proceq

# Instruction manual

**version 1.1 dated 30.07.2014**

# ZRM 6013+

## Retroreflectometer $R_L$/Qd

**Firmware as from v.1.2.3**

# Index

**Enclosures:**

- Certificate of manufacturer
- Certificate of calibration

# 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. Instrument description

The retroreflectometer **ZRM 6013+** is a portable, rechargeable battery-powered precision measuring instrument for the determination of night ($R_L$) and/or day (Qd) visibility of road markings.

The following features distinguish the **ZRM 6013+**:

- The determination of both night and day visibility is possible at any time of the day – in full daylight as well as by night.
- Big 5.7“high resolution colour touchscreen with easy to use guided menu.
- Ultrafast measurement in about only 2 seconds for $R_L$ and Qd; single $R_L$ or Qd in about 1 second.
- Possible stray light is being compensated.
- Easy and quick calibration.
- Clever Proceq mapping and data analysis software MappingTools to put the results on a map.
- Multiple measurements with on-going updated average; each single measurement is also stored.
- Suitable for all kinds of road markings: Road marking paints, Thermoplastic and cold plastic material, pavement marking tape.
- Suitable for road markings with and without reflective beads.
- Suitable for glass and ceramic beads.
- Likewise suitable for plane and textured markings.
- For measuring the visibility of dry, humid and wet road markings.
- Integrated temperature measurement (°C / °F).
- Integrated measurement of relative humidity (rH).

# 2. Safety precautions and warning notes

## 2.1 Dangers

⚠ **Caution!**

This note is included in this instruction manual wherever it is warned about dangers which will arise to life and limb of persons 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 these instruction manual the generally applicable safety instructions and regulations for prevention of accidents have to be taken into account.

**Note**

This symbol marks instructions you should take notice of in order to follow directions, specifications and the correct working process as well as to avoid data loss, damage or destruction of the instrument

## 2.2 Safety notes

⚠ **It is strictly forbidden to open the housing of the ZRM 6013+!** If not observed, all the guarantee and liability claims to **Proceq SA** will expire

⚠ The Retroreflectometer **ZRM 6013+** is a high quality, state of the art instrument and is safe to operate. Nevertheless there is a chance of risk when the instrument is handled inappropriately.

⚠ Every person working with the **ZRM 6013+** or maintaining the **ZRM 6013+** must read and understand the manual completely. In particular the safety precautions and warnings.

The **ZRM 6013+** is exclusively designed for the determination of the night and/or day visibility of road markings as well as ambient temperature (°C/°F) and relative humidity (rH %). Any other application is not in accordance with the regulations. 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 6013+**. Especially the determination of the night and/or day visibility of road markings must take place as described in this instruction manual.

Never leave the **ZRM 6013+** under direct sun exposure. Always store the **ZRM 6013+** in its carrying case.

Zehntner refuses all warranty and liability claims for damages caused by usage of the **ZRM 6013+** in combination with **non-original accessories**, or accessories from 3rd party suppliers.

Unauthorized modifications and changes of the **ZRM 6013+** are not allowed.

Reproduction without permission is not permitted.

All maintenance and repair not explicitly allowed and described in this manual (cf. chapter 16 “Maintenance” as from page 64) may only be executed by Proceq SA or your authorized Proceq-agent, otherwise all warranty expires.

Make sure that the **ZRM 6013+** is unplugged from power supply and turned off before any maintenance.

For the operation of the **ZRM 6013+** apply all local safety regulations.

# 3. Delivery of device

## 3.1 Damages during carriage

During carriage the **ZRM 6013+** is to be handled with the usual care. To ensure carriage without damages the device is to be transported in the original packaging and under normal freight conditions. If the device was supplied in a carrying case or storage box, this original packaging needs to be used also for later shipments. Pushes during carriage need to be avoided.

At the receipt of the goods, you have to check if there are any visible damages at the outer packaging. If the packing is alright, you can sign the receipt documents. If you even suspect by your visual impression that damage has occurred, make a note of the suspected damage on the delivery receipt or freight papers and get the carrier to sign it. Moreover, the forwarding agent / courier service must be held responsible for the damage in writing.

If a hidden damage is discovered while unpacking, you have to inform and must held the forwarding agent / courier service immediately in the following way: “When **opening** the parcel we had to notice that …. etc. etc.“ This superficial checking of the goods has to be done before the time limit of the forwarding agent / courier service expires which is normally within 7 days. However, the period could be less. Hence, it is recommended to check the exact time limit when receiving the goods.

If there are any damages inform also immediately your authorized Proceq-agent or Proceq directly.

## 3.2 Standard delivery

**The following parts are included in the delivery:**

| | |
|---|---|
| 1 battery operated retroreflectometer with 5.7" colour touchscreen |  |
| 1 calibration standard |  |
| 1 universal battery charger (100 - 240 V, 50 - 60 Hz) |  |
| 1 mapping and data analysis software "MappingTools" |   |
| 1 USB cable for data transfer to PC/laptop |  |
| 1 certificate of manufacturer |  |
| 1 certificate of calibration |  |
| 1 transportation carrying case with wheels |  |

## 3.3 Transportation carrying case

The **ZRM 6013+** is delivered in a transportation carrying 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 carrying case is at the same time an optimal storage case for the **ZRM 6013+** when not in use. The **ZRM 6013+** is always to stow away locked into the calibration standard.

## 3.4 Options

### 3.4.1 Options requiring a modification of the ZRM 6013+ (built-in)

| | |
|---|---|
| extended handle with measuring button |  |
| WAAS GPS unit |  |
| Bluetooth®-interface |  |
| built-in thermal printer |  |

Proceq refuses all warranty and liability claims for damages caused by usage of the **ZRM 6013+** in combination with **non-original accessories**, or accessories from 3rd party suppliers.

### 3.4.2 Separate options

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

All options can be bought after the sale at Proceq or an authorized agent. Extended handle with measuring button, WAAS GPS-unit, Bluetooth®-interface, built-in thermal printer and bigger SD flash memory cards require an upgrade of the **ZRM 6013+** at the manufacturer. It is recommended combining this with the maintenance and calibration.

Proceq refuses all warranty and liability claims for damages caused by usage of the **ZRM 6013+** in combination with **non-original accessories**, or accessories from 3rd party suppliers.

**Proceq SA**
Ringstrasse 2
CH-8603 Schwerzenbach
Switzerland
Phone +41 43 355 38 00
Fax +41 43 355 38 12
info-europe@proceq.com

# 4. Quick guide

## 4.1 Important remarks

Before using the **ZRM 6013+** for the first time, you need to have read and understood at least the chapter 2 “Safety precautions and warning” as from page 7 of the instruction manual. This quick guide only explains the most basic functions/operation steps. Some of the features shown on the model may be optional at extra cost.

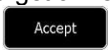
## 4.2 On/Off

Before you take out the instrument from the transportation carrying case, turn on the unit by shortly pressing the on/off button  . Before the display changes to the measure mode, you will see shortly the logo of the manufacturer on a white background. For further information please refer to chapter 6 „Setting up“ as from page 16.

## 4.3 Calibrate

If the instrument indicates that the calibration is outdated, or if it is required by the applicable regulations, the **ZRM 6013+** has to be calibrated. Press the symbol  and 

to open the calibration function. In the standard setting there are listed night visibility $R_L$ and day visibility Qd to be calibrated on the calibration standard. Take care that the **ZRM 6013+** is placed correctly on the included calibration standard. Otherwise, the **ZRM 6013+** will give you an error message. By pressing 

you trigger the calibration. After the calibration you get a message that the calibration was successful or you get a remark of the deviation. With 

you confirm the calibration and you get back to the measure mode. For further information please refer to chapter 8 „Calibrate“ as from page 17.

## 4.4 Measure mode

For the correct positioning please refer to chapter 9 “Measure” as from page 24.

By pressing the measuring button 

the reading is started. During the measuring period which is about 2-3 seconds, you will see „-„ on the top line and the symbol  on the top left side. After a successful reading, the measurement values will be shown on the top. If you take further measurements, the last measurement value is always shown in the second line on the top. For further information on the measure mode, please refer to chapter 9 „Measure” on page 24. For changing the settings of the measure mode, please refer to chapter 14.3 „Measure mode“ as from page 47. By pressing the measuring button you get back to the measure mode from each function.

## 4.5 Average reading

For activating average reading press on the touchscreen the symbol  . If the symbol  is shown, the average reading is activated. The single values are still displayed. On the left side of the page the measurements are numbered. On the bottom line you see the symbol for the average reading  where you see the current average.

## 4.6 Edit, delete and store measurements

If you wish to e.g. edit a measuring value from the list of the measuring window, you have to press on the specific line and an editing menu beside the list will be opened.

## 4.7 Print

By  and 

you start the printer menu. There you can choose between the optional built-in thermal printer or an external printer for printing out the test report. For further information please refer to chapter 10.4 „Print “ as from page 28.

## 4.8 Archive (memory)

All stored files are located in the archive. By  and 

you open the archive (memory). There you are able to edit, delete, export to USB flash drive as well as to print out. For further information please refer to chapter 12 „Archive“ as from page 40.
In case measurements are not stored automatically, the settings have been changed. This is described in chapter 14.3.2 „Auto save measurements” on page 48.

## 4.9 Miscellaneous menu settings

By  and 

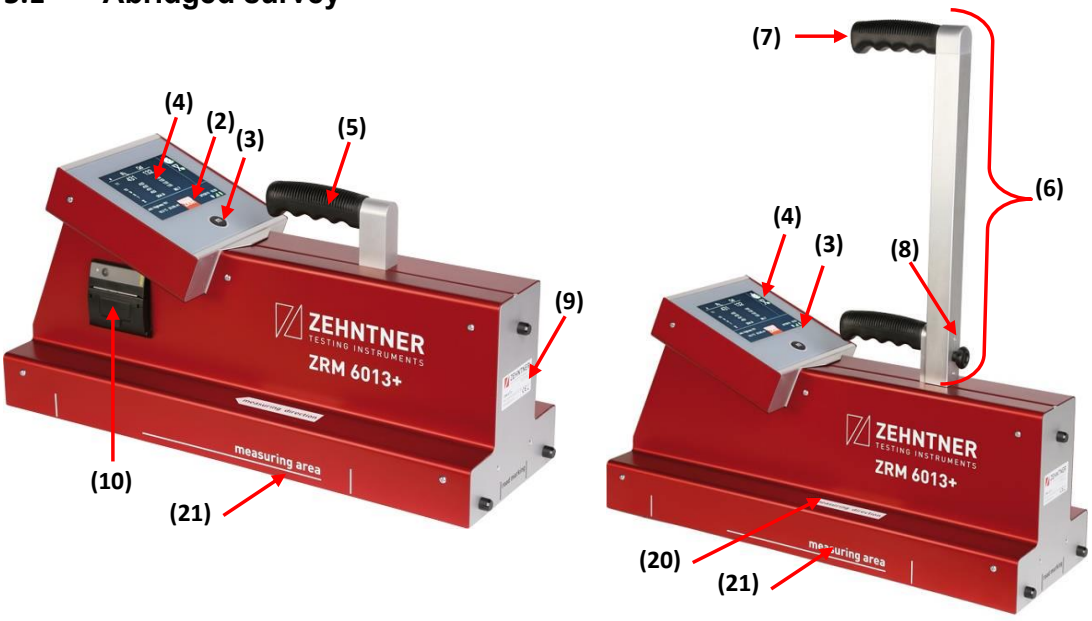
and Setup you can set different setting such as e.g. sound, date and time, user, language. For further information please refer to chapter 14.6 „Setup“ as from page 55.

## 4.10 Further features/information

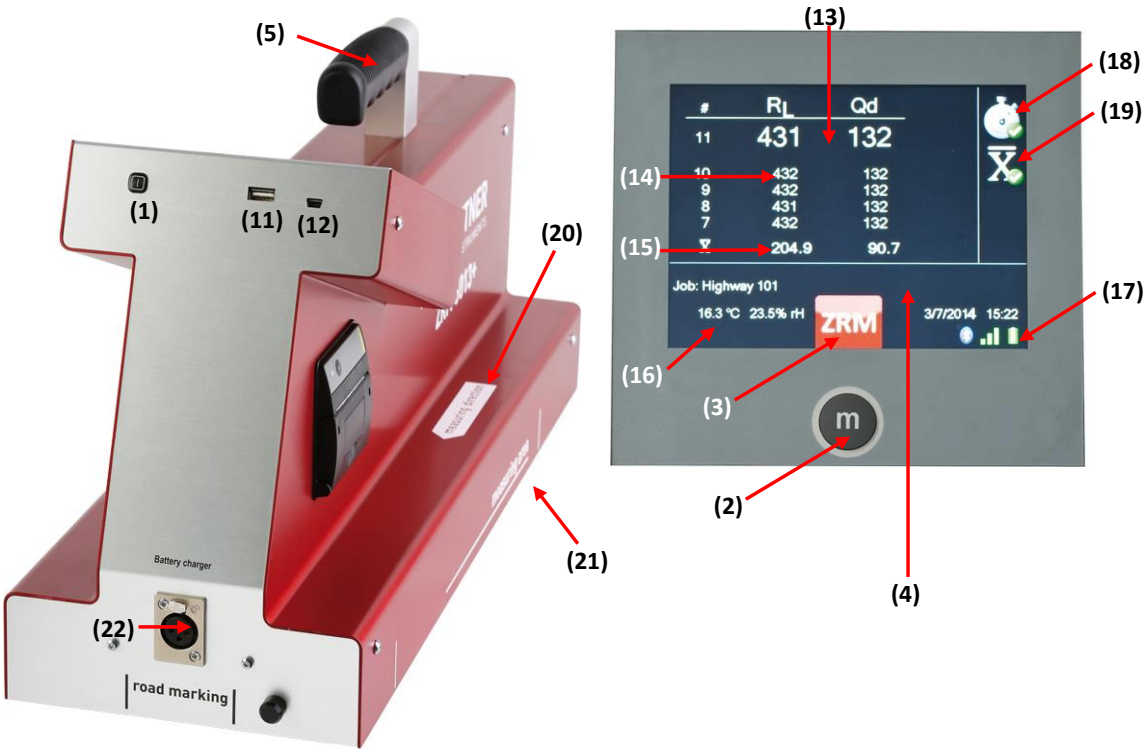
Please refer to our instruction manual for any features which are not described in this quick guide.

# 5. Display and functions

## 5.1 Abridged survey




| | |
|---|---|
| **(2)** | Measuring button m |
| **(3)** | Quick start menu button |
| **(4)** | Touchscreen |
| **(5)** | Handle |
| **(6)** | Optional extended handle |
| **(7)** | Measuring button of extended handle |
| **(8)** | Fixing screw of optional extended handle |
| **(9)** | Label incl. serial number |
| **(10)** | Optional built-in thermal printer |
| **(20)** | Measuring direction marking |
| **(21)** | Measuring area |




| | |
|---|---|
| **(1)** | On/off button |
| **(2)** | Measuring button |
| **(3)** | Quick start menu button |
| **(4)** | Touchscreen |
| **(5)** | Handle |
| **(11)** | Host USB-interface (type A) |
| **(12)** | Mini USB-interface (type B) |
| **(13)** | current measuring value |
| **(14)** | Single values |
| **(15)** | Average value |
| **(16)** | Ambient temperature & relative humidity |
| **(17)** | Battery status |
| **(18)** | Wet timer |
| **(19)** | Multiple measurement with average |
| **(20)** | Measuring direction marking |
| **(21)** | Measuring area |
| **(22)** | Port for battery charger |

# 6. Setting up

By pressing the on/off button ⏻ shortly, the instrument is switched on or off respectively.
The display will automatically change to the measure mode.

If you press the measuring button m continuously during switching on you will get directly into the language settings.
After the “auto off time” has been reached or after the battery was completely empty, the instrument is switched off automatically. The “auto off time” can be set in the menu as described in chapter 14.6.4 “Power” on page 56.

# 7. Navigation

## 7.1 Activation respectively deactivation


A high-resolution 5.7” colour touchscreen with easy to use guided menu makes it easy to learn and use the **ZRM 6013+**. By pressing icons certain functions are activated or deactivated.
This is either shown with a white tick on green background, a green thick ✓, with a yellow marking e.g. Menu or a grey marking e.g. 338.

