection of the housing, exterior markings, user manual, accessories and power cable to ensure that they are present and intact. If parts are missing or damage is visible, the device should not be used and should be taken out of service.



WARNING - RISK OF ELECTRIC SHOCK

Please take care that the following operational requirements are met before using the device each time:

- Use the power cable supplied with the device. The device will be powered through the instrument table.
- The plug must be inserted into a power outlet that has an intact protective ground connection.
- All cables and plugs may be used only if they are in perfect working condition.



WARNING - RISK OF ELECTRIC SHOCK

Do not touch one or more parts shown in Fig. 5 and the patient simultaneously. There is a risk of electric shock from current leakage.



Switching on

- Switch on the device by pressing the power switch (6, Fig. 5) and wait until it has booted.



Do not switch off the device before initialization has been completed. It may cause motor movement error.

- If the device is PIN-protected, enter the PIN (Fig. 13).



You will not be able to use the device if you do not know the user PIN. Contact your device administrator.



Fig. 13 Entering the user PIN

- Open the printer cover (3, Fig. 3) and check that the printing paper is properly inserted and sufficient paper is available. Insert new paper if needed (refer to Section *Maintenance*, page 107).
- Check that the chin rest height control is working properly.
- Check that the stage locking system (4, Fig. 3) is released.
- Ensure that the dust cap (3, Fig. 4) has been removed.
- If required, perform a test eye measurement (2, Fig. 1)



Use suitable chin rest paper.

Operation of the device

CAUTION - GENERAL HAZARDS

The patient should not touch the device with his/her hands. In particular, the device should not be used as a support or an aid when standing up.

Do not use the device with sweaty or wet hands.



CAUTION - RISK OF PINCHING

Take precautions to ensure that fingers and hands are not pinched when lifting the device.

Ensure that no parts of the body (fingers, hands), or objects, are trapped beneath the device when lowering the device.

Do not place hand or fingers under the chin rest. This could result in damage or injury.



CAUTION - RISK OF FALSE DIAGNOSIS

Direct and lateral light incidence to the front of the device or eye being examined should be avoided. The best results will be obtained when the examination room is slightly darkened (about 55 lux to 100 lux).

Ensure that the front lens of the objective is clean. If necessary, polish the front lens (see Section *Care and cleaning*, page 108). A smudged objective may lead to incorrect measurements.

Temperature fluctuations will cause vapor condensation on the protective glass in the measurement window and on optical parts inside the device. In this case, wait about 40 min until the condensation disappears before performing measurements.



Warning and information messages

The device has two warning message levels.

Level	Symbol	Function	Explanation
2		Warning	e.g. note on uncertain measurement
3		Error	Reports a software or measurement error. The error may be remedied by repeating the action. If it is not possible to eliminate the error, contact ZEISS Service.

The warning messages are displayed on the screen.

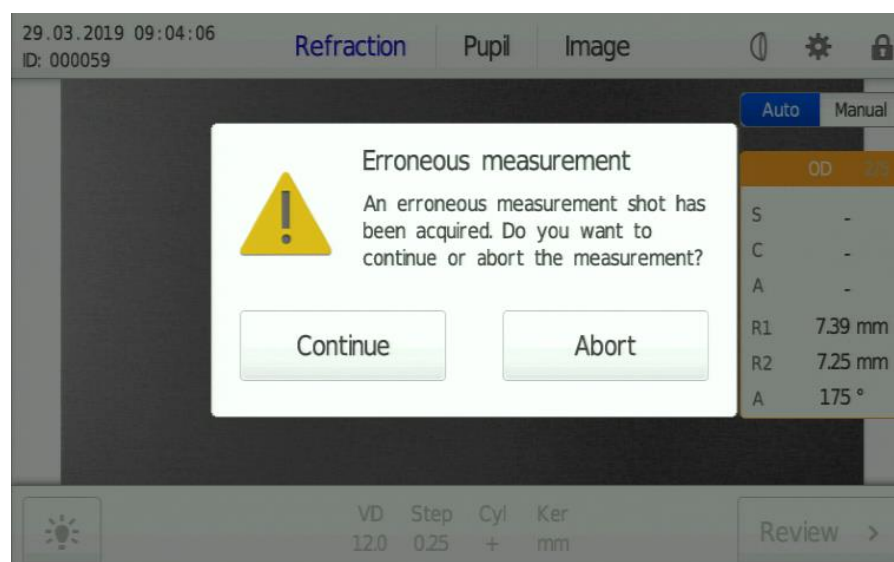


Fig. 14 Error message (example)

Operating concept

Position the patient for measurement using the joystick (7, Fig. 3) and buttons for chin rest height control (5, Fig. 3).

After positioning the patient, the device is operated via the touch screen (2, Fig. 3). The user interface is based on graphical elements and responsive operating buttons, enabling simple and intuitive operation of the device. It supports the measurement procedure which the user is used to. The device settings allow setting various parameters of the user interface to the needs of the user.

Screen layout

During the normal workflow the device's touchscreen contains measurement and review screens. The device settings can also be changed (see Section *Device settings*, page 87). The different setting menus can be opened by tapping the **Settings** icon (7, Fig. 16). An on-screen keyboard is used to enter text-based parameters.

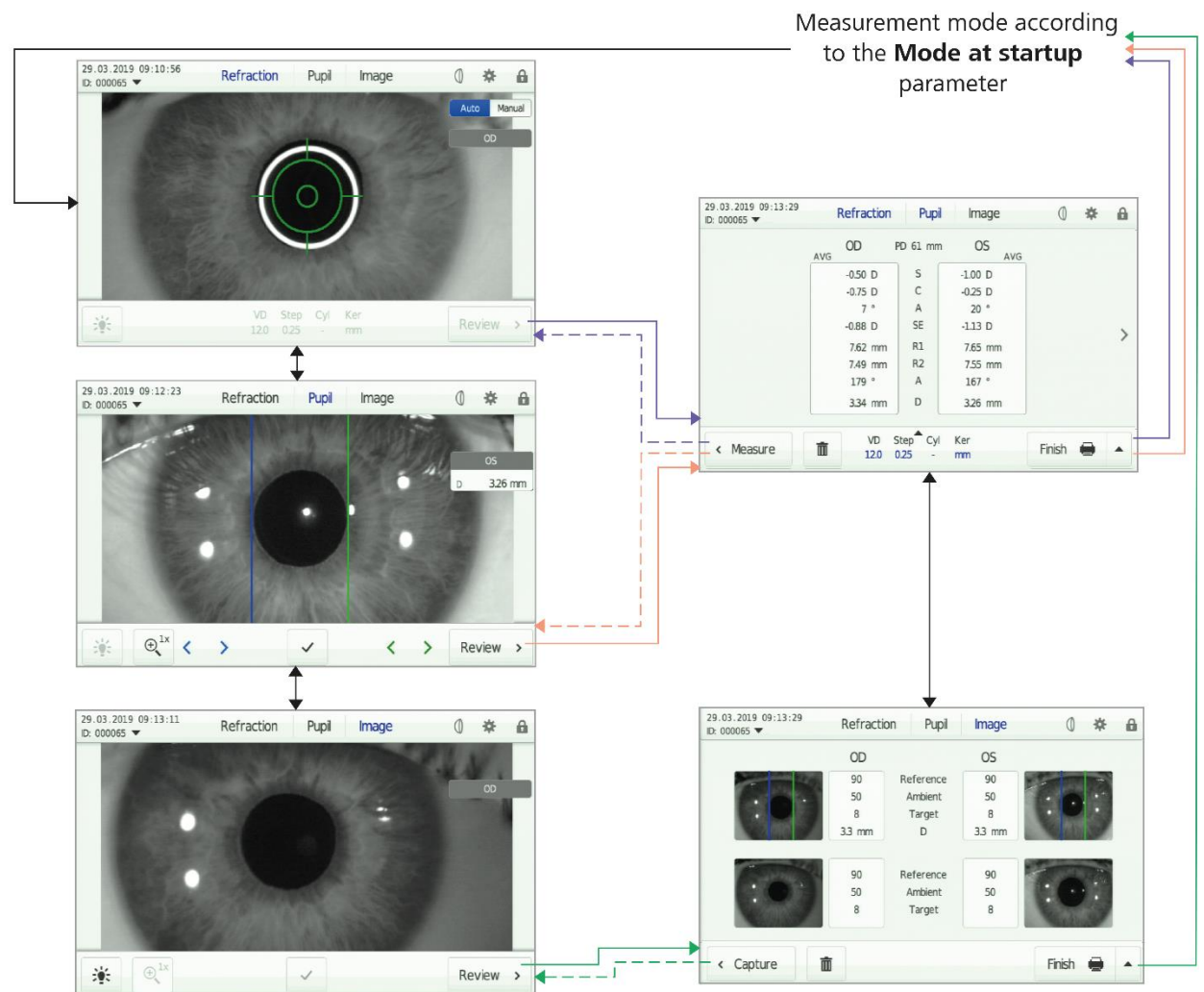
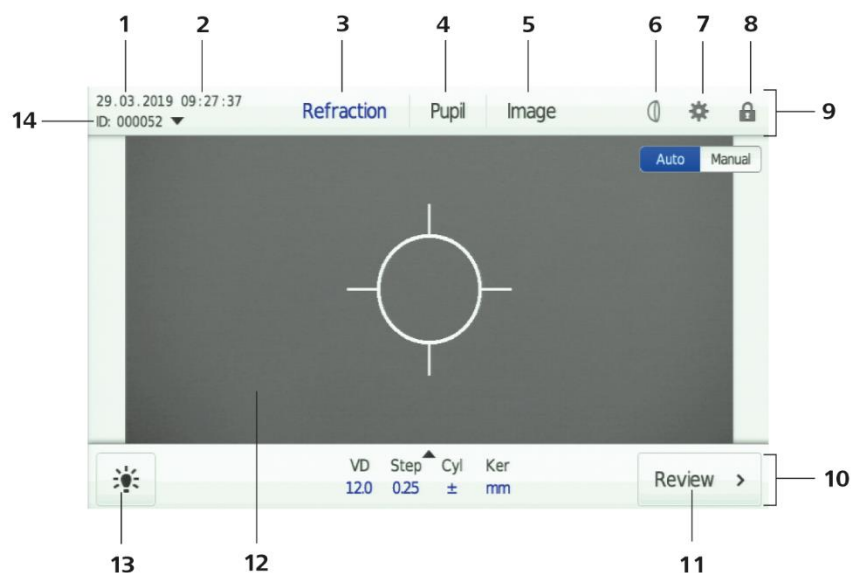


Fig. 15 Main operating functions within the workflow

Measurement screens

The measurement screens for the refraction, pupil and contact lens measurement modes, as well as for the image capture mode, have common and recurring controls (Fig. 16).

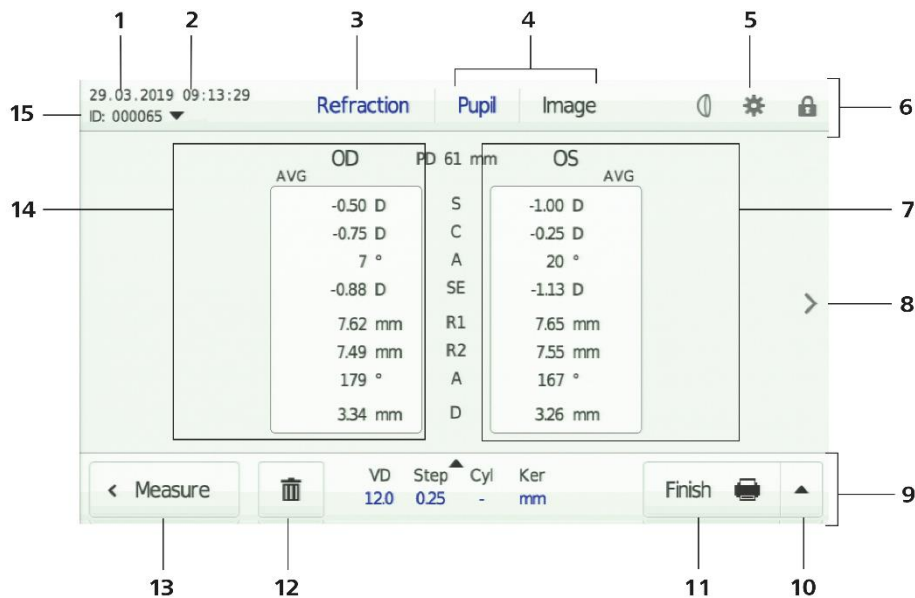


- 1 Date
- 2 Time
- 3 Refraction measurement mode (Refraction)
- 4 Pupil diameter measurement mode (Pupil)
- 5 Image capture mode (Image)
- 6 Contact lens measurement mode
- 7 Settings
- 8 Lock device
- 9 Upper navigation bar
- 10 Lower navigation bar
- 11 Open the review screen
- 12 Live image of the eye
- 13 Select the illumination parameters
- 14 Identification for measurement, access to patient list and storage location of completed measurements

Fig. 16 User interface in measurement screen

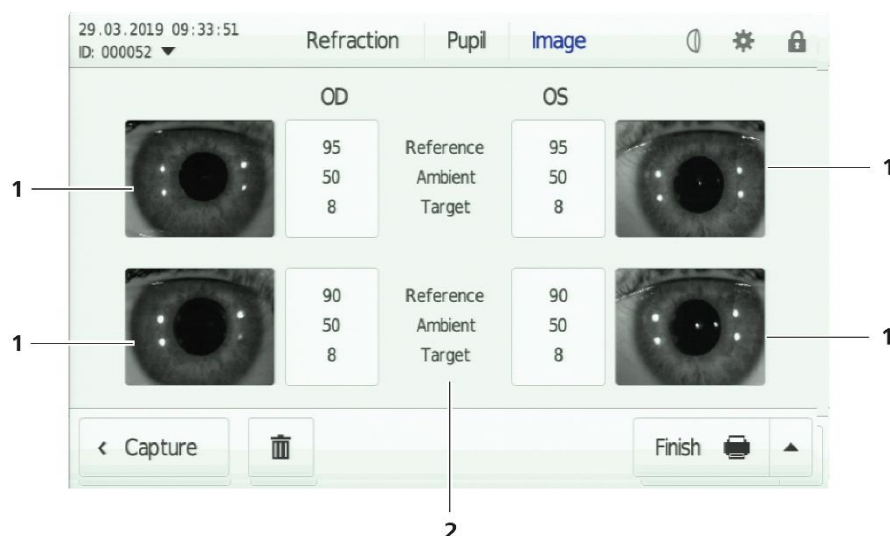
Review screens

The review screens for the refraction, pupil and contact lens measurement modes as well as for the image capture mode have common and recurring controls (Fig. 17 and Fig. 18).



- 1 Date
- 2 Time
- 3 Display the modes for which measurement data is shown (blue letters)
- 4 Display the modes for which no measurement data can be shown (grey letters)
- 5 Settings
- 6 Upper navigation bar
- 7 Display field for left eye measurement results (OS)
- 8 Navigation arrow to results of single measurements (optional)
- 9 Lower navigation bar
- 10 Select various options to finalize the measurement
- 11 Finalize the measurement (default Finish option)
- 12 Delete measurement data
- 13 Return to measurement screen
- 14 Display field for right eye measurement results (OD)
- 15 Identification for measurement, access to patient list and storage location of completed measurements

Fig. 17 User interface in review screen for measurement data



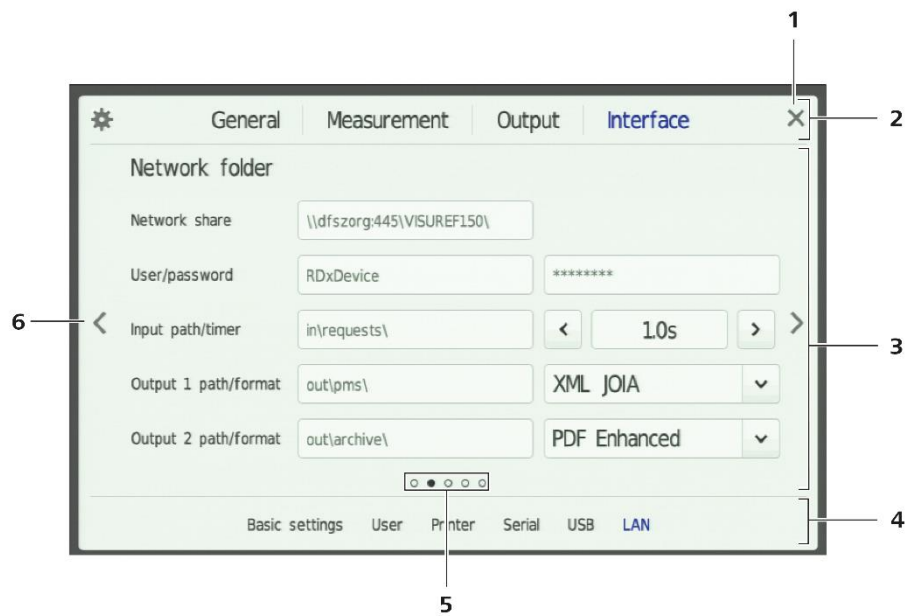
- 1 Reduced display of images captured; change to full size image by tapping the image
- 2 Illumination parameters of the captured images

Fig. 18 User interface in review screen for images

Device settings

The **Device settings** window has up to three navigation levels consisting of an upper tab display (2, Fig. 19), a lower tab display (4, Fig. 19) and various detail pages (3, 6, Fig. 19). The selected upper and lower tab will be highlighted in blue. If there is only one detail page in the corresponding submenu, the navigation elements (5, 6, Fig. 19) will be hidden.

When tapping the black cross in the right upper corner (1, Fig. 19) the window closes and the changes will be saved.



- 1 Close
- 2 Upper tab display (first navigation level)
- 3 Area to change device settings
- 4 Lower tab display (second navigation level)
- 5 Number of detail pages on third Navigation level, current selection is highlighted in black
- 6 Direction arrows for navigating through the detail pages (third navigation level)

Fig. 19 Navigation elements in the device settings window

Device setting parameters are entered by entering text, using pop-up menus, browser selection or using sliders.

On-screen keyboard

The on-screen keyboard is used to fill out the text boxes. It will be displayed as soon as the user touches a text box. Fig. 21 shows the most important elements of the on-screen keyboard.

- To the left of the Device settings symbol, a headline indicates the current submenu and parameters to be edited (**1**, Fig. 21).
- Below the text input field a user instruction is shown summarizing the information, input field and input format (**14**, Fig. 21).
- Capitals can be entered using the Cap button (**12**, Fig. 21) or the Shift button (**11**, Fig. 21). If these buttons are activated, they appear in white letters on a blue background.
- The keyboard has a long touch function (Fig. 20) This enables the uses of diacritical characters and symbols.



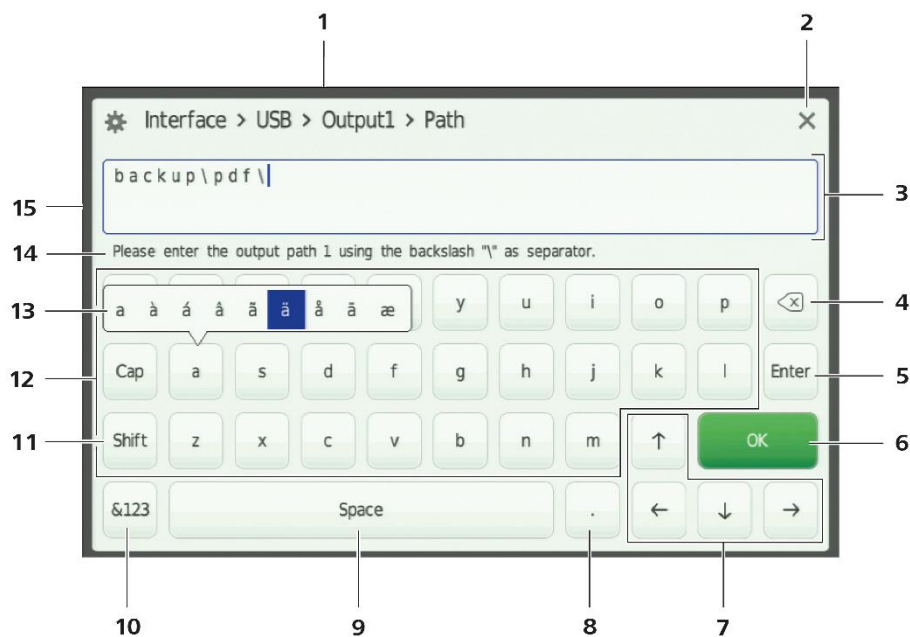
Fig. 20 Long touch for special characters

The following overview shows a selection of relevant characters which can be set by using the long touch function.

