PERI InSite Construction
SONO WZ

Translation of the Original Instructions of Use – Version 2.0

Content

Overview

Main components

Key

Pictogram | Definition


Danger / Warning / Caution


Note


To be complied with


Load-bearing point


Visual inspection


Tip


Incorrect use


Safety helmet


Safety shoes


Safety gloves


Safety goggles


Personal protective equipment to prevent falling from a height (PPE)

Arrows

- Arrow representing an action
- Arrow representing a reaction of an action*
- Arrow representing forces

* If not identical to the action arrow.

Safety instruction categories
The safety instructions alert site personnel to the risks involved and provide information on how to avoid these risks. Safety instructions are featured at the beginning of the section or ahead of the instructions, and are highlighted as follows:


Danger
This sign indicates an extremely hazardous situation which, if not avoided, will result in death or serious, irreversible injury.


Warning
This sign indicates a hazardous situation which, if not avoided, could result in death or serious, irreversible injury.


Caution
This sign indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.


Note
This sign indicates situations in which failure to observe the information can result in material damage.

Format of the safety instructions


Signal word
Type and source of hazard!
Consequences of non-compliance.
⇒ Preventative measures.

Dimensions
Dimensions are usually given in cm. Other measurement units, e.g. m, are shown in the illustrations.

Conventions
- Instructions are numbered with: 1. …., 2. …., 3. …..
- The result of an instruction is shown by: →
- Position numbers are clearly provided for the individual components and are given in the drawing, e.g. **1**, in the text in brackets, for example (**1**).
- Multiple position numbers, i.e. alternative components, are represented with a slash: e.g. **1/2**.

Notes on illustrations
The illustration on the front cover of these instructions is understood to be a system representation only. The assembly steps presented in these instructions of use are shown in the form of examples with only one component size. They are valid for all component sizes contained in the standard configuration.

To facilitate understanding, detailed illustrations are sometimes incomplete. The safety installations which have possibly not been shown in these detailed illustrations must nevertheless be available.

Safety instructions

Cross-system

Safety instructions apply to all service life phases of the system.

Deviations from the standard configuration and/or intended use present a potential safety risk.

When using our products, all country-specific laws, standards and other safety regulations shall be observed.

In the case of unfavourable weather conditions, suitable precautions and measures are to be implemented in order to guarantee occupational safety and stability.

System-specific

Safety instructions apply to all service life phases of the system.

The lancehead-shaped probe and the hand-held measuring instrument are manufactured and tested in accordance with EN 61010 Safety Regulations for Electronic Measuring Instruments and have left the factory in perfect working order.

If the lancehead-shaped probe or the hand-held measuring instrument can no longer be operated safely, they must be taken out of operation, and further use must be prevented through appropriate labelling.

In case of doubt, the lancehead-shaped probe or the hand-held measuring instrument must be returned to the manufacturer or contractual partner for repairs or maintenance to be carried out.

The lancehead-shaped probe or the hand-held measuring instrument may only be operated by trained personnel. The operating personnel must have read and fully understood the instructions of use.

The hand-held measuring instrument must not be submerged in water or other liquids.

The hand-held measuring instrument may only be connected to a correctly installed power outlet using the supplied power cable that corresponds to the technical specifications.

The power outlet must be easily accessible so that the mains plug can be pulled out quickly if necessary.

Only an adapter that is suitable for the country of use may be utilised.

The hand-held measuring instrument may only be operated with the original accessories supplied with the device. Spare parts or other accessories can be obtained from the manufacturer.

The hand-held measuring instrument may not be used if
- the hand-held measuring instrument, lancehead-shaped probe, plug-in power supply, power cable or accessories are damaged.
- the lancehead-shaped probe or hand-held measuring instrument does not work as intended.
- the lancehead-shaped probe or hand-held measuring instrument has been dropped.

The plug-in power supply must be disconnected from the plug socket
- if the lancehead-shaped probe or the hand-held measuring instrument has not been used for a longer period.
- before the lancehead-shaped probe or hand-held measuring instrument is cleaned or adjusted.
- when work is carried out on the lancehead-shaped probe or hand-held measuring instrument.
- if a fault occurs during operations.
- if a thunderstorm occurs.

Intended use

Product description
PERI products have been designed to be used exclusively in industrial and commercial sectors only by suitably trained personnel!

Only use SONO WZ for the described purpose, while always taking into account the technical data.

Usage other than for the intended purpose is not permitted.

The function and operational safety of the SONO WZ can only be guaranteed if the generally applicable safety precautions, national regulations and the special safety instructions in these instructions of use are observed during usage.

The SONO WZ is used to measure moisture content in accordance with the measuring purpose and measuring range defined and stipulated in the technical data.

Only compliance with the instructions described in the instructions of use is considered as the intended use.

These instructions of use describe the connection, usage and maintenance of the SONO WZ.

Before a sensor or measuring system is connected and operated, the instructions of use must be carefully read.

The instructions of use are considered to be part of the product and must be kept in an easily accessible location near to the sensor or measuring system.

Instructions for Use

Use in a way not intended, deviating from the standard configuration or the intended use set forth in the instructions of use, represents a misapplication with a potential safety risk, e.g. risk of falling.

Changes to PERI components are not permitted.

Only PERI original components may be used. The use of other products and spare parts, represents a misapplication with a potential safety risk.

Operation with damaged or incomplete system components is not permitted.

The system described in these instructions of use may contain patent-protected components.

Target groups

Contractors
These instructions of use are intended for contractors who
- use them, e.g. for concreting, or
- allow them to be used, e.g. for forming operations.

Construction site coordinator
The Safety and Health Protection Coordinator*
- is appointed by the client,
- must identify potential hazards during the planning phase,
- determines measures that provide protection against risks,
- creates a safety and health protection plan,
- coordinates the protective measures for the contractor and site personnel so that they do not endanger each other,
- monitors compliance with the protective measures.

Competent personnel
Due to the specialist knowledge gained from professional training, work experience and recent professional activity, the competent person qualified to carry out inspections has a reliable understanding of safety-related issues and can carry out inspections correctly. Depending on the complexity of the inspection to be undertaken, e.g. scope of testing, type of testing or the use of certain measuring devices, a range of specialist knowledge is necessary.

Qualified personnel
PERI products may only be used by personnel who are suitably qualified to do so. Qualified personnel must have completed a course of training** in the work to be performed, covering the following points at least:
- Explanation of the plan for the assembly or dismantling of the PERI product in an understandable form and language.
- Description of the measures necessary to safely assemble, or dismantle the PERI product.
- Designation of the safety precautions in the event of changing weather conditions that could adversely affect the safety of the PERI product, as well as the personnel concerned.
- Details regarding permissible loads.

* Valid in Germany: Regulations for Occupational Health and Safety on Construction Sites 30 (RAB 30).

** Instructions are given by the contractor themselves or a competent person selected by them.

- **In other countries, ensure that the relevant national guidelines and regulations in the respective current version are complied with!**
- **If no country-specific regulations are available, it is recommended to proceed according to German guidelines and regulations.**

Cleaning and maintenance instructions

When cleaning, do not use aggressive chemical agents or abrasives.

