MOTION & CONTROL™

NSK

USER MANUAL

LASER ALIGNMENT TOOL – SHAFT

aip

NSK experts

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Table of contents

1. Introduction

This user manual is for the correct operation of the NSK LAS-Set Laser Alignment – Shaft device. For safe and efficient operation please follow the instruction provided in this manual.

2. Safety precautions

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. Failure to observe the safety precautions and operating instructions may cause injury, fire and damage to the equipment. Do not disassemble, modify or use the equipment in other ways than explained in the operating instructions. NSK Europe Ltd. will not accept any liability for such use.

Warning

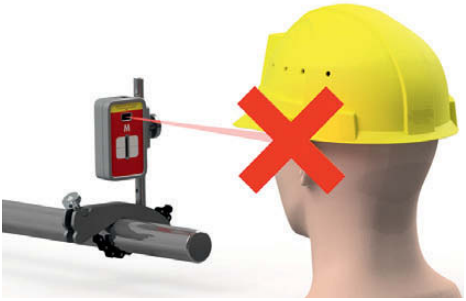
Do not mount equipment on running machines and take all appropriate measures to prevent unintentional start-up of machines. Make sure to fully comply with all appropriate shut down procedures, safety measures and regulations at worksite and local regulations regarding safety in a machine environment.

Laser precautions

NSK LAS-Set uses laser diodes with a power output of < 1.0 mW. The laser classification is Class 2.

Class 2 is considered safe for its intended use with only minor precautions required. These are:

- Never stare directly into the laser transmitter.
- Never shine the laser directly into anyone else's eyes.



Your system complies with the requirements in:

- IEC-60825-1:2014
- USA FDA Standard 21 CFR, Ch 1, Part 1040.10 and 1040.11

Caution

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Power supply

NSK LAS-Set is powered by high-capacity rechargeable Li-Ion batteries mounted in the units charged by the external power unit.

When used in typical conditions the Li-Ion battery will sustain good capacity for approximately 3–5 years before needing replacement. Contact your sales representative for battery replacement.

Improper replacement of batteries can cause damage and risk of personal injury.

Warning

Battery replacement shall only be performed by authorized NSK representatives.

Handle any batteries with care. Batteries pose a burn hazard if handled improperly. Do not disassemble. Keep away from heat sources. Handle damaged or leaking batteries with extreme care. Please keep in mind that batteries can harm the environment. Dispose of batteries in accordance with local regulatory guidelines, if in doubt contact your local sales representative.

Only use the external power adapter supplied by NSK for use with the measurement units. Using other power adapters can cause damage to the unit and personal injury.

Wireless transceiver

The NSK LAS-Set system is fitted with a wireless transceiver. Make sure that there are no restrictions on the use of radio transceivers at the site of operation before using the wireless transceivers.

Warning

Before using the wireless transceivers make sure that there are no restrictions on the use of radio transceivers at the site. Do not use on aircraft.

3. Care of the equipment

Cleaning

The system should be cleaned with a cotton cloth or a cotton bud moistened with a mild soap solution, with the exception of the detector and laser window surfaces, which should be cleaned with alcohol.

For the best possible function, the laser diode apertures and detector surfaces should be kept free from grease or dirt. The display unit should be kept clean and the screen surface protected from scratches.

Do not use paper tissue, which can scratch the detector surface.

Do not use acetone.

The chains on the V-block fixtures are delivered dry. If the system is used in highly corrosive environments, the chains should be oiled.

4. Main components and operating modes

Display unit

USB slave

Shaft Mounting Bracket

Sensors M and S

Mini USB for charging

ON/OFF button with status indication LED

Battery status LED

Laser transmission indication LED

Wireless Communication status LED

Operating modes display unit

The display unit has two operating modes: On and Off.

The display unit is turned on by a short press on the On/Off button.

To turn off the unit, while in the main menu press the On/Off button on the front.

In case the system fails to respond, a long press the On/Off button to switch the unit off.

Connections

USB slave; for attaching the Display Unit to a PC.

Power supply

The Display Unit is powered by a high-capacity rechargeable Li-Ion cell, or by the external power unit. The operating time of the batteries is approximately 8 hours when the system is used for a typical alignment work (continuously on).