Special characters	Selection option for this character via long touch						
+	±						
-	¬	~	_	←	→	↔	
\		/	÷	↑	↓	↕	
(	{	[	<				
)	}	]	>				
.	,	:	;	-	!	?	" ' "

Table 2 Overview of special characters via long touch

- Numerals and operators can be displayed using the **&123** or **abcd** field (10, Fig. 21).
- Save the currently entered text and close the on-screen keyboard by tapping the **OK** button (6, Fig. 21).
- When the black cross in the right upper corner is tapped, the on-screen keyboard closes without saving the entered text (2, Fig. 21).



- 1 Title indicating the edited parameter
- 2 Close
- 3 Text input field
- 4 Delete the character before the current cursor position
- 5 Enter button for line break
- 6 OK button (Save and close)
- 7 Buttons for positioning the cursor
- 8 Access to punctuation marks (long touch)
- 9 Space bar
- 10 Switch to mode for numerals and operators "&123" or switch to mode for alphabetic entries "abcd"
- 11 Shift key
- 12 Caps lock key
- 13 Example for access to diacritical characters (long touch)
- 14 User comments (dependent on parameters)
- 15 Cursor

Fig. 21 On-screen keyboard with long touch for special characters



The on-screen keyboard supports only Latin characters. Asian and Cyrillic fonts are not supported.

Full measurement procedure

In general, the following steps are performed when running a complete measurement procedure with the ZEISS VISUREF 150 Autorefractor/Keratometer:

- Patient selection
- Refraction measurement
- Pupil diameter measurement
- Images of the eye
- Finalization of measurement procedure with output of measurement results

If desired, the user can delete the recorded measurement data, view the results of already completed measurements again or change the device settings at any time between the measurements.

The steps actually performed depend on the device configuration and scope of measurements:

- The **Patient selection** step requires the device to be integrated into an EMR/PMS system and depends on the type of integration and selected workflow. By default, all measurements are anonymous, the measurement data will be identified by a device-internal counter and not allocated to patient data. The various options offered for linking measurement and patient data are explained in Section *Patient selection*, page 47.

The user can freely choose the type of measurements and their sequence. This applies both to the selection of measurement modes and patient eyes to be examined. To complete a measurement procedure, at least one measurement must be performed. The various steps for the different measurement modes are described in Section *Measurement of refraction and keratometry*, page 51, *Measurement of pupil and corneal diameters*, page 64 and *Image captures*, page 71. Moreover, the device provides the option to measure contact lenses (see *Measurement of contact lenses*, page 77).

- Finalization of a measurement, its storage location (local, on a USB drive or in a network folder), printing to a printer (local or in a network) or output to an interface (serial or via the network) depends on the device configuration. The various options are described in Section *Device settings*, paragraph Output/Advanced on page 87.

Patient selection

There are two equivalent options for allocating measurement and patient data:

- The patient is selected from a list prior to the measurement procedure (see Section *Patient selection prior to measurement procedure*).
- The measurement procedure is anonymized and the data is allocated later when the measurement is finalized (see Section *Subsequent patient allocation*).

Patient selection prior to measurement procedure

If a patient list is transferred from a connected application to the device, an arrow will be shown beside the **ID** label (**1**, Fig. 22). This arrow can be used to display the patient list as a pull-down menu.



The list is not updated in the overview screen. To update the list, go back to the measurement screen (**13**, Fig. 17).

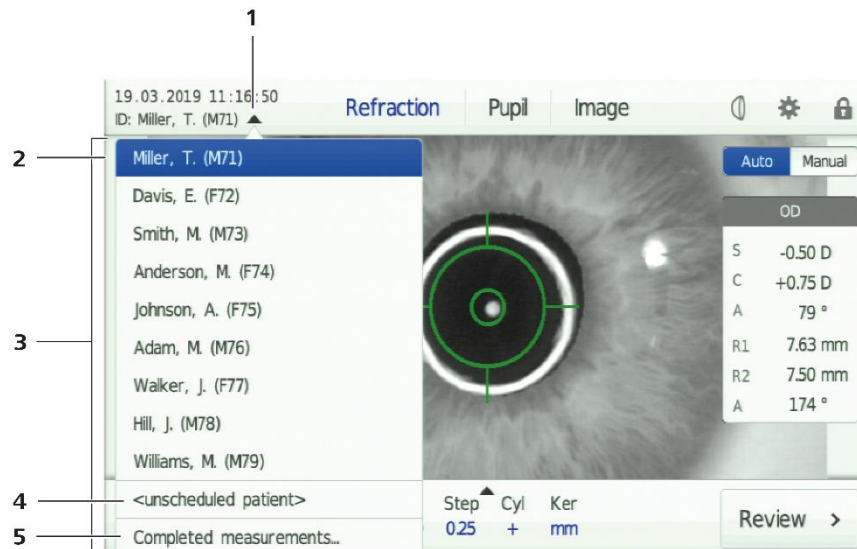
The user has now several options:

- Select a patient from the patient list (**2**, Fig. 22) whose name will be highlighted in blue.
- Start measurement by selecting **<unscheduled patient>** (**4**, Fig. 22) without allocating a patient.



If required, the patient can be allocated later after completing the measurement (see Section *Subsequent patient allocation*, page 49).

- The **Completed measurements** entry (**5**, Fig. 22) allows you to access the results of the last measurements made on the device. When performing further measurements, data previously stored in this memory will be overwritten in chronological order. Long-term storage of data is thus recommended (see Section *Output of measurement results*, page 84).



- 1 Arrow for hiding and showing the patient list
- 2 Currently selected patient
- 3 Patient list
- 4 Select an anonymous patient
- 5 Access to completed measurements

Fig. 22 Unfolded patient list

After completing a measurement with a patient who was previously selected from the patient list, the device goes back to the "<unscheduled patient>" selection as the default setting. Patients are displayed in the patient list in chronological order of assignment to the device.

Please note that when connecting to ZEISS FORUM, the patient will be deleted from the patient list after a measurement has been completed.

When connected to VISUCONSULT 500/i.Com mobile, the patient remains in the patient list as long as the list is not reloaded or overwritten by the server.

Subsequent patient allocation

If a measurement is performed without allocating it to a patient, the allocation can be done after finalizing the measurement. Proceed as follows:

- Activate this option in the device settings by entering the parameters of your EMR/PMS system in the **Output/Advanced/Data allocation** menu.
- Tap the **Finish** button to finalize the measurement.
- Define the patient search by entering text into the text input field which will open then (Fig. 23).

The following search patterns are possible for ZEISS i.Com mobile:

- "Family name[, Given name][; Gender][; Date of birth]"
 - With the exception of the family name, all elements of the pattern are optional.
 - The different elements can only partially describe the searched data record.
 - The abbreviations "m" (male), "f" (female) or "d" (diverse) can be used as search terms for gender.
 - The date of birth must be entered in the format "YYYY-MM-DD".
- Examples: the following search definitions are possible
 - „Thom;f“ finds all female patients with the family names Thomas, Thomson or Thompson etc.
 - "Doe, J;m;1966" finds all male patients with the year of birth 1966 and family names like Doe, John, James etc.
 - "1968-11-19" finds all patients born on 19 November 1968.
- "#ID":
 - ID is the identification number of the searched patient in the searched patient database or the first part of this number.



Depending on the type of EMR/PMS integration, this step may be skipped and existing patient selection may be accessed.

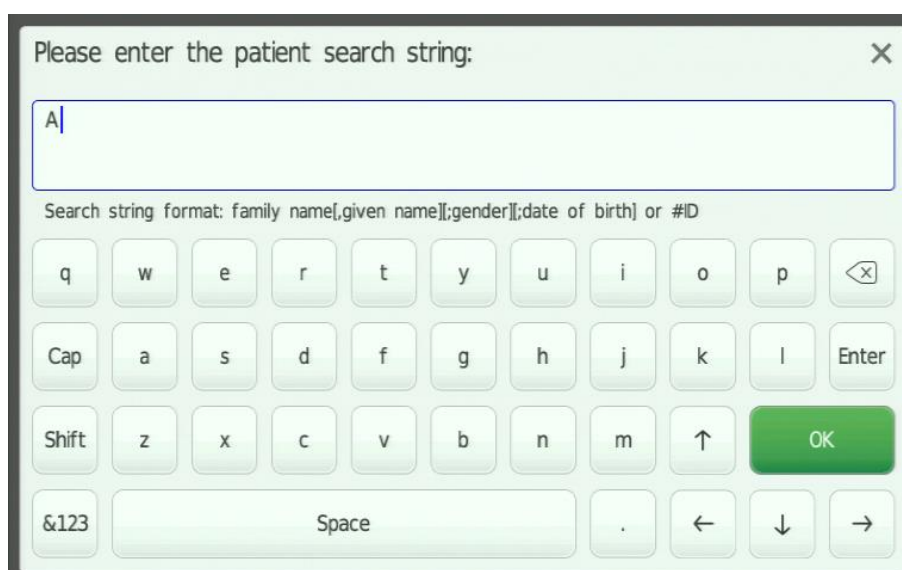


Fig. 23 Text input field to define a patient search

- Select a patient from the displayed list (Fig. 24).

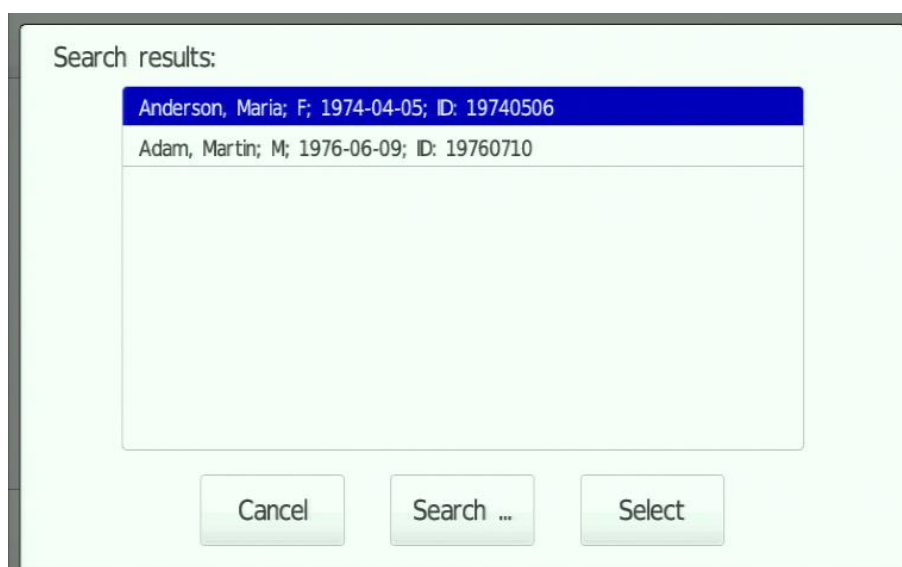


Fig. 24 Patient selection list



In Russian, Korean, Japanese and Chinese languages, the patient list will always be displayed in English.

Measurement of refraction and keratometry



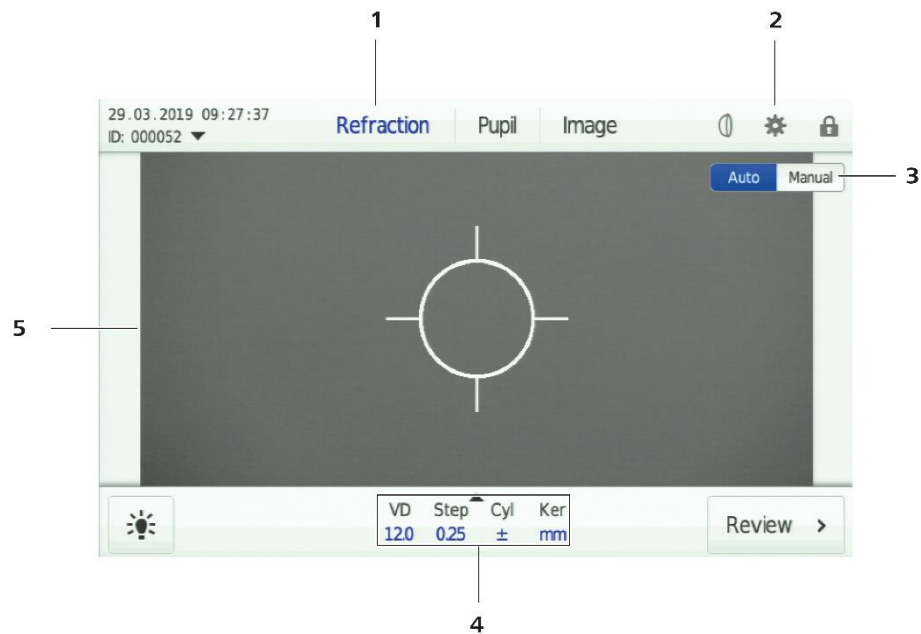
The device records refraction and keratometry data in the **Refraction** measurement mode. It is only possible to acquire both types of measurement data if the illumination mode is set to **Standard**. In **IOL** and **User-defined** illumination modes, only refraction data is recorded.

Preparation of the device for measurement

- Select the desired patient from the patient list (see Section *Patient selection*, page 47) or start measurement by selecting **<unscheduled patient>** (default setting).
- Select the **Refraction** menu in the upper navigation bar. As soon as the word **Refraction** is displayed in blue, the **Refraction** measurement mode is enabled (**1**, Fig. 25)
- Select the mode for the measurement (**3**, Fig. 25). To do this, press the corresponding button on the two-function button. The activated measurement mode will be displayed in white on a blue background.
 - In **Manual** measurement mode measurement is triggered by pressing the measurement button on the joystick.
 - In automatic mode (**Auto**) the device automatically releases a measurement as soon as the camera image is correctly focused and centered.



The fully automatic measurement of both eyes is not possible on this device. The measuring head is positioned manually on both sides.



- 1 Refraction measurement mode, enabled
- 2 Settings
- 3 Select manual or automatic measurement mode
- 4 Parameter control panel
- 5 Live image of the eye in the reticle

Fig. 25 User interface in Refraction measurement screen (automatic measurement mode)

Checking the device settings

Check the enabled **device settings** for refraction measurement. Use the parameter control panel (4, Fig. 25) on the measurement screen or the general access to device settings (2, Fig. 25).

- The **parameter control panel** provides immediate access to the most important settings of output parameters including corneal vertex distance (**VD**), increment length of display accuracy of the sphere and cylinder (**Step**), cylinder notation option (**Cyl**) and the output unit for keratometry (**Ker**).

- ➡ After tapping the **parameter control panel** (4, Fig. 25), a pop-up window opens where the desired parameters (Fig. 26) can be set. The changes in this window are saved immediately. The current values are shown in blue characters.
- ➡ By tapping outside of the pop-up window, the window will be closed.

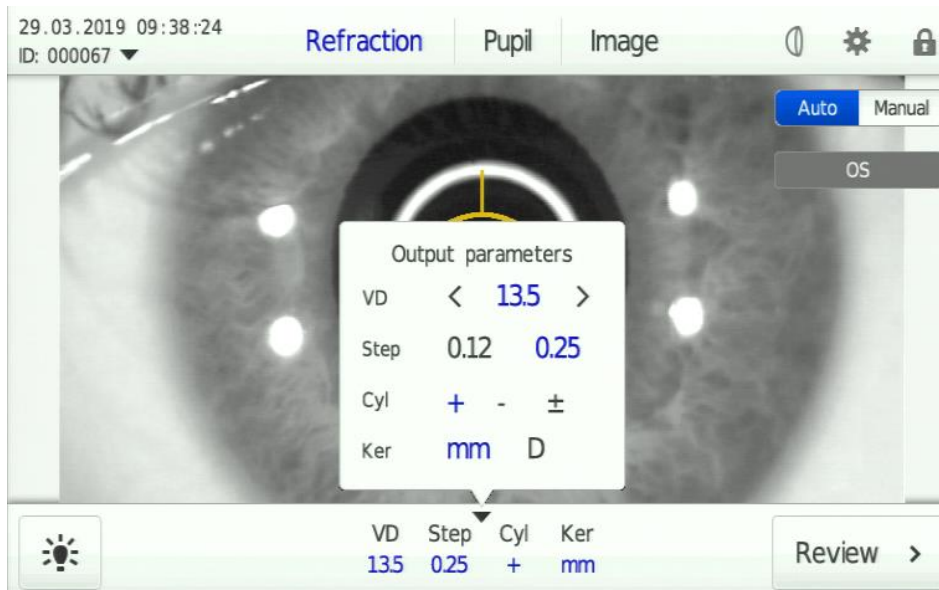


Fig. 26 Unfolded parameter control panel

- ➡ If the examination parameters in the parameter control panel are not to be edited with a single click, this function can be disabled. To do this, select the **Direct control** parameter in the **Interface/User/User interaction** tabs of the Device settings menu. Fig. 27 shows the parameter control panel when disabled.



Fig. 27 Disabled parameter control panel

- Alternatively to the parameter control panel, the examination parameters can also be set by using the **Output/Format/Measurement data** tabs of the **Device settings** menu.
- In addition, the measurement parameters **Number of measurements** and **Sphere shift** can be set using the device settings in the **Measurement** tab.



1, 3, 5, and 7 measurements per eye can be selected both in automatic and manual mode. In automatic mode, multiple measurements are performed consecutively as soon as the eye is focused and centered correctly. During this sequence the display is locked for the user.



The sphere shift can be set in steps of 0.125 D and a range of -2.0 D to +2.0 D.

Setting the illumination parameters

The device permits the adjustment of various illumination parameters for refraction measurement. This can be helpful, particularly in the case of eyes with clouded lenses or implanted IOL. When measuring eyes without pathological finding, the **Standard** mode illumination parameters can be retained.

Table 3 summarizes the illumination parameters of the device.

Illumination parameters	Description	Scale
Reference	- Controls the illuminance of reference illumination of the eye - This parameter can be changed to make the eye appear lighter or darker in the live image.	from 0 (low) to 100 (high) in increments of 1
Ambient	- Controls the illuminance of ambient illumination of the eye - This parameter can be changed to make the surroundings of the eye appear lighter or darker in the live image.	from 0 (low) to 100 (high) in increments of 1
Target	- Controls the illuminance of the fixation target in the internal display of the device - Changes in this parameter may not be perceived by the user.	from 0 (low) to 100 (high) in increments of 1

Table 3 Description of illumination parameters

The device provides the three illumination modes **Standard**, **IOL** and **User-defined**. These modes coordinate the illumination parameters **Reference**, **Ambient** and **Target**.

- According to the clinical application you should decide which illumination mode is most appropriate for your measurement (see Table 4).
- If you do not change the illumination parameters, the device uses the settings of the **Standard** illumination mode (see Table 4).
- In case of a user-defined change of illumination parameters, the device cannot perform keratometry. Keratometry values can only be measured in **Standard** and **IOL** illumination mode.

Illumination mode	Application	Keratometry
Standard	Eyes without pathological finding	yes
IOL	Eyes with implanted IOL or eyes with slight lens clouding (cataract)	yes
User defined	Depending on user decision	no

Table 4 Overview of illumination parameters in different illumination modes

Tap the **Illumination** button (Fig. 28) to configure the illumination parameters. A pop-up window will open where you can set each parameter to your specific needs.