Do not use hard sponges when cleaning.

Repairs are to be carried out only by the manufacturer. Only original components may be used.

Wear appropriate personal protective equipment when cleaning components, e.g.:

- safety helmet,
- safety shoes,
- safety gloves,
- safety goggles.

Storage and transportation

Store and transport the hand-held measuring instrument and lancehead-shaped probe in such a way that no unintentional change in their position is possible, as well as ensuring no damage occurs.

Do not drop the hand-held measuring instrument or lancehead-shaped probe.

Use original PERI storage and transport systems, e.g. SONO WZ case.

The hand-held measuring instrument and lancehead-shaped probe must be protected against the effects of the weather, all types of oil, and aggressive materials if safety is then likely to be affected!

During transport or intermediate storage, ensure that the products remain free of dirt and the respective functionality is not affected.

Type plates

Type plate for the lancehead-shaped probe

Danger
- **Do not use if the type plate is missing or illegible!**
- **If the type plate is missing or illegible, immediately arrange an inspection by a qualified person and subsequently attach a new type plate. The results of the inspection must be documented.**

Fig. 1a

Type plate for the hand-held measuring instrument

Danger
- **Do not use if the type plate is missing or illegible!**
- **If the type plate is missing or illegible, immediately arrange an inspection by a qualified person and subsequently attach a new type plate. The results of the inspection must be documented.**

Fig. 1b

Additional technical documentation

- Quick user guide:
  – SONO WZ

Rechargeable battery

The battery may only be replaced by a qualified person.

The specified maximum operating times apply only under optimum conditions. The ambient temperature and charging cycle can significantly reduce performance times. In addition, the charging capacity is reduced due to technical reasons during use or when stored in conditions with very high or low temperatures.

Charging the hand-held measuring instrument

- **For charging the hand-held measuring instrument, only use the supplied charger or comparable voltage source.**
- **A deviation in the charging voltage can result in damage to the device.**

The device heats up during the charging process.
If the hand-held measuring instrument only functions briefly or not at all despite repeated charging, the built-in battery is defective and must be replaced. Please contact PERI if this is the case.

Environmental conditions

The hand-held measuring instrument has been designed for use in harsh environments.
Operations outside of the specified conditions may result in damage to the equipment.

Operating elements

Brief overview of the key functions
The hand-held measuring instrument allows for a simple and structured measuring procedure using only 4 operating buttons.

“Up”
– Select menu item or setting

“Down”
– Select menu item or setting

“Measure”
– Switch on / off
(> press for 1 second)
– Carries out a measurement
– Selection of a menu item
– Saving and activating a setting

“Settings”
– Activate settings
(> press for 1 second)
– End settings
– Back to menu items

Fig. 2

For concretes, the standard calibration curve “Cal. No.: 4” is generally preset. When the hand-held measuring instrument is switched on, it indicates that the device is preset to Cal. No. 4. This setting should not be changed unless another material is being measured instead of fresh concrete.

Commissioning

Safety instructions
Important: prior to starting commissioning, be sure to read the General Information, Point 1, at the beginning of these instructions of use. Improper use can result in damage to the equipment.

Check package content
– Hand-held measuring instrument
– Lanzensonde
– Plug-in power supply (**12V/2A**)
– Charging adapter
– Protective cap
– Instructions of Use

Charging the battery
Charge the fitted battery before the first use. To do this, plug the supplied charging adapter into the 7-pin socket on the hand-held measuring instrument. Then connect the plug-in power adapter to the charging adapter. If the hand-held measuring instrument is already switched on or the battery is deep-discharged, the charging process will start immediately. Otherwise, turn on the hand-held measuring instrument by pressing the "Measure" button for approx. 1 second. An active charge is indicated on the display by an animated battery icon.

The integrated charging electronics charge the battery until it is fully charged. The entire procedure takes about 2 hours. As soon as charging is finished, all 4 "battery bars" appear permanently on the display and trickle charging then begins.

Only charge the battery at room temperatures (approx. 10 °C to approx. 30 °C).
If the temperatures are too low, the end-of-charging shut-off may not operate safely and the battery could be overcharged. If the ambient temperatures are too high, the hand-held measuring instrument may be damaged by the heat generated during charging.

Connecting the probe
The hand-held measuring instrument is operated with the lancehead-shaped probe:
The lancehead-shaped probe is connected to the hand-held measuring instrument via the 7-pin connector. The union nut is then tightened.

Operation

Button explanation	
Button	**Description**
	**Measure** – Switch On / Off → press and hold for 1s – Carry out measurement → press briefly – Activate a menu item → press briefly – Save a setting → press briefly
	**Settings** – Activate instrument settings by pressing > 1 second – End settings – Back to menu items
	**Up** – Previous menu item or setting
	**Down** – Next menu item or setting – Delete value memory (mode – mean value)

Display symbols	
Symbol	**Description**
	Remaining battery capacity
	Measuring active
	Setting saved
	Background brightness
	Time before switching off (lighting / APO)
	Press “Up” button
	Press “Down” button
	Warning sign: water content values less than 100 litres are not taken into account or the validity of the measured value is questioned if the scattering is too great.

Meaning of text	
Text (German)	Meaning
Density:	Gross density value of the measured fresh concrete
Water content:	Darr water content in l/m³
EC-T	Electrical conductivity – on The basis of the TDR radar signal, and thus a statement regarding the cement in the concrete mixture.
Serial no.:	Serial no. of the lancehead-shaped probe and hand-held measuring instrument
HW:	Hardware version
FW:	Firmware version

Switching on the hand-held measuring instrument

To turn on the hand-held measuring instrument, press and hold the C button for about 1 second.
The hand-held measuring instrument tries to communicate with the connected probe during the activation procedure.
This takes about 4 seconds. If no probe is connected or the probe cannot be reached due to another reason, an error message appears on the display.
If the probe has been successfully found, the measurement background appears on the display according to the operating mode.
During the switching-on phase, the "Calibration" message appears at the bottom of the display.
This means that the hand-held measuring instrument calibrates itself to the lancehead-shaped probe. After this, the SONO WZ is ready for use.

If no connection with the probe is possible in spite of repeated attempts, check whether the probe has been connected correctly. If this does not help, please contact PERI.

