

USER MANUAL MEAX



meax

ACOEM Group

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WELCOME TO OUR WORLD

Since the very beginning in 1984, ACOEM AB has helped industries throughout the world to achieve more profitable and sustainable production. We have reached where we are today by having the courage to think beyond the norm and follow slightly unconventional paths. We have had the courage to make mistakes and find new directions. Through our resolve, ambition and knowledge we have become a global player and a leader in innovative, user-friendly measurement tools.

MEAX

As ever-increasing demands are being placed on machine tools, we have arrived at the conclusion that an optimally functional machine forms the basis for better business. Modern machine tools must maintain a high level of flexibility, a high degree of utilization and a minimum downtime which calls for the correct geometry in all the machine's movements.

So, we created MEAX and started to sketch solutions for machine tool measurements that, in our opinion, are so self-evident that they should have been developed a long time ago.

By performing fast measurements, possessing a logical user interface, smart applications and fewer complicated functions, we can now build a future for machine tool measurement.

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.

The software contained in the system is the property of ACOEM AB, any copying or redistribution is strictly prohibited.

Modifying, disassembling, reverse engineering or decompiling the system or any part thereof is strictly prohibited.

Disclaimer of warranties: To the maximum extent permitted by applicable law, ACOEM AB and its suppliers provide the software contained in this product 'as is' and with all faults, and hereby disclaim all other warranties either expressed, implied or statutory.

Limited liability: No liability shall exceed the price of the product, and the sole remedy, if any, to any claim shall be a right of return and refund.

ACOEM AB or its suppliers shall, to the maximum extent permitted by applicable law, not be liable to any indirect, special, incidental, punitive, and consequential damages arising from the use of the system or any part thereof, authorized or unauthorized.

ACOEM AB (formerly known as Elos Fixturlaser AB) is since mid-2014 a fully owned subsidiary of ACOEM Group, headquartered in Lyon, France. Other brands within ACOEM Group are 01dB, ONEPROD, METRAVIB and FIXTURLASER. For more information please visit www.acoemgroup.com

DECLARATION OF CONFORMITY

In accordance with the EMC Directive 2004/108/EC, the Low Voltage Directive 2006/95/EC, including amendments by the CE-marking Directive 93/68/EEC & EC directives RoHS 2011/65/EU.

Type of equipment

Machine Tool Measurement System

Brand name or trade mark

MEAX

Type designation(s)/Model no(s)

1-1013 MEAX DU 01
1-0984 MEAX LM 201
1-0985 MEAX LR 201
1-0986 MEAX SM 201
1-0987 MEAX SR 201

1-1039 MEAX P 100
1-1058 MEAX P 250

Manufacturer's name, address & phone no

ACOEM AB
Box 7
SE-431 21 Mölndal
Sweden

Phone: +46 31 7062800

The following standards and/or technical specifications, which comply with good engineering practice in safety matters in force within the EEA, have been applied:

Standard/Test report/Technical construction file/Normative document

EN 61000-6-3:2007.

EN 61000-6-2:2005, EN 61000-4-2, -3, -4, -5, -6, -11.

EN 61010-1:2010

ISO9001:2008 Ref. No/ Issued by: DNV
Certification AB Certification No. 2009-SKM-
AQ-2704/2009-SKM-AE-1419.

The laser is classified in accordance with the
International Standard IEC-60825-1:2014,
USA FDA Standard 21 CFR, Ch 1, Part
1040.10 and 1040.11 except for deviations
pursuant to laser notice No. 50, dated June
24, 2007.

The wireless device complies with Part 15 of
the FCC Rules. Operation is subject to the
following two conditions;

- (1) this device may not cause harmful
interference, and
- (2) this device must accept any interference
received, including interference that may
cause undesired operation.

Additional information

The product was CE-marked in 2015.

As manufacturer, we declare under our sole
responsibility that the equipment follows the
provisions of the Directives stated above.

Date and place of issue

Mölnadal 2015-12-01

Signature of authorized person

A handwritten signature in black ink, appearing to read 'Hans Svensson', with a stylized, sweeping flourish at the end.

Hans Svensson, Managing Director

SAFETY

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 pre-cautions and operating instructions can cause bodily injury, fire, and damage to the equipment.

Do not disassemble, modify or use the equipment in other ways than explained in the operating instructions. ACOEM AB will not accept any liability for such use.



WARNING!

Make sure to fully comply with all appropriate safety measures and regulations at worksite and local regulations regarding safety in a machine environment. Do not operate a machine such as a lathe, if you have not received safety instructions and understand how to use the machine. Take all appropriate measures to prevent unintentional start-up of machines.

LASER PRECAUTIONS

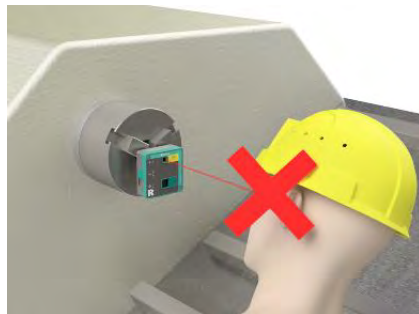
MEAX Instruments uses laser diodes with a power output of < 1.0 mW. The laser classification is Class 2.

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.



COMPLIES WITH 21 CFR 1040.10 AND 1040.11
EXCEPT FOR DEVIATIONS PURSUANT TO
LASER NOTICE No. 50, DATED JUNE 24, 2007



CAUTION!

USE OF CONTROLS OR
ADJUSTMENTS OR
PERFORMANCE OF
PROCEDURES OTHER THAN
THOSE SPECIFIED HEREIN
MAY RESULT IN HAZARDOUS
RADIATION EXPOSURE.

Your system complies with the requirements in:

- IEC-60825-1:2015
- British Standard BS EN 60825-1
- DIN EN 60825-1

USA FDA Standard 21 CFR, Ch 1, Part 1040.10 and 1040.11

POWER SUPPLY

The MEAX equipment is powered by high-capacity rechargeable Li-Ion packs mounted in the display unit and the sensors.

Do not expose the power adapter to rain or wet conditions.

Always unplug the charger from the electrical outlet after charging.

Leaving a display unit or a measurement unit with an empty battery for a prolonged time can reduce the capacity of the battery or even damage the battery.

If the system is not used for a long time, charge the batteries to approximately 50-75% before storing the system, if kept in storage repeat this every 3-4 month (if needed).

When used in typical conditions the battery will sustain good capacity for approximately 2-3 years before needing replacement. Contact your sales representative for battery replacement.

The batteries contain safety circuitry to operate safely with the display unit and the sensors. The display unit and the sensors can therefore only be used with the Li-Ion batteries supplied by MEAX.

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



WARNING!

BATTERY REPLACEMENT SHALL ONLY BE PERFORMED BY AUTHORIZED MEAX REPRESENTATIVES.

USE OF ANY OTHER BATTERIES THAN THOSE SUPPLIED BY MEAX WILL CAUSE SEVERE DAMAGE TO THE SENSOR AND CAN CAUSE RISK FOR PERSONAL INJURY!

Handle any batteries with care. Batteries pose a burn hazard if handled improperly. Do not disassemble and 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 MEAX for use with the display unit and the sensors.

Using other power adapters can cause damage to the unit and personal injury.

WIRELESS TRANSCEIVER

The MEAX system is fitted with Bluetooth wireless transceivers.

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.

CARE

PACKING THE CASE

Make sure to use the supplied case when transporting the system.

Calibration certificates are placed behind the lid foam.



CLEANING

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



For the best possible function, the laser diode apertures, detector surfaces and connector terminals 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.

HOME MENU

The MEAX systems are available with different programs for specific purposes.

The programs included depend upon which program packages you have selected.



Press the ON button to start the system.



In the Home Menu, you can select the program that you want to use.

In the Home Menu, you will also find the Memory Manager and Global Settings.

APPLICATION PROGRAMS



Straightness and Level



Spindle Direction



Coaxiality



Squareness



Vertical Spindle Direction



Vertical Coaxiality



Spindle Parallelism



Vertical Spindle Parallelism



Sensor Display Level



Sensor Display Position



Sensor Display Pen



Max Min Pen



Temperature Log

MEMORY MANAGER



Memory Manager

SYSTEM FUNCTIONS



Global Settings



Battery Status



Decrease Backlight



Increase Backlight



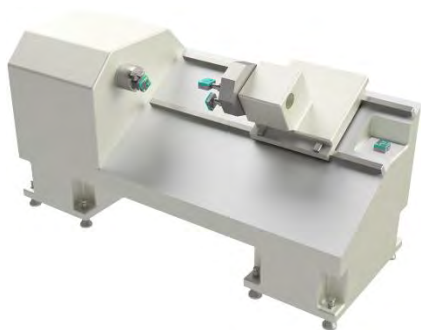
Off



Bluetooth Indicator
On/Off

STRAIGHTNESS AND LEVEL

INTRODUCTION



The Straightness and Level program is used for measuring the straightness and pitch/roll of the different axis of motion in the machine. Up to 4 MEAX sensors can be used to perform all measurements (SM, SR, LM and LR).

The straightness measurement uses a laser

beam from the SR unit as reference which is placed parallel to the axis of motion. The 2-axis SM sensor is mounted on the tool holder/carriage and measures the movement in two directions when the carriage is moved along the machine guideway.

The pitch/roll is performed at the same time by having the LM sensor mounted on the tool holder/carriage and the LR sensor mounted on the machine foundation as a reference.

Measurement values are recorded from all 3 sensors by moving the carriage in different position along the axis of motion.

The results are presented graphically and numerically and can be compared to selected tolerances.

All results can be saved in the memory on the display unit and can easily be transferred to a computer for full documentation of the measurement.

MEASUREMENT METHOD

The straightness measurement is performed by placing a laser beam along the axis of motion. The laser beam is fixed and work as a reference during the entire measurement. The SM sensor is mounted on the measuring object in a position so the laser beam hits the 2-axis detector on the sensor. The SM sensor measures the position in two directions (b and a) when the object is moved to different measurement positions along its axis of motion. The distances between measuring points are also entered in the measurement.

When all measuring points are recorded, the system will recalculate the results with a best-fit calculation or according to selected reference points.

The results are presented in a graph and in a list and can be saved in the memory manager on the system.

The pitch/roll measurement is performed by using the MEAX LM and LR sensors which measures the angular difference towards gravity in two directions (α and β).

The LM sensor is mounted on the tool holder/carriage and measures the angular deviation in the different measuring points along the axis of motion.

The LR sensor is mounted on a fixed position on the machine foundation. It records the angular movements of the machine while the measurements are recorded.

The results from pitch/roll measurements are presented in a graph and in a list.

In the result screen, the user can toggle between showing the results of the straightness and pitch/roll.



STARTING THE PROGRAM



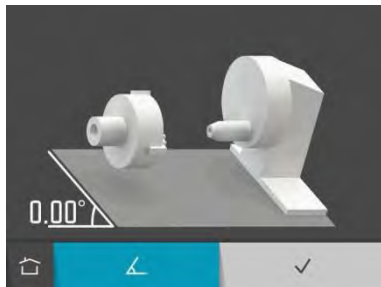
Start the Straightness and Level program by touching its icon in the Home Menu.

Turn on the laser on the SR sensor.

CONFIGURATION

Machine bed slant

When entering Straightness and Level, the machine bed slant screen is displayed.



The machine bed slant is measured with the SM sensor.

If you have an existent machine bed slant you just need to confirm it.



