Hardness Measurement Device
Shore A nano

Type SHAN.01

Manual / Device Documentation

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Preface

Congratulations. With the hardness test device Shore A nano Type SHAN.01 you have chosen a powerful instrument that now permits even Shore measurements on finished parts of small dimensions and of different forms.
The measurement corresponds to the specific physical load parameter of the Shore A-test according to standard.
The friction-free working measurement system allows reproducible measurements over the entire hardness range of -7.3 to 100 Shore A and over a wall thickness from 0.5 mm and compared from 50 µm respectively.

It offers an easy operation, a full automatic sequence and a laser positioning aid.

Our aim is a reliable measurement technique together with a proven high quality level and a rational simple operation at the same time.
The technical development and practical application change the demand profile constantly. Information on feature enhancements and errors support us in the further development and redesign of devices. For information about positive and negative user experiences, we are grateful.

We wish you every success

Q-tec GmbH

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1. Hardness test after Shore

1.1 Shore-Hardness

The hardness test after Shore is one of the most applied parameter to characterise the hardness of non-metallic materials. It is an easy-to-use system that allows in a short time to determine an important product property.

By hardness after Shore A we understand the resistance against the penetration of a body of a certain form (frustum) at a defined spring force. Shore D uses a taper rounded at the top. The hardness scale covers a range of 0.0 up to 100.0 hardness units whereby 0.0 corresponds to the smallest and 100.0 to the highest hardness. The needle normally is pre-loaded to the 0 Shore value and therefore does not allow measurements smaller than approx. 10 Shore A. The new measurement procedure functions without needle preloading and therefore permits the measurement of very soft materials being smaller than 0 Shore A (up to approx. -5 Shore A). The theoretically lowest measured value is -7.3 Shore A.

Soft materials oppose a smaller penetration resistance to the spring-loaded needle than harder products. Due to the penetration depth depending power (deep penetration depth - minor force) and the progressive sample geometry (frustum or taper respectively), Shore A / Shore D measurements allow to test a very large hardness range. The Shore hardness is calculated from the linear dependence of the needle penetration depth to the Shore value according to a defined measurement time.

1.2 Shore Test Methods

The hardness test after Shore differs by two methods.
For soft materials and elastomers: **Shore A**
For harder materials and plastics: **Shore D**
The construction of the penetration needle and the spring characteristics are different and stipulated in accordance with DIN 53505, DIN ISO 7619-1, DIN EN ISO 868 and/or the corresponding ASTM or JIS standards.

The Nano Shore A-measurement corresponds in its physical load properties to the standard Shore A-test. The load pressure and the dependent load surface are reduced by a factor of 100. The separate surface support unit and the active needle positioning allow measurements independent of the surface form. A flat locating surface as needed for the pre-loaded needle is no longer necessary.

1.3 Hardness Measurement after Shore A (Standard-method)

The standard test after Shore A in accordance with DIN 53505 / DIN EN ISO 868 / DIN ISO 7679-1allows to determine the hardness of specimen produced of elastomers. The measured values depend on their visco-elastic properties, in particular on their tension values in accordance with DIN 53504. The Q-tec standard hardness device after Shore A is applicable for a range -5 up to 90 Shore A. Harder specimen are measured after Shore D. Due to the friction- and load-free needle positioning, even very soft samples up to -5 Shore A can be measured without any problems.

The standardised hardness test after Shore A is currently subject to major measurement inaccuracies that may be caused by the tester, the measurement device and the specimen quality. In order to increase the accuracy of the measurement procedure, the causes for deviations need to be eliminated.

Tests yielded that measurements of products of a Shore A hardness within the range of 25 to 50 and of a standardised sample thickness of 6.3 ±0.3 mm systematically result in hard measurement results. The reason for it is a sample thickness that is too small.
The absolute hard contact surface influences the outcome towards too hard. With an actual product Shore A hardness of 30, it leads to a result of about 31 Shore A points: The Shore A difference is approx. +1 point.

1.3.1 Permitted geometry Tolerances of the Measuring needle

The Geometry of the measuring needle does systematically influence the measurement results**.** Manufacturing and wear tolerances also cause measurement result tolerances. For example: The diameter tolerance of the needle’s truncated cone in accordance with DIN 53 505 is 0.79 ±0.01 mm signifies a Shore A-tolerance of approx. ±0.15 Shore units (fig. 4). The deviations were determined in experiments.

1.3.2 Permitted tolerances of the Position senor

The path measurement of the penetration needle, even concerning standard measurements, calls for high requirements, as a deviation of ± 0.1 Shore A causes a change of path of ±0.0025 mm. To keep the total error low, an accurate distance measurement with a 1 µm resolution is required.

1.3.3 Permitted Tolerances of the Spring characteristic

Tolerances in accordance with DIN 53 505: ± 0.0375 N.
The tolerance is caused by the spring constant deviation and friction factors of the needle bearing. The tolerance of ±0.0375 N corresponds to a Shore A-tolerance of
± 0.50 Shore A-units.
Minimizing the measurement deviations implies a smaller deviation from the nominal linear spring rate. Besides the exact positioning of the spring constant, a high-quality measuring pin bearing is necessary in order to exclude friction influences. The gradient and linearity deviation of the spring characteristics must not exceed ±0.1 Shore units in order to meet high measurement demands. The maximum load deviation must not exceed ± 0.1 Shore A ± 0.005 N
(5 mN) in order to achieve a high measurement accuracy.

1.3.4 Form error of the Test specimen surface

The correct positioning of the measurement sensors on the test specimen:
In order to avoid measurement errors, the measurement sensor must rest plane parallel on the test specimen surface in accordance with DIN 53 505 / DIN ISO 7619-1 / DIN EN ISO 868. The specimen must have a thickness of 6.3 ±0.3 mm. Other thicknesses have to be agreed upon separately. To exclude measurement errors the measurement device has to compensate plane parallel errors of the test specimens. The measurement sensor must align itself automatically on the test specimen surface. Form defects lead to higher, non quantifiable stochastic Shore measurement errors.

