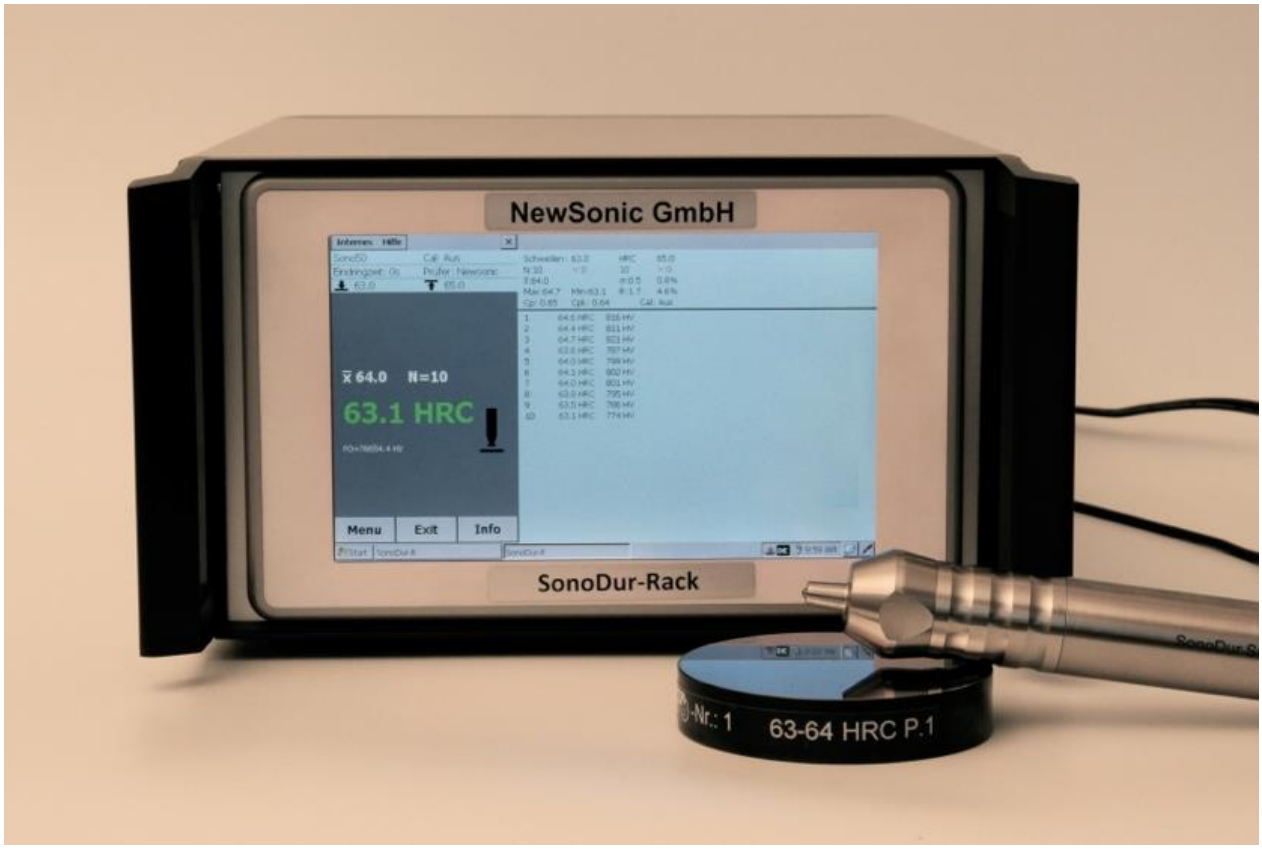
SonoDur-R Instruction Manual

Automated UCI-Hardness Testing System
with
Motorized and Hand-Held Probes



This issue 4, 08/2015 applies to software version V2.16 and higher, SonoDur-R.

Subject to technical alterations.

1 Table of Contents

Attention:

WARNING:
Before using the device, please read the following manual carefully, including safety instructions, provided in Section 2.2 Safety Information, Page 10.

Attention:

WARNING:
SonoDur-R starts automatically when switching on the instrument. After this any manipulation outside of the SonoDur operating panel will be detected and indicated as system error and Alarm level is set. Changes in system folders for instance can cause total failure of the whole measurement system and consequently will lead to loss of any warranty claims.

2 Introduction

This instruction manual describes the SonoDur-R hardness tester with motorized and hand-held probes for automated UCI hardness testing (Ultrasonic Contact Impedance). The SonoDur-R is an instrument for integration with automated test equipment. SonoDur-R uses the same intuitive operation scheme as the portable SonoDur Plus.

2.1 Measuring Method

The hardness measurement by means of ultrasonic indirectly evaluates the indentation testing of the Vickers diamond and digitally displays the result immediately. The application of force can be implemented either motor-driven or manually against a spring. A hardness value is calculated at a defined force (penetration force), which correlates to the area of impression after indentation, although the measurement was carried out under load.

The UCI hardness testing is standardized according to ASTM A 1038, DIN 50159-1 and -2 and described in VDI / VDE Standards 2616, Sheet 1.

Thereby, it must be noted that the measurement result also depends, for instance, on the elastic properties of the test material and therefore, the measurement device must be calibrated onto the test material. Hence, the UCI hardness testing is representing a comparative method attributed to reference standards (calibrated or adjusted by the operator). The Vickers units (HV) are the reference scale for the hardness testing. Calibration can be indirectly performed on hardness reference blocks or directly via comparative measurement, for instance, by means of a Vickers machine (identical test force) on a specimen of the test material.

If a different test method is being used (Rockwell, Brinell, etc.), shape and material of the indenter, indentation size and hence, the measuring range varies. Therefore, depending on the material, treatment and surface condition, calibration or conversion of hardness values can be incorrect or inadmissible with one another as well as with tensile strength values.

Conversions from the calculated Vickers hardness values are therefore permitted with restrictions and only in accordance with relevant standards. All conversion tables in accordance with EN ISO 18265, ASTM E 140 are defined in the SonoDur-R instrument. However, the responsible individual has to make the decision himself on the admissibility of a conversion from the calculated Vickers hardness on the basis of his specific requirements and experiences.

Motorized probes:
Based on the very low test forces between 1 N (HV0, 1) and 8.6 N (HV1), the measurements are virtually non-destructive at almost constantly low dispersion of measured values, even at high hardness levels. Thus, the main applications for motorized probes, are production control and maintenance checks of smooth (polished, lapped) and thereby also coated surfaces (hard chrome, copper), such as rollers, rotogravure cylinders, automotive components and other components. They are associated with high-level requirements pertaining to a clean and undamaged material surface. It is also very well possible to measure small spring components or other precious components, if a possible component vibration can be suppressed by holding or fastening the device properly.

Handheld probes:
With, for instance, test forces of 10N (HV1), 50N (HV 5) and 100N (HV10), handheld probes have fewer roughness requirements. Therefore, the area of application is wider, also rather tends to very large and heavy components in hardening plants, for example, after induction hardening, on welding seams of boilers and pressure pipes. For the cutting edge assessment on structural steel, HV10 measurements have become mandatory as of July 2012 in accordance with EN ISO 1090.

Further applications are described below:

SONO-10H, 10N Test Load (HV1):
In principle, all measurement tasks described under the SONO-8M motorized probe can be accomplished.
The smaller design enables improved accessibility, i.e. components with more complex geometry can be measured more easily from all directions – toothed wheels with a smaller number of modules, forming tools, thin-walled parts.

SONO-50H, 50N Test Load (HV5):
This probe is used most frequently in day-to-day operations, since it can be used not only on thinly coated components, but also on all components of the above described probes.
There are lower requirements on the surface characteristics than with all probes mentioned above, which allows testing of more coarse grained materials as well.
In relation between surface condition and manual test force or manual control needed, the application is very well balanced.

SONO-100H, 98N Test Load (HV10):
Conversions in tensile strength of steel are possible here, for instance on hardened and tempered steels after flame or induction hardening - according to this standard, it does not apply below HV10 – in addition, conversions in the range of Rockwell and Brinell testing is more likely, since the surface portion decreases relative to the volume fraction of the measurement.

Rougher surfaces, such as cold work tool steel for stamping tools, embossing dies and stamps, forging jaws, sintered metals and high-strength vehicle components, are well suited for HV10 measurements.

Further applications cover weld seam testing, in accordance with HV10 regulation, safety containers, etc.

Information on the test loads:
In publications and in our documents, the conversion from HV1, HV5, HV10, etc., is sometimes indicated in rounding numbers due to the conversion factor 1 kp (kgf) = 9.81 N in Newton, N is sometimes indicated as rounding number (HV 5 = 49N is frequently indicated with 50N and HV10 = 98 N with 100 N). But, the force is precisely adjusted in Newton, thus, for instance: 49N, 98N!

The test conditions in terms of surface characteristics (surface roughness) or layer thicknesses comply with the requirements of the traditional Vickers hardness measurement. At a HV1 measurement, the UCI standard DIN 50159-1/2 specifies a maximum roughness Ra of <0.5 µm, which corresponds to $d \approx 10 - 20 \times Ra$ in relation to the penetration depth. Accordingly, with HV5, it comes to 0.8 µm and with HV 10 to 1.0 µm.

In this context, penetration depth (d) and average diagonal length (Ld) can be determined by

$$d = 62 \times \sqrt{\frac{Nominal\ Test\ Load\ [N]}{Hardness\ [HV]}}\ [\mu m] \text{ and } Ld = 434{,}9\sqrt{\frac{\text{Nominal Test Load [N]}}{\text{Hardness [HV]}}}\ [\mu m]$$

The table below shows a few examples of the more significant penetration depth (in "µm"]:

Hardness	HV10	HV5	HV1	HV0.3	HV0.1
800 HV	22	15	7	4	2
600 HV	25	18	9	5	2,5
300 HV	36	25	11	6	4

In general, the nature of the component surface in the range of low-load hardness testing, are of particular importance. High dispersion of measured values can be an indication of excessive surface roughness. In this case, reworking of the surface with suitable abrasives as well as a re-measurement may be recommended.

Some other influencing factors are summarized below:

- Minimum layer thickness: 10 x d (no noticeable influence by the base material after calibration)
- Minimum material thickness without coupling: > 3 mm (component resonances can falsify measurement values)
- Minimum mass without coupling: > 0.3 kg (component resonances can falsify measurement values or may make it impossible to perform a measurement)
- Minimum distance from the edge of the component edge of the element = 3 x Ld, between the indentations = 6 x Ld.

Besides surface roughness, material properties such as texture, mechanical tensions, layer structures and underground also play a role for measurement value variations and deviations from nominal values.

Above information is by experience where the real practical situation has to be tested on the material and part in question.

The permissible limiting deviations for average values on hardness reference blocks apply in the assessment of measurement accuracy of UCI devices – refer to table below (from DIN 50159-1/2):

Test Force	Limiting Deviation [%]			
	< 250 HV	250 HV – 500 HV	500 HV – 800 HV	> 800 HV
HV 0.1	6	7	8	9
HV 0.3	6	7	8	9
HV 0.8	5	5	6	7
HV 1	5	5	6	7
HV 5	5	5	5	5
HV 10	5	5	5	5

All SonoDur-R probes must meet internal standards with max. ± 3% from 3 -5 measurements on hardness reference blocks (see 12.2 Technical Data – SonoDur-R, Page 59).

In accordance with the UCI standard DIN 50159-1/2, hardness reference blocks with specific dimensions are mandatory for the testing, namely a thickness of 16mm and a diameter of 80mm. These blocks are often hardly obtainable. However, docking the hardness reference block to a flat hard surface, most preferably made of steel, has much higher significance than the "correct" dimension. Depending on the support material (wood, cloth, etc.), test force and test position, test reference blocks can develop macroscopically very complex panel vibrations that can make the performance of an UCI measurement more difficult or even impossible. Here the widely used riangular Vickers hardness reference blocks with a thickness of 6 mm (see image below) are very much prone to panel vibrations and therefore it must definitely be ensured that these are always well coupled!

Attention

These triangle reference blocks need well coupling!

Figure 2.1

The best way to derive this type of influence is to observe the ranges of a measurement series. Depending on the probe and hardness, mean values are furthermore generally more or less significantly lower or higher than the indications provided on the reference block itself.

Caution is also needed on some Rockwell reference blocks (HRC), if they are only roughly grounded and therefore depending on the test force, may tend to indicate too low UCI hardness values.

Furthermore special care is to be taken when using hot isostatic pressed blocks are used (applied for some Leeb-Blocks and Vickers-Blocks) because of local scatter in Hardness or Young's modulus.

The surface of the test object must be definitely bare, free of surface coverage and scale as well as liquids. In addition, the test object may not make any movements or vibrations when measurement is performed.

During the operation with induction hardening machines, measurements must not be performed while a high-frequency field is present, since disturbances could occur or the measurement system may temporarily fail completely.

2.2 Safety Information

The SonoDur-R is manufactured and tested in accordance with the applicable safety regulations (EN 60950-1:2006, EC Low Voltage Directive) and has left the factory in a safety-related flawless condition. In order to maintain this condition and to ensure safe operation, please make sure you read the following safety information before you start using the device:

- UCI hardness measuring probes are highly accurate precision measurement instruments which must not under any circumstances, exposed to shocks or impact load!
- The device must be exclusively used for material testing, other applications, e.g. medical applications are not allowed!
- Keep measurement devices and accessories out of children's reach!
- The test device and / accessories must no longer be used and need to be secured against unintentional commissioning, if
    - visible damages are apparent
    - the system no longer works properly
    - the device had been under extraordinary transportation stress
    - after prolonged storage under extremely unfavorable environmental conditions (temperature / humidity)
- Store and operate the test device and accessory only in the specific environmental conditions (temperature / humidity)!
- When used in commercial facilities, the accident prevention regulations of the professional trade association for electrical installations and equipment must be observed.
- Repairs may only be performed by authorized specialist staff.
- Never turn on the device / power supply unit, if the device / accessory is moved from a cold to a warm area. The generated condensation water may damage the device / accessory under unfavorable conditions! Leave the device / equipment switched off before it has been adjusted to room temperature.

2.3 Meaning of "Attention" and "Please note"

Attention

Ignoring these important facts can potentially lead to severe consequences.

Please note

Information provided to make your work easier and to improve results.

2.4 Hardness Testing Requirements

An adequate training of operating personnel in the field of material testing is required in order to perform hardness measurements. This includes, for instance, adequate knowledge of:

- General hardness testing
- Effect of material characteristics on the hardness testing and selection of the measurement system
- Influence of surface condition
- Selection of test force
- Understanding about the comparability to other measurement methods, conversion.

Attention:

Lack of knowledge may lead to incorrect test results and cause unforeseeable consequences!

3 Measurement Components

The SonoDur-R consists of a benchtop unit and the herewith connected hardness measuring probe. The hardness measuring probe can be either a motorized or hand-held probe, equipped with the relevant features to perform the required measurements. All probes will be attached to the display unit by USB interface with the cable that is firmly connected to the device. In contrast to other commonly used devices, the probe is equipped with a microcontroller that already performs the control system functions, raw data acquisition and signal processing inside the probe.

Hence, the probe can be easily integrated into almost any measurement system via a standard USB interface.

An overview of the scope of delivery and accessories can be found in the Appendix under Section 12.1 Scope of Delivery and Accessories, Page 56.

3.1 Device Connections

Figure 3. 1

Please note:

All connectors are polarized and can only connect to the device plug in one position. When plugging the cable, it must be ensured that the cable plug is in the correct position towards the device plug (if necessary, determine by gently rotating it). In this position, the plug can be effortlessly slid by a few mm into the device plug. Only then, the plug can be clicked into place by pressing it down firmly - but without using any force. Otherwise, the plug connection may be damaged or destroyed!

For interface definition and electrical data please refer to chapter 11 Connectors and Electrical Specification, page 49.
Please check the instructions for connecting the probe on chapter 6 Connect and Disconnect Probe , page 15.
Please make sure that the instructions for connecting the plug connectors are definitely observed!

Attention:

If a plug is forcibly pushed into the connector socket, the entire connector system may be damaged, resulting in an unusable measurement system.

3.2 Initial Commissioning

Each of our products is thoroughly inspected and carefully packed prior to delivery. However, please check that the shipment is complete and has not been damaged during transportation. (Please see also Safety Guidelines below).

ATTENTION:

All connectors can only be inserted one way into the jack. Do not, under any circumstances, use force since the connector system may get damaged.

Connect the instrument to a clean 24 VDC supply voltage source (see section 4 Supply Input Voltage and section 11 Connectors and Electrical Specification, page 49.

Connect the probe to the instrument, see section 3.1 Device Connections, page 12.

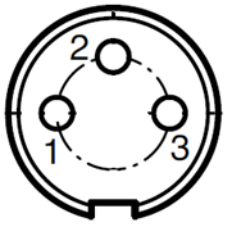
Turn on the device, as described in Section 5 Turning On and Off, Page 14. When the start menu appears, the unit is ready to perform measurements.

4 Supply Input Voltage

Because of country wise specific trade- and safety marks, the SonoDur-R benchtop instrument does not have an internal power supply. It just needs a single DC input voltage, please connect the power supply connector via the SONO-24V cable to a clean DC voltage, we recommend 24 VDC or use our 24 V power supply (order number 11307, see section 12.1 Scope of Delivery and Accessories, page 56).

4.1 Power Supply Connector (PSC)

The connector is specified according DIN EN 60130-9 (Type C901A 3-pin fem., Amphenol T 3263 000)



Pin	Signal Name	Description	Voltage Level
1	Vin	Power supply voltage	12-24 VDC
2	---	Not connected	---
3	GND	Ground	0 V

View on contact side.

Note: The power input is reversed voltage protected and filtered.

Attention:

Please also observe our Safety Guidelines under Section 2.2 Safety Information, page 10

5 Turning On and Off

The device is turned on / off via the switch (1) on the rear side (see section 3.1 Device Connections, page 12). Please make sure that all connections are made, the probe is connected and the power supply can deliver the necessary power.

Please note:

If no probe is connected, the instrument will start in the simulation mode (see section 6.4 Operating without Probe – Simulation Mode, page 16). During the simulation mode, the instrument will not automatically switch over to regular measurement mode, if a probe is connected. Please end the program, connect the probe and start the SonoDur-R application again!