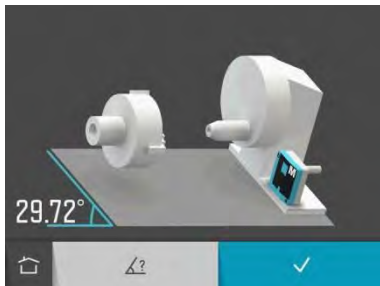
Measure machine bed slant.



Confirm existent machine bed slant.



Home.



When measuring machine bed slant with the SM sensor, the angle value is displayed live.

Place the SM sensor at the machine bed slant.



Confirm measured machine bed slant.

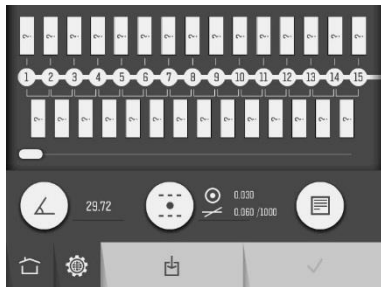
The machine bed slant can also be entered manually.



Enter machine bed slant manually.

Machine bed slants between -2° and 90° are accepted.

Measurement points



Up to 99 points can be measured.

Number of points is selected by entering their positions or by entering distances between them.

Enter positions



Touch and release one of the position boxes above the measurement points to enter a position.

Rules for entering positions

If position is entered at point 1 first and then at another point, positions in between will be filled with equal distances between them.

If position is entered at another point than 1 first, position will be set to 0 at point 1.

If position 0 is entered first at any point, nothing else will be filled. If then, position at a point between this point and point 1 is entered, positions in between will be filled with equal distances between them.

Position at a point can only be changed to a value between the positions of the neighboring points.

The last point can be removed by changing its position value to blank.

Enter distances



Touch and release one of the distance boxes below the measurement points to enter a distance.

Rules for entering distances

If position is entered at point 1 first and then distance is entered between any two points, positions in between will be filled with equal distances between them.

If distance is entered between any two points first, position will be set to 0 at point 1.

If a distance is changed the positions of all the points after this distance will be changed.

The last point can be removed by changing the distance before it to blank.



The selected measurement area is marked in blue.



Tolerance



Open window for tolerance settings.

Note



Open notes.

Confirm configuration



Confirm configuration and continue to summary screen.

Save configuration

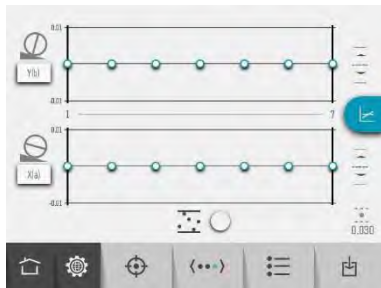
The configuration can be saved separately, to be opened up later.



Save configuration.

MEASUREMENT

Summary screen



The summary screen shows all the measurement points.

Measurement points are registered in the measurement point screen.



Touch and release a point to open the measurement point screen.

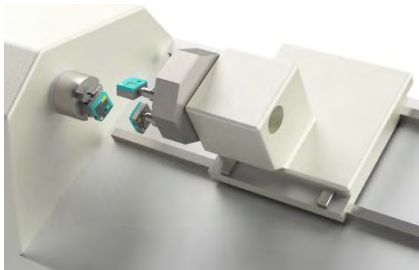
The touched point is marked in blue.

If you want to change configuration, it is possible to return to the configuration.



Touch the configuration icon to return to the configuration.

Measurement point screen



Place the carriage with the SM and LM sensors at the point to be measured.

Make sure that the laser beam hits the target and that the SM sensor is close to 0° .

Wait about 20 seconds for the values to stabilize, before registering the measurement point.



The measurement point screen shows b- and a-values and rotational angle from the position sensor and alpha- and beta-values from the level sensor.



A flashing circle around the measurement point number indicates that values are live.



Touch the measurement icon to register the measurement point.

The color of the values indicates the status of the b, a, alpha and beta values in relation to the selected tolerances.

+0.004 Within tolerance (black).

+0.089 Out of tolerance (orange).



When a measurement point is registered, fixed values are shown.



A filled circle around the measurement point number indicates that the point is measured and that values are fixed.

Note

A note with up to 20 characters can be entered at each point.



Touch the note icon for entering a note.

Neighbor points

It is possible to continue to a neighbor point direct in the measurement point screen, without returning to the summary screen in between.



Go to neighbor point to the left.



Go to neighbor point to the right.

Re-measure a point



Touch the re-measure icon.

Delete a point

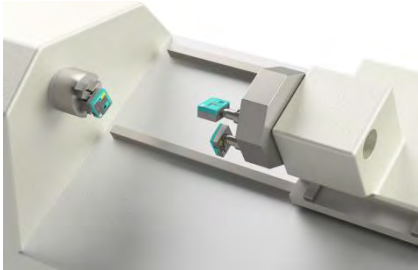


Touch the delete icon.

Return to summary screen



Touch the confirmation icon to return to summary screen.



Move the carriage with the SM and LM sensors to another measurement point and repeat the measurement procedure.

REFERENCES

There are different ways to select references.

Manually selected reference points

Reference points are selected in the measurement point screen.

In Straightness, one or two reference points can be selected.



Straightness reference point selected.

In Level, one reference point can be selected.



Level reference point selected.

Best fit

In Straightness, there are also a Best fit function.

Best fit can be enabled in the Straightness summary screen.

Contrary to the selection of reference points, best fit is a function that can be enabled or disabled. The function calculates a reference line that minimizes the deviation from measured points. In Straightness, a minimum of two measured points is required for the function to be accessible. When the function is enabled, it will continuously recalculate a reference line or plane whenever the input parameters to the function are changed.

These parameters are changed if a new point is measured, a point is re-measured, a measured point is removed or if a user given distance is changed.



Best fit enabled.

MEASUREMENT RESULT

Summary screen

The summary screen shows all the measurement points, Straightness on one page and Level on another.

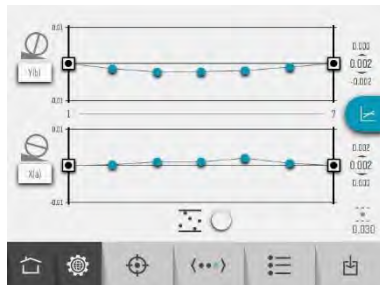
The diagram scale is automatically adjusted according to the biggest value.



Show Straightness page.

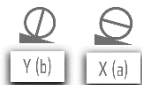


Show Level page.

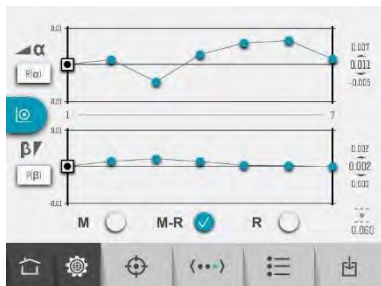


Summary screen – Straightness

The b and a axes can be named with up to 3 characters.

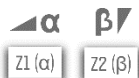


Name b and a axes by touching their boxes.



Summary screen – Level

The alpha and beta axes can be named with up to 3 characters.



Name alpha and beta axes by touching their boxes.

The symbols indicate status of the measurement point.



Values within tolerance.



Values out of tolerance.



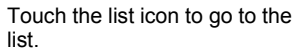
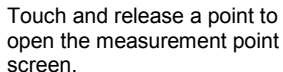
Unmeasured point.



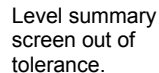
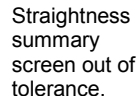
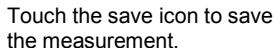
Reference point.

When a reference sensor LR is used, level values can either be presented as M-R values (relative to the R sensor) or as M values (not relative to the R sensor). See “Level reference sensor (LR)”.

Tolerance, maximum and minimum values and the difference between the maximum and minimum values are also shown.



ry



List screen



	Y(b)	X(a)	\angle	R(α) M-R	P(β) M-P
1	250	0.000	0.000	0.16	0.000
2	313	-0.001	0.000	0.16	+0.001
3	377	-0.002	+0.001	0.16	-0.005
4	440	-0.002	+0.001	0.16	+0.003
5	503	-0.002	+0.002	0.16	+0.006
6	567	-0.001	+0.001	0.16	+0.007
7	630	0.000	0.000	0.16	+0.002

The list screen shows all the measurement points in a list with positions and values.

The color of the values indicates the status of the b, a, alpha and beta values in relation to the selected tolerances.

+0.004 Within tolerance (black).

+0.089 Out of tolerance (orange).

There is also a tolerance indication at the measurement point number.

If all values at a point are in tolerance the point number is black.

If any value at a point is out of tolerance the point number is orange.

The list can be scrolled up and down.



Touch the summary icon to return to the summary screen.



	Y(b)	X(a)	\angle	R(α) M-R	P(β) M-P
1	0	-0.100	0.040	0.15	0.100
2	20	-0.010	-0.010	0.15	-0.010
3	40	-0.100	0.002	0.15	0.100
4	10	-0.100	-0.010	0.15	-0.010
5	1.00	0.100	-0.005	0.15	0.100
6	1.00	-0.100	-0.005	0.15	-0.005
7	200	0.000	-0.005	0.15	-0.005
8	200	0.100	-0.005	0.15	0.100
9	300	-0.100	-0.007	0.15	-0.007
10	200	0.000	0.000	0.15	0.000
11	400	-0.100	-0.005	0.15	-0.005

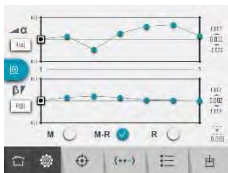
List screen out of tolerance.

LEVEL REFERENCE SENSOR (LR)

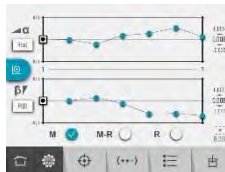
The Straightness and Level program can be used with or without a level reference sensor (LR).

When LR is used, level values can either be presented as M-R values (relative to the R sensor) or as M values (not relative to the R sensor). It is also possible to see the R-values.

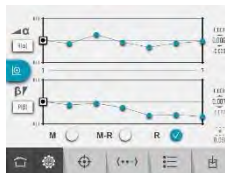
Select M, M-R or R values with the check boxes in the Level summary screen.



Level summary screen showing M-R-values.



Level summary screen showing M-values.



Level summary screen showing R-values.



Toggle between M-R, M and R values with the M/R icon in the measurement point screen or in the list.



SENSOR DISPLAY

Sensor Display is accessible directly from the summary screen, Sensor Display Machine Tool from the Straightness page and Sensor Display Level from the Level page.



Start Sensor Display.



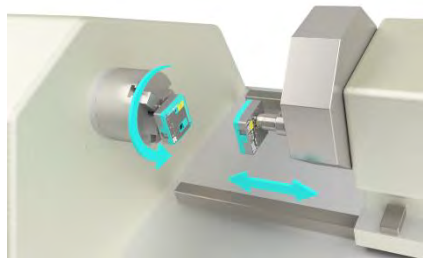
SPINDLE DIRECTION

INTRODUCTION

The Spindle Direction program is used to determine the direction of the rotational axis of a spindle or any other rotating object, in relation to a guideway motion in a machine tool. The guideway is used as a reference line.

The direction of the spindle is presented as an angle towards the reference guideway in 2 axes.

MEASUREMENT METHOD



The direction of the spindle rotational axis is obtained by measuring the position of the spindle rotational center at two points along the guideway.

The MEAX SR sensor is mounted on the spindle and its laser is representing the axis of rotation when the spindle is rotated.



The MEAX SM sensor is mounted on the carriage (or any other part) that moves along the guideway. The MEAX SM sensor is adjusted in a position that the laser hits the detector area of the MEAX SM sensor.