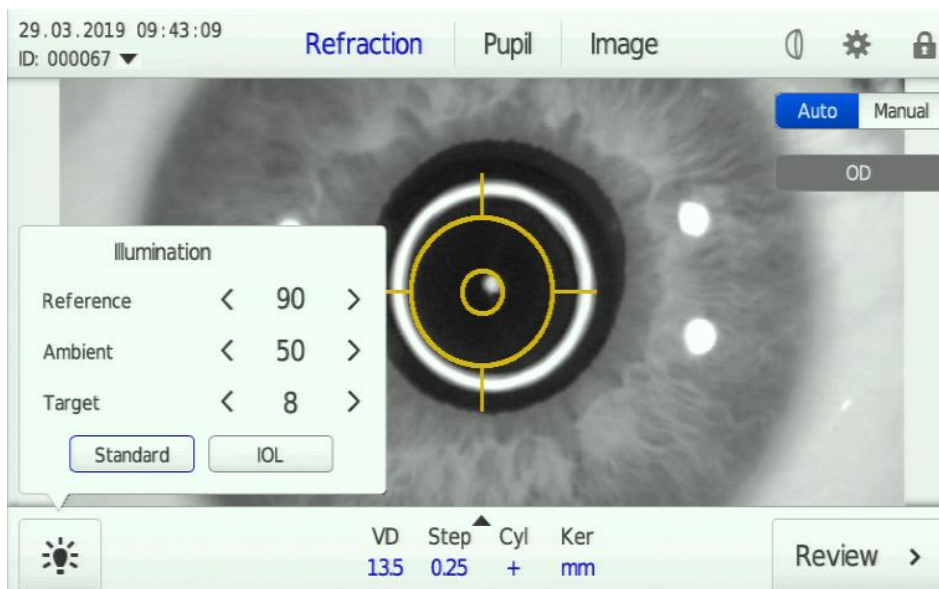


Fig. 28 Pop-up window with unfolded illumination parameters

- Click on the arrow symbols beside the illumination parameters to adjust them to your specific needs (**User defined** mode). If you decide to enter an illumination parameter which is not pre-set, it will be displayed in blue.



Touching the arrow symbols longer causes a quicker run through the scale until the desired target value is displayed.

- Beside these user-defined settings, you can also return to the pre-set illumination modes by selecting **Standard** or **IOL** (Table 4). If you use one of the pre-set modes, the illumination parameters are displayed in grey (Fig. 28).
- If you use the **IOL** or **User-defined** illumination modes, the selected illumination parameters are shown on the measurement screen. In **IOL** illumination mode, the words "IOL mode" are displayed in the left lower corner of the live image. When using user-defined settings, the reference, ambient and target illumination values are displayed separately (Fig. 29).



Fig. 29 Display of user-defined illumination parameters in the measurement screen of Refraction mode

Positioning the patient and explaining the procedure to the patient

- Ask the patient to position his/her chin on the motorized chin rest and forehead against the forehead rest. Ensure that the patient's chin is on the front edge of the chin rest. Ensure that the patient does not hold onto to the chin rest.
- Using the height adjustment buttons (5, Fig. 3), adjust the motorized chin rest so that the patient's eyes are set to the height of the Canthus marks (6, Fig. 4).



Disinfect the chin rest after each patient.

CAUTION - RISK OF PINCHING

The motorized chin rest should only be height-adjusted while maintaining direct visual contact with the patient.



- Explain to the patient that measurements with the device are contactless.
- Inform the patient about the measurement procedure prior to measurement.
- Ensure that there are no foreign bodies in the tear film (e.g. eyelashes). Ask the patient to blink once or twice prior to the start of measurements.

Performing a measurement

If you wish to start measurement with the right eye, move the measuring head to the left using the joystick. OD will be displayed on the screen. If you wish to measure the left eye, move the measuring head to the right using the joystick. OS will be displayed on the screen.



If the device does not identify an eye, the cross hairs will be displayed in white, and no laterality information will be shown.

As soon as the device identifies an eye, the cross hairs change to yellow (Fig. 30 left). Now focus and center on the patient's pupil.

- To focus (i.e. generate a focused image of the eye), move the joystick back and forth.
- To center (i.e. move the light point in the center of the pupil into the inner ring of the cross hairs) move the joystick to the left or right. For fine adjustment of the height, rotate the joystick.

As soon as the eye is focused and centered, the cross hairs change to green (Fig. 30 right).

During measurement the patient will see a fixation object in the form of a hot air balloon over a long road on the internal display. If positioned correctly, he/she should be able to clearly identify this image.



Encourage the patient to relax and look at the red part in the center of the balloon. This minimizes the accommodation effect.



Shortly before the start of the measurement procedure, ask the patient not to move during measurement and to keep his/her eye wide open.

In manual measurement mode, trigger measurement by pressing the measurement button on the joystick (**6**, Fig. 3). In automatic measurement mode, the measurement will be triggered automatically as soon as the image is correctly focused and centered.

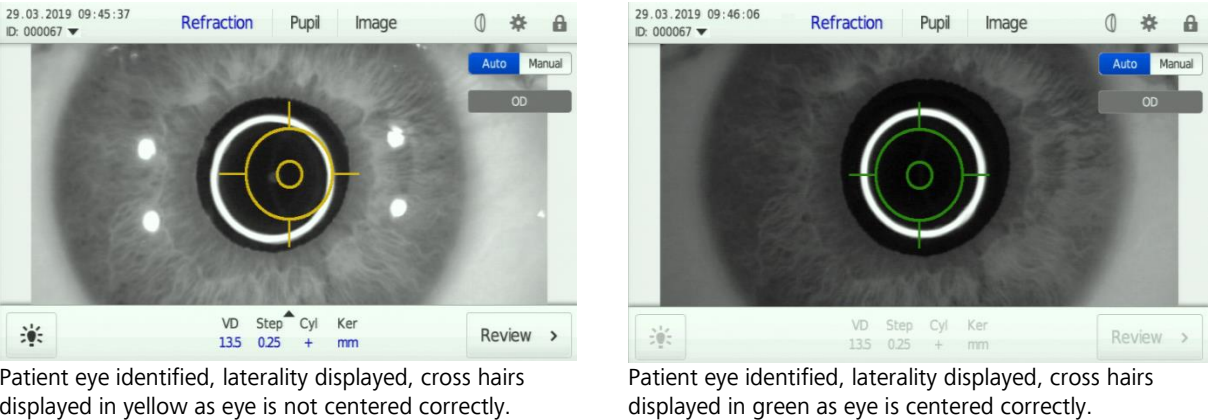


Fig. 30 Cross hairs with decentered (left) and centered image (right)

The measurement results of each eye are displayed in the column on the right side of the screen (Fig. 31 and Fig. 32).

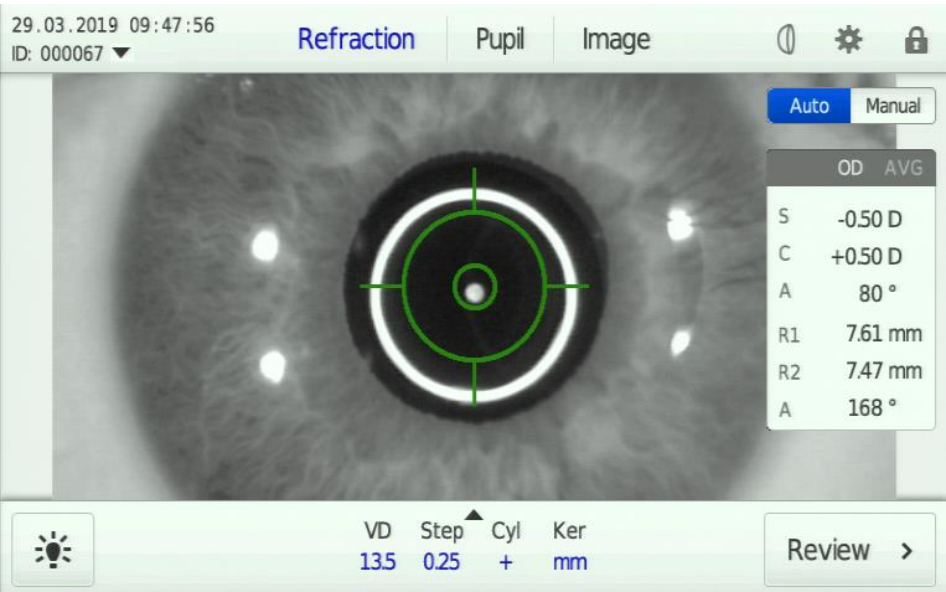


Fig. 31 Display of measurement results for a measurement sequence of OD (measurement screen, without display of pupil distance)

Using the joystick, now move the measuring head to the other eye and perform a refraction measurement for this eye.

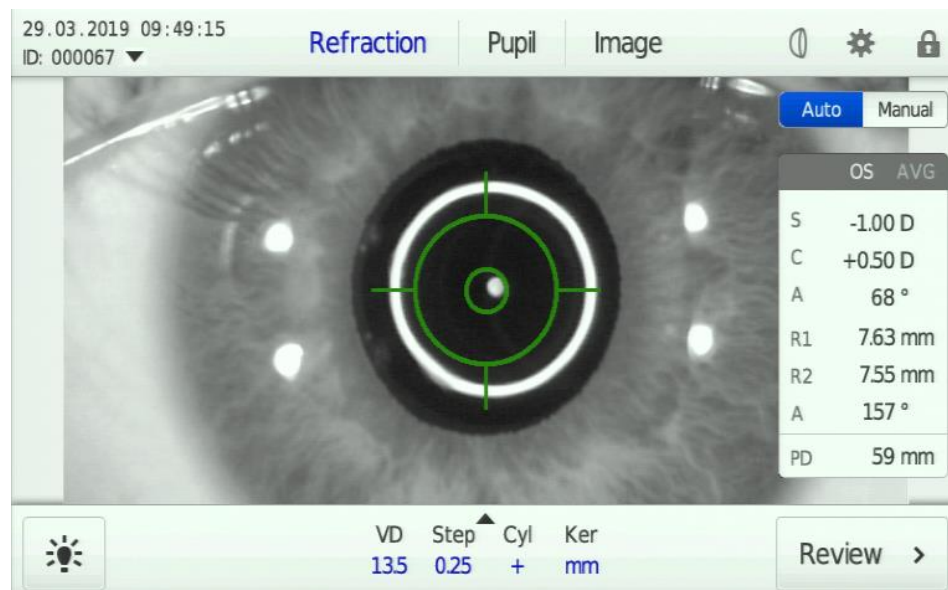


Fig. 32 Display of measurement results for a measurement sequence of OS (measurement screen, including display of pupil distance)

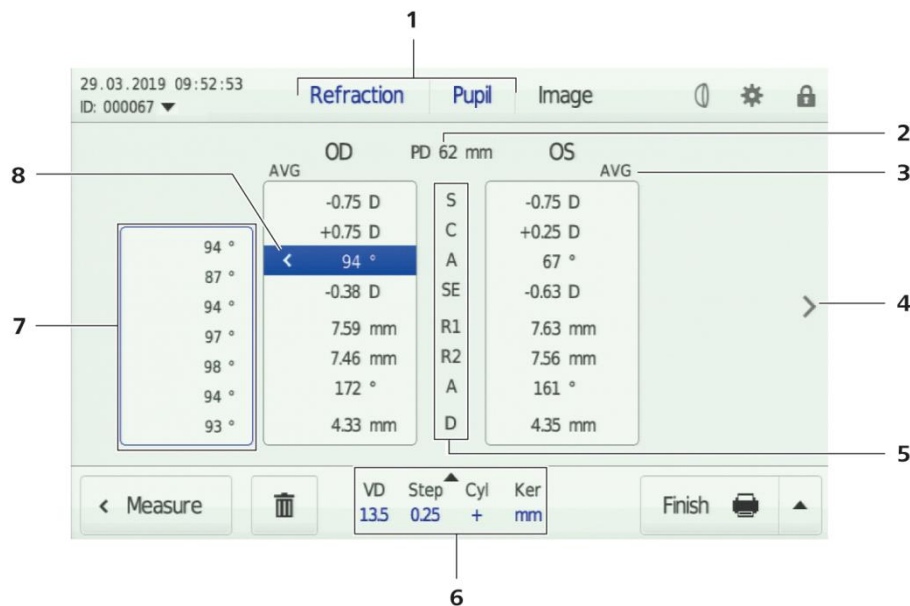
Now tap on **Review** to switch to the review screen in refraction mode and display the measurement results.



If you want to switch automatically to the review screen after successful measurement, set the **Workflow mode** parameter to **Simplified** in the **Interface/User/User interaction** tab of the device settings.

Data display in the review screen

Fig. 33 shows the general design of the review screen. Fig. 33 also shows the special features of the **Refraction** and **Pupil** modes in the review screen.



- 1 Data output enabled for the Refraction and Pupil modes
- 2 Pupil distance value (PD)
- 3 AVG indicator displays the average values of all measurement sequences
- 4 Direction arrow to navigate through single measurements
- 5 Term used to describe the measurement parameters
 - Refraction:* D = Sphere, C = Cylinder, A = Axis, SE = Spherical equivalent
 - Keratometry:* R1 = Corneal curvature radius for flat meridian/K1 = k-value for flat meridian
R2 = Corneal curvature radius for steep meridian / K2 = k-value for steep meridian
A = Axis of corneal curvature
 - Pupil measurement:* c = Pupil diameter
- 6 Parameter control panel
- 7 Detailed display of all measured values
- 8 Selected measured value (highlighted in blue)

Fig. 33 Review screen Refraction and Pupil (average values)

- After refraction measurement and determination of pupil diameter, both terms will be displayed in the upper navigation bar of the review screen in blue (1, Fig. 33).
 - If refraction data is available, the word **Pupil** will be displayed in grey and the pupil diameter indication will remain empty (D value in display 5, Fig. 33).

- The recorded measured values will be displayed in white columns for the right (OD) and left eye (OS). Between the columns you can see the measurement parameters (5, Fig. 33).
- If only one measurement sequence is performed per eye, the **AVG** indicator (3, Fig. 33) will not be displayed. If more than one measurement sequence is performed, the **AVG** indicator will be displayed on the right or left upper edge of the measurement column. This indicates that the displayed values are **arithmetic mean values** of the total measurement sequence.
- If a measurement sequence is recorded from several single measurements, the single measurement values of each parameter and each measurement within this measurement sequence can be displayed.
 - The detailed display (7, Fig. 33) can be opened by tapping on the desired measurement value in the corresponding column (8, Fig. 33). The latter shows all recorded measurement values of this parameter in this sequence. In Fig. 33, seven measurements have been performed.
 - By tapping the direction arrow (4, Fig. 33) you can see the results of all single measurements. In Fig. 34, for example, the first of seven measurements is shown.
 - Deletion of single measurement values is described in Section *Delete measurement data*, page 82.



Fig. 34 Display of measurement results of a single measurement (review screen)

- If the illumination parameters of the device have been changed (see Section *Setting the illumination parameters*, page, 54), these are displayed beside the overview columns of measurement values (Fig. 35).

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Refraction Pupil Image

OD PD 61 mm OS

8/10 8/10

Reference	OD	OS	Reference
85	-0.75 D	-0.75 D	85
	+0.75 D	+0.50 D	
	88 °	74 °	
	-0.38 D	-0.50 D	
Ambient	-	-	Ambient
45	-	-	45
Target	-	-	Target
8	-	-	8

< Measure VD 135 Step 025 Cyl + Ker mm Finish

Fig. 35 Display of measurement values of a single measurement with changed illumination parameters

- The parameter control panel can also be used in the review screen (if this function has not been disabled by device settings). Tapping on the panel (6, Fig. 33) in the lower navigation bar will instantaneously display the measurement values in a different notation or convert them on the basis of the selected parameters.
 - Depending on the selection of the output unit of keratometry, the user interface shows the **R1** or **R2** corneal curvature values in mm or the **K1** or **K2** values for corneal refraction in diopters.
- The measurement is now completed by one of the following actions:
 - Close the measurement by tapping on **Finish**. Further notes on this are to be found in Section *Output of measurement results*, page 84.
 - Discard the measurement by tapping on **Delete**. Further notes on this are to be found in Section *Delete measurement data*, page 82.
 - Return to the measurement screen by tapping on **Measure**.



Measurement of pupil and corneal diameters

The following chart shows the **Main control functions** for measuring the pupil or corneal diameter (Fig. 36).

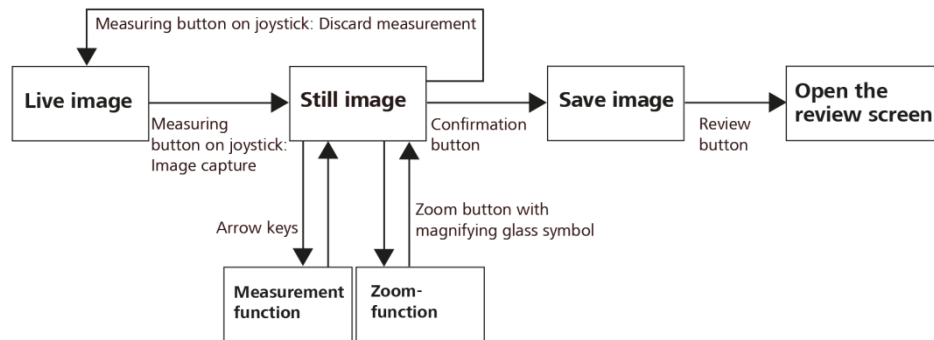


Fig. 36 Main control functions in Pupil mode

Preparation of the device for measurement

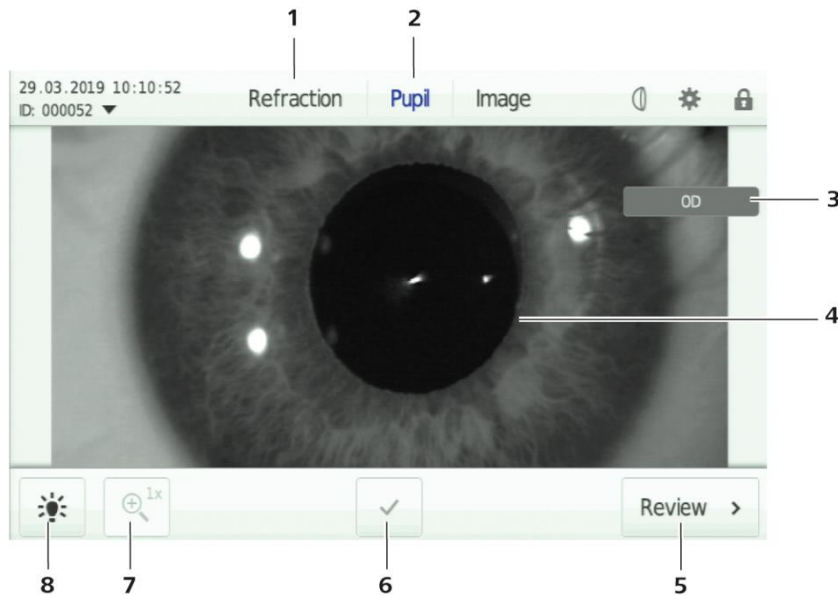
Selecting the measurement mode

- Select the desired patient from the patient list (see Section *Patient selection*, page 47) or start anonymized measurement (default setting)
- Select the **Pupil** menu in the upper navigation bar. As soon as the word **Pupil** is displayed in blue, the **Pupil** measurement mode is enabled (2, Fig. 38).



Fig. 37 Message that image data will be overwritten

- If no image is captured from which the pupil diameter can be determined, the **Zoom** (7, Fig. 38) and **Confirmation** (6, Fig. 38) buttons are disabled.



