proceq

ZRM 6014
Retroreflectometer R_L/Qd

Firmware as from 2.0.0

Instruction Manual

Index

Exclusion of liability

Illustrations, descriptions as well as the technical specifications conform to the instruction manual on hand at the time of publishing or printing.

However, Proceq SA policy is one of continuous product development. All changes resulting from technical progress, modified construction or similar are reserved without obligation for Proceq SA to update.

Some of the images shown in this instruction manual may be of a pre-production model and/or are computer generated; therefore, the design / features of the delivered product may differ in various aspects.

The instruction manual has been drafted with the utmost care. Nevertheless, errors cannot be entirely excluded. The manufacturer will not be liable for errors in this instruction manual or for damages resulting from any errors.

The manufacturer will be grateful at any time for suggestions, proposals for improvement and indications of errors.

1 Description of device

The ZRM 6014 is a portable handheld top class Retroreflectometer for determination of night visibility (R_L) and/or day visibility (Qd) for all types of road

markings as well as ambient temperature (°C/°F) and relative humidity (rH %) combined in one compact instrument.

In particular, this instrument has the following features

- 5.7“ high resolution colour touchscreen with excellent visibility under all light conditions
- Fold-away telescopic handle and wheels for easy field and laboratory operation
- Ultrafast retroreflection measurement (R_L and Qd) in about 2 seconds
- Innovative options to customize the reflectometer to personal requirements such as integrated 5-megapixel camera, WAAS GPS-unit, compass and level-meter as well as various printer versions
- Intelligent, easy-to-use menu navigation in several languages
- Factory calibration traceable to the independent Swiss Federal Institute of Metrology METAS
- Approved by the accredited association StrAus-Zert, Germany (test No. 0913-2010-16)
- Integrated wet-timer (stop watch) carries out retrorefletion measurement (R_L and/or Qd) automatically after expiry of the time set
- Automatic stray light supervision and compensation, particularly important for measuring profiled markings
- Through V (λ) adaptation road markings of all colours can be measured without recalibrating the retrometer
- Intelligent calibration: automatic zero, R_L and Qd calibration at the push of a button
- Multiple retroreflection measurements with continuously updated average; additionally each single measurement is stored
- Easy management of the measuring data in the instrument´s archive
- Data transfer to printers or USB flash drives within seconds using the built-in USB-interface
- Easy evaluation and export to Microsoft Excel through the included mapping and data analysis software “MappingTools”
- Compact dimensions and low weight for easy transportation
- The precision retroremeter is CE approved and in accordance with RoHS requirements
- In accordance with the standards ASTM E1710 (R_L), ASTM E2177 (R_L wet), ASTM E2302 (Qd) and EN 1436 (R_L and Qd)

Features of options:

- The integrated 5-megapixel camera takes pictures of the road marking for additional visual evaluation

- The data of the compass and level-meter deliver additional information to the retroreflection measuring values
- With the WAAS GPS unit is possible to display the measurement in the included mapping and data analysis software “MappingTools”
- Optional built-in thermal printer or portable USB-printer for easy printouts directly on site for simple reporting of the retroreflectivity of road markings

2 Safety information

2.1 Symbols used

This note comprises instructions needed to follow directions, specifications, proper working procedure and to avoid data loss, damage or destruction of the instrument.

This note signifies a warning about dangers to life and limb if the apparatus is handled improperly. Observe these notes and be particularly careful in these cases. Also inform other users on all safety notes. Besides the notes in this instruction manual the generally applicable safety instructions and regulations for prevention of accidents must be observed.

2.2 Safety notes and hints

It is strictly forbidden to open the housing of the ZRM 6014. If not observed, all the guarantee and liability claims to Proceq SA will be void.

The ZRM 6014 is a high quality, state of the art instrument and is safe to operate. Nevertheless there is always risk when the instrument is handled inappropriately.

Every person working with the ZRM 6014 or maintaining the ZRM 6014 must read and understand the manual completely. In particular the safety precautions and warnings.

The ZRM 6014 is exclusively intended for the determination of night visibility (R_L) and/or day visibility (Qd) for all types of road markings. Any other use is considered as not being in accordance with the intentions of the manufacturer. The manufacturer is not liable for damage resulting from inappropriate application. The user bears the full responsibility.

Avoid any mode of operation that could affect the safe working with the ZRM 6014. Especially the determination of the night and/or day visibility of road markings must take place as described in this instruction manual.

Proceq SA refuses all warranty and liability claims for damages caused by usage of the ZRM 6014 in combination with **non-original accessories**, or accessories from 3rd party suppliers.

Unauthorized modifications and changes of the ZRM 6014 are not allowed.

Reproduction without permission is not allowed.

- All maintenance and repair work which is not explicitly allowed and described in this manual (see chapter 15.1 “Maintenance carried out by the user” on page52 shall only be carried out by **Proceq SA** or your authorized Proceq agent, failure to comply voids warranty.
- Keep the device dry. **Danger of short circuit!**
- Make sure that the ZRM 6014 is unplugged from power supply and turned off before any maintenance.
- For the operation of the ZRM 6014 apply all local safety regulations.

3 Delivery of device

3.1 Damages during carriage

On the receipt of the goods, check for any visible damages on the packaging. If it is undamaged you may sign the receipt of the goods. If you do suspect by your visual inspection that damage has occurred, make a note of the visible damage on the delivery receipt and request the courier to countersign it. Moreover, the courier service must be held responsible for the damage in writing.

If a hidden damage is discovered while unpacking, you have to inform and hold the courier liable immediately in the following way: “When opening the parcel we had to notice that … etc.“ This superficial checking of the goods has to be done within the time limit set by the carrier, which is normally 7 days. However, the period could vary depending on the courier. Hence, it is recommended to check the exact time limit when receiving the goods.

If there are any damages also inform your authorized Proceq agent or **Proceq SA** immediately.

3.2 Shipment

Should the device be transported again, it must be packaged properly. Preferably use the original packaging for later shipments. Additionally use filling material in the package to protect the device from any shock during carriage.

3.3 Standard delivery

Following parts are included in the delivery:

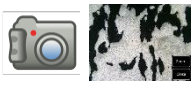
1 battery operated retroreflectometer with 5.7" colour touchscreen, extendable fold-away handle and fixed mounted wheels	
1 battery charger (100 - 240 V, 50 - 60 Hz)	
1 mapping and data analysis software "MappingTools"	
1 USB cable	
1 certificate of manufacturer	
1 certificate of calibration	
1 calibration standard	
1 Carrying case with wheels	

3.4 Carrying case

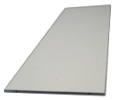
The ZRM 6014 is delivered in a transportation case. Whenever you want to transport the instrument, use the case. Nevertheless, please take care that for shipments the case has to be put into a cardboard box and protected with filling material. The transportation case is an optimal storage case for the equipment. When not in use, the ZRM 6014 should be locked into the calibration standard and safely stowed in the carrying case.

3.5 Options

3.5.1 Options requiring a modification of the ZRM 6014 (built-in)

• integrated camera for pictures in the same geometry as the readings are taken	
• built-in thermal printer	
• compass and level-meter	
• WAAS GPS-unit	

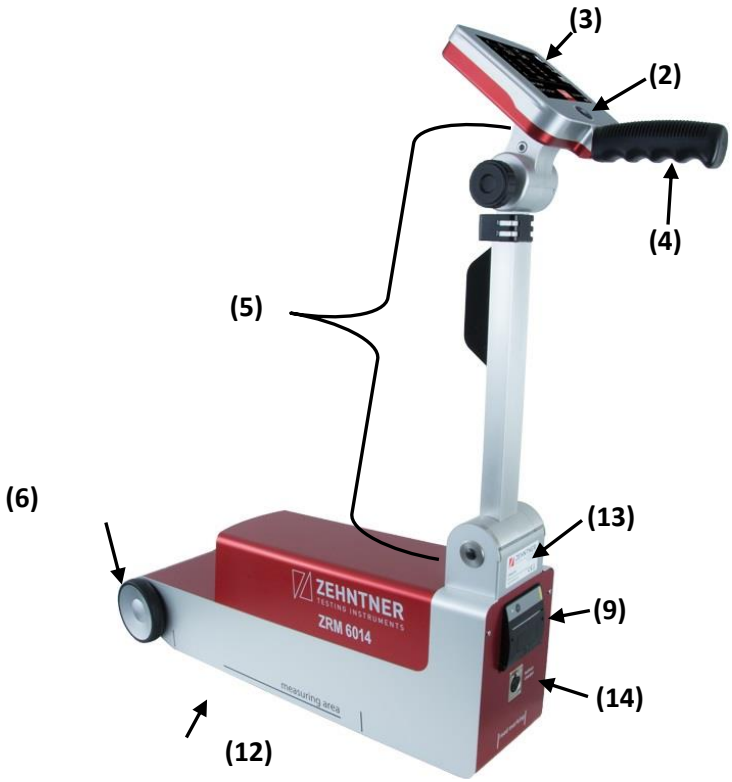
3.5.2 Separate options

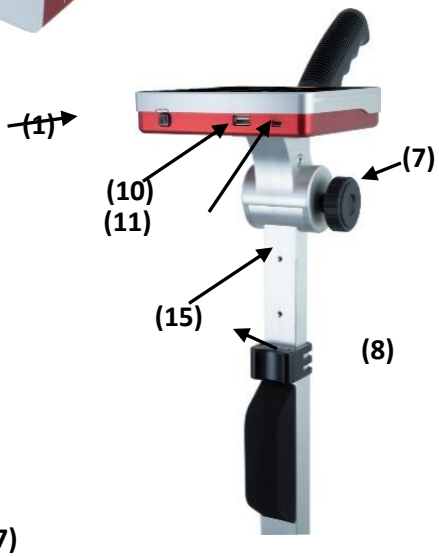
• portable USB-printer	
• 2nd calibration standard (pavement marking tape) measured by Zehntner incl. certificate of calibration	
• voltage converter 12 V/230 V to be plugged into the car cigarette lighter	

All options can be retro-fitted, but some require return to the manufacturer for installation.

Proceq SA refuses all warranty and liability claims for damages caused by usage of the ZRM 6014 in combination with **non-original accessories**, or accessories from 3rd party suppliers.