## 7.2 Scrolling

At certain functions you need to scroll. For scrolling you can either press an arrow button e.g. ▼ so that it will get yellow ▼ or use your finger by pressing and pulling in the desired direction.

Arrow functions:
Scrolling down: ▼ activated: ▼
Scrolling upwards: ▲ activated: ▲

## 7.3 Exit

By pressing the measuring button m you will get to the measure mode from every function.
The only exceptions are functions with a cancel button Cancel. Here you have to press the cancel button Cancel before you are able to get back to the measure mode by pressing the measuring button m.
In certain functions you have a backwards arrow ◀ to go back a level. Press it in order to activate it which is shown by a yellow marking ◀.

# 8. Calibrate

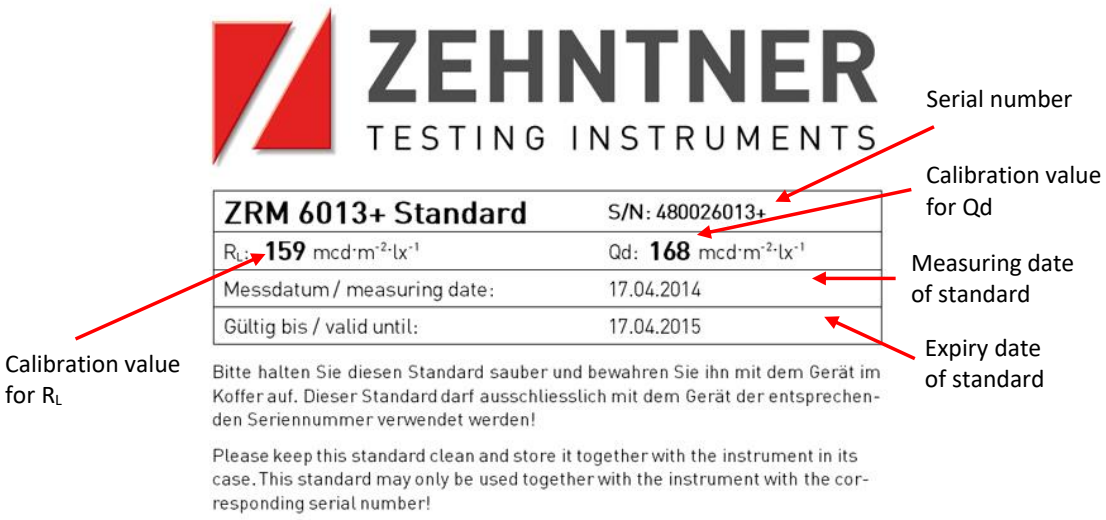
## 8.1 Calibration standard

Always protect the calibration standard from dust, moisture and other environmental factors, keep it stored in the transportation carrying case of the **ZRM 6013+**. The calibration standard has been measured by Proceq in the factory and the calibration value of $R_L$ and Qd has been inscribed.

It is valid for 2 years and should be replaced or calibrated at **Proceq** after this time.

The calibration standard delivered with the **ZRM 6013+** is not changeable and is valid only for the delivered instrument.

Following indications are noted on the label of the calibration standard:




After the expiry date of the calibration standard a factory calibration of the **ZRM 6013+** and its corresponding calibration standard is required. Contact either **Proceq** or your authorized Proceq-agent.

## 8.2 Cleaning

- The calibration standard has to be protected from dust
- If the calibration standard should be soiled or covered by dust, it can carefully be cleaned using window cleaner and a soft tissue.

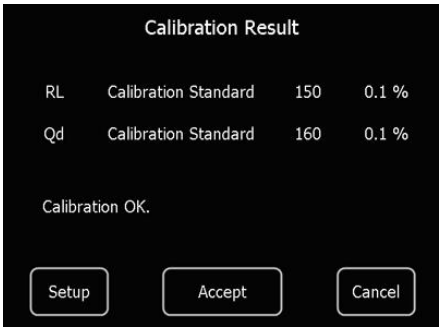
A damaged or a polluted calibration standard may cause incorrect calibration and therefore incorrect measuring results!

## 8.3 Calibration on calibration standard

If the instrument indicates that the calibration is outdated, or if it is required by the applicable regulations, the ZRM 6013+ has to be calibrated.



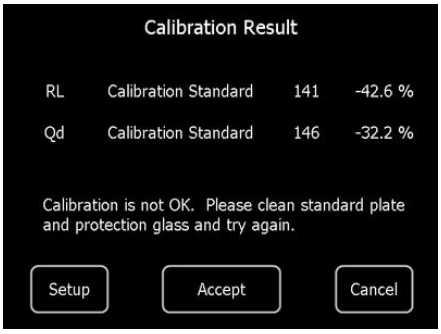
Take care that the ZRM 6013+ is placed correctly on the included calibration standard. Otherwise, the ZRM 6013+ will give you an error message. The instrument has to snap in which is indicated by a click sound.




Press the symbol and Calibrate to open the calibration function. In the standard setting there are listed night visibility RL and day visibility Qd to be calibrated on the calibration standard.

By pressing Calibrate you trigger the calibration. After the calibration you get a message that the calibration was successful or you get a remark of the deviation.

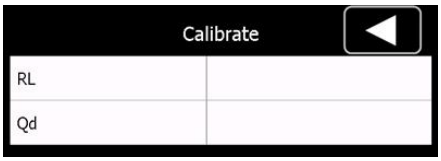
With Accept you confirm the calibration and you get back to the measure mode.



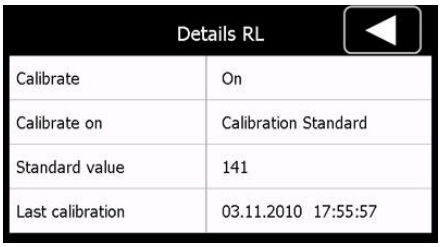

In order to prevent an unintentional calibration to completely wrong values (e.g. if the standard is damaged or soiled or the optic window on the bottom side of the instrument is soiled), the instrument tells you how much the calibration diverges from the nominal value.

If you get suddenly a higher deviation than usual, we recommend rejecting this calibration by pressing Cancel and determinate the cause through e.g. cleaning the calibration standard as described in chapter 8.2 „Cleaning" on page 17 and recalibrate again.

If a deviation higher than 15% occurs repeatedly, a calibration by the manufacturer is most probably needed.




In the standard setting there are listed night visibility RL and day visibility Qd to be calibrated on the calibration standard.
You can have a look at the standard settings if you press in the menu „Calibrate" the button Setup and choose a geometry ($R_L$ or Qd).




If one of the geometries ($R_L$ or Qd) is deactivated, you can activate them by clicking on the line „Calibrate" and choose „On".

Remark:
You can change the calibration interval as described in chapter 14.6.9 on page 59.

## 8.4 Calibration on 2nd calibration standard $R_L$ & Qd

### 8.4.1 General

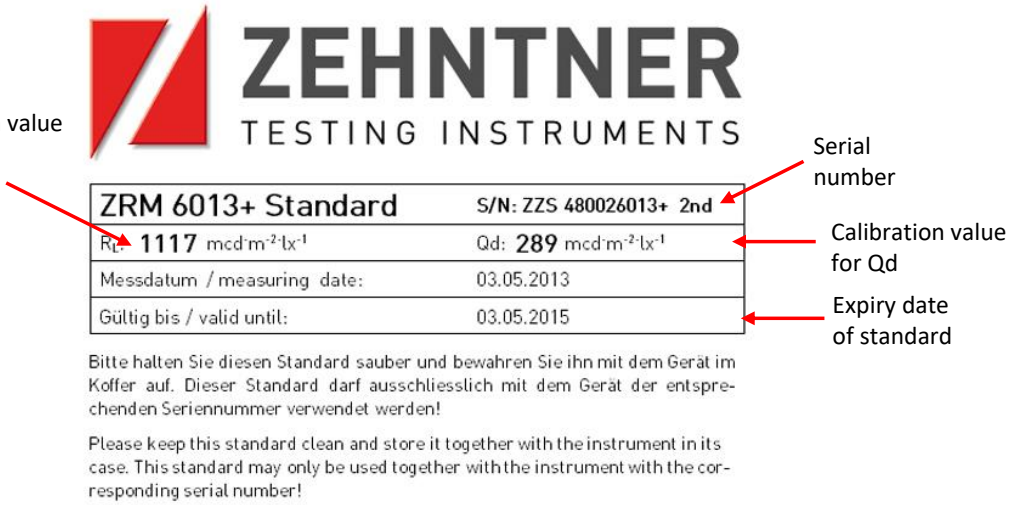
For the optional 2nd calibration standard $R_L$ & Qd we affix a pavement marking tape (road marking foil) on a glass plate and indicate the measuring area. The retroreflection values are measured and certified by Proceq. However, the values of the 2nd calibration standard $R_L$ & Qd may differ because it is more prone to soiling than our regular calibration standard. The 2nd calibration standard $R_L$ & Qd should only be used in special cases for additional checking/controlling.

Front side:


Back side:


Regular calibration should be carried out using the calibration standard which belongs to the instrument (black plate) in accordance with chapter 8.3 “Calibration on calibration standard” on page 18.

Following indications are noted on the label of the:



### 8.4.2 Storage

- Handle the carefully in order to protect the glass beads so they will not get detached.
- The calibration standard has to be protected from dust and soiling.
- Store protected from light without contact on the surface, e.g. in a cupboard.
- Store and use it at a temperature around 23°C and at a relative humidity of less than 60%.

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

### 8.4.3 Cleaning

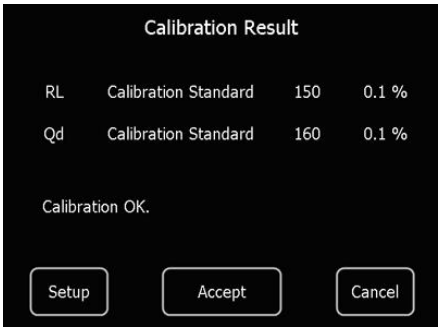
- Cleaning the may change the retroreflection values. Hence you should avoid cleaning by proper handling and storage as mentioned in chapter 8.4.2 “Storage” on page 21.

If you observe deviations on the retroreflection values and you suspect the ACC175 has been soiled, clean it carefully with water and a clean and soft brush and set it to dry at room temperature at around 23°C.

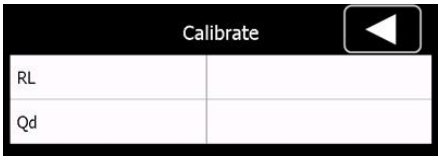
- Do not use any detergents.

### 8.4.4 Carry out the calibration

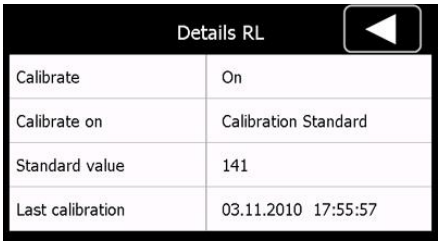
- Before carrying out the calibration always take care that the **ZRM 6013+** was properly positioned.



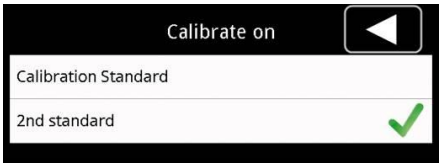

Press the symbol and Calibrate to open the calibration function. In the standard setting there are listed night visibility RL and day visibility Qd to be calibrated on the calibration standard. If you wish to check the **ZRM 6013+**, you need to change the calibration settings. Press in the menu „Calibrate“ the button Setup.



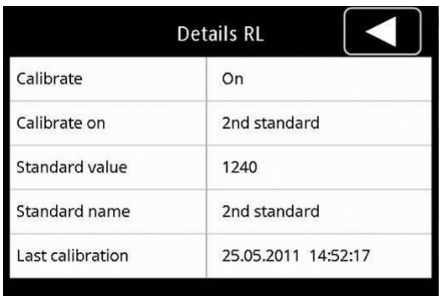

Now choose the $R_L$ geometry.




Press on the line “Calibrate on”.

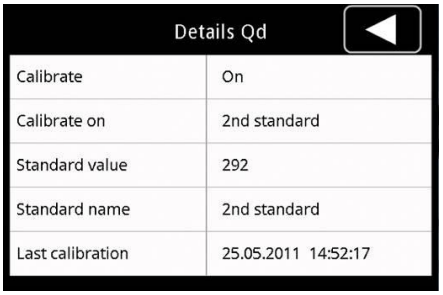



For calibrating you need to choose "2nd standard".



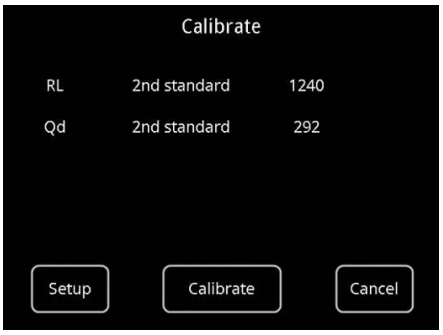

Afterwards you will be shown the information. The standard value needs to be consistent with the retroreflection values mentioned on the label which is on the backside. Adjust the standard value if necessary.

If one of the geometries (RL or Qd) is deactivated, you can activate them by clicking on the line „Calibrate" and choose „On".



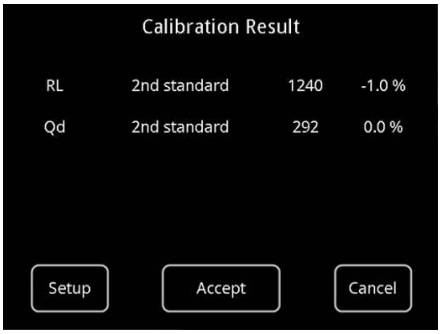

Please check the calibration settings also for the Qd geometry and if necessary change them accordingly.

Afterwards press the backwards arrow  for getting back to the calibration menu.




By pressing 

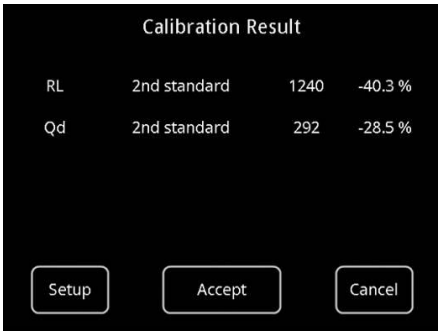
you trigger the calibration.




Depending on the setup settings the deviation of the 2nd standard will be shown or hidden. By pressing  and 

and selecting "Setup" and "Calibration" you can change these settings. With 

you confirm the calibration and you get back to the measure mode.




In order to prevent an unintentional calibration to completely wrong values (e.g. if the standard is damaged or soiled or the optic window on the bottom side of the instrument is soiled), you have the possibility to display the deviation in percent from the nominal value of the 2nd standard. By pressing  and 

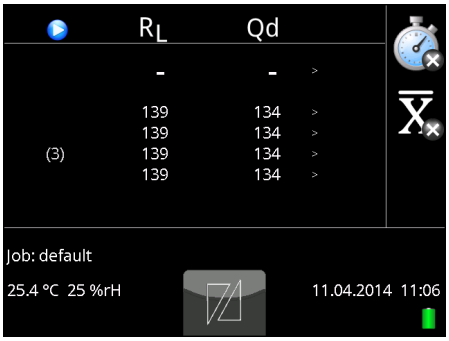
and selecting “Setup” and “Calibration” you can change these settings.


If you get this error message when calibrating, there is something wrong in the calibration setup. Please go back to the beginning of chapter 8.4.4 “Carry out the calibration” on page 21 and start again.

# 9. Measure

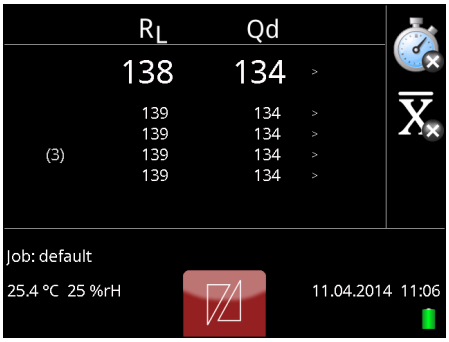
## 9.1 Measure mode

### 9.1.1 Taking single measurements




By pressing the measuring button m the reading is started. During the measuring period which is about 2-3 seconds, you will see „-„ on the top line and the symbol on the top left side.