The carriage is positioned at two points, close to the spindle and at far distance. The distance between the points are entered into the system. In each position, the spindle is rotated 180°, to determine the spindle rotational center on the detector. Any deviation in the position of the rotational centers is recorded and is presented as an angular error between the spindle and the guideway.

STARTING THE PROGRAM



Start the Spindle Direction program by touching its icon in the Home Menu.

CONFIGURATION

Machine bed slant

When entering Spindle Direction, the machine bed slant screen is displayed.



The machine bed slant is measured with the SM sensor.

If you have an existent machine bed slant you just need to confirm it.



Measure machine bed slant.



Confirm existent machine bed slant.

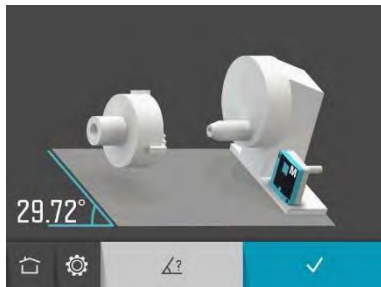


Settings.



Home.





When measuring machine bed slant with the SM sensor, the angle value is displayed live.

Place the SM sensor at the machine bed slant.



Confirm measured machine bed slant.



The machine bed slant can also be entered manually.



Enter machine bed slant manually.

Machine bed slants between -2° and 90° are accepted.



Direction of work holding spindle



Select direction of work holding spindle according to your machine. The spindle to the left (reference, R) and the tool holder to the right or the spindle to the right (reference, R) and the tool holder to the left.



Screen Flip.

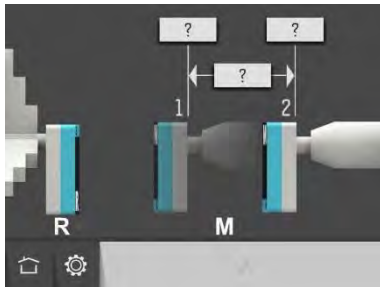
When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to positions and distances.



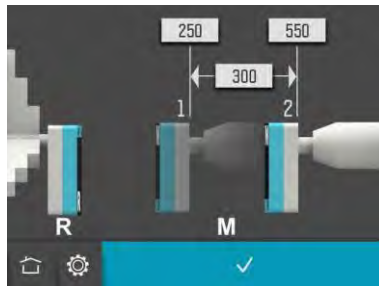
Go to positions and distances.

The procedures in the manual are described for machines with the work holding spindle to the left.

Positions and distance



Enter positions at the measurement points and/or distance between the measurement points.



Confirm positions and distance.

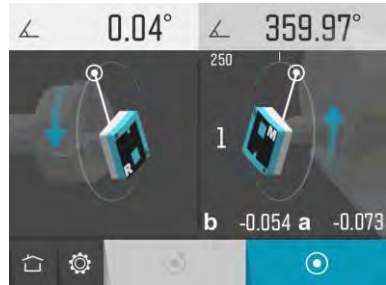


MEASUREMENT

The screen displays the main spindle with the SR sensor to the left and the tool holder with the SM sensor to the right.

The rotational angles for each sensor are displayed at the top. These angles are relative to the machine bed slant.

The measurement is carried out by register values in two positions at each measurement point. The small circles show where to rotate the sensors.



Place the tool holder with the SM sensor at the first measurement point and set the SM sensor at 0° .

Set the SR sensor at the first measurement position at 0° .



Touch the measurement icon.

This registers the first measurement position at the first measurement point.



Rotate the SR sensor to the second measurement position at 180°.



Touch the measurement icon.

This registers the second measurement position at the first measurement point.



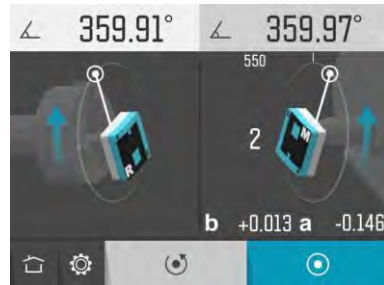
Move the tool holder with the SM sensor to the second measurement point.

Let the SM sensor stay at 0° and let the SR sensor stay at the position 180° .



Touch the measurement icon.

This registers the first measurement position at the second measurement point.



Rotate the SR sensor back to the measurement position at 0° .



Touch the measurement icon.

This registers the second measurement position at the second measurement point.



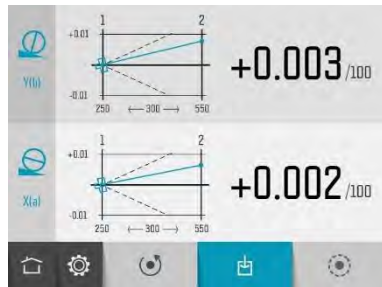
During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.



RESULT



The measurement result screen displays angle values in two directions, perpendicular to the machine bed slant and parallel to the machine bed slant.

The symbols, the diagram and the color of the values show if the values are inside the selected tolerance or not.



Perpendicular direction in tolerance.



Perpendicular direction out of tolerance.



Parallel direction in tolerance.



Parallel direction out of tolerance.

The axes can be custom named (up to 3 characters) by touching them.



Name perpendicular axis.



Name parallel axis.

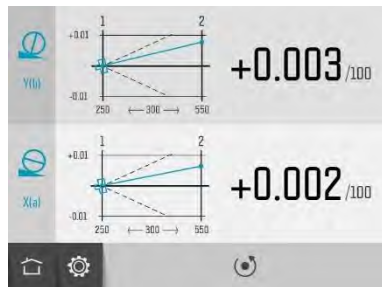


Save the measurement result.



Go to adjustment.

ADJUSTMENT



The adjustment screen displays the angle values live.

Flashing axis symbols indicates that values are live.

Adjust the machine until all values are within tolerance.



Both the sensors must remain inside 0.1° during the adjustment.



If not, a warning appears.

Orange for a sensor that is out of 0.1° and blue for a sensor that is still inside 0.1° .

To confirm the result, re-do the measurement.

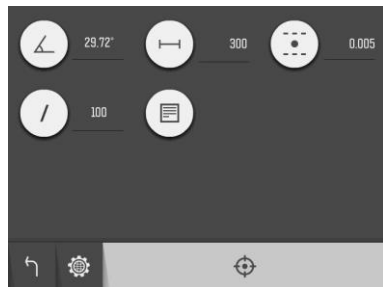


Re-measure.

(Re-measuring after the measurement is completed means re-measuring of all positions.)



SETTINGS



The settings menu includes settings for Spindle Direction.

For most of the settings, the current selection is shown beside the icon.

Machine Bed Slant



Open window for machine bed slant settings.

Positions & Distance



Open window for position and distance settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.



Notes



Open notes.

Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return



Return to the program.





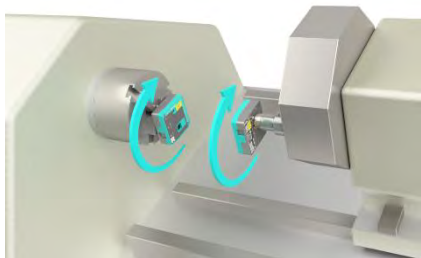
COAXIALITY

INTRODUCTION

The Coaxiality program is used to determine the direction of the rotational axis of a secondary spindle or a tool holder, in relation to a main spindle in a machine tool. The axis of rotation in the main spindle is used as a reference and the axis of rotation of the other object is measured in relation to that. The result is presented as an angular and offset deviation in two directions, perpendicular and parallel to the bed slant.

The Coaxiality program is also used to monitor the actual position of the secondary spindle or a tool holder during adjustment. During adjustment, the program shows the offset and angular misalignment live in both directions.

MEASUREMENT METHOD



The angular and offset error of the secondary spindle (or tool holder) is determined by measuring the distance between the rotational center of the main and secondary spindle in two planes.

The MEAX SR sensor is mounted on the main spindle (reference) and the MEAX SM sensor is mounted on the secondary spindle (or tool holder). The distance between the sensors

are entered into the system. By rotating both spindles and recording the radial displacements in 4 rotational angles, the angular and offset error can be calculated.

STARTING THE PROGRAM



Start the Coaxiality program by touching its icon in the Home Menu.

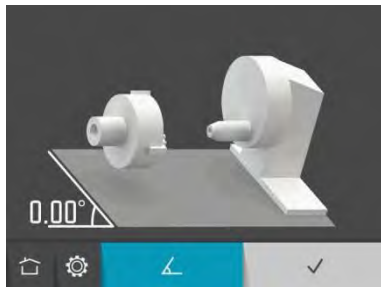




CONFIGURATION

Machine bed slant

When entering Coaxiality, the machine bed slant screen is displayed.



The machine bed slant is measured with the SM sensor.

If you have an existent machine bed slant you just need to confirm it.



Measure machine bed slant.



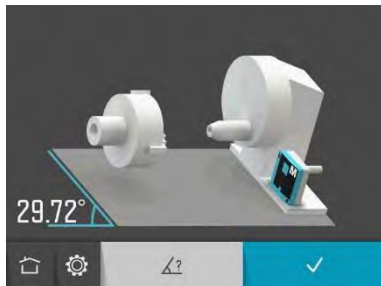
Confirm existent machine bed slant.



Settings.



Home.



When measuring machine bed slant with the SM sensor, the angle value is displayed live.

Place the SM sensor at the machine bed slant.



Confirm measured machine bed slant.

The machine bed slant can also be entered manually.



Enter machine bed slant manually.

Machine bed slants between -2° and 90° are accepted.



Direction of work holding spindle



Select direction of work holding spindle according to your machine. The spindle to the left (reference, R) and the tool holder to the right or the spindle to the right (reference, R) and the tool holder to the left.



Screen Flip.

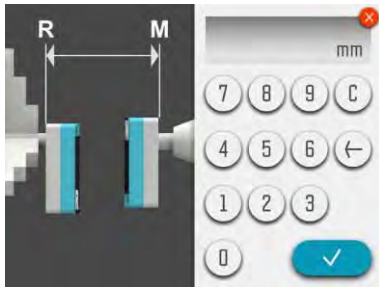
When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to distances.



Go to distances.

The procedures in the manual are described for machines with the work holding spindle to the left.

Distances



Measure and enter distance between the sensors SR and SM.



Measure and enter distance from the sensor SM to the turret front.

This gives the offset position.



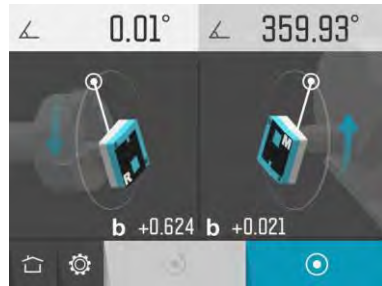
MEASUREMENT

The screen displays the main spindle with the SR sensor to the left and the tool holder with the SM sensor to the right.

The rotational angles for each sensor are displayed at the top. These angles are relative to the machine bed slant.

The measurement is carried out by register values in four positions, 0° , 90° , 180° and 270° . The small circles show where to rotate the sensors.

NOTE: Both the sensors must be inside 0.1° at each position.

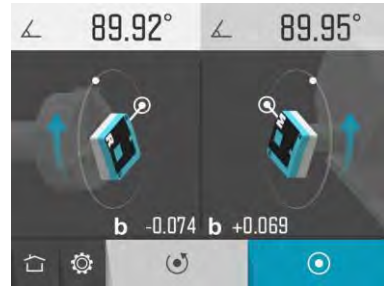


Set the sensors at the first measurement position, at the rotational angle 0° .



Touch the measurement icon.

This registers the first measurement position.



Rotate the sensors to the second measurement position, at the rotational angle 90° .



Touch the measurement icon.

This registers the second measurement position.



Rotate the sensors to the third measurement position, at the rotational angle 180° .