4 Device overview

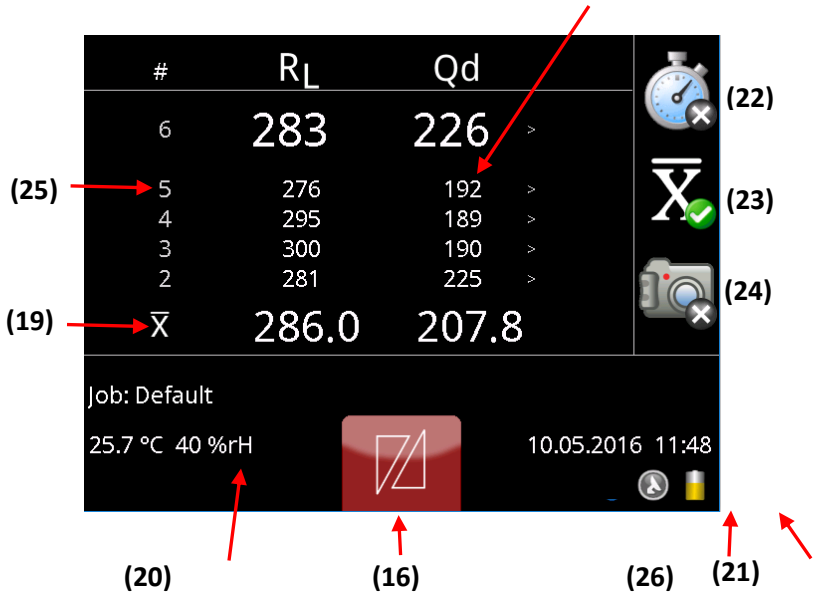




(1) On/off button
(2) Measuring button
(3) Touchscreen
(4) Handle
(5) Telescopic handle
(6) Wheels
(7) Release turning knob
(8) Height shifting knob
(9) Optional built-in thermal printer
(10) Host USB-interface (type A)
(11) Mini USB-interface (type B)
(12) Measuring area
(13) Label incl. serial number
(14) Port for battery charger
(15) Height lock

(17)

(18)



(16) Quick start menu button
(17) Current measuring value
(18) Single values
(19) Average value
(20) Ambient temperature & relative humidity
(21) Battery status
(22) Wet-timer
(23) Multiple measurement with average
(24) Optional camera
(25) Number of measurements in average mode
(26) GPS status indication

5 Setting up

By pressing the on/off button , you switch on /off the instrument.
During startup, the Zehntner-logo will be displayed.

Press and hold the measuring button m during startup to directly access display for language selection.
If the battery was completely empty or the instrument was shut off completely after the “auto time to shut off” has been reached, the startup will take about 30 seconds.

6 Navigation

6.1 Activation / deactivation

By pressing icons on the display certain functions are activated or deactivated.

This is either shown with a white tick on green background for activated functions, a green thick for selected menu options, with a yellow marking e.g. Menu for active controls or a grey marking 338 for selected measurements.

6.2 Scrolling

Scroll through lists by pressing the and buttons or by swiping up or down on the list.

6.3 Exit

Return to measuring mode from any function by pressing the measuring button m

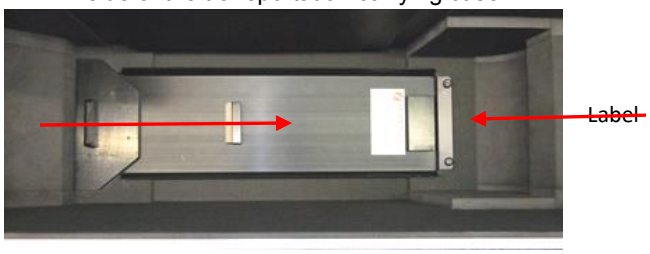
The only exception are functions with a cancel button Cancel which need to be explicitly closed by pressing cancel or accept. Some functions allow going up a level by pressing the backwards arrow .

7 Calibrate

7.1 Calibration standard

Always protect the calibration standard from dust, moisture and other environmental factors, keep it stored in the transportation carrying case.
The calibration standard has been measured by Zehntner in the factory and the calibration value of R_L and Qd has been inscribed.

Inside of the transportation carrying case



After the expiry date of the calibration standard a factory calibration of the ZRM 6014 and its corresponding calibration standard is required. Contact either Proceq or your authorized Proceq-agent. The factory calibration is valid for 2 years.

The calibration standard delivered with the ZRM 6014 is not changeable and is valid only for the delivered instrument.

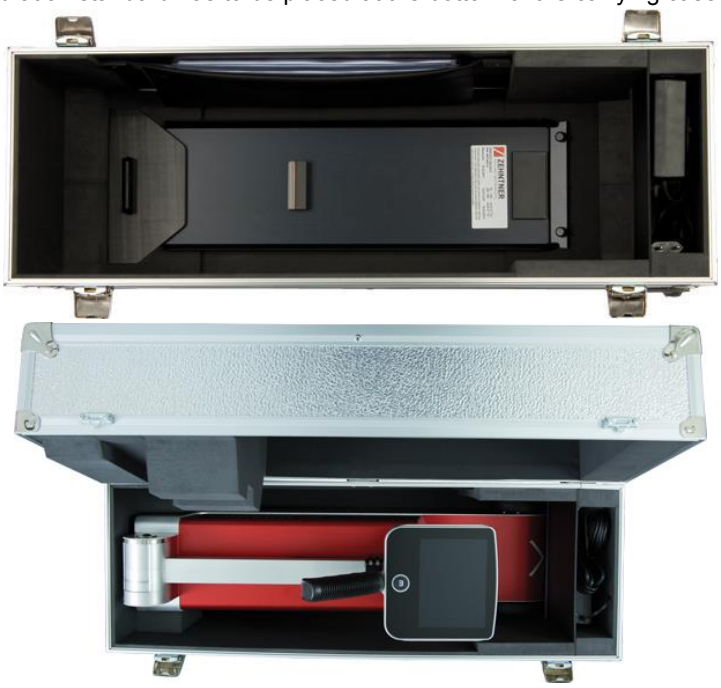
7.2 Cleaning of the calibration standard

If the calibration standard is soiled or covered by dust, it can be cleaned carefully using window cleaner and a soft tissue.

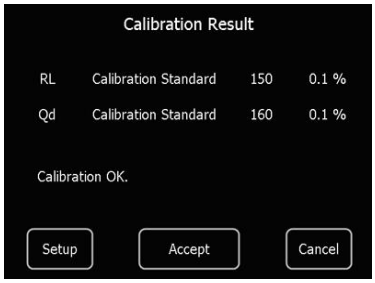
A damaged or a polluted calibration standard may cause incorrect calibration and therefore incorrect measuring results.

7.3 Calibration on calibration standard

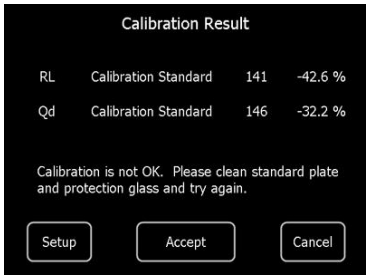
If the instrument indicates that the calibration is outdated, or if it is required by the applicable regulations, the ZRM 6014 has to be calibrated.
Zehntner recommends to carry out the calibration in the carrying case after startup.
The calibration standard has to be placed at the bottom of the carrying case.



Ensure that the ZRM 6014 is placed correctly on the calibration standard. The ZRM 6014 will indicate incorrect placement with an error message. The instrument has to snap in which is indicated by a click sound.

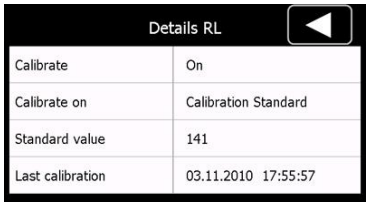


Press the symbols  and  to open the calibration function. By default, both night visibility (R_L) and day visibility (Qd) are calibrated. Trigger the calibration by pressing Calibrate. The “Calibration Result” displays the measured values as well as the deviation from the expected values in percent. Successful calibration is indicated through “Calibration OK”. Confirm the calibration by pressing Accept and to return to the measuring mode.



Calibration results with deviations greater than 15 % are indicated by “Calibration is not OK”. This can be caused by a soiled or damaged standard or a soiled optic window. It is suggested to reject such a calibration result by pressing Cancel before determining the reason for the deviation. Clean the standard as described in chapter 7.2 “Cleaning of the calibration standard” on page 16 and recalibrate again.

By experiencing repeatedly a deviation greater than 15%, a calibration by the manufacturer might be required.



The standard settings of R_L and Qd can be seen by pressing  ,  and Setup then selecting the geometry R_L or Qd. The required geometry can be activated / deactivate by clicking on the line “Calibrate” and choose “On” or “Off”.

8 Measure

8.1 Preparation

The ZRM 6014 has an extendable fold-away handle which grants triggering measurements more comfortable.
Remove the ZRM 6014 from the calibration standard and take it out of the carrying case. Position the handle vertically by turning the release turning knob and pulling the handle. Make sure that the handle is snapped in place. Now press the height shifting knob and move the display to the desired height. Move the display forward and backward to the ideal viewing angle by turning the release turning knob. To stow the fold-away handle back to the horizontal position, first retract the handle to its minimal extension, then fold the handle back down.

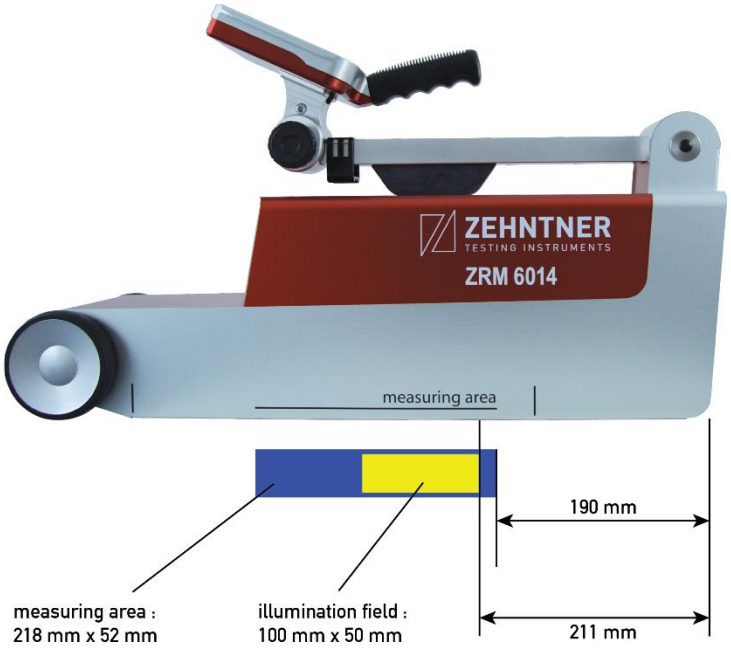
Always shift the handle to the smallest height position, before folding it back down.

horizontal position middle position vertical position smallest height pos.