For the correct positioning of the **ZRM 6013+** on the road marking please refer to chapter 9.2 „Common information for a proper measuring procedure" on page 27 and chapter 9.3 „Special instructions" on page 27.



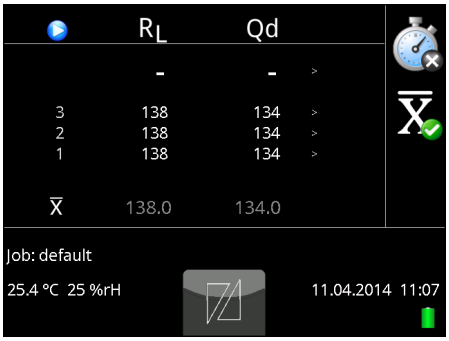

After a successful reading, the measurement values will be shown on the top.

If you take further measurements, the last measurement value is always shown in the second line on the top.

For editing or deleting such a measurement please refer to chapter 9.1.4 „Edit, delete and store measurements" on page 26.

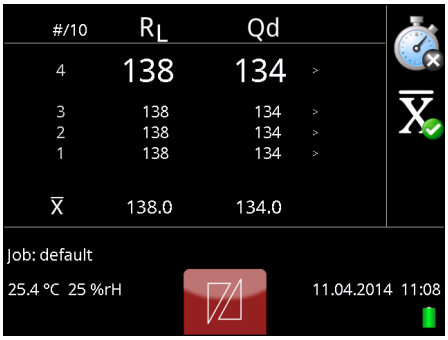
For changing the settings of the measure mode, please refer to chapter 14.3 „Measure mode" as from page 47.

### 9.1.2 Taking average measurements




For activating average reading press on the touchscreen the symbol . If the symbol is shown, the average reading is activated.

By pressing the measuring button m the reading is started. During the measuring period which is about 2-3 seconds, you will see „-„ on the top line and the symbol on the top left side.
For the correct positioning please refer to chapter 9.3 "Special instructions" on page 27 and chapter 9.4 "Obtain exact measuring values" on page 27.




The single values are still displayed. On the left side of the page the measurements are numbered. On the bottom line you see the symbol for the average reading X̄ where you see the current average.

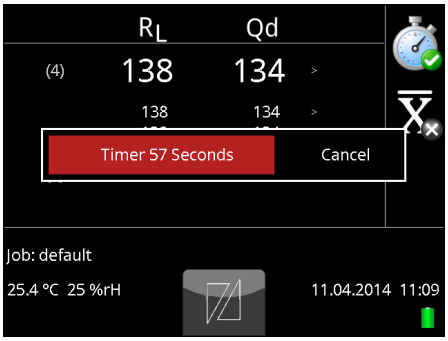
For editing or deleting such a measurement please refer to chapter 9.1.4 „Edit, delete and store measurements” on page 26.

### 9.1.3 Taking wet measurements

The **ZRM 6013+** 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.

Up to now, a stopwatch was needed in order to take a measurement in due time after moistening the road. In the **ZRM 6013+**, the stopwatch is integrated and releases the measurement automatically after the requested time.

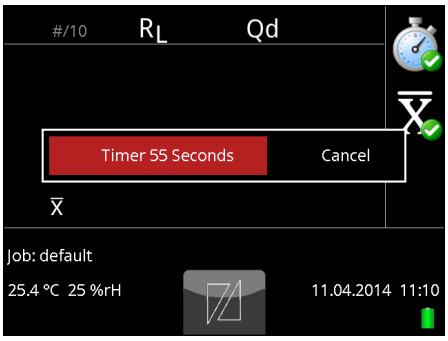
⚠ Never pour water on the instrument. Never dip the **ZRM 6013+** into water! Do not expose the **ZRM 6013+** to the rain!




For activating the wet timer press on the touchscreen on the symbol . If the symbol is shown, the wet timer is activated.

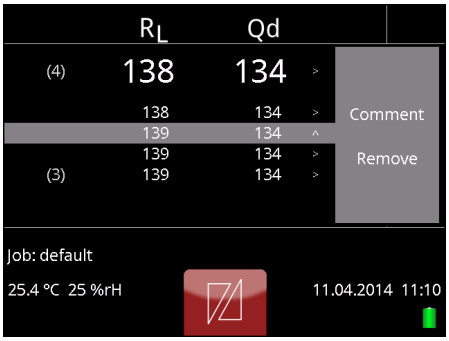
Press the measuring button (m) and you will see the wet timer before the measurement is taken.

For the correct positioning please refer to chapter 9.2 „Common information for a proper measuring procedure” on page 27.

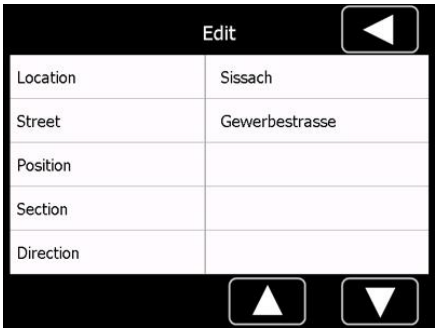



You can also use the function average X̄ together with the wet timer.
Furthermore, you can also combine the interval timer with the wet timer. For further information please refer to chapter14.4.4 “Practical sample combination of wet timer and interval timer” on page 53 .

### 9.1.4 Edit, delete and store measurements




If you wish to e.g. edit a measuring value from the list of the measuring window, you have to press on the specific line and an editing menu beside the list will be opened.
If you wish to delete several measurements at the same time you can do this either in the archive (see chapter 12 “Archive” as from page 40), at “delete jobs” (see chapter 14.5 “Jobs” as from page 55) or using the software “MappingTools” (see separate instruction manual “MappingTools”).

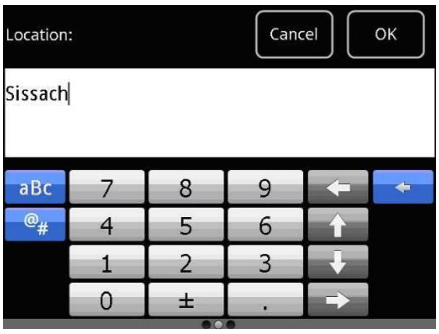



Activate and scroll as described in chapter 7 “Navigation” as from page 16.

Here you are able to add additional information using the touchscreen. The inserted information will be added to all future readings until you edit the additional information again.
You also have the possibility to add the additional information later on in the archive. This is described in chapter 12 “Archive” as from page 40.

For faster editing, it is possible to connect a keyboard on the USB-interface.


Sample of information which can be inserted additionally either directly at the measure mode or in the archive.
For choosing the special signs you keep pressing the button until the respective special sign is shown. For choosing the sign “&” you need to press the button “h” until “&” appears. Alternatively you can press the button 12? for getting the number keyboard or the button @# for getting the special signs keyboard.




Here is the number keyboard activated. For getting back to the standard keyboard, press the button aBc. If you wish to get the special signs keyboard, you need to press the button @#.


Here is the special signs keyboard activated. For getting back to the standard keyboard, press the button aBc. If you wish to get number keyboard, you need to press the button 12?.

## 9.2 Common information for a proper measuring procedure

The **ZRM 6013+** should be placed on the road marking as even as possible. Put the **ZRM 6013+** with a slight pressure forwards onto the sample or marking to be measured. For height differences (profiles) from -1 mm up to 5 mm, the given measuring geometry is warranted. Bigger height differences may lead to wrong measuring results.

## 9.3 Special instructions

### 9.3.1 Profiled markings from 5 mm up to 12 mm

The **ZRM 6013+** 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. This instruction is available at Proceq or at an authorized Proceq-agent.

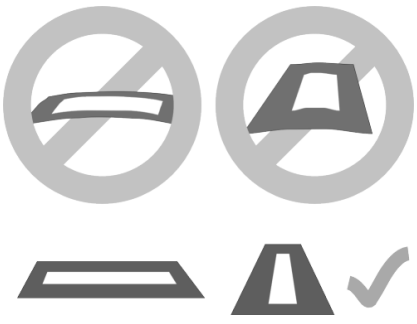
### 9.3.2 Local regulations

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.

## 9.4 Obtain exact measuring values

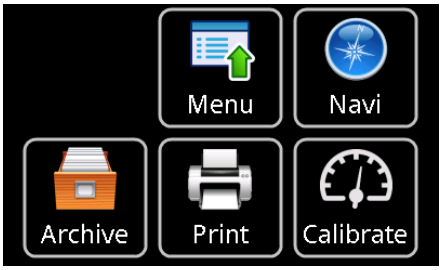
Observe that the marking you want to measure is as flat as possible along in the whole range of the measuring instrument. Otherwise the measuring geometry would be adulterated. Crooked or twisted samples will cause incorrect measuring results. For unevenness up to 5 mm, the given measuring geometry is warranted.

The procedure for measurement in the laboratory is the same. Observe likewise that the samples are absolutely flat. The length of the samples should be at least 500 mm in order to guarantee that the instrument stands on all 3 feet.



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

# 10. Quickstart menu




By pressing the button  you get to the quickstart menu.

## 10.1 Menu

Press the button  and  to get into the menu where you can set different settings. The menu is explained in chapter 14 „Menu“ as from page 46.

## 10.2 Navi

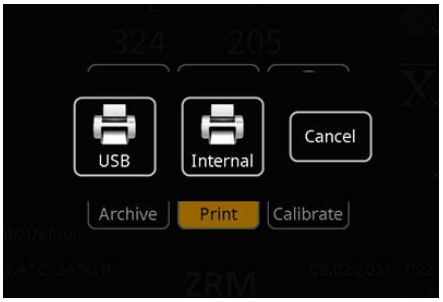

This is an option at extra cost. Therefore this icon will only be shown if the WAAS GPS-unit has been purchased.

Press the button  and  so that you get some information about the current positioning of **ZRM 6013+**. Further information is available in chapter 11.1 “WAAS GPS-unit” as from page 30.

## 10.3 Archive

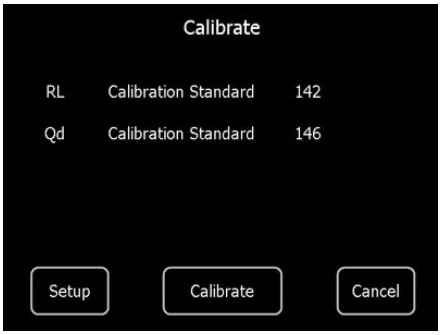
All stored files are located in the archive. By  and  you open the archive (memory). There you are able to edit, delete, export to USB flash drive as well as to print out. For further information please refer to chapter 12 „Archive“ as from page 40.

## 10.4 Print




By pressing the button  and  you have the possibility to print out either the last measurement or a specific measurement earlier marked in the measure mode display using the optional built-in thermal printer or an USB-printer such as our optional portable printer. Without marking the last measurement will be printed. The default setting which information is included in the measuring report can be changed in the menu as described in chapter 14.6.8 “Printer” on page 58.

## 10.5 Calibrate

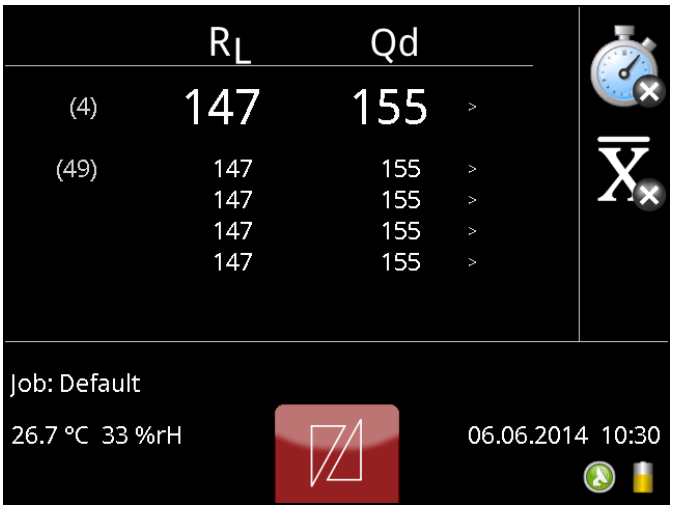



Press the symbol and to open the calibration function. In the standard setting there are listed night visibility RL and day visibility Qd to be calibrated on the calibration standard. By pressing Calibrate you trigger the calibration. After the calibration you get a message that the calibration was successful or you get a remark of the deviation. With Accept you confirm the calibration and you get back to the measure mode.

# 11. Options

## 11.1 WAAS GPS-unit

The **ZRM 6013+** offers the possibility to store the GPS coordinates of a measurement.
If the **ZRM 6013+** is switched on and is equipped with WAAS GPS-unit, there will be a GPS status indication besides the battery status indication.




**GPS status indication on the display:**

| | | |
|---|---|---|
| | 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 signal is fine. |
| | Intense GPS Signal | The WAAS GPS-unit is receiving the positioning signal. The signal quality is very good. |

The quality of the GPS Signal basically indicates how many satellites are used to determine the position of the **ZRM 6013+**. Better signal quality means more precision of the coordinates.

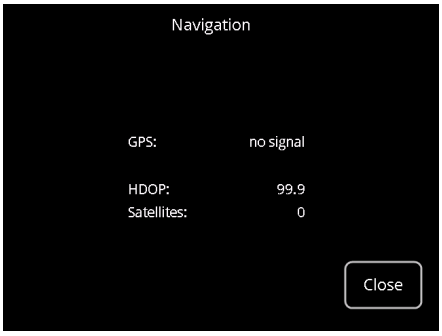
The GPS status indication is related to the HDOP (Horizontal Dilution of Precision).

| 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. |


By pressing  and 

you can see the GPS coordinates.

If you take now a measurement, the GPS coordinates will also be stored in the archive.




The WAAS GPS-unit is not able to receive a positioning signal. The coordinates cannot be displayed.

In this case, no GPS coordinates will be stored at the measurement.

After switching on the **ZRM 6013+**, 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

## 11.2 Bluetooth®-interface for data transfer to a PC

### 11.2.1 Description

The **ZRM 6013+** offers the possibility of transferring data to a Bluetooth® enabled PC/laptop within seconds.

For transferring data the OBEX (Object Exchange) protocol is used. The following functions are provided:

- Navigation through the folders
- Upload or download files or folders
- Delete files or folders
- Move files or folders
- Create folders

To use the Bluetooth® functionality your PC/laptop must be equipped with the Bluetooth® hardware and the corresponding driver software must be installed and activated. The standard Bluetooth® for Windows® software is the WIDCOMM Bluetooth® software. The driver software for Windows 8 / Windows 7 / Windows Vista or Windows XP can be updated under the following link: http://www.broadcom.com/support/bluetooth/update.php.

Before updating the WIDCOMM Bluetooth® software please check whether you have different Bluetooth® software installed on your PC/laptop. If you are not able to get a connection following the procedure below, it might be necessary to replace that Bluetooth® software with the WIDCOMM Bluetooth® software.

Only one device can connect to the **ZRM 6013+** at one time.

The transfer rate and the transfer distance depend on the Bluetooth® hardware and the environmental conditions.

The Bluetooth® graphical user interface depends on the software type and the operating system. In the description below we used the Bluetooth® settings of Windows 7. When using a different operating system the actual procedure might vary.