Switching off the hand-held measuring instrument

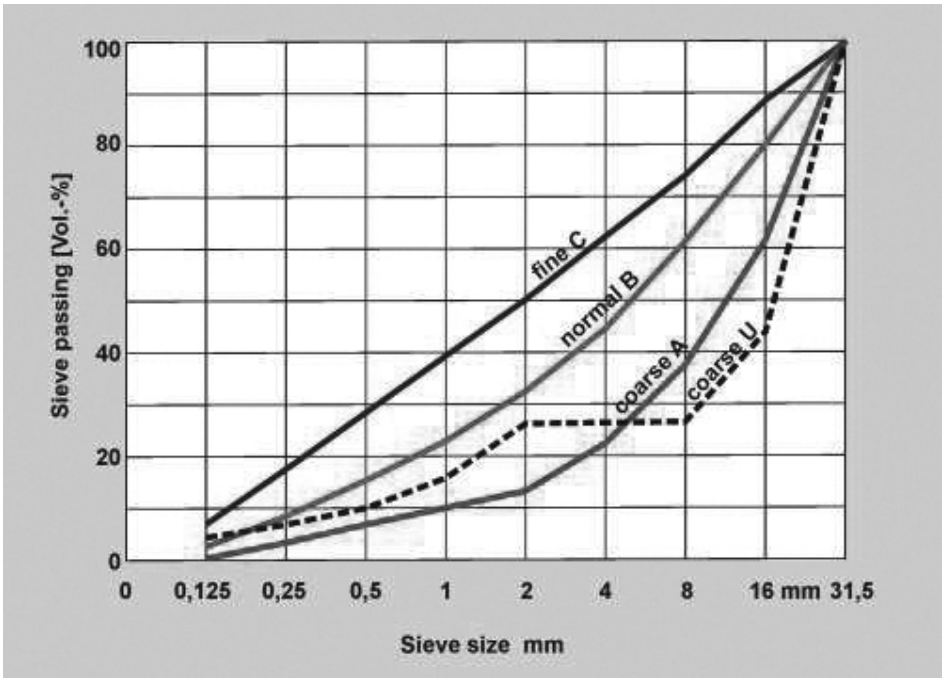
To switch off the hand-held measuring instrument, press and hold the C button for about 1 second.

CHAR parameters for the concrete formulation characteristics

In order for the hand-held measuring instrument to be able to display the water content as a Darr value with a required accuracy of +-1 to +-3 litres/m³, the system must first be programmed for a "concrete formulation characteristic" and for the rock used. This setting is created using the CHAR and G-Set parameters.

The SONO WZ reveals a range of grading curve dependencies with differing concrete formulation characteristics.
Therefore, SONO WZ 4 offers various setting options that can be selected as CHAR parameters on the hand-held measuring instrument.

The 4 possible CHAR parameters:
fine (Grading Curve C),
normal (Grading Curve B),
coarse (Grading Curve A),
special (Grading Curve U).



Fine C Grading Curve C The SONO WZ measures an insufficient amount of water and thus needs to correct the water content slightly upwards.	Concrete with a high mortar content, i.e. a lot of sand, especially with high content of fine material, a lot of cement. Standard additives, Standard admixtures and PCEs.
Normal B Grading Curve B None or only slight corrections	Continuous and relatively well-distributed grading curves. Standard additives, standard admixtures and PCEs.
Coarse A Grading Curve A The SONO WZ measures too much water and thus needs to correct the water content slightly downwards.	1. Concrete with higher k-values and low mortar content. 2. Concrete with continuous and relatively well-distributed B-grading curves with a special feature: low target water content, which is less than 160 l/m³, as well as a lot of PCE high-performance superplasticiser, which ensures general flowability.
Special U Gap Grading U The SONO WZ measures too much and must therefore correct the water content downwards.	Gap Grading U: i.e. very little or no 2/8 or 4/8 gravel. Standard additives, standard admixtures and PCEs.

General G-Set parameters

SONO WZ measures the free water in the fresh concrete, as well as some of the core and suction water. There are types of rock that absorb very little core water, but also strong absorbing types of rock, e.g. sandstone or lime grit, which can absorb up to 50 l of core water.
The core or suction water is not used for cement bonding and is therefore not taken into consideration for the w/c (water/concrete) ratio.

SONO WZ measures three types of water
In principle, the SONO WZ measures the same amounts of water as the Darr method.

1. The free water in the concrete mix, which is taken into account for the w/c ratio. This water is the actual target value that is looked for when using the SONO WZ.
2. Some of the core water, water that is absorbed by the aggregates, whereby only a part (approx. 1/3) of the core water can be measured here by the SONO WZ. Depending on the type of rock, the core water can amount to 10 to 35 l/m³. This (correction) value is represented in the G-Set parameter (approx. 2/3 of the core water) depending on the concrete formulation and rock type. Typically, the G-Set value is approx. -10 l/m³, assuming a core water content of 15 l/m³. This -10 l/m³ is then automatically subtracted during measurement with the SONO WZ so that the display in the hand-held measuring instrument matches the effective water content. (Fig. 3)
3. Additives that behave like water are therefore also measured by the SONO WZ This should be taken into account accordingly. (Fig. 4)

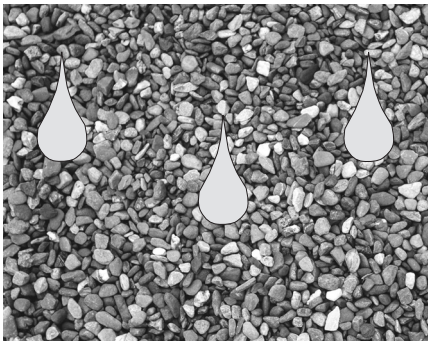


Fig. 3

Fig. 4

For the G-Set, the SONO WZ should therefore only be set once to accommodate both the formulation and type of rock used. In order to be able to display the effective (or Darr) water content in the hand-held measuring instrument, a unique value for the "G-Set" parameter for the formulation together with the rock type must be taken into account.

If the SONO WZ indicates that the water content is too high for a specific concrete, G-Set must be adjusted by the corresponding number of litres.

There are two ways to check or determine the exact value for the G-Set to be taken into consideration for the formulation with rock type (location) that is to be entered into the hand-held measuring instrument:

A) Using comparative concrete measurements from the SONO WZ with several correct and known water content values of the concrete, e.g. by mixing concrete with dried aggregates.

B) Using comparative concrete measurements from the SONO WZ with several correct (!) Darr values according to the Darr.
With the Darr, it is important to take into account the possible sources of error.

The Darr water content is comprised of the following:
Darr value = effective amount of water + core water + additives that behave like water.

Adjusting the formulation parameters

Adjusting the raw density
The hand-held measuring instrument can only be switched to the measurement mode for measuring water content once the adjustable parameters have been entered.

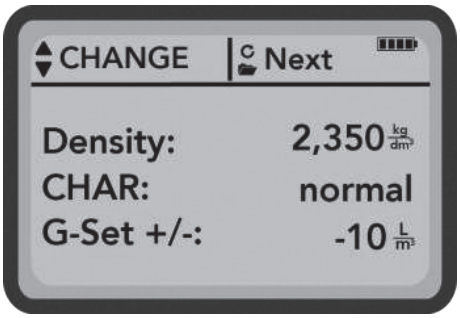


Fig. 5

Raw Density D (density):
Here, the raw density can be entered in kg/dm³. This is important because it is directly included when calculating the water content.

Characteristic (CHAR):
of the concrete formulation
with 4 setting possibilities:
coarse (negative correction),
normal (no correction),
fine (plus correction), or
special (negative correction with gap grading).
Note: the mortar content in concrete substantially affects this parameter.