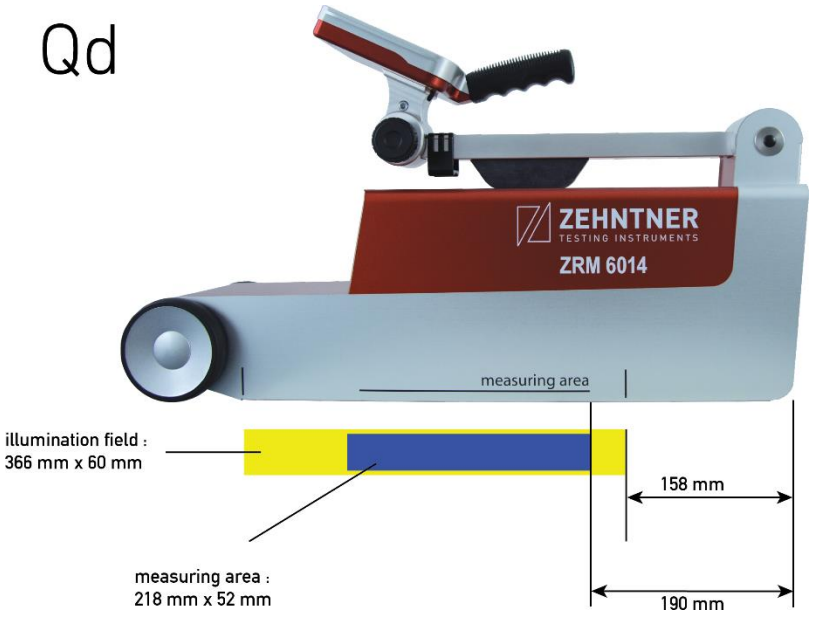
Position shifting of extendable fold-away handle height shifting of handle

8.2 Measuring area

R_L



Qd



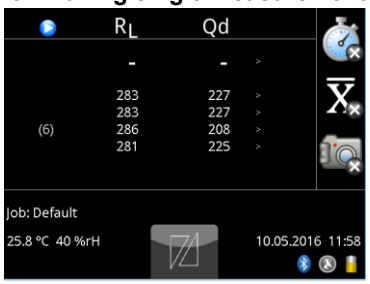
8.3 Measure mode

For instructions on the correct positioning of the unit on the road marking please refer to chapter 8.4 and 8.5 as from page 23.

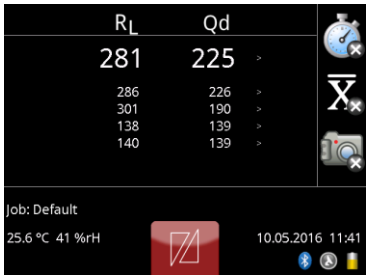
For editing or deleting measurements please refer to chapter 8.3.5 on page 22.

For changing the settings of the measure mode, please refer to chapter 13.3 on page 41.

8.3.1 Taking single measurements

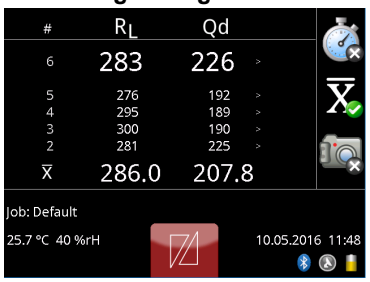


To trigger a measurement press the measuring button m.Active measurement period is indicated by "-" on the top line and the symbol in the top left corner.



After a successful reading the current measurement values will be shown on the top. Previous measurements are shown on the following lines, with the most recent one at the top.

8.3.2 Taking average measurements



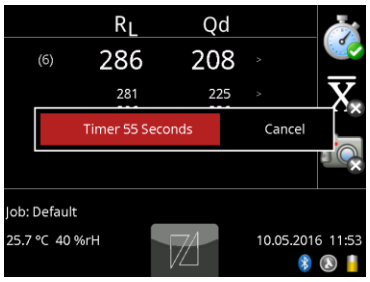
Activate average reading by tapping the symbol . To trigger a measurement press the measuring button m.
Single measurements are displayed with a sequence number and the current average is displayed at the bottom

8.3.3 Taking wet measurements

The ZRM 6014 is perfectly suitable for measuring night and day visibility on wet roads and on moistened road markings (e.g. according to the "bucket" method),

thanks to the built-in timer. The ZRM 6014 has an integrated stopwatch which releases the measurement automatically after the requested time.

⚠ Never pour water on the instrument. Never dip the ZRM 6014 into water. Do not expose the ZRM 6014 to the rain.

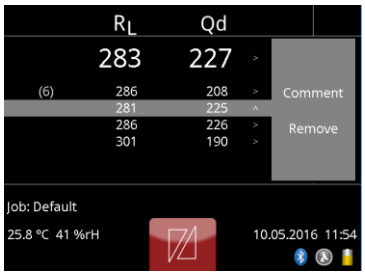


To activate the wet timer press the symbol on the touchscreen. Press the measuring button m and you will see the wet timer before the measurement is taken. You can also take average measurements and pictures together with the wet timer.

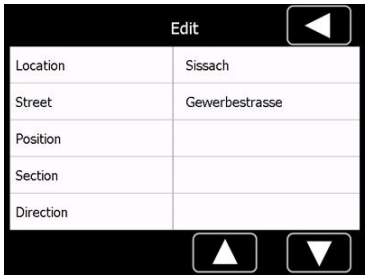
8.3.4 Taking measurements with picture

If the ZRM 6014 is equipped with the optional „integrated camera for pictures in the same geometry as the readings are taken" pictures to a measurement can be taken. The use of this option is described in chapter 10.1.1 "Taking measurements with picture" on page 31.

8.3.5 Edit, delete and store measurements



To add location, manufacturer and other info to a measuring value, tap the measurement you want to edit. An editing menu will be opened beside the list. Edit additional information for the measurement by tapping "Comment".
Delete a measurement by tapping "Remove". Deleting multiple measurements at once is possible in the archive (see chapter 11 "Archive" as from page 34, at "delete jobs" see chapter 13.5 "Jobs" on page 45 or using the "MappingTools" software, see separate instruction manual.



The "Edit" menu allows to add additional information using the touchscreen. The inserted information will be applied to all future readings until the additional information is changed again.
Additional information can also be adjusted later on in the archive. For this refer to chapter 11 "Archive" as from page 34.

Sample of additional information. To add special characters, press and hold the button until the respective special character is shown. Alternatively tap the button 12? to open the numeric keyboard or the button @# to open the special characters keyboard. For faster editing it is possible to connect a keyboard on the USB-interface.

8.4 Information for a proper measuring procedure

The ZRM 6014 should be placed on the road marking as evenly as possible. Position the ZRM 6014 on the sample or marking to be measured. The given measuring geometry is warranted for height differences (profiles) from -1 mm up to 5 mm. Larger height differences may lead to wrong measuring results.

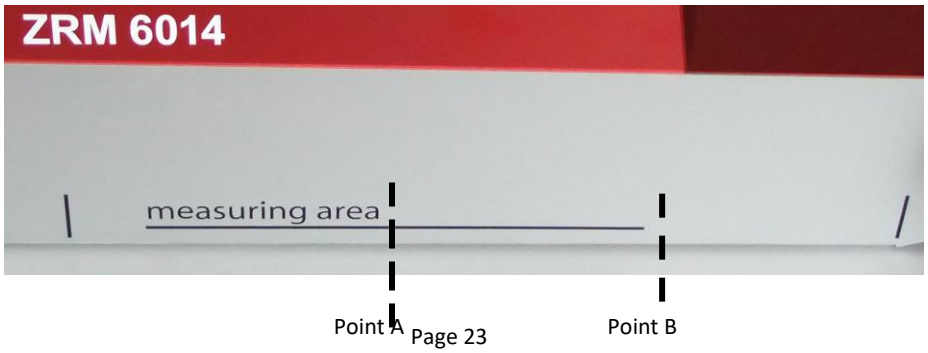
8.5 Measuring profiled markings from 5-12 mm

The ZRM 6014 is capable of measuring profiled road markings with profiles up to 5 mm. However, if the profile is higher than 5 mm you will need to follow a certain procedure in order to get reasonable values.
If the distance between the profiles is more than 300 mm, a support plate is needed with the same height as the profile to ensure the correct measuring geometries.

8.5.1 Getting started

Locate the two indicators on the Retroreflectometer. At the ZRM 6014 one indicator is the end of the description “measuring area”, the other one is the end line of the “measuring area”. These indicators are located on both sides of the equipment.

When measuring a profiled road marking, the raised part of the road marking has to be located between point A and point B. It is suggested to take three measurements between Point A and B.



8.5.2 Measurements with profile distances under 300 mm

1. Place the instrument on the profile whereas Point B is on the middle of the profiled marking, switch to average mode and take a measurement.

Chosen profile

2. Move the instrument forward for approximately 5 cm and take the next measurement.

Chosen profile

3. Move the instrument forward once again, so that Point A is in the middle of the profiled marking and take a measurement.

Chosen profile

4. Read the average value of the three measurements. Repeating this procedure on further profiles ensures more precise and meaningful measuring values.

8.5.3 Measurements with profile distances over 300 mm

If the distance between two profiles of the marking is more than 300 mm, a support plate is needed to make sure the device sits even on the marking. The support plate has to have the same height as the profile of the marking to be measured.

support plate

profiled marking

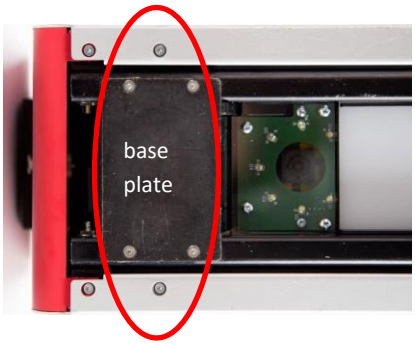
Example of a support plate

The support plate has **always** to be placed at the rear side of the instrument and on the base plate.

Correct placement of the support plate:

Side view of the unit

Bottom view of the unit, the support plate should be placed on the base plate



1. Place the instrument on the profile whereas Point B is on the middle of the profiled marking, switch to average mode and take a measurement.

Chosen profile

2. Move the instrument and the support plate forward for approximately 5 cm and take the next measurement.

Chosen profile

3. Move the instrument together with the support plate forward once again, so that Point A is in the middle of the profiled marking and take a measurement.

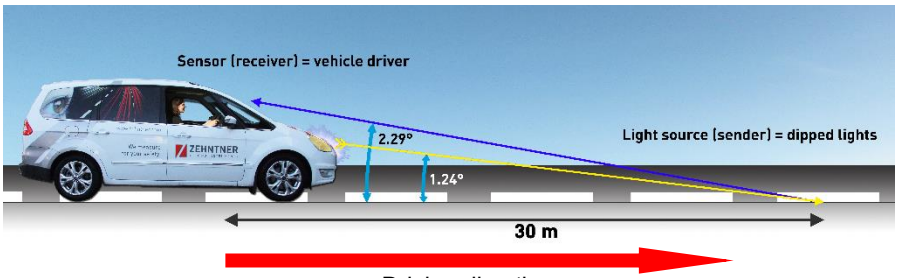
Chosen profile

4. Read the average value of the three measurements. Repeating this procedure on further profiles ensures more precise and meaningful measuring values.