- 1 Refraction measurement mode, disabled
- 2 Pupil measurement mode, enabled
- 3 Laterality display
- 4 Live image of the eye (moving)
- 5 Open the review screen
- 6 Confirmation, disabled
- 7 Zoom, disabled
- 8 Illumination

Fig. 38 User interface in Pupil measurement screen (live image)

Setting the illumination parameters

- In order to achieve an optimum image of the pupil diameter, the illumination parameters can also be set in **Pupil** mode. To do this, tap on the **Illumination** symbol button (8, Fig. 38).



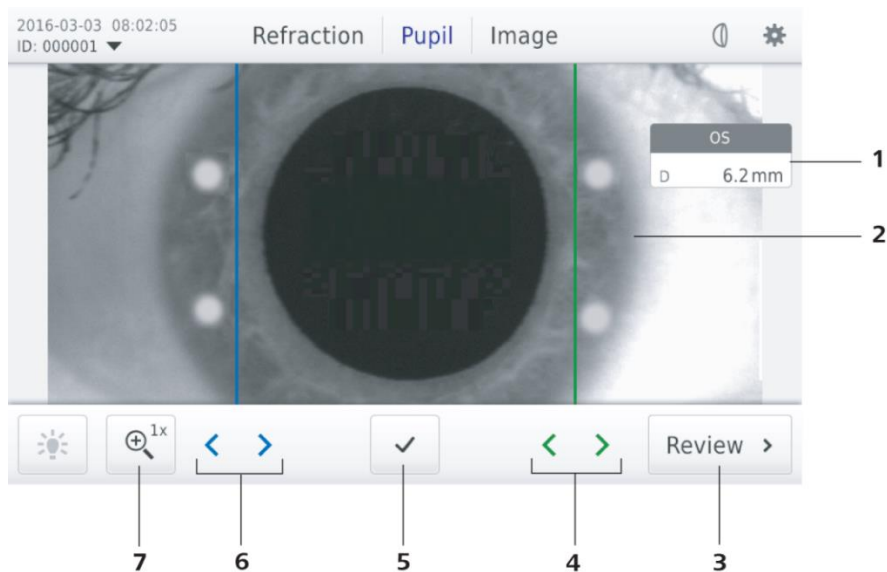
Measurement of pupil or corneal diameter

- Make sure that the patient is correctly positioned and explain the measurement to him/her (see Section *Positioning the patient and explaining the procedure to the patient*, page 57).
- Take an image of the eye for which you want to determine the desired diameter. Focus and center the displayed live image of the eye using the joystick.
- Press the measuring button of the joystick (6, Fig. 3) to capture an image.

As soon as the device has captured an image, the moving live image (4, Fig. 38) will be replaced by the still captured image of the eye, and new control elements will be displayed (Fig. 39).



The device can save up to two images per eye. If the memory store is full, the device shows a corresponding message (Fig. 37) that saving a new image will overwrite the oldest existing image. If this is an image that was captured during pupil diameter measurement, the corresponding measurement value will be deleted.



- 1 Display of determined diameter
- 2 Captured image (still)
- 3 Open the review screen
- 4 Arrows to position the green measurement line (right)
- 5 Confirmation, enabled
- 6 Arrows to position the blue measurement line (left)
- 7 Zoom, active

Fig. 39 User interface in Pupil measurement screen (still image)

- Now position the blue (left) and green (right) measurement line at the edges of the pupil. To do this, either tap on the desired area in the image or use the arrow symbols in the color corresponding to the desired measurement line (4 and 6, Fig. 39)
- The pupil diameter **D** determined from the distance of the two measurement lines, will be displayed below the laterality display (1, Fig. 39). This value changes with each movement of the measurement line.
- In order to perform a measurement which is as accurate as possible, you can use the **Zoom** function (7, Fig. 39) which can easily be identified by the magnifying glass symbol.



As soon as you tap on the **Zoom** button, a pop-up window (Fig. 40) will open. Here you can select single (1x), double (2x) or triple (3x) image magnification.



Now select the desired magnification level. The enabled magnification factor will be displayed in blue.



The device automatically adjusts the image and the position of the measurement lines in each magnification level. At double or triple magnification, it may be possible that the measurement lines are outside the image.

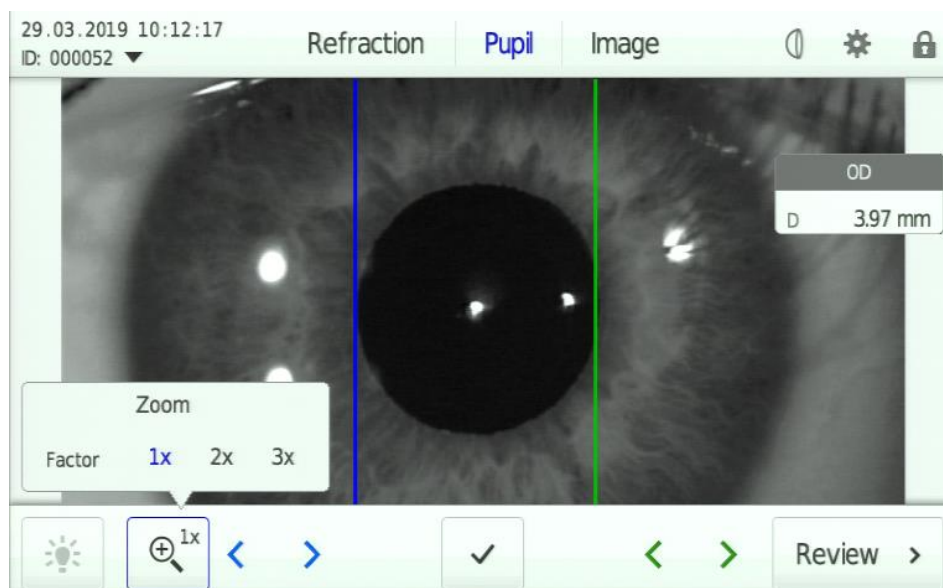


Fig. 40 Pop-up window with zoom function in Pupil mode

- Close the pop-up window **Zoom** by tapping again on the **Zoom** button.
- After closing the **Zoom** pop-up window, the selected magnifying factor is displayed beside the magnifying glass symbol (Fig. 41).

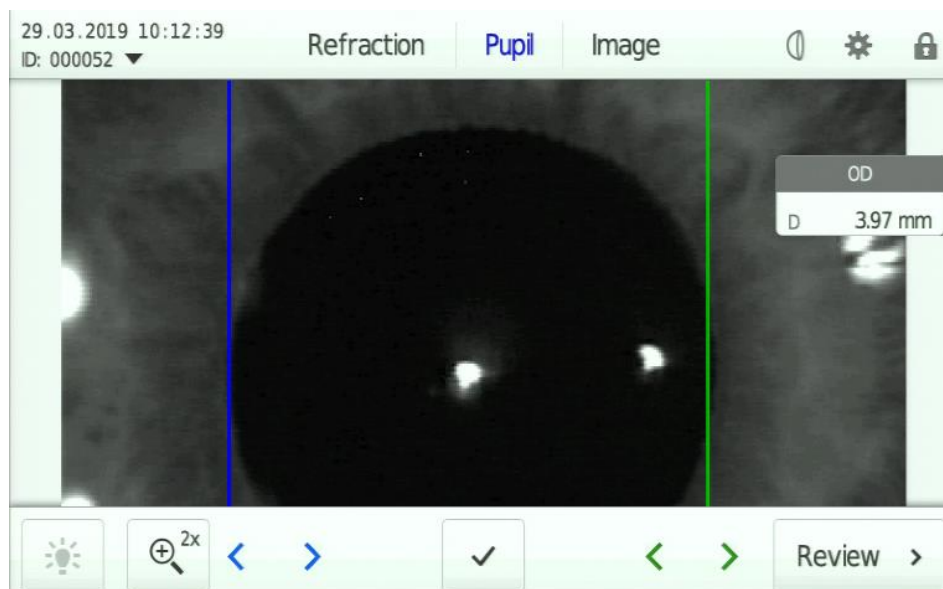


Fig. 41 Measurement screen of pupil diameter with double magnification.

- If you want to discard the image, press the measuring button on the joystick once. The device will display a query message if you want to discard the image and the related measurement. This message can be suppressed by changing the device settings in the **Interface/User/User interaction** menu (see page 95). As soon as you have confirmed by pressing the **Discard** button, the device returns to the live image mode (see also Fig. 36 and Fig. 38). Now you can measure the diameter again.

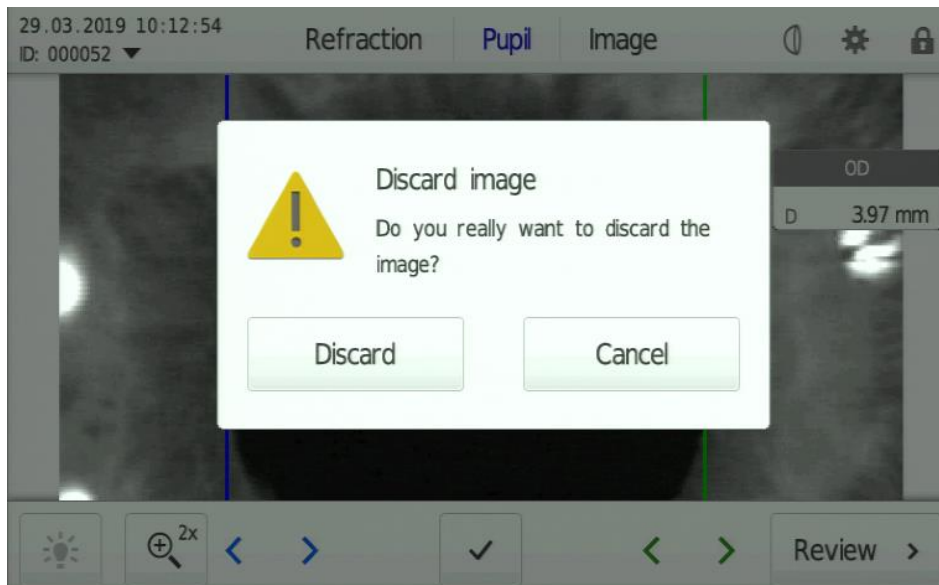


Fig. 42 Confirm image discard

- When both measurement lines are correctly positioned, confirm the measurement by tapping the corresponding button (5, Fig. 39). The determined measurement value, the illumination parameters set for the image and the image itself (with measurement lines) are saved (see Fig. 36).
 - Measure the second eye, if required, in the same way.
-  For each eye two measurements can be performed. After the second measurement, a mean value is shown.
- If you want to display a measurement result in the review screen, tap on the **Review** button.

Review screen displays

- The measurement value of the pupil diameter will be displayed together with the measurement values for refraction and keratometry in the review screen for measurement data. For more information on data display in the review screen see the paragraph *Data display in the review screen*, page 61 of Section *Measurement of refraction and keratometry*.
- The image on which the measurement is based and the measurement lines are stored together with the measurement value. This can be displayed on the review screen for images (Fig. 43).
- When tapping on the displayed preview images a pop-up window will open to display the selected image in full screen mode (Fig. 43, below).

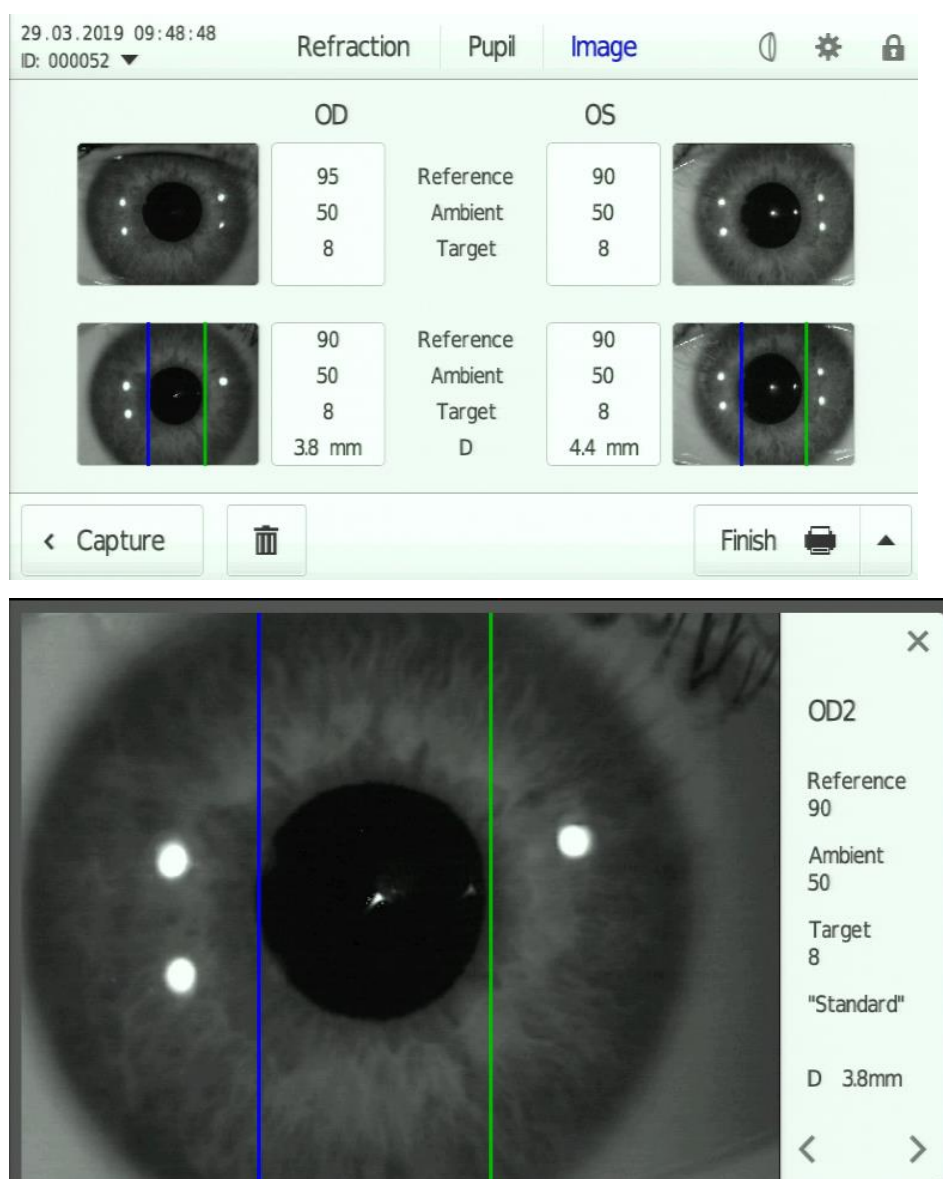


Fig. 43 Measurement of pupil diameter in the review screen for images (above) and full screen view (below)

Image captures

The following chart shows the **main control functions** for capturing images of the eye with this device (Fig. 44)

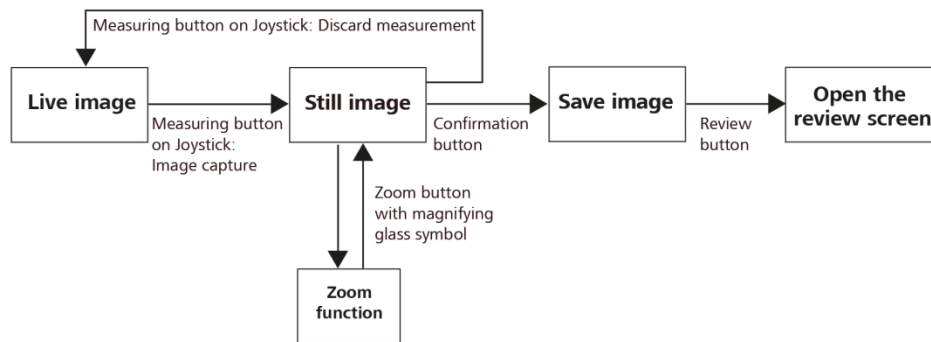


Fig. 44 Main control functions in Image mode

Preparation of the device for measurement

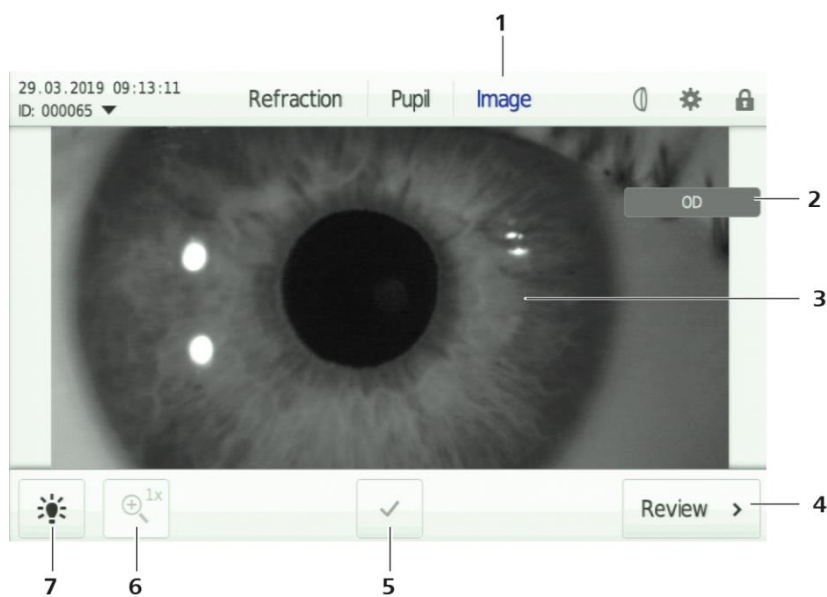
Selecting the measurement mode

- Select the desired patient from the patient list (see Section *Patient selection*, page 47) or start anonymized measurement (default setting)
- Select the **Image** menu in the upper navigation bar. As soon as the word **Image** is displayed in blue, the **Image** measurement mode is enabled (1, Fig. 45)



The device can save up to two images per eye. If the memory store is full, the device shows a corresponding message (Fig. 37) that saving a new image will overwrite the oldest existing image. If this is an image which was captured during pupil diameter measurement, the corresponding measurement value will be deleted.

While no image is captured, the **Zoom** and **Confirmation** (5, 6, Fig. 45) buttons are disabled.



- 1 Image capture mode (Image), enabled
- 2 Laterality display
- 3 Live image of the eye (moving)
- 4 Open the review screen
- 5 Confirmation, disabled
- 6 Zoom, disabled
- 7 Select the illumination parameters, enabled

Fig. 45 User interface in Image measurement screen (live image)

Setting the illumination parameters

- In order to achieve an optimum image of the pupil diameter, you can also set the illumination parameters in **Image** mode. To do this, tap on the **Illumination** symbol button (7, Fig. 45).

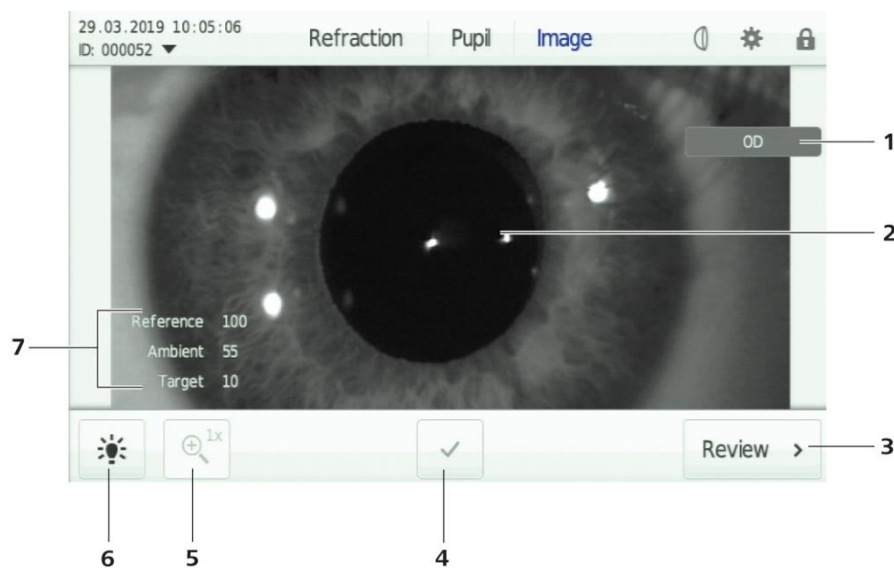


Capturing images

Make sure that the patient is correctly positioned and explain the measurement to him/her (see Section *Positioning the patient and explaining the procedure to the patient*, page 57).