### 11.2.2 Establishing connection

Transferring files from the **ZRM 6013+** to a PC/laptop over a Bluetooth® connection consists of two steps:

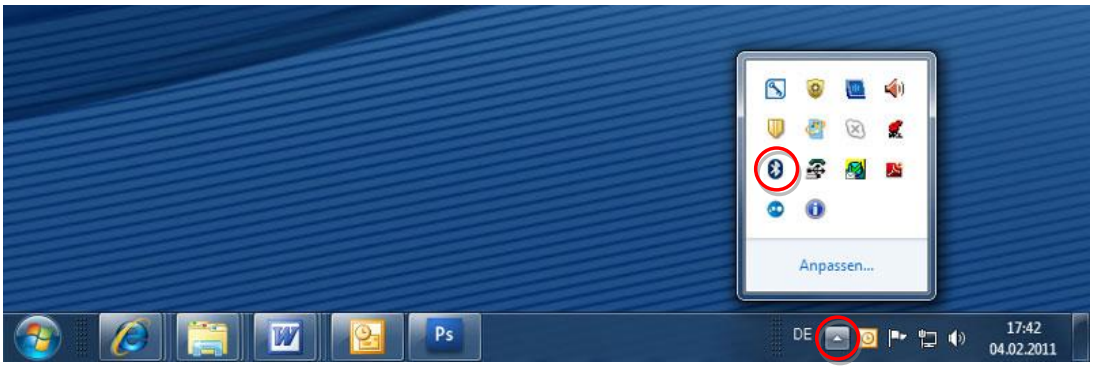
- Initial setup of the Bluetooth® devices as described in chapter 11.2.2.1 on page 33
- File transfer as described in chapter 11.2.2.2 on page 38

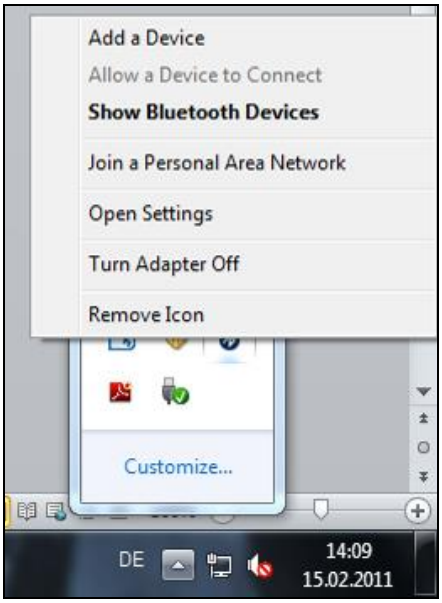
### 11.2.2.1 Initial setup of the Bluetooth® devices

In order to establish a connection over Bluetooth® between the **ZRM 6013+** and a PC/laptop, both devices have to be set up properly. This initial setup has to be made only once for each device.

The device which you want to connect via Bluetooth® to the **ZRM 6013+** must be visible, otherwise it won't be detected by the **ZRM 6013+**.The Bluetooth® settings are accessible through the Bluetooth® icon in the Windows taskbar.

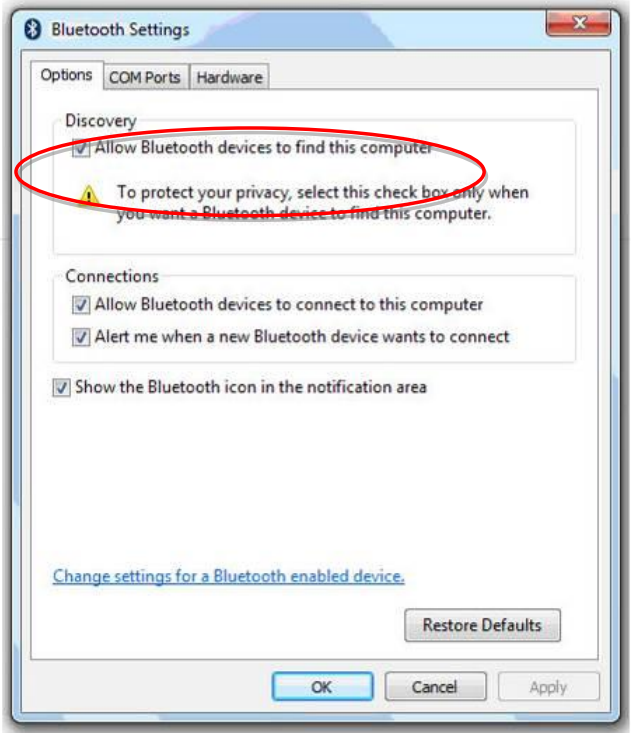

If that is not the case, check the extended taskbar.

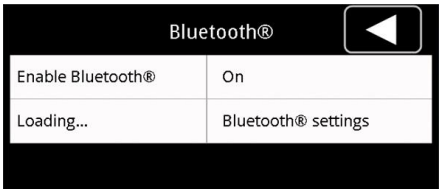



Do a right mouse click on the Bluetooth® icon and open the "Open Settings" dialog.

Make your device visible checking “Allow Bluetooth devices to find this computer”.

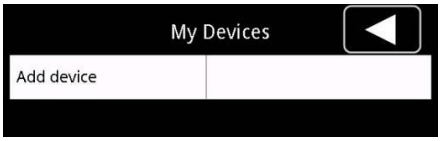


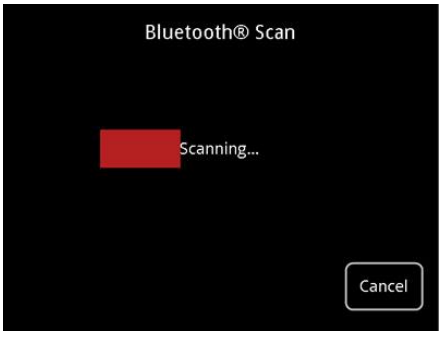

The **ZRM 6013+** starts loading the Bluetooth® settings.

It might be necessary to reload the screen using the backwards arrow and selecting “Bluetooth®”.

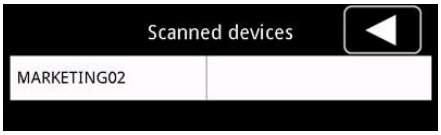

Click on “My Devices”.



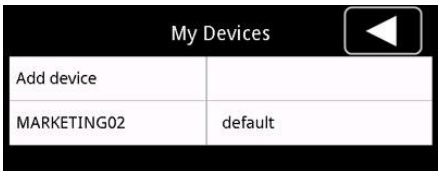

Click on “Add device”.




**ZRM 6013+** starts scanning for Bluetooth® devices.



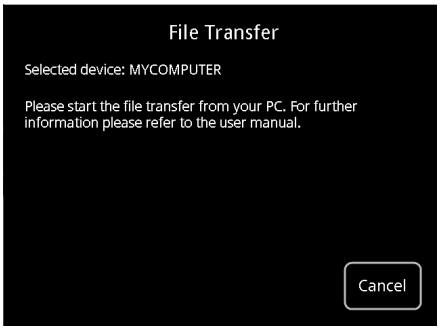

Visible Bluetooth® devices within reach of the **ZRM 6013+** are displayed. Select the desired device by pressing on its name.




By selecting a device it will be set automatically as the default device and will be registered with the pin 1234.
This pairing process will only have to be carried out once as long as the paired device is not removed from “My devices”.

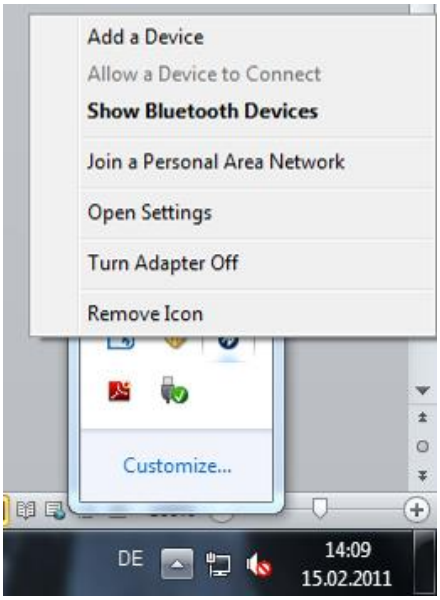
Press the backwards arrow 


Press “File Transfer”.

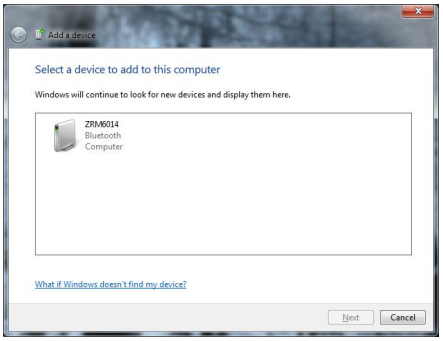



Now the **ZRM 6013+** is ready for connecting to your Bluetooth® device.

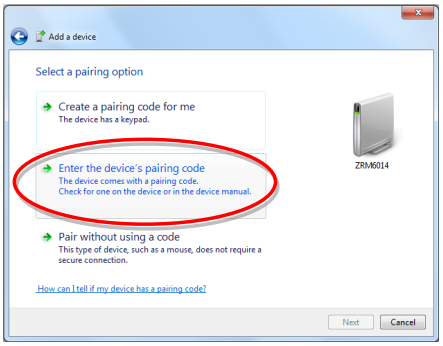
Do not close this window until you have enabled the file transfer service (Obex) as described below.



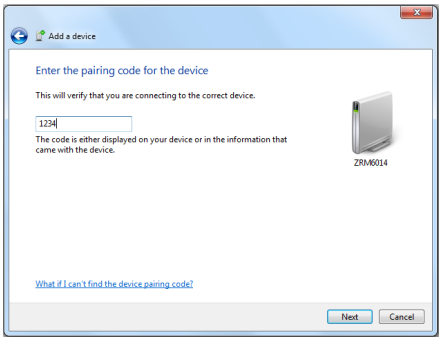

Do a right click on the Bluetooth® icon  in the Windows taskbar and open the “Add a Device” dialog.



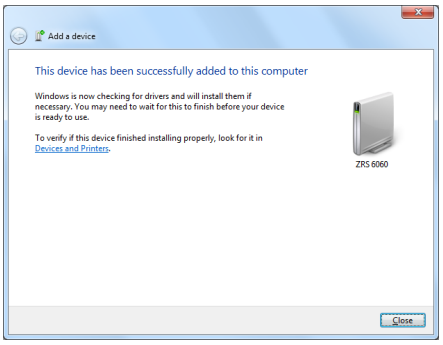

Choose the device “**ZRM 6013+**” and press “Next”.



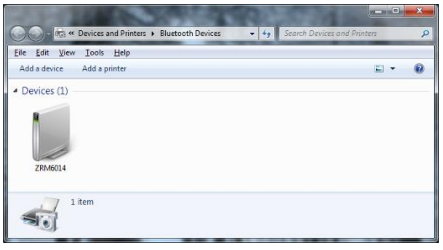

Choose “Enter the device’s pairing code” and press “Next”.




Enter the pin code **1234** and press “Next”.

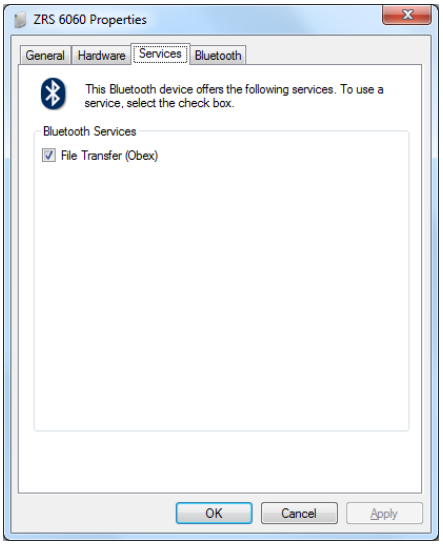



This message indicates a successful pairing of the **ZRM 6013+**” with the PC/laptop.




Make sure that the File Transfer Service (Obex) is activated.

Right click on the Bluetooth® icon in the Windows taskbar of your device (PC/laptop) and choose “Show Bluetooth Devices”. Do a right click and open “Properties”.




Go to the “Services” tab and check “File Transfer (Obex)”. Click “Apply” to save the changes, and then close the window.

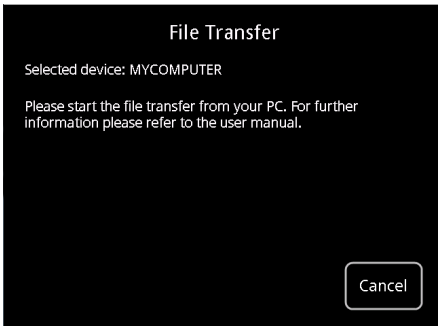
In case the “File Transfer (Obex)” service is not available, you have to install the WIDCOMM Bluetooth® software as described earlier in this chapter.

### 11.2.2.2 File transfer

This chapter describes how to proceed for establishing a Bluetooth® connection to the PC/laptop after the initial setup as described in chapter 11.2.2.1 on page 33 has been carried out. Do not proceed without prior initial setup.

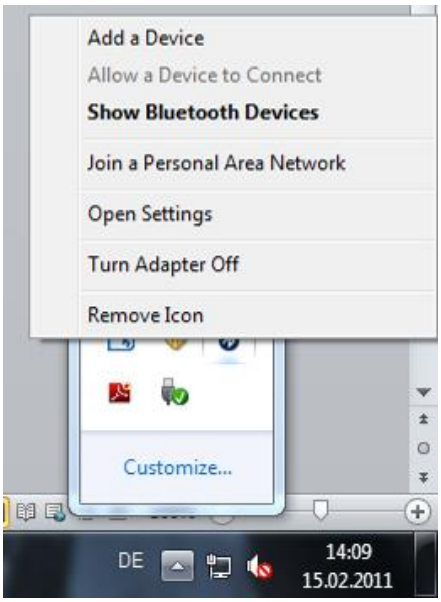

Prepare the **ZRM 6013+** for file transfer by pressing  and 

and selecting “Setup” and “Bluetooth®“ and “File Transfer”.

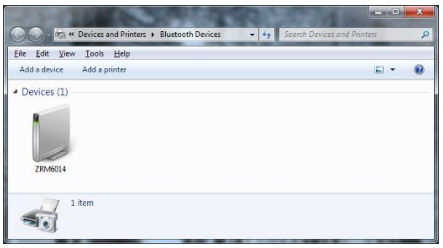



Now the **ZRM 6013+** is ready for file transfer. Use your PC/laptop as described below to upload / download files.

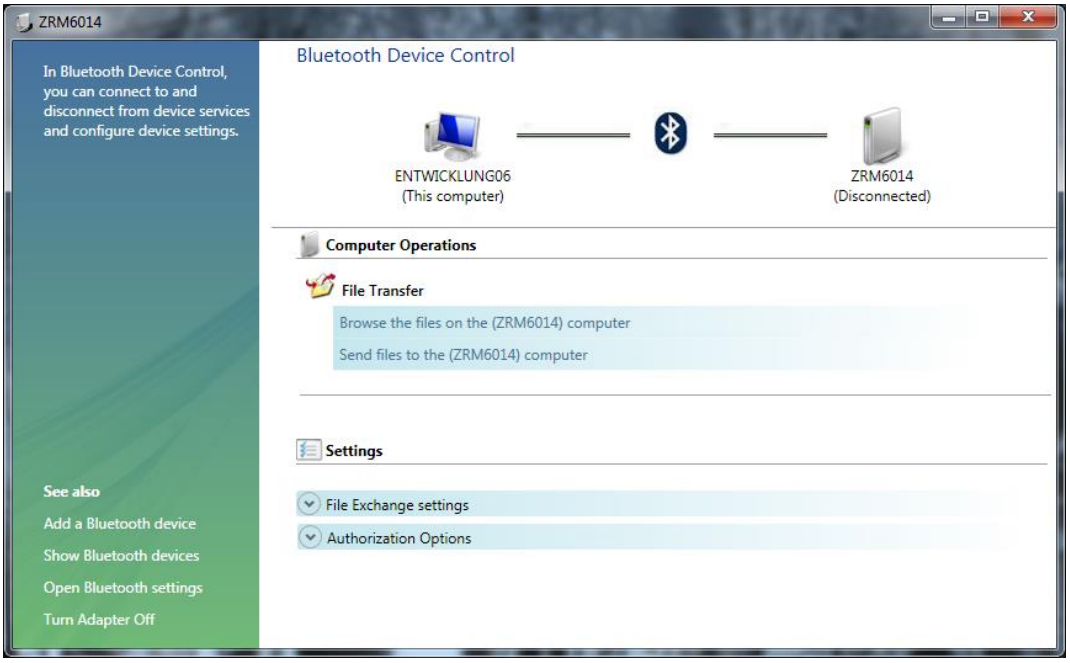
Do not close this window until you have finished transferring files.




Do a right click on the Bluetooth® icon  in the Windows taskbar and open the “Show Bluetooth Devices” dialog.




Open the “Bluetooth® Device Control” by double clicking on the device “**ZRM 6013+**”.