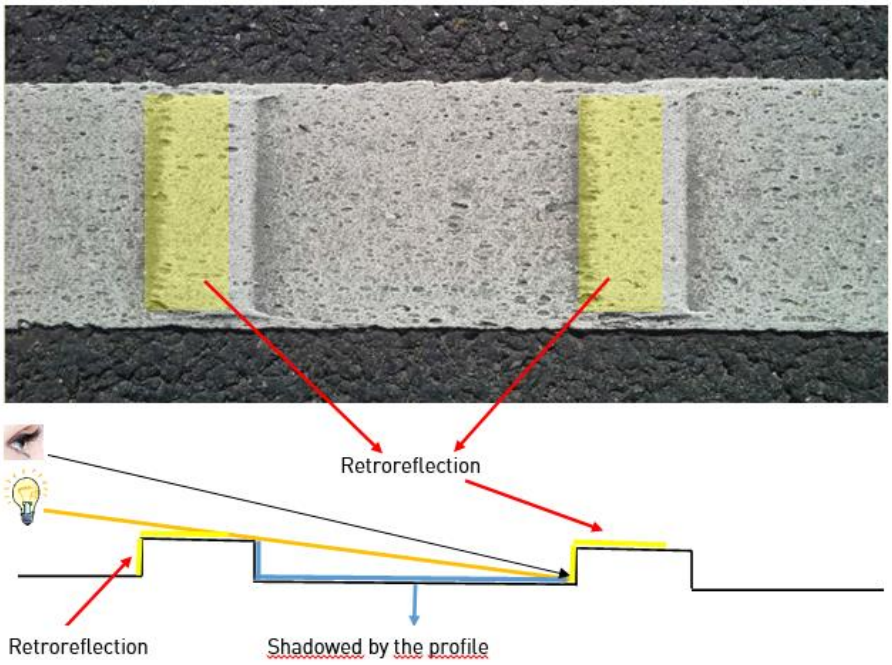
8.5.4 Explanation of profile measurements

On the most profiled markings, the face of the profile gives back a higher value than the top of the profile. By moving the device and taking several measurements, you will get back a value that judges the face and the top of the profile.

Principle of R_L measurement: (The testing instruments are built in accordance with this illustration in reduced scale.)



Driving direction



8.6 Local regulations

Please observe that some countries have regulations regarding the measuring procedure. E.g. it could be regulated how many measurements must be taken. Take care that you read up on all local regulations.

8.7 Obtain exact measuring values

Ensure that the marking to be measured is as flat as possible along the whole measuring range of the device. Otherwise the measuring geometry would be adulterated. Crooked or bent samples will cause incorrect measuring results. The given measuring geometry is warranted for unevenness up to 5 mm.

Make sure to use large enough, absolutely plane samples, insensitive to moisture, as e.g. sheet steel

9 Quickstart menu

Open the quickstart menu by pressing the symbol  . Various functions can be accessed by pressing the respective icons, described below.

This is an option at extra cost and this icon will only be shown when purchased. Press the icon to see how the picture will look like when using camera during measurement. Pictures with or without zoom can be taken. For further information refer to chapter 10.1 on page 30.

In the menu different settings can be made. For more information on this please refer to chapter 13 “Menu” as from page 40.

This is an option at extra costs. This icon will only be shown if either the option compass and level meter or the WAAS GPS unit have been purchased. Press the icon to get some information about the current positioning of ZRM 6014. For further information refer to chapter10.2 on page 32 or to chapter 11.3 on page 36.

All stored files are located in the archive (memory). Here is possible to edit, delete, export to USB flash drive as well as to print out measurement results. For further information refer to chapter 11 “Archive” on page 34.

Here is possible to print out either the last measurement or a specific measurement marked earlier in the measuring mode display using the optional built-in thermal printer or an USB printer such as our optional portable printer. If no measurement is selected, the latest one will be printed. The default settings on the information of the printed measuring report can be changed in the menu, as described in chapter 13.6.11 “Options” on page 49.

This option allows to calibrate the night visibility (RL) and the day visibility (Qd), as well as to change the calibration settings. For further information refer to chapter 7 “Calibrate” as from page 15.

10 Options

10.1 Built-in camera for pictures

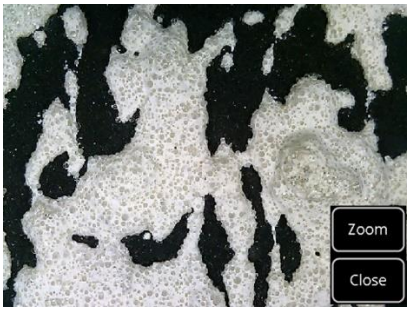
The ZRM 6014 offers the possibility to take pictures (600 x 230 px) of the road marking. This is very helpful for the interpretation of the measuring data. The pictures are intended for the evaluation of road markings in regard of colour, type

(type-I or type-II), embedding and allocation of glass beads, and if there is heavy soiling.

10.1.1 Taking measurements with picture

Pictures can be taken while measuring when the symbol  is activated. It is possible to make single or average measurements with pictures. Choose between pictures with or without zoom.

Picture without zoom

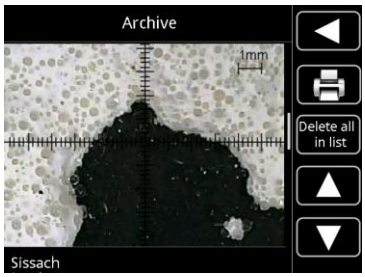


Picture with zoom

For instructions on the correct positioning of the unit on the road marking please refer to chapter 8.4 and 8.5 as from page 23.

Taking single measurements with picture

Only the symbol  is activated. To trigger a measurement press the measuring button m. The picture will be shown for about 5 seconds after the measurement. After this period, pictures can be viewed in the archive, as described in chapter 11 “Archive” as from page 34.



This is an example of a picture taken with zoom, as shown in the archive.

Taking average measurements with picture

For this both symbols  and  have to be activated. By default at average readings only one picture at the first reading will be taken. To change this setting please refer to chapter 13.6.7 “Camera” on page 48. The measuring procedure is the same as for single measurements with picture.

10.2 Compass and level-meter

The ZRM 6014 allows to store the orientation of the device at the time a measurement is taken. This will prevent discussion in which driving directions the measurements have been taken. This is particularly interesting for center lines.

It is also possible to store the gradient of the road to a measurement. The gradient is an important factor in assessing wet measurements.

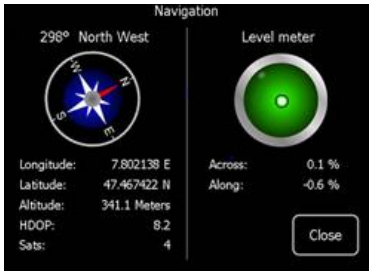
Further information is available in chapter 9 “Quickstart menu” on page 30.

10.3 WAAS GPS-unit

The ZRM 6014 offers the possibility to store the GPS-coordinates of a measurement. If the ZRM 6014 is switched on and is equipped with WAAS GPS-unit, there will be a GPS status indication besides the battery status indication.

	No GPS signal	The WAAS GPS-unit is not able to receive a positioning signal. The coordinates cannot be displayed.
	Weak GPS Signal	The WAAS GPS-unit is receiving the positioning signal. The quality of the GPS signal is poor.
	Normal GPS signal	The WAAS GPS-unit is receiving the positioning signal. The quality of the GPS signal is fine.
	Intense GPS signal	The WAAS GPS-unit is receiving the positioning signal. The quality of the GPS signal is very good.

DOP Value	Rating	Description
1	Ideal	This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times.
1-2	Excellent	At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications.
2-5	Good	Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user.
5-10	Moderate	Positional measurements could be used for calculations, but the fix quality could still be improved. A more open view of the sky is recommended.
10-20	Fair	Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location.
>20	Poor	At this level, measurements are inaccurate by as much as 300 meters with a 6 meter accurate device (50 DOP × 6 meters) and should be discarded.



GPS coordinates and device orientation can be viewed by pressing  and 

. Coordinates will be stored for each measurement. A “No signal” indicator means that the WAAS-GPS-unit is not able to receive a positioning signal and no GPS coordinates will be stored.

After switching on the ZRM 6014, connecting the WAAS GPS unit can take up to 15 minutes until the unit is receiving coordinates. The performance of the WAAS GPS unit can be affected by narrow streets and high buildings that prevent clear view to the sky. In most cases it is not possible to receive coordinates indoors.

Technical Data:

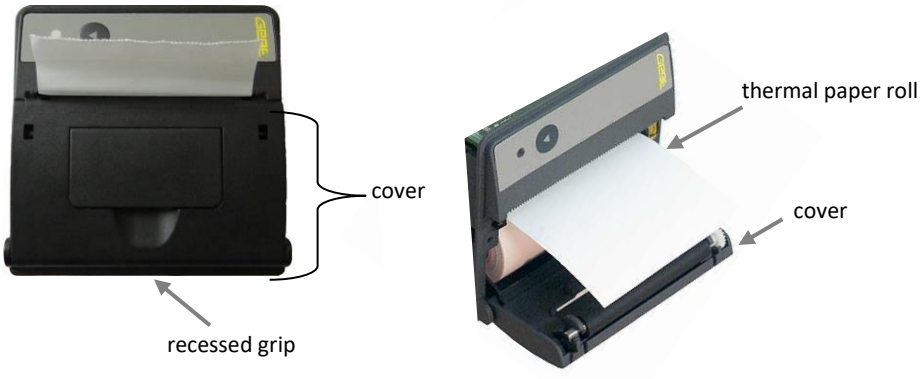
Accuracy:	min. ±15 meters, < ±3 meters under good conditions
Earth Datum Index:	WGS84

10.4 Built-in thermal printer

The ZRM 6014 offers the possibility to print out a measuring report using the optional built-in thermal printer.

Replacing the thermal paper roll

For replacing the thermal paper roll, you have to carry out the following steps:



- Position your finger under the recessed grip and open it with a slight pull.
- Put the paper roll into the thermal paper roll feeder so that the end of the paper roll is on the top.
- Close the cover, so that a slip of paper will be on the outside.
- Now the thermal printer is ready to use.

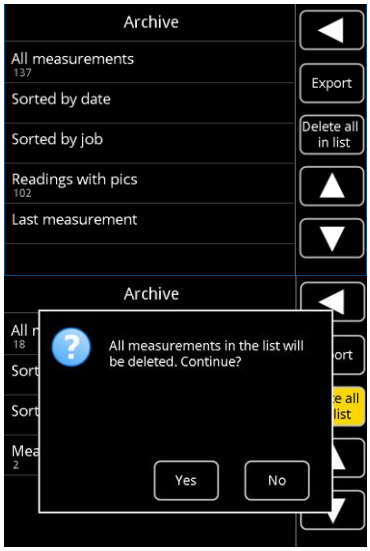
11 Archive

All stored files are located in the archive. The archive can be accessed by pressing  and selecting 

.

In case the measurements are not stored automatically, the settings have been changed. This is described in chapter 13.3 “Measure mode” on page 41.

11.1 Sorting of the measurements

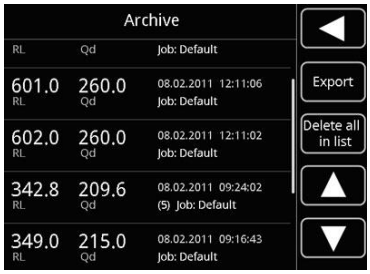


Measurements can be sorted by different criteria. “Readings with pics” are grouped by date. “All measurements” are sorted by date and time in descending order. If the last measurement was a single measurement, it is listed under “Last measurement”. Tap the corresponding line to display the sorted list.

Emptying the archive cannot be undone. All data is lost irrevocably. Only delete an archive if the data is no longer needed.

It is recommended carrying out a back-up copy on your computer or on a USB-flash drive. If you really wish to delete the complete archive, you need to confirm this message.