General-Set (G-Set +/-):
Fine adjustment of the SONO WZ for concrete type together with the type of rock and core water.
Input max. ±50 l
Typical value: -10 l (**2/3 from core water**), which is automatically subtracted during measurement if the effective water content (effective water) is to be measured.
If the Darr water content is to be measured with the SONO WZ, enter the G-Set with a plus value, with 1/3 of the core water.

As the first parameter, the raw density can be adjusted in increments of ±0.005. Ideally, the raw density has already been set correctly on the hand-held measuring instrument before the water content measurement.

Determining the density value D of your fresh concrete with a concrete test piece is set using the ▲ and ▼ buttons. After this, the value is confirmed using the C button.
The hand-held measuring instrument automatically returns to the "ADJUST" menu.

Entering the raw density value is important because it is directly included when calculating the water content. If the raw density cannot be determined on site, the target raw density value can also be entered to obtain an acceptable measurement result. A deviation in the density of ±0.02 would result in an error in the water content measurement of ±1.6 l. A difference in the raw density of 0.1, i.e. from a density of 2.200 to 2.300, means an 8 l difference in the water content.

Setting up the CHAR concrete formulation characteristics

Entry of the CHAR parameter is carried out by activating one of the four possible settings "fine", "normal", "coarse" or "special". The mortar content in the concrete substantially affects the CHAR parameter. One of the four possibilities for CHAR must be selected with the ▲ and ▼ buttons and confirmed with the C button.

Fine adjustment of the G-Set for concrete type together with the type of rock and core water

The G-Set value is entered using l/m³ and can be entered in 1-litre steps up to ±50 l. It is recommended to archive found G-Set values for a particular rock type.
Enter the value for G-Set in ±1 litre steps up to max. ±50 l/m³ with the ▲ and ▼ buttons and confirm with the C button.
After adjusting or setting the raw density value, CHAR parameter and the G-Set, pressing the C button will automatically take you to the following measurement menu.

Measure

Measurement mode “Average”
After entering the raw density value and G-set, the following display will appear in the measurement menu. The SONO WZ generally measures in the “average” mode and determines the Darr water content of a fresh concrete sample in l/m³ using the given raw density value.

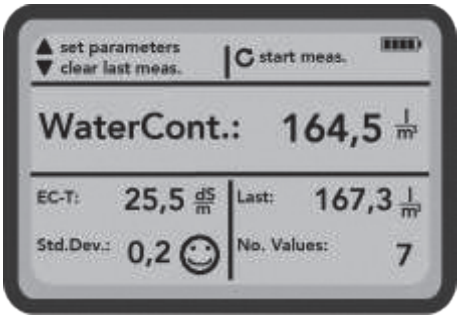


Fig. 6

Measurement menu display:

Set parameters
Set parameters

Clear last meas.
press button briefly:
clear last individual value
press and hold button:
clear complete measurement series

EC-T
Conductivity of or
statement regarding cement

Std.Dev.
Standard deviation:
For standard deviations >0.5,
more individual measurements
are required!

Water cont.
Water content as average value

Last
Last measured individual value
(can be cleared again)

No. Values
Number of measurements carried out

Adjusting and measuring

A single measurement is started by briefly pressing the C button. The measurement begins and a rotating C symbol appears in the top right corner during the measurement in place of the battery symbol. During this time, no other actions can be carried out.
A single measurement takes around 2–3 seconds. When the measurement procedure is complete, the battery icon re-appears. The display shows the water content that has been determined in l/m³ using the raw density D. This includes the number of individual measurements "No. Values" carried out.

In order to obtain a representative mix of materials, at least 5 individual measurements are recommended. For types of concrete that tend to bleed, the number of individual measurements should be increased as this will result in an increase in the representativeness and accuracy.

Incorrectly mixed concretes are difficult to measure with the SONO WZ.

The SONO WZ provides a statement regarding the quality of the measurement by displaying the standard deviation Std.Dev. (Standard Deviation). The Std.Dev. is an indication of the quality of the measurement. With Std.Dev. values > 0.5, the concrete mixture is probably too inhomogeneous, so that it is recommended to carry out even more individual measurements. Only after at least 6 individual measurements and a Std.Dev. of 0.1 to 0.5, are individual measurements discontinued and the measured value taken as the final result. For very inhomogeneous concretes (e.g. strongly bleeding concrete), it is difficult to achieve a Std.Dev. of less than 0.5.

Smileys on the display show if the standard deviation is good (<0.2), acceptable (**0.2...0.49**) or not acceptable (>0.5).

The hand-held measuring instrument automatically filters out measurement results of water content values that are <100 l. This could happen, for example, if the start button is accidentally pressed during a series of measurements or if the probe was not completely submerged in the concrete. These measured values (<100 l) are indicated by a waning sign ⚠ and are not used for calculating the average value!

By pressing the ▼ button, the series of measurements can be deleted and the SONO WZ is then ready for a new measuring cycle.

EC-TRIME

The EC-T parameter is displayed on the hand-held measuring instrument. The SONO WZ uses the innovative TRIME measuring method to determine the electrical conductivity (Electrical Conductivity EC-TRIME) of the concrete by means of the high-frequency attenuation of the radar pulse, thus, enabling a statement to be made regarding the cement content or type of cement.
The EC-T parameter displayed can already be interpreted as a raw value for the cement content or cement type during the individual measurement and, thus, ensures increased reliability when a known type of concrete is checked. We recommend documenting the respective concrete types measured by the user, in order to be able to verify subsequent test measurements more effectively. Whether and how the EC-T parameter depends on individual cement types will be further investigated.

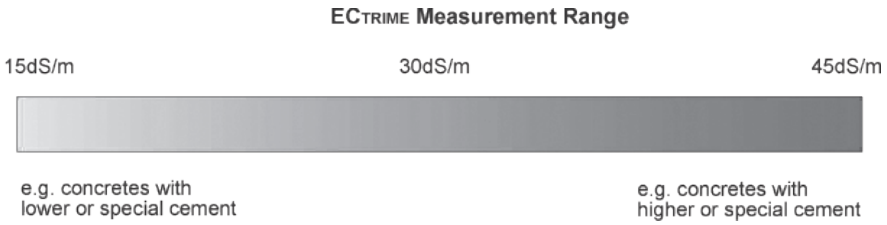


Fig. 7

An evaluation of EC-T only makes sense if only one known type of concrete is regularly checked.

General settings

The settings of the hand-held measuring instrument can be changed and adjusted.
Pressing and holding (**2 seconds**) the button will take you to the "Settings" menu.
By pressing the and buttons, the desired entry can be marked and selected with the button. Press the button to leave the current menu item and the Settings menu.