Click on “Browse the files on the (**ZRM 6013+**) computer”. The **ZRM 6013+** is displayed like a USB-flash drive, and all common file and folder operations (move / delete / copy) are available. You might have to press “F5” to refresh the display.
An error occurs if the connection cannot be established, see chapter 17.7 “Bluetooth® error message “The connection could not be completed” on page 66.

## 11.3 Built-in thermal printer

The **ZRM 6013+** offers the possibility to print out a measuring report using the optional built-in thermal printer.

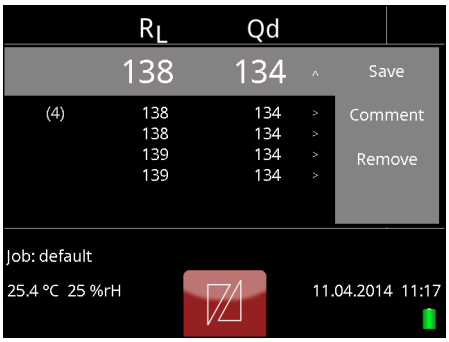
### 11.3.1 Replacing the thermo paper roll

For replacing the thermo 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 ACC154 into the thermo 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 ACC227 is ready for use.

# 12. Archive

All stored files are located in the archive. By  and  you open the archive (memory).




In case measurements are not stored automatically, the settings have been changed. This is described in chapter 14.3.2 „Auto save measurements” on page 48. Not stored measurements can be stored individually by choosing in the measure mode a single measurement and choose „Save”.

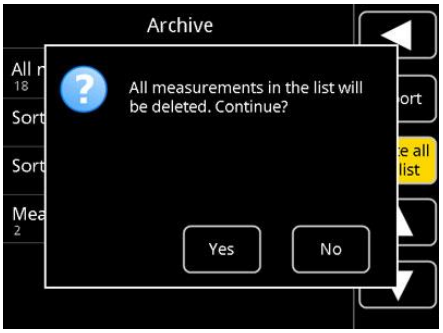
## 12.1 Sorting of the measurements


Here the measurements can be sorted using the following criteria:

- By date (grouped by date)
- By job (grouped by job)
- Last measurement
- All measurements (sorted by date and time, the last measurement is on the top)

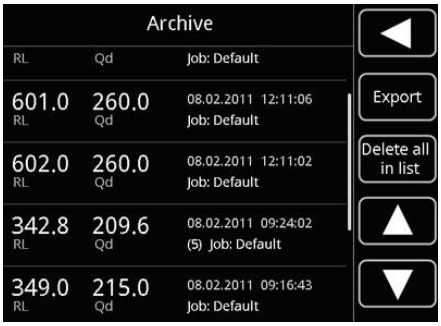
If the last measurement was a single measurement, it is listed under “Last measurement”.

Press the corresponding line for showing the desired list.




The deletion of the archive cannot be undone. All data are lost irrevocably. Only delete an archive if you no longer need the data. It is recommended carrying out a back-up copy on your PC/laptop or on a USB-flash drive. If you really wish to delete the complete archive, you need to confirm this message.

## 12.2 Overview measurements (sorted)

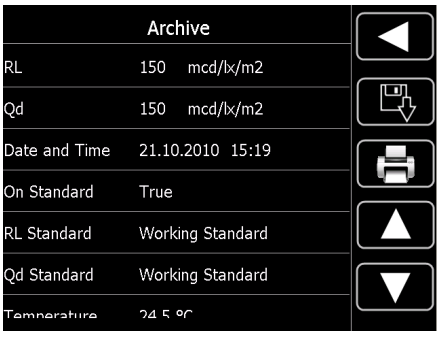



In the first column you see the $R_L$-values and in the second column the Qd-values. In the third column there are listed the date, time, the number of single measurements e.g. (5) at average measurements as well as the job. Press on a desired line for getting some additional information to the entry.

You get a list of all measurements stored under the job “Default” if you have chosen at the sorting of measurements “by job” and afterwards the job “Default”. If you press in this selection the button “Delete all in list” then every single measurement stored under the job “Default” will be deleted at once. It is recommended carrying out a back-up copy on your PC/laptop or on a USB-flash drive.


Here you are able to delete this single entry or opening the quick entry information by pressing the button “More”.

## 12.3 Detailed entry information

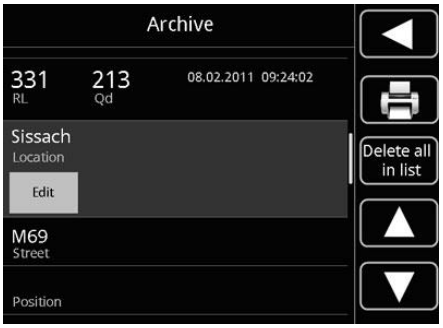



At a measurement entry you will find firstly the measuring values, the date/time and on which standard the instrument has been calibrated for this measurement or series of measurement respectively.

Furthermore, you have different additional information such as temperature and humidity. If the instrument is equipped with the optional GPS, the GPS coordinates will be shown as well.

“On Standard: True” means that the measurement has been made on the calibration standard. Such a measurement must not be used for the evaluation of a road marking.

## 12.4 Input of additional information

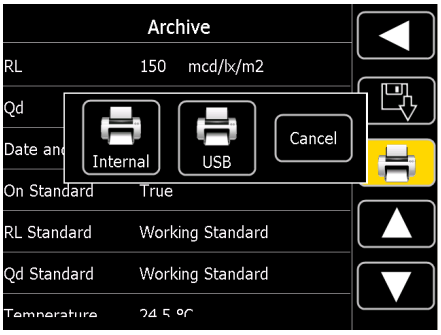



Further below this list, you can add or change additional information to the measurement entry such as Location, Street and so on.

For changing the Location, press this line and afterwards the icon „Edit“ for opening the edit window.

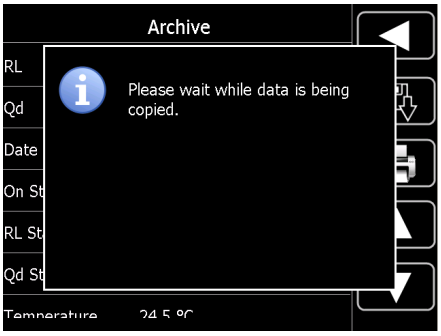

For choosing the special signs you keep pressing the button until the respective special sign is shown. For choosing the sign “&” you need to press the button “h” until “&” appears. Alternatively you can press the button 12? for getting the number keyboard or the button @# for getting the special signs keyboard.

## 12.5 Printing of a measuring report




By pressing the symbol  you are opening the window for selecting a printer. Here you can either choose the optional built-in thermal printer or an external printer connected to the USB-interface. By pressing the desired printer the measuring report will be printed out.
For choosing the information to be printed on the measuring report, please refer to chapter 14.6.8 ”Printer” on page 58.

## 12.6 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 message beside will be shown during copying. The exported measurements can be opened on a computer/laptop using the mapping software “MappingTools”. The Use of MappingTools is described in the separate instruction manual.

# 13. Data export and MappingTools software

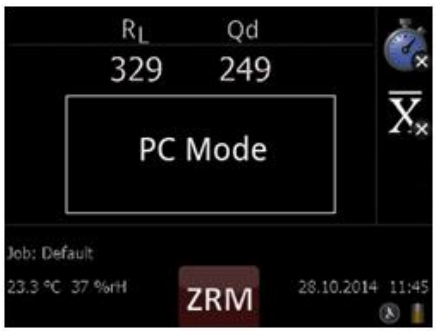
## 13.1 Interfaces

The **ZRM 6013+** is equipped for data export with the following interfaces:

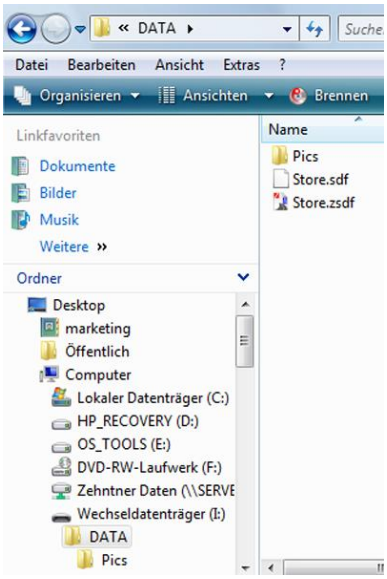

Host USB-interface (type A) for external units such as USB-stick and keyboard.

Client USB-interface (type B mini) for connection to a PC.

## 13.2 PC Mode




Connect the **ZRM 6013+** with a USB-cable to a computer. The message „PC Mode" should appear on the touchscreen of the **ZRM 6013+**.




After the software has been recognised the Windows explorer might look as shown on the left side. You are able to make a back-up copy (the files Store.sdf, Store.zsdf and the folder Pics) on your local hard disk.

You are able to open the measuring archive on the **ZRM 6013+** using our free mapping software „MappingTools".

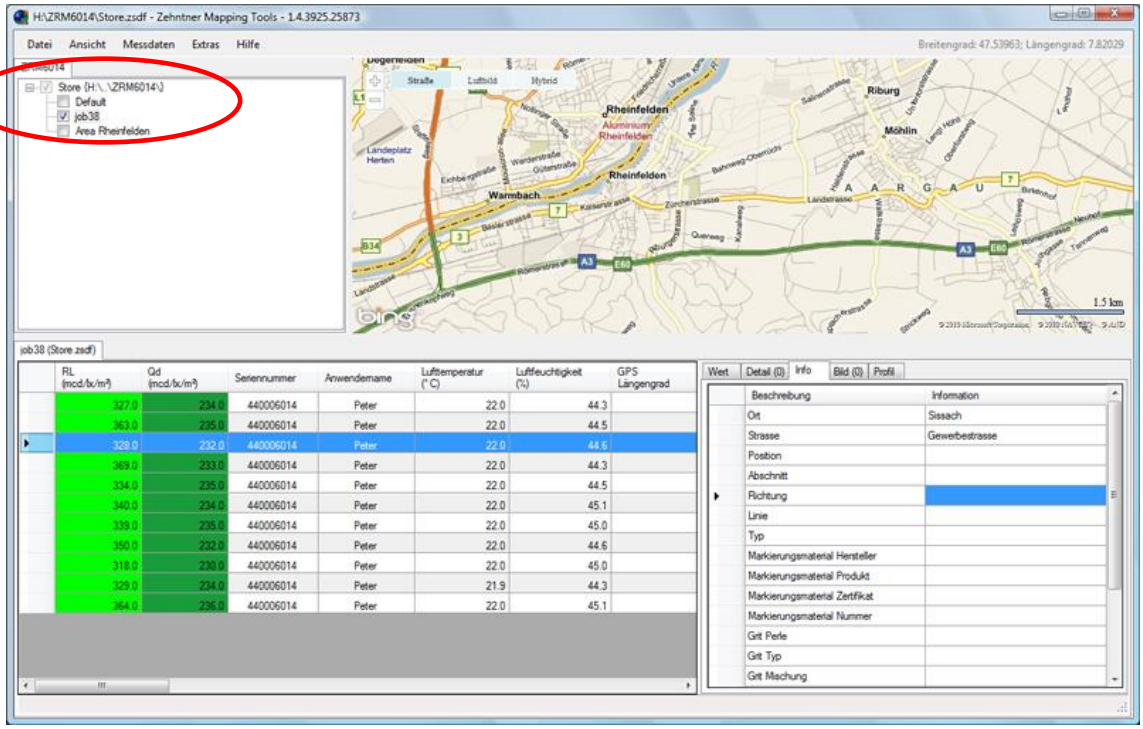
## 13.3 Storing the measuring data on a USB flash drive

An alternative to using a PC connection would be to store the archive on a USB-stick as described in chapter 12.6 „Storing the measuring data on a USB flash drive” on page 42.

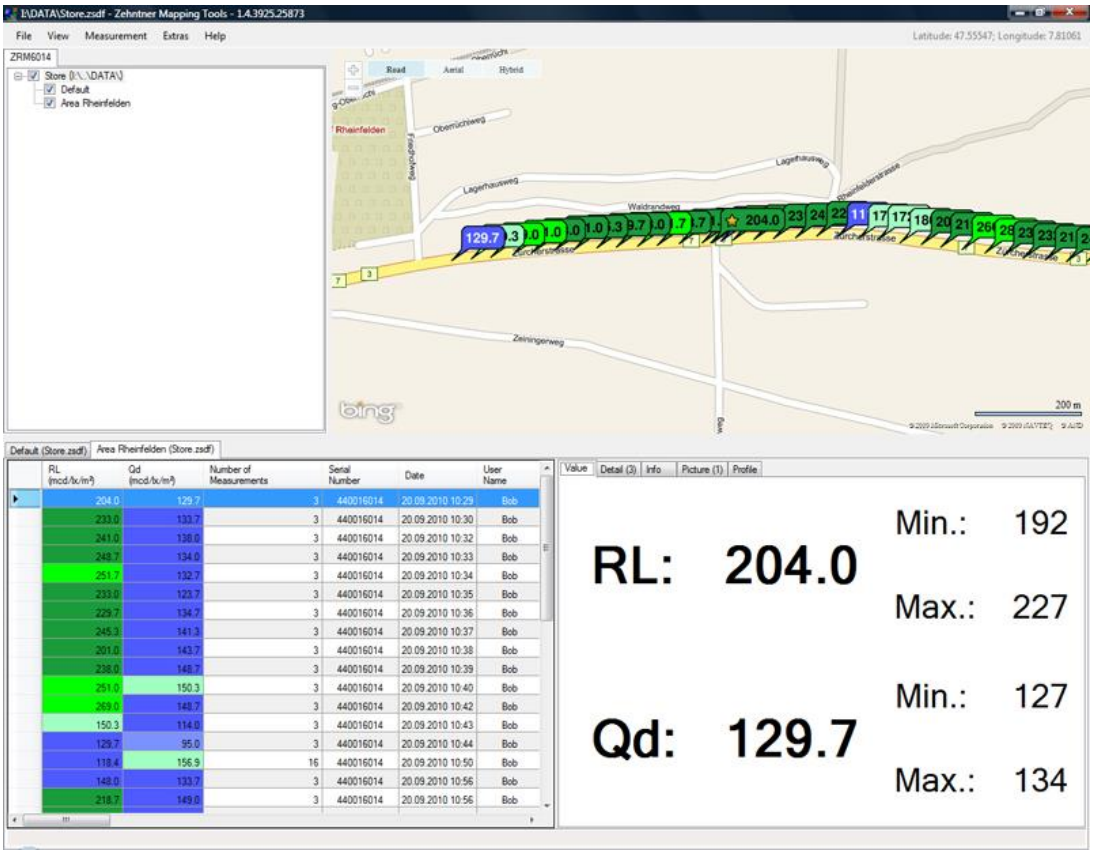
## 13.4 Evaluation and mapping software „MappingTools“

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

After opening you need to tick the archive so that they will be displayed 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 6013+** 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.