Touch the measurement icon.

This registers the third measurement position.



Rotate the sensors to the fourth measurement position, at the rotational angle 270° .



Touch the measurement icon.

This registers the fourth measurement position.



During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.



RESULT



The measurement result screen displays angle and offset values in two directions, perpendicular to the machine bed slant and parallel to the machine bed slant.

The symbols and the color of the values show if the values are inside the selected tolerance or not.



Perpendicular direction in tolerance.



Perpendicular direction out of tolerance.



Parallel direction in tolerance.



Parallel direction out of tolerance.



Angle in tolerance.



Angle out of tolerance.



Offset in tolerance.



Offset out of tolerance.



The axes can be custom named (up to 3 characters) by touching them.



Name perpendicular axis.



Name parallel axis.



Save the measurement result.



Go to adjustment.



ADJUSTMENT



The adjustment screen displays the angle and offset values live.

Flashing axis symbols indicates that values are live.

Adjust the machine until all values are within tolerance.



Both the sensors must remain inside 0.1° during the adjustment.



If not, a warning appears.

Orange for a sensor that is out of 0.1° and blue for a sensor that is still inside 0.1° .

To confirm the result, re-do the measurement.



Re-measure.

(Re-measuring after the measurement is completed means re-measuring of all positions.)



SETTINGS



The settings menu includes settings for Coaxiality.

For most of the settings, the current selection is shown beside the icon.

Machine Bed Slant



Open window for machine bed slant settings.

Distances



Open window for position and distance settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.



Notes



Open notes.

Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return

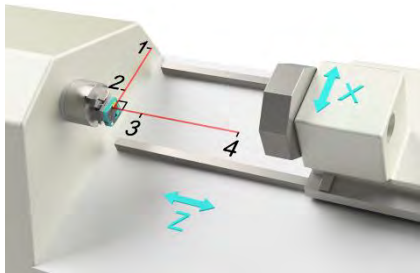


Return to the program.



SQUARENESS

INTRODUCTION



The Squareness program is used to determine the squareness error between two axes of motion in a machine.

The measurement is performed by using a laser beam from a laser transmitter together with an angular prism that deflects the laser beam exactly 90 degrees when engaged.

Together with an angular prism the laser beam can be used as an “optical square”, working as a reference during the entire measurement.

The squareness error is determined by measuring the deviation between the two axes of motion to the “optical square” at two positions at each axis.

The result is presented as an angular error in a graphical and numerical format.

The results can be saved and documented in the memory manager on the system and/or transferred to an external PC.



MEASUREMENT METHOD

A laser transmitter (SR) is mounted in the machine at a position where its laser beam will be parallel to the machine axis that is chosen to be the reference (the Z axis in the picture above).

An angular prism is mounted on the SR. It can be positioned in front of the out coming laser beam. When engaged, the angular prism will deflect the laser beam exactly 90 degrees, then running along the second machine axis (the X axis in the picture above).

The SM sensor is mounted in the tool holder or turret in a way so it records values a position 1 and 2. The SM sensor is then moved and mounted in a way to record values at position 3 and 4. By entering the positions and distances between the measuring points, the system can calculate the angular deviation of each machine axis to the “optical square”. The difference in angular deviation between the two axes will be the squareness

error between the reference axis and the measured axis (squareness error of X-axis to the Z-axis in the picture above).



STARTING THE PROGRAM

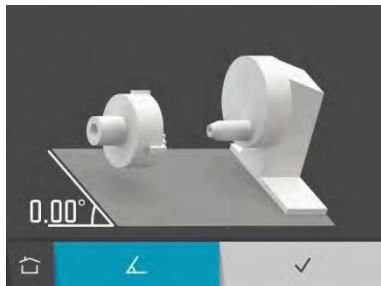


Start the Squareness program by touching its icon in the Home Menu.

CONFIGURATION

Machine bed slant

When entering Squareness, the machine bed slant screen is displayed.



The machine bed slant is measured with the SM sensor.

If you have an existent machine bed slant you just need to confirm it.



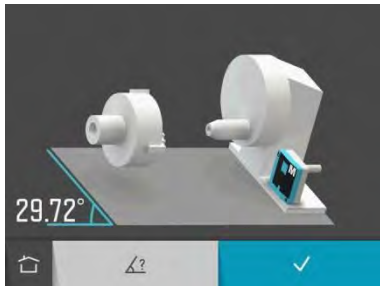
Measure machine bed slant.



Confirm existent machine bed slant.



Home.



When measuring machine bed slant with the SM sensor, the angle value is displayed live.

Place the SM sensor at the machine bed slant.



Confirm measured machine bed slant.

The machine bed slant can also be entered manually.

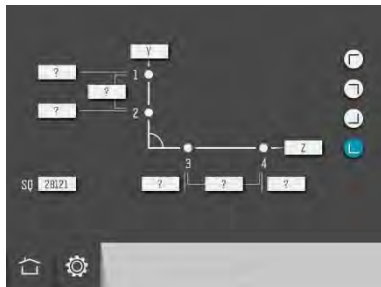


Enter machine bed slant manually.

Machine bed slants between -2° and 90° are accepted.



Positions and distances



Select machine orientation



Select machine orientation.



Enter positions



Touch one of the position boxes to enter a position.

Enter distances



Touch one of the distance boxes to enter a distance.

Name axes

The axes can be named with up to 3 characters.



Name axes by touching their boxes.

Enter serial number of SQ

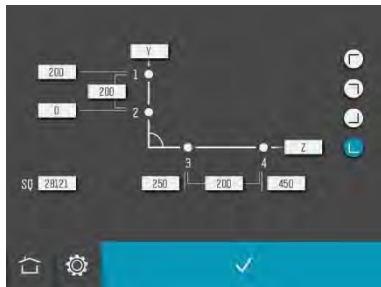


Touch the box beside SQ to enter serial number.

Settings



Open settings.



Confirm configuration



Confirm configuration and continue to summary screen.

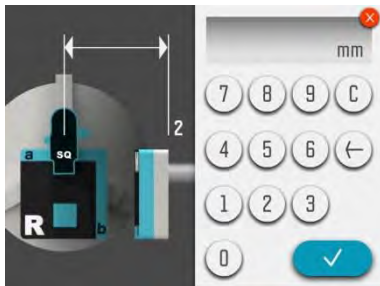


LASER ADJUSTMENT

To achieve full accuracy from the squareness measurement it is necessary to align the laser. It need to be parallel to the motion in the first measured line. The system will guide you through the adjustment of the laser.

The software need the distance from the rotational center to the back side of the SM, one reading in the second measuring point and then adjustment in the first measuring point.

Place the fixture with the SM sensor at the second measurement point.



Measure and enter the distance from the center of the R sensor to the back of the M sensor.



Ensure that you have the machine on the correct coordinate.

Check that the rotational angle for the R sensor is close to zero.



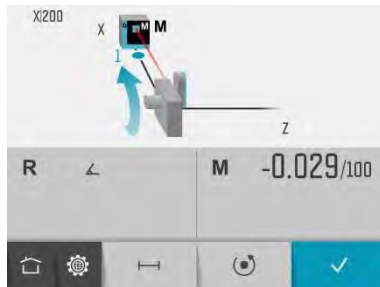
Zero the values at the second measurement point.



Move the machine (the fixture with the SM sensor) to the first measurement point.



Confirm that the machine is moved to the correct position.



The parallelism error is now shown and can be adjusted by rotating the RM. The blue arrow will guide you.

The value should be within 0.020 /100. When it is, the value will go to black.



Confirm the laser adjustment.



If needed, repeat the laser adjustment.



MEASUREMENT

The screen displays the four measurement points, two on each axis.

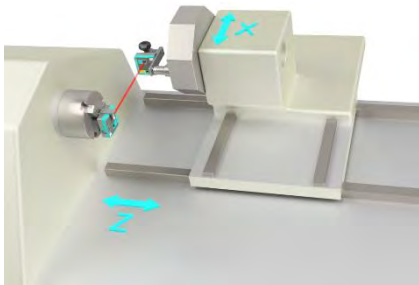
The rotational angle from the SR sensor is displayed to the left. Values from the SM sensor are displayed to the right. The rotational angles are relative to the machine bed slant.

The measurement is carried out by register values at four measurement points, two on each axis. The screen shows where to place the sensor.

Axis 1-2

Engage the Angular Prism

Rotate the SR sensor to 0°.



Place the fixture with the SM sensor at the first measurement point.

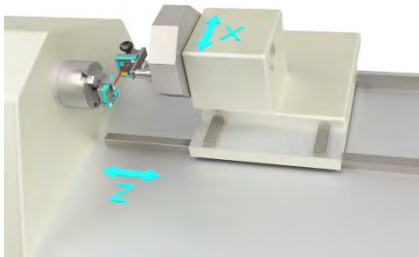


The main value a and the b value are shown from the SM sensor.



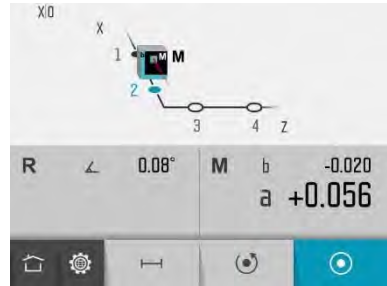
Touch the measurement icon.

This registers the first measurement point.



Move the fixture with the SM sensor to the second measurement point.

When using the MEAX bracket 90°, the second measurement point is in center of the machine (X0).



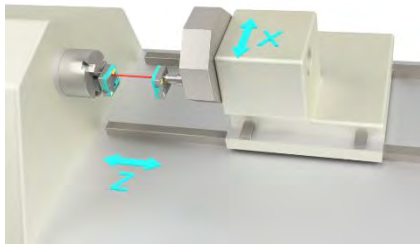
Touch the measurement icon.

This registers the second measurement point.

Axis 3-4

Disengage the Angular Prism

The SR sensor must still be at 0° .



Place the SM sensor in the tool holder at the third measurement point.



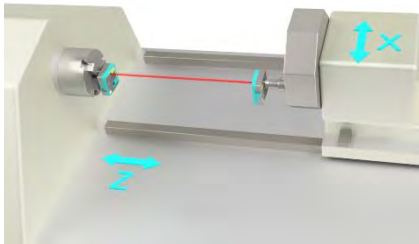
The main value a, the b value and the rotational angle are shown from the SM sensor.

Rotate the SM sensor to 0° .



Touch the measurement icon.

This registers the third measurement point.



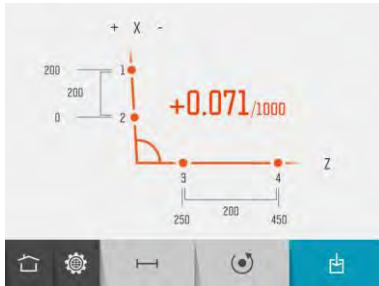
Move the tool holder with the SM sensor to the fourth measurement point.



Touch the measurement icon.

This registers the fourth measurement point.

RESULT



The measurement result screen displays the deviation from squareness.

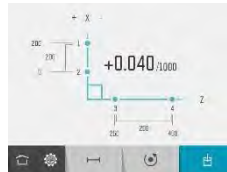
The diagram and the color of the values show if the values are inside the selected tolerance or not. The direction of the deviation is also shown.



Save the measurement result.



Re-measure.



Squareness measurement in tolerance.



SETTINGS



The settings menu includes settings for Squareness.

For most of the settings, the current selection is shown beside the icon.

Machine Bed Slant



Open window for machine bed slant settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.

Notes



Open notes.



Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return



Return to the program.