If start screen appears, the instrument is ready to take measurements. The middle area of the screen is the SonoDur-R menu window, the rightmost section is read-only and shows statistic and single values.

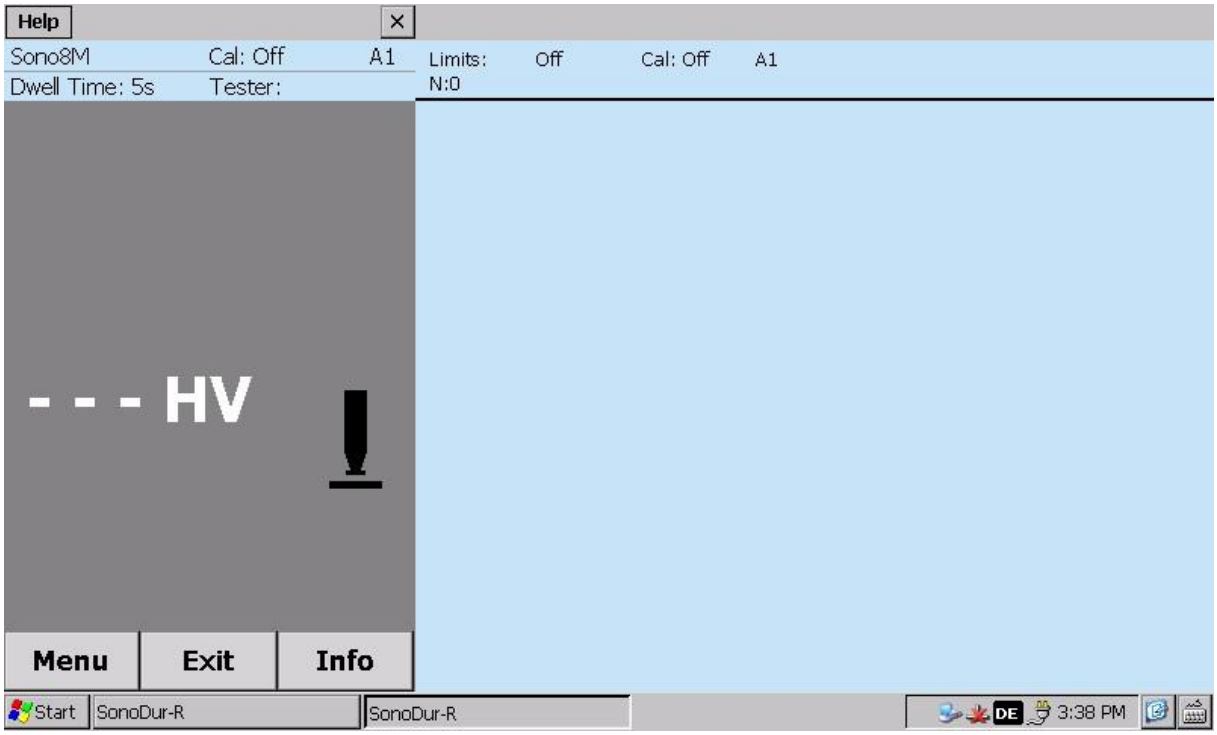


Figure 5. 1

Please note:

If the main window gives up control to another window (this happens p.e. if changing over to a sub menu, touching to the desktop screen or if an error box appears) the right window area (statistic window) changes to red and the ALARM output is active. As long as the red window is shown, SonoDur-R is not in the measuring mode and no measurements can be taken (see figure 5.2)!

In that case, finish your settings und return to the main (measuring) menu. The red window will change to blue again and SonoDur-R is now ready to take measurements.

If you touch by mistake the desktop background, the red window will appear as well. Just touch the main measuring window to return to measuring mode.

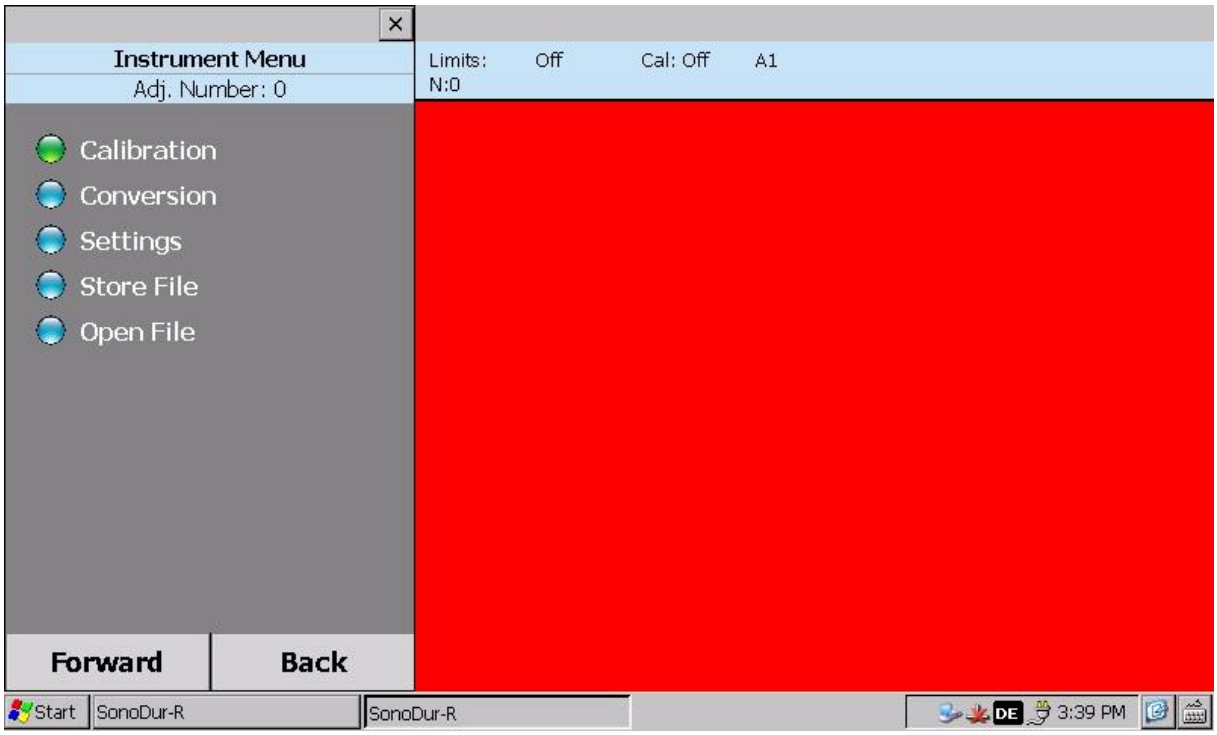


Figure 5.2

6 Connect and Disconnect Probe

The probes are connected with the SonoDur-R through the connection cable that is firmly connected to the device. The silver metal plug is a locking connector in accordance with the push-pull principle: When inserting the connector, 3 claws securely lock the connector into the jack. **Releasing is only possible by pulling back the outer sleeve of the plug which releases the locking claws!**

Please note:

The connector has a contact arrangement, which allows the connection in only one position.

6.1 Connect Probe

Carefully slide the silver metal plug into the probe socket and rotate until the plug has reached the correct position and can be smoothly pushed into the socket. Locking is indicated by a "Click". The connector is now firmly locked with the jack through 3 claws.

6.2 Disconnect Probe

Unlock the silver probe connector by pulling back the sleeve and pulling it out of the jack.

Please note:

The probe connector should not be separated from the probe during operation!

6.3 Removing Probe Connector during Operation

If the probe connector is removed during operation, the program SonoDur-R will be closed and can be called up again by touching the SonoDur start icon on the touch screen. In some unfavorable cases the system may not recognize the probe and an error message will be generated. In this case the probe should be disconnected again and the SonoDur-R switched off and on. Afterwards the probe may be connected then calling the SonoDur-R program.

6.4 Operating without Probe – Simulation Mode

The device is equipped with a special feature when turning it on without a connected probe: The simulation mode makes it possible to test all functions of the SonoDur-R measurement program, without having to perform self-measurements with probes.

“Measurement Values" will now be generated by touching the probe symbol and all functions in connection with the testing procedure can be operated – a special way of fast training for operators and also to give presentations to all those who are interested.

To return to normal operation connect the probe to SonoDur-R and switch the machine “OFF” and “ON” and the probe will be automatically detected.

Start program without probe:

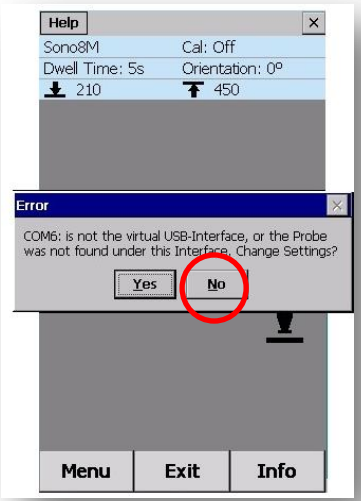


Figure 6. 1

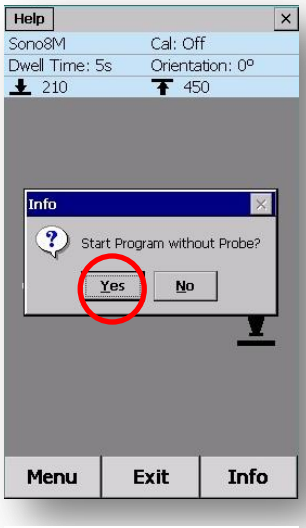


Figure 6. 2

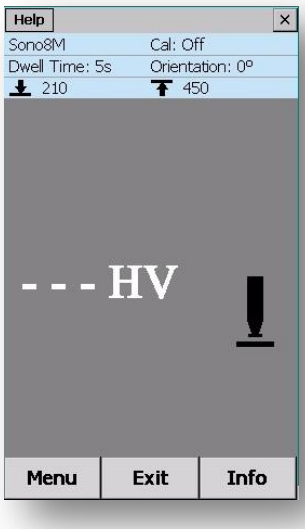


Figure 6. 1

7 Operation

7.1 Control Elements

The SonoDur-R is operated via touch-sensitive fields on the middle area of the screen ("soft keys“). These soft keys can be labeled fields, round buttons or symbols, numbers and figures. Except “Orientation” all other symbols, numbers or figures give direct access to the corresponding menu.

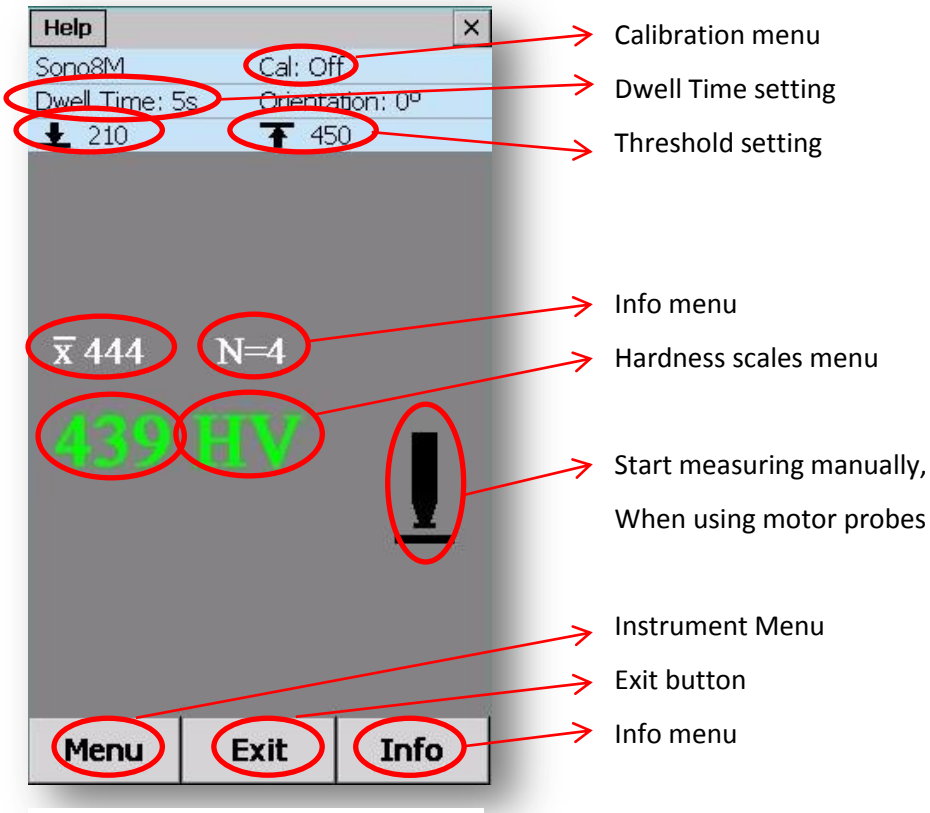


Figure 7. 1

7.1.1 Operating Structure

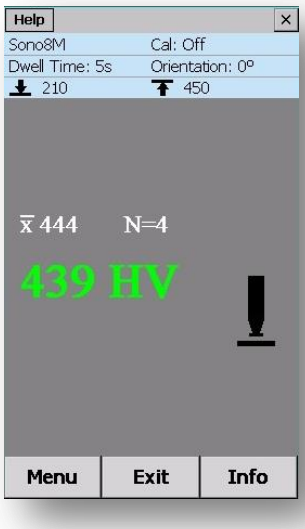


Figure 7. 2

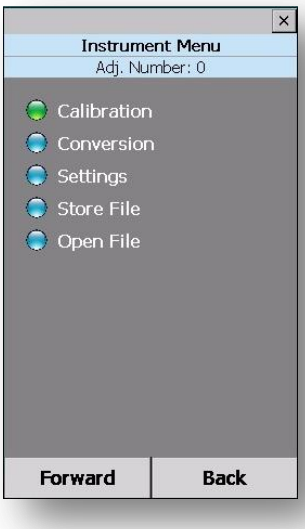


Figure 7. 3

The SonoDur-R basically provides two-level operation, the Measuring Menu (Figure 7.1) and the Instrument Menu (Figure 7.3).

Attention:

CAUTION! Never use anything other than the stylus on the touch screen. Otherwise this could cause a permanent damage.

7.1.2 Description of Control Elements

Changeovers between the menus are performed via touch-sensitive menu buttons at the lower edge of the screen.

Menu

Changeover to the Instrument Menu

Exit

1. Exiting the Measurement Menu, end of the measurement series
2. Exiting any sub-program within the Instrument Menu and changeover into the Measurement Menu
3. Closing SonoDur-R (after processing the last measuring series and prior to the first new measurement value).

Info

Display device settings for the measurement process, display of measurement results such as statistics, single values and corresponding correction possibilities.

Next

Call up “green” highlighted menu item and take one step forward within the sub-menu

Back

Go back one step within the sub-menu

File (within the “Info” sub-menu)

Activating and displaying of stored measurement data.

7.2 Soft Keys:

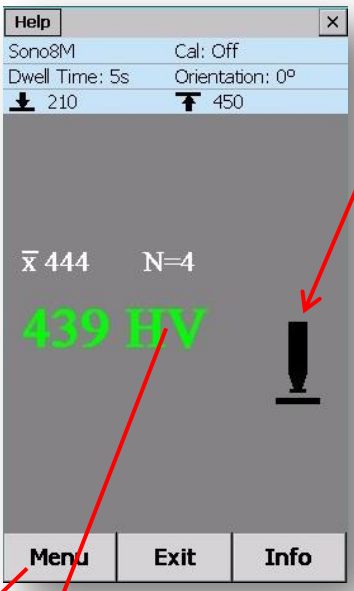
By touching the screen within the Measurement menu, direct changeovers to specific sub-programs can take place, for instance:
In the Measurement Result field by touching of

- “**HV**“: Change over to the hardness scale selection
- “**610**“ HV, current measurement value with the inquiry, whether the latest measurement value shall be deleted.

- Average value "**Overline X**": Change over to "Info Menu", Section 7.5 after processing of measurement values (analogous to the **Info** button)
- "**Indentation Time 5 s**" to change the indentation time
- **"SONO3M**", if a motorized probe is connected (or SONO1M, SONO8M), change over to the measurement method selection "motor-driven" or "freehand measurement"
- "**CAL: Off**": Change over to subprogram "Calibration"
- Line indicating the **tolerance thresholds** (if it has been set): "Thresholds"
- "**Probe Symbol**", manual initiation of hardness measurement (see measurement process)
- **"Direction: 0**", correction of measurement direction (is currently still without function)

Examples:

"Cal: Off" Standard Calibration, Sono8M: motor probe 8,6N Test Force
"Penetration Time: 5 seconds"
"Direction: 0", Measurement Direction (currently still no function), **"210; 450",** lower and upper tolerance thresholds.
"439" Delete measurement value?
"HV" Change hardness scale?
"**Overline X 444"(average and N=4 No. of measurements),** Process measurement values.



Probe Symbol:
Manual initiation of measurement cycle by touching the probe symbol

Instrument Control:
Menu = Instrument Menu
Exit = Change over to "measurement" or "end of measurement"
Info = Display of settings and results
File = Displaying stored data

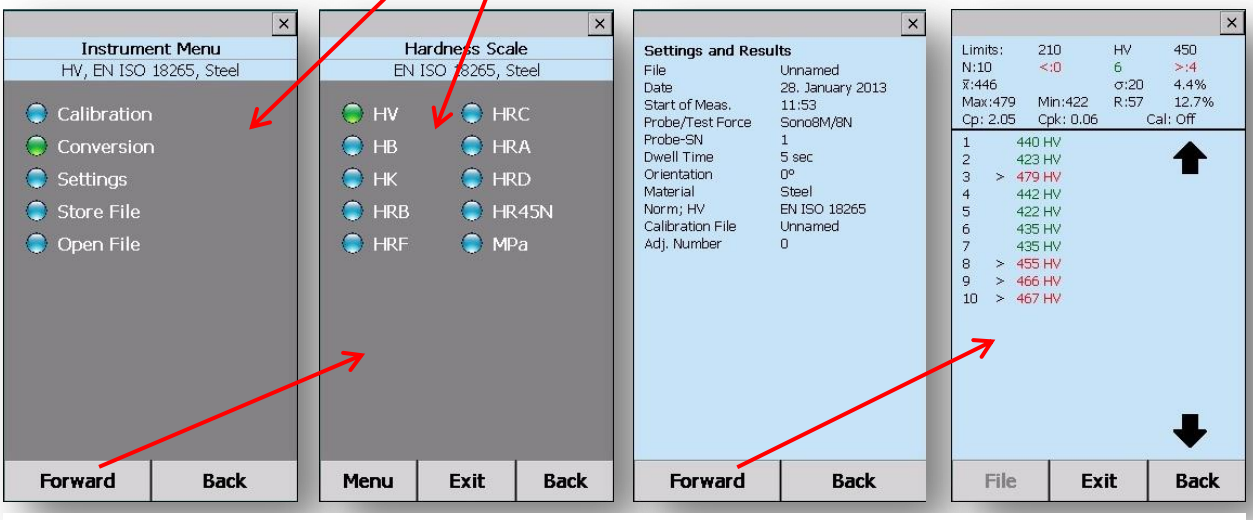


Figure 7. 4

Current evaluations in other hardening scales in accordance with standard and depending on connected probe.