## 13.5 Data export to Microsoft Excel

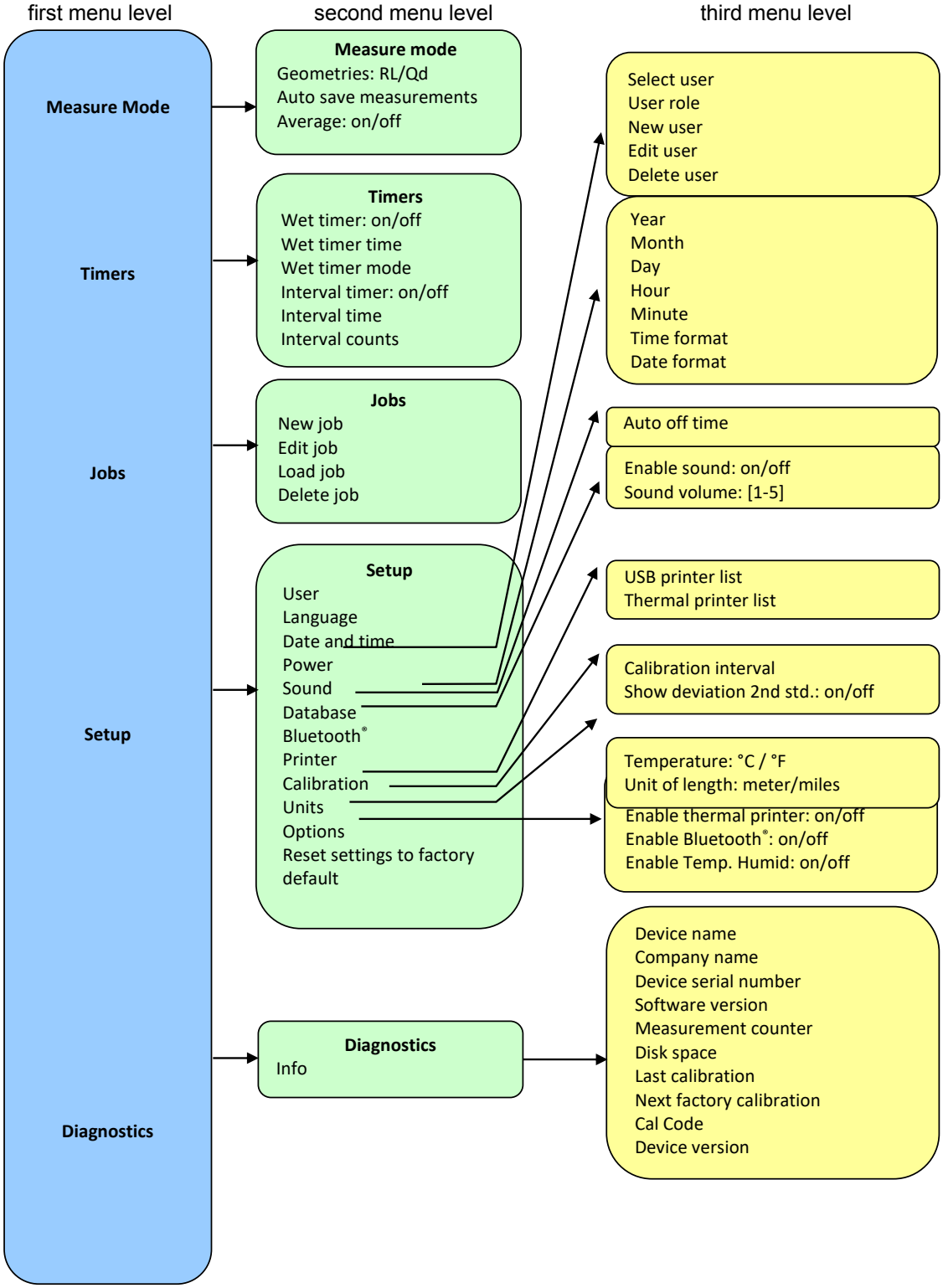
After opening the measuring data using the „MappingTools“ you are able to export them to Microsoft Excel. This is described in the separate instruction manual „MappingTools“. An Excel-Measuring report may look as follows:

| | |
|---|---|
| Job Name: | Default |
| Device Name: | **ZRM 6013+** |
| Serial Number: | 480006013+ |

| Date | Number of Measurements | RL (mcd/lx/m²) | Qd (mcd/lx/m²) | Location | Serial Number |
|---|---|---|---|---|---|
| 04.03.2014 10:17 | 1 | 92 | 259 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 93 | 259 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 95 | 258 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 97 | 258 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 99 | 257 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 101 | 257 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 103 | 256 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 105 | 256 | Sissach | 480006013+ |

# 14. Menu

## 14.1 Menu structure

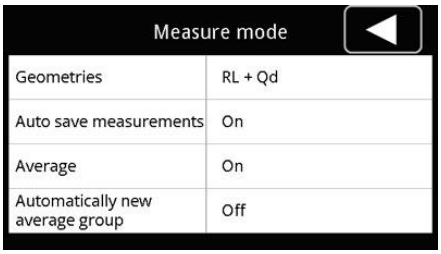


## 14.2 Navigation in the menu


Press the button and to get into the menu where you can set different settings. Activate, deactivate, scroll and exit the menu as described in chapter 7 “Navigation” on page 16. On the top of each window you can read in which menu you are.

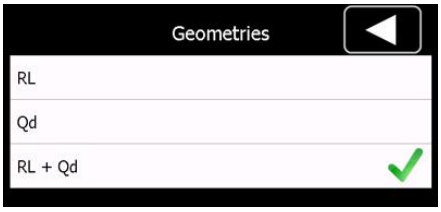
## 14.3 Measure mode

By and and selecting “Measure mode” you are able to change the measurement settings.




### 14.3.1 Geometries

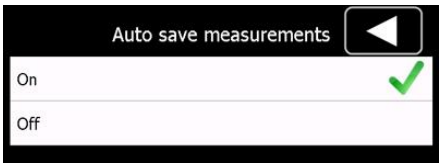
Path: -> and selecting “Measure mode”




The default setting is “$R_L$ + Qd”. We recommend choosing this setting so you will always have the complete information.
If you decide to choose e.g. $R_L$ for faster single measurements you need to remember to change back to the setting “$R_L$ +Qd” as soon as you need also the Qd values.

### 14.3.2 Auto save measurements

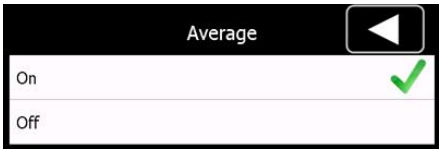
Path:  ->  and selecting “Measure mode”




The default settings are set that every measurement is stored in the archive (memory).

### 14.3.3 Average

Path:  ->  and selecting “Measure mode”




Here you can activate average readings.
A faster way would be to press on the touchscreen the symbol  . If the symbol  is shown, the average reading is activated.

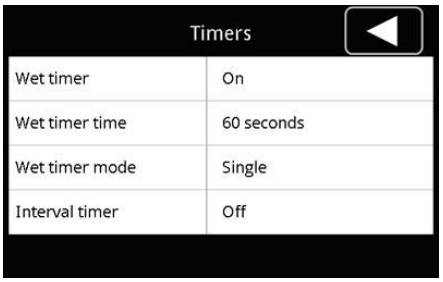
## 14.4 Timers

### 14.4.1 Wet timer

Path:  ->  and selecting “Timers”



The **ZRM 6013+** is equipped with a wet timer so that the measurement will be taken right after the desired time after the road marking has been moistened. Here you can activate the wet timer.
A faster way would be to press on the touchscreen the symbol  . If the symbol  is shown, the wet timer is activated.



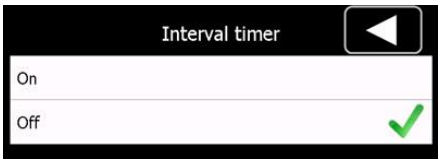

If the wet timer is activated, you can see the current setting for the wet timer time and wet timer mode. For changing these settings, you need to press on the respective line.


The backwards counting wet timer can be set between 2 and 1'000 seconds.

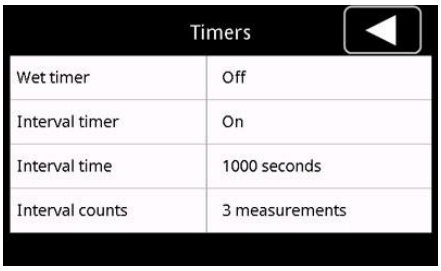

In the mode "Single" the wet timer will be deactivated after each measurement. This is shown after the measurement on the display in the measure mode by the icon .
In the mode "Continuous" the wet timer will remain activated also after a measurement has been taken. This is shown in the display in the measure mode by the icon .

### 14.4.2 Interval timer

Path: -> and selecting "Timers"

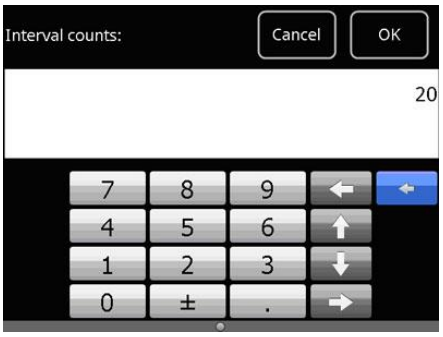




Here you can activate the interval mode. By this continuous measurements will be taken. The interval timer can be used e.g. to define the performance of the retroreflection of a marking in dependence on the effluent water at wet measurements. The measurements will be taken continuously until the indicated number of interval counts has been reached.

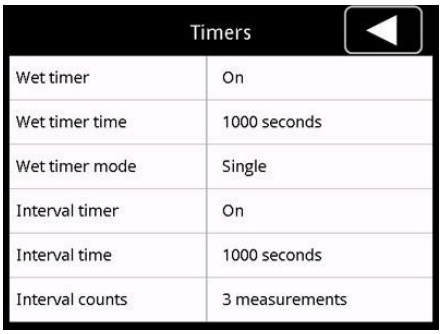



If the interval timer is activated, you can see the current setting for the interval time and interval counts. For changing these settings, you need to press the respective line.


Here you can set the interval time between 5 and 1’000 seconds.




Here you can set the interval counts between 2 and 500.




If both timers are activated, all current timer settings are shown.

### 14.4.3 Practical sample of interval timer

The interval timer can be used e.g. to define the performance of the retroreflection of a marking in dependence on the effluent water at wet measurements. 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 chapter 14.4.4 „Practical sample combination of wet timer and interval timer" on page 53.

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:

**Interval timer: activated**
The interval timer has been activated as mentioned in chapter 14.4 „Timers" on page 48.

**Interval time: 5 seconds**
The interval time has been set at 5 seconds as described in chapter 14.4.2 „Interval timer" on page 49.

**Interval counts: 12**
The interval counts has been set at 12 as described in chapter 14.4.2 „Interval timer" on page 49.

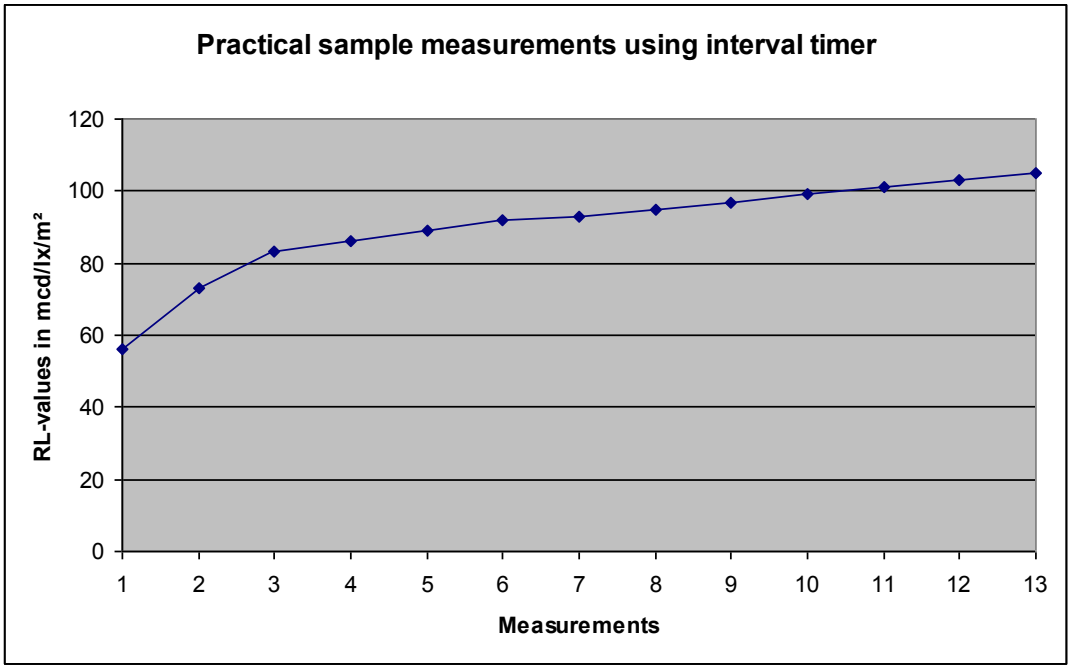
After carrying out the measurements we exported the measuring data to Microsoft Excel using the software „MappingTools". For doing so the measuring data needed to be stored before on an USB flash drive as described in chapter 12.6 „Storing the measuring data on a USB flash drive" on page 42 or you get direct access to the **ZRM 6013+** using the USB-interface as described in chapter 13 „Data export and MappingTools software" on page 43.

Sample Excel-report exported using MappingTools:

| | |
|---|---|
| Job Name: | Default |
| Device Name: | **ZRM 6013+** |
| Serial Number: | 480006013+ |

| Date | Number of Measurements | RL (mcd/lx/m²) | Qd (mcd/lx/m²) | Location | Serial Number |
|---|---|---|---|---|---|
| 04.03.2014 10:17 | 1 | 56 | 256 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 73 | 260 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 83 | 260 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 86 | 260 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 89 | 259 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 92 | 259 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 93 | 259 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 95 | 258 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 97 | 258 | Sissach | 480006013+ |
| 04.03.2014 10:17 | 1 | 99 | 257 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 101 | 257 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 103 | 256 | Sissach | 480006013+ |
| 04.03.2014 10:18 | 1 | 105 | 256 | Sissach | 480006013+ |

Using this table, you are able to create a diagram for showing the $R_L$ performance:




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 the road marking and start interval timer by pressing the measuring button at: 04.03.2014 10:17 | 0 | 1 | 56 |
| 04.03.2014 10:17 | 5 | 2 | 73 |
| 04.03.2014 10:17 | 10 | 3 | 83 |
| 04.03.2014 10:17 | 15 | 4 | 86 |
| 04.03.2014 10:17 | 20 | 5 | 89 |
| 04.03.2014 10:17 | 25 | 6 | 92 |
| 04.03.2014 10:17 | 30 | 7 | 93 |
| 04.03.2014 10:17 | 35 | 8 | 95 |
| 04.03.2014 10:17 | 40 | 9 | 97 |
| 04.03.2014 10:17 | 45 | 10 | 99 |
| 04.03.2014 10:18 | 50 | 11 | 101 |
| 04.03.2014 10:18 | 55 | 12 | 103 |
| 04.03.2014 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.

### 14.4.4 Practical sample combination of wet timer and interval timer

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

The following drawing shows the effect of the settings below:

**Wet timer: activated**
The wet timer has been activated as mentioned in chapter 14.4 „*Timers*" on page 48.

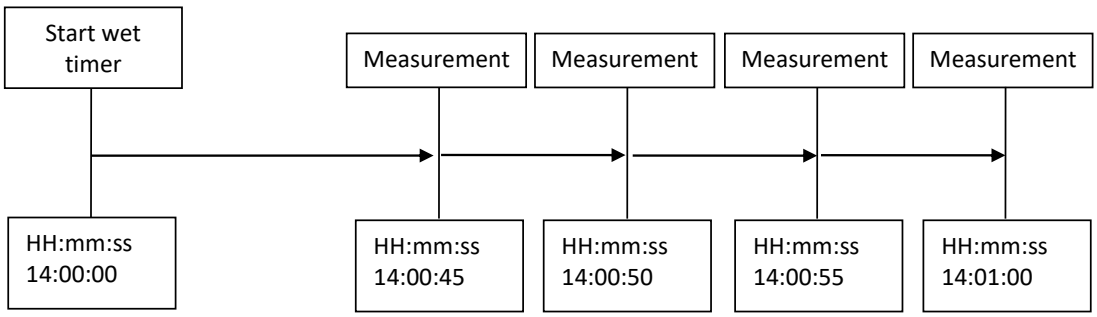
**Wet timer time: 45 seconds:**
The wet time has been set at 45 seconds as described in chapter 14.4.1 „Wet timer" on page 48.

**Interval timer: activated**
The interval timer has been activated as mentioned in chapter 14.4 „*Timers*" on page 48.

**Interval time: 5 seconds**
The interval time has been set at 5 seconds as described in chapter 14.4.2 „Interval timer" on page 49.