1.3.5 Sensor touch-down speed

To get a precise Shore measurement the sensor touch down speed has to be defined. Due to different touch down conditions the Shore measurement value is influenced. The deviation is not definable.
A touch down speed of 500 mm/min has proved well. A non-defined touch down speed affects inter alia the active measuring time of the needle with a defined force. In accordance with DIN 53505, section 7.4 / DIN ISO 7619-1, section 4.1.5, the hardness is determined by a defined time after the contact on the bearing surface of the hardness test device and the specimen.

The needle however already hits onto the specimen surface before it touches the sensor bearing surface. Thus the penetration time changes according to the touch down speed.

1.3.6 Test specimen quality

The test specimen must be manufactured according to defined procedures. It must neither in production nor in positioning be mechanically loaded (bent, stretched, etc.) Improper test specimen wear leads to non-recognizable stochastic measurement errors. Product specific properties, such as aging and manufacturing methods have to be considered.

1.3.7 Temperature influence on the Measurement

The test has to be made in accordance with DIN 53505, DIN ISO 7619-1 at a temperature of 23 ±2° C. A temperature deviation of 5° C causes at systems with a pre-loaded needle a device specific measurement deviation depending on the utilised load needle. If, while measuring, the measurement sensors are exposed to other than standardised temperatures, this has to be separately reported. The automatic calibration of the Q-tec standard device permits correct measurements at ambient temperatures deviating from 23° C.
This error analysis is independent of changes of the Shore hardness of the measured products. The temperature influence is compensated by the Nano measurement technology (see section 1.4.7).

1.4 Hardness measurement after Shore A nano

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The test represents the specific physical parameters of the Shore A measurement. The measurement results are comparable to the Shore A values of the standard measurement methods in accordance with DIN, ISO, ASTM and JIS.
The new measurement method brings a very high accuracy and repeatability, as adverse specimen properties, such as form and geometry variations are of no influence in wide areas. Individual factors that lead for the Shore A measurement (see above) to measurement uncertainties were minimized consistently. Thus, the repeatability and accuracy could be significantly increased.

1.4.1 Measurement method „Nano Shore A“

The aim of the measurement method is a reduction of the measuring unit and a change of the load unit in the way that the specimen geometry and size do not affect the measurement results. For this purpose, a measuring unit was designed that exerts a steer- and controllable force on the load medium (Shore A measurement needle) and measures the reaction of the test specimen. The geometry of the penetration needle corresponds to the standard needle, but it was reduced by the factor of 10. Thus, the smallest dimension of the sample thickness measured is reduced in relation to standard measurement by the factor of 10 and reaches minimally 0.6 mm. Therefore a new method of traceable measurements versus Shore A is possible for measurements up to a sample thickness of 50 µm. The geometry independence is achieved by a novel surface detection and the elimination of the sensor locating surface. The specimen surface is permanently controlled and/or adjusted as to the penetration depth and load value.

Since no load value of the spring limits the measurement range to 0 Shore A, even Shore A values, smaller than 0 are measureable concerning very soft materials. The testable geometry diversity and hardness range is therefore practically unlimited.

To maintain the high measuring accuracy, the geometric deviations of the test needle were reduced. The conical tip of the measuring needle has to have a tolerance of 0.079 +0.001 mm (fig. 3). Thus the maximum error of the needle geometry is <0.1 Shore A points.

1.4.2 Permitted deviations of the Measurement needle „Nano Shore A“

The geometry of the measurement needle affects the measuring result at a fixed load curve and leads to systematic measurement deviations. Necessary is a precisely defined load pressure of the penetration path to get the hardness value. The pressure is calculated e.g. in standard Shore A = 0 from $p = F/A$ F with F = 550 mN and $A = d^2 \pi / 4$ with d = 0.79 mm² to p = 1122.64 mN / mm. For the Nano Shore A-measurement an identical load profile is used and it results for Shore An = 0 and a needle tip diameter of d=0.078 mm in a force of Fn = 5.50mN. If the specific dependence of the penetration load pressure depth is precisely adhered to, very exact hard measurements are possible. The needle geometry for Shore A corresponds to figure 3.

1.4.3. Permitted Deviations of the path measurement / positioning unit "Nano Shore A"

Concerning the path measurement and positioning unit high requirements need to be made, as a deviation of ± 0.1 Shore An cause a change of path of ± 0.25 µm. To keep the error low, a measuring and positioning accuracy of 0.1 µm is required.

1.4.4 Permitted Deviations of the Load characteristic "Nano Shore A"

The penetration load of the measuring needle of the Nano Shore A- device is at 100 Shore An 80.65 mN, at 0 Shore An it is at 5.5 mN. The special absolutely frictionless needle bearing allows a very accurate control of the needle load in order to measure the product hardness. Since the measurement needle is not pre-loaded as in the standard Shore A test unit, even results smaller than 10, respectively smaller than
O Shore An, are measurable on very soft specimens (fig. 1). The change of the Shore An value of 0.1 means a needle diameter of 0.079 mm and a load change on the measuring needle of 0.07515 mN (75.15 µN).
The measurement device resolution is 0.005 mN (5 µN), therefore allows measurements of an accuracy below 0.1 Shore An.

1.4.5 Measurements regardless of the Part geometry

The completely redesigned load unit does not need to measure the exact Shore value an even locating surface as measurement basis. The measurement works independently of the surface geometry and is only influenced by the measurement needle contact. The position of the surrounding surface is independently recorded as to compensate the specimen movements during the measurement.
In order to get physically comparable measurement results, the plane needle cone tip (fig.3) has to hit onto the specimen surface tangentially. This is especially true for hard specimens as in a first penetration area and due to a possible oblique contact, the entire plane surface is not active and thus generates Shore hardness values that are too low (fig. 2). This could be avoided in a simple manner by a proper positioning of the sample. The specimen geometry does normally not enter into measurements as the needle tip diameter of 79 µm is in relation to a specimen surface deviation very small.