Overview of the setting options	
Setting	**Description**
Detect Probe	Carries out a new search for a connected probe (if an error has occurred during activation of the instrument)
Language	Switching the system language – German – English
Auto-Power-Off	Setting of the automatic shut-down
LCD Illumination	Adjusting the background lighting – turn-off time – brightness
LCD-Contrast	Setting the optimum contrast
Probe Info	Provides various pieces of information about the probe
Material Calibr.	Selection of calibration curves for different materials (The Cal. 4 setting for fresh concrete should not be changed).
Info	Provides various pieces of information about the SONO-DIS hand-held measuring instrument

Detect Probe
If there are communication problems with the probe when the hand-held measuring instrument is switched on, or if no probe has been connected, or if the probe must be changed during operations, the "Detect Probe" menu item can be selected. After selecting this menu item, the hand-held measuring instrument will again attempt to establish a connection to the connected probe. If this attempt is successful, the serial number of the probe will appear on the display.

If a connection is not possible, "No Probe Detected" will be shown on the display.

If no connection with the probe is possible in spite of repeated attempts, check whether the probe has been connected correctly. If this does not help, please contact PERI.

Language
In this menu item, the language of the hand-held measuring instrument can be selected. The user can choose between German and English. Select the language by pressing the ▲ and ▼ buttons and confirm with the C button. After activating the language, the 🖫 symbol appears in the upper right-hand corner of the display.

Auto-Power-Off
Using the "Auto-Power-Off" menu item, the user can select automatic shut-down with different time settings.
The following times can be selected:
– -- minutes (shut-down function deactivated)
– 1 minute
– 2 minutes
– 5 minutes
– 10 minutes
– 20 minutes

Use the ▲ and ▼ buttons to select the required shut-down time and confirm by pressing the C button. After activation, the 🖫 symbol appears in the upper right-hand corner of the display.

The hand-held measuring instrument will only shut down automatically if no additional button is activated. If any button is pressed the shut-down countdown will start again.

LCD Illumination
If required, the background lighting on the display can be individually adjusted. This allows power to be saved resulting in a longer operational period.
After selecting the menu entry, the following screen is presented on the display:

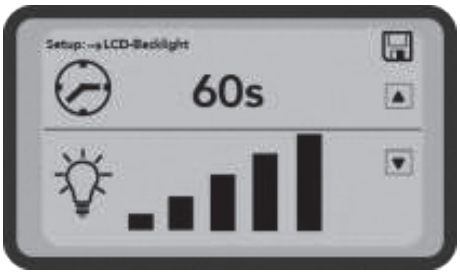


Fig. 8

By pressing the ▲ button, the automatic shut-down function of the background lighting, or the time until shut-down occurs, is selected by repeated pressing of the button.
Using the ▼ button, it is possible to adjust or turn off the brightness of the lighting.
The settings are activated by using the C button. After activation, the 💾 symbol appears in the upper right-hand corner of the display.

LCD-Contrast
In the case of incidence of light, it may be necessary to adjust the LCD-Contrast for optimal readability.

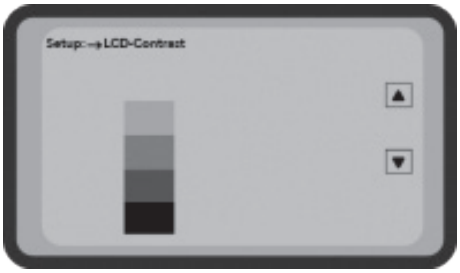


Fig. 9

After selecting the "LCD-Contrast" menu item, the contrast is adjusted using the ▲ or ▼ buttons. The contrast must be adjusted so that all shades of grey in the bar chart are clearly recognisable. The settings are activated and saved with the C. After activation, the 💾 symbol appears in the upper right-hand corner of the display.

Probe Info
By selecting this menu item, information will be provided on the lancehead-shaped probe.
This includes:
– Name
– Module Code
– Serial number
– Hardware Version (HW)
– Firmware Version (FW)

Material Calibr.
By selecting this menu item, the lancehead-shaped probe can be adjusted to accommodate another material calibration curve. After switching on the hand-held measuring instrument, the calibration curve selected in this menu item is displayed at the bottom of the screen for approx. 3 seconds.

For measuring concrete, the standard calibration curve "Cal. No.: 4" is generally preset. This setting should not be changed unless another material is being measured instead of fresh concrete.
A total of up to 15 calibration curves can be handled for materials such as ceramic suspension and sludges. Furthermore, the selection of a different calibration curve can change the sensitivity of the concrete measurement.

Info
By selecting this menu item, information is shown about the hand-held measuring instrument.
This includes:
– Serial number
– Hardware Version (HW)
– Firmware Version (FW)
– Battery capacity
– Battery voltage

Handling the lancehead-shaped probe

Introduction

The SONO WZ uses 1 GHz radar technology, utilising a lancehead-shaped probe whose measuring field penetrates deep into the material to be measured. Plastic and liquid fresh concrete with F2 to F6 consistency can be measured easily and directly by hand with the SONO WZ. For a representative measurement with different material mixtures, automatic averaging takes place when carrying out 4-10 individual measurements. Thanks to the structured measuring procedure, representative and precise measurement results are displayed within a few minutes.
SONO WZ works with the innovative TRIME TDR technology (Time Domain Reflectometry) based on guided radar waves. Guided radar waves with very low power of only 10 milliwatts (i.e. no potential hazard from electromagnetic radiation, etc.) are also used, for example, in industrial level measuring. In the TDR measurement according to the TRIME method, the radar pulse is attenuated depending on the cement content and cement type, and used as the ECTRIME conductivity in dS/m (Dezi-Siemens per metre) for statements regarding the cement.

– For concretes that do not comply with the specifications according to DIN EN 206-1 and DIN 1045-2 (which, for example, have a tendency to bleed), considerable fluctuations in the measured values can occur.
– Incorrectly mixed concretes are difficult to measure with the SONO WZ (even when using a Darr Test).

Measuring characteristics of the lancehead-shaped probe

In theory, the penetration depth of the electromagnetic field lines extends infinitely into the material to be measured. However, the effective measurement-relevant penetration depth of the lancehead-shaped probe is max. 5 cm around the probe surface on the dark-coloured ceramic plate.

With regard to the measuring field intensity, it must be taken into consideration that all dielectric measurement methods such as TDR, microwave and the capacitive measuring process, are not linear but feature exponential field line distribution, i.e. the field line intensity is greatest for all measuring methods directly at the probe head and decreases exponentially moving away from the probe head. This is a physical principle and cannot be changed constructively. As a consequence, for humidity probes this now means that larger gravel positioned directly at the head of the probe can falsify the measurement value.

When measuring with the SONO WZ, it is a question of changing the depositional relationship of sand, cement and larger gravels so that a representative mix of materials is produced with multiple individual measurements. This is achieved by carrying out several individual measurements using different depositional relationships on the probe head.

It is important when carrying out measurements that the probe head is completely immersed in the concrete to be measured, making sure there are no “air holes”

Ensure that the probe head is not inserted in the same place in the concrete when taking several measurements. If the probe is repeatedly immersed in the same place, there is a risk of separation at this point because, as the probe head is pulled out, the void can be filled with finer or liquid particles, and the water content value would then gradually turn out to be higher.