**Interval counts: 4**
The interval counts has been set at 4 as described in chapter 14.4.2 „Interval timer" on page 49.

After the setting, press the measuring button m and the following procedure will start:



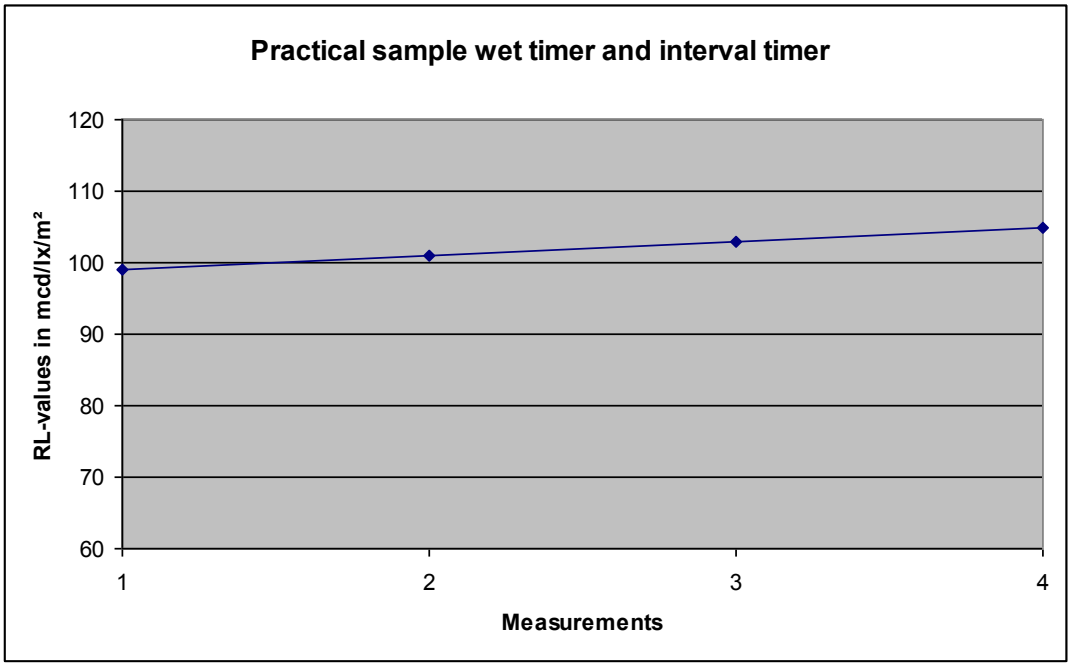

The first measurement will be carried out by the wet timer. Afterwards the set number of interval counts will be carried out. So in this sample there will be altogether 4 measurements.

The measurements can be shown on your computer using the free software „MappingTools". For this you need either to store the measuring data on an USB flash drive as described in chapter 12.6 „Storing the measuring data on a USB flash drive" on page 42 or open the measuring data directly on the **ZRM 6013+** as described in chapter 13 „Data export and MappingTools software" on page 43.

Excel Measuring report exported using MappingTools:

| | |
|---|---|
| Job Name: | Default |
| Device Name: | **ZRM 6013+** |
| Serial Number: | 480006013+ |

| Date | Number of Measurements | RL (mcd/lx/m²) | Qd (mcd/lx/m²) | Location | Serial Number |
|---|---|---|---|---|---|
| 04.03.2014 14:00 | 1 | 99 | 257 | Sissach | 480006013+ |
| 04.03.2014 14.00 | 1 | 101 | 257 | Sissach | 480006013+ |
| 04.03.2014 14.00 | 1 | 103 | 256 | Sissach | 480006013+ |
| 04.03.2014 14.01 | 1 | 105 | 256 | Sissach | 480006013+ |



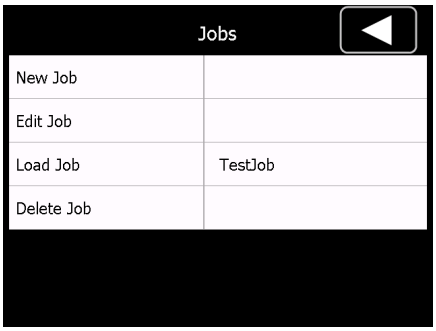

For the interpretation of the above measuring data, we give you the following explanation:

| Date | Seconds after start | Measurement No. | RL (mcd/lx/m²) |
|---|---|---|---|
| Moistening of road marking and start wet timer by pressing the measuring button | 0 | | |
| 04.03.2014 14.00 | 45 | 1 | 99 |
| 04.03.2014 14.00 | 50 | 2 | 101 |
| 04.03.2014 14.00 | 55 | 3 | 103 |
| 04.03.2014 14.01 | 60 | 4 | 105 |

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

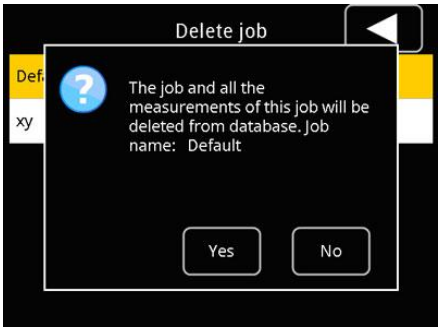
## 14.5 Jobs

Path:  ->  and selecting “Jobs”




The **ZRM 6013+** 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 product “xy” and so on.


If you do not change anything in this menu, the job “default” will be indicated in the measure mode.

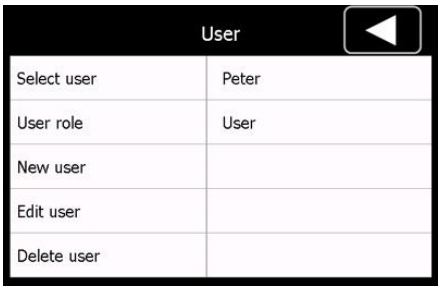



For deleting a job you need to press the line “Delete Job”, choose the job you wish to delete and confirm the delete message.

## 14.6 Setup

### 14.6.1 User

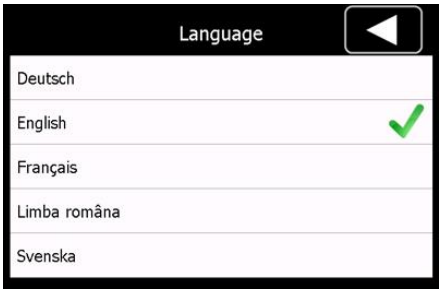
Path:  ->  and selecting “Setup”




To add 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 on the bottom of the measuring report which can be printed. If you change any setting at a certain user this will be stored automatically at the user profile.
E.g. if you have chosen the user profile „Jim” and you now set the sound to volume „3” and the language “French” then these settings will be stored in the user profile. Then you have another employee “James” who prefers the sound volume at 4 and the language “English”. If you switch now between these two users, all stored information will change accordingly.

### 14.6.2 Language

Path:  ->  and selecting “Setup”




Here you are able to choose your desired language.

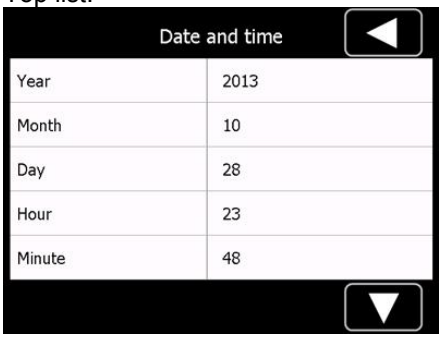
The current language is marked with ✓.

If you want to contribute and translate a new language or if you have some comments on an existing language, please feel free to contact Proceq.

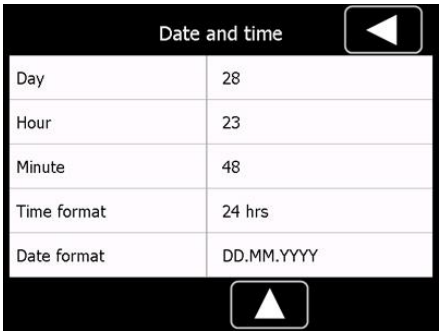
### 14.6.3 Date and time

Path:  ->  and selecting “Setup”

Top list:




Bottom list:

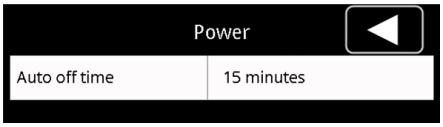



**Error! Reference source not found.**

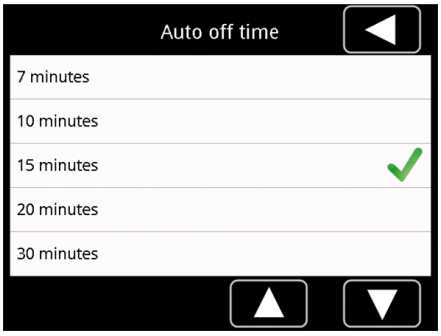
Here you are able to set date and time.

### 14.6.4 Power

Path:  ->  and selecting “Setup”




Here you are able to set the “Auto off time” for saving power and increasing the battery time.




If there is no action the instrument will shut off once the “Auto off time” has been reached.

You can choose between given “Auto off time” from “2 minutes” up to “120 minutes”.

You can switch off the instrument also by pressing the on/off button shortly.

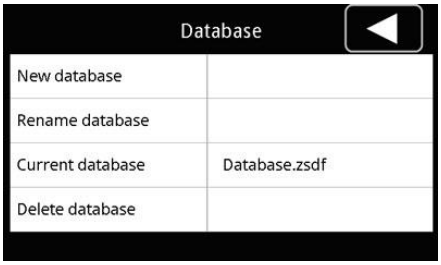
### 14.6.5 Sound

Path: -> and selecting “Setup”


At “Enable sound” you are able to activate or deactivate the sound which will be played after a measurement.
At “Sound volume” you are able to set the volume from 1 to 5.

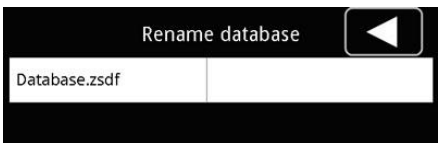
### 14.6.6 Database

Path: -> and selecting “Setup”

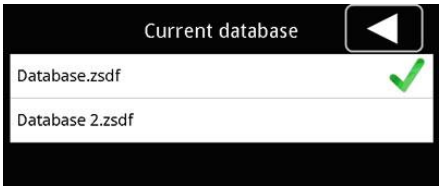



Here you are able to choose your desired database, rename a database and delete a database which is no longer used. Sometimes it is helpful to store all measurements for a specific project in a new database.

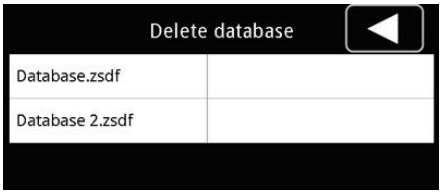

If creating a new database it is recommended choosing a meaningful name.



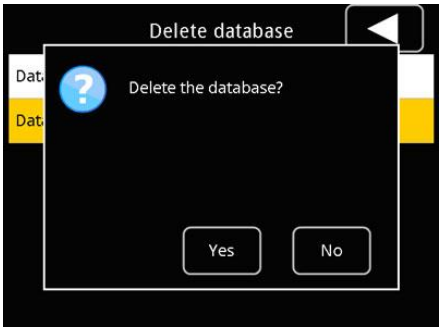

Here you have the possibility to rename an existing database.




The current database in use is marked with ✓.



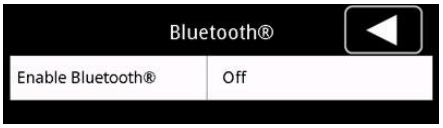

If deleting a database, please always make sure that you select a database which is no longer used. It might be reasonable having a backup on a computer or USB flash drive.




If you are sure that you have selected the correct database, you need to confirm this message for finishing the delete job.

### 14.6.7 Bluetooth®-Interface

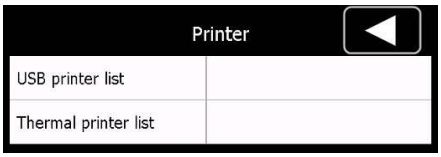
Path:  ->  and selecting “Setup”



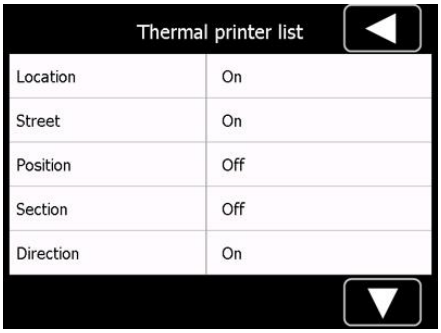

The Bluetooth® functionality is described in chapter 11.2 “Bluetooth®-interface for data transfer to a PC” as from page 32.

### 14.6.8 Printer

Path:  ->  and selecting “Setup”



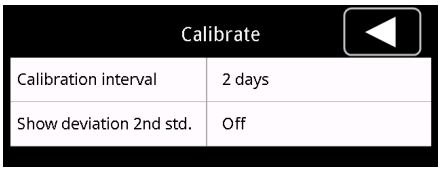

In this menu you can set which information should be included in the test report if printed by a “USB printer” or if printed by the optional built-in thermal printer.



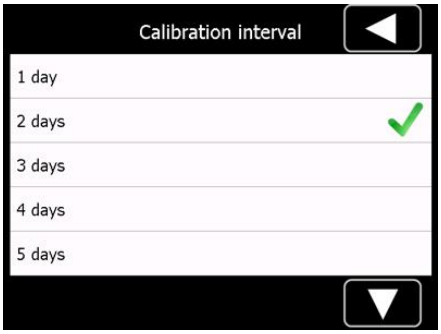

At both lists you are able to have the following information:
Location, Street, Position, Section, Direction, Line, Type, Remarks, Producer, Product, Manufacture-no, Certificate, Glass beads, Type, Mixture, Batch no, Supplier, Product, Type, Batch no

### 14.6.9 Calibration

Path:  ->  and selecting “Setup”



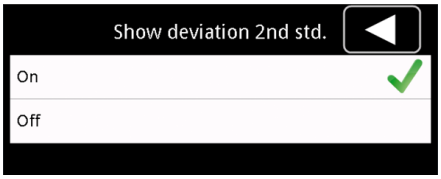

In this menu you can set some general calibration settings.




The **ZRM 6013+** will remind you after the calibration interval that the calibration of the instrument is due.

By pressing  and  and selecting “Setup” and “Calibration” you are able to set the calibration interval between 1 day and 49 days.

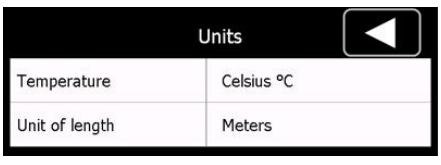
The current calibration interval is shown by a green tick  .



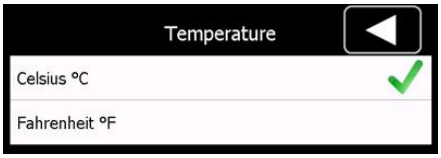

By pressing  and  and selecting “Setup” and “Calibration” you can either show the deviation of the 2nd standard or leave it hidden. The current setting is shown by a green tick  .

### 14.6.10 Units

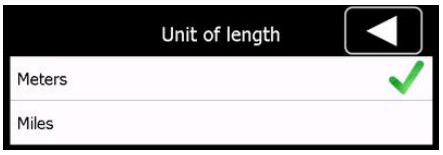
Path:  ->  and selecting “Setup”




By pressing  and  and selecting “Setup” and “Units” you are able to choose the units of temperature and the unit of length.



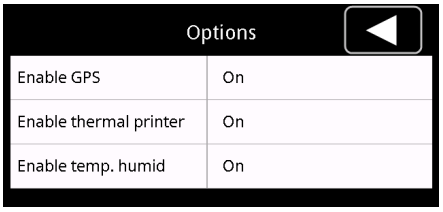

The current unit of temperature is indicated by  .




The current unit of length is indicated by ✓.

### 14.6.11 Options

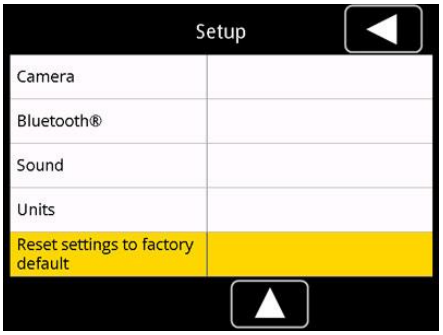
Path:  ->  and selecting “Setup”



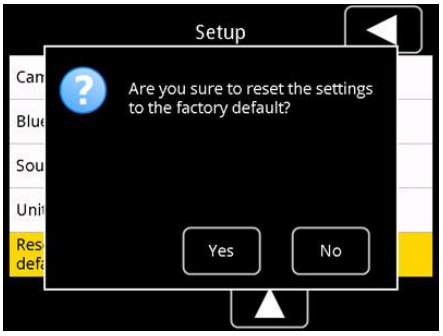

In this menu you are able to activate or deactivate additional functions. These settings are stored in the user profile.