"Info": Settings and Results.
"Forward": Details, correct individual measurement errors.

7.3 Entries via System Keyboard or SonoDur-R Keyboard

All entries in input fields requesting numbers be can be done by the SonoDur-R keypad or the system keypad. The system keypad is located in the bottommost right corner of the screen and can be

activated by clicking on the keypad symbol. If letter symbols are needed (in case of naming data sets), the system keypad will automatically pop up and disappear, when the entry is finished. The system keypad can be closed manually by clicking “Hide Input Panel”

Any position inside the input field can be marked, modified or supplemented.

Numbers however should be entered via the large and more user-friendly SonoDur-R keyboard: Number field, horizontal arrow as Delete key (individual symbols on the left hand side in order to place the cursor), decimal point or minus sign.

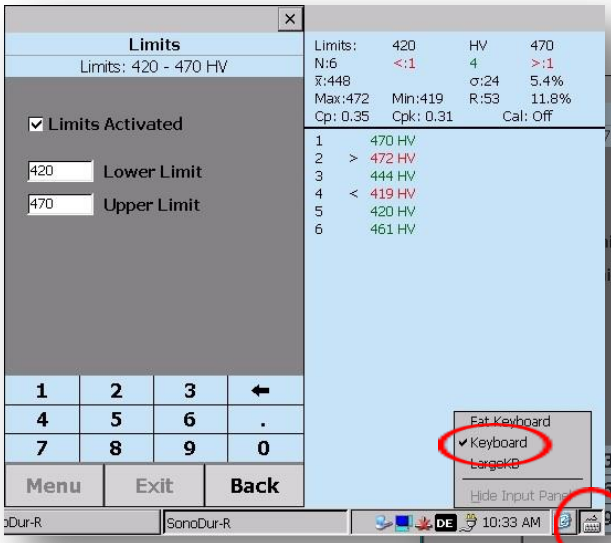


Figure 7. 5

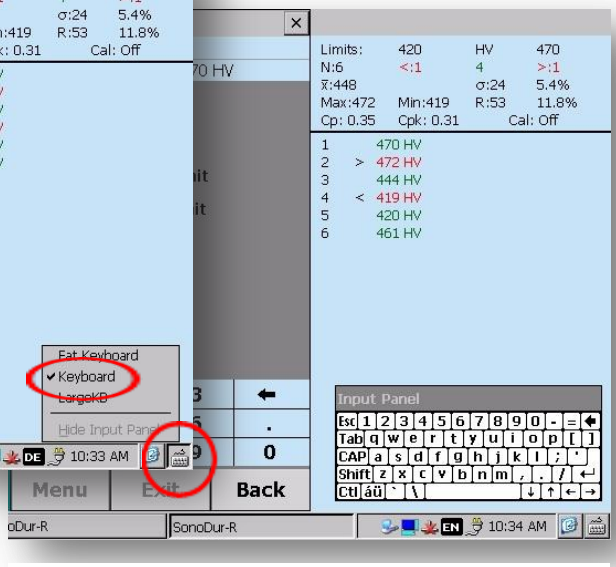


Figure 7. 6

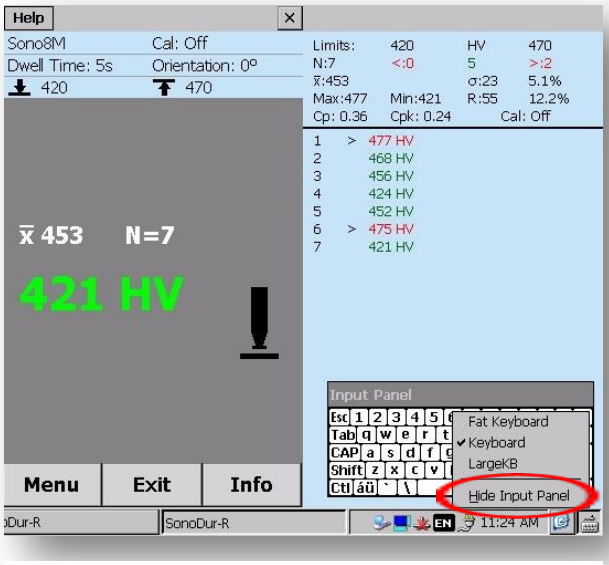


Figure 7. 7

7.4 Main Menu Measurement

7.4.1 Carrying out of Measurement by Means of Motorized Probes

The SonuDur-R benchtop instrument must be in the main menu “Measurement“, to enable the accomplishment of a measurement. The Measurement menu can be accessed from any program item via the **Exit** button.

Figure 7. 8

Figure 7. 9

Measurement menu and probe guidance during the performance of a measurement: As shown in the image above, it is recommended to hold the probe on the bottom of the probe base during the penetration phase in order to prevent it from tipping over. This risk is particularly high, if the probe is only hold on the top.

7.4.1.1 Automatic Measurement with Probe Shoe and Switching Sleeve:

Carefully attach the SonoDur motorized probe (Figure 7.9), keep it pressed down and wait until the measurement process is completed. When the probe touches down, the switching sleeve will be pressed backwards, triggering the motor control through a micro-switch. The Vickers diamond will be automatically moved from the casing towards the material surface. This process is indicated by a directional arrow in the probe symbol of the device display. As soon as the nominal test force has been reached, the probe symbol will be replaced by the remaining penetration time (units, indicated in seconds) and the countdown starts to run. Once the preset penetration time has expired, the measured value will be indicated and the reverse engine movement simultaneously displayed by an arrow in the opposite direction, until the end position has been reached (see picture sequence below).

It is recommended to not raise the motorized probe for the next measurement beforehand. In this way, potential surface damages by the retracting Vickers diamond can be definitely avoided.

In either case, a new measurement cannot be triggered until the end position had been reached.

Please note:

Invalid measurement results are displayed by the error message "Invalid Measurement". Measurement readiness will be restored via the "OK" button in the display field. This type of error message occurs, e.g. when the Vickers diamond was not able to touch the material surface (Figure 7.13).

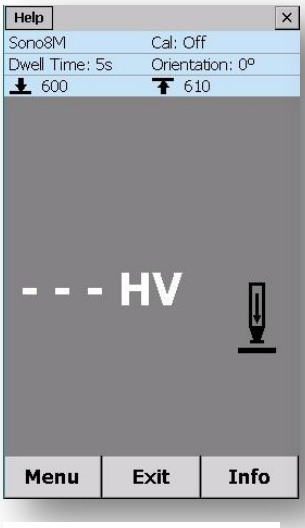


Figure 7. 10

Figure 7. 11

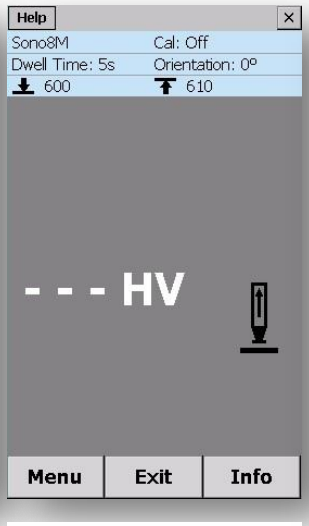


Figure 7. 12

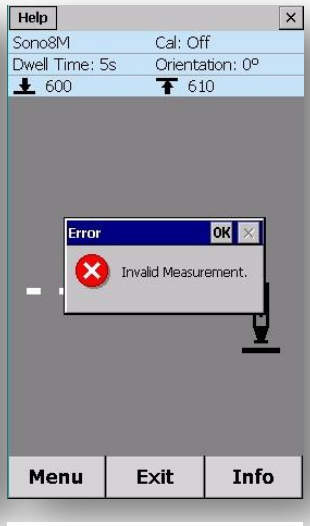


Figure 7. 13

Figure 7.10 until Figure 7.12: Probe movement, countdown of penetration time (in this case, 4 sec are elapsed), probe moves up until end point is reached.

Figure 7.14

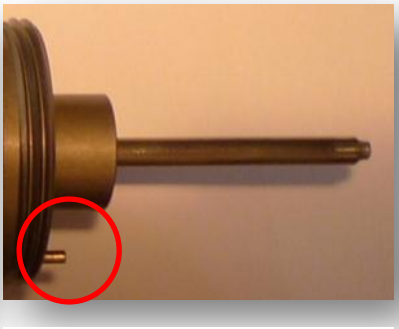


Figure 7.15

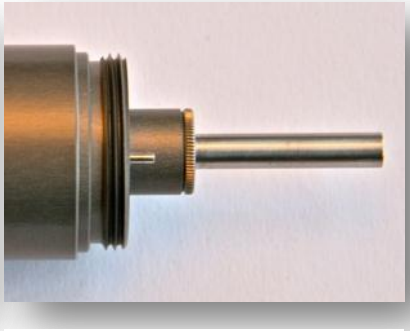


Figure 7.16

When the probe shoe is unscrewed (Figure 7.14), the switching sleeve protrudes approximately 5 mm from the casing and starts the motor once it is placed on the material surface (automatic measurement) by activating the micro switch (red circle). Figure 7.15 and 7.16 show manual measurements with free vibrating rod (Figure 7.15) or by a screwed-on protective sleeve (Figure 7.16, right side) for measurements in places with difficult access.

7.4.1.2 Manual Measurement without Switching Sleeve:

Figure 7.17

After removing the switching sleeve, (in the picture on the left, Figure 7.17) the measurement will be triggered by touching the probe symbol on the SonoDur-R display or by pressing and holding the micro-switch.

Example – Measurements with Probe Shoe:

Measurement points can be set in close distance from each other without lifting the motorized probe. After reaching the upper position (end position) of the Vickers diamond, slightly shifting the probe and touching the probe symbol on the device is sufficient in order to take a new measurement.

Attention:

In order to prevent damages to the surface or to the Vickers diamond as a result of shifting the probe too soon, it is absolutely required to wait until the upper probe position has been reached!

Example – Motorized Measurements without Probe Shoe:

In this configuration, however, the vibrating rod of the motorized probe, is free and can be easily damaged by careless handling (Figure 7.15). This configuration is only recommended, when operating with a stand, good probe guidance and defined distance between probe tip and test object or by very well trained and experienced operating personnel. By screwing on the protection sleeve, the probe rod is optimally protected against mechanical damages (Figure 7.16). However, stable probe guidance is also required in this case.

In both cases, the measurement is triggered via touch screen command or by pressing the micro-switch on the underside of the probe.

Free Measurements with Protection Sleeve:

The probe is gently placed onto the test object, and the measurement commences. It must thereby be ensured that the probe will not be tilted during the measurement phase. After the measuring time has lapsed, the vibrating rod returns to its initial position.

When performing such freehand measurements, it can easily happen that a slight tilting of the probe occurs during the motor movement. This is due to the small surface area of the circular protective tube. Hence, the hardness measurement value could be indicated too low. This effect can be avoided by pressing firmly on the test object surface with both hands and keeping it still, after the probe has been placed. Another possibility is to only hold it softly at first, so that the motor is pushing the probe slightly upwards, once it moves outside. At the end of the motor movement, the operator can gently press against it with his hand and reattach the probe protective tube onto the test object

without any great effort. The measuring time should be as short as possible, for instance, 2 or at maximum of 3 seconds. In this way, the effect of tilting will be minimized in both cases. As in all manual measurements, this procedure requires a certain amount of practice and patience.

Free Measurements with Free Vibrating Rod:

Attention:

This testing guidance requires extensive training on hardness reference blocks and shall be only performed by experienced operators!

When taking measurements with a free vibrating rod (Figure 7.15), it should be proceed in such a way, that the penetration time is initially set to 2 seconds. Preferably, the probe is held perpendicular to the test surface with one hand. At first, the vibrating rod does not touch the surface, i.e. it directly sticks out above the material surface into the air (this task is normally fulfilled by the protective tube). The motor movement will now be commenced with the other hand by tapping the probe symbol on the SonoDur-R device and the probe carefully placed and held with the diamond tip onto the test object. As soon as the diamond touches the material surface, the motor will press against the operator's hand. The operator must held quiet against, until the measurement time has elapsed and the motor retracts again.

Example: Measurements without Motor and without Probe Coupler:

In the device menu Settings (Figure 7.18, 7.19), the measurement mode with lifted probe tip (approximately 4 mm) can be selected. This is indicated in the Measurement menu by "Free Hand" at the top left corner (Figure 7.20) – by tapping on it, you will also get directly into the selection menu "Free Hand Measurement" (Figure 7.19). Once the operator manually pushes the vibrating rod

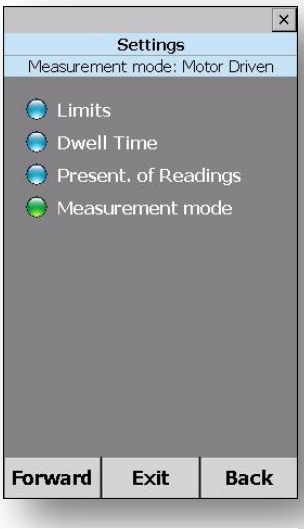


Figure 7. 18

Figure 7. 19

Figure 7. 20

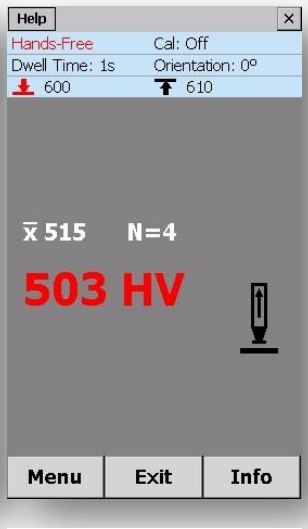


Figure 7. 21

carefully on the test material, a hardness measurement will be taken. Shortly after contact has taken place with the test object, the penetration time starts to count down and the measurement will be triggered. As soon as the manual measurement is completed, an arrow will be shown in the display, indicating that the probe should be raised (Figure 7.21). When measuring without a protective sleeve, the vibrating rod is carefully attached by hand and the probe is pushed down slightly

(approximately 3 - 4 mm) and held until measurement time has lapsed (2 or a maximum of 3 seconds). Also in this case, an extensive practical training is recommended.

7.4.2 Performing a Measurement by Means of Hand-held Probes

The performance of measurements is only possible, if the SonoDur-R display device is set to the Measurement mode. The test force has to be applied manually against a spring in the probe casing. As a general rule, the forces are significantly higher than when using motorized probes (HV1-10N, 50N-HV 5 or HV 10-100N) and the spring is already strongly pre-stressed, so that the nominal test force will be reached after a very short distance – approx. 3 mm penetration path back into the housing. This requires an extremely careful handling of hand-held probes in order to prevent damage to the diamond if it touches the surface too hard!

Please note:

Dwell time is set fixed to zero (will be automatically chosen if a handheld probe is connected) and has to be verified before measuring!

This is the proper way to proceed:

1.) Carefully attach it preferably perpendicular to the test object surface – the contact signal appears in the display
2.) Press the probe gently and continuously on the material until the probe attachment sleeve slightly touches the test object surface or, if the probe attachment sleeve is unscrewed, until the inner end stop in the probe casing has been reached. Thereby, always keep an eye on the probe or the test position – since the device display only shows the old measurement value!
3.) When gently pressed, the nominal test force will be already reached before the end position and the hardness value will be immediately calculated from the measured frequency shift – **raise the probe and only now you should read the measurement value!**

It is absolutely unnecessary and also hazardous to press hard and long time because the measurement has already been performed long before the end stop is reached. It is also not required to perform the test sequence within a short period of time limit as it is possibly need to be done with any other hardness testers. On the contrary: **It is advisable to leave yourself enough time in order to perform the entire process slowly and in a controlled manner.** In this way, overloads or damages to the diamond can be prevented. The probes behave extraordinarily good-natured and any operator influence is hardly felt. In addition, the measurement results are regardless of direction.

With the above method, exact measuring results can be achieved after a short training, which otherwise can be only achieved by means of additional guidance supports or support stands.

Figure 7. 22

Figure 7. 23

Figure 7. 24

Figure 7. 25

The force shall be exclusively applied starting from the probe closure head via the palm of the hand or the thumb. Other fingers are solely there for the "force-free" probe guidance. A second hand can serve for this purpose as well. In any case the force vector must point into the direction of the oscillation rod axes in order to avoid disturbances by lateral forces. When the probe attachment sleeve is unscrewed, small and narrow test positions can be also securely measured (figure on the right, SONO-100H, HV10 to test cutting edges on construction steel according to EN ISO 1090).

7.5 Information Menu

Display of current device settings, measurement results and analysis and processing of measurement data.