1.4.6 Sensor touchdown speed "Nano Shore A"

To get a precise Shore measurement the sensor touch down speed has to be defined. Due to different positioning conditions the Shore measurement value is influenced.
A touch down speed of 500 mm/min has proved well. A non-defined touch down speed affects inter alia the active measuring time of the needle with a defined force. In accordance with DIN 53505, section 7.4 / DIN ISO 7619-1, section 4.1.5, the hardness has to be determined by a defined time after the contact between the bearing surface of the hardness test device and the specimen.
The needle however already hits onto the specimen surface before it touches the sensor bearing surface and it therefore affects the specimen because of a longer touch down speed.

To achieve comparative a load data for the standard measurement, we need for the Nano Shore A-measurement a touch down speed of 50 mm/min.

1.4.7 Measurement temperature/Temperature deflection “Nano Shore A”

The test unit is calibrated at a temperature of (23 ± 2) °C. The zero point calibration of the load unit is made prior to each measurement inside the device automatically thus minimizing temperature-induced measurement errors. Thermal expansion effects of the measuring needle play no role and do not lead within ±10° to any device-related measurement errors larger than Shore An ± 0.1.

The temperature-dependent physical properties of the specimens are measured according to the product properties of the specimen temperature.

1.4.8 Specimen quality

The Nano-Shore measurement permits the measurement of finished products and allows the assessment of part quality. It can be especially used to measure new products or items that were already used for a specific time.

1.4.9 Measurement accuracy "Nano Shore A"

The accuracy tolerances mentioned in section 1.4.1 to 1.4.7 are minimized due to the optimized test system. Concerning measurements in accordance with section 1.4.5, very high absolute measurement accuracies of smaller than ± 0.1 of the Shore An-values are achievable.
Vertical movements of the test specimen on the measurement device during measurements are controlled and corrected. **Tilting motions lead to measurement errors**.
The comparison with the standard Shore A measurement involves a touch down speed of 50 mm / min in order to get identical evaluation times and penetration conditions.

1.4.10 Measurement of Wall thicknesses smaller than 0.5 mm

For the measurement and verification of very thin parts and coatings up to a thickness of 50 µm, the penetration depth and measuring force is reducible. The maximum depth of 268.3 µm of the standard measurement methods can be reduced by 10% increments up to 26.83 µm.
Therefore layer thicknesses up to 50 µm are testable. The results however do not correspond to the Shore A characteristic. By comparative measurements after the Shore standard measurement method and the measurement of the reduced penetration depth, the measured results can be traced back to the Shore A value. Due to a penetration path of 10% of the total penetration path, the resolution is reduced by the factor of 10.

2. Installation/ Start-up

The test device is supplied with a magnifying glass, a manual and a power cable. Please do keep the original card box after unpacking, as well as the packing material, in case you want to dispatch or transport the test device later.

The Shore test device is a precision measurement device and must not be exposed to strong vibrations. It is appropriate for a long life span and a constant measuring quality.

Warning:

Check the device for damages in transit!

Connect the device to duly earthed sockets only!

Case parts must be removed by a technician only.

2.1 Installation:

The device is transportable and can be placed on any solid table or suitable even firm surface. You can work with the device while you are sitting or standing. The installation place should be protected against humidity and meet the measuring conditions such as temperature references. Distance to the rear 10 mm at minimum.

The installation location should not be exposed to strong vibrations. Vibrations lead to considerably longer measuring times, as surface recognition by iterative approximation requires more time.

Procedure:

1. Take the device out of the transport box.
2. Put the device horizontally on the measuring place. Fastening is not required.
3. **Prior to connect the device, remove the transport locks according to picture 1 and 2 of the “brief operation instruction”.**
4. Check the device for damages in transit.
5. Attach the included keypad to one of the two USB-connections at the device.
6. The device is connected by means of the included electric cable to a duly earthed plug socket.

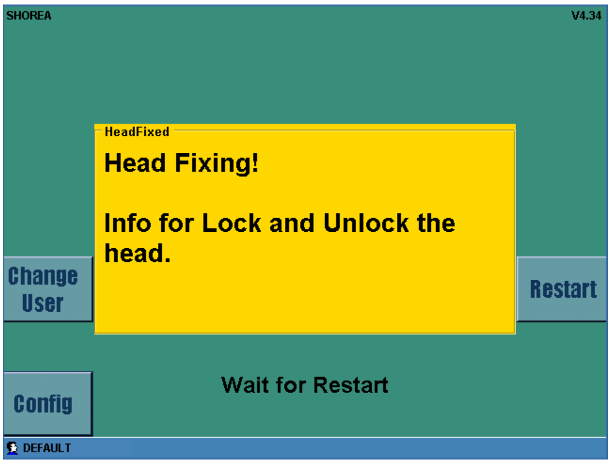
2.2 Start up

For the start-up of the Shore measurement device please proceed as follows:

1. Switch on the power switch at the rear panel of the device next to the IEC connector.

2. Due to activation the Windows XP embedded operating system starts automatically - on your VGA screen you see the start up routines. During launch the system components are initialised and the measuring unit is checked for the active transportation lock.