### 14.6.12 Reset settings to factory default

Path:  ->  and selecting “Setup”




Here you have the possibility to reset the **ZRM 6013+** to the factory settings.




The reset to the factory default cannot be done. If you are sure that you wish to carry out the reset to the factory default you need to confirm this message.

## 14.7 Diagnostics

Path:  ->  and selecting “Setup”

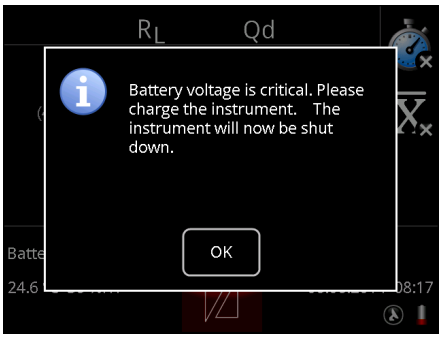
The following information can be seen at diagnostics:

- Device name
- Last calibration
- Device version
- Device serial number
- Software version
- Disk space
- Measurement counter

# 15. Built-in battery and charging

## 15.1 Battery

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




In order to prevent a damage of the battery, the instrument switches automatically off before the battery is completely empty. The **ZRM 6013+** announces this by displaying the symbol of an empty battery and an error message.

If there is no action the instrument will shut off once the “Auto off time” has been reached.
In order to preserve the battery you have the possibility to set the “auto off time”. Please refer to chapter 14.6.4 “Power” on page 56.

## 15.2 Battery status indication on the display

Battery is empty. The instrument switches automatically off.

Battery is soon empty. The instrument should be charged.

approx. 50%

approx. 80%

100% battery is full

Instrument is connected with the battery charger
-> the charging status is shown on the battery charger.

## 15.3 Charging


To charge the battery, plug in the charger plug on the **ZRM 6013+** and connect the charger to a wall socket (100 - 240 V, 50 - 60 Hz).

The special plug on the battery cable has a reverse polarity protection. The **ZRM 6013+** can be turned off or on while charging.

The battery charger may be connected to the **ZRM 6013+** also after finishing the charging cycle as long as it is still connected to a wall socket. For disconnecting the charger press the “push button” on the port for battery charger.

### 15.3.1 Charging status indication / charging cycle

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

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

- Always charge the battery with the charger supplied!
- If possible, the battery should always be charged completely which is shown with the green charging status indication light.
- The battery may only be replaced by Proceq or by an authorized Proceq-agent!
- If you have not used your **ZRM 6013+** during several months, the battery should be charged before using.

# 16. Maintenance

## 16.1 Maintenance carried out by the user

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

- Charging as described in chapter 15 “Built-in battery and charging” on page 62
- Calibration as described in chapter 8 on page 17
- Cleaning as described in chapter 16.2 on page 64
- Replacing the thermo paper roll as described in chapter 11.3.1 on page 39 (if your instrument is equipped with the optional built-in thermal printer)

All other maintenance and repair operations may only be done by Proceq or your authorized Proceq-agent, otherwise all warranty expires.

Make sure that the **ZRM 6013+** is turned off and unplugged from battery charger before maintenance except for charging.

The instrument consists of delicate optic and electronic precision parts. Do not drop it and protect it from shocks, moisture and dust. Please store the instrument including its accessories in the transportation carrying case.

## 16.2 Cleaning

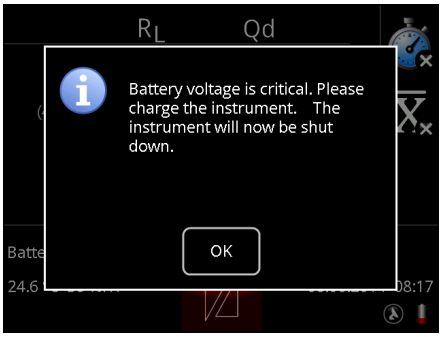
We recommend that the instrument is checked and certified by Proceq once a year. Otherwise clean the instrument periodically using water- and oil-free compressed air (max. 1.5 to 2 bar), or wipe the exit window on the bottom of the optics housing with a soft brush.

The exit window is coated with a special anti reflection 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 **must 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.

# 17. Status and error messages

## 17.1 Status message „Battery voltage is critical”

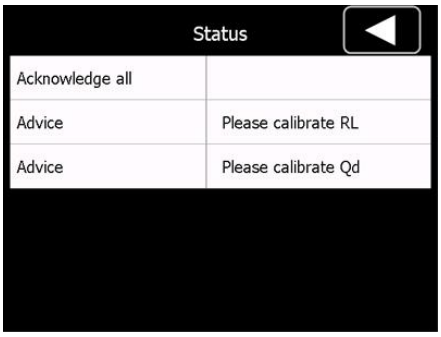



In order to prevent a damage of the battery, the instrument switches automatically off before the battery is completely empty. The ZRM 6013+ announces this by displaying the symbol of an empty battery and an error message.

- Charge battery as described in chapter 15 “Built-in battery and charging” on page 62.

## 17.2 Status message „Please calibrate RL“


If you press the warning triangle, you will get a more detailed explanation.



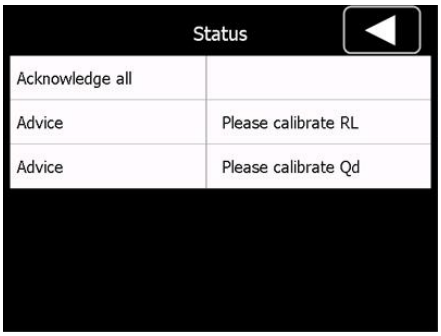

For solving this status message, you should carry out a calibration as described in chapter 8 “Calibrate” as from page 17.

If you are sure that it is not necessary to carry out a calibration, you can press “Acknowledge all” and the status message will disappear.

You can change the calibration interval as described in chapter 14.6.9 on page 59.

## 17.3 Status message „Please calibrate Qd“


If you press the warning triangle, you will get a more detailed explanation.

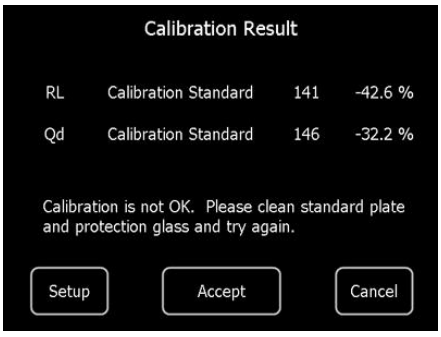



For solving this status message, you should carry out a calibration as described in chapter 8 “Calibrate” as from page 17.

If you are sure that it is not necessary to carry out a calibration, you can press “Acknowledge all” and the status message will disappear.

You can change the calibration interval as described in chapter 14.6.9 on page 59.

## 17.4 Error message „Calibration is not OK.”



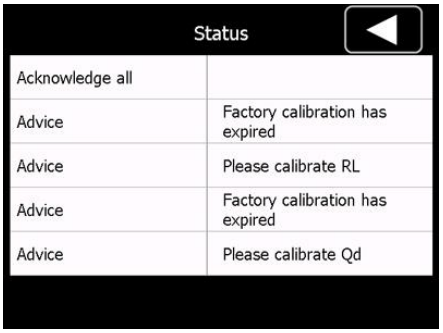

In order to prevent an unintentional calibration to completely wrong values (e.g. if the standard is damaged or soiled or the optic window on the bottom side of the instrument is soiled), the instrument tells you how much the calibration diverges from the nominal value.

If you get suddenly a higher deviation than usual, we recommend rejecting this calibration by pressing Cancel and determinate the cause through e.g. cleaning the calibration standard as described in chapter 8.2 „Cleaning” on page 17 and recalibrate again.

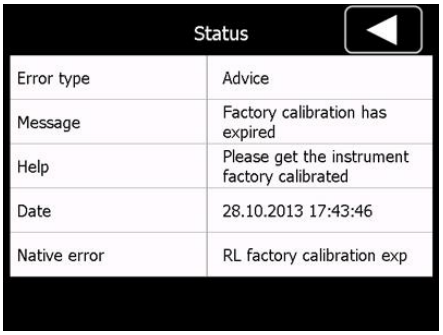
If a deviation higher than 15% occurs repeatedly, a calibration by the manufacturer is most probably needed.

## 17.5 Error message „Factory calibration has expired.


If you press the warning triangle, you will get a more detailed explanation.




If you press the advice “Factory calibration has expired” you will get again a more detailed explanation.




The instrument has been calibrated in the factory 2 years ago or even more time 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.

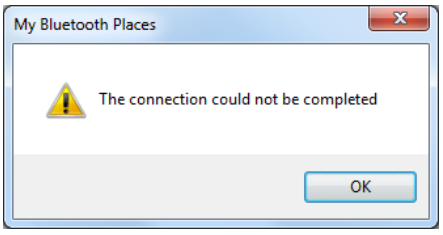
## 17.6 Bluetooth® error message “No new devices found”


If you get this error message you need to press Cancel and check the following points:

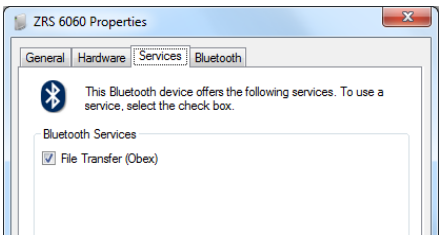
- Make sure that Bluetooth® are allowed to find your PC/Laptop as described in chapter 11.2.1 “Description” on page 32.
- Make sure that Bluetooth® is enabled on your PC/laptop.

For further information please also refer to chapter 11.2.2 “Establishing connection” as from page 32.

## 17.7 Bluetooth® error message “The connection could not be completed”




An error message will occur on your PC/laptop if the connection cannot be established. In this case check if the Obex service is activated on your PC/laptop. Right click on the Bluetooth® icon on the toolbar of your device (PC/laptop) and choose “Show Bluetooth Devices” and the tab “Services” and check “File Transfer (Obex)”.




In case it is already activated, it might help to remove the **ZRM 6013+** at the device control of your PC/laptop. Then remove your PC/laptop in the “my devices” window of your **ZRM 6013+** and start again with the initial setup described in chapter 11.2.2 “Establishing connection” on page 32.

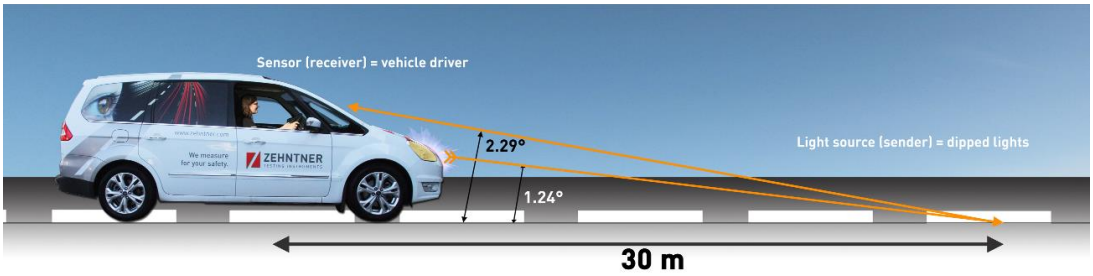
## 17.8 Reset of ZRM 6013+

If the firmware of the **ZRM 6013+** has a hang-up, you can reset the instrument by pressing the on/off button ⏻ for at least 8 seconds.

# 18. Graphical illustration of the measuring principles

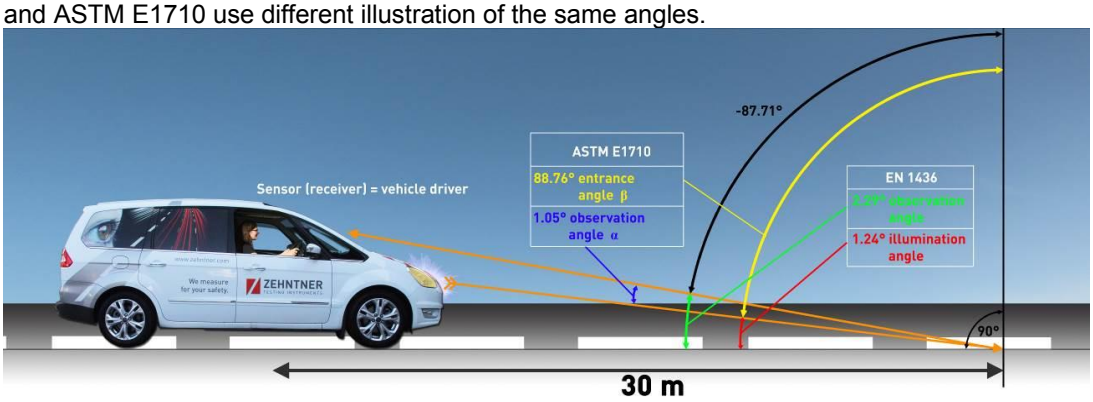
## 18.1 Night visibility $R_L$

RL is the coefficient of retroreflected luminance (night visibility) of 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°.



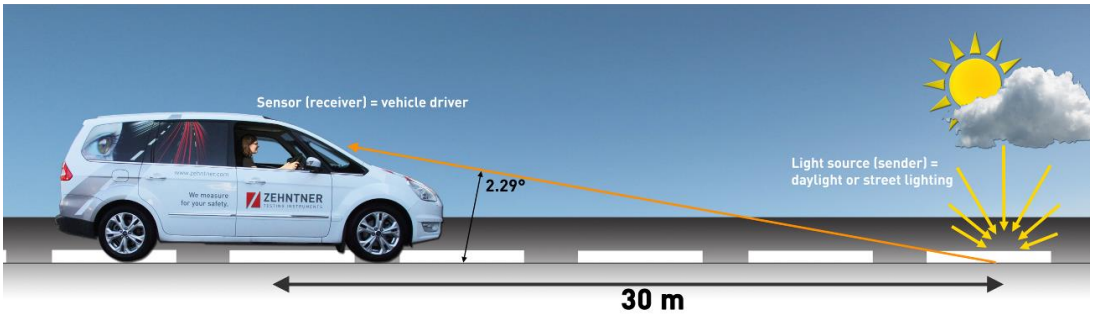

## 18.2 Different illustration of $R_L$

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.




## 18.3 Day visibility Qd

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.



# 19. Technical specifications

| | |
|---|---|
| Equivalent observation distance: | 30 m, according to CEN-geometry |
| Observation angle: | EN 1436: 2,29°<br>ASTM E 1710: 1.05° |
| Illumination angle: | $R_L$: EN 1436: 1,24°<br>$R_L$: ASTM E 1710: 88,76°<br>Qd: diffuse |
| Measuring area: | 52 mm x 218 mm (2.05” x 8.58”) |
| Measuring sensor: | adapted to V ($\lambda$) |
| Measuring range: | $R_L$: 0 - 4‘000 $mcd \cdot m^{-2} \cdot lx^{-1}$<br>Qd: 0 - 400 $mcd \cdot m^{-2} \cdot lx^{-1}$<br>profiled markings 5 mm (0.2”), up to 12 mm (0.47”) with instruction |
| Measuring period: | approx. 2 seconds for $R_L$ and Qd; single about 1 second |
| Memory: | 1 GB SD flash memory about 50‘000 measurements |
| Touchscreen display: | 5.7“ colour TFT (LCD), LED backlight, VGA resolution |
| 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 |
| Working life 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 (L x W x H): | 560 mm x 190 mm x 280 mm (22.05” x 7.48” x 11.02”),<br>Carrying case: 725 mm x 250 mm x 440 mm |
| Weight: | 6.8 kg (14.99 lbs) net<br>17.6 kg (38.8 lbs) with transportation carrying case |
| Standards: | EN 1436 (for $R_L$ and Qd)<br>ASTM E1710 (for $R_L$)<br>ASTM E 2302 (for Qd)<br>ASTM E 2177 (for $R_L$ wet) |
| Warranty: | 2 years |

# Glossary

## A



## B



## C



## D

# E



# F



# G



# H



# I



# J



# L

## M



## N



## O



## P



## Q

# R



# S



# T



# U



# W

www.proceq.com

Version 1.1 dated 30.07.2014