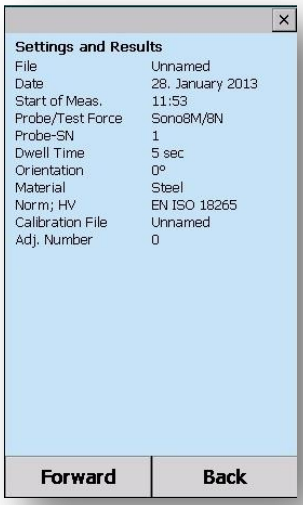


Figure 7.26

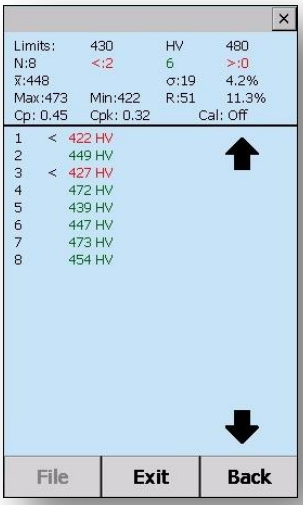


Figure 7.27

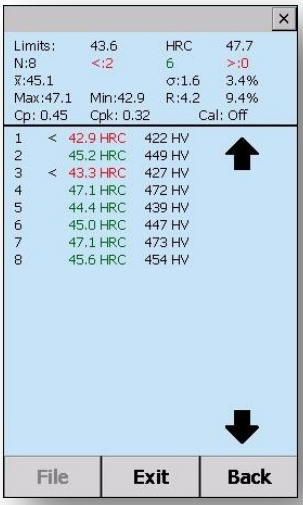


Figure 7.28

All relevant information is displayed at a glance (Figure 7.26) and via "Forward" button, information on the measurement results (Figure 7.27 and 7.28). Figure 7.27 shows the same result as Figure 7.28 with the only difference, that the original measurement values (HV) have been converted to HRC, whereas the results of the original scale are always carried along for information purpose. The relevant tolerance thresholds will be automatically converted from the original scale to the re-evaluated hardness scale along with the summarized results for the average value, overline X, mean error of individual measurement σ, range R, minimum and maximum.

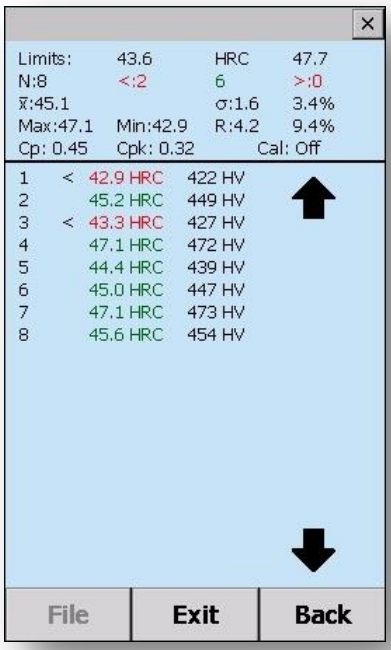


Figure 7.29

Interpretation of results (in this case, in HRC):

Thresholds: Minimum, maximum, hardness unit HRC
Measurement quantity N = "8", thereof "6" measurements within the tolerance range, "0" above, "2" below.
Average value, overline X =45.1 HRC, σ = 1.6 HRC or 3.4 % of overline X
Extreme values: Max = 47.1 HRC, Min = 42.9 HRC, R = 4.2 HRC or 9.4 % of overline X
Process parameters: Cp=0.45 or Cpk=-0.32; Cal= off (dimensionless, standard steel)
Individual results: Green = Ok, Red = beyond tolerance, > = above and < = below, X = deleted, Black = Vickers values for comparison.

Please see Appendix for further explanations on terms and formulas.

Correction of measurement results by tapping on a measurement value (in this case: No. 3, 43.3 HRC, Figure 7.31) by confirming (Yes / No) or recovery of deleted measurement values (in this case: measurement value 43.3 HRC, former measuring point, No. 3, Figure 7.32). “Deleted” readings are only marked with an “X” and still present.

Any measurement values can be deleted or restored after analysis has been performed. The results are updated and newly calculated for each condition.

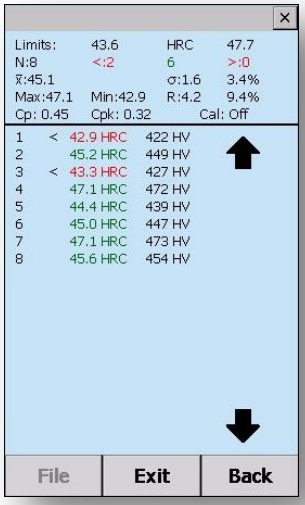


Figure 7.30

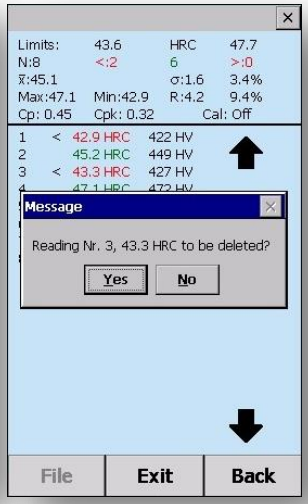


Figure 7.31

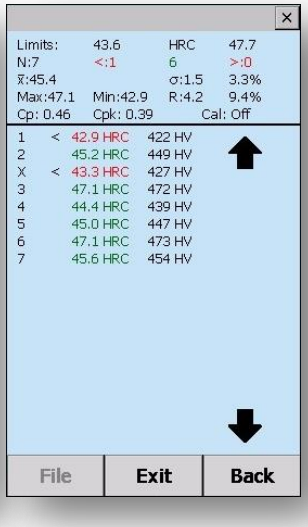


Figure 7.32

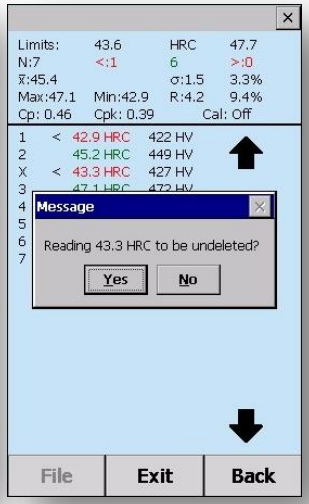


Figure 7.33

7.6 Instrument Menu

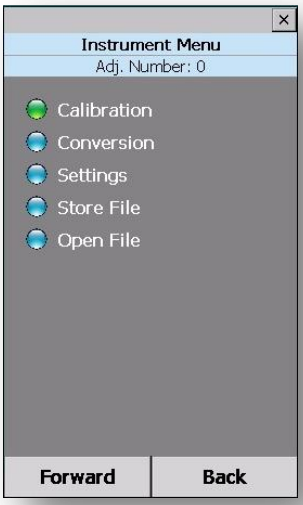


Figure 7. 33

The instrument menu can be accessed via the **Menu** button on the Measuring Menu.

Additional program steps are indicated in plain text with the aforesaid colored dots:

Green: Will be executed by the Forward button
Blue: is available as menu item
Red: is not available as menu item
By tapping a blue highlighted menu item, the item will become highlighted in green and executed via the Forward button. Within the new menu item, the name of the menu item and the currently selected setting will appear once again on the top of the status bar.

7.7 Calibration

This is where the measuring system can be calibrated to the test material by determining a setting value containing the material properties (E-modulus deviating from low-alloy steel) and applies to the specified test method. This setting value depends on the test load, probe type (hand-held or motorized probe) and on the measurement process (penetration time and measurement direction). Stored calibrations only apply to the specific probe type.

The adjustment is carried out via the subprogram "Adjust Measurement Value", in which the setting value is directly determined through a direct calibration measurement on the test object or via "Set of Adj. Number" by entering the setting value without performing a calibration measurement, whereas all measurement values will be immediately recalculated by using this new setting value.

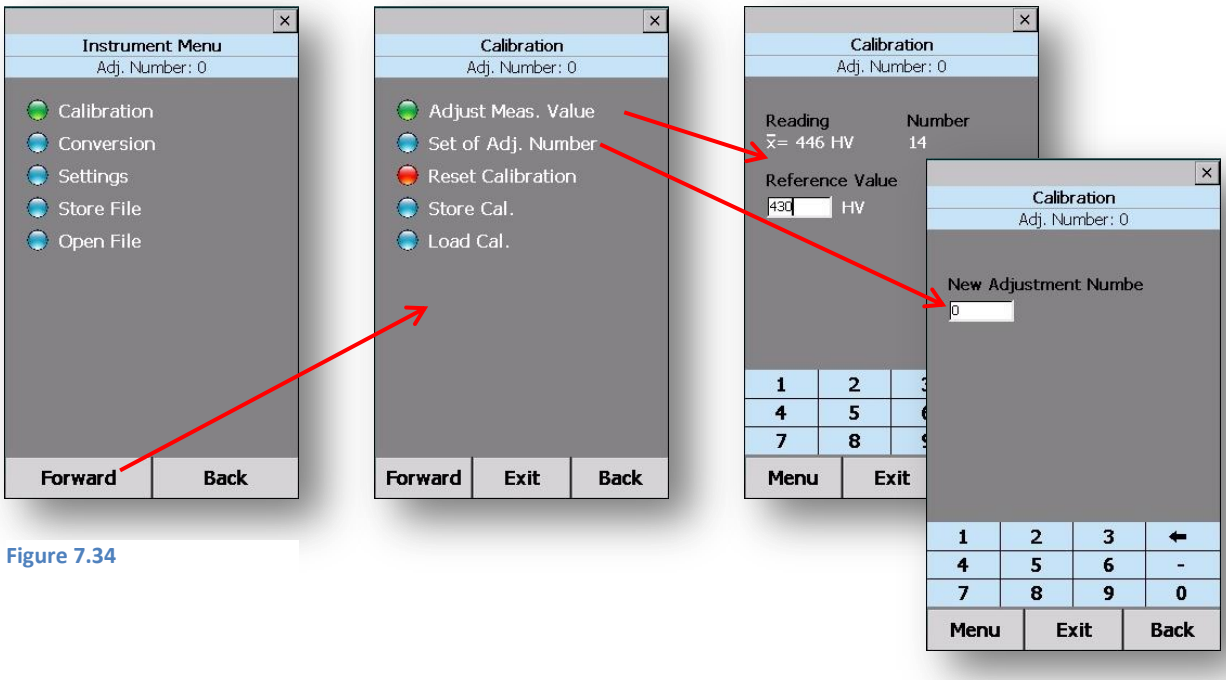


Figure 7.34

7.7.1 Adjust Measurement Value

If a measurement series has been recorded, there are two adjustment options, which are described under a) and b.). The system asks whether the result (average) of the readings already recorded, shall be used for the calibration.

a.) “YES": The determined average value will be immediately indicated in the "Measurement Value" field as well as in the "Nominal Value" field. The desired reference hardness value can now be entered here via the keyboard (Figure 7.36).

Thereby, each digit in the nominal value field can be separately highlighted and modified. If there is subsequently a difference between “measured value” and “nominal value”, by pressing one of the buttons "Menu", "Exit", "Back" it is queried whether these changes should be carried over (YES) or not (NO) with the possibility of cancellation (Figure 7.37). In case of cancellation (red circle), the system remains in the previous state and further modifications can be carried out

(e.g. to correct incorrect inputs). If the result of the calibration is accepted with "Yes", SonoDur-R queries if a new test series should be applied (Figure 7.38).

If “No” is selected, the measurement data will be converted with the new calibration number and the measurement series will be continued (Figure 7.38 and 7.39).

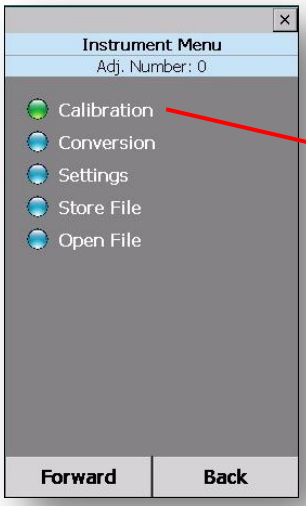


Figure 7.35

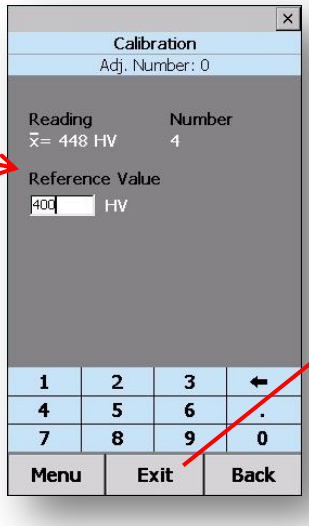


Figure 7.36

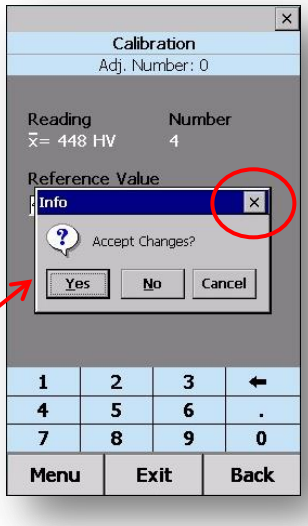


Figure 7.37

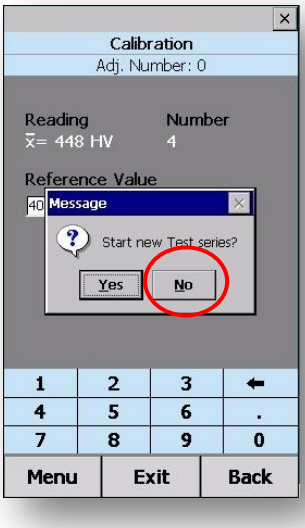


Figure 7.38

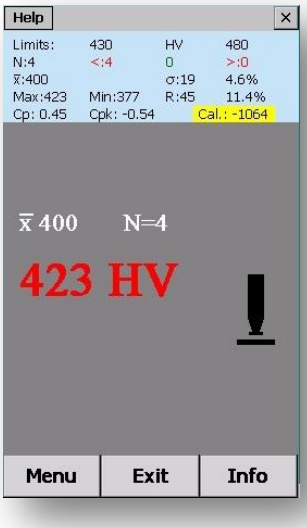


Figure 7.39

If "Yes” is selected, SonoDur-R asks whether the data should be stored or not. If "Yes", the sub-program Store File (see section 7.11.1 Store File, Page 39), opens up. After storing the data set, a new measurement series will be started and the measurement counter will be set to N = 0.

b.) “NO": The determined average value is not used and therefore, (3-5) measurement values must now be recorded within the calibration program (Figure 7.41). Only the average value will be displayed.

Subsequently, the nominal value can be entered and reconfirmed.

If no measurement series is available, the calibration measurement will be directly started, as described under b.).

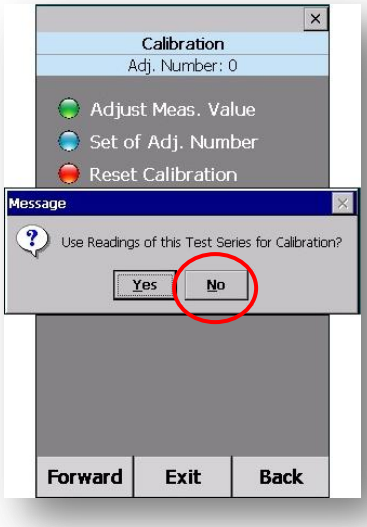


Figure 7.40

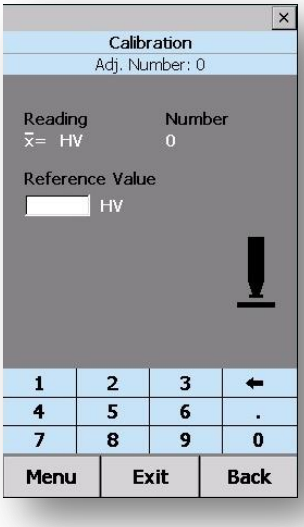


Figure 7.41

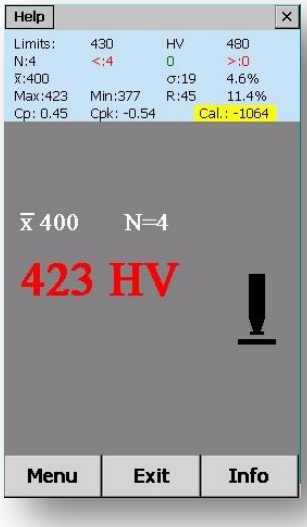


Figure 7.42

Please note:

The proceeding under a.) i.e. recording a measurement series at first, has the advantage that the individual measurements can be analyzed in the run-up via the info button in the measurement menu and hence, potential rogue results can be detected and eliminated. In this way, an “improved’ calibration measurement is possible in the first place, since under b.) the possibility of correction of individual measurements is not provided.

7.7.2 Adjustment Number Directly

The adjustment value (often named “CAL factor”) can be directly entered if already known. You will be asked, if a new test series should be start (Figure 7.46) . If “NO”, all measurement values and statistic will be re-calculated with the new calibration factor (see Figures 7.43 through 7.47). If “YES” is selected, you will be asked to store the dataset and a new dataset will be started.

Figure 7.43

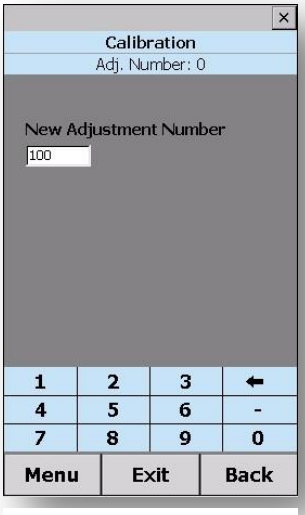


Figure 7.44

Figure 7.45

Figure 7.46

Figure 7.47

7.7.3 Delete Calibration

By executing via the Forward button in figure 7.48, the adjustment number will be set back to 0 = low alloy steel, if a calibration exists. SonoDur-R then queries, if a new test series should be started. If “NO”, all existing measurements will be re-calculated to low alloy steel. The menu item in the device

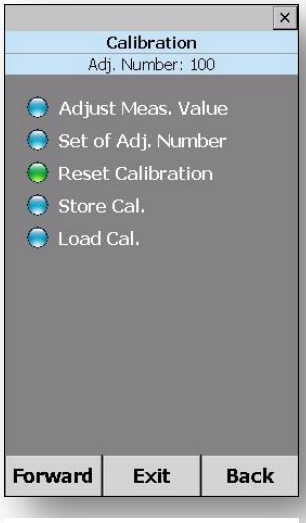


Figure 7.48

Figure 7.49

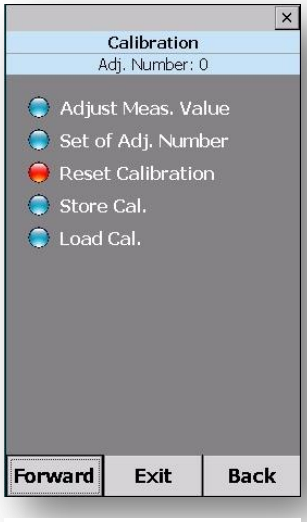


Figure 7.50

menu will then be marked in "red” – “not available", since it has already been executed, until a new calibration figure has been determined (Figure 7.50).