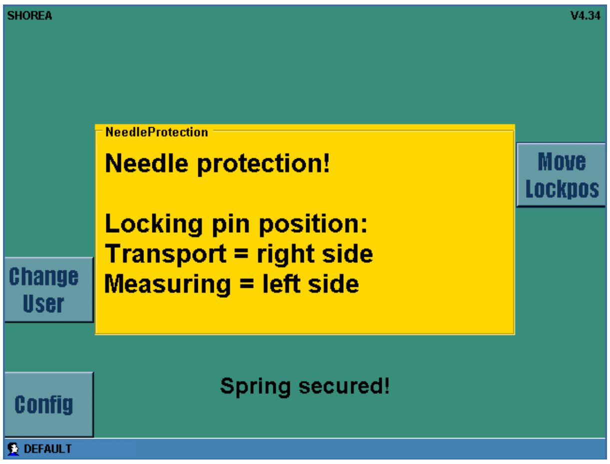
In case the transport lock in position 2.1 has not been removed, you get the message:



Measures to be taken:
- Remove head fixing according to instructions
- Press the key **[Restart]** (if the screen does not react, press the key **[Restart**] once more.

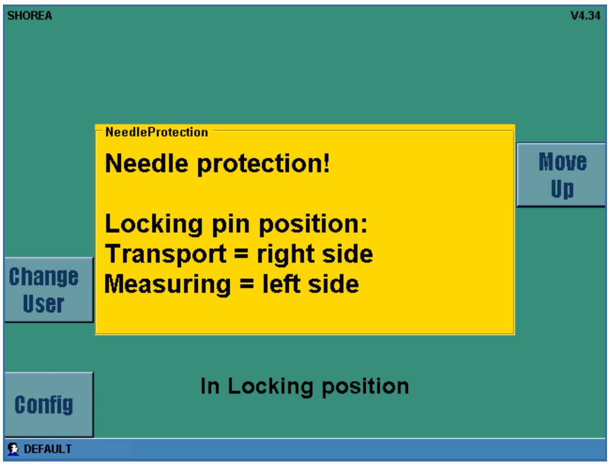
The head fixing screw is only needed for shipments with unpredictable vibrations (shipment by forwarders or parcel services) see brief instructions before start-up.

If the needle protection is active you see the following display:



Measures to be taken:

- Press **[move Lockpos]**
  The measuring head goes down to the unlocking-position
- Bring safety latch into position measuring = left side,
  Press the lever right of the measuring head down and turn it to the left (towards the head) until it locks in place. The needle is now clear.



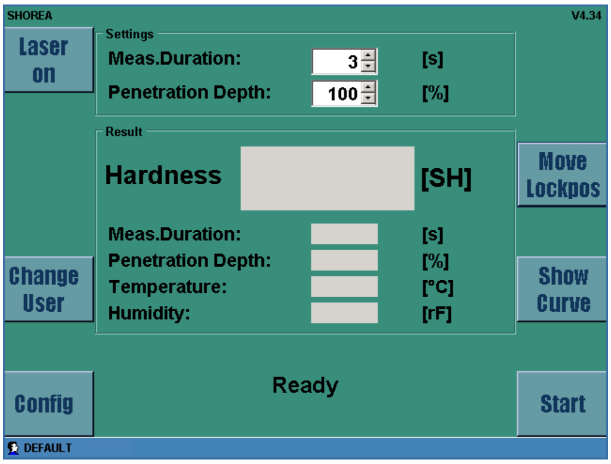
- Press **[Move up]**
  The measuring head goes back into starting-position
  At the screen you see the measurement display

In order to protect the measurement device of damages, the measurement needle has to be protected on transports by the transportation lock. During an active transport protection you see at the screen the display “Needle protection”.

Att**.:** If you press the key **[Move Lockpos]** again, you can activate the transportation lock (refer to brief instructions). By this, a damage of the measurement spring in transport can be avoided.

To obtain a high accuracy, the measurement device should be switched on prior to the first measurement for at least 30 to 60 minutes.

The device is now “**Ready**” for measurement and displays the screen.

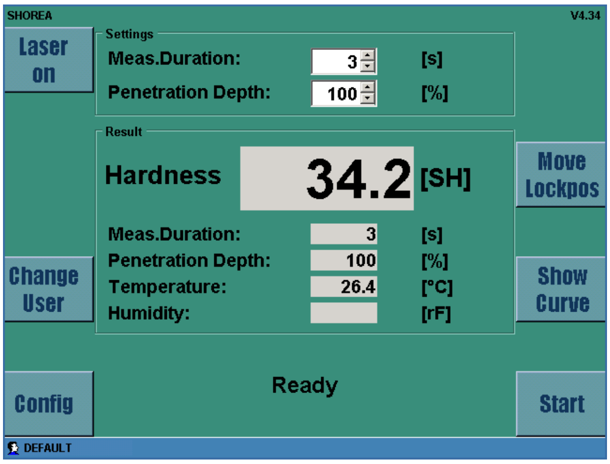


3. By pressing the **[Start]**-key (select key on the screen or green start key on the control panel) a measurement with the displayed default configuration will start. By measuring on a hard surface, such as on the object slide, you can check whether the measurement is 100 ShAn. If the values are <100, the device is switched on for too short or by repeated measurements dirt particles adhering to the needle tip can be removed.

   Under no circumstances try to clean the needle tip manually!

4. Measuring procedure:

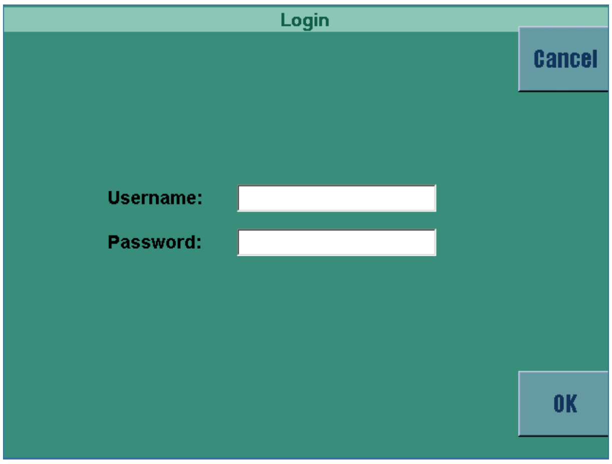
   With the key [**Start**] you begin the measurement process. The measurement head touches down on the sample and detects the surface with the needle.
   After detection the surface postion is exactly determined. If the surface position is determined, the measurement is started and after 3 seconds or the configured time the Shore A-hardness value is calculated and displayed.