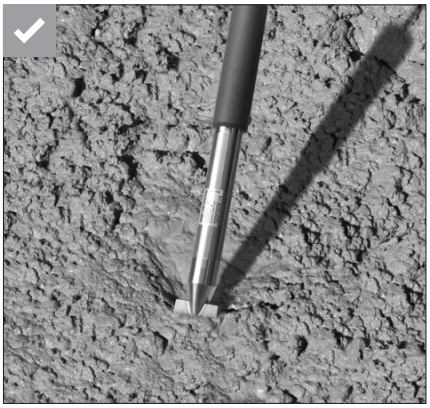


Fig. 10

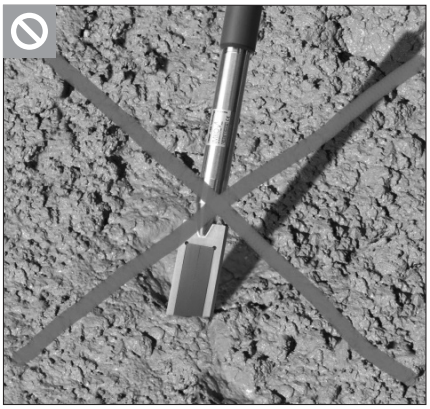


Fig. 11

Measuring procedure in a plastic bucket

Measuring fresh concrete should always take place in a plastic bucket because here the influence of any metal parts is excluded. Due to the expansion of the measurement field, a bucket with approx. 10 l capacity should be selected as shown below (Fig. 12). The bucket height must be large enough to ensure that there is still sufficient space at the bottom of the bucket when inserting the probe.

In order to prevent any separation, the fresh concrete inside the bucket should not be shaken. After inserting the probe, the concrete can be compacted a little by knocking the bucket 2–3 times with the foot so that the fresh concrete encloses the surface of the probe around the dark ceramic surface, making sure there are no air pockets (Fig. 14).

PERI recommends carrying out at least 4 to 5 measurements with the probe immersed at an angle of 70° to 90° at different places along the edge of the bucket (Fig. 13).

- Ensure that there is no concrete residue on the ceramic part of the probe surface. If necessary, clean the surface with a wire brush.
- The bucket should be filled at least 3 cm higher than the head of the probe (<18 cm). Especially with high water content, ensure that the concrete does not separate during or due to the measuring procedure.
- Completely insert the probe head into the concrete at a slight angle from the edge of the bucket. Compact concrete in the bucket by knocking on the side.

This ensures that the fresh concrete on the probe surface is optimally compressed for the measuring procedure.

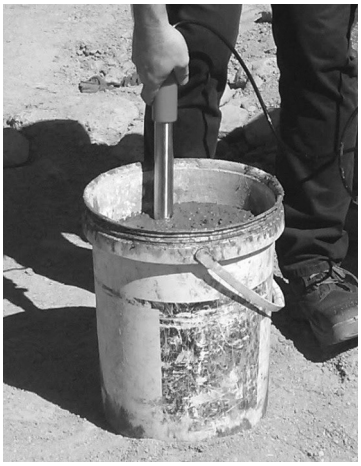


Fig.12

Measuring procedure for concretes

Flow diameters F2, F3, F4
After inserting, carry out an individual measurement in this position. After this, pull the probe out of the bucket. When pulling out the probe, the fresh concrete can separate at this point and fine particles can penetrate into the cavity.
Therefore, re-insert the probe at approx. 70° to 90° from the edge of the bucket. Compact the concrete by knocking on the side (e.g. with the foot) so that the concrete makes good contact with the surface of the probe. Carry out an individual measurement again.
Repeat the procedure 4 to 5 times, inserting the probe at an angle of 70° to 90° from the edge of the bucket.

The dark ceramic surface of the lancehead-shaped probe must be wiped clean each time, removing any concrete residue prior to the measuring procedure to ensure that concrete residue on the lancehead-shaped probe will not falsify the measurement.

Concretes with flow diameters F2, F3 and F4 do not easily separate. Therefore, this measuring procedure ensures the best possible measurement results due to the lateral insertion and compaction by knocking on the side of the bucket.

For the relatively stiff F2 concrete, it may be necessary to compact the concrete in the bucket with the probe on a vibrating table prior to taking a measurement.

Fig. 13


Fig. 14

Handling the lancehead-shaped probe

Slump F5 and F6
Highly free-flowing concrete has a tendency to separate, and measurements are not easy to take. There is a risk of larger fractions accumulating at the bottom of the bucket. Furthermore, there is the risk of fine particles accumulating around the probe surface after the lancehead-shaped probe has been inserted, which could lead to an excessively high water content being measured. We therefore recommend the following procedure for concretes with flow rates F5 to F6:

Darr sampling and the Darr test of concretes with flow rates F5 and F6 can also be faulty. If the concrete for the Darr test is removed from the surface or bottom of the bucket, a difference of up to 40 litres of water content can occur in concretes prone to bleeding.

1. Fill a 12 l bucket up to ¾ full with concrete.
2. Completely insert the probe head into the concrete with the WZ shovel (made of plastic) in a vertical position at the edge of the bucket. The shovel ensures that the larger pieces of gravel do not "drift" laterally onto the probe head during the measurement, which can lead to deviations. (Fig. 15)
3. Press the tip of the probe with the black ceramic surface slowly and diagonally to the opposite edge on the bottom of the bucket so that the handle rests on the edge of the bucket (Fig. 16). This ensures that there is a representative concrete mixture on the probe's surface. Carry out this procedure several times, inserting the probe at the respective angle. Delete individual readings if they are far outside the indicated average value.

Fig. 15

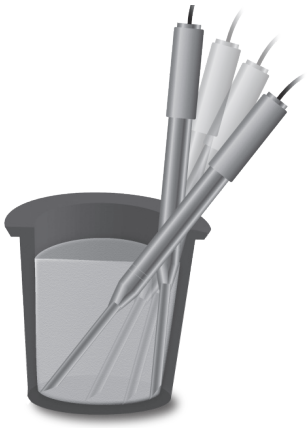


Fig. 16

After completion of 4-5 measurements:
If the standard deviation is not acceptable after 4–5 measurements (i.e. > 0.5) or the measured value fluctuations are too large, further individual measurements must be carried out. For this, we recommend re-mixing the fresh concrete in the bucket. Ideally, professional mixing tools, e.g. stirrer, are used, ensuring that fresh concrete easily separated due to the measuring procedure is optimally and uniformly re-mixed. (Fig 17) Ensure that mixing does not go on for too long, otherwise water can escape from the concrete. Further measurements can then be made.

Fig. 17

Non-optimal concrete formulations have a greater impact on measured value fluctuations. A concrete that has a tendency to bleed will separate. Whether a measurement deviation of the SONO WZ with water content that is determined to be too high is then interpreted as a disadvantage, must be decided on a case-by-case basis. For concretes that do not comply with the specifications according to DIN EN 206-1 and DIN 1045-2 (which, for example, have a tendency to bleed), considerable fluctuations in the measured values can occur. Incorrectly mixed concretes are difficult to measure with the SONO WZ (even when using a Darr Test).