7.7.4 Save and Load Calibration

Store a calibration (Figure 7.51): The device automatically suggests a name. A new name can now be selected by means of the keyboard. The corresponding input panel is at the lower edge on the right hand side of the screen (one press). Here you can select between small (Fig. 7.51) and large Keypad. After use “hide input panel” must be selected.

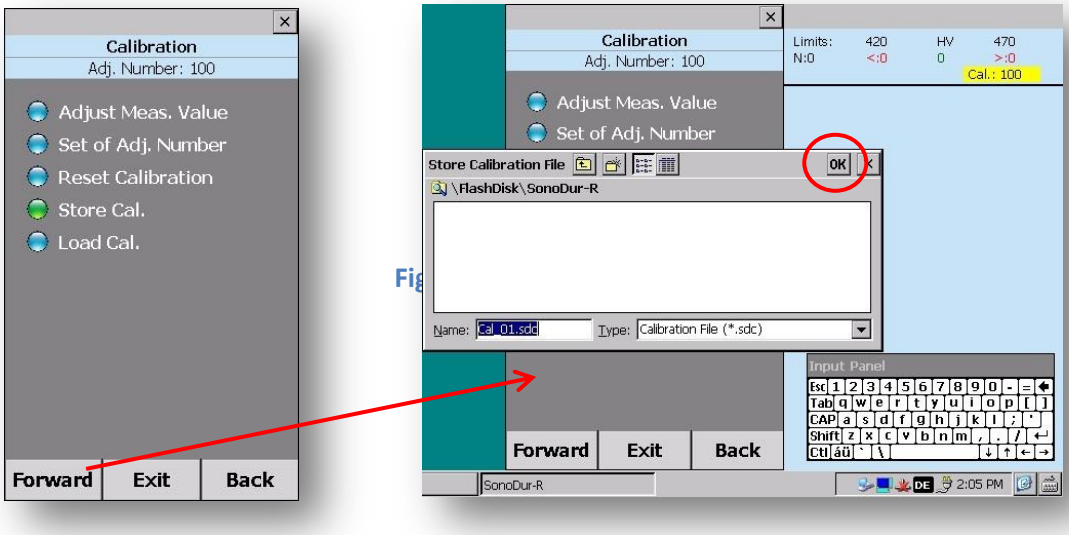


Figure 7. 51

If “Load Cal.” is selected, a similar menu will appear, open up the folder with the stored calibration files. If a calibration file is selected and confirmed with “ok”, a message window will open, asking if the actual measurements should be stored.

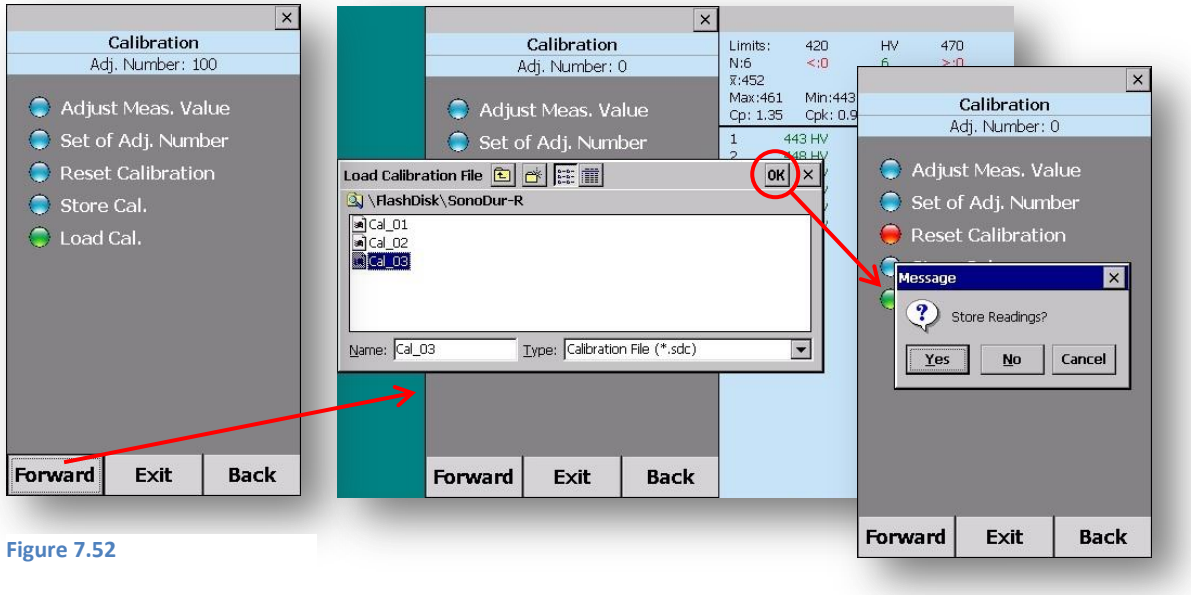


Figure 7.52

Please note:

Selecting “No” will delete the actual measurements! If “Yes” is selected, the store data menu will pop up, thus allowing the actual readings to be stored.

If the calibration data does not fit to the probe, an error message will be generated.

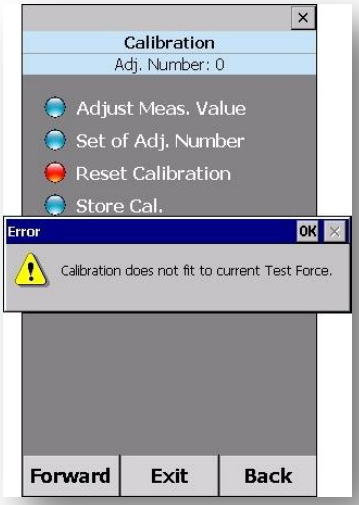


Figure 7.53

Please note:

Calibrations can only be loaded for the specific probe type, for instance, data for SONO 1M are not carried over, if SONO 3M is connected and the above-mentioned error message is shown (Figure 7.53).

7.8 Conversion

From the Instrument Menu, selecting “Conversion” leads to the setting for scale, standard and material.

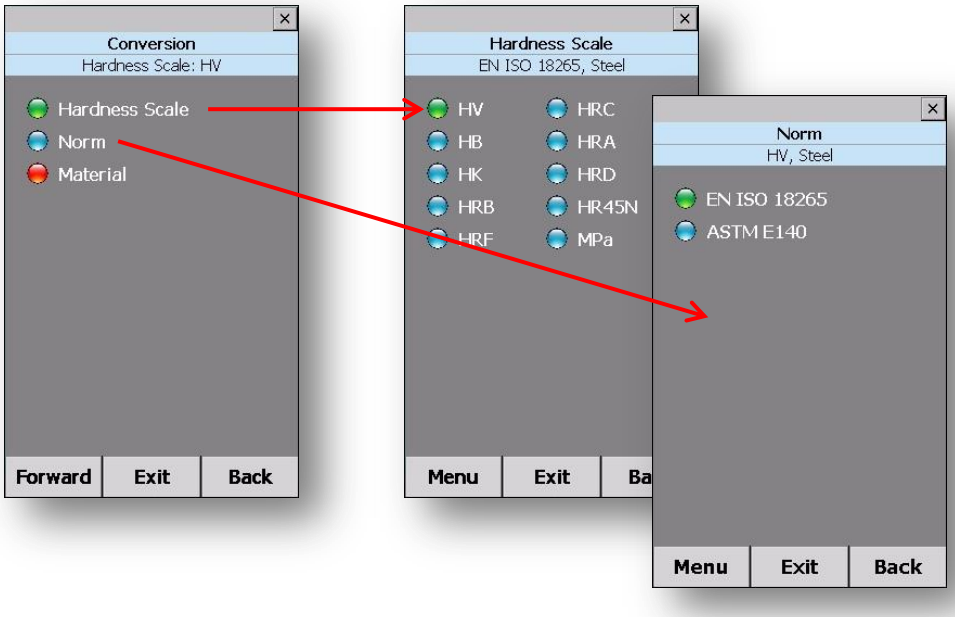


Figure 7.54 Figure 7.55 Figure 7.56

7.8.1 Hardness Scale

Selection can be made by tapping on the available scale symbol or following the menu tree. The conversion standard and selected material will be indicated in the status bar. Standard or material can also be selected by means of the "Back" button.

7.8.2 Standard

Both conversion standards, in accordance with ASTM E140 and EN ISO 18265, are available in its current version (Figure 7.56).

Attention:

Regarding conversion standards, please see explanations provided in Section 2.1 Measuring Method, page 6.

7.8.3 Material

At the present time, conversion standards are only stored for steel (Figure 7.55 and Figure 7.56).

This holds also for the upper and lower conversion limits where Aluminum for instance can be measured using the Vickers-Scale but in other Hardness scales can hardly be handled within the SonoDur-R conversions. Here it is recommended to use the calculation rules given in ASTM E140 standard and compute the Brinell Hardness and others from there and vice versa.

7.9 Measurement Results

Selection of measurement result displays in the device menu under "Settings".

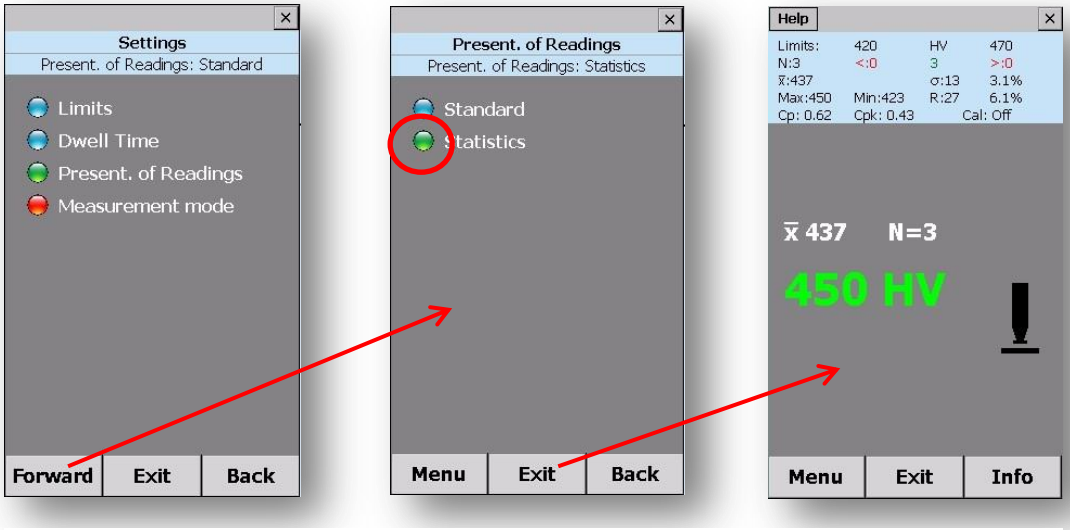


Figure 7.57

SonoDur-R is pre-programmed to “Standard (e.g. Figure 7.57). Users, who want to view all measurement results, may select "Statistics" (Figure 7.57, red circle). However, the direct access to the submenus will be turned off and the operation is only possible via the lower menu buttons.

7.10 Settings

7.10.1 Thresholds

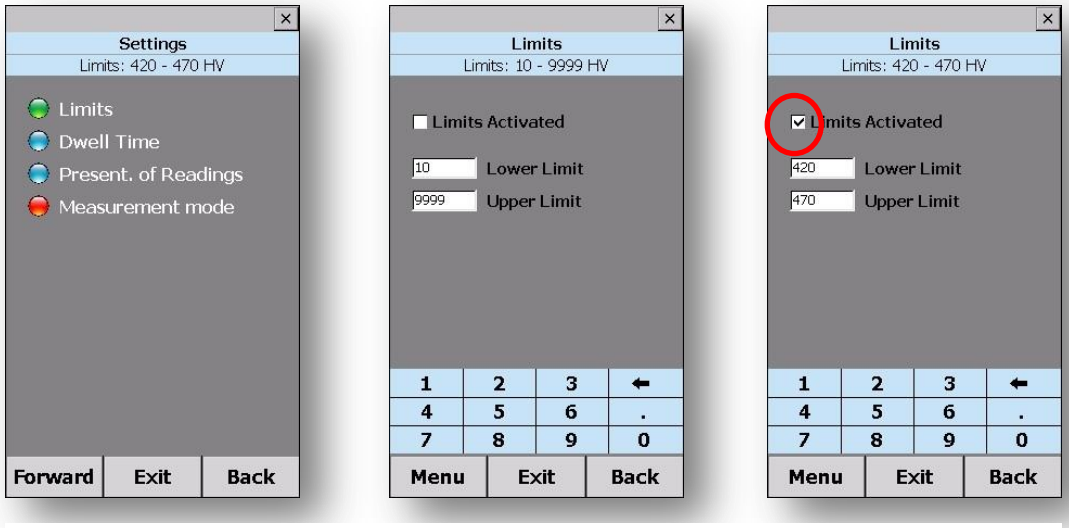


Figure 7.58 Figure 7.59 Figure 7.60

If no thresholds have never been defined (Figure 7.59), the maximum tolerance range for the selected hardness scale will be displayed for selection.

The selected tolerance thresholds must be turned on via "thresholds active" (check mark, Figure 7.60). Tolerance thresholds can be set at any time of measurement in order to optimize the analysis of results.

7.10.2 Penetration Time:

In accordance with the instructions for motorized probes, the penetration time can be adjusted between 1 and 99 seconds (Figure 7.61 to Figure 7.64). If the input value goes beyond the permitted limits, an error message will be generated which must be confirmed in the display via the OK button. Thereupon, the initial numerical value will be displayed once again, which then can be corrected in the input field. If the penetration time gets changed, a current series of measurement must be completed and a new series must be started (Figure 7.63 and Figure 7.64).

Attention:

The **penetration time has been fixed to "0" seconds** for hand-held probes, as otherwise incorrect measurements would be generated (please also see the use of **hand-held probes**).

Setting of penetration time (not available for handheld probes)

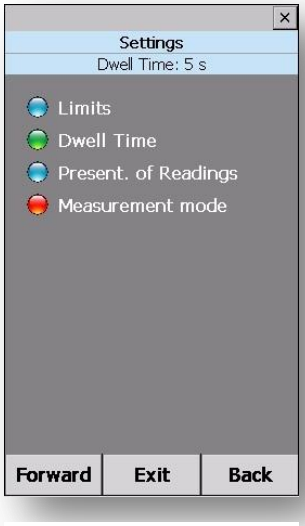


Figure 7.61

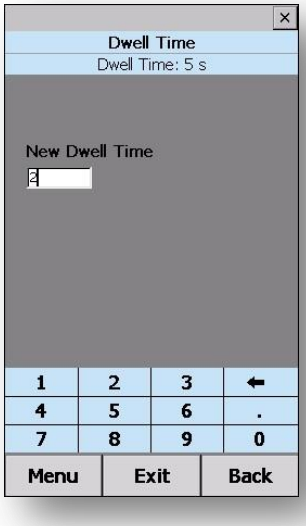


Figure 7.62

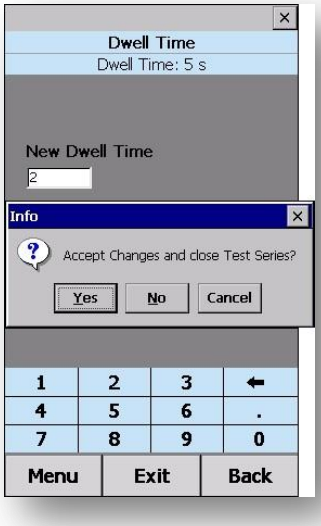


Figure 7.63

Figure 7.64

7.10.3 Tester

From software version 2.06 on SonoDur-R offers the ability to personalize the results by entering the tester's name. Change over from the instrument menu to the setting menu and select "tester". You can enter the name of the inspector using the keyboard (see figure 7.65 and figure 7.66). Direct access is also possible by tapping the soft-key "tester" in the measuring menu. The name of the tester will appear in the log file as well (figure 7.67)

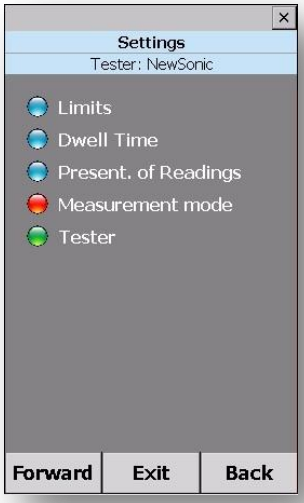


Figure 7.65

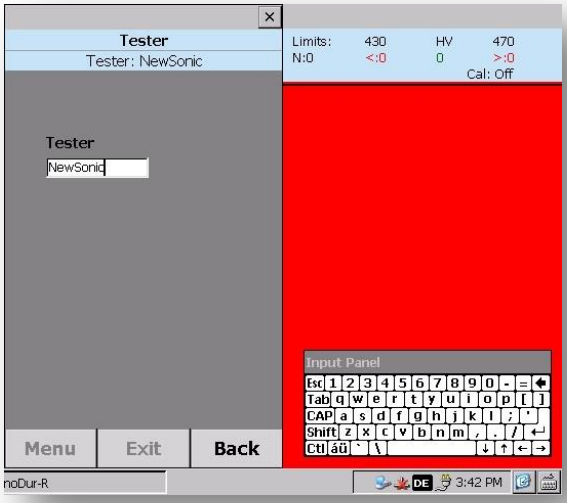


Figure 7.66

How to find the input panel refer to Chapter 7.7.4

File		File_01
Date		25. March 2013
Start of Meas.		14:08
Tester		NewSonic
Probe/Test Force		Sono8M/8N
Probe-SN		1
Dwell Time		5 sec
Orientation		0°
Material		Steel
Norm; HV		EN ISO 18265
Calibration File		Unnamed
Adj. Number		0
Limits		430 - 470 HV
Number		8 (<:0 =:6 >:2)
Mean		457 HV
Std. Deviation		15 HV; 3.3%
Maximum		472 HV
Minimum		432 HV
R		40 HV; 8.8%
Cp		0.44
Cpk		0.30
1	459	HV
2	465	HV
3	440	HV
4	432	HV
5 >	472	HV
6	448	HV
7 >	471	HV
8	466	HV

Figure 7.67

7.11 SonoDur-R Data Handling

SonoDur-R device provides the opportunity to store and access measurement data and transfer to external computers.