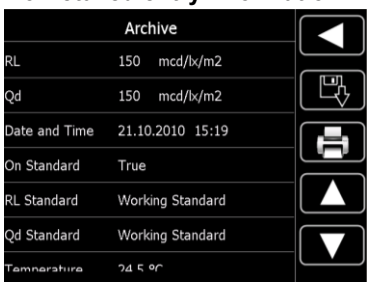
11.2 Overview measurements (sorted)



This is an example sorted by job. All measurement files under a certain job are listed. R_L and Qd values are shown, in addition to date, time and job listed in the third column. For average measurements, the total count of measurements is also displayed in the last column. Please note: “Delete all in list” will delete all single measurements sorted in this job.

Tap a single measurement to get additional options. “Delete” will delete the measurement from memory. “More” opens a window where additional info such as location, manufacturer etc. can be viewed and adjusted.

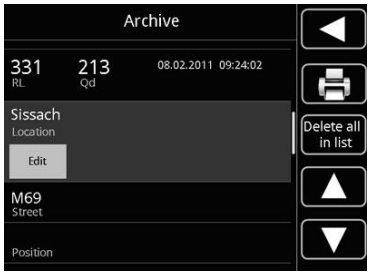
11.3 Detailed entry information



The detailed info view displays measuring values, the date / time and on which standard the instrument has been calibrated for this measurement.

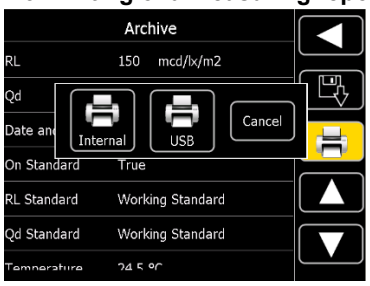
Additional information such as temperature, humidity and – depending on equipment - picture, GPS-coordinates, compass indication etc. is also displayed.
"On Standard: True" indicates that the measurement has been made on the calibration standard. Such a measurement must not be used for the evaluation of a road marking.

11.4 Input of additional information



Below the measurement data, additional information such as Location, Street etc. can be added or changed.
To edit a value, tap the entry and press "Edit", then enter the new value and confirm.

11.5 Printing of a measuring report



Select a printer by pressing the symbol 
The optional built-in thermal printer or an external printer connected to the USB-interface can be used. The measuring report can be printed out by selecting the desired printer the measuring report will be printed out. To choose the information to be printed on the measuring report, please refer to chapter 13.6.8 "Printer" on page 48.

11.6 Storing the measuring data on a USB flash drive

Connect a USB-stick on the USB-interface (host). By pressing the button 

all measuring entries will be stored on the USB-stick. The exported measurements can be opened on a computer using the software "MappingTools". For further information, refer to the separate "MappingTools" instruction manual.

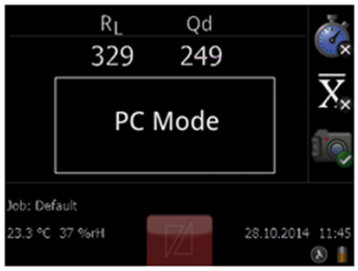
12 Data export and “MappingTools” software

12.1 Interfaces

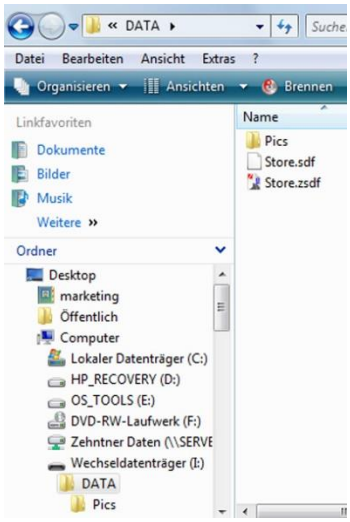
The ZRM 6014 is equipped with the following interfaces for data export:

- Host USB-interface (type A) for external units such us USB-stick and keyboard
- Client USB-interface (type B mini) for connecting to a computer.

12.2 PC Mode



The ZRM 6014 can be connected to a computer using a Mini-USB cable connected to the client interface on the ZRM 6014. The message „PC Mode” on the touchscreen of the ZRM 6014 indicates a successful connection.



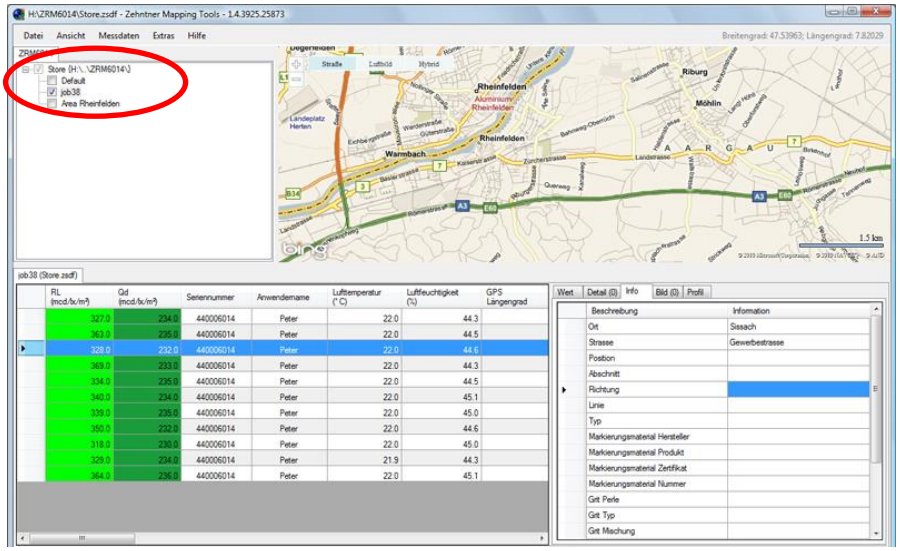
After the device has been recognised, it will be displayed in Windows as a removable device. To create a back-up of the data, copy (the files Store.sdf, Store.zsdf and the folder Pics) to your desired backup volume.

The measuring archive on the ZRM 6014 can be viewed using our free mapping software „MappingTools”.

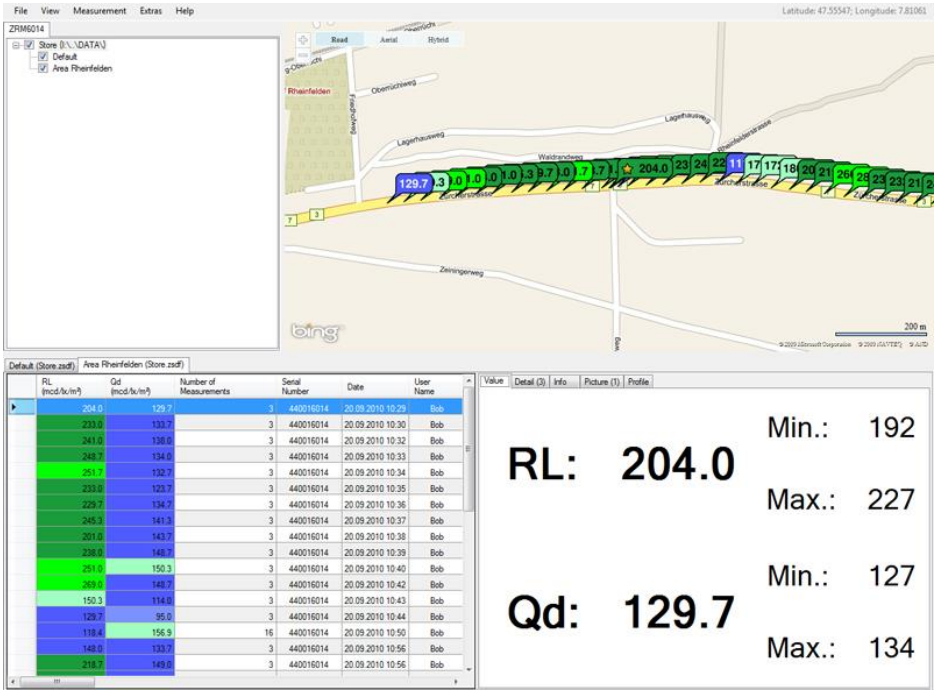
12.3 Evaluation and mapping software “MappingTools”

For evaluation of measurements start the free software „MappingTools“. For information on installation and working with the mapping software, please refer to the separate instruction manual.

After opening tick the archive in order to display it in the „MappingTools”. If the measurements have been taken without the optional WAAS GPS-module, the mapping browser will show you a random map. The mapping browser can be deactivated as described in the separate instruction manual „MappingTools“.



If the ZRM 6014 is equipped with the optional WAAS GPS-module and there was signal when the measurements have been taken, then the measurements will be displayed in the mapping browser.



12.4 Data export to Microsoft Excel

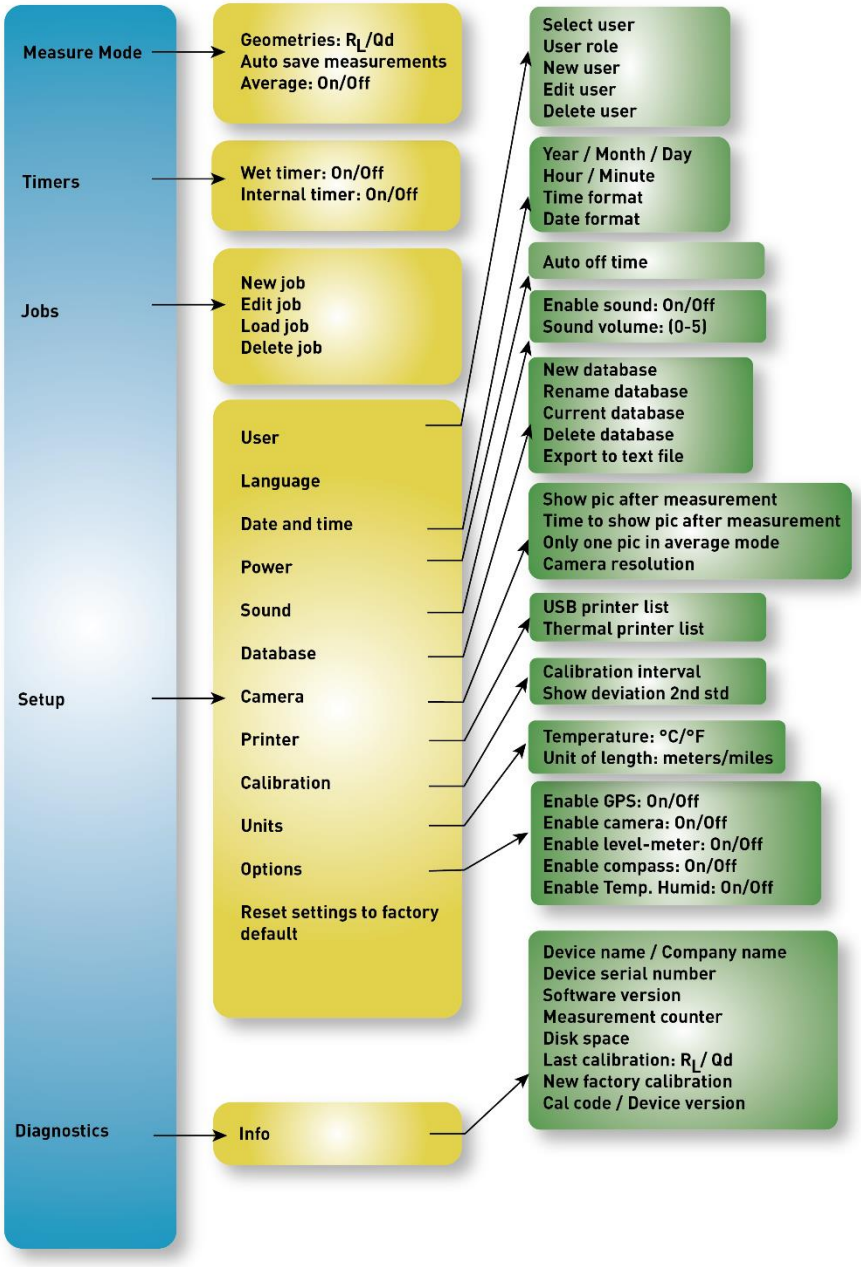
After opening the measuring data using the „MappingTools“ you are able to export them to Microsoft Excel, as described in the instruction manual „MappingTools“. An Excel-Measuring report may look as follows:

Job Name: Default
Device Name: ZRM 6014
Serial Number: 44000601|4

Date	Number of Measurements	RL (mcd/lx/m²)	Qd (mcd/lx/m²)	Location	Serial Number
08.11.2010 10:17	1	92	259	Sissach	440006014
08.11.2010 10:17	1	93	259	Sissach	440006014
08.11.2010 10:17	1	95	258	Sissach	440006014
08.11.2010 10:17	1	97	258	Sissach	440006014
08.11.2010 10:17	1	99	257	Sissach	440006014
08.11.2010 10:18	1	101	257	Sissach	440006014
08.11.2010 10:18	1	103	256	Sissach	440006014
08.11.2010 10:18	1	105	256	Sissach	440006014

13 Menu

13.1 Menu structure



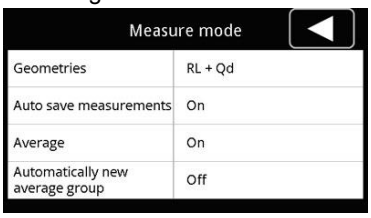
13.2 Navigation in the menu

Press  and 

to open the menu. The top bar shows the name of the currently selected option. Most device options can be configured and turned on/off from the menu. Refer to chapter 6”Navigation” on page 15 for instructions on how to navigate in the menu.

13.3 Measure mode

Selecting “Measure mode” from the menu opens the measurement settings.



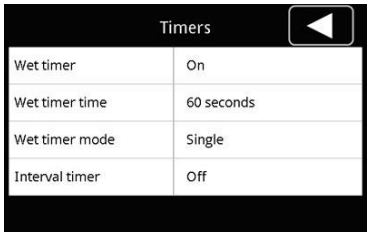
By default, both R_L and Qd geometries are selected. If required, this can be changed to measure only either R_L or Qd.
“Auto save measurements” defines, whether all settings are saved to the archive automatically or need to be saved individually. By default, “Auto save measurements” is activated.
“Average” activates average measurement mode by default. Average measurement mode can also be activated by pressing  on the touchscreen when in measurement mode. “Automatically new average group” creates a new group automatically when the desired number of measurements has been reached.

13.4 Timers

13.4.1 Wet timer

The ZRM 6014 is equipped with a wet timer in order to take a measurement at the right (desired) time after the road marking has been moistened.

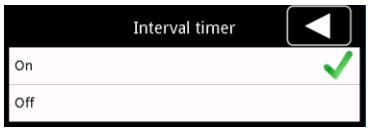
Select “Timers” and “Wet timer” from the menu to activate the wet timer. Alternatively, press  symbol in measurement mode on the touchscreen to activate the wet timer.



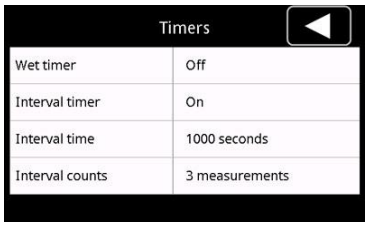
If the wet timer is activated, the “Timers” menu shows the current settings for the wet timer. “Wet timer time” allows to set the stopwatch between 2 and 100 seconds. “Wet timer mode” allows to select between “Single” and “Continuous” mode. “Single activates the timer for one measurement, “Continuous” keeps it active for each measurement.

13.4.2 Interval timer

The interval timer can be used to define the performance of the retroreflection of a marking in dependence on the drained water at wet measurements.



Select “Timers” and “Interval timer” from the menu to activate the internal timer.



The interval timer takes multiple measurements at the defined interval up to the selected count. “Interval time” sets the time between measurements and can be set from 5 to 1000 seconds. “Interval counts” sets how many measurements will be taken.It can be set to a value from 2 to 500. If both timers are activated, all current timer settings are shown.

Practical example of interval timer

At the interval timer the first measurement starts right after pressing the measuring button m. It is recommended to combine the interval timer with the wet timer if the first measurement should start after a certain period after the measuring button has been pressed. Please also refer to “Practical sample combination of wet timer and interval timer”.

Here, the performance of the R_L-value of a moistened type-II road marking tape is measured during 60 seconds at an interval of 5 seconds. As the measurements should start right after moistening the road marking tape, it does not make sense using the wet timer. This example requires the following settings:

- Activate the internal timer.
- Set the interval time to 5 seconds.
- Set the interval counts to 12.

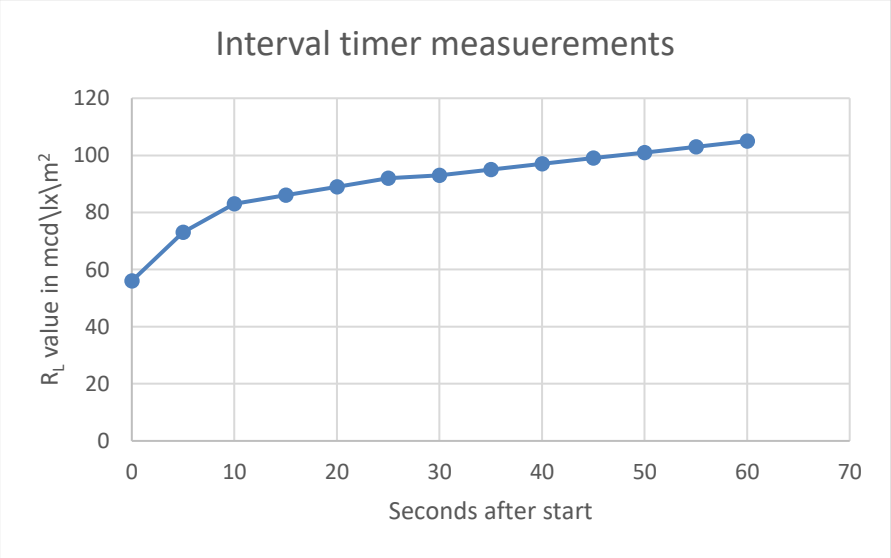
After carrying out the measurements, the measuring data can be exported to Microsoft Excel using the software „MappingTools“.For this you need either to store the measuring data on a USB flash drive as described in chapter 11.6” Storing the measuring data on a USB flash drive” on page 36 or open the measuring data directly on the ZRM 6014 as described in chapter 12 “Data export and “MappingTools” software” as from page 37.

Example Excel-report exported using “MappingTools”:

Job Name: Default
Device Name: ZRM 6014
Serial Number: 440006014

Date	Number of Measurements	RL (mcd/lx/m²)	Qd (mcd/lx/m²)	Location	Serial Number
08.11.2010 10:17	1	56	256	Sissach	440006014
08.11.2010 10:17	1	73	260	Sissach	440006014
08.11.2010 10:17	1	83	260	Sissach	440006014
08.11.2010 10:17	1	86	260	Sissach	440006014
08.11.2010 10:17	1	89	259	Sissach	440006014
08.11.2010 10:17	1	92	259	Sissach	440006014
08.11.2010 10:17	1	93	259	Sissach	440006014
08.11.2010 10:17	1	95	258	Sissach	440006014
08.11.2010 10:17	1	97	258	Sissach	440006014
08.11.2010 10:17	1	99	257	Sissach	440006014
08.11.2010 10:18	1	101	257	Sissach	440006014
08.11.2010 10:18	1	103	256	Sissach	440006014
08.11.2010 10:18	1	105	256	Sissach	440006014

Using this table, you are able to create a diagram to show the R_L performance.



For the interpretation of the measuring data, we give you the following explanation:

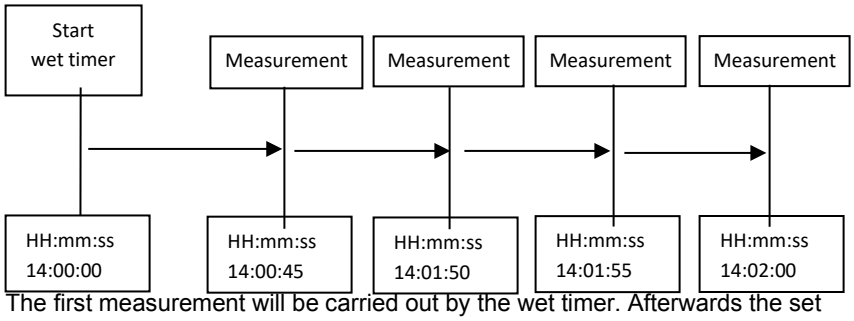
Date	Seconds after start	Measurement No.	RL (mcd/lx/m²)
Moistening of the road marking and start interval timer by pressing the measuring button at: 08.11.2010 10:17	0	1	56
08.11.2010 10:17	5	2	73
08.11.2010 10:17	10	3	83
08.11.2010 10:17	15	4	86
08.11.2010 10:17	20	5	89
08.11.2010 10:17	25	6	92
08.11.2010 10:17	30	7	93
08.11.2010 10:17	35	8	95
08.11.2010 10:17	40	9	97
08.11.2010 10:17	45	10	99
08.11.2010 10:18	50	11	101
08.11.2010 10:18	55	12	103
08.11.2010 10:18	60	13	105

At the beginning the R_L-values surge until there is only a slight increase. This is expected from a type-II road marking sample.

Practical example combination of wet timer and interval timer
A combination of the wet timer and interval timer makes sense if the interval measurements should not start immediately after moistening of the road marking.

- Activate the wet timer.
- Set the wet timer time to 45 seconds.
- Activate the internal timer.
- Set the interval time to 5 seconds.
- Set the interval counts to 3.