The measurement procedure is fully automatic.
If the device is exposed to stronger vibrations, the accurate determination of the surface location needs more time and the measurement process is prolonged, respectively this can cause increased measurements deviations.

5. With a multi-state application system, the device is configured according to demands and the safe-guarding of the measurement targets is carried out.
   The registration can be started by pressing the key **[Change User]:**

   You see the login screen and in-put fields:



Username:
Password:

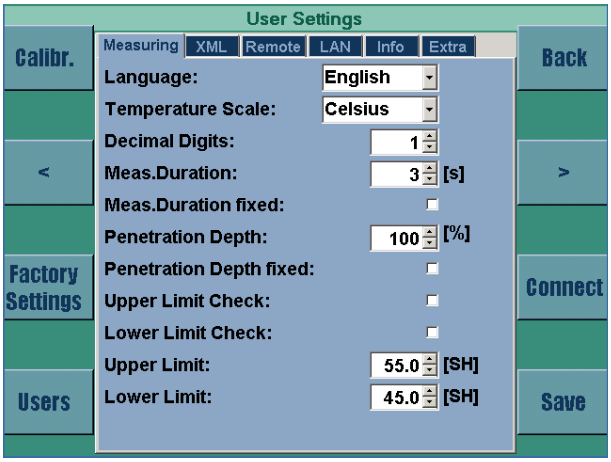
If no entry is made “default” is automatically set and the system is left via **[Cancel]** or **[OK]** but this does not change the settings.

If the User logs in with the appropriate password as an poweruser/administrator, the module Config is active and callable by the key [**Config**]. The key [**Config**] however is only visible if the User is logged in as an poweruser/administrator.

By pressing the key **[Config]** the configuration module is started and permits specific settings concerning the measurement procedure, communication and the measurement value display.

For a detailed explanation of the configuration, see section 3.4. in this user guide.

6. By pressing the key **[Config]** the configuration module is started and permits specific settings concerning the measurement procedure, communication and the measurement value display.



A detailed explanation for the configuration you find in section 3.4 of this guide.

3. Operation

The user guidance is displayed on a control panel with a screen and function keys.
The measurement sequence is fully automatic.

The single operational steps are:

3.1 Positioning of the test specimen (Laser System)

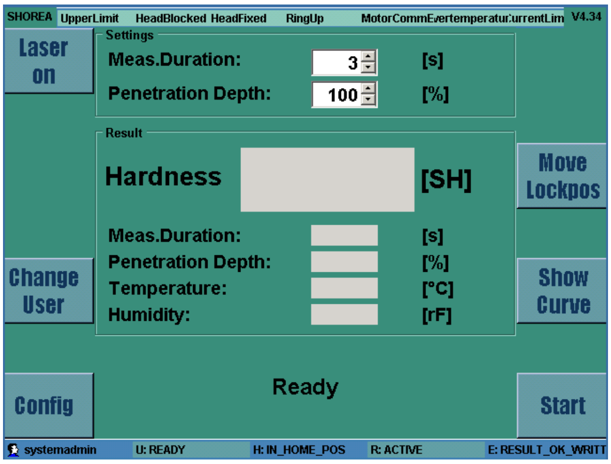
3.2 Start measurements by pressing key [START]

3.3 Display of measurement results on the screen

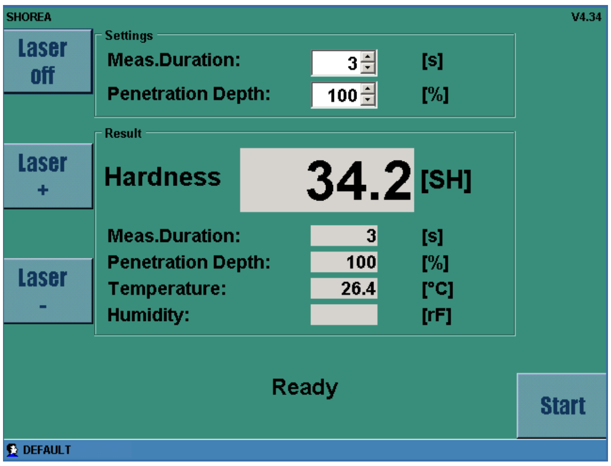
3.4 Configuration

3.1 Positioning of test specimen:

For finished parts is the definition and positioning of the measuring point, which determines the hardness, a very important step.
With the laser crosshair – press key **[Laser on]** a very simple and very accurate positioning of the sample is granted. The intersection shows the measuring position on the surface. If a very accurate positioning is demanded, you can get support by using the magnifying glass.

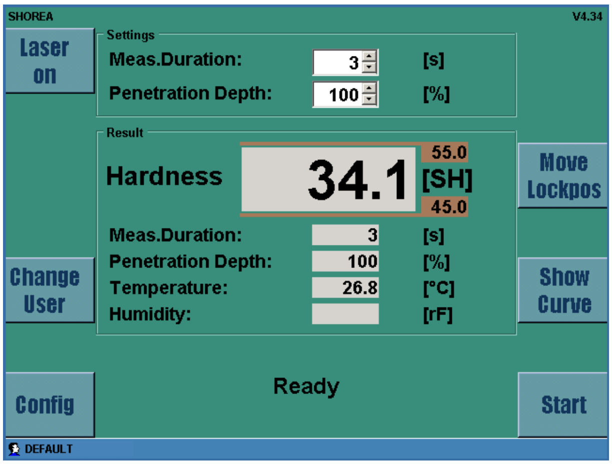


The line width of the laser can be adjusted to be darker or brighter according to requirements by pressing the key **[Laser +]** or [**Laser -**].