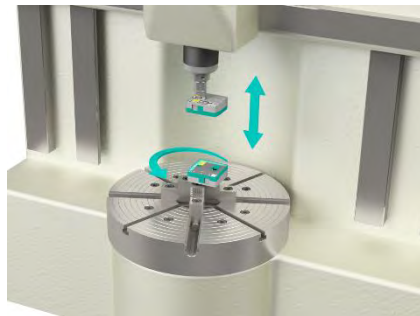
VERTICAL SPINDLE DIRECTION

INTRODUCTION

The Vertical Spindle Direction program is used to determine the direction of the rotational axis of a spindle or any other rotating object, in relation to a guideway motion in a machine tool. The guideway is used as a reference line.

The direction of the spindle is presented as an angle towards the reference guideway in 2 axes.

MEASUREMENT METHOD



The direction of the spindle rotational axis is obtained by measuring the position of the spindle rotational center at two points along the guideway.

The MEAX SR sensor is mounted on the spindle and its laser is representing the axis of rotation when the spindle is rotated.



The MEAX SM sensor is mounted on the carriage (or any other part) that moves along the guideway. The MEAX SM sensor is adjusted in a position that the laser hits the detector area of the MEAX SM sensor.

The carriage is positioned at two points, close to the spindle and at far distance. The distance between the points are entered into the system. At each point, the spindle is rotated 180° , to determine the spindle rotational center on the detector. Any deviation in the position of the rotational centers is recorded and is presented as an angular error between the spindle and the guideway.

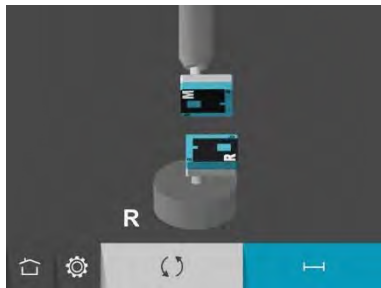
STARTING THE PROGRAM



Start the Vertical Spindle Direction program by touching its icon in the Home Menu.

CONFIGURATION

Direction of work holding spindle



Select direction of work holding spindle according to your machine. The spindle at the bottom (reference, R) and the tool holder at the top or the spindle at the top (reference, R) and the tool holder at the bottom.



Screen Flip.

When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to positions and distances.

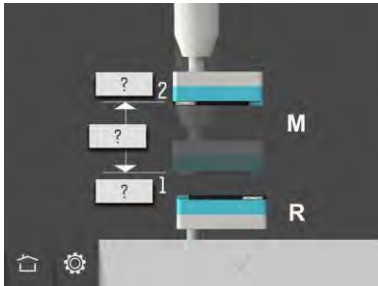


Go to positions and distances.

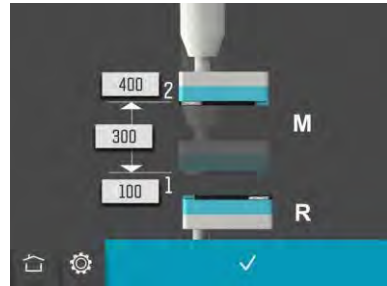
The procedures in the manual are described for machines with the work holding spindle at the bottom.



Positions and distance



Enter positions at the measurement points and/or distance between the measurement points.



Confirm positions and distance.



MEASUREMENT

The screen displays the work holding spindle with the SR sensor at the bottom and the tool holder with the SM sensor at the top.

The measurement is carried out by register values in two positions at each measurement point.

The graphics show where to rotate the sensors.

When the SR sensor is positioned at the first measurement point, the SM sensor can be positioned with the help of a relative rotational angle. The rotational angle is shown when the laser from the SM sensor hits the detector of the SR sensor.



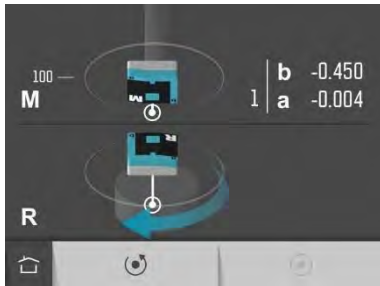
Set the SR sensor at the first measurement position, with the help of the rotation of the work head spindle (CNC).

Place the tool holder with the SM sensor at the first measurement point and set the SM sensor at 0° ($\pm 0.5^\circ$).



Touch the measurement icon.

This registers the first measurement position at the first measurement point.

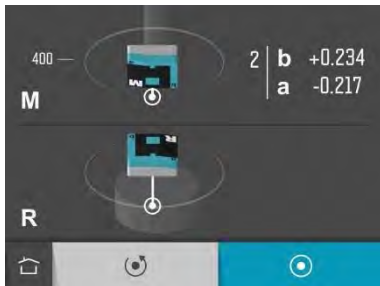


Rotate the work holding spindle with the SR sensor 180° to the second measurement position.



Touch the measurement icon.

This registers the second measurement position at the first measurement point.



Move the tool holder with the SM sensor to the second measurement point.

Let the SM sensor stay at the same rotational position and let the work holding spindle with the SR sensor stay at the same rotational position.



Touch the measurement icon.

This registers the first measurement position at the second measurement point.



Rotate the work holding spindle with the SR sensor 180° back to the first rotational position.



Touch the measurement icon.

This registers the second measurement position at the second measurement point.



During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.

RESULT



The measurement result screen displays angle values in two directions, in-out and side-to-side.

The symbols, the diagram and the color of the values show if the values are inside the selected tolerance or not.



In-out direction in tolerance.



In-out direction out of tolerance.



Side-to-side direction in tolerance.



Side-to-side direction out of tolerance.

The directions can be custom named (up to 3 characters) by touching them.



Name in-out direction.



Name side-to-side direction.

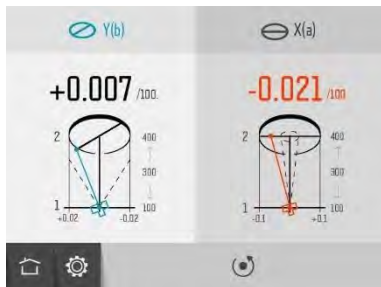


Save the measurement result.



Go to adjustment.

ADJUSTMENT



The adjustment screen displays the angle values live.

Flashing axis symbols indicates that values are live.

Adjust the machine until all values are within tolerance.



Both the sensors must remain inside 0.1° during the adjustment.



If not, a warning appears.

Orange for a sensor that is out of 0.1° and blue for a sensor that is still inside 0.1°.

To confirm the result, re-do the measurement.

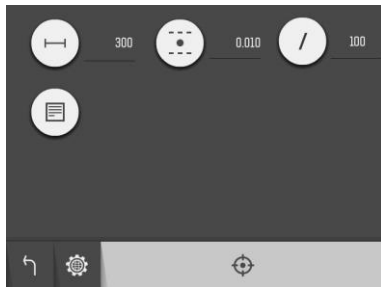


Re-measure.

(Re-measuring after the measurement is completed means re-measuring of all positions.)



SETTINGS



The settings menu includes settings for Vertical Spindle Direction.

For most of the settings, the current selection is shown beside the icon.

Positions & Distance



Open window for position and distance settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.

Notes



Open notes.



Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return



Return to the program.





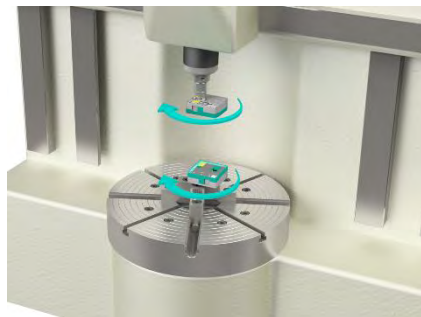
VERTICAL COAXIALITY

INTRODUCTION

The Vertical Coaxiality program is used to determine the direction of the rotational axis of a secondary spindle or a tool holder, in relation to a main spindle in a machine tool. The axis of rotation in the main spindle is used as a reference and the axis of rotation of the other object is measured in relation to that. The result is presented as an angular and offset deviation in two directions.

The Coaxiality program is also used to monitor the actual position of the secondary spindle or a tool holder during adjustment. During adjustment, the program shows the offset and angular misalignment live in both directions.

MEASUREMENT METHOD



The angular and offset error of the secondary spindle (or tool holder) is determined by measuring the distance between the rotational center of the main and secondary spindle in two planes.

The MEAX SR sensor is mounted on the main spindle (reference) and the MEAX SM sensor is mounted on the secondary spindle (or tool holder). The distance between the sensors

are entered into the system. By rotating both spindles and recording the radial displacements in 4 rotational angles, the angular and offset error can be calculated.

The positions of the rotational angle are defined by the main spindle (CNC).

STARTING THE PROGRAM

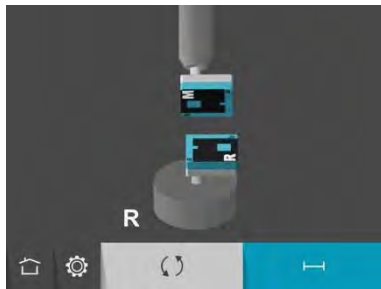


Start the Vertical Coaxiality program by touching its icon in the Home Menu.



CONFIGURATION

Direction of work holding spindle



Select direction of work holding spindle according to your machine. The spindle at the bottom (reference, R) and the tool holder at the top or the spindle at the top (reference, R) and the tool holder at the bottom.



Screen Flip.

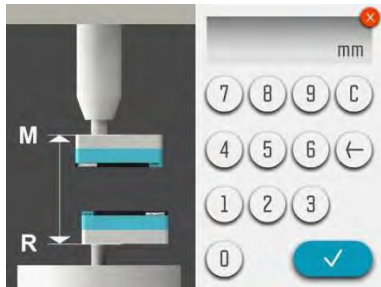
When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to positions and distances.



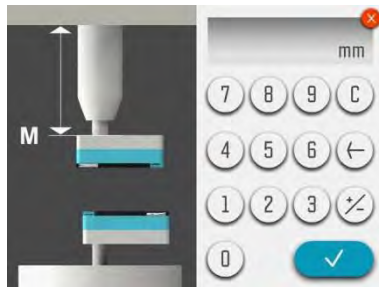
Go to distances.

The procedures in the manual are described for machines with the work holding spindle at the bottom.

Distances



Measure and enter distance between the sensors SR and SM.



Measure and enter distance from the sensor SM to the turret front.

This gives the offset position.



MEASUREMENT

The screen displays the main spindle with the SR sensor at the bottom and the tool holder with the SM sensor at the top.

The measurement is carried out by register values in four positions, 0°, 90°, 180° and 270° (CNC). The graphics show where to rotate the sensors.

When the SR sensor is positioned, the SM sensor is positioned with the help of a relative rotational angle. The rotational angle is shown when the laser from the SM sensor hits the detector of the SR sensor.

NOTE: The relative rotational angle must be inside 0.1° at each position in order to get a good result.



Set the SR sensor at the first measurement position, with the help of the rotation of the work head spindle (CNC).

Set the SM sensor at the first measurement position, with the help of the relative angle.

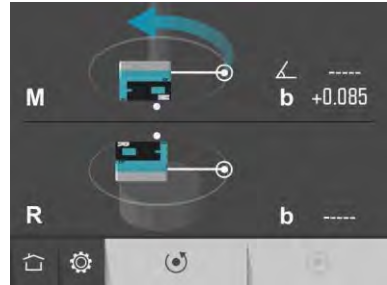


Touch the measurement icon.

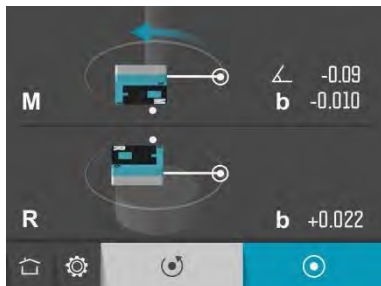
This registers the first measurement position.