- Now take an image of the eye. Focus and center the displayed live image of the eye using the joystick.
- Press the measuring button of the joystick (6, Fig. 3) to capture an image.

As soon as the device has captured an image, the moving live image (3, Fig. 45) will be replaced by the still captured image of the eye. The Zoom (5, Fig. 46) and Confirmation (4, Fig. 46) functions will be enabled and the illumination parameter setting (6, Fig. 46) will be disabled.



- 1 Laterality
- 2 Captured image (still)
- 3 Open the review screen
- 4 Confirmation
- 5 Zoom
- 6 Select the illumination parameters
- 7 Display of user-defined illumination parameters

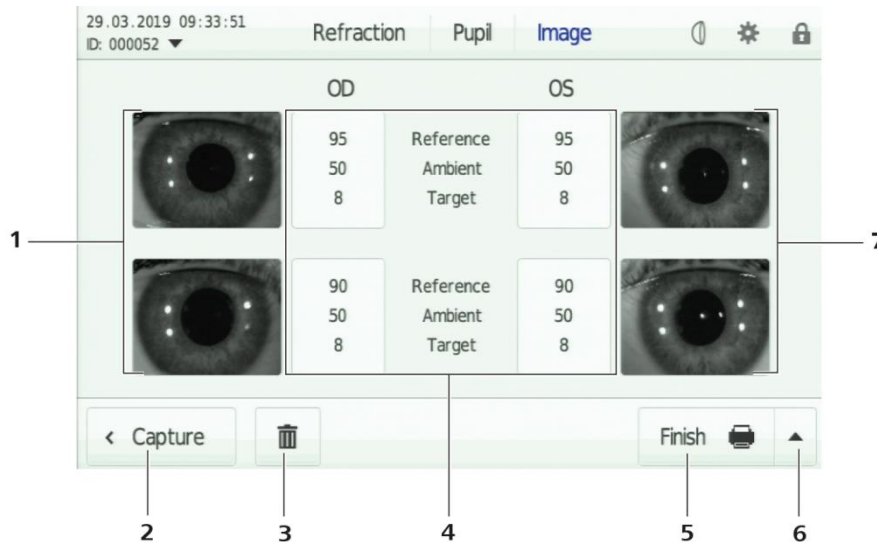
Fig. 46 User interface in Image measurement screen (still image)



- The Zoom function is available as in **Pupil** mode (5, Fig. 46) which can easily be identified by the magnifying glass symbol.
-  As soon as you tap on the **Zoom** button, a pop-up window will open. Here you can select single (1x), double (2x) or triple (3x) image magnification.
-  Now select the desired magnification level. The enabled magnification factor will be displayed in blue.
-  The device automatically adjusts the image in each magnification level.
-  Close the pop-up window by tapping again on the **Zoom** button.
- After closing the pop-up window, the selected magnifying factor is displayed beside the magnifying glass symbol (Fig. 46).
- If you want to discard the image, press the measuring button on the joystick once (6, Fig. 3). A query is displayed if you want to discard the image really. This message can be suppressed by changing the device settings in the **Interface/User/User interaction** menu (see page 95).
- As soon as you have confirmed by pressing the **Discard** button, the device returns to the live image mode (Fig. 45). Now you can take the image again.
- After you have captured the image and approved it, you can tap the **Confirmation** button (4, Fig. 46). The image will be stored together with the illumination parameters set for the image (see also Fig. 44).
- If required, take other pictures of this or a second eye according to this procedure.
-  For each eye two images can be captured and stored. If you want to capture more than one image per eye, the older image will be overwritten and replaced by the new one.
- If you want to display a measurement result in the review screen, tap on the **Review** button.

Image display in review screen

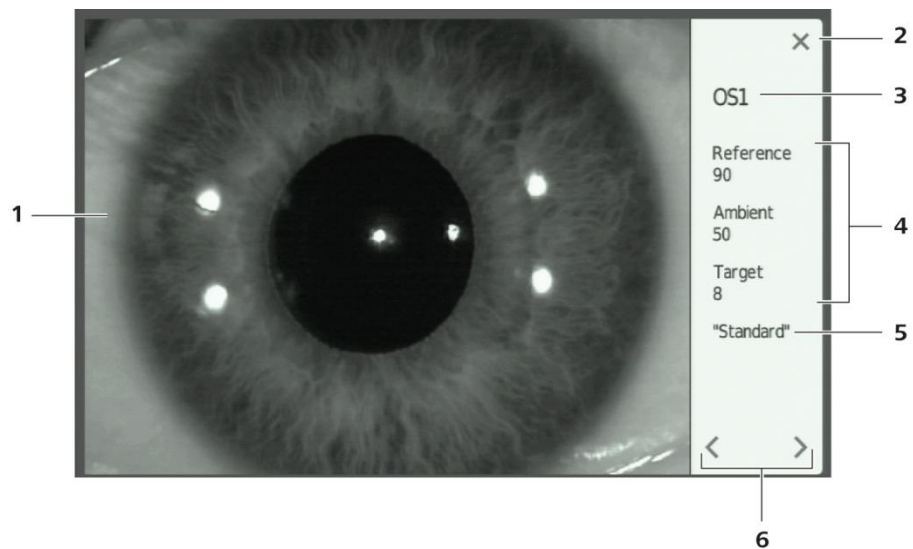
Fig. 47 shows the general structure of the review screen for images.



- 1 Preview images of left eye (OS)
- 2 Return to measurement screen
- 3 Delete measurement data
- 4 Display of illumination parameters set for each image capture
- 5 Finalize the measurement (default Finish option)
- 6 Select various options to finalize the measurement
- 7 Preview images of right eye (OD)

Fig. 47 Image review screen with 4 images

- When tapping on the displayed preview images (1 and 7, Fig. 47) a pop-up window will open to display the selected image in full screen mode (Fig. 48).
- The image is on the left side of the pop-up window. The name of the image (3, Fig. 48), data on illumination parameters used (4, Fig. 48) and data on the illumination mode used (5, Fig. 48) are displayed on the left.
- If more than one image has been captured, you can browse through all available images in full screen mode using the arrows (6, Fig. 48).
- By tapping the black cross in the upper right corner (2, Fig. 48) the full screen mode will be closed.



- 1 Full screen image
- 2 Close
- 3 Name of image
- 4 Name of used illumination parameter
- 5 Name of used illumination mode ("Standard" or "IOL")
- 6 Arrows to navigate through different images in full screen mode

Fig. 48 Image capture in full screen mode

- Now finish the image capture by one of the following actions:



- Save the images by tapping **Finish**.
Further notes on this are to be found in Section *Output of measurement results*, page 84.
- Discard the measurement by tapping on **Delete**. Further notes on this are to be found in Section *Delete measurement data*, page 82.
- Return to the measurement screen by tapping on **Measure**.

Measurement of contact lenses



In the contact lens measuring mode, only the curvature radii of the contact lenses to be measured are recorded.

Preparation of measurement

- Now prepare measurement by performing the following steps:
 - Moisten the rear surface of the test eye and insert the contact lens (2, Fig. 1) and insert the contact lens so that its convex side points downwards to the test eye surface (Fig. 49).

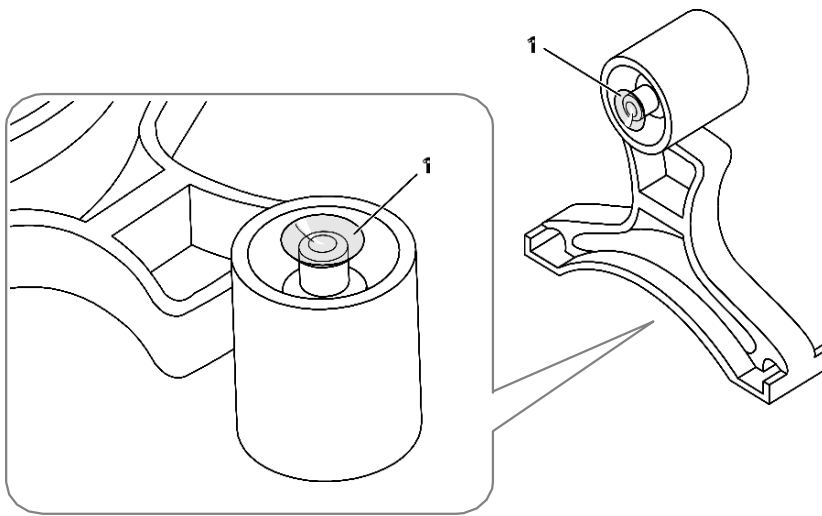


Fig. 49 Attaching the contact lens to the rear of the test eye

- Remove any chin rest paper so that only the fixation pins are attached to the chin rest (5, Fig. 4).
- Place the test eye with the contact lens attached in the center of the chin rest and fix it underneath the fixation pins. Make sure that the contact lens points towards the measuring head ((Fig. 50).

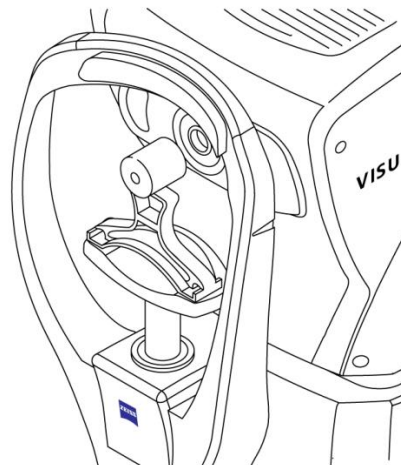
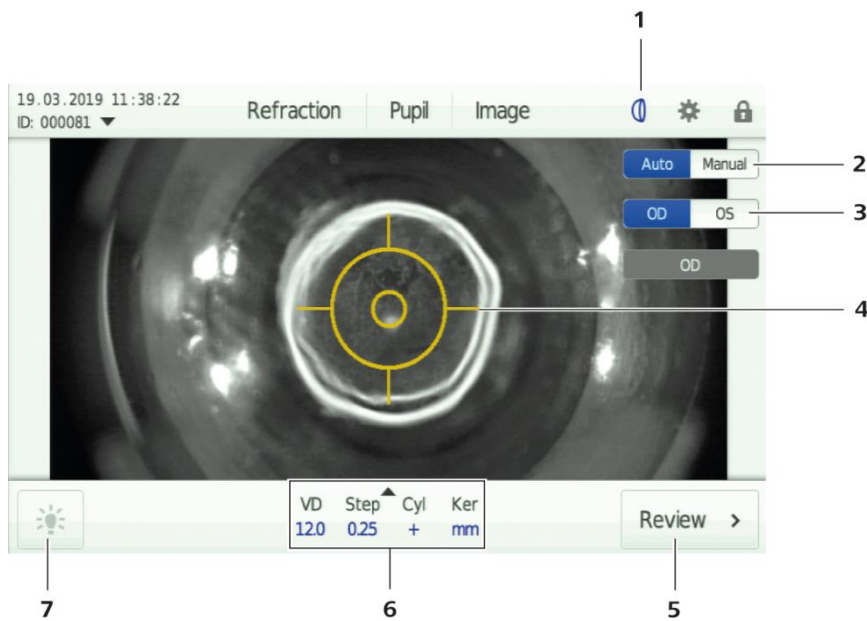


Fig. 50 Positioning the test eye with attached contact lens in front of the measuring head

- Using the height adjustment buttons (**5**, Fig. 3), adjust the motorized chin rest so that the contact lens is set to the height of the Canthus marks (**6**, Fig. 4).

Performing contact lens measurement

- Tap the **Contact lens** button in the upper navigation bar to enter the contact lens measurement mode (**1**, Fig. 51).
- Select the measurement mode (**Auto** or **Manual**) (**2**, Fig. 51) to perform measurement. Tap on the corresponding side of the two-function button. The activated measurement mode will be displayed in white on a blue background.
 - In **Manual** measurement mode measurement is triggered by pressing the measurement button on the joystick.
 - In automatic mode (**Auto**) the device automatically releases a measurement as soon as the camera image is correctly focused and centered.
- Now select the laterality of the contact lens to be measured (**3**, Fig. 51). Tap on **OD** (right eye) or **OS** (left eye). The activated side will be displayed in white on a blue background.
- In contact lens mode, the selection of illumination parameters (**7**, Fig. 51) and the parameter control panel (**6**, Fig. 51) are disabled.



- 1 Contact lens measurement mode, enabled
- 2 Select manual or automatic measurement mode
- 3 Laterality
- 4 Cross hairs (here with decentered measuring object)
- 5 Open the review screen
- 6 Parameter control panel (disabled)
- 7 Select the illumination parameters (disabled)

Fig. 51 User interface in contact lens measurement mode

- Focus and center the measuring head as described in Section *Performing a measurement*, page 58.
- Release the measurement by pressing the measurement button on the joystick (6, Fig. 3).
- The measurement results of the contact lens are displayed in the column on the right side of the screen (Fig. 52).

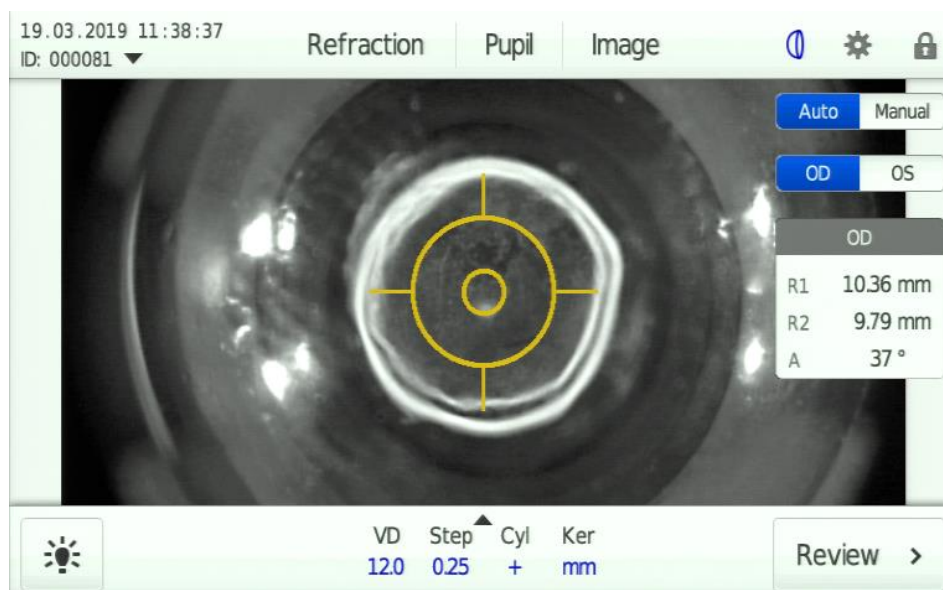


Fig. 52 View of measurement results in the measurement screen of contact lens mode

- To measure another contact lens, release the test eye from the chin rest and carefully remove the contact lens. Repeat the steps described in *Section Preparation of measurement*, page 77 and *Performing contact lens measurement*, page 78.

Data display in the review screen

Fig. 53 shows the general design of the review screen. Fig. 53 shows the review screen in **Contact lens** mode.

- Further information on the review screen can be found in Section Measurement of refraction and keratometry, subsection Data display in the review screen, page 61.

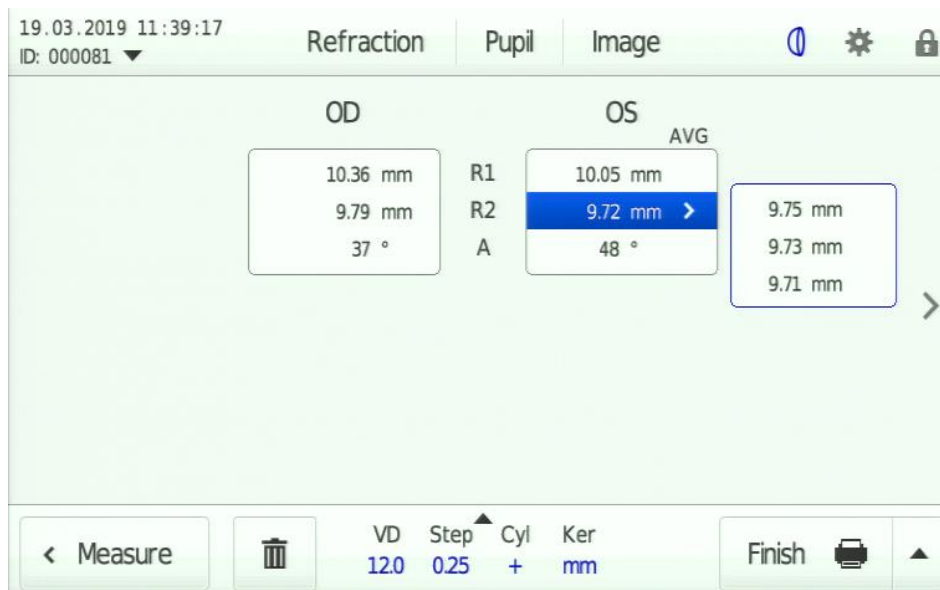
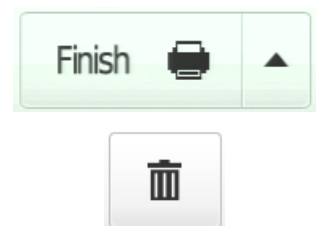


Fig. 53 Contact lens review screen with detailed display of a single measurement value

- Finish the measurement by one of the following actions:
 - Save the images by tapping **Finish**. Further notes on this are to be found in Section *Output of measurement results*, page 84.
 - Discard the measurement by tapping on **Delete**. Further notes on this are to be found in Section *Delete measurement data*, page 82.
 - Return to the measurement screen by tapping on **Measure**.



Delete measurement data

Measurement and patient data can be deleted in the review screen. Proceed as follows:

- Open the review screen.
- If refraction, keratometry and measurement values of the pupil diameter are available, the user can preselect the data to be deleted in the review screen. Tap on **Refraction** to delete refraction and keratometry data or on **Pupil** to delete measurement values of the pupil diameter (Fig. 54).



Fig. 54 Preselection of data to be deleted, example for refraction/keratometry data

- If you want to delete data of a certain single measurement (and not all data of a selected type), navigate to the display of the single measurement to be deleted. Use the arrow key (**8**, Fig. 17).
- Then click the **Delete** button. A pop-up window will open to preselect the data to be deleted in the corresponding context (Fig. 55).
- Choose the data to be deleted. In general, you have the following options (several options can be selected):
 - Delete the measurement data for the left and/or right eye



If a measurement value for the pupil diameter has been selected as well, the corresponding image will be deleted at the same time.



- Delete one or both images of the left and/or right eye



If an image has been selected which was captured during measurement of the pupil diameter, the corresponding measurement value will also be deleted.

- Delete a selected patient from the current patient list of the device or delete the complete list.
- Delete all measurement data stored in the device.
- Select **Delete** to delete the selected data.