Measurement problems

Measurement problem 1: mixing concrete with dried aggregates
Depending on the type of rock, it takes some time for dried aggregates to become saturated after mixing.
This can take 3–5 minutes for relatively absorbent aggregates, whereby less absorbent aggregates can take an hour.
As the SONO WZ "sees" only a third of the core water, we recommend waiting a certain amount of time after mixing dried aggregates before checking the water content with the SONO WZ.

Example: a dry, very absorbent rock can absorb a maximum of up to 30 litres of water per cubic metre relatively quickly. Due to compensation moisture, the used and stored rock is not completely dry but has a typical water content of 7 l/m³. For a concrete formulation with 175 l/m³ effective water content, 175 + 23 = 197 l were used. Immediately after mixing, the SONO WZ would measure approx. 185 l and then display a measured value of 175 litres relatively quickly after a waiting time of approx. 3–5 minutes (depending on the rock).

For the hand-held measuring instrument, the G-Set parameter would have been entered with two thirds of the maximum core water.
For the G-Set in this case, two thirds of maximum 30 l would be core water, i.e. G-Set = -20 l has been entered into the hand-held measuring instrument if the effective water is to be measured.
When mixing with dry aggregates, depending on the type of rock, a certain waiting time must be taken into account before measuring with the SONO WZ.

Measurement problem 2: problems due to the subsequent adding of water to the concrete
Laboratory testing often results in problems if carried out as follows:

1. The water content of approx. 8 l of fresh concrete was measured in a bucket with the SONO WZ.
   For example, 178 l/m³ was measured in this case with the SONO WZ.
2. Following this, 50 g of water was added to the fresh concrete, which corresponded to an increase in the water content from 178 l/m³ to, e.g. 184.25 l/m³. After mixing for about one minute in a small mixer, the concrete was then checked for raw density and slump. The concrete from the density and slump check was then poured back into the bucket to determine the water content with the SONO WZ.
3. The concrete-water content was once again measured with the SONO WZ; however, the result was not the expected 184.25 l/m³ but only 181 l/m³.

What happened here?

When mixing relatively small quantities in an open container, the water adheres to the container wall over a large area and evaporates. If the concrete is then additionally used for the slump and raw density test, no gravel and virtually no sand will remain on the outer walls of the test equipment, but the water and the fine particles remain "stuck" on these surfaces due to water adhesion.

It is easy to check this effect. After the first SONO WZ measurement result with 178 l/m³, the concrete is mixed again for approx. one minute and the water content is then re-checked with the SONO WZ. The decrease in the water content by 2-3 l/m³ is then an indication of the evaporation effect through mixing.
This means subsequent mixing of concrete causes significant deviations in the water content.

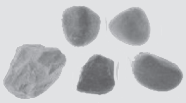
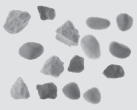
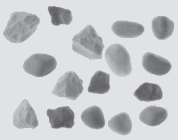
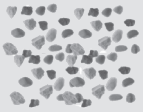
Handling the lancehead-shaped probe

Measurement problem 3: sampling in the concrete plant
Before filling a truck mixer with the concrete, a concrete sample was drawn directly from a twin-shaft mixer into a bucket. The concrete sample with a normally distributed grading curve and a water nominal value of 170 l/m³ was measured with the SONO WZ, and 170 l/m³ was displayed as the result. A concrete sample quantity of 5 kg was then kiln dried. The Darr value was determined to be 149 litres, i.e. there was a difference of -21 litres from the SONO WZ measured value of 170 l/m³.

What happened here?

Because it was mixed in a twin-shaft mixer without repeated continuous mixing in the truck mixer, a high number of large gravels were contained in the first sample in the Darr sampling. These large gravels have led to a significant error in the sampling, as there were simply too many large gravels in the sample, pulling the Darr value down to 149 l/m³ (gravel has no water content).

Consequently, the degree of cement paste was very high, which led to the SONO WZ deviating from the (actually incorrect) Darr value. It is natural to ask whether this was a disadvantage, as in this case the cement paste had a water content value that was too high (so it would not have become good concrete).
The following table is intended to illustrate the influence of large gravel during sampling:
One must take into account that a single 16/32 mm piece of gravel weighs between 10-50 g. If one assumes an average of 20 g per piece of gravel, the sampling procedure is much more important than it initially seemed.

	Influence of the water content of the gravel during sampling	Formulation A with relatively high fine particle content and low 16/32 mm gravel content	Formulation B with gap grading, i.e. few 4/8 mm pieces of gravel and high 16/32 mm gravel content
 Concrete sample of 1.5 kg	± 2 large pieces of gravel cause an error of ±9 l/m³	 approx. 5 pieces of 16/32 mm gravel	 approx. 15 pieces of 16/32 mm gravel
 Concrete sample of 5.0 kg	±2 large pieces of gravel cause an error of ±3 l/m³	 approx. 16 pieces of 16/32 mm gravel	 approx. 100 pieces of 16/32 mm gravel

Formulation management and archiving

With the adjustment of the two parameters CHAR (fine, coarse, normal, special) and G-Set (core water and additive), relatively good conformity of the SONO WZ results with verified actual values or target values can probably be guaranteed.

In order to achieve the best possible accuracy of the SONO WZ, we recommend archiving the settings required for the measurements while repeatedly checking the different types of concrete.
The following example table shows one possibility of archiving.

Type of concrete or type no.	Target bulk density value	CHAR parameters	G-Set parameters
F600TL	2.422	coarse	-10
AAV2	2.441	normal	-5
163,802	2.330	normal	-8
3716CL	2.367	fine	-5

Construction site test

Date	Test point and tester:	Concrete type (C30/37...)	
Target bulk density value according to formulation:	Target water content according to formulation in l/m³		
Cement type and weight in kg/m³	Additives and weight: (e.g. fly ash 30 kg)	Chemical additives BV, LP etc. in l/m³	
Amount of aggregates: Sand 0/2 Gravel 2/8 Gravel 2/16 Gravel 16/32		Max. possible core or suction water of the rock (in l/m³)	
Moisture content (Darr) and Darr method information:			
Moisture content (Darr) in l/m³ including core water:	Darr method (microwave, gas oven):	Quantity (Darr) in kg:	Drying time (Darr):
Set parameters in the Sono-Dis:			
Bulk density in kg/dm³	CHAR-Parameter (normal B, fine C, coarse A or U) CHAR-Parameter (normal B, fine C, coarse A or U)	G-Set for formulation with rock type:	
Set parameters in the Sono-Dis:			
Water content in l/m³:	Std.Dev. standard deviation:		
EC-TRIME in dS/m:	No. of measurement values:		
Radar time tp (press and hold the ▲ button to display the radar time):	If possible, please complete all fields		