As support aid changeable slides of 1 mm thickness are used. To get support for thicker parts you can also use plasticine.
In order to get especially for harder materials (>60 Shore A) correct measuring values, you have to take care, that the sample surface is positioned tangentially to the needle face.
At measurements oblique to the needle tip the result is too soft, since the penetration area due to the oblique contact and low penetration depth (hard parts) is smaller. The surface geometry is insignificant, since the needle face (d=79 µm) is in comparison to the sample geometry very small (see section 1.4.5.)
For repeated measurements on identical parts, you can equip a specific carrier with one or more slides for easy und equal positioning of the test items. Thus an identical positioning of geometry identical parts is secured in a simple way. If a specific sample preparation for the hardness measurement is necessary, we have optionally an external positioning unit with a laser positioning system that permits a test preparation independent of the hardness measurement device.

3.2 Start Measurements by pressing on [Start]



Measurement is started by pressing on the key [Start].
The measurement conditions, such as measuring time, min-max. control, calibration registration, decimal digits, communication intersections etc. are defined via the config-function. To set and change config-values you have to register as an Administrator in the future (login is made by pressing the key **[Change User],** see section 3.4.).

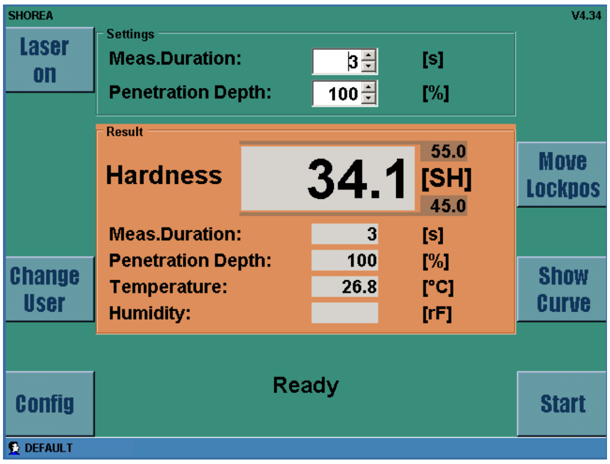
Presently not yet activated!

After the start, the measurement is fully automatic and permits no manual interference. Displayed are the measurement sequences, such as: Find specimen, find surface and measure Shore A. The measurement head makes the necessary tests and returns to starting position after the measurement ends.
The measurement device is optional fully remote controllable and thus easy to integrate into automated systems.

Warning: The measurement item must not be shifted or moved during measurement. This can cause a complete damage of the measurement needle!

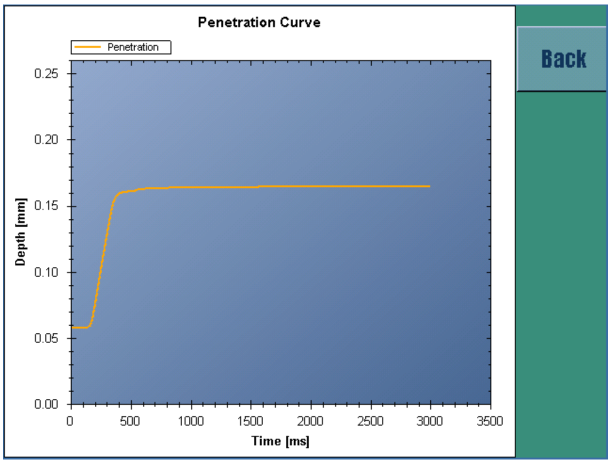
3.3 Measurement result display on the screen

The measurement results are displayed at the end of the run time/measuring time on the VGA screen.



The display remains until the next keystroke or measurement is made. Displayed are single measurement values in Shore An, besides values of temperature and device settings.
If the data results are within defined limits the basic colour is green, if they are outside the min-max control the colour is orange and it is red for incorrect measurements.

To evaluate the measurement the penetration curve can be displayed by pressing on key **[Show Curve]**.

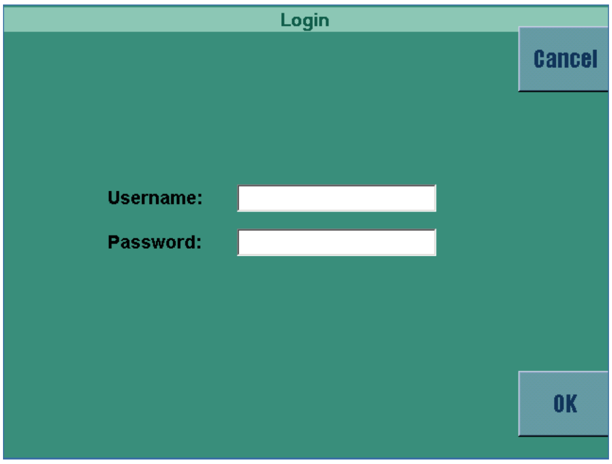


By pressing key **[Back]** you return again to the display with the measurement values.

3.4 Configuration

By a multi-stage sign-in system, the device can be configured according to requirements and the safeguarding of measurement guidelines can be carried out.
The login can be started by pressing the key **[Change User]**
The device has 3 User level.
- Default (ordinary test sequence without config changes)
- poweruser (required for configuration changes)
- administrator (required for LAN-settings/service
- System Administrator (Factory settings for the basic configuration of the test device)

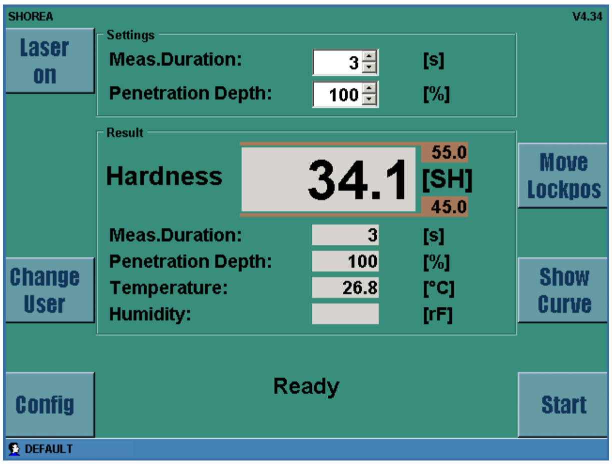
You see the login screen and in-put field.