The Display Unit can be charged with the supplied combined charger or any 5V USB charger or battery life extender. When the external power supply is connected, the unit will automatically start charging the batteries. This will be indicated by the first battery status LED turning orange, when the unit is fully charged the LED will turn green.

The charging time is approximately 8 hours for fully drained batteries. The charging time will be longer if the unit is turned on while being charged. When used in typical conditions the batteries will sustain good capacity for approximately 3-5 years before needing replacement. Contact your sales representative for battery replacement.

The batteries contain safety circuitry to operate safely with the unit. The unit can therefore only be used with the Li-Ion batteries supplied by NSK. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter 2 on safety for further instructions.

Backlight

If no button is pressed within 15 minutes the backlight will turn off automatically.

Press one of the navigation buttons to turn the backlight on again.

Auto-off

If no button is pressed within 60 minutes the system will turn off automatically.

Resume function

If the system is turned off due to low power or auto-off, the resume function will save the data.

When the system is turned on again after auto-off, you will be prompted to choose whether to return to the stage when the system was turned off (i.e. resuming operation without loss of data) or start the main menu.

Operating modes sensor heads

M and S units have two operating modes: On and Off.

Turn the units on and off by pressing the ON/OFF button firmly.

In case the units fail to respond, it is possible to turn it off by pressing down the ON button for more than 10 seconds.

Connections

Wireless connection

The main connection for M and S units is the built in Wireless connection. The units will automatically connect to the display unit when turned on as long as they are paired. See chapter 8 “System settings” for instructions on how to pair measurement units to the display unit.

Power supply

The M and S units are powered by a high-capacity rechargeable Li-Ion cell, or by the external power unit.

The operating time of the batteries is approximately 12 hours when the system is used for a typical alignment work (continuously on).

The M and S units can be charged with the supplied combined charger or any 5V USB charger or battery life extender.

When the external power supply is connected, the unit will automatically start charging the batteries. This will be indicated by the first battery status LED turning orange, when the unit is fully charged the LED will turn green.

The charging time is approximately 8 hours for fully drained batteries. The charging time will be longer if the unit is turned on while being charged.

When used in typical conditions the batteries will sustain good capacity for approximately 3-5 years before needing replacement. Contact your sales representative for battery replacement.

The batteries contain safety circuitry to operate safely with the unit. The unit can therefore only be used with the Li-Ion batteries supplied by NSK. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter 2 on safety for further instructions.

Sensor head indicators

1. ON/OFF button with status indication LED
   - Continuously green - On

2. Laser transmission indication LED
   - Green – Laser transmission

3. Wireless communication status LED
   a) Continuously blue – paired and ready
   b) Flashing blue – searching/ready to pair

4. Battery status LED
   a) LED continuously red – less than 10% charge left
   b) LED flashing red – less than 5% charge left
   c) LED continuously orange – charging
   d) LED continuously green – fully charged

Display unit

Press the On/Off button to start the system and the Main Menu appears.

In the Main Menu you can select the Shaft Alignment program or the Memory Manager and System Settings.

OK

Select icon with the arrow buttons and confirm with the OK button.

Application programs

Shaft alignment horizontal machines

Memory manager

Memory Manager

System functions

System Settings

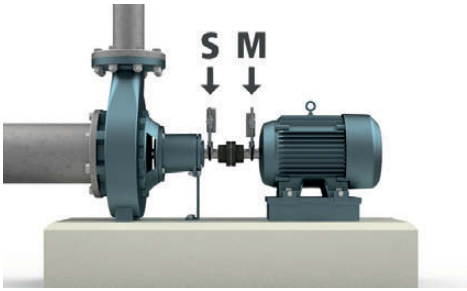
Battery indicator

5. How to perform a shaft alignment

Introduction

Shaft alignment: Determine and adjust the relative position of two machines that are connected, such as a motor and a pump, so that the rotational centers of the shafts are collinear, when the machines are working in a normal operating condition. Correction of horizontal shaft alignment is done by moving the front and the rear pair of one machine's feet, vertically and horizontally, until the shafts are aligned within the given tolerances. A tolerance table is available in the system software.

The NSK LAS-Set system has two measuring units that are placed on each shaft by using the fixtures supplied with the system.



The S unit is placed on the stationary machine and the M unit is placed on the machine to be moved during alignment i.e. the movable machine. The movable machine is typically an electric motor.

After rotating the shafts into different measuring positions the system calculates the relative alignment error between the two shafts.