Hand-held measuring instrument

Height:			36 mm
Width:			64 mm
Length:			150 mm
Weight:			(with battery) approx. 437 g
Power consumption	Power Down		approx. 35 µA
	Idle	Background lighting off	approx. 26 mA
		Background lighting on	approx. 56 mA
	Probe switched on		approx. 100 mA
	Measurement		approx. 350 mA
Measurements per charge:	20°C / background lighting max		up to approx. 5000
Connectable sensors:			SONO WZ lancehead-shaped probe
Storage temperature:			-30 °C to 80 °C
Working temperature:			-20 °C to 70 °C
Charging temperature:			10 °C to 30 °C
Charging voltage:			Nom. 12 V, min. 12 V, max. 15 V
Charging current:			approx. 1 A
Charging time:			with completely discharged battery approx. 2 h
Battery:			Ni-MH (4 x 1.2 V)(AA), 2000 mAh, >1000 measurements
Physical BUS:			RS485
BUS protocol:			IMP-BUS protocol II

Lanzensonde

Power supply:	7 V–24 V DC
Current consumption:	150 mA with 12 V/DC during 2–3 s measuring cycle time
Measurement range:	0–100 % water content
Repeatability accuracy of water content measurement (with stationary probe in concrete):	±2 l/m³
Absolute accuracy:	± 3 % of the amount of water
Conductivity range:	0–40 dS/m
Measurement range:	0.5 l
Temperature range of probe:	0 °C–50 °C
Calibration:	Calibration for fresh concrete pre-installed
	Self-calibration is possible, storage capacity for up to 15 calibration curves
Protection type for probe:	Waterproof encapsulated in Protection Class IP67
Probe dimensions:	155 x 60 mm
Interfaces:	1.5-m cable with 7-pin coupling socket

EC Declaration of Conformity

EU - Konformitätserklärung

im Sinne der EMV-Richtlinie 2014/30/EU
Anhang IV

In der Gemeinschaft ansässige Person, die bevollmächtigt ist, die technischen Unterlagen zusammenzustellen:

Dipl.-Ing. Rainer Bolz
PERI GmbH
Rudolf-Diesel-Strasse 19
89259 Weißenhorn

Beschreibung und Identifizierung des Betriebsmittels:

Produktgruppe:	Baustellenzubehör
Typ:	Handmessgerät
Artikel-Nr.:	130,627
Handels-Bez.:	SONO WZ Handmessgerät

Es wird ausdrücklich erklärt, dass das Betriebsmittel allen einschlägigen Bestimmungen der folgenden EU-Richtlinien entspricht:

EMV-Richtlinie 2014/30/EU

Diese Konformitätserklärung ist für folgende Seriennummern gültig:

1223,
1569 – 1618

Weißenhorn, 31/01/2018

Hersteller
PERI GmbH
Postfach 1264
89259 Weißenhorn

Leitung Produktentwicklung

Dipl.-Ing. Rainer Bolz
PERI GmbH

This document is a translation into
English from the German original.

EC Declaration of Conformity

according to the EMC Directive 2014/30/EC
Annex IV

Person residing within the Community authorised to compile the relevant technical documentation:

Dipl.-Ing. Rainer Bolz
PERI GmbH
Rudolf-Diesel-Strasse 19
89259 Weissenhorn, Germany

Description and identification:

Product Group:	Construction site equipment
Typ:	Portable measuring instrument
Article No.:	130,627
Commercial Designation:	SONO WC Portable Measuring Instrument

It is expressly declared that this product fulfils all relevant provisions of the following EU Directives:

EMC Directive 2014/30/EC

This Declaration of Conformity is valid for the following serial numbers:

1223,
1569 – 1618

Weissenhorn, 31/01/2018

Manufacturer
PERI GmbH
Postfach 1264
89259 Weissenhorn,
Germany

EC Declaration of Conformity

EU - Konformitätserklärung

im Sinne der EMV-Richtlinie 2014/30/EU
Anhang IV

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Dipl.-Ing. Rainer Bolz
PERI GmbH
Rudolf-Diesel-Strasse 19
89259 Weißenhorn

Beschreibung und Identifizierung des Betriebsmittels:

Produktgruppe:	Baustellenzubehör
Typ:	Lanzensonde
Artikel-Nr.:	130,625
Handels-Bez.:	SONO WZ Lanzensonde

Es wird ausdrücklich erklärt, dass das Betriebsmittel allen einschlägigen Bestimmungen der folgenden EU-Richtlinien entspricht:

EMV-Richtlinie 2014/30/EU

Diese Konformitätserklärung ist für folgende Seriennummern gültig:

40959,
43988 – 44037

Weißenhorn, 31/01/2018

Hersteller
PERI GmbH
Postfach 1264
89259 Weißenhorn

Leitung Produktentwicklung

Dipl.-Ing. Rainer Bolz
PERI GmbH

This document is a translation into
English from the German original.

EC Declaration of Conformity

according to the EMC Directive 2014/30/EC
Annex IV

Person residing within the Community authorised to compile the relevant technical documentation:

Dipl.-Ing. Rainer Bolz
PERI GmbH
Rudolf-Diesel-Strasse 19
89259 Weissenhorn, Germany

Description and identification:

Product Group:	Construction site equipment
Typ:	Probe
Article No.:	130,625
Commercial Designation:	SONO WC Probe

It is expressly declared that this product fulfils all relevant provisions of the following EU Directives:

EMC Directive 2014/30/EC

This Declaration of Conformity is valid for the following serial numbers:

40959,
43988 – 44037

Weissenhorn, 31/01/2018

Manufacturer
PERI GmbH
Postfach 1264
89259 Weissenhorn,
Germany

SONO WZ

Item no.	Weight kg	
137,098	5.000	**ISC SONO WZ** Probe and measuring instrument optimised for fleet operation. Complete set consisting of probe, measuring instrument and case.

131,870	5.000	**SONO WZ** Complete set includes: - 130625 SONO WZ Lancehead-Shaped Probe - 130627 SONO WZ Portable Measuring Instrument - 130626 SONO WZ Case

130,625	1.000	**SONO WZ Lancehead-Shaped Probe**

130,627	1.000	**SONO WZ Portable Measuring Instrument**

The optimum system for every project and every requirement

Wall formwork

Column formwork

Slab formwork

Climbing systems

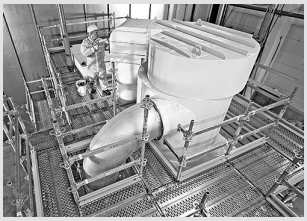
Bridge formwork

Tunnel formwork

Shoring

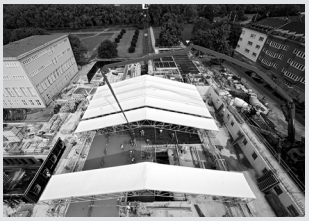
Working scaffolds

Working scaffolds façade



Working scaffolds industry

Means of access



Safety scaffolds

Safety systems

System-independent accessories

Services

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