After pressing the measuring button the following procedure starts:



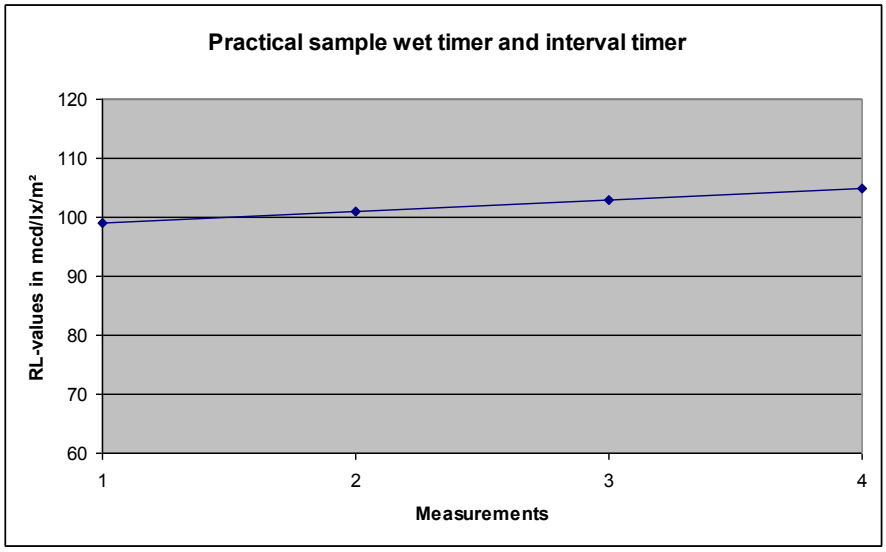
The first measurement will be carried out by the wet timer. Afterwards the set number of interval counts will be carried out. So in this sample there will be a total of 4 measurements.

The measurements can be shown on your computer using the „MappingTools”. For this you need either to store the measuring data on a USB flash drive as described

in chapter 11.6 ”Storing the measuring data on a USB flash drive” on page 36 or open the measuring data directly on the ZRM 6014 as described in chapter 12 “Data export and “MappingTools” software” as from page 37.

Job Name: Default
Device Name: ZRM 6014
Serial Number: 440006014

Date	Number of Measurements	RL (mcd/lx/m²)	Qd (mcd/lx/m²)	Location	Serial Number
08.11.2010 10:17	1	99	257	Sissach	440006014
08.11.2010 10:18	1	101	257	Sissach	440006014
08.11.2010 10:18	1	103	256	Sissach	440006014
08.11.2010 10:18	1	105	256	Sissach	440006014



For the interpretation of the above measuring data, we give you the following explanation:

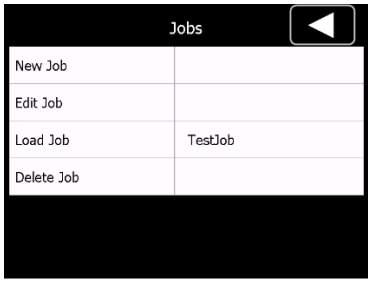
Date	Seconds after start	Measurement No.	RL (mcd/lx/m²)
Moistening of road marking and start wet timer by pressing the measuring button	0		
08.11.2010 10:17	45	1	99
08.11.2010 10:18	50	2	101
08.11.2010 10:18	55	3	103
08.11.2010 10:18	60	4	105

In the time range between 45 seconds and 60 seconds there is only a slight increase of the R_L-values.

13.5 Jobs

The ZRM 6014 offers the possibility to relate measurements to a specific job. Depending on the type of your company (contractor, road laboratory, manufacturer

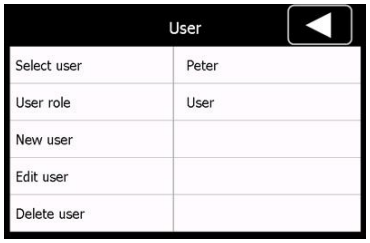
of road marking materials) a job could be a specific client, the development of a specific product and so on.



Selecting “Jobs” from the menu opens the job options. Here is possible to add a new job or edit, load and delete an existing one.
If nothing has been changed in this menu, the job “default” will be indicated in the measure mode.

13.6 Setup

13.6.1 User



Select “Setup” and “User” from the menu. Adding a user enables relating measurements to a specific operator and to store user specific settings. If no user has been added, the user „Peter” will be used for each measurement. The operator is shown at the bottom of the measuring report.
If a user is selected, all other settings will be stored for that user. Switching to another user sets all other settings accordingly.

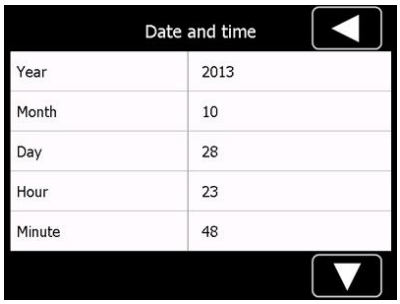
13.6.2 Language

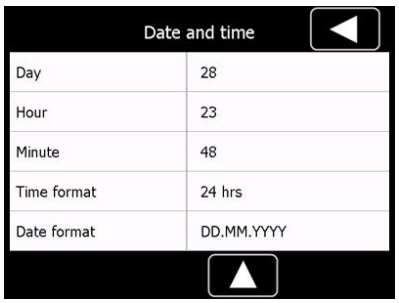
Select “Setup” and “Language” from the menu and choose the desired language. The current language is marked with ✓.
If a wrong language has been chosen and you don´t find the language menu back, switch off the unit. Press and hold the measuring button m during startup to directly access display for language selection.
If you want to contribute and translate a new language or if you have some comments on an existing one, please feel free to contact Proceq.

13.6.3 Date and time

Select “Setup” and “Date and time” from the menu. The current date and time as well as the date and time format can be changed in this menu.

Top list: Bottom list





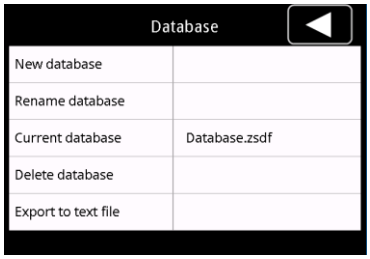
13.6.4 Power

Select “Setup” and “Power” from the menu to set the auto off time. The instrument will automatically shut off after the selected time. The timer can be set from 10 to 60 minutes.

13.6.5 Sound

Select “Setup” and “Sound” from the menu. “Enable sound” activates or deactivates the sound played after a measurement. “Sound volume” sets the volume between 1 and 5.

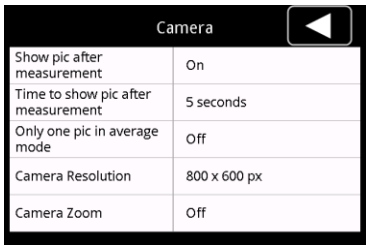
13.6.6 Database



Select “Setup” and “Database” from the menu. Here is possible to create a new database or select, rename and delete an existing one. You can export a database to a semicolon separated text file, which can be edited e.g. in Excel.

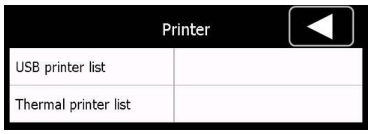
Before deleting a database, make sure you have selected the correct one and made a backup of it before if necessary.

13.6.7 Camera



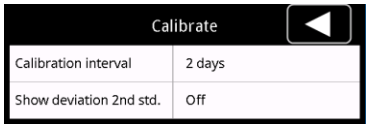
Select “Setup” and “Camera” from the menu. “Show pic after measurement” will show the picture after each measurement. It is activated by default. .
“Time to show pic after measurement” sets how long the picture will be displayed. If the function “Only one pic in average mode” is activated, a picture will only be taken for the first measurement of an average mode.
“Camera resolution” sets the resolution for the pictures taken. “Camera Zoom” defines whether the camera will be zoomed in by default.

13.6.8 Printer



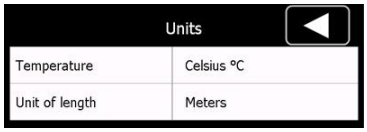
Select “Setup” and “Printer” from the menu. Select an available printer from the USB or Thermal printer list to set which information should be included on reports with the selected printer.

13.6.9 Calibrate



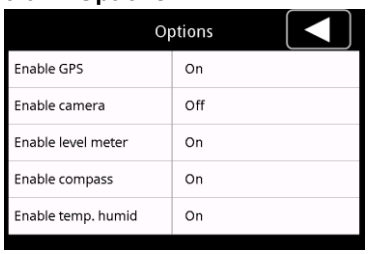
Select “Setup” and “Calibration” from the menu to change calibration settings.
“Calibration interval” sets the time after which the device will require calibration in the standard.
“Show deviation 2nd std” sets whether the deviation should be shown when calibrating with the second standard.

13.6.10 Units



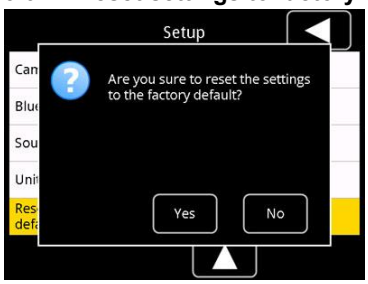
Select “Setup” and “Units” from the menu to choose the preferred measurement units.

13.6.11 Options



Select “Setup” and “Options” from the menu. Installed options can be activated and deactivated for each user profile. Only installed options are shown.

13.6.12 Reset settings to factory default



Select “Setup” from the menu.
“Reset settings to factory default” will reset all settings of the ZRM 6014 to factory defaults. This cannot be undone. If you are sure to carry out the reset to the factory default you need to confirm this message.

13.7 Diagnostics

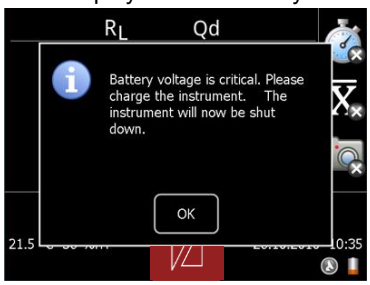
Select “Setup” and “Diagnostics” from the menu to display diagnostic information. The following information will be displayed:

- Device name
- Company name
- Device serial number
- Software version
- Measurement counter
- Disk space
- Last calibration R_L
- Last calibration: Qd
- Next factory calibration
- Cal Code
- Device version

14 Built-in battery and charging

14.1 Battery

The LI-Ion-Mn battery used has a very high capacity. The capacity is continuously being observed. When the voltage becomes too weak the battery sign is shown on the display and the battery has to be charged.



In order to prevent a damage of the battery, the instrument switches off automatically before the battery is completely empty. The ZRM 6014 announces this by displaying the symbol of an empty battery and an error message. In order to save power you can set a shorter “Auto off time”. For this please refer to chapter 13.6.4 “Power” on page 47.

14.2 Battery status indication on the display

Battery is empty. The instrument switches off automatically.

Battery is critically low. The instrument should be charged.

approx. 50 %

approx. 80 %

100 % - battery is full

The instrument is connected to the battery charger. The charging status is shown on the battery charger.

Charging cycle

The charge indicator light on the charger shows the charge of the battery in the charging cycle:

- If the indicator is light red, the unit is fast charging. The battery charger is in constant current mode and the charge current is maximum.
- If the indicator light is orange, the charging cycle “final charge” is active. The charger switches to final charge when the battery is approx. 80% charged. The battery charger is in constant voltage mode.
- If the indicator light is green, the battery is fully charged.

14.3 Charging

To charge the battery, connect the charger to the ZRM 6014 and a wall socket (100 - 240 V, 50 - 60 Hz).
The special plug on the battery cable has a reverse polarity protection. The ZRM 6014 can be turned off or on while charging.
For disconnecting the charger press on the “push button” on the port for battery charger.