7.11.1 Store File

Measurement data can be stored under an individual name and reactivated. Upon completion of the measurement series via the Exit button, SonoDur-R queries whether the measurement data should be stored. This also applies to the event, that the measurement process should be changed (penetration time, new calibration figure). If the question is answered with "Yes", the device menu for the saving of measurement data opens up (Figure 7.69). SonoDur-R suggests a file name and increments it by "one" each time, if new measurement series are started.

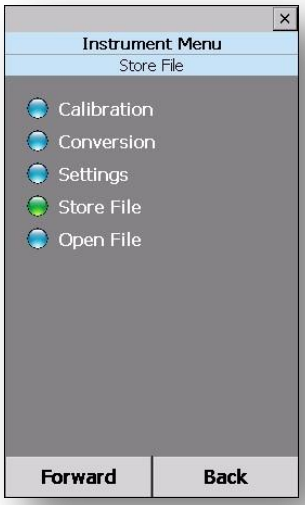


Figure 7.68

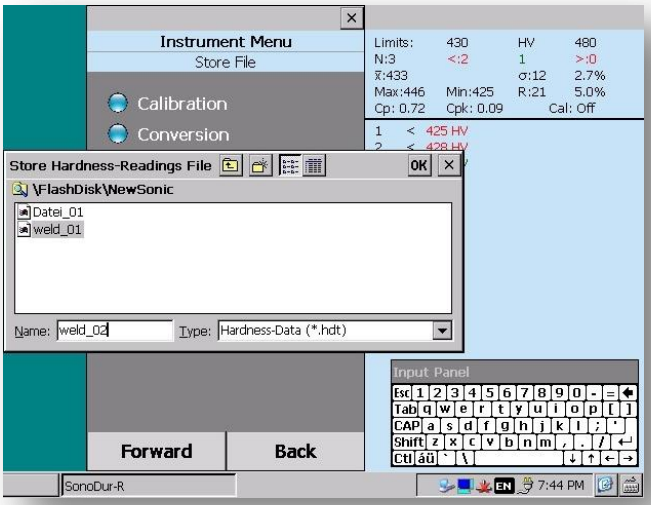


Figure 7.69

The domain "SD-Card\SonoDur\Data\" is predefined as data folder. This can be modified using the file explorer but is not recommended. Further details are provided in the next section 7.11.2 Open File, page 40.

7.11.2 Open File

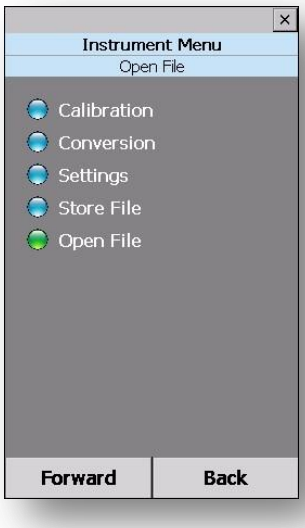


Figure 7.70

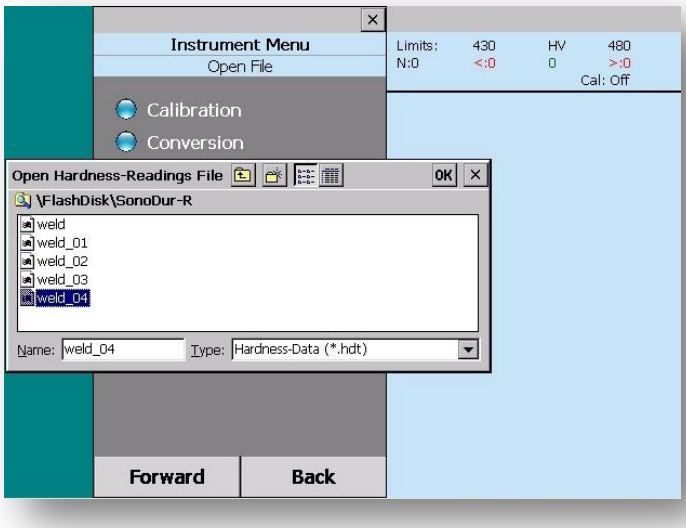


Figure 7.71

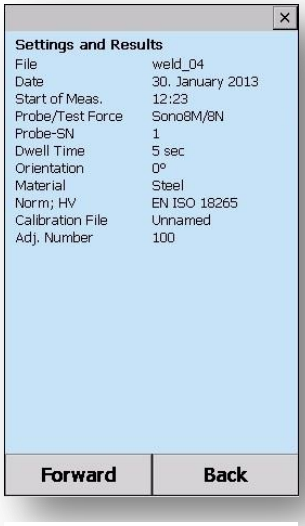


Figure 7.72

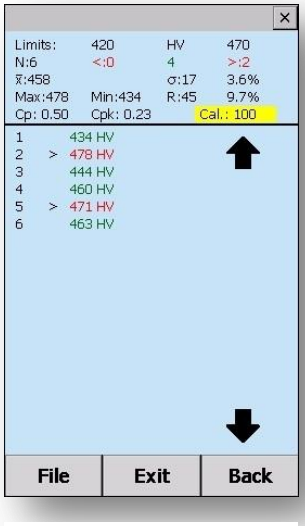


Figure 7.73

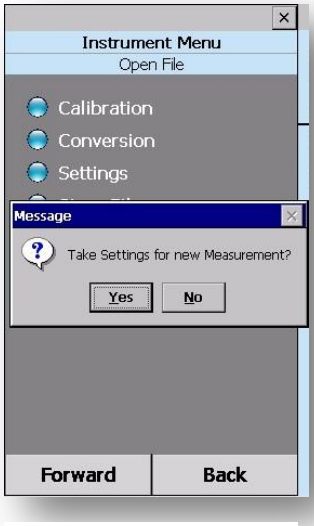


Figure 7.74

If you select "File Open" in the device menu, any saved measurement series can be indicated again. The accessible program area is limited to the information area, i.e., the data can only be viewed. (Figure 7.72 through 7.74). It is not possible to make any further changes (measuring value correction) and tapping on a measurement line is responded with an error message. This can be easily cancelled by clicking the OK button.

Please note:

When leaving the INFO menu via the EXIT button (Figure 7.73), the stored measurement settings of this file can be carried over in the transition to the measurement menu, if the query becomes confirmed with "Yes" (Fig. 7.74) and the currently connected probe features the same test force than the probe under which the measurements have been stored. This enables the direct continuation of measurement series with the familiar settings.

7.12. Data Transfer and Interfaces

In order to be able to transfer data via USB cable the installation software for the SonoDur-R device must be installed.

Detailed descriptions of computer systems, based on WIN XP and WIN 7 can be found in section 10.6 Installing Interfaces and Drivers on page 47.

Please note:

It is generally recommended to back up important calibration data into higher-level computer systems in order to avoid data loss in case the device is defective.

Information on SonoDur-R:

- The saved measurement data are stored in two file formats, namely text files (.txt), and source files (.hdt). After data transfer completion, the text files can be further processed in any desired form.
- However, the original data are immutable and should therefore also be stored in higher-level computer systems.
- These original measurement data are important for the verification of data security and traceability of test results for potential audits.

7.12.1 USB Cable

Connect the SonoDur-R device to the PC via USB cable and turn on the device. The driver software will now be automatically installed on your PC and the appropriate communication program starts automatically.

WIN XP: The system folder "Windows Mobile" can now be opened via "My Computer" and like with any other external storage device, data can be read or folders may be created and deleted.

WIN 7: Windows Mobile will be automatically started and the SonoDur-R device will be configured. The "Windows Mobile Device Center" will open up and the setup of the SonoDur-R device is provided – however, this is not necessarily required and therefore can be interrupted – please also see Section 10.6.1 USB Installation, Page 47. Under "File Management" the internal memory of the SonoDur-R device can be accessed and the data processing can now take place with a PC.
All stored data can now be completely transferred from the SonoDur-R device to the PC in one go and the text files, for instance, can be converted into Excel files. For this purpose, Excel has to be started in order to import the desired text document.

7.12.4 SD (Data Card) Operation

The SonoDur-R saves all measurement and calibration data on the internal flash disk or an exchangeable SD card. The advantage of the last solution is that in the (unlikely) event of a device defect, measurement and calibration data remain safe with very high probability and can be easily transferred from the SD card to a PC. In this event, please contact our customer service. The SD card is not accessible from the outside!

8 Functional Monitoring by the Operator

The UCI tester is a precision device and should therefore guarantee flawless operation over a long period of time, if appropriately and carefully used. Nevertheless, it is advisable to perform the following system checks:

- Check the measurement accuracy and reproducibility with hardness reference blocks (we recommend MPA-certified hardness reference blocks). It is described in **DIN 50159.** Here we deviate from the mandatory use of a specific size of block, but recommend in any case to couple any reference plate to a solid plane steel block using NewSonic special coupling fluid for instance. At least 3 measurements should be performed (spread over the entire area of the hardness reference block). The permissible deviation from the mean value to the nominal value of the block must not exceed 5 % at test forces between HV 5 and HV 10 or depending on the range, 7 % at HV 1. In the low load range from HV 0.1 until HV 08, the maximum uncertainty of measurement amounts up to 9%. (Section 2.1Measuring Method, page 6)
- Check the penetration diamond under the microscope for damages.

If you notice any damage to the probe and / or tester, you should immediately put the device out of operation and send it to our service department for inspection. This also applies to the case if measurement deviations are too high.

Please note:

We recommend to have the system reviewed on an annual basis by our service department or by any other authorized NewSonic sales and service partners.

8.1 Software Version

The version of the SonoDur-R device software can be queried via the Softkey ***Help -> About***:

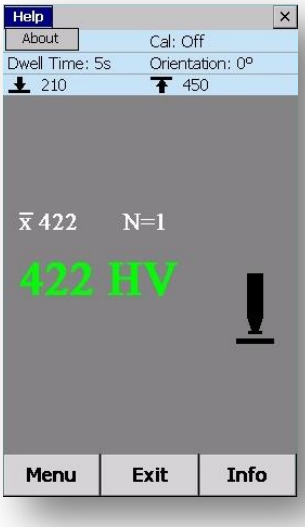
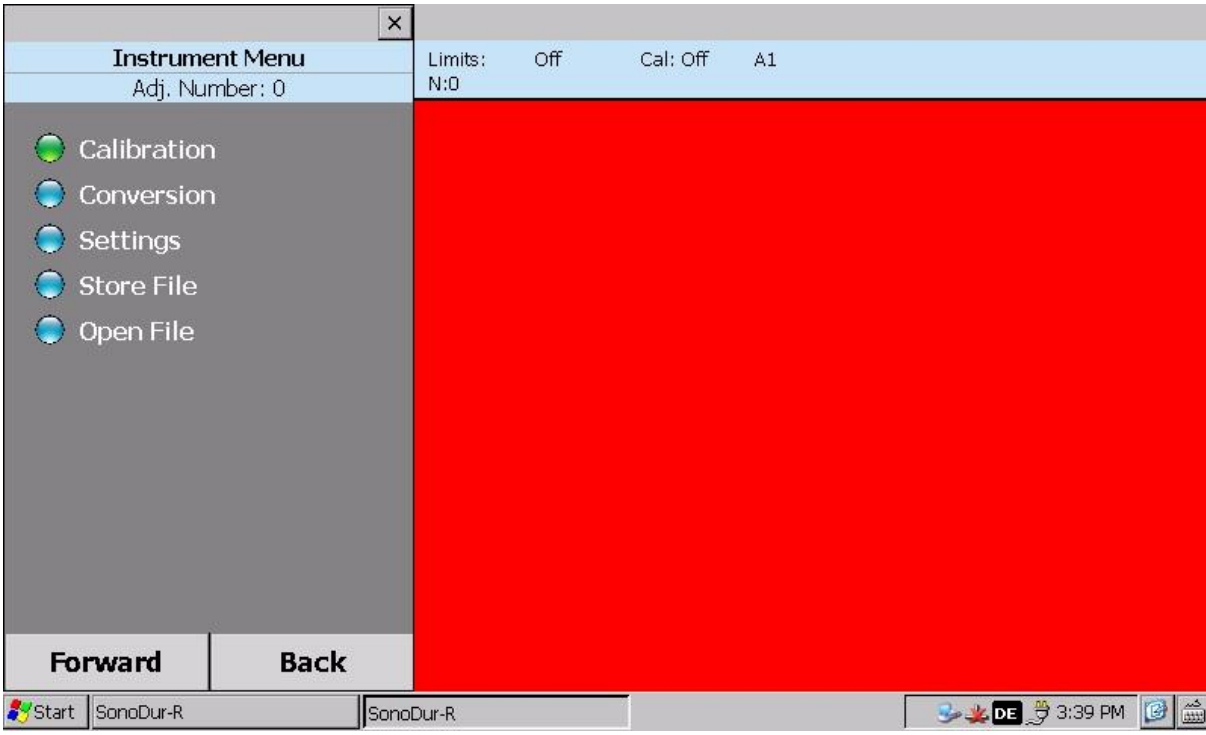


Figure 7.72

Figure 7.73

8.2 Error Messages

Error Message	Corrective Action
Connection is interrupted, shut-down of Program.	No communication with probe. This can happen if the probe is disconnected or the cable is damaged. See section **Please note:** If the main window gives up control to another window (this happens p.e. if changing over to a sub menu, touching to the desktop screen or if an error box appears) the right window area (statistic window) changes to red and the ALARM output is active. As long as the red window is shown, SonoDur-R is not in the measuring mode and no measurements can be taken (see figure 5.2)! In that case, finish your settings und return to the main (measuring) menu. The red window will change to blue again and SonoDur-R is now ready to take measurements. If you touch by mistake the desktop background, the red window will appear as well. Just touch the main measuring window to return to measuring mode.  Figure 5.2 6 Connect and Disconnect Probe.
Error in measurement	Confirm with “OK“, raise the probe, start a new measurement.

signal	
Zero frequency out of range	This is a warning about too large shift of oscillation frequency. The operator must confirm “o.k.” and has to decide to continue the test. But it is highly recommended: Probe should be sent back for a check and recalibration.
Calibration does not fit to current test force	Select probe with correct test force

8.3 Troubleshooting

SonoDur-R executes an internal system self-test during startup and monitors mains system functions during operation. If error messages are displayed, please follow the instructions.

Screen remains dark after switch on.	Check voltage Supply and cable.
The screen flickers, the instrument starts up periodically.	Check voltage supply, if the start-up current is not limited to a low level (switch current sense to >= 1 A if available).
No measurement with hand held probe possible.	Check if dwell time is set to zero.
Measurement data are unsteady.	Does the piece have sufficient dimensions? Or if not, is it well coupled to a massive block? Is the material homogeneous? Is the surface clean and the roughness low enough? Correct dwell time? Check instrument with reference block
Readings are out of tolerance.	Does the test material have the correct young’s modulus or does the test piece need calibration? Correct dwell time (0 for handheld probe)? Check instrument with reference block.
The input/outputs do not work.	Check if thresholds are set. Check wiring.

9 Care and Maintenance

9.1 Test Device, Probe and Cable

From time to time, wipe the instrument, probe and cable with a damp, but not moist cloth, e.g. microfiber cloth. Under no circumstances, chemicals or cleaning agents should be used.

9.2 Screen

Do not use any sharp objects, chemicals or detergents for cleaning, since the protective foil could be destroyed. Please use moist lens cleaning cloths instead. A protective film is attached in order to protect the touch-sensitive touch screen. If it contains severe stains or scratches, the protective film can be replaced by a new one.

10 System

The test device is an energy-efficient mini-computer (i.MX35) with a Microsoft Windows CE operating system. This enables adjustments of many energy and display settings. Upon delivery, the SonoDur-R is preset to optimal default values, so that you usually no longer have to worry about these settings. The following guidelines are intended for customer-specific settings, but we recommend to keep these settings unchanged!

10.1 System Settings

The System Settings can be accessed via the ***Start*** button at the left upper edge of the screen.

Start -> Settings -> Control Panel

10.2 Display Backlight

To adjust the display backlight, you can access the menu via the icon …***-> Display*** (double-click)

An Image Error appears, please query with ***ok***.

The ***Display Properties*** window appears, select the ***Backlight*** tab.

Select ***Brightness-> Advanced…*** and move the adjuster to the desired position.

We recommend that you do not make any changes.

10.4 Adjust Touch Screen

In case the operation of the touch-sensitive screen fails, you should adjust the touch screen. For more information, touch the ***Stylus*** icon from the control panel and select ***Calibration***. Follow the instructions!

10.5 Virtual Keyboard

The virtual keyboard can be activated by pressing the button at the lower right bottom of the screen (if entries are necessary). The appearance can be modified by selection via the arrow symbol. More information can be found under Chapter 7.3

10.6 Installing Interfaces and Drivers

The SonoDur-R device features USB data transmission interface (Ethernet upon request, please ask your NewSonic representative). In the following, the installation for operating systems on the basis of Windows XP and WIN 7 will be explained. During the installations, please follow the setup instructions displayed on your screen. In case you are unsure or use other systems, please contact your network administrator.

10.6.1 USB Installation

In order to exchange data with a PC, you must have the software **ActiveSync** (Windows XP) or **Windows Mobile Device Center** (Vista, Windows 7) installed on your PC. The corresponding program is already installed on the SonoDur-R device.

Press ***-> Start -> All Programs*** and look for **Microsoft ActiveSync** or **Microsoft Mobile Device Center**. If none of these programs exist, you have to install it.