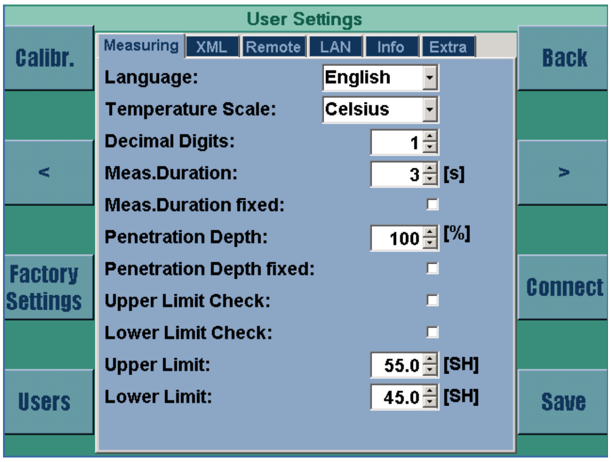
User name:
Password:
(see Appendix B: User administration for username and password)

If no entry is made “default” is automatically set and the system is left via **[Cancel]** or **[OK]** but this does not change the settings.

If the User logs in with the appropriate password as a “poweruser”, the module Config is active and callable by the key [**Config**]. The key [**Config**] however is only visible if the User is logged in as a “poweruser”.
If the User logs in with the appropriate password as an “administrator”, the module LAN-settings/service in the module Config is active.



The automatic test sequence is defined via the config-function. It is callable by pressing the key **[Config].**
The config screen is divided into menus for the different functional areas.

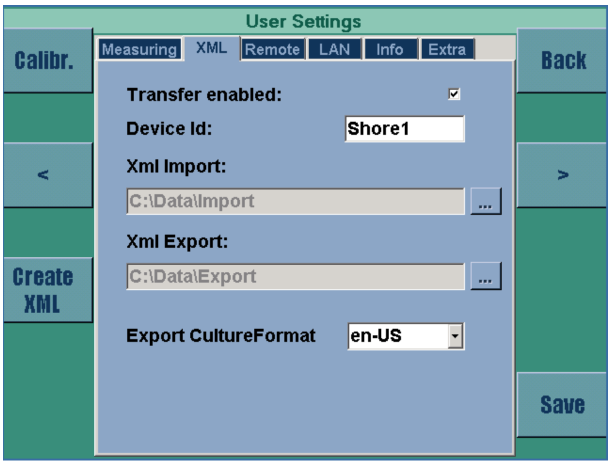


Menu Measurement

Language:	Select
Temperature Scale:	° Celsius or ° Fahrenheit
Decimal Digits:	1 or 2
Measurement Duration:	1.0 to 100.0 seconds (default 3.0 sec)
Measurement duration fixed::	yes (not changeable on the screen)
Penetration depth relative:	10 % to 100 % (standard 100 %)
Penetration depth fixed:	yes (not changeable on the screen)
Upper limit check:	yes (upper limit check on)
Lower limit check:	yes (lower limit check on)
Upper Limit:	-7.4 to 100.0 Shore An
Lower Limit:	-7.4 to 100.0 Shore An

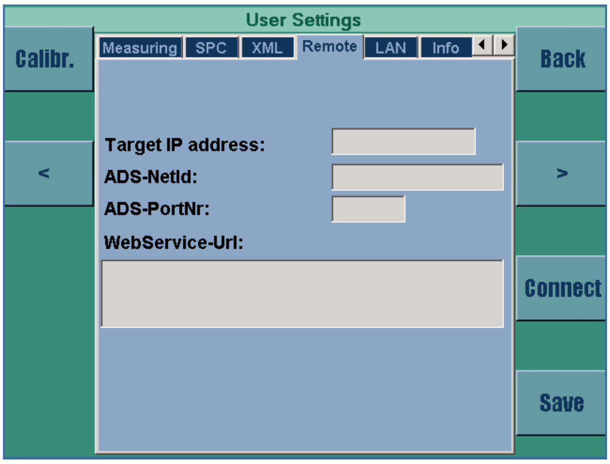
Factory Settings: Pressure on numeric keypad puts settings on factory default

If the upper or lower limit check is not activated, the values do not appear



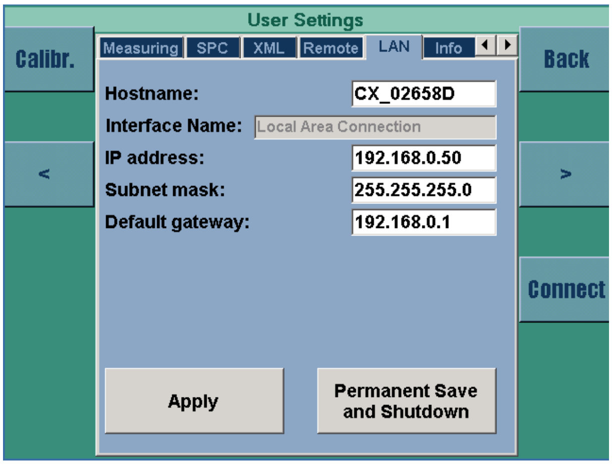
Menu XML

Here, the XML data exchange and save locations for the file storage can be configured. Configuration and measured values, as well as curve values are transferred.