Always charge the battery completely and only with the supplied charger.

The battery may only be replaced by Proceq or by an authorized Proceq-agent!

If you have not used your ZRM 6014 during several months, the battery should be charged before using.

15 Maintenance

15.1 Maintenance carried out by the user

You may only carry out the following maintenance and repair yourself:

- Charging as described in chapter 14.3 on page 51.
- Cleaning as described in chapter 15.2 on page 52.
- Replacing the thermal paper roll as described in chapter 10.4 “Built-in thermal printer” on page 34 (if your instrument is equipped with the optional built-in thermal printer).

All other maintenance and repair work may only be carried out by Proceq SA Testing Instruments or your authorized Proceq agent, otherwise all warranty voids.

Make sure that the ZRM 6014 is unplugged from power supply and turned off before any maintenance, except for charging.

The instrument consists of delicate optic and electronic precision parts. Protect it from shocks, moisture and dust. Please store the instrument in the transportation case.

15.2 Cleaning

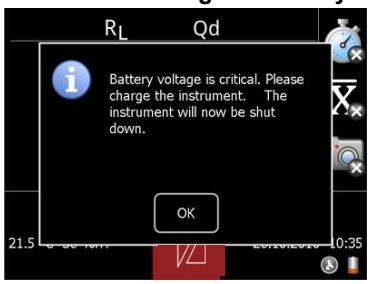
We recommend that the instrument is checked and certified by Zehntner every two years. Otherwise clean the instrument periodically using water- and oil-free compressed air (max. 1.5 to 2 bar), or wipe the exit window on the bottom of the optics housing with a soft brush.

The exit window is coated with a special antireflection coating that should not be damaged. If the soft brush is not sufficient for cleaning the window, you may use a soft paper tissue and window cleaning liquid.

The optics housing may not be opened under any circumstances since the measuring geometry would be misaligned. The measuring geometry can only be adjusted by means of special testing equipment in our factory.

16 Status and error messages

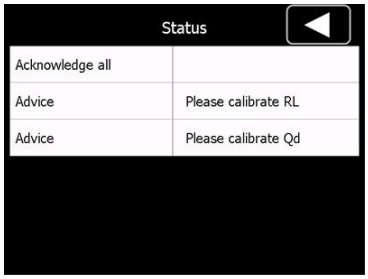
16.1 Status message – “Battery voltage is critical”



In order to prevent a damage of the battery, the instrument switches off automatically before the battery is completely empty. The ZRM 6014 announces this by displaying the symbol and a status message.
Charge the battery as described in chapter 14.3 “Charging” on page 51.

16.2 Status message – “Please calibrate R_L”

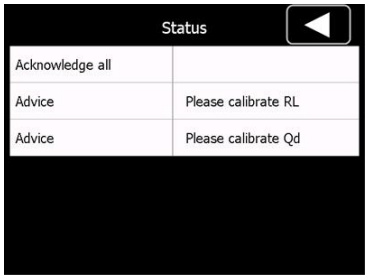
Press the warning triangle to get a more detailed explanation.



To solve this, carry out the calibration as described in chapter 7 “Calibrate” as from page 15. If you are sure that is not necessary to carry out a calibration, you can press “Acknowledge all” and the message will disappear.
To change the calibration interval refer to chapter 13.6.9 “Calibrate” on page 48.

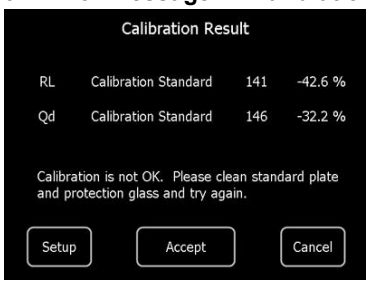
16.3 Status message – “Please calibrate Qd”

Press the warning triangle to get a more detailed explanation.



To solve this, carry out the calibration as described in chapter 7 “Calibrate” as from page 15. If you are sure that is not necessary to carry out a calibration, you can press “Acknowledge all” and the message will disappear.
To change the calibration interval refer to chapter 13.6.9 “Calibrate” on page 48.

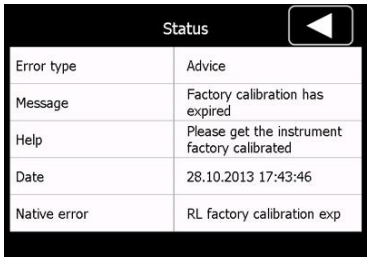
16.4 Error message – “Calibration is not OK”



Calibration results with deviations greater than 15 % are indicated by “Calibration is not OK”. This can be caused by a soiled or damaged standard or a soiled optic window. It is suggested to reject such a calibration result by pressing Cancel before determining the reason for the deviation. Clean the standard as described in chapter 7.2 on page 16 and recalibrate again. By experiencing repeatedly a deviation greater than 15%, a calibration by the manufacturer might be required.

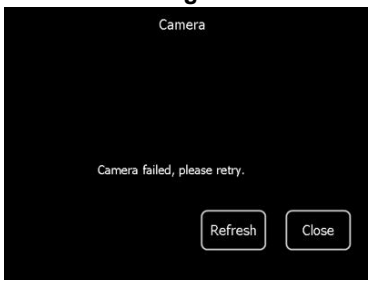
16.5 Error message – “Factory calibration has expired” ”

Press the warning triangle and afterwards the advice “Factory calibration has expired” to get a more detailed explanation.



The instrument has been calibrated in the factory 2 years ago. It should be sent back to the manufacturer for checking, calibration and certification. Contact Proceq or your authorized Proceq-agent for returning the unit.

16.6 Error message – “Camera failed, please retry”



- Press the button Refresh.
- If the camera still failed, restart the instrument as described in chapter 5 “Setting up” on page 15.

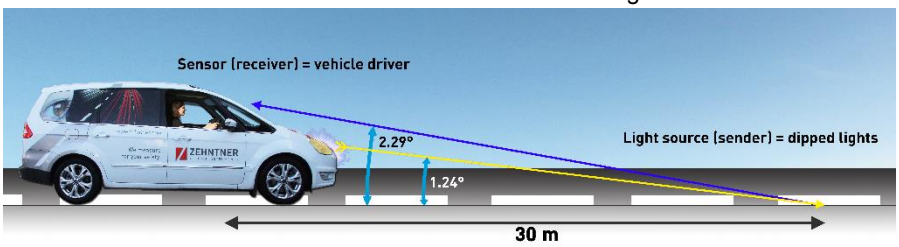
16.7 Reset of the ZRM 6014

If the firmware of the ZRM 6014 has a hang-up, you can reset the instrument by shutting of the instrument completely as described in chapter 5 “Setting up” on page 15.

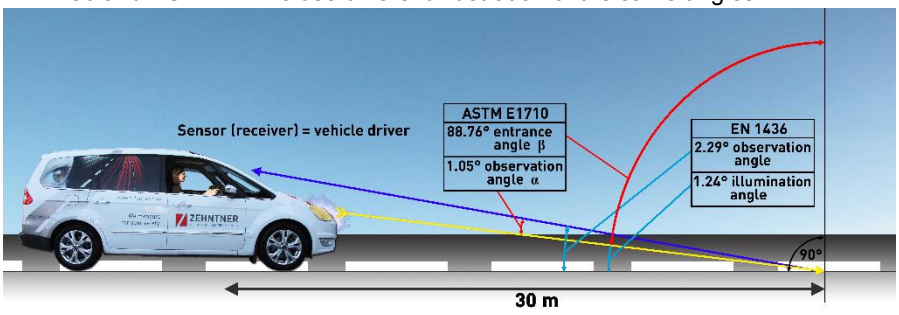
17 Graphical illustration of the measuring principles

17.1 Night visibility R_L

R_L is the coefficient of retroreflected luminance (night visibility) of road markings. The observation angle of 2.29° corresponds to the viewing distance of a vehicle driver of 30 m under normal conditions. The illumination angle is 1.24°.

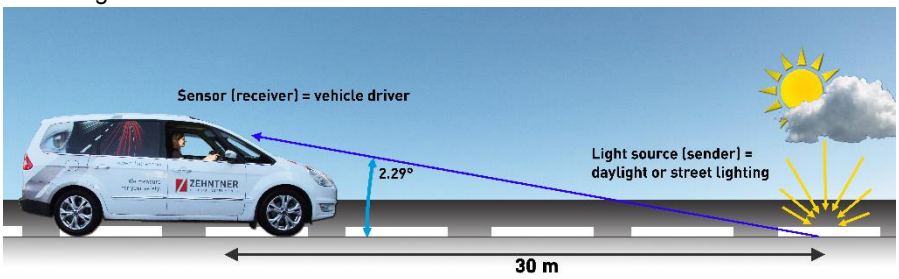


The angle definitions above are valid for EN 1436. It is important to understand that EN 1436 and ASTM E1710 use different illustration of the same angles.



17.2 Day visibility

Qd is the luminance coefficient under diffuse illumination (day visibility) of road markings. The observation angle of 2.29° corresponds to the viewing distance of a vehicle driver of 30 m under normal conditions. EN 1436 and ASTM E2302 use the same angle definitions.



18 Technical specification

Observation distance:	30 m, according to CEN-geometry
Observation angle:	EN 1436: 2.29°
	ASTM E1710: 1.05°
	ASTM E2302: 2.29°
Illumination angle:	R_L: EN 1436: 1.24°
	R_L: ASTM E1710: 88.76°
	Qd: diffuse
Measuring area:	52 mm x 218 mm
Measuring sensor:	adapted to V (λ)
Measuring range:	R_L: 0 - 4‘000 $mcd \cdot m^{-2} \cdot lx^{-1}$
	Qd: 0 - 400 $mcd \cdot m^{-2} \cdot lx^{-1}$
	profiled markings -1 mm up to 5 mm (-0.04” to 0.2”),
	up to 12 mm (0.5”) with instruction
Measuring period:	approx. 2 seconds for R_L and Qd (without picture)
	single about 1 second (without picture)
Memory:	1 GB Micro-SD flash memory about
	10‘000 measurements (without pictures)
Display:	VGA 5.7“ colour touchscreen
Pictures:	resolution: 600 x 230 px, image format: jpg
External charger:	100 - 240 V / 50 - 60 Hz, 50 VA, universal
Battery:	Li-Ion-Mn, 14,4 V, 6,5 Ah
Charging time:	approx. 3 hours
Life cycle LED:	approx. 500'000 measurements
Operating:	- 10° C to + 50° C (14°F to 122°F)
Storage:	- 20° C to + 60° C (-4°F to 140°F), non condensing
Dimensions (LxWxH):	658.5 mm x 190 mm x 408.5 mm,
	Carrying case: 725 mm x 250 mm x 440 mm
Weight:	7.5 kg (16.5 lbs) net
	17.6 kg (38.8 lbs) with transportation carrying case
Standards:	EN 1436 (for R_L and Qd)
	ASTM E1710 (for R_L)
	ASTM E2302 (for Qd)
	ASTM E2177 (for R_L wet)
Warranty:	2 years, battery without warranty

Glossary

www.proceq.com

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