In order to find out which operating system you are using, press ***-> Start, ->right mouse click on My Computer*** and then click on ***-> Properties***. You will find the appropriate driver for your operating system on the SonoDur-R system CD. Double-click on the appropriate installation file and follow the instructions (Please also see next page).

PC's running Windows 7 operating system, no installation is necessary. When SonoDur-R is connected the first time to the PC, the installation process will start automatically. Please follow the instructions. Do not allow to synchronize your PC with SonoDur-R.

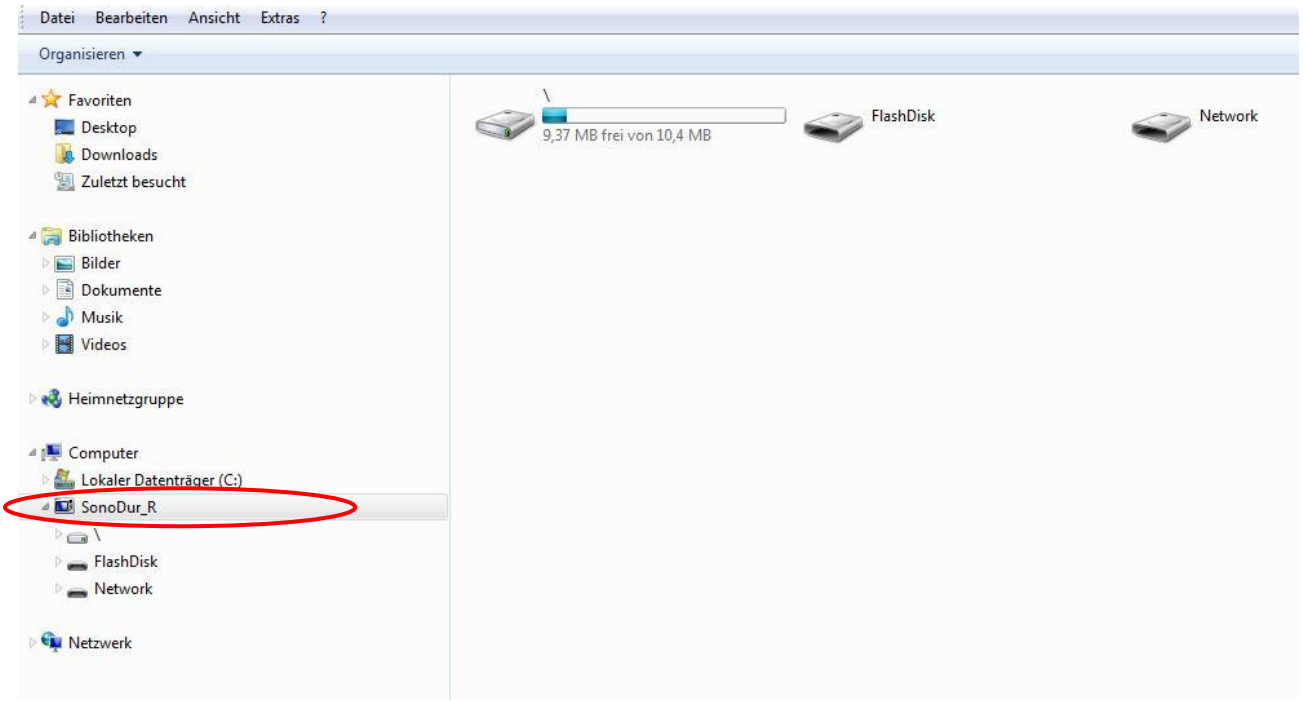
PC's running Windows XP operating system, needs active sync (if not installed on your PC, please install from the SonoDur USB stick). Follow the installation instructions and do not allow active sync to synchronize with SonoDur-R.

Subsequently, connect the SonoDur-R device to the PC by means of a data cable. (See Section 3.1 "Device Connections"). The connection will be indicated by an acoustic signal and the synchronization program begins to run. Follow the instructions of the installation wizard. Remove all check marks in the synchronization options!

The SonoDur-R device is now shown as a mobile device in File Explorer and you can access the measurement and calibration data in the SonoDur-R directory (Please see figure on the next page).

Attention:

Be careful not to accidentally damage or delete important data or system files!



11 Connectors and Electrical Specification

11.1 Position of Connectors

Figure 11.1

11.2 Power Supply Connector

The connector is specified according DIN EN 60130-9 and IEC 61076-2-106 (Lumberg 0308 03)

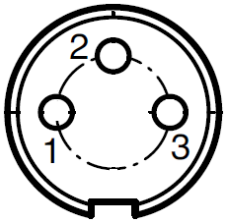


Figure 11. 2

Pin	Signal Name	Description	Voltage Level
1	Vin	Power supply voltage	12-24 VDC
2	---	Not connected	---
3	GND	Ground	0 V

Note: The power input is reversed voltage protected.

11.3 Probe Connector

Lemosa ERD.0S.304.CLL

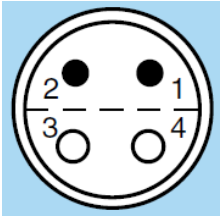


Figure 11. 3

Pin	Signal Name	Description	Voltage Level
1	GND	Ground	0 VDC
2	VCC	Supply Voltage	+5 VDC
3	D-	Data-	400mV differential, 3.3 VDC max.
4	D+	Data+	

11.4 Digital Input / Output signals

All inputs and outputs are fully isolated and protected against ESD.
Please refer to technical data for input / outputs specifications.

Attention:

Warning: Please note the following specifications!
When the boundary values are crossed, the exits can be damaged; in this case we cannot give any guarantee.

Attention:

The exits always have to be driven by a series resistance!

11.4.1 Technical data input/outputs

Isolations Voltage	3750 Vrms for 1 min per UL1577
ESD (Electric Static Discharge)	IEC 61000-4-2 level 4 15 kV (air discharge), 8 kV contact)discharge)
Response time	< 1ms
Input / Output Withstand Voltage	3 - 24 VDC / 30 VDC max.
Output Load Current	0,6 A max. / Output
Output Power Dissipation	0,36W max. / Output

11.4.2 Pin Description

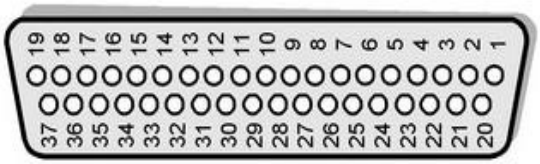
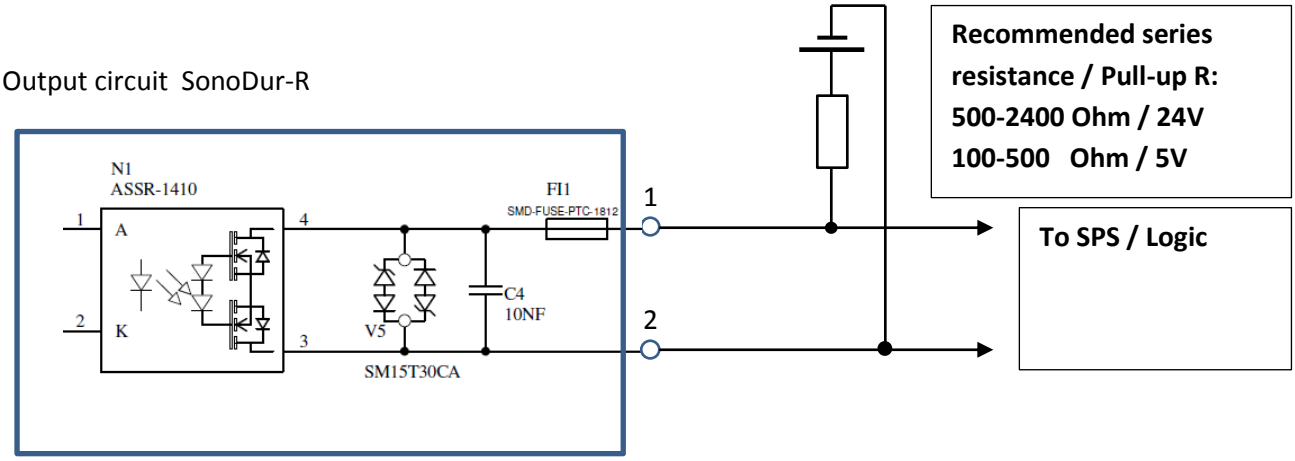


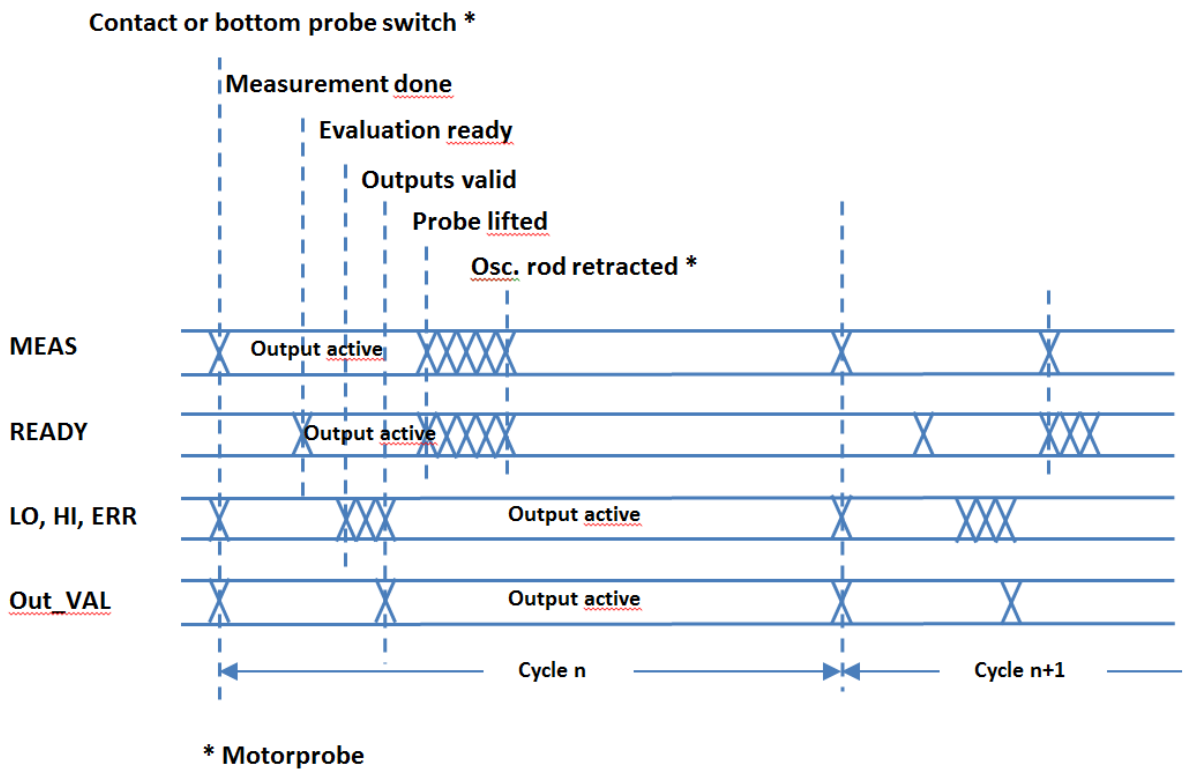
Figure 11.4

Output circuit SonoDur-R



Pin	Signal	Type	Description
1-3	--	--	Not connected
4	EXIT_1	EXIT, Input Contact 1	Close current Measurement Set, same as Exit Button
5	EXIT_2	EXIT, Input Contact 2	
6-7	--	--	Not connected
8	MOT_1	MOT, Input Contact 1	Start Measurement (only motorized probe)
9	MOT_2	MOT, Input Contact 2	
10-	--	--	Not connected
20	--	--	Not connected
21	--	--	Not connected
22	LO_1	LO, Contact 1	Switch open (active, no current) if threshold is exceeded
23	LO_2	LO, Contact 2	
24	HI_1	HI, contact 1	Switch open (active, no current) if threshold is exceeded
25	HI_2	HI, Contact 2	
26	ERR_1	ERR, Contact 1	Switch open (active, no current) on error
27	ERR_2	ERR, Contact 2	
28	ALARM_1	ALARM, Contact 1	Switch open (active, no current) on error (Probe defect or not Connected, self-test error
29	ALARM_2	ALARM, Contact 2	
30	MEAS_1	MEAS, Contact 1	Switch open (active, no current) if measurement is activ
31	MEAS_2	MEAS, Contact 2	
32	READY_1	READY, Contact 1	Switch open (active, no current) if measurement is finished
33	READY_2	READY, Contact 2	
34	OUT_VAL_1	OUT_VAL, Contact 1	Switch open (active, no current) when outputs (LO, HO, ERR) are valid
35	OUT_VAL_2	OUT_VAL, Contact 2	
36	--	--	Not connected
37	--	--	Not connected

11.4.3 Signal Flow Chart Outputs



11.5 Serial Interface

Through the serial interface COM1, the current value and the measurement unit are given with each measurement (factory setting, detachable through remote control)

The remote control, additionally, permits access to the equipment parameter, please see the list of instructions on the following pages.

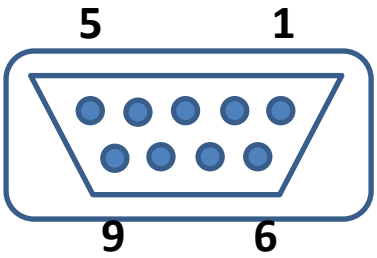
COM2 is not connected.

For the connection to a computer you will need a 1:1 cable (connector – pin).

Data format:

- 115200 baud
- No parity
- 1 Stop bit
- HW handshake: no
- SW handshake: no

Pin content of the 9-pole D-Sub connector (COM1):



Pin	Signal	Type	Description
1	--	--	Not reserved
2	TXD	Transmit data	Output, V24 Level
3	RXD	Receive data	Input, V24 Level
4	--	--	Not connected
5	Mass	Mass	Signal ground 0 V
6	--	--	Not connected
7	CTS	Clear to send	Input, V24 Level
8	RTS	Request to send	Output, V24 Level
9	--	--	Not connected

11.5.1 Remote Control Commands

Each communication is being initiated through a command from the Host-PC. SonoDur-R sends an answer with each command.

Each command and each answer are being packed in the control character <STX> (Start of Text, 0x02, CTRL B (Hyperterminal)) and <ETX> (End of Text, 0x03, CTRL C (Hyperterminal)).
The commands are complied, so that they could work wihtout control character in ASCII Terminal, in a Text-Modus.

After starting, the software automatically sends the measuring value after a successful measuring.
<STX>123.4 HRC<CR><ETX>
This automatic output can be turned on and off with the command #AO.

<u>Switch of the automatic output of the measuring values:</u>

<u>OFF:</u>

<STX>#AO 0<CR><ETX>
Answer from Sono-R: <STX>#AO 0<CR><ETX>

<u>ON:</u>

<STX>#AO 1<CR><ETX>
Answer from Sono-R: <STX>#AO 1<CR><ETX>

<u>Writing of the CAL-Faktors:</u>

<STX>#CL 1234<CR><ETX>
Answer from Sono-R: <STX>#CL 1234<CR><ETX>
Answer from Sono-R, if the CAL-Faktor was given wrong: <STX>#CL ERR<CR><ETX>
Depending on the CAL-Factor, the current measuring row is being closed, saved automatically under a standard-file name and the new measuring row will be stared.

Reading of the CAL-Faktors:

<STX>#CL ?<CR><ETX>

Answer from Sono-R: <STX>#CL 1234<CR><ETX>

Measuring start (only with Motor-Probe):

<STX>#MS<CR><ETX>

Answer from Sono-R: <STX>#MS<CR><ETX>

Answer from Sono-R, if measuring start is not possible (for Example whithin a current measuring time): <STX>#MS ERR<CR><ETX>

Status request:

<STX>#ST<CR><ETX>

Answer from Sono-R, ready for the start of measuring : <STX>#ST RDY<CR><ETX>

Answer from Sono-R, current measurement: <STX>#ST MAC<CR><ETX>

Answer from Sono-R, measurment ended sucessfully, single output of the current taken measurement value: <STX>#ST MEA 123.4 HRC<CR><ETX>

Answer from Sono-R, Motor drives up: <STX>#ST BSY<CR><ETX> (Only Motor-Probe)

Answer from Sono-R, Probe-Error (Probe disconnected, does not communicate): <STX>#ST PROBE ERR<CR><ETX>

Answer from SonoDur-R, general Error: <STX>#ST ERR<CR><ETX>

Release of the File-Headers:

<STX>#FH<CR><ETX>

Answer from Sono-R: <STX>#FH<CR> File-Header in Text-Format as already given, lines with <CR> separated <ETX>

Release of the last measuring value (repeatable):

<STX>#MW<CR><ETX>

Answer from SonoR-R: <STX>#MW 123.4 HRC<CR><ETX>

Answer from SonoR-R, if there is no measuring value given (only after the start of the software, before the first measuring): <STX>#MW ERR<CR><ETX>

Release of the equipment-Softwareversion:

<STX>#GV<CR><ETX>

Answer from Sono-R: <STX>#GV 2.16<CR><ETX>

Release of the Probe-Serial-Number:

<STX>#SN<CR><ETX>

Answer from Sono-R: <STX>#SN 100<CR><ETX>

Answer from Sono-R, if there is no probe connected: <STX>#SN ERR<CR><ETX>

Release of the equipment-Serial-Number:

<STX>#GN<CR><ETX>

Answer from Sono-R: <STX>#GN 100<CR><ETX>

Answer from Sono-R, if the GERSN.txt Data does not exist: <STX>#GN ERR<CR><ETX>

End of the programm:

<STX>#EX<CR><ETX>

Answer from Sono-R: <STX>#EX<CR><ETX>

After the answer, SonoDur-R Software closes.

Writing of the measuring time (only with Motor-Probe):

<STX>#MT 4<CR><ETX> **(hier: 4 sec)**

Answer from Sono-R: <STX>#MT 4<CR><ETX>

Answer from Sono-R, if the measuring time was inserted wrong or no motor-probe is connected: <STX>#MT ERR<CR><ETX>

After each change of the measuring time, the current measuring row is being closed, saved automatically under a standard-file name and the new measuring row will be stared.