Rotate the SR sensor to the second measurement position, with the help of the rotation of the work head spindle (CNC).

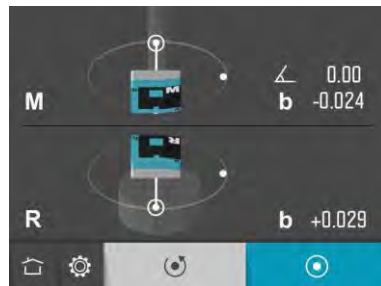


Rotate the SM sensor to the second measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the second measurement position.



Touch the measurement icon.

This registers the third measurement position.



Rotate the SR sensor to the fourth measurement position, with the help of the rotation of the work head spindle (CNC).

Rotate the SM sensor to the fourth measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the fourth measurement position.



During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.



RESULT



The measurement result screen displays angle and offset values in two directions, in-out and side-to-side.

The symbols and the color of the values show if the values are inside the selected tolerance or not.



In-out direction in tolerance.



In-out direction out of tolerance.



Side-to-side direction in tolerance.



Side-to-side direction out of tolerance.



Angle in tolerance.



Angle out of tolerance.



Offset in tolerance.



Offset out of tolerance.

The directions can be custom named (up to 3 characters) by touching them.



Name in-out direction.



Name side-to-side direction.

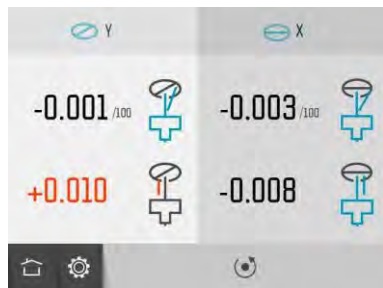


Save the measurement result.



Go to adjustment.

ADJUSTMENT



The adjustment screen displays the angle and offset values live.

Flashing direction symbols indicates that values are live.

Adjust the machine until all values are within tolerance.

To confirm the result, re-do the measurement.



Re-measure.

(Re-measuring after the measurement is completed means re-measuring of all positions.)





SETTINGS



The settings menu includes settings for Vertical Coaxiality.

For most of the settings, the current selection is shown beside the icon.

Distances



Open window for position and distance settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.

Notes



Open notes.



Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return



Return to the program.





SPINDLE PARALLELISM

INTRODUCTION

The Spindle Parallelism program is used to determine the parallelism between the rotational axis of a spindle and the direction of a horizontal axis of motion on which the spindle is mounted. The axis of motion is used as a reference and the result is shown as an angular deviation of the rotational axis in two directions.

MEASUREMENT METHOD

For this measurement, an external and secondary axis of rotation is used to determine the parallelism between the spindle rotational axis and its own movement on a horizontal guideway. The measurement is performed in two steps.

The first step is to measure the direction of the secondary spindle to the axis of movement using the same procedure as for spindle direction. The second step is to measure the coaxiality between the spindle and the external axis of rotation by rotating both rotational axis in 4 positions. The result of the entire measurement combines the results from the first and second step.



STARTING THE PROGRAM

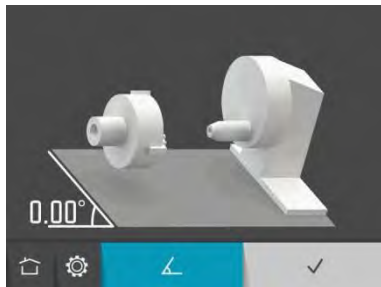


Start the Spindle Parallelism program by touching its icon in the Home Menu.

CONFIGURATION

Machine bed slant

When entering Spindle Parallelism, the machine bed slant screen is displayed.



The machine bed slant is measured with the SM sensor.

If you have an existent machine bed slant you just need to confirm it.



Measure machine bed slant.



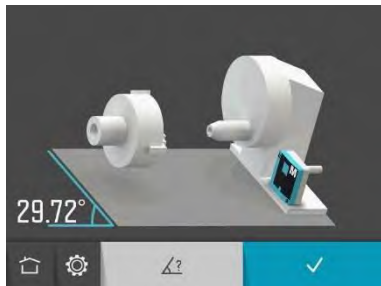
Confirm existent machine bed slant.



Settings.



Home.



When measuring machine bed slant with the SM sensor, the angle value is displayed live.

Place the SM sensor at the machine bed slant.



Confirm measured machine bed slant.

The machine bed slant can also be entered manually.

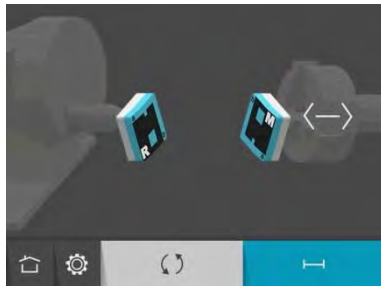


Enter machine bed slant manually.

Machine bed slants between -2° and 90° are accepted.



Direction of spindle to measure



Select direction of spindle to measure according to your machine. The spindle to measure to the right or the spindle to measure to the left.



Screen Flip.

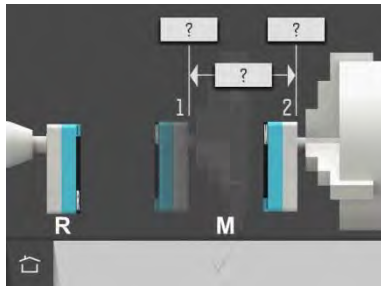
When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to positions and distances.



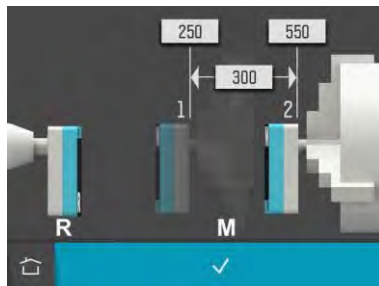
Go to positions and distances.

The procedures in the manual are described for machines with the spindle to measure to the right.

Positions and distance



Enter positions at the measurement points and/or distance between the measurement points.



Confirm positions and distance.



MEASUREMENT

Spindle

The screen displays the SR sensor to the left and the spindle to measure with the SM sensor to the right.

The rotational angles for each sensor are displayed at the top. These angles are relative to the machine bed slant.

The measurement is carried out by register values in two positions at each measurement point. The small circles show where to rotate the sensors.



Place the spindle to measure with the SM sensor at the first measurement point and set the SM sensor at 0°.

Set the SR sensor at the first measurement position at 0°.



Touch the measurement icon.

This registers the first measurement position at the first measurement point.



Rotate the SR sensor to the second measurement position at 180° .



Touch the measurement icon.

This registers the second measurement position at the first measurement point.



Move the spindle to measure with the SM sensor to the second measurement point.

Let the SM sensor stay at 0° and let the SR sensor stay at the position 180° .



Touch the measurement icon.

This registers the first measurement position at the second measurement point.



Rotate the SR sensor back to the measurement position at 0°.



Touch the measurement icon.

This registers the second measurement position at the second measurement point.



During the measurement, it is possible to re-measure the latest position.

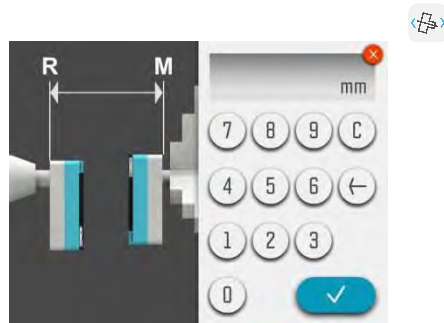


Touch the re-measure icon to re-measure the latest position.

Coaxiality



Go to distance.



Measure and enter distance between the sensors SR and SM.

The screen displays the tool holder with the SR sensor to the left and the main spindle with the SM sensor to the right.

The rotational angles for each sensor are displayed at the top. These angles are relative to the machine bed slant.

The measurement is carried out by register values in four positions, 0° , 90° , 180° and 270° . The small circles show where to rotate the sensors.

NOTE: Both the sensors must be inside 0.1° at each position in order to get a good result.

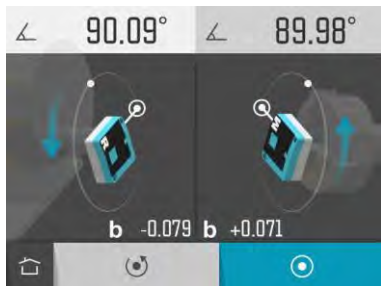


Set the sensors at the first measurement position, at the rotational angle 0° .



Touch the measurement icon.

This registers the first measurement position.



Rotate the sensors to the second measurement position, at the rotational angle 90° .



Touch the measurement icon.

This registers the second measurement position.

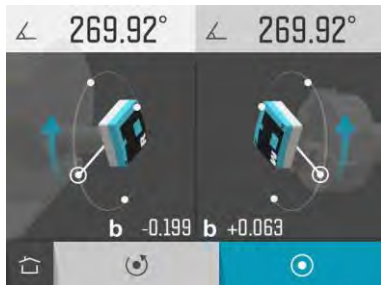


Rotate the sensors to the third measurement position, at the rotational angle 180° .



Touch the measurement icon.

This registers the third measurement position.



During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.

Rotate the sensors to the fourth measurement position, at the rotational angle 270° .

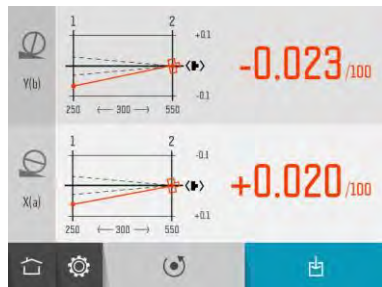


Touch the measurement icon.

This registers the fourth measurement position.



RESULT



The measurement result screen displays angle values in two directions, perpendicular to the machine bed slant and parallel to the machine bed slant.

The symbols, the diagram and the color of the values show if the values are inside the selected tolerance or not.



Perpendicular direction in tolerance.



Perpendicular direction out of tolerance.



Parallel direction in tolerance.



Parallel direction out of tolerance.

The axes can be custom named (up to 3 characters) by touching them.



Name perpendicular axis.



Name parallel axis.



Save the measurement result.

When the measurement is completed it is possible to re-measure all the coaxiality positions.



Re-measure.



SETTINGS



The settings menu includes settings for Spindle Parallelism.

For most of the settings, the current selection is shown beside the icon.

Machine Bed Slant



Open window for machine bed slant settings.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.

Notes



Open notes.



Sensor Display



Open Sensor Display
Machine Tool.

Global Settings



Open Global Settings.

Return



Return to the program.





VERTICAL SPINDLE PARALLELISM

INTRODUCTION

The Vertical Spindle Parallelism program is used to determine the parallelism between the rotational axis of a spindle (main spindle) and the direction of a vertical axis of motion on which the spindle is mounted. The axis of motion is used as a reference and the result is shown as an angular deviation of the rotational axis in two directions.

MEASUREMENT METHOD

For this measurement, an external and secondary axis of rotation is used to determine the parallelism between the spindle rotational axis and its own movement on a vertical guideway. The measurement is performed in two steps.

The first step is to measure the direction of the secondary spindle to the axis of movement using the same procedure as for vertical spindle direction. The second step is to measure the coaxiality between the spindle and the external axis of rotation by rotating both rotational axis in 4 positions. The result of the entire measurement combines the results from the first and second step.