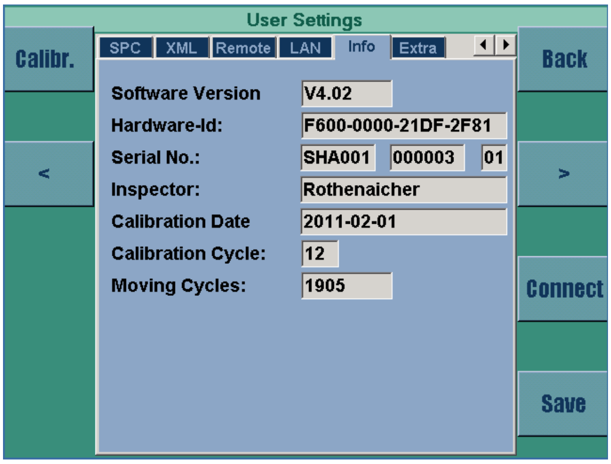
Menu Remote Control

Here, the parameter for the Remote Control are set.



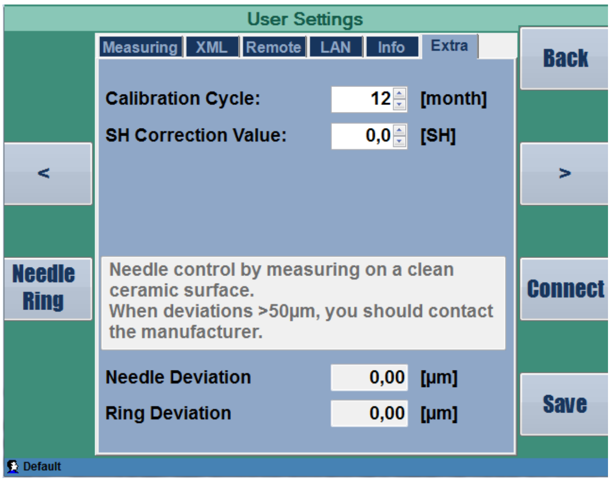
Menu LAN

Here, the IP-addresses for communication are set.
By pressing the key **[Apply]** and **[Permanent Save]** the set values can be stored temporarily or permanently.



Menu **Info**

Here, the general device information is displayed.



Menu **Extra**

Here, the calibration cycle for the maintenance of the device is set.
This value ranges between 1 and 36 months.

The ShA correction value permits by adding it to the measurement value an adjustment of the measured value. Thus, for known measurement deviations, due to special conditions such as very thin samples or penetration depths, a correction of the measurement results to the physically correct values, is possible. To this end comparative test measurements are essential.
The needle control is a possibility, to check the needle correctness.
To evaluate the measurement can be displayed the values by pressing on key **[Needle Ring]**.

4. Maintenance

4.1 Maintenance work

The test device is designed to be maintenance-free. Except for a manual cleaning of normal dirt and/or dust no permanent maintenance is necessary.

4.2 Calibration / Adjustment

Essential for the application of a test device is the quality of the test result. In order to prove the quality of measurements two procedures are applied. Both have a vital influence on the measuring certainty in test engineering.

Calibration

Calibration of measuring devices means to compare it to well-known physical dimensions and to document the result. If the result is not within the tolerable range of the measuring device, calibration or adjustment is necessary.
In accordance with DIN ISO 9000ff the measurement equipment must be control at all times. The monitoring has to be given in form of traceability of all measurements and calibrations based on national standards. This procedure is necessary to ensure, that a measurement device does not only measure tolerances with utmost precision, but also on provable levels. Incorrect measurement standards lead in consequence to false adjustments of the device and to unrecognisable systematic measuring errors.

Calibration periods

The calibration of the hardness test device is usually made in intervals of
6 months up to 2 years. Shorter intervals are not necessary as within this period no discernible deviations are to be expected.
By measuring on a hard surface, e.g. on a glass slide, the measurement device can be checked. The hard surface has to reach a 100 Shore A hardness.
If the display shows <100 Shore A please repeat the measurement – in order to remove possible dirt from the needle.

Warning: Under no circumstance try to clean the measuring needle manually!

4.2.1 Calibration procedure

The calibration demands the observation of specifications in the Manufacturer's test certificate M in accordance with DIN 55350, section 18. The calibration is made with special calibrating tools by technical personnel. The single values, specified in the test report (see section 4.4) have to be observed, in order to ensure the accuracy of measurement results.

4.3 Calibration data schedule

Customer specific statements of calibration periods

4.4. Calibration Certificates / Test reports

Filing of the calibration certificates and test reports

5. Error Treatment

Error treatment needs a chronological recording of occurred errors and measures for troubleshooting. A useful listing is provided in Appendix E “Equipment history” in this manual. By a permanent recording the test device quality can be proved in a very simple and easy way.

5.1 Error status

5.1.2 The device is not ready for use

Check power supply (94 … 264 V ~ 47 … 66 Hz)
Check input fuse of IEC connector at the rear panel of the equipment and replace it, if necessary.
If both systems are in good order, the device must be checked by a qualified electrician.

6. Options

6.1 Accessory

6.1.1 Standard Accessory

- Brief instruction for operation
- User guide book
- Power cable
- 10 object slides (glass 70x70mm)
- Plasticine

6.1.2 Additional components

- x-y-sledge
- customer specific object slides

6.2 Interfaces (PC, Printer, Host, …)

The device is controlled via an „Embedded-PC“ and has various interfaces for communication purposes:

- Ethernet RJ45
- USB

6.3 Software-Module

6.3.1 Standard

6.3.2 Additional Modules

6.4 Hardware to display and record measurement results

Appendix A

Technical Data

Appendix B

User administration (key **[Change User]**)

Default user:	Username: Password:	default 1234	default
PowerUser:	Username: Password:	poweruser config	(for measuring config)
Administrator:	Username: Password:	administrator master01	(for LAN-settings/service)

Appendix C

Designs / Illustrations

Appendix D

EU-Declaration of Conformity

Appendix E

Standards / Literature References

Appendix F

Device History (Orders / Alterations / Errors etc.)

Appendix G

General Information / Publications/…

Appendix H

Brochures / Device information