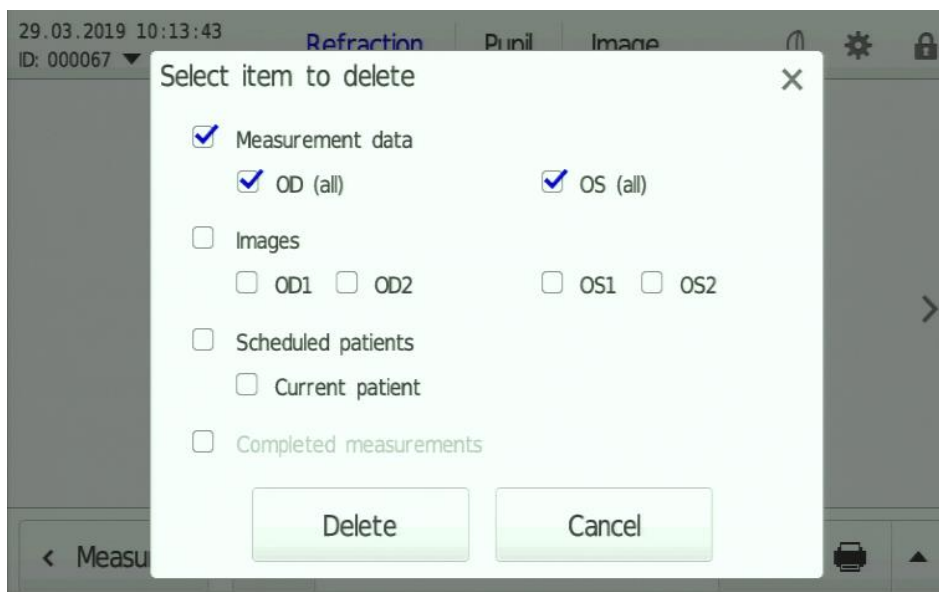


Fig. 55 Delete pop-up window with preselection of data to be deleted

Review of completed measurements

The list of completed measurements can be accessed via the pull-down menu (5, Fig. 22) or, if a patient list exists, via the menu item (3, Fig. 22). To review the results of a measurement that has already been completed, proceed as follows:

- Select a measurement from the displayed list to open the measurement.
- Navigate through the various elements of the open measurement.

Output of measurement results

Measurement results can be output using the **Finish** button.



This button has two functions. On the left side (the word **Finish** with the printer symbol) the preselected default option can be selected and released immediately. On the right side (with the arrow pointing upwards) a pop-up window will open to get access to other pre-configured output options (Fig. 56).

For a detailed description of all possible output options see Section *Device settings, Output submenu*, page 92.

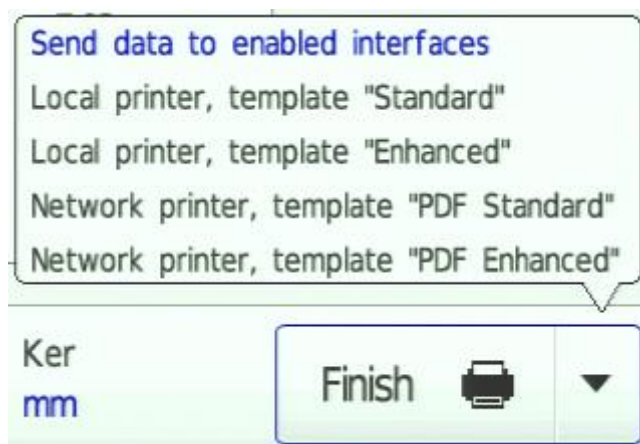


Fig. 56 Finish pop-up window with various output options

To output measurement results, proceed as follows:

- Tap the **Finish** button.

 By tapping on the corresponding line you can perform one of the options in the Finish pop-up window.

- During measurement result output details on the individual steps are displayed on the screen (Fig. 57).

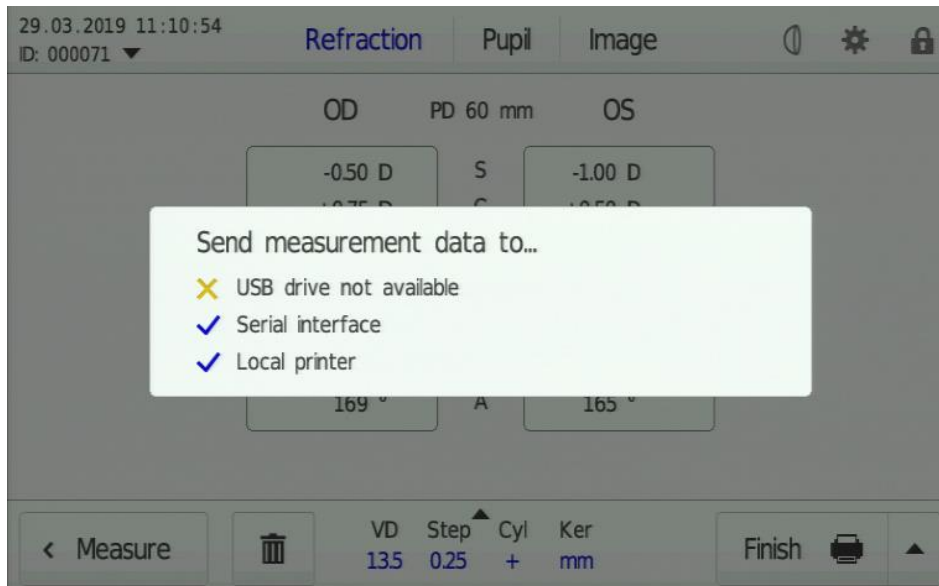


Fig. 57 Screen display during data output

- In case of an error you may have the choice how to proceed (Fig. 58).

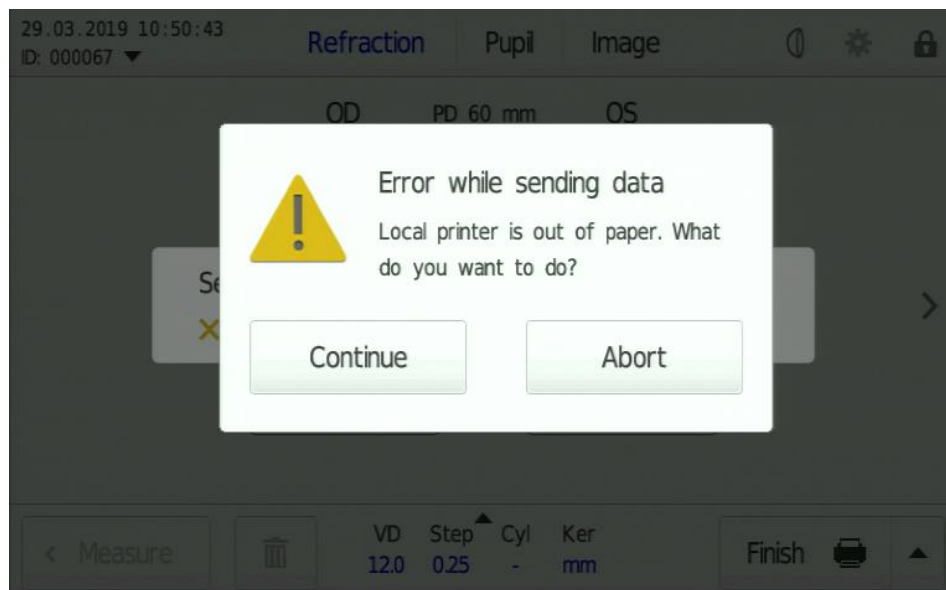


Fig. 58 Screen display during data output

- After finalization of data output the device will be prepared for the next measurement automatically. This includes the following steps:
 - Incrementing the internal measurement counter
 - If a patient list has been transferred to the device, the next patient in the list will be selected.



Use the **Patient ID** context menu (1, Fig. 22) to select another patient or anonymized measurement (<**unscheduled patient**> option).

- Configure the measurement screen with the preselected measurement mode (see *Device settings, Measurement submenu*, page 91).

CAUTION - PROPERTY DAMAGE

If auto cutting mode is switched on, do not pull the paper before it cuts. It may cause paper jam.



Records on thermal paper can be spoiled by heat. If the results are to be kept for a long period, make a copy.

Device settings

Tap on the Device settings icon to access the Settings menu from any window.



If the access to device settings is protected by a PIN code (see page 34) you will be asked to enter the administrator PIN code (Fig. 59). After you have entered the PIN code correctly, the Device settings window, General submenu will be opened (see Fig. 60). All setting options are explained in the following sections.

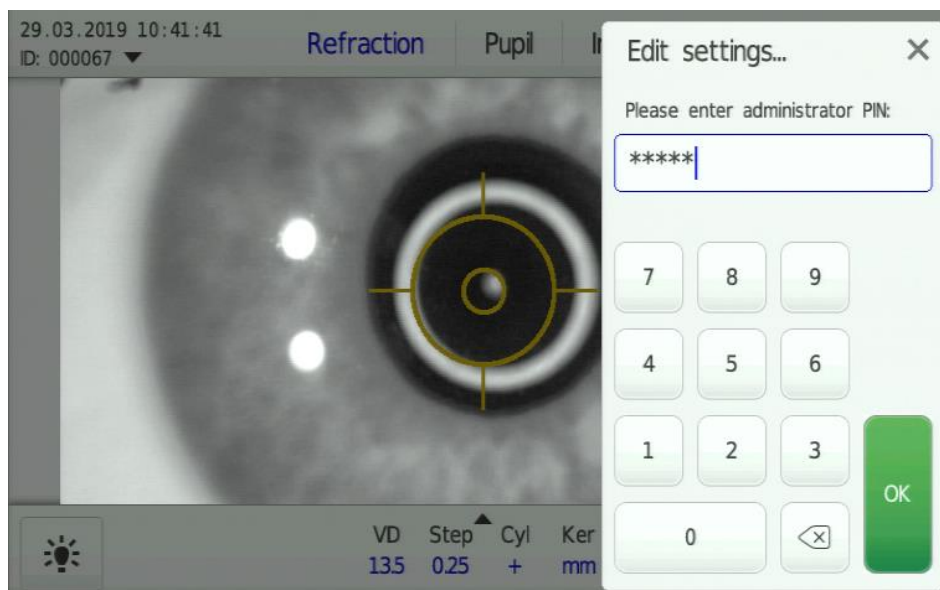


Fig. 59 Administrator PIN input dialog box

General submenu

On the second navigation level in the **General** submenu you can find the **Basic settings**, **Administration** and **Service** tabs (Fig. 60). Table 5 explains the user setting options in the **General** submenu.

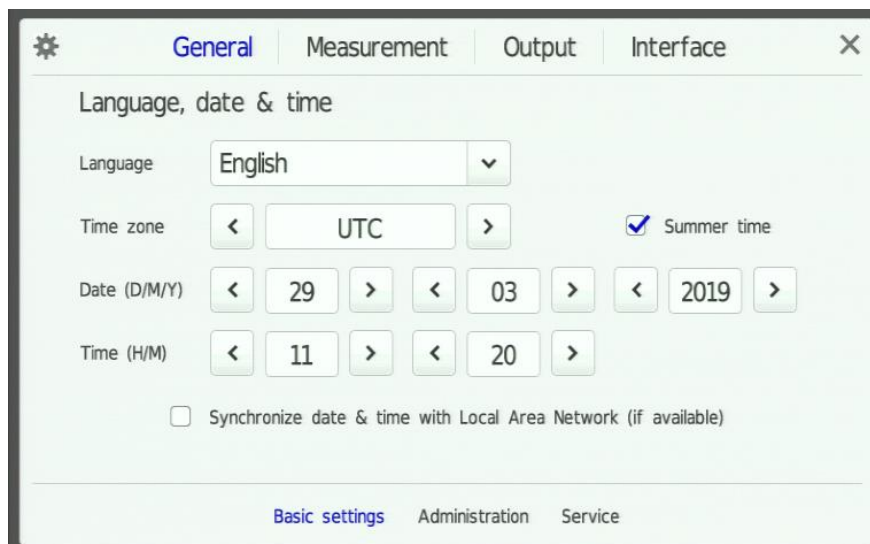


Fig. 60 Settings in the General submenu

Parameter	Description	Selection and input options
Basic settings Language, Date, Time		
Language	Language selection	German English* Italian French Russian Spanish Portuguese Chinese Japanese Korean
Time zone	Selecting a time zone	All time zones UTC*
Summer time	Enabling summer time	
Date (D/M/Y)	Entering the date	
Time	Entering the time	
Synchronize date & time with Local Area Network	Synchronize date and time with the local area network This parameter is only effective if the device is connected to a local area network.	
Administration PIN protection		
Usage	PIN protection when using the device	Enabled Disabled*
User PIN	Define a PIN for use of the device	Numeric code
Administration	PIN protection for administration and configuration of the device	Enabled Disabled*
Administrator PIN	Define a PIN for administration/configuration of the device	Numeric code
Service Page 1/2 Device information		
Serial number	Serial number of the device	No change possible
Software version	Software version of the device	No change possible
Interface controller	Designation of software version of the interface controller of the device	No change possible
MAC Address	Hardware address of the network adapter of the device	No change possible
Room ID	Room identifier The identifier of the location of the device will be used within the patient data allocation (<i>Patient selection</i> , page 47).	Text input
Device ID	Device number This designation of the device is used in various places, such as the web server interface and the FORUM interface.	Text input Standard*: VR150:<serial number>

* indicates default values

Parameter	Description	Selection and input options
Service Page 2/2 Functions		
Save current configuration	Saves the configuration data of the device in a file on a USB drive or a network folder+	No selection possible
Restore configuration	Restores the configuration data of the device from a file on a USB drive or a network folder+	If there are several possible configuration files available on the storage medium, the desired file can be selected.
Save log file	Saves the log file of the device on a USB drive or network folder+	No selection possible
Reset to factory settings	Resets the device to factory settings. All user-specific settings will be lost.	Resetting consists of two individually selectable steps: Delete all measurement data stored in the device. Reset of the current device settings
Enter service mode	Access for ZEISS service to manage advanced device parameters. When starting the service mode, a service PIN is queried.	No selection possible

* indicates default values

+ If a USB drive has been inserted, it will be used. If no USB drive has been inserted, the network folder will be used. If neither a USB drive has been inserted nor a network folder has been configured or connected, this button is disabled.

Table 5 Parameters in the General submenu



Note the PIN code selected when enabling PIN protection and keep it at a safe place.



If you do not know the set PIN code you have no access to use or configure the device.

Measurement submenu

The **Measurement** submenu consists of only one detail page (Fig. 61) and does not contain further tabs on the second navigation level.

Table 6 explains the user setting options in the **Measurement** submenu.

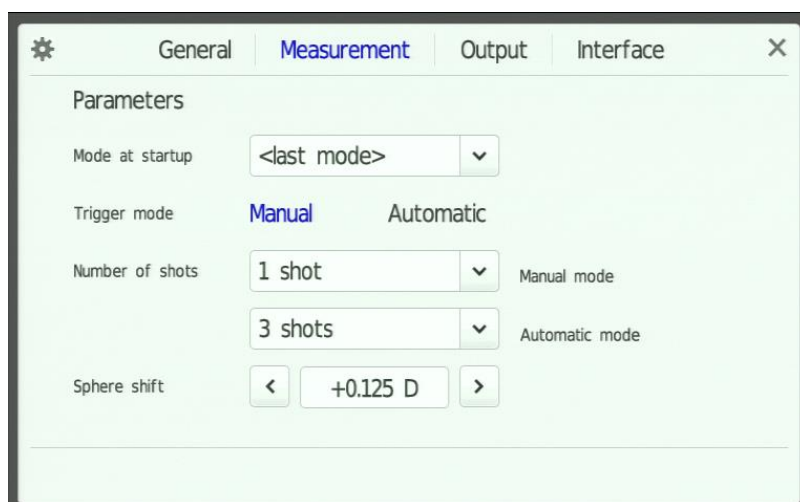


Fig. 61 Settings in the Measurement submenu

Parameter	Description	Selection and input options
Measurement parameters		
Mode at startup	Sets the measurement mode which shall be displayed on startup of the device	<Last mode> Refraction* Pupil Image Contact lens
Trigger mode	Select manual or automatic measurement triggering. On manual triggering the user must release measurement by pressing the measurement button on the joystick.	Manual Automatic*
Number of shots in manual measurement release mode	Number of shots which the device releases on manual measurement release mode.	1 shot* 3 shots 5 shots 7 shots
Number of shots in automatic measurement release mode	Number of shots which the device releases on automatic measurement release mode.	1 shot 3 shots* 5 shots 7 shots
Sphere shift	Value for the correction of systematic spherical deviations	Selection range from -2.0 D to +2.0 D, in steps of 0.125 D, 0.00*

* indicates default values

Table 6 Parameters in the Measurement submenu

Output submenu

On the second navigation level in the **Output** submenu you can find the **Basic settings**, **Format** and **Advanced settings** tabs (Fig. 62).

Table 7 explains the user setting options in the **Output** submenu.

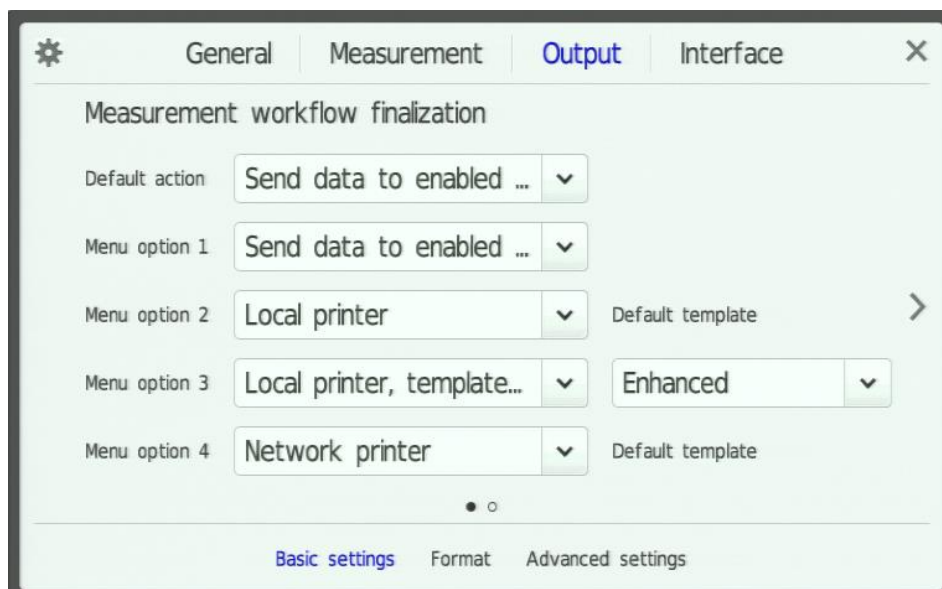


Fig. 62 Settings in the Output submenu

Parameter	Description	Selection and input options
Basic settings Page 1/2 Measurement finalization		
Default action	The administrator of the device decides which option will be offered after a measurement as default action or as additional option. If "no option" is set, the Finish pop-up menu is shortened by one line.	Save data locally
Menu option 1		Send data to enabled interfaces
Menu option 2		Local printer
Menu option 3		Local printer, template "..."
Menu option 4		Network printer
		Network printer, template "..."
		No option
Basic settings Page 2/2 Measurement review finalization		
Default action	The administrator of the device decides which option will be offered after a measurement as default action or as additional option. If "no option" is set, the Finish pop-up menu is shortened by one line.	Back
Menu option 1		Local printer
Menu option 2		Local printer, template "..."
Menu option 3		Network printer
Menu option 4		Network printer, template "..."
		No option
Format Page 1/2 Measurement data		
Step [D]	Display accuracy of sphere and cylinder and of K1 and K2 keratometry values	0.12 0.25*
Cylinder	Selecting cylinder notation	+* - ±
Keratometry	Output unit for keratometry	mm* D
Corneal vertex distance [mm]	Selection of corneal vertex distance	0.0 10.0 12.0* 13.5 15.0
Format Page 2/2 Date and time		
Date format	Selection of date format for data output on screen and printer	DD.MM.YYYY* YYYY-MM-DD MM/DD/YYYY
Time format	Selection of time format for data output on screen and printer	12h 24h*
Format Page 2/2 PDF		
Logo	Selection of a logo for the PDF document to be generated Using a web interface, customer-specific logo files can be transferred to the device (see Section <i>Configuration of PDF content</i> , page 102).	Selection of a list of logo files saved on the device

* indicates default values

Parameter	Description	Selection and input options
Advanced settings Data allocation		
Allocation mode	Mode for allocation measurement data to patient and/or examiner data	No allocation
		Standard* This mode provides a search function for related patient databases (see Parameter in the Network socket menu).
		Advanced In addition to the search function, this mode also offers the possibility of accessing the data of patients for whom an assignment to measurement data has already been made in the recent past on neighboring devices (only if web service is enabled, see following parameters).
Consider allocations on neighboring devices	Allows you to access the data of patients for whom measurement data was collected on neighboring devices in Advanced allocation mode.	Enabled* Disabled
within the same room only	When considering adjacent devices, only include devices with the same room ID (see Room ID parameter).	Enabled* Disabled
Consider measurement time stamp	When taking into account already existing allocations of measurement data to patient data, only take measurements within a limited time period into account.	Enabled* Disabled
Time frame		Default: 30 min*

* indicates default values

Table 7 Parameters in the Output submenu

Interface submenu

On the second navigation level in the **Interface** submenu you can find the **Basic settings**, **User**, **Printer**, **Serial**, **USB** and **LAN** tabs (Fig. 63). Table 8 explains the user setting options in **Interface** submenu.