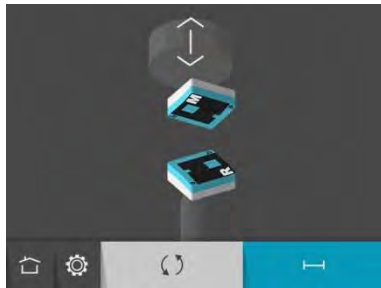
STARTING THE PROGRAM



Start the Vertical Spindle Parallelism program by touching its icon in the Home Menu.

CONFIGURATION

Direction of spindle to measure



Select direction of spindle to measure according to your machine. The spindle to measure at the top or the spindle to measure at the bottom.



Screen Flip.

When entering the program, the latest used direction is shown. If this corresponds to your machine, just continue to positions and distances.

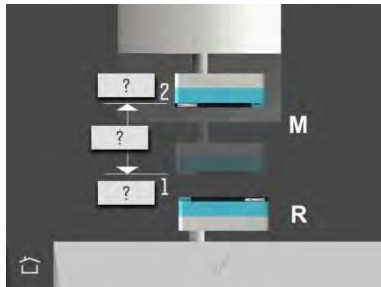


Go to positions and distances.

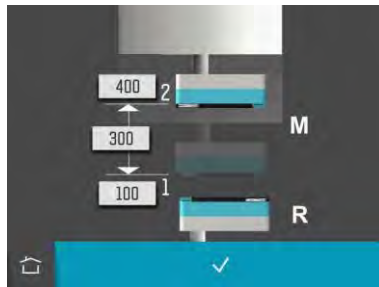
The procedures in the manual are described for machines with the spindle to measure at the top.



Positions and distance



Enter positions at the measurement points and/or distance between the measurement points.



Confirm positions and distance.

MEASUREMENT

Spindle

The screen displays the SR sensor at the bottom and the spindle to measure with the SM sensor at the top.

The measurement is carried out by register values in two positions at each measurement point.

The graphics show where to rotate the sensors.

When the SR sensor is positioned at the first measurement point, the SM sensor can be positioned with the help of a relative rotational angle. The rotational angle is shown when the laser from the SM sensor hits the detector of the SR sensor.



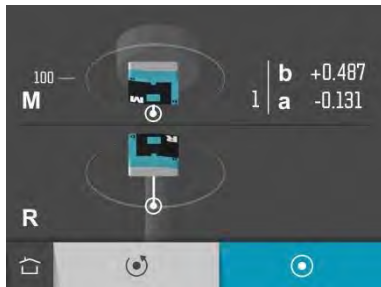
Set the SR sensor at the first measurement position. Index from CNC control or fixture is needed.

Place the spindle to measure with the SM sensor at the first measurement point and set the SM sensor at 0° ($\pm 0.5^\circ$).



Touch the measurement icon.

This registers the first measurement position at the first measurement point.

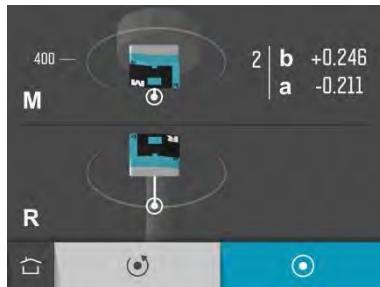


Rotate SR sensor 180° to the second measurement position.



Touch the measurement icon.

This registers the second measurement position at the first measurement point.



Move the spindle to measure with the SM sensor to the second measurement point.

Let the SM sensor and the SR sensor stay at the same rotational position.



Touch the measurement icon.

This registers the first measurement position at the second measurement point.



Rotate the SR sensor 180° back to the first rotational position.



Touch the measurement icon.

This registers the second measurement position at the second measurement point.

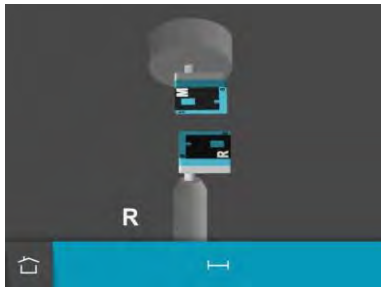


During the measurement, it is possible to re-measure the latest position.

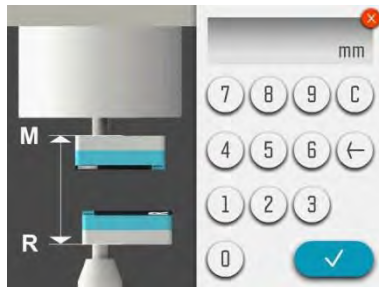


Touch the re-measure icon to re-measure the latest position.

Coaxiality



Go to distance.



Measure and enter distance between the sensors SR and SM.



The screen displays the SR sensor at the bottom and the SM sensor at the top.

The measurement is carried out by register values in four positions, 0°, 90°, 180° and 270°. Index from CNC control or fixture is needed. The graphics show where to rotate the sensors.

When the SR sensor is positioned, the SM sensor is positioned with the help of a relative rotational angle. The rotational angle is shown when the laser from the SM sensor hits the detector of the SR sensor.

NOTE: The relative rotational angle must be inside 0.1° at each position in order to get a good result.



Set the SR sensor at the first measurement position.

Set the SM sensor at the first measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the first measurement position.



Rotate the SR sensor to the second measurement position.

Rotate the SM sensor to the second measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the second measurement position.



Rotate the SR sensor to the third measurement position.

Rotate the SM sensor to the third measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the third measurement position.



Rotate the SR sensor to the fourth measurement position.

Rotate the SM sensor to the fourth measurement position, with the help of the relative angle.



Touch the measurement icon.

This registers the fourth measurement position.



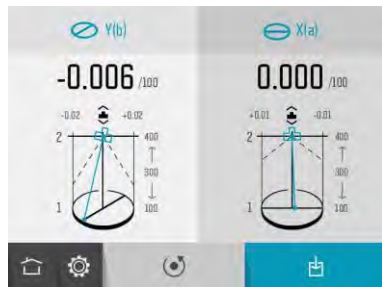
During the measurement, it is possible to re-measure the latest position.



Touch the re-measure icon to re-measure the latest position.



RESULT



The measurement result screen displays angle values in two directions, in-out and side-to-side.

The symbols, the diagram and the color of the values show if the values are inside the selected tolerance or not.



In-out direction in tolerance.



In-out direction out of tolerance.



Side-to-side direction in tolerance.



Side-to-side direction out of tolerance.

The directions can be custom named (up to 3 characters) by touching them.



Name in-out direction.



Name side-to-side direction.



Save the measurement result.



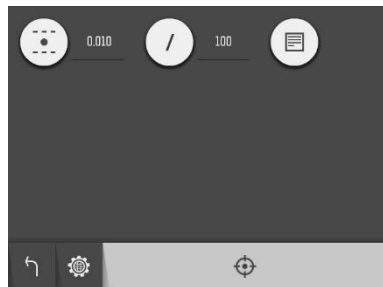
When the measurement is completed it is possible to re-measure all the coaxiality positions.



Re-measure.



SETTINGS



The settings menu includes settings for Vertical Spindle Parallelism.

For most of the settings, the current selection is shown beside the icon.

Tolerance



Open window for tolerance settings.

Per distance



Open window for per distance settings.

Notes



Open notes.

Sensor Display



Open Sensor Display Machine Tool.



Global Settings



Open Global Settings.

Return



Return to the program.





SENSOR DISPLAY LEVEL

INTRODUCTION



The Sensor Display for the MEAX Level sensors can be used for different applications where you want to use the readings from the sensors in different ways. The program can be used with one sensor (LM) or two sensors (LM and LR) connected to the display unit. (The program cannot be used with LR only.)

With the one sensor connected it is possible to measure an objects angle towards gravity (levelling) or be able to measure an objects relative angular deviation (roll and pitch).

When two sensors are connected it is also possible to measure an objects angle towards a reference.

The Sensor Display program can show the values from the 2-axis sensors in both directions (α and β) as live values or it can record readings and present a fixed value for a measurement point. It is also possible to download recorded measuring values or stream values to a data file.

When two sensors are connected (M and R) it is possible to display the values in different ways.

R and M

R and M-R



MEASUREMENT METHOD

When measuring an objects angle towards gravity (levelling), the M sensor is placed on the object and the displayed values are set to zero. Then, the sensor is rotated 180° and the displayed values are set to half. The shown values on the Sensor Display are the objects deviation towards gravity.

To measure the relative angle of an object, the M sensor is placed on the object and the displayed values are set to zero. The object can then be moved or the sensor can be placed on another object. The displayed values are the angular deviation relative to the first measuring point/object (zero).

When two sensors are connected (M and R) it is possible to measure an objects relative angle in relation to a reference. The M-sensor is mounted on the measuring object and R-sensor is placed on the reference. The values on the display unit shows the difference in

angles between the object and the reference (M-R).

STARTING THE PROGRAM



Start the Sensor Display Level program by touching its icon in the Home Menu.



FUNCTIONS

When entering Sensor Display Level, raw data from the connected Level sensors are displayed.

If any value is missing, ----- is shown.



Wait about 20 seconds for the values to stabilize, before using any function.

Available functions at start



Zero values.



Sample and display a single value.



Record values to file.



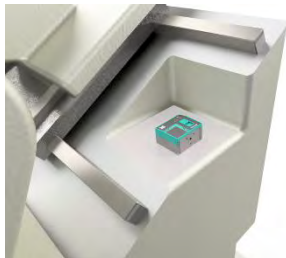
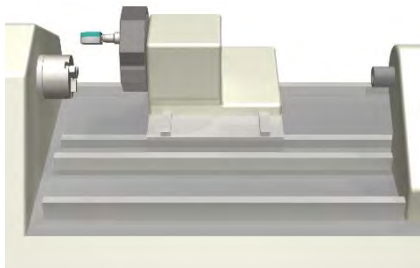
Global settings.



Home.

M / M-R

The values from the M sensor can either be displayed as M values (not relative to the R sensor) or as M-R values (relative to the R sensor).



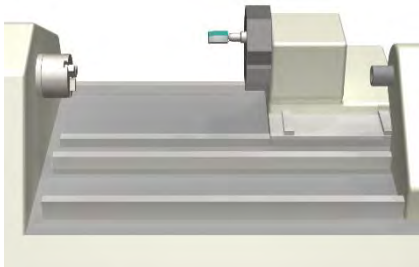
Zero values



Halve values.



Reset values to raw data.



Sample and display a single value



Return to live values.

Record values to file

Records values that are sampled from the sensors and stores them in a file.

Enter file name and confirm.



Record single values.



Start continuous recording.
(All values are recorded until the function is stopped.)



Stop and confirm continuous recording.
(Only available when continuous recording is active.)



Finish recording values to file.

Recording can be started and stopped several times and all the recorded values will be stored in the same file.

The recorded values are stored in a text file with a time stamp for each sampling.



SENSOR DISPLAY

POSITION

INTRODUCTION

The Sensor Display for the MEAX Position Sensors can be used for different applications where you want to use the readings from the sensors in various ways. The program is used with two sensors connected, SM and SR, to the display unit.

The Sensor Display program can show the values from both sensors. Each sensor is measuring in two directions (b and a) together with the rotational angle. The displayed values can be shown live or it can record readings and present a fixed value for a dedicated measurement point. It is also possible to download recorded measuring values or stream values to a data file.

MEASUREMENT METHOD

The Sensor Display program is used for general purposes. The displayed live values can be zeroed to measure the relative movement on a measuring object. This function can be used to check in a field test to check that the values from the sensor are corresponding to a known movement.

After the values have been zeroed they can also be halved. This function can be used to find out the center position of a rotating object.

STARTING THE PROGRAM



Start the Sensor Display Position program by touching its icon in the Home Menu.