The distances between the two measuring heads, distance to the coupling and distances to the machine feet are entered into the system. The display box then shows the actual alignment condition together with the position of the feet. Adjustment of the machine can be made directly, according to the on screen instruction and the displayed values. The alignment results can be saved in the memory manager. The measurements in the memory manager can easily be transferred to a PC for further documentation purposes.

Pre-alignment functions

In an effort to obtain the best possible conditions for shaft alignment, it is necessary to perform some pre-alignment checks. In many cases it is necessary to make these checks in order to obtain precise alignment. It is often impossible to reach the desired alignment results if you do not make any pre-alignment checks.

Before going on site, check the following:

- What are the required tolerances?
- Any offsets for dynamic movements?
- Are there any restrictions for mounting the measuring system?
- Is it possible to rotate the shafts manually?
- Are shim sets available?

Before setting up the alignment system on the machine, check the machine foundation, bolt and shim condition. Also check if there are any restrictions in adjusting the machine (if e.g. there is enough space to move the machine).

After the visual checks have been performed, there are some conditions that have to be considered:

- Check that the machine has the right temperature for alignment. (close to operating temperature)
- Take away old rusty shims (check that you can remove shims).
- Check coupling assembly and loosen the coupling bolts.
- Check soft foot conditions.
- Mechanical looseness.
- Check coupling and shaft run-out.
- Pipe work strain.
- Coarse alignment.
- Check coupling gap (axial alignment).

Mounting

The sensor marked “M” should be mounted on the movable machine and the sensor marked “S” on the stationary machine. The sensors shall be assembled on their V-block fixture, and placed on each side of the coupling.

1

Hold the V-block fixture upright and mount it on the shafts of the measurement object.

2

Lift the open end of the chain, tension it so that the slack is removed and attach it to the hook.

3

Firmly tighten the chain with the tensioning screw. If necessary, use the supplied tensioning tool. Do not over-tighten. If the shaft diameter is too large the chains can be extended with extension chains.

4

Adjust the height of the sensor by sliding it on the post until a line of sight is obtained for both lasers. Secure its position by locking the nut on the side of the unit.

Powering up the system

Switch on the detector heads and display unit ensuring that sufficient battery charge is indicated for operation.

Check the wireless connection has been established with the blue light being displayed.

Starting the program

Start the program by selecting the Shaft Alignment icon in the Main Menu and press OK.

This will start the lasers on the M and S measurement units. Adjust the height and angle of both units so both laser lines are roughly in the centre of the detector opening of the opposite unit.

Tolerance table

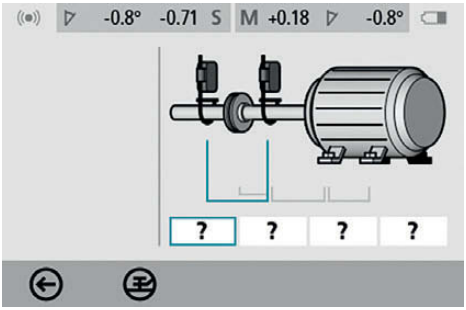
Alignment tolerances depend to a large extent on the rotation speed of the shafts. Machine alignment should be carried out within the manufacturer's tolerances. The table provided in NSK LAS-Set can be helpful if no tolerances are specified. The suggested tolerances can be used as a starting point for developing in-house tolerances when the machinery manufacturer's recommended tolerances are not available. The tolerances are the maximum allowed deviation from desired values.

Select tolerance

The arrow to the left indicates selected tolerance. Select tolerance by scrolling up/down and press OK.

Select the OK icon and press OK to continue to shaft alignment.

Enter dimensions



The screen displays the movable machine.

? Select the dimension boxes to enter dimensions.

Measure and enter dimensions.
You must enter all the distances. The distance between the sensors, the distance between the centre of the coupling and the M-sensor, the distance between the M-sensor and the first pair of motor feet and the distance between the first and second pair of motor feet.

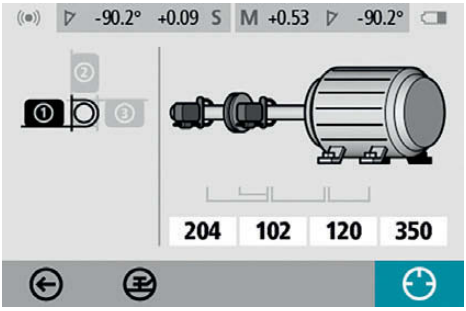
Dimensions are entered in mm or inches on the numeric pad and confirmed by pressing the OK button (default setting is mm; for inch input this needs to be selected in the settings menu).