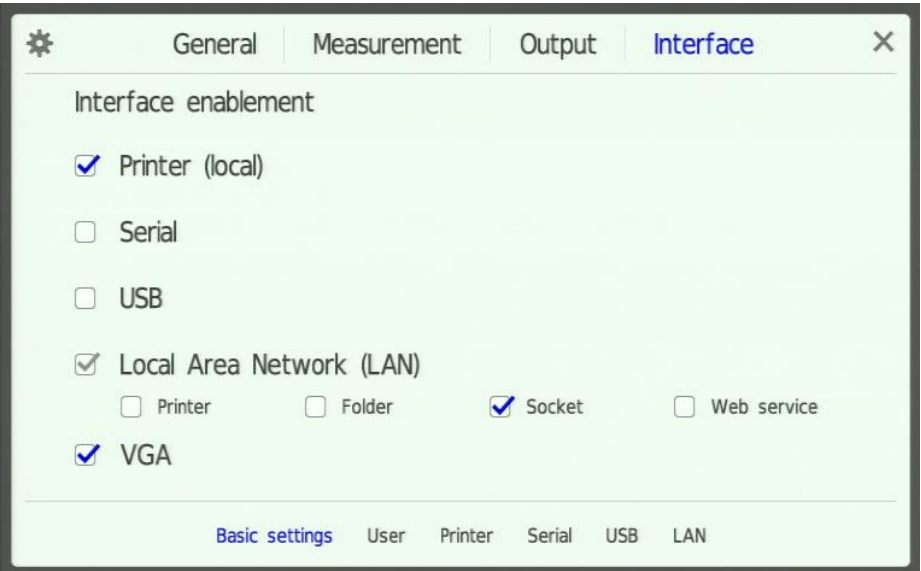


Fig. 63 Settings in the Interface submenu

Parameter	Description	Selection and input options
Basic settings Interface enablement		
Printer (local)	Activation of a local printer on the device	Enabled* Disabled
Serial	Activation of data output to a serial interface of the device	Enabled* Disabled
USB	Activation of data output to a USB drive connected to the device	Enabled Disabled*
Local area network (LAN)	Supporting element to enable or disable all output options of the network interface	Enabled Disabled*
Printer	Enabling data output on network printer	Enabled Disabled*
Folder	Enabling data input/output via network folder	Enabled Disabled*
Socket	Enabling direct data output on EMR/PMS application within the network	Enabled Disabled*
Web service	Enabling the web service interface of the device	Enabled Disabled*
User Page 1/3: Display		
Screensaver	Defines the duration after which the screen saver is automatically enabled or disables the screen saver. If PIN protection is enabled, the device is automatically blocked.	5 min. 15 min.* 30 min. Disabled
Brightness	Selecting screen brightness	Scale between "Low" (0) and "High" (100), default: 75*
Display date	Date display on measurement screens	Enabled* Disabled
Display time	Time display on measurement screens	Enabled* Disabled

* indicates default values

Parameter	Description	Selection and input options
User Page 2/3 User interaction		
Direct control	Enabling parameter control panel on measurement screen	Enabled* Disabled
Changes in device settings	Confirmation of changes in device settings	Manual confirmation* Automatic confirmation
Discarding images	Confirmation of discarding/overwriting images	Manual confirmation* Automatic confirmation
Workflow mode	Selection between "Standard" and "Simplified" workflow in the device	Standard* After successful measurement the user taps the Review button to open the review screen manually. Simplified After successful measurement the device automatically switches to the review screen.
User Page 3/3: Sound playback		
Monitor	Sound playback upon tapping the screen	No beep* Low beep Loud beep
Joystick button	Sound playback upon pressing the joystick button (measuring button)	No beep* Low beep Loud beep
Measurement	Sound playback after successful measurement	No beep Low beep* Loud beep
Error	Sound playback in case of an error	No beep Low beep Loud beep*
Printer (local) Printout		
Auto cutting	Enabling the automatic cutting of the printout	Enabled* Disabled
Default template	Default template for output on local printer	Basic* Advanced
Header	User-specific layout of the printout header	Text input
Comments	User-specific layout of the comment line in the printout	Text input
Footer	User-specific layout of the printout footer	Text input

* indicates default values

Parameter	Description	Selection and input options
Serial port		
Baud rate	Setting of baud rate in serial interface	9600 Bd* 19200 Bd 38400 Bd 57600 Bd 115200 Bd
Number of bits - Data	Selection of the number of data bits	7 bits 8 bits*
Number of bits - Stop	Selection of the number of stop bits	1 bit* 2 bits
Parity	Setting of parity in serial interface	None* Odd Even
Handshaking	Setting of handshaking in serial interfaces	None* Software Xon/Xoff Hardware RTS/CTS
Output format	Setting of output format of serial interface	v1.6* Compatibility v1.7 Other formats depend on installation
Output protocol	Setting of the protocol of serial interface	Blind transmission* Other protocols depend on installation
USB interface		
Output path 1	Definition of output path 1 for saving measurement data on a USB drive.	Text input of output path Default*: data\txt
Output format 1	Definition of an output path format for storage on the output path 1 USB drive.	v1.6* v1.7 XML JOIA PDF simple PDF enhanced Other formats depend on installation
Output path 2	Definition of output path 2 for saving measurement data on a USB drive.	Text input of output path Default*: data\pdf
Output format 2	Definition of an output path format for storage on the output path 2 USB drive.	v1.6 v1.7 XML JOIA PDF simple PDF enhanced* Other formats depend on installation

* indicates default values

Parameter	Description	Selection and input options
LAN Page 1/5 Network configuration		
Mode	Selection of configuration mode	Manual DHCP*
IP Address	"Manual" configuration mode: entry of network parameters "DHCP" configuration mode: display of data obtained from the DHCP server	Text input (in "Manual" configuration mode)
Subnet mask		
DNS servers		
Gateway		
Time server		
LAN Page 2/5 Network folder		
Network share	Input of a network share following the syntax \\<Fileserver>\<Folder> The file server can be entered via its IP address or its network designation.	Text input Example: \\192.168.99.10\RDx or \\dfszorg445\RDx
User name	Input of a user name to get access to the file server. Depending on the configuration of the network, it may be necessary to specify the network instance that manages/grants access authorization in addition to the user name. In this case use the syntax <user name>,domain=<domain>. Here, <domain> stands for the IP address or the network name of the domain controller.	Text input Example: guest1, domain=server1
Password	Input of a user name and the corresponding password to get access to the file server.	
Input path	Path specification for an input folder (for example, for software update via the network)	Text input Default: device\input*
Timer	Definition of a time constant for the periodic reading from the input folder	Selecting the timer Default: 5s*
Output path 1	Definition of an output path 1 for storage of measurement data on a network folder. Please note, that ZEISS VISUREF 150 does not create any folders. The folders should already have been created in the network.	Text input Default: data\txt*
Output format 1	Definition of an output path format for storage on output path 1 of the network folder	v1.6* v1.7 XML JOIA PDF simple PDF enhanced Other formats depend on installation
Output path 2	Definition of output path 2 for saving measurement data on a USB drive Please note, that ZEISS VISUREF 150 does not create any folders. The folders should already have been created in the network.	Text input of output path Default*: data\xml

* indicates default values

Parameter	Description	Selection and input options
Output format 2	Definition of an output path format for storage on the output path 2 of the network folder.	v1.6 v1.7 XML JOIA* PDF simple PDF enhanced Other formats depend on installation
LAN Page 3/5 Network socket		
Peer address	Input of IP address (as an alternative: host name) and port for the EMR/PMS application in the network. Both data must be separated by a colon.	Text input Example: 192.168.99.10:123
Peer ID	Enter the ID of the host of the EMR/PMS application (optional)	Text input CZMAMWL; CZMA*
User name	Input of a user name and the corresponding password to access the EMR/PMS application	Text input
Password		
Output format	Selection of a communication protocol for data storage in the EMR/PMS application	XML JOIA XML ZEISS DICOM* Other formats depend on installation
Output protocol	Selection of a communication protocol for data storage in the EMR/PMS application	SOAP i.Com mobile DICOM
LAN Page 4/5 Network printer		
Printer name	Selection of a network printer	List of configured network printers (see Section <i>Network printer/Printer configuration</i> , page 102)
Default template	Default template for output on network printer	Basic* Advanced Other user-specific templates are dependent upon the installation
LAN Page 5/5 Web service		
Port	Input of port number under which the web service can be reached	Text input Default*: 8080
User name	Input of a user name and the corresponding password for the web service	Text input
Password		

* indicates default values

Table 8 Parameters in the Interface submenu

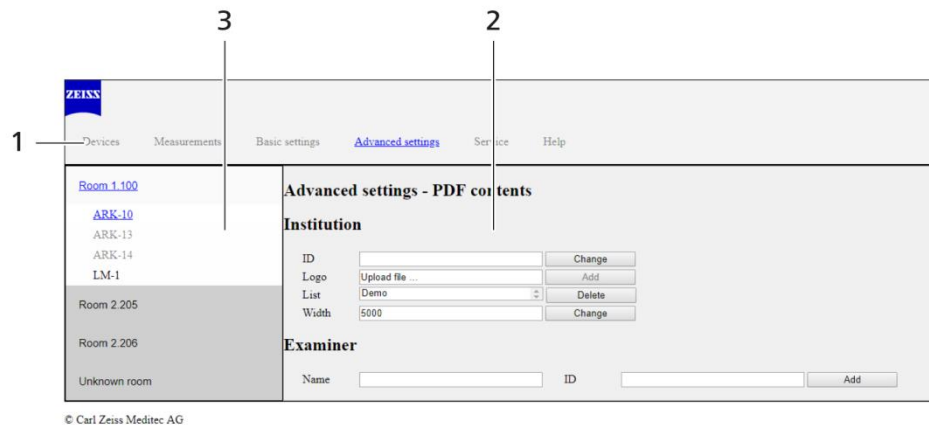


Use the long touch function of the on-screen keyboard to enter the backslash "\". To do this, first tap the "&123" key for special characters, then hold down the "/" key (see Section *On-screen keyboard*, page 44).

Web server interface

The web server interface of the device is used to configure network printers.

To open the web server, enter the IP address of the device - this can be found in the device settings in the **Interface-LAN** submenu - in the address line of your browser. Use the Navigator menu (**3**, Fig. 64) to comfortably access the web server outputs of the other devices in your network.



- 1 Menu bar, changes between different sites of the web server
- 2 Main window
- 3 Navigator menu, switches to web server interface of other devices in the network

Fig. 64 Page layout

Page "Advanced settings"

Network printer/Printer configuration



To set up a network printer, the device uses the standard-based Open Source Print System CUPS¹. You can access the CUPS web interface **via the link of the same name, which opens in a separate** browser window.

To set up a printer with CUPS, please proceed as follows:

- Select the **Add printer** function.
- Find out the IP address of your printer and the supported printer protocol. Refer to the printer's user manual.
- In step 1/5 select the printer protocol.
- In step 2/5 enter the connection URI. Follow the syntax of the given examples.
- In step 3/5, enter the name of the printer and a description of the device and its location.
- In step 4/5, load a ppd file suitable for your printer and then tap "Add printer".
- In step 5/5, configure the added printer.



You can find ppd files, for example, at <http://www.openprinting.org/printers>

Configuration of PDF content

The following options are available for the configuration of PDF contents:

- Institution name: Enter the name of your business, clinic or laboratory.
- Manage logo files: Load or delete logo files of your institution on the device. The selection of the output logo is made in the device settings under Output/Format.
- Manage the examiner list: Manage the list of your colleagues who will be working with the device. If the list contains several persons, a selection window will be opened when the PDF is created.

¹ CUPS and the CUPS Logo are registered trademarks of Apple Inc.. CUPS is protected by copyright 2007-2014 by Apple Inc, all rights reserved.

Shutting down

Switching off the device

WARNING - GENERAL HAZARD

If one of the following events should occur, switch the device off immediately at the power switch and disconnect the cable from the power supply.

- Electric shock
- Penetration of substances
- Smoke, sparks or strange noises
- Faults that cannot be remedied based on the information provided in this user manual.

Label the device clearly as out of service and report the problem to the ZEISS service.



CAUTION - RISK OF ELECTRIC SHOCK

Be sure to unplug if the system is not used for a longer period of time.



- Switch off the device at the power switch (6, Fig. 5).
- Use the supplied cover to protect the device from dust when not in use.

Maintenance and care



WARNING - GENERAL HAZARD

The device may only be opened, put into operation, modified and repaired by the manufacturer's customer service technicians or specialists expressly authorized in writing by Carl Zeiss Meditec. If in doubt, insist on seeing the written authorization or contact Carl Zeiss Meditec directly.

The manufacturer is not liable for damage caused by unauthorized tampering with the device. Such actions will render any warranty claims invalid.

Troubleshooting

Problem	Cause	Solution
No local printing possible The message "Paper roll in local printer is empty." will be displayed.	The printer is out of paper.	Insert new printer paper. Please also note the information in section <i>Replacing the printer paper</i> roll, page 107 and following.
The device displays the heading "Error" and the error message "The operation failed due to an internal error."	Various internal device failures can trigger this message.	Reboot the device. If the message reappears, contact ZEISS Service.
Incorrect measurement	The pupil is smaller than the outer reticle ring.	Ask the patient to open his or her eyes wide. Repeat the measurement.
	Patient has an intra-ocular lens (artificial lens).	Use the illumination parameters in the "IOL" illumination mode for measurement. Repeat the measurement.
	Patient moved during the measurement	Ask the patient not to move until the measurement is complete. Repeat the measurement.
	The ambient light is too bright.	Check the light sources in the room and make sure that there is no direct lighting from above on the device. Use a slightly darkened room and repeat the measurement.

Update device software

To update the device software, proceed as follows:

- Save the archive file that you received from ZEISS Service on a PC with a USB port.
- Insert the USB drive (**9**, Fig. 1) into the USB port of your PC and unpack the archive file on the drive into the directory "/device/input".
- Make sure that the USB interface of your device is enabled (see Device settings, *Interface submenu*, page 95). Now insert the USB drive into the USB port (**5**, Fig. 5) of your device. After a few seconds a window opens with information on the update process.
- Wait until the process is completed and the window closes again.
- After the successful update, remove the USB drive from the USB port of the device. If required, disable the USB interface (see device settings *Interface submenu*, page 95).
- Reset the device to its default values. Configure the device according to your preferences.



During the update it is possible that the device restarts again. Do not switch off the device during the entire process.

Alternatively, you can simply unpack the archive file in the input folder of your network drive (see Device settings, *Interface submenu*, page 95).

Replacing the fuses



WARNING - RISK OF ELECTRIC SHOCK

The device must be switched off and disconnected from the power supply before being cleaned or serviced.



WARNING - RISK OF ELECTRIC SHOCK

Internal fuses may only be changed by service staff specially trained in maintenance and service work.

Opening up the casing while the unit is turned on exposes the operator to the risk of a fatal electric shock.



WARNING - RISK OF ELECTRIC SHOCK

Before changing the fuses, disconnect the device from the power supply to prevent the risk of serious injury or death. Replace the fuses in the power input module with fuses that conform with the specifications in Section *Technical data* on page 113 of this user manual.

- Disconnect the device from the power supply.
- Loosen the fuse carrier with the blown fuse (**1**, Fig. 65) by turning with a screwdriver and pulling it forward out of the device.
- Remove the blown fuse (**3**, Fig. 65).
- Insert the new fuse in accordance with the specifications into the fuse carrier (**2**, Fig. 65).
- Re-insert the fuse carrier into the device and turn the screwdriver to secure the carrier.

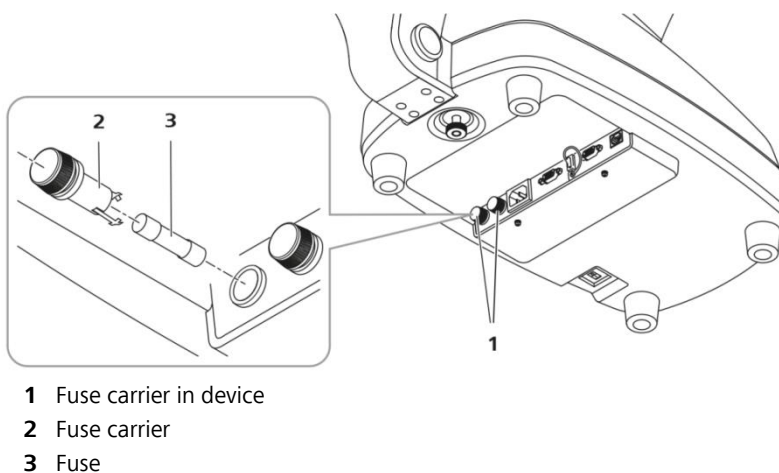
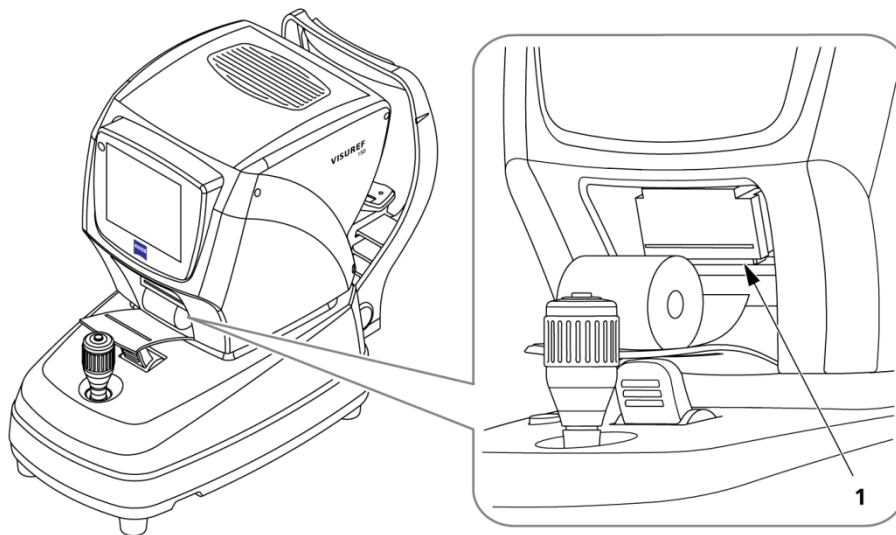


Fig. 65 Replacing the fuses

Maintenance

Replacing the printer paper roll

If a red line appears on the paper, or if 'NO PAPER' message is displayed on the screen bottom, the printer paper unit must be refilled.



1 Printer paper insertion slit

Fig. 66 Inserting printer paper

- Turn the joystick clockwise to lift up the upper part of the body case.
- Open the printer cover.
- Install the paper roll so that the printable side of the paper (smoother and shinier than the other side) faces upwards when fed through to the printer assembly.
- Feed the printer paper from below into the slit of the black printer unit, then push it up gently. If it is correctly positioned, the printer will automatically pull the paper upward for printing.
- Insert the end of the paper (emerging from the printer) into the slit in the printer cover, then close the cover.
- Carefully pull out the end of the paper if necessary.