Reading of the measuring time (only with Motor-Probe):

<STX>#MT ?<CR><ETX>

Answer from Sono-R: <STX>#MT 4<CR><ETX>

Unknowns command:

<STX>xxx<ETX>

Answer from Sono-R: <STX>CMD ERR<CR><ETX>

Example for Terminal print: During measurement process the command **<STX>#FH<CR><ETX>** has been executed (six measurements), after this command and three more measurements have been recorded

File	**File_05**
Date	**5. August 2015**
Start of Meas.	**13:51**
Tester	
Probe/Test Force	**Sono8M/8N**
Probe-SN	**306**
Dwell Time	**5 sec**
Material	**Steel**
Norm; HV	**EN ISO 18265**
Calibration File	**Unnamed**
Adj. Number	**0**
Limits	**Off**
Number	**6**
Mean	**732 HV**
Std. Deviation	**5 HV; 0.7%**
Maximum	**738 HV**
Minimum	**726 HV**
R	**12 HV; 1.7%**
Cp	
Cpk	
749 HV	
747 HV	
748 HV	

12 Appendix

12.1 Scope of Delivery and Accessories

12.1.1 Standard parts and packages

Part	Description	Order No.
SonoDur-R	**Hardness Tester SonoDur-R "Rack" for automatic online Hardness Testing in Productions, WIN CE Operating System** including (**probe not included**): Mounted Table Housing 19'' with Handles Connectors for Probe, Controls, 24V-Power Unit, USB-Client (PC) SONO-RM, 3m Probe Connection cable SONO-Stylus, Stylus-Pin SONO-NG-24V Power supply 115VAC-230VAC/24VDC for SonoDur-R SONO-CD, Product-USB-Stick incl. Operating Manual	
Attention!	**Hardness blocks to be ordered separately**	
	Instrument Package	11006

12.1.2 Probes

Part	Description	Order No.
	Handheld Probes	
SONO-10H	Handheld Probe 10N (1 kgf), Standard Version	11101
SONO-50H	Handheld Probe 49N (5 kgf), Standard Version	11102
SONO-100H	Handheld Probe 98N (10 kgf), Standard Version	11103
SONO-10H-L	Handheld Probe 10N (1 kgf), Long rod Version	11104
SONO-50H-L	Handheld Probe 49N (5 kgf), Long rod Version	11105
	Motor Probes	
SONO-1M	Motor Probe 1N (0,1 kgf) with attachment sleeve	11106
SONO-3M	Motor Probe 3N (0,3 kgf) with attachment sleeve	11107
SONO-8M	Motor Probe 8,6N (0,9 kgf) with attachment sleeve	11108

12.1.3 Recommended Accessories

Part	Description	Order No.
	Recommended Accessories	
SONO-PS-1	Precision Test Stand for handheld probes	11220
SONO-SF-1	Universal Probe shoe for handheld probes (prism, flat)	11221
SONO-PM-1	Prism support for concave surface shape ca. 100 to 350mm for Motor Probes	11206
SONO-PM-4	Prism support set for motor probes	11209
SONO-ZG-F	Special Coupling Fluid, to suppress resonances, 100 gr.	11210
Attention:	Hardness Reference Blocks refer to separate price list	

12.1.4 Replacement Parts

Part	Description	Order No.
	Replacement Parts SonoDur-R	
SONO-RM	Probe cable 3,0m for motor and handheld probes	11305
SONO-24V	Input voltage cable with connector and one end open	11306
SONO-NG-24V	Power supply 115VAC-230VAC/24VDC for SonoDur-R	11307
SONO-R-Stylus	Stylus-Pen, handmade, special tip	11315

12.1.5 Hardness Reference Blocks

Part	Description	Order No.
	Reference Blocks	
SONO-Y900HVy	Round Hardness Blocks, 900±15 HV30, HV1; Ø64x15 mm, Factory Certificate	1140807
SONO-Y600HVy	Round Hardness Blocks, 600±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140808
SONO-Y500HVy	Round Hardness Blocks, 500±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140809
SONO-Y400HVy	Round Hardness Blocks, 400±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140803
SONO-Y300HVy	Round Hardness Blocks, 300±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140804
SONO-Y200HVy	Round Hardness Blocks, 200±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140805
SONO-Y150HVy	Round Hardness Blocks, 150±15 HV10, HV1; Ø64x15 mm, Factory Certificate	1140806
SONO-Y800HVy	Round Hardness Blocks, 800±15 HV30, HV1; Ø64x15 mm, Factory Certificate	1140802

SONO-Y700HVy	Round Hardness Blocks, 700±15 HV30, HV1; Ø64x15 mm, Factory Certificate	1140801
SONO-S300HVy	Round Hardness Blocks Ø115x16 mm (300 HV Standard, Company Calibration)	1140701
SONO-S540HVy	Round Hardness Blocks Ø115x16 mm (540 HV Standard, Company Calibration)	1140702
SONO-S780HVy	Round Hardness Blocks Ø115x16 mm (780 HV Standard, Company Calibration)	1140703
SONO-MPA	MPA certificate each test block and test force	1141000
Others	Hardness Reference Blocks on request, delivery time approx. 6-8 weeks.	

12.2 Technical Data – SonoDur-R

System (Instrument and Probe)	
Test Method	UCI Method, corresponds to DIN 50159, ASTM A1038
Test Tip	Vickers diamond 136°
Test Loads Newton scale (1kgf = 9.81 N)	Motor probes: 1N (0.1 kgf), 3N (0.3kgf) and 8.6 N (0.9 kgf) Handheld Probes: 10N (1 kgf), 49N (5kgf), 98N (10kgf)
Hardness Scales (for details see table above)	Conversions are acc. to ASTM E140 and EN ISO 18265. Conversions into tensile strength: 98N (10kgf) test load only.
Measurement uncertainty	< 3% of the average out of 5 measurements relative to the plate value.
Repeatability (mean square deviation) and range	≤ 2% relative to the average out of 5 measurements on reference block 300HV using motor probes 3N, 8.6N and <3% range
Operating Temperature/	0 to +50 °C
Storage Temperature	-20 to +70 °C
Humidity	Max. 90%, non-condensing
Dimensions Instrument Dimensions Motor Probe Dimensions Handheld Probe Dimensions Handheld Probe "Long nose"	Ca. H/B/T 132,55 x 235,54 x 313,5mm (360mm with handle) Ca. Ø38, L190 mm, Free Length Oscillation rod ca. 33 mm Ca. Ø25, L176 mm Free Length Oscillation rod ca. 12,5 mm Ca. Ø25, L207 mm Free Length Oscillation rod ca. 43 mm
Weight Instrument Weight Motor Probe Weight Handheld Probe	Ca. 3.400 gr Ca. 370 gr Ca. 280 gr
Instrument	
Input-Power	12 - 24 VDC (Max. 30VDC)
Power consumption	6 W
Screen : Size (Inch/mm) Active Area Colors Luminance Viewing Direction	TFT-Display 800x480 Pixel with LED-Backlight Touch-Screen 7.0/ 178 152,4mm x 91,44mm 262144 400 cd/m2 12 o'clock
Protection class	IP20
Storage capacity	Ca. 256 MB internally (good for >11.000 data sets with 1000 Measurements each) and extendable on SD card for virtually unlimited measurement data and calibration sets.
Interfaces	
Probe connector Input / Output	Lemo ERD.0S.304, USB specification 37 pos. D-Sub with Filter, isolated, max. voltage 30 VDC USB-Device, Type B RS232
Operating system	Windows CE 6.0 in English
Instrument language	German, English, more on request (simple Chinese possible)

12.3 Hardness Scales and Limits

Conversion limits:

The Vickers scale is the basis for all conversions. Currently, SonoDur-R carries all the conversion tables where a correlation between Vickers and other classical Hardness is given according to EN ISO 18265-2014 and ASTM E140-12b$^{\varepsilon 1}$. The table work below shows the conversions given for low-alloy steel (table A1 or table T1, T2 resp.).

Measurement range, in HV (UCI): 10 – 2000 (9999)

Minimum conversion: 80 HV = 76 HB, maximum conversion: 940 HV = 68 HRC

Conversion rules according to EN ISO 18265 for low-alloy steel:

Scale	HB	HRB	HRF	HRC	HRA	HRD	HR45N	Rm [MPa]	HK
Min	76	41	82,6	20,3	60,7	40,4	19,9	255	-
Max	618	105	115,1	68,0	85,6	76,9	75,4	2180	-

Conversion rules according to ASTM 140-07 for low-alloy steel:

Scale	HB	HRB	HRF	HRC	HRA	HRD	HR45N	Rm [MPa]	HK
Min	100	55	88,2	20,0	37,2	40,1	19,6	-	112
Max	739	100	99,6	68,0	85,6	76,9	75,4	-	920

12.4 Formulas and Terms

Section 7.5 “Information Menu“, contains calculation results that are described in detail below (see also EN ISO 18265).

Limits:	49.1	HRC	52.3
N:8	<:1	6	>:1
x̄:51.9		σ:3.5	6.7%
Max:60.2	Min:49.0	R:11.2	23.3%
Cp: 0.15	Cpk: 0.03	Cal: Off	

Figure 0.1

Average value in Figure 0.1 is represented by the letter X with a bar over it, here referred to as “Overline X”.

Overline X = $$\frac{1}{N} * \sum_{1}^{N} X(i) \qquad (1)$$

With X(i) = Individual Hardness Measurement Value, N = Total Quantity of Measurements

If hardness gradient measurements are not performed, the average value is usually the characteristic degree of hardness for a material or for a particular test position on the test object. Impacts caused by the operator and/or material inhomogeneity effects can be reduced by averaging. (Highly heterogeneous materials such as GG or GGG-cast iron are an exception).

R = Range/spread or maximum error in a series of measurements (absolute value):

R = X(Max) – X(Min) (2)

Please note:

Relative range is defined dependent on the used scale according EN ISO 18265:

$$R\,[\%] = \frac{R}{\text{Overline X}} * 100 \qquad \text{(for HV, HB, HK, MPa)} \qquad (3)$$

$$R\,[\%] = \frac{R}{100 - \text{Overline X}} * 100 \qquad \text{(for HRC, HRA, HRD, HRN)} \qquad (4)$$

$$R\,[\%] = \frac{R}{130 - \text{Overline X}} * 100 \qquad \text{(for HRB and HRF)} \qquad (5)$$

The range enables the trapping of individual faulty measurements that can be deleted, whereas the distribution of measured values within a series of measurements has to be taken additionally into account. The respective test requirements and procedures must be observed in terms of the deletion of obvious faulty measurements.

Mean error of the single measurement σ:

$$\sigma = \sqrt{\frac{\sum_{1}^{N}\left(\overline{X} - X(i)\right)^2}{(N-1)}} \qquad (6)$$

Or relative mean error of the individual measurement σ [%] from (6):

Please note:

Relative mean error of an individual measurement is defined dependent on the used scale according EN ISO 18265:

$$\sigma\,[\%] = \frac{\sigma}{\overline{X}} * 100 \qquad \text{(for HV, HB, HK, MPa)} \qquad (7)$$

$$\sigma\,[\%] = \frac{\sigma}{100 - \overline{X}} * 100 \qquad \text{(for HRC, HRA, HRD, HRN)} \qquad (8)$$

$$\sigma\,[\%] = \frac{\sigma}{130 - \overline{X}} * 100 \qquad \text{(for HRB and HRF)} \qquad (9)$$

The mean error of the individual measurement is an estimation of the individual faulty measurement that contains random components as well as systematic components, such as:

- Individual care and skill when handling the probe by the operators (hand-held measurements, guided measurements by means of stands or probe guidance).
- Testing material properties (local solidification and mechanical stresses, porosity, thermal pre-treatments) as well as geometry (size, mass, thickness, shape, installation position).
- Surface condition (roughness, texture, granularity, machining grooves).
- Environmental influences (temperature, humidity, cleanliness of test object).
- Device specific dispersion.

The mean error of the individual measurement optimally reflects the quality of the test result in its entirety as measured by the above factors.

The process parameters Cp and Cpk:

Both parameters essentially describe the process capability, mainly in automated test facilities and when measuring large quantities.

Cp describes the dispersion of the measured values (Xi) around an average value Overline X within an admissible tolerance range (upper and lower thresholds Tmax, Tmin). The formula reads as follows:

$$Cp = \frac{Tmax - Tmin}{6\,\sigma} \qquad (10)$$

With σ = mean error of an individual measurement and 6σ = width of normal distribution curve.

As already mentioned, the application of this formula requires the presence of a large number of measured values, which come close to a normal distribution.

The position of the measured value distribution is characterized by the second parameter Cpk. The distance of the average value Overline X to the respective closer threshold value (Tmax – Overline X) or (Overline X - Tmin) across half of the distribution width of the Gaussian distribution curve will be correlated herewith.

$$Cpk = \frac{Tmax - \text{Overline } X}{\mathbf{3\,\sigma}} \quad \text{or} \quad \frac{\text{Overline } X - Tmax}{\mathbf{3\,\sigma}} \qquad (11)$$

depending on which difference is smaller.

A negative sign indicates that the process has moved beyond the tolerance limits. For further considerations it is referred to relevant literature.

12.5 Compliance with Environmental Constraints

NewSonic actively participates in the take-back initiative applicable in Europe, "Waste Electrical and Electronic Equipment" (WEEE) Directive 2002/96/EC.

The test device contains an integral li-ion accumulator (lithium-ion accumulator) that could harm health and/or environment in case of improper disposal, and therefore must not be disposed as unsorted household waste within the European Union.

Attention:

Therefore, please always return the device to the manufacturer NewSonic, even after the period of product durability has expired!

12.6 Limited Warranty

For a period of two (2) years from the date of purchase, we warrant that this instrument will be free of any claim of ownership by third parties, (ii) when new, be free from defects in material and workmanship and perform in accordance with the product's specifications under normal use and service for the applicable warranty period, following the date of sale. The second year of this warranty is only valid, if the instrument is calibrated either by us or one of our certified service providers to values within the provided specifications, after month twelve of ownership, but before month fourteen begins. The duration of the warranty may be extended or modified by explicit service contracts.

This limited warranty shall not apply to any problems arising from (i) failure to follow the product instructions or failure to perform preventive maintenance, (ii) service, repair or modification by someone other than us or one of our authorized service representatives; or (iii) external causes, such as accident, abuse, misuse, or problems with electrical power.

This warranty does not cover parts identified as wear-and-tear parts or lamps, transducers, tubes, accessories, or optional equipment not manufactured by us, which possibly may be covered by separate manufacturers' warranties. Our obligation under this warranty is limited to the repair or replacement of components determined by us to be defective within the warranty period at no cost to the original purchaser. Customer shall arrange for delivery to us in approved packing material. This warranty extends to the original purchaser and cannot be assigned or transferred to any other party.

EXCEPT FOR THE WARRANTY SET ABOVE, WE EXPRESSLY DISCLAIM ALL WARRANTIES AND REPRESENTATIONS OF ANY KIND WITH RESPECT TO OUR PRODUCTS, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, TITLE AND ANY WARRANTIES ARISING FROM COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

13 Accessories

13.1 SONO-PM-4, Prisms Attachment Kit for Motorized Probes

This manual describes the use of the prism attachments for motorized probes of the SonoDur-R product family. The operation of the motorized probes is described in the SonoDur-R instruction manual. Knowledge about such devices is required.

13.1.1 Technical Data and Components

The prisms attachment kit consists of a special probe base with screw thread, featured with four levels to enable the best possible adaptation to curved surfaces as well as three pre-fitted plates and one plate for flat surfaces that can be screwed onto the special probe foot.

Figure 13. 1

SONO-PM-4, Order Number: 11209

Special probe base with screw-in sleeve and switching sleeve

Probe plate for small cylindrical parts, Ø 36mm

Probe plate with Ø 70mm

Probe plate with milled edges Ø 50, width 36mm

Figure 13. 2

Attention:

The switching sleeve of the special probe base (see right figure below) is differently designed than the standard probe base and should therefore not be mixed up.

Figure 13.3

Standard probe base special probe base

13.1.2 Handling

To start with, gently unscrew the standard probe base. Select the desired probe plate and screw it into the special probe base by paying attention to the engraved spacer rings. These indicate the possible diameter range for each test specimen, as shown in Table 1, which applies to all probe plates. After screwing it onto the motorized probe, the special probe base is ready to be used for curved surfaces.

Just like when using the standard probe base, the operating mode can be selected to automatic measuring via the switching sleeve or manual measuring without switching sleeve. In order to do that, the switching sleeve must be taken out of the special probe base. Triggering the initiation of measurement cycle is now only possible by touching the probe symbol on the SonoDur-R screen, which however, simplifies the exact positioning.

The probe plate for flat surfaces serves the same purpose as the standard probe base and permits fast and simple switching between different probe plates.

Figure 13.4

Table 13.1:	
Ring	Possible Diameters
3 (top)	From 0 to 10 mm
2	From 10 to 50 mm
1	From 50 to 100 mm
0 (bottom)	From 100 until even
Measured each time for the ring on the vision reference block of the probe base, located in opposite to the lower rim of the probe base.	

The spacer rings define the possible diameter range according to Table 13.1.

Attention:

Incorrect diameter setting causes that the motorized probe spring force is either too low or too high and thereby increases the risk of erroneous measurements. If the diameter is set significantly too high, the Vickers diamond may possibly not reach the test object surface and an error message will be issued. (Section7.4.1Carrying out of Measurement by Means of Motorized Probes, page 21).

Once the correct diameter adjustment has been made, carefully place the probe with the notch in longitudinal direction of the cylindrical surface and wait for the measurement process.

Figure 13.5

Attention:

Please ensure that the measuring probe rests fully and is firmly tightened during the measurement performance.

14 Glossary

15 Addresses

Head Office & Service Center:

NewSonic GmbH, Unter den Linden, D-72762 Reutlingen, www.newsonic.de, info@newsonic.de

Phone #: +49-7121-680855-0, Fax #: +49-7121-270539, Mobile Phone #: +49-151-16503517

Service Hotline: +49-7121-680855-0