FUNCTIONS

When entering Sensor Display Position, raw data from the connected position sensors are displayed.

R	M
b +0.684 mm	b -0.810 mm
a +0.162	a -0.587
$\angle +329.95^\circ$	$\angle +330.22^\circ$
  	 

Available functions at start



Zero values.



Sample and display a single value.



Record values to file.



Global settings.



Home.



Zero values

R	M
b 0.000 mm	b 0.000 mm
a 0.000	a 0.000
$\angle +329.95^\circ$	$\angle +330.22^\circ$

1/2

Halve values.



Reset values to raw data.

Sample and display a single value

R	M
b +0.001 mm	b -0.002 mm
a +0.001	a -0.004
$\angle +329.96^\circ$	$\angle +330.22^\circ$



Return to live values.

Record values to file

Records values that are sampled from the sensors and stores them in a file.

Enter file name and confirm.



Record single values.



Start continuous recording.
(All values are recorded until the function is stopped.)



Stop and confirm continuous recording.
(Only available when continuous recording is active.)



Finish recording values to file.

Recording can be started and stopped several times and all the recorded values will be stored in the same file.

The recorded values are stored in a text file with a time stamp for each sampling.



SENSOR DISPLAY PEN

INTRODUCTION

The Sensor Display for the MEAX Pen Sensors can be used for different applications where you want to use the readings from the sensors in various ways. The program is used with up to two sensors connected, P, to the display unit.

The Sensor Display program can show the values from both sensors. Each sensor is measuring distance (d). The displayed values can be shown live or it can record readings and present a fixed value for a dedicated measurement point. It is also possible to download recorded measuring values or stream values to a data file.

MEASUREMENT METHOD

The Sensor Display program is used for general purposes. The displayed live values can be zeroed to measure the relative movement on a measuring object.

After the values have been zeroed they can also be halved.

STARTING THE PROGRAM

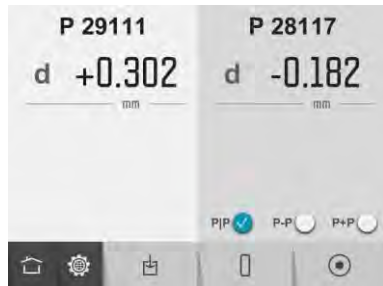


Start the Sensor Display Pen program by touching its icon in the Home Menu.



FUNCTIONS

When entering Sensor Display Pen, raw data from the connected pen sensors are displayed.



Available functions at start



Zero values.



Sample and display a single value.



Record values to file.



Global settings.



Home.

P|P / P-P / P+P

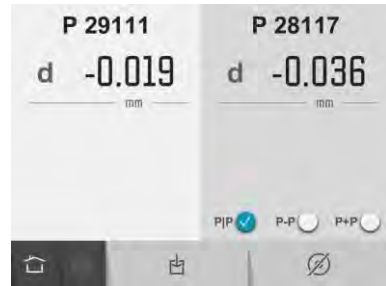
The values from the second pen (to the right) can either be displayed separately or relative to the first pen (to the left), either P-P or P+P.



Zero values



Sample and display a single value



Halve values.



Reset values to raw data.



Return to live values.

Record values to file

Records values that are sampled from the sensors and stores them in a file.

Enter file name and confirm.



Record single values.



Start continuous recording.
(All values are recorded until the function is stopped.)



Stop and confirm continuous recording.
(Only available when continuous recording is active.)



Finish recording values to file.

Recording can be started and stopped several times and all the recorded values will be stored in the same file.

The recorded values are stored in a text file with a time stamp for each sampling.



MAX MIN PEN

INTRODUCTION

The Max Min Pen program for the MEAX Pen Sensors can be used for several applications where the user wants to measure the relative movement on an object during a certain time period.

A typical application is to measure run-out on a machine spindle. The MEAX Pen sensor is mounted in the desired measurement direction, radial or axial, and values are continuously recorded during rotation of the spindle.

Result from the measurement are shown directly on the screen. The maximum value (max) and the minimum value (min) are shown together with the difference (max-min).

The measuring result can be saved and stored in the memory for further documentation.



MEASUREMENT METHOD

The method uses the measuring values from the MEAX Pen sensor. The Max Min Pen program continuously register values from the MEAX Pen sensors under a dedicated sampling time. The sampling time can be adjusted in the settings.

The values from the MEAX Pen sensor can be zeroed before starting the max min measurement.

When the recording is finished the maximum value (max) and the minimum value (min) are shown on the screen together with the difference (max-min).

STARTING THE PROGRAM



Start the Max Min Pen program by touching its icon in the Home Menu.



RAW DATA

When entering Max Min Pen, raw data from the connected pen sensors are displayed.



Adjust the position of the pen to be within the measuring range, using the raw data on the screen.



Zero values.



Measure max min.



Settings.



Home.



ZERO VALUES



Measure max min.



Reset values to raw data.



MAX MIN



When max min is measured the difference during the measurement is displayed. The max and min values are also displayed.

The displayed measurement result can be saved.



Measure max min.



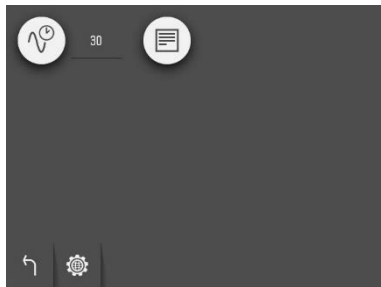
Save the measurement result.



Return to live values.



SETTINGS



The settings menu includes settings for Max Min.

Sampling time



Open window for sampling time settings.

Notes



Open notes.

Global Settings



Open Global Settings.

Return



Return to the program.



TEMPERATURE LOG

INTRODUCTION

The Temperature Log program creates a diagram log from a connected temperature data logger.

The Temperature Log program works with the external accessory ElmaLOG 181T – Mini PDF USB temperature data logger.

STARTING THE PROGRAM



Start the Temperature Log program by touching its icon in the Home Menu.



CREATING A TEMPERATURE LOG

When the program is started you will be instructed to connect the temperature logger.

When the temperature logger is connected, the log diagram will be created.



The diagram shows the temperature during the measured time. Highest temperature, lowest temperature and the difference between these are also shown.

Add a Note



Open notes.

Save the temperature log



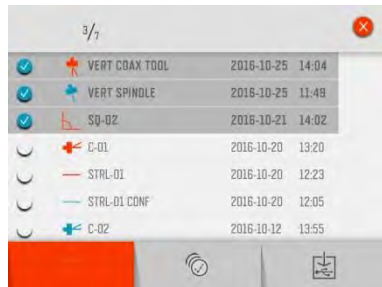
Touch the save icon to save the temperature log.

MEMORY MANAGER

EXPRESS MANAGER

Express Manager makes it easy to transfer files to a PC.

Insert a USB flash drive in the display unit while standing in the Home Menu and the Express Manager appears.



In the Express Manager measurements are sorted by date without folders.

Open file

Touch a file to open it.

Select files



Touch the check box to the left to select a file.



Touch the select all files icon to select all files.

Transfer files to USB flash drive



Transfer selected files to USB flash drive.

Delete files

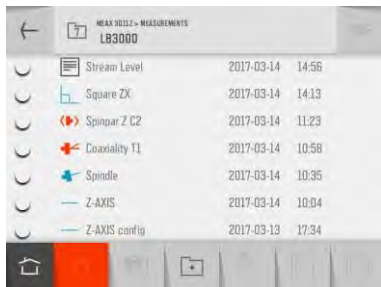


Delete selected files.

STANDARD MANAGER

In the Standard Manager, all editing functions are available.

Open the Standard Manager from the Home Menu.



Measurements are sorted by date in folders.

Open file or folder

Touch a file or folder to open it.

19.2

Select files

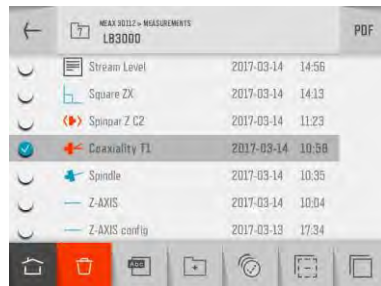


Touch the check box to the left to select a file.

Select all files.
(Under construction)



Deselect all files.





Cut, Copy and Paste



Cut selected items.



Copy selected items.



Paste items that have been cut or copied.

New folder



Create a new folder.

Change name of file or folder



Change name of selected file or folder.

Delete



Delete selected items.

PDF-report



Generate a PDF-report with the selected files.

Folder up



Go up one level in the file structure.

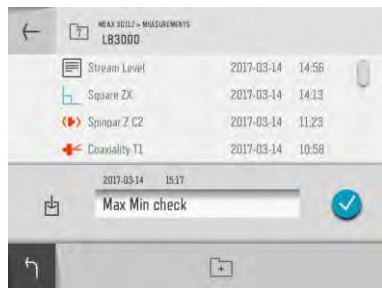
Home



Home.



SAVE MEASUREMENT



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

In some programs, there will also be a list file (lst) in the PC.

Recorded values from Sensor Displays will only generate a text file.

Enter file name

Touch the white field to enter a file name.

Confirm



Confirm.

TRANSFER FILES TO A PC

Files can be transferred to a PC using a USB flash drive.

Express Manager

Express Manager is the easiest way to transfer files to a PC. See “Express Manager”.

Standard Manager

Standard Manager can also be used to transfer files to a PC.

Insert the USB flash drive in the USB port of the display unit, and the USB flash drive will be available in the Standard Manager.

Files can be transferred to the USB flash drive with the cut/copy/paste functions in the Standard Manager.

The USB flash drive has to be open when pasting files.

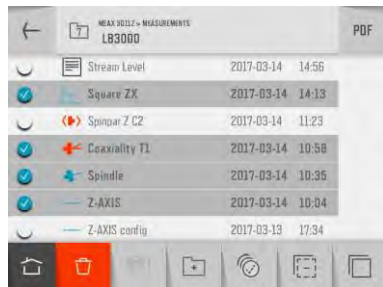
Files in the PC

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

PDF REPORT

A PDF report with several measurements from a folder in the Memory Manager can be generated.

Select files



Touch the check box to the left to select files.

Generate a PDF-report

PDF

Touch the PDF icon to generate a PDF-report with the selected files.

Enter file name



Enter and confirm file name for the PDF report.

Enter data for the PDF report

Touch the white field at the top to enter a header for the PDF-report.

Touch the white fields to enter data.



Confirm data and generate PDF report

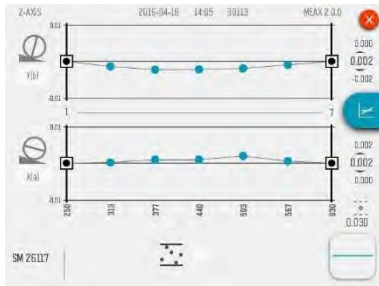
Transfer PDF file to a PC

The PDF file will appear in the folder where it was generated and can then be transferred to a PC.

PDF files cannot be opened in the display unit.



STRAIGHTNESS AND LEVEL



The screen displays measurement results, positions, machine bed slant, tolerance, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version. Straightness is shown on one page and Level on another.

It is possible to go directly to Straightness and Level to continue measuring. All measurement data will be uploaded.



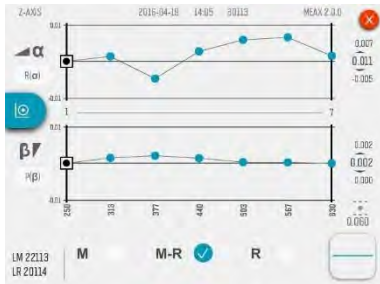
Switch to Level page.



Close.



Go to Straightness and Level.