Soft foot control

Before any alignment measurements and corrections are made, it is important to check the soft foot conditions. Failure to do this can result in false reading and inaccurate results.

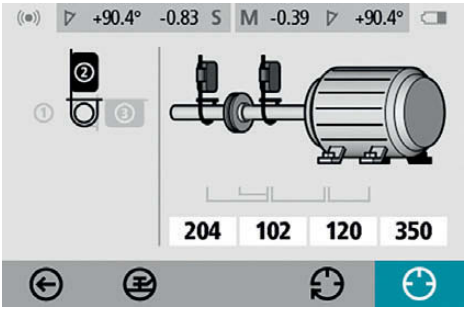
See chapter 6 “Soft Foot Control”.

Measurement point registration



Set the sensors so that they are at 9 o'clock when viewed from behind the movable unit as indicated in the screen.

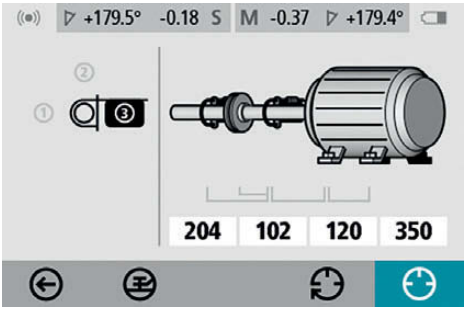
Select the register icon and press OK. This registers the first reading.



Rotate the shafts to the next position at 12 o'clock as indicated.

For best result make sure to eliminate any backlash in the coupling.

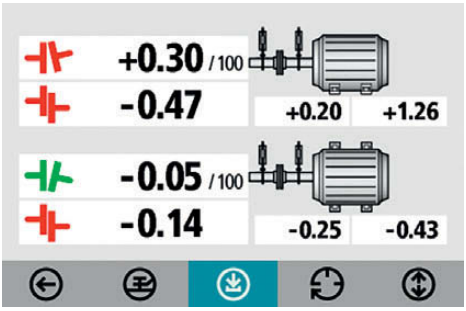
Select the register icon and press OK. This registers the second reading.



Rotate the shafts to the third position at 3 o'clock.

Select the register icon and press OK. This registers the third reading.

Measurement results



The Measurement Result screen shows coupling values and foot values in both the vertical and horizontal direction.

The symbol to the left of the coupling values indicates the angular direction and offset, and also if the values are within tolerance.

Within tolerance (green).

Out of tolerance (red).

Evaluating the result

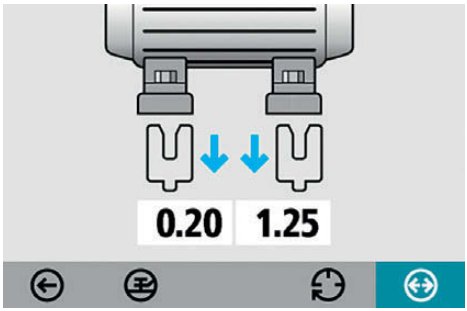
The angle and offset values are used to determine the alignment quality. These values are compared with the alignment tolerances to determine whether correction is necessary. If suitable tolerances are selected in the tolerance table, the symbols described above indicate if the angle and offset values are within tolerance or not. The foot values indicate the movable machine's foot positions where corrections can be made.Depending on the result, the program will also guide the user. First, the program will always recommend the user to save the measurement. Then, if the measurement result shows that the machine is misaligned, the user will be recommended to go to shimming.

Go to shimming.

If the measurement result is within tolerance, the system will recommend the user to exit the measurement.

Save the measurement result.

Shimming



The Shimming screen shows foot values in the vertical direction as suitable shim values.

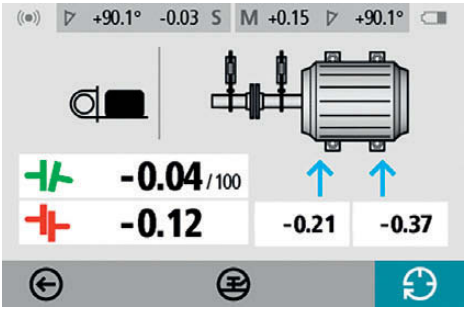
The arrows show if shims must be added or removed to adjust the machine in the vertical direction.

The OK shows that shimming is not needed.

When shimming is completed, continue to alignment for adjustments in the horizontal direction.

Go to alignment.

Alignment



Live alignment shows how to adjust the movable unit in the horizontal direction. If the units have moved since taking the last measurement point rotate the shafts to the 3 o'clock position to make adjustments in the horizontal direction. The angle guide helps you to reach the right position. Adjust the machine horizontally until the values for both angular and parallel alignment are within tolerance. The arrows at the feet show in which direction the machine shall be moved.

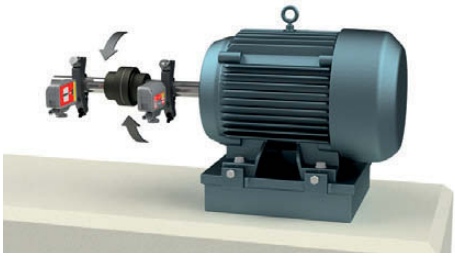
Re-measure

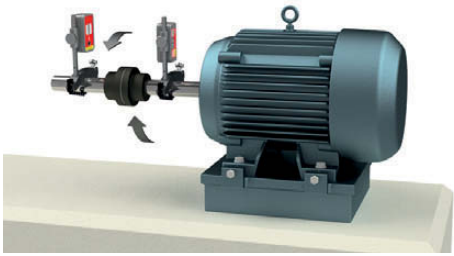
Alignment is now completed. To confirm the result, re-do the measurement.

Re-measure.

Other considerations

Eliminate coupling backlash





To get repeatably measurement it is important to control the backlash in the coupling if present.

This can be done by engaging the coupling in the direction or rotation at all the measuring points.

6. Soft foot control

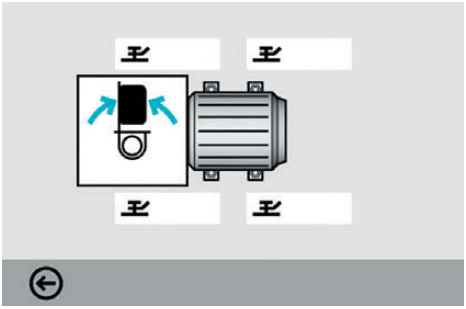
Introduction

A soft foot condition needs to be corrected before any alignment takes place. If not, the measurement result will be of no value. It is more or less impossible to establish if there is a soft foot condition without using some kind of measurement tool. The NSK Alignment System's built-in Soft foot program checks each foot and displays the result in mm.

The Soft Foot Control program is entered from the Shaft Alignment program.

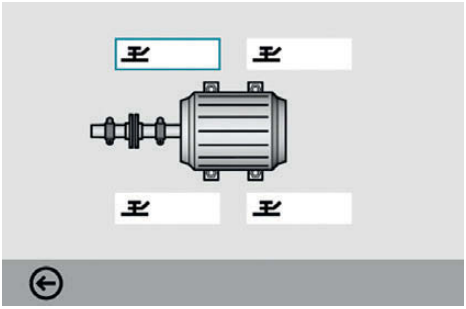
Starting the program

Start the Soft Foot Control by selecting its icon in the Shaft Alignment program and press OK.

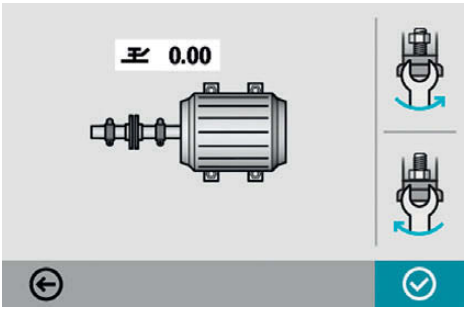


Place the sensors at the 12 o'clock position All the distances must be entered, before checking for soft foot. Check that all foot bolts are firmly tightened.

Measurement value registration

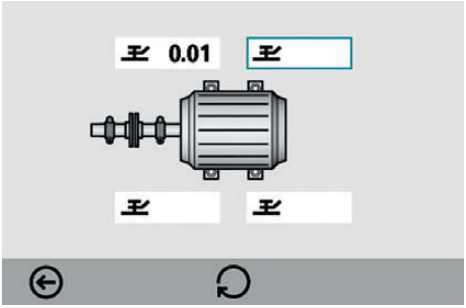


Select a bolt of your choice and press OK.

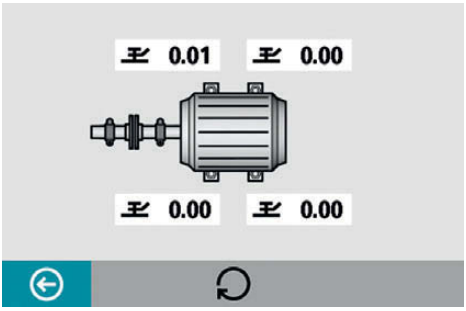


Loosen the bolt fully and then tighten it firmly, preferably with a torque wrench.

Press OK to register the measurement value.



Continue with the rest of the bolts. Re-measurements can be done at any time by selecting the requested bolt again and press OK.



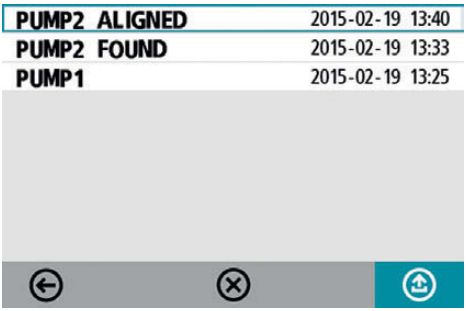
Adjustments needed will be indicated on the screen. Make the necessary corrections and then check each foot again (the values show the required shims necessary to eliminate the soft foot).

Shaft alignment

Return to shaft alignment by selecting the Exit icon and press OK.

7. Memory Manager

File manager



Select file

Files can be selected by scrolling.

Scroll upwards.

Scroll downwards.

Opens selected file.

Archive

Goes to archive (only available when it contains folders with older files).

Delete

Deletes selected file.

Exit

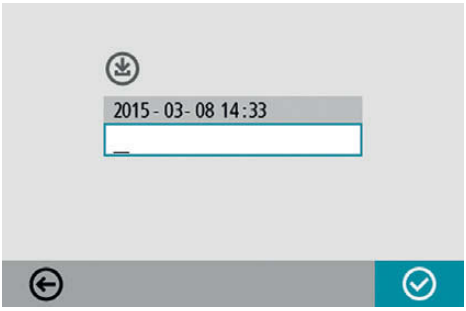
Exits the Memory Manager.

Open file

The Memory has the capacity to store approximately 1500 measurements. When the number of measurements, exceeds 100 measurements in the file manager, a folder with the older files will be automatically created. These folders can then be found in the archive.

NOTE: When there are a lot of files in the memory, processing can be slow. It is recommended to transfer files regularly to a PC for long term storage.

Save measurement



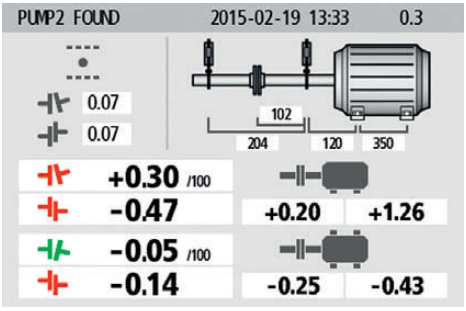
Enter file name
Enter file name with the keyboard, when the file name field is selected.

Confirm

OK	Confirm.

When saving a measurement, both a text file and a picture file (bmp) are created.

Display files



The screen displays measurement results, dimensions, target values if any, file name, date and time, serial number of the display unit, program, program version and tolerances.

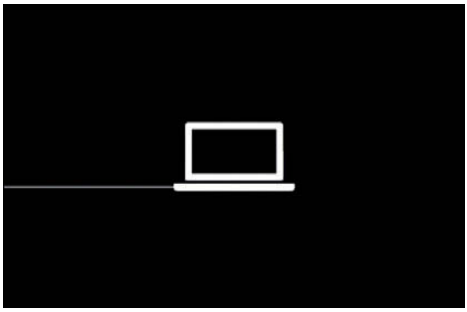
OK	Exits the measurement file.
^	Scrolls to next measurement.
v	Scrolls to previous measurement.
C	Deletes the measurement file.

Transfer files to a PC

1. Turn on the display unit and stay in the Main Menu and attach the display unit to the PC with the USB cable.

2. A new icon will appear in the lower right corner of the main menu. Select the new PC connection icon and the display unit will be automatically detected and will appear as a mass storage device on the PC.

3. The screen will change into a black background with an image of a PC in it when connected. The files in the display unit can be transferred to the PC using the ordinary functions in Windows Explorer (i.e. cut, copy or drag and drop).

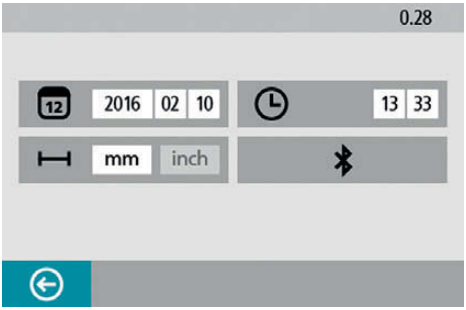


In the PC there will be two files for each measurement; a picture file (.bmp) and a text file (.txt). The picture file shows the same picture as in the memory. The text file shows just the measurement data.

It is recommended that you delete the files from the display unit after they have been safely transferred in order to avoid full memory.

8. System settings

General settings



The system settings menu includes settings that are universal for all applications.

For most of the settings, the current selection is shown in the icon. The program version number is also shown on this screen.

Date

To change date, select the date icon and press OK. Enter year and press OK. Enter month and press OK. Enter day and press OK.

Time

To change time, select the time icon and press OK. Enter hour and press OK. Enter minute and press OK.

Changes between mm mode and inch mode. To change measurement unit, select the measurement unit icon and press OK. Select mm or inch with the left/right buttons and press OK.

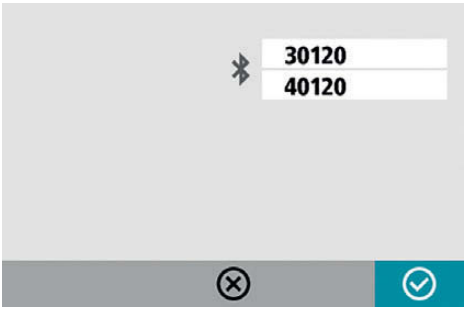
Wireless Communication settings

Open the Wireless Communication settings by clicking the icon and press OK.

Exit

9. Settings for Wireless Communication

Communication



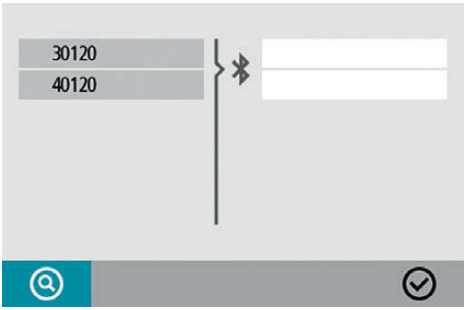
Information on which units are paired to the display unit is displayed. The display unit will only communicate with units that are paired.

Pairing wireless units

Select the search icon and press OK, to search for units that are available.

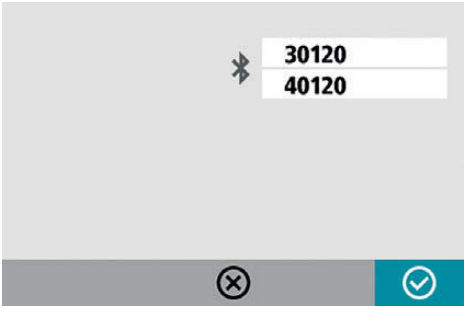
Available units will appear in the search list to the left.

Wireless units must be switched on for the display unit to discover them. The display unit will only discover suitable measurement units.



Select the units to pair in the search list and press OK. (Maximum two units.)

Available units will appear in the search list to the left.



Units that are paired to the display unit are shown in the boxes below the blue B.

The display unit will only communicate with units that are paired and displayed in the boxes.

Select the OK icon and press OK to confirm Wireless communication settings.

Unpairing wireless units

If there are units paired to the display unit, they have to be unpaired before it is possible to pair new units.

Select the delete icon and press OK to unpair units.

10. Technical data

Display unit	
Housing material	ABS plastic
Operating temp	0 to 50° C
Weight	328 g
Dimensions	184 x 100 x 33 mm
Environmental protection	IP54
Flash storage memory	500 Mb
Display	Colour TFT-LCD backlit
Display size	4" diagonal (84 x 56 mm)
Interface	Membrane Switch Keyboard
Peripherals	1 USB slave port ; Charging: 5V, 0,5A
Wireless communication	2,4 GHz
Power supply	Rechargeable Li-Ion battery or external power supply
Operating time	8 hours continuous use

Shaft brackets	
Fixture	2 pcs V-fixture with chain, width 22 mm
Material	Anodized aluminium
Shaft diameter	Ø 30-150 mm Ø 30-500 mm (with optional extension chains)
Rods	2 pcs 150 mm

Accessories	
Tape measure	2 m metric

Sensor units	
Housing material	Anodized Aluminum frame and ABS plastic
Operating temp	0 to 50° C
Weight	222 g
Dimensions	94 x 87 x 37 mm
Environmental protection	IP54
Laser	650 nm class II diode laser
Laser power	< 1 mW
Measurement distance	Up to 2 m
Detector	Digital line sensor
Detector active length	20 mm
Measurement accuracy	1 % ± 1 digit
Wireless communication	2,4 GHz
Communication range	10 m
Peripherals	1 USB Mini port; Charging: 5 V, 0,5 A
Power supply	Rechargeable Li-Ion battery or external power supply
Operating time	12 hours continuous use (measuring)
LED indicators	Wireless communication, laser transmission and battery status indicators

Complete system	
Weight (incl. all standard parts)	3,95 kg
Storage temperature	-20 to 70° C

Case	
Material	Double Walled Polypropylene
Dimensions	390 x 310 x 192 mm

11. FAQ

1. The measurement units don't fire up the lasers and I don't get any values from them?

› Make sure the measurement units are turned on and paired with the display unit.
› Make sure that the laser line is not obstructed and is hitting the detector.
› Check all units are adequately charged.

2. The measurements are not repeatable/ repeated adjustments doesn't get the machines within tolerance.

› Make sure there are no loose parts in the coupling or machines
› Make sure that the movable machine isn't suffering from soft foot.
› Make sure there isn't excessive backlash in the coupling, and if so eliminate it.
› Make sure the measuring units are clean and the laser window of detector opening are not covered with grease or dirt.

3. What happens if the wireless connection is not established?

› Make sure that both measuring heads have been paired with the display unit.
› Check all units are adequately charged.

4. How often does my unit need calibration?

› We recommend between 12 and 24 months.
› However if the machine is damaged or dropped we recommend that it is checked for calibration earlier.

5. What do I do if my equipment is damaged or needs servicing ?

› Return the equipment to your NSK representative.
› A condition assessment and recommended repair report will be completed before any work is undertaken.

12. Upgrading the software

Any upgrades of the software will be made available for download on our website www.nskeurope.com

1. Turn on the display unit and stay in the Main Menu and attach the display unit to the PC with the USB cable.

2. A new icon will appear in the lower right corner of the main menu. Select the new PC connection icon and the display unit will be automatically detected appearing as a mass storage device on the PC.
   NOTE: The display unit must be turned on and in the Main Menu before it is connected to the PC in order for the display unit to appear on the PC.

3. Copy the file containing the new software to the display unit.
   NOTE: A zipped file must be unzipped before copying it to the display unit.

4. Disconnect the display unit from the PC and wait until the display unit turns itself off (this can take several minutes).

5. Turn on the display unit. The upgrade file will be automatically detected and installed. This can take approximately one minute. Wait until the Main Menu is displayed, and the display unit is then ready to be used again.

Settings and stored measurements will not be affected by an upgrade.

The upgrade file will be automatically deleted from the display unit when the upgrade is completed.

13. Software end user license agreement

The rights to use the software in this product are offered only on the conditions that you agree to all the terms stated below, i.e. the end user agreement. By using this product you agree to be bound by this agreement. If you do not accept this agreement your sole remedy is to return the entire unused product, hardware and software, promptly to your place of purchase for a refund.

The user is granted a single license to use the software contained in this product. Use is only permitted on the hardware it has been installed on at the time of purchase. The software may not be removed from the hardware.

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For more information please visit www.nskeurope.com

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