Care and cleaning



WARNING - RISK OF ELECTRIC SHOCK

Prevent moisture from penetrating the device or keyboard. Disconnect the power cable from the power supply before cleaning or disinfecting the device.



CAUTION - SURFACE DAMAGE TO THE DEVICE

Use an aldehyde and/or alcohol-based disinfectant. The addition of quaternary compounds is acceptable. To avoid damaging the surfaces, do not use any disinfecting components other than those specified below.

The maximum concentrations for application are:

- For alcohol (tested with isopropyl alcohol): 60%
- For aldehyde (tested with glutaraldehyde): 2%
- For quaternary compounds (tested with DDAC): 0.2%



CAUTION - RISK OF FALSE DIAGNOSIS

Use the supplied cover to protect the device from dust when not in use.

CAUTION - PROPERTY DAMAGE

The national disinfecting regulations must be observed in the choice of disinfectants and disinfection procedures. Please note that some cleaning agents and disinfectants may have an adverse effect on plastic components. Damage caused by such disinfectants is not covered by our warranty. The surfaces of the device have been tested and are guaranteed to resist frequent treatment with alcoholic disinfectants and cleaning agents in the long term.

Do not use any aggressive or abrasive cleaning agents.

The outer surfaces of optical components (objective) can be cleaned if necessary.

- Remove dust from optical surfaces by using a blower or a clean and grease-free brush.
- Fine cleaning can be done with moist antistatic cleaning tissues. Please follow the instructions on the cleaning cloth packaging.

This will enable you to maintain the high image quality of your product.

Cleaning and disinfection of painted surfaces

All painted surfaces may be cleaned with a damp cloth.

The display should be cleaned with a lightly moistened cloth only.

Do not use any aggressive or abrasive cleaning agents.

Use wipe disinfectants for cleaning and disinfecting the device casing, chin rest and forehead rest.

Ensure that no moisture penetrates the system during cleaning and disinfection.

Safety inspections



WARNING - RISK OF ELECTRIC SHOCK

If no legal requirements exist in your country, the device must undergo an electrical safety test in accordance with IEC 62353:2007 after maximum 24 months of use. This test must be performed and documented by specialists with the required know-how.

To perform a safety check of the device, proceed as follows:

- Check the protective earth conductor resistance. For this purpose, connect the device to the measuring device using the power cable. To perform the measurement, press the measuring tip against the metallic holding plate (Fig. 67) of the plugs on the bottom of the device. The measured value may not exceed 0.3 Ω .

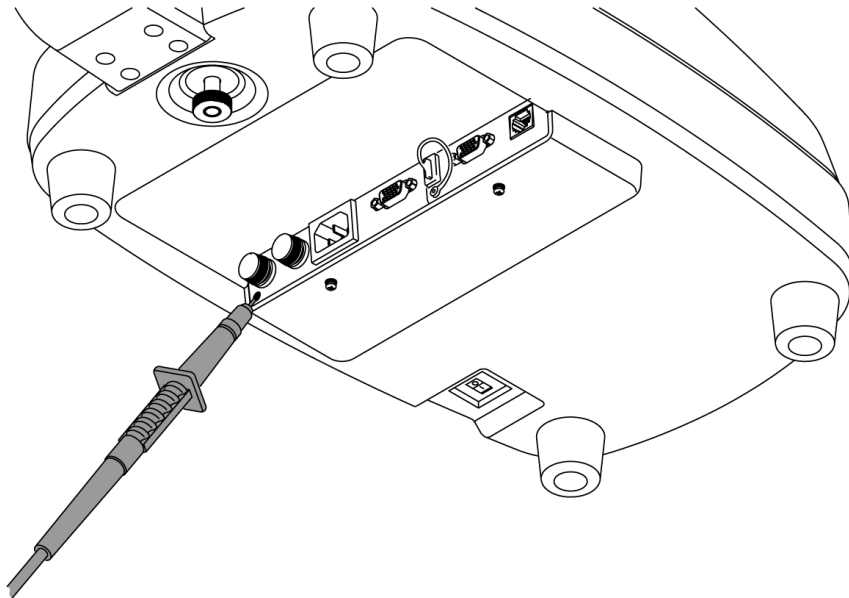


Fig. 67 Performing an electrical safety inspection

- After successful measurement, the device leakage current must be measured. This is preferably done using the differential current method while the device is in its operating state. Press the measuring tip once more against the metallic holding plate (Fig. 67) of the plugs. The measured value may not exceed 0.5 mA.
- Finally, measure the insulation resistance using a test voltage of 500 V. The measured value may not fall below 2 M Ω .
- Note down the measured values.

Transport

Transport without packaging

- Switch off the device at the power switch and disconnect the power cable of the device (see Section *Shutting down*, page 103).
- Lock the stage using the clamping screw (1, Fig. 5) and lever (4, Fig. 3).
- When transporting, lift the bottom of the device with both hands.

CAUTION - PROPERTY DAMAGE

When moving the device, do not lift the system using the forehead rest as a grip.

Transport with packaging

- Switch off the device at the power switch and disconnect the power cable from the device.
- Lock the stage using the clamping screw (1, Fig. 5) and lever (4, Fig. 3).
- Use the supplied plastic bags and foam parts to protect the device and place it inside the box. Lift the bottom of the device with both hands.
- Close the box with adhesive tape.
- Prevent the box from falling or being dropped during transport.

CAUTION - RISK OF INJURY

Holding the box by the straps or packing rope may cause injury to your fingers.



CAUTION - RISK OF INJURY

In the case of damage to or wetting of the packaging material, please contact ZEISS Service or your local distributor.



**CAUTION - RISK OF INJURY**

Be careful when cutting the packing ribbon because it can snap up and injure you. Hold the ribbon on both sides of the cut.

Wear protective gloves when unpacking the device.

Unpack the device on a level surface to prevent slipping.

CAUTION - PROPERTY DAMAGE

Do not place heavy objects (over 20 kg) on the package.

Do not throw or drop from a high distance.

- Make sure the box is always stored and transported upright.

Technical data

Dimensions (W x D x H)	275 mm x 525 mm x 450 mm
Weight	18 kg
Power supply	100 V to 240 V AC $\pm 10\%$; 50 / 60 Hz
Power consumption	90 VA
Fuses	T2AH 250 V
Protection class	1
Protection class	IP X0
Device type	B (DIN EN 60601-1)
Optical radiation	Class 1 (EN ISO 15004-2)
Battery type, manufacturer	CR2032, Hitachi Maxwell
Storage memory	10 measurement for each eye
Time display	7" TFT LCD color monitor with touch control Resolution 800 x 480
Chin rest	Electrically controlled height adjustment (max. 65 mm)
Internal printer	
Type	Thermal printer
Printing paper	Thermal paper (width 57 mm, external diameter of roll 50 mm, surface weight 60 g/m ² , thickness 59 μ m)
Refractometry	
Corneal vertex distance	0.0, 10.0, 12.0, 13.5, 15.0 mm
Sphere	-25.00 D to +22.00 D (VD = 12 mm), in steps of 0.12/0.25 D
Cylinder	0.00 D to ± 10.00 D in steps of 0.12 D / 0.25 D
Axis	0° to 180°, in steps of 1°
Cylinder units	-/+/ $\pm$
Pupil distance (PD)	10 mm to 85 mm
Minimum pupil diameter	2 mm
Keratometry	
Curvature radius	5.00 mm to 10.20 mm, in steps of 0.01 mm
Corneal refraction power	33.00 D to 67.50 D, in steps of 0.12 D / 0.25 D
Corneal astigmatism	0.00 D to -15.00 D, in steps of 0.12 D / 0.25 D
Axis	0° to 180°, in steps of 1°
Corneal diameter	2.0 mm to 12.0 mm, in steps of 0.1 mm

Measurement precision in accordance with ISO 10342

Refraction, sphere (± 0 D, ± 5 D, ± 10 D)	± 0.25 D
Refraction, sphere (± 15 D)	± 0.5 D
Refraction, cylinder	± 0.25 D
Refraction, cylinder axis	$\pm 5^\circ$

Measurement precision in accordance with ISO 10343, Type B

Keratometry, corneal radius	± 0.05 mm
Keratometry, axis	
for radial difference in main sections ≤ 0.3 mm	$\pm 4^\circ$
for radial difference in main sections > 0.3 mm	$\pm 2^\circ$

Ambient conditions for intended use

Temperature	+10 °C to +40 °C
Relative humidity	30 % to 90 %
Atmospheric pressure:	70 kPa to 106 kPa
Shock (without packaging)	10 g/6 ms

Ambient conditions for storage and transport

Temperature	-40 °C to +70 °C
Relative humidity	10 % to 95 %
Atmospheric pressure:	50 kPa to 106 kPa
Shock:	30 g/6 ms (permanent shock: 10 g/6 ms)
Oscillations (sine curve):	10Hz to 500Hz, 0.5 g



The device may not be stored in the following conditions:

- In dusty environment
- In the vicinity of salt or sulphur
- Exposed to vibration or shock
- In the vicinity of flammable vapors and liquids
- In direct sunlight

Electromagnetic compatibility

The ZEISS VISUREF 150 meets the requirement regarding the electromagnetic compatibility in accordance with IEC 60601-1-2:2014.
CISPR 11: Group 1
CISPR 11: Class B

Ambient conditions for intended use

Regarding the electromagnetic compatibility, the ZEISS VISUREF 150 is intended in the domestic medical environment in accordance with IEC 60601-1-2:2014.

The ZEISS VISUREF 150 is not intended for use in special environments such as military areas, heavy industrial areas or medical treatment areas with high-powered equipment or inside RF-shielded rooms such as MRI.

Limitations on essential performance features

The ZEISS VISUREF 150 does not have any that are defined as essential features according to IEC 60601-1. Therefore, no limitations on essential performance of ZEISS VISUREF 150 are to be expected due to electromagnetic interference.

CAUTION - GENERAL HAZARDS

If operation is required in the domestic healthcare environment, in special environments or in hospitals together with RF devices such as diathermy or MRI, the distance between ZEISS VISUREF 150 and the RF devices must comply with the specifications of Table 9 of IEC 60601-1-2:2014 or be calculated according to the specifications of the standard. Furthermore, ZEISS VISUREF 150 must also be regularly monitored to ensure its proper operation in the environment where it is used.



CAUTION - GENERAL HAZARDS

Portable and mobile RF communications equipment may affect the device. When operating radio devices or components for radio transmission, observe a minimum distance of 30 cm to any part of ZEISS VISUREF 150, including cables specified by the manufacturer. Otherwise, a malfunction or reduced performance of the device is to be expected.



**CAUTION - GENERAL HAZARDS**

The ZEISS VISUREF 150 may not be placed next to or stacked together with other equipment, except in the device configurations described in this user manual. If operation close to or together with other devices is necessary, the ZEISS VISUREF 150 must be closely observed in order to monitor its proper functioning in this configuration.

**CAUTION - GENERAL HAZARDS**

Special precautionary measures apply to medical electrical devices with regard to electromagnetic compatibility (EMC). Such devices must be installed and operated as specified in the EMC notes in the accompanying documents.

Replacement cables may only be purchased from Carl Zeiss Meditec or from dealers authorized by Carl Zeiss Meditec.

The use of accessories, all types of transducers and cables not specified in this user manual or not sold by Carl Zeiss Meditec as replacement parts may result in higher emissions or reduced immunity of the device.

Relevant accessories:

- Local power supply cable (2.5 m)
- Serial cable RS232, double shielded (3 m)

**CAUTION - GENERAL HAZARDS**

If obvious damage to the device is detected (e.g. housing or cables), contact ZEISS Service. It is possible that ZEISS VISUREF 150 will still function although damaged, but it is significantly more susceptible to electromagnetic radiation.

**CAUTION – RISK OF ELECTROMAGNETIC RADIATION**

The device may not be placed next to or stacked together with other equipment, except in the device configurations described in this user manual. If operation close to or together with other devices is necessary, the device must be closely observed in order to monitor its proper functioning in this configuration.

Electromagnetic emission

Emitted interference	Standard	Compliance
Conducted emission	CISPR 11	Group 1
Radiated interference	CISPR 11	Class B
Harmonic distortion	IEC 61000-3-2	Class A
Voltage fluctuations and flicker	IEC 61000-3-3	Complies

Electromagnetic immunity

Phenomenon	Standard	Test level
Electrostatic discharge	IEC 61000-4-2	± 8 kV contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air (device, connection, (3, 4, 5, Fig. 5), chin rest)
Radiated RF EM fields	IEC 61000-4-3	10 V/m 80 MHz to 2.7 GHz 80 % AM at 1 kHz
Electrical fast transient/burst	IEC 61000-4-4	± 2 kV, 100 kHz repetition rate (power cable) ± 1 kV, 100 kHz repetition rate (data cable)
Surge voltage/surges line to line	IEC 61000-4-5	± 0.5 kV, ± 1 kV (power cable)
Surge voltage/surges line to earth		± 0.5 kV, ± 1 kV, ± 2 kV (power and data cables)
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V 0.15 MHz to 80 MHz 6 V in ISM frequency bands between 0.15 MHz and 80 MHz 80 % AM at 1 kHz (power and data cable)
Rated power frequency magnetic fields	IEC 61000-4-8	30 A/m 50 Hz or 60 Hz
Voltage dips	IEC 61000-4-11	0% U_T ; 0.5 cycle at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % U_T ; 1 cycle and 70 % U_T ; 25 cycles @50 Hz/30 cycles @60 Hz single-phase: at 0°
Voltage interruptions		0 % U_T ; 250 cycles @50 Hz/300 cycles @60 Hz

Phenomenon	Standard	Test frequency (MHz)	Service	Immunity test level [V/m]
Immunity to radiated radio frequencies, caused by wireless communications equipment in accordance with IEC 60601-1-2	IEC 61000-4-3	385	TETRA 400	27
		450	GMRS 460, FRS 460	28
		710	LTE Band 13,17	9
		745		
		780		
		810	GSM 800/900; TETRA 800; iDEN 820; CDMA 850; LTE Band 5	28
		870		
		930		
		1720	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	28
		1845		
		1970		
		2450	Bluetooth; WLAN 802.11b/g/n; RFID 2450; LTE Band 7	28
		5240	WLAN 802.11 a/n	9
		5500		
		5785		

Abbreviations/Glossary

CUPS	Open Source printing system; CUPS and the CUPS Logo are registered trademarks of Apple, Inc.. CUPS is protected by copyright 2007-2014 by Apple Inc, all rights reserved.
D	Diopter
DDAC	Quaternary ammonium compound for disinfection and cleaning
EMR	Electronic medical record
Fig.	Figure
IOL	Intraocular lens
JOIA	Japan Ophthalmic Instruments Association
PD	Pupil distance
PMS	Practice management system
VD	Vertex distance

Figures

Fig. 1	Package check list	6
Fig. 2	External labels	11
Fig. 3	Operator's side of the device	16
Fig. 4	Patient's side of the device	17
Fig. 5	Bottom side view	18
Fig. 6	Releasing the stage locking	20
Fig. 7	Patient environment	24
Fig. 8	Start-up screen	27
Fig. 9	Device initialization - Language selection	28
Fig. 10	Device initialization - Selecting a time zone	28
Fig. 11	Enter the peer address and select output format and protocol ..	32
Fig. 12	Settings for connection to ZEISS VISUCONSULT/i.Com mobile...	33
Fig. 13	Entering the user PIN	36
Fig. 14	Error message (example)	38
Fig. 15	Main operating functions within the workflow	39
Fig. 16	User interface in measurement screen	40
Fig. 17	User interface in review screen for measurement data	41
Fig. 18	User interface in review screen for images	42
Fig. 19	Navigation elements in the device settings window	43
Fig. 20	Long touch for special characters	44
Fig. 21	On-screen keyboard with long touch for special characters	45
Fig. 22	Unfolded patient list	48
Fig. 23	Text input field to define a patient search	50
Fig. 24	Patient selection list	50
Fig. 25	User interface in Refraction measurement screen (automatic measurement mode)	52
Fig. 26	Unfolded parameter control panel	53
Fig. 27	Disabled parameter control panel	53
Fig. 28	Pop-up window with unfolded illumination parameters	55
Fig. 29	Display of user-defined illumination parameters in the measurement screen of Refraction mode	56
Fig. 30	Cross hairs with decentered (left) and centered image (right)	59
Fig. 31	Display of measurement results for a measurement sequence of OD (measurement screen, without display of pupil distance) ..	59
Fig. 32	Display of measurement results for a measurement sequence of OS (measurement screen, including display of pupil distance)	60
Fig. 33	Review screen Refraction and Pupil (average values)	61
Fig. 34	Display of measurement results of a single measurement (review screen)	62
Fig. 35	Display of measurement values of a single measurement with changed illumination parameters	63
Fig. 36	Main control functions in Pupil mode	64
Fig. 37	Message that image data will be overwritten	64
Fig. 38	User interface in Pupil measurement screen (live image)	65
Fig. 39	User interface in Pupil measurement screen (still image)	67
Fig. 40	Pop-up window with zoom function in Pupil mode	68

Fig. 41	Measurement screen of pupil diameter with double magnification.....	68
Fig. 42	Confirm image discard	69
Fig. 43	Measurement of pupil diameter in the review screen for images (above) and full screen view (below)	70
Fig. 44	Main control functions in Image mode.....	71
Fig. 45	User interface in Image measurement screen (live image)	72
Fig. 46	User interface in Image measurement screen (still image)	73
Fig. 47	Image review screen with 4 images.....	75
Fig. 48	Image capture in full screen mode	76
Fig. 49	Attaching the contact lens to the rear of the test eye	77
Fig. 50	Positioning the test eye with attached contact lens in front of the measuring head	78
Fig. 51	User interface in contact lens measurement mode.....	79
Fig. 52	View of measurement results in the measurement screen of contact lens mode	80
Fig. 53	Contact lens review screen with detailed display of a single measurement value.....	81
Fig. 54	Preselection of data to be deleted, example for refraction/keratometry data	82
Fig. 55	Delete pop-up window with preselection of data to be deleted	83
Fig. 56	Finish pop-up window with various output options	84
Fig. 57	Screen display during data output	85
Fig. 58	Screen display during data output	86
Fig. 59	Administrator PIN input dialog box	87
Fig. 60	Settings in the General submenu	88
Fig. 61	Settings in the Measurement submenu	91
Fig. 62	Settings in the Output submenu.....	92
Fig. 63	Settings in the Interface submenu	95
Fig. 64	Page layout.....	101
Fig. 65	Replacing the fuses	106
Fig. 66	Inserting printer paper	107
Fig. 67	Performing an electrical safety inspection.....	110

Tables

Table 1	Configuration parameters in ZEISS FORUM	31
Table 2	Overview of special characters via long touch	44
Table 3	Description of illumination parameters	54
Table 4	Overview of illumination parameters in different illumination modes.....	55
Table 5	Parameters in the General submenu	90
Table 6	Parameters in the Measurement submenu	91
Table 7	Parameters in the Output submenu	94
Table 8	Parameters in the Interface submenu.....	100

Index

A

Abbreviations 119

C

Care 108

Classification of the device 7

Cleaning 108

Country-specific information 7

D

Daily startup 35

Description of the device 16

Device software 105

Disposal 10

E

Electromagnetic compatibility 115

External labels 11

F

Figures 120

Functional description 14

G

Glossary 119

I

Installation 19

Intended use 8

Intended user profile 9

L

Labels on the device 11

M

Maintenance and care 104

Manufacturer's declaration 7

O

Operation of the device 20, 37

P

Package check list.....	6
Performance specifications.....	14

R

Replacing the fuses.....	106
--------------------------	-----

S

Safety inspections	110
Service life	15
Shutting down.....	103
Switching off	103
Switching on.....	36
Symbols.....	5

T

Technical data	113
Transport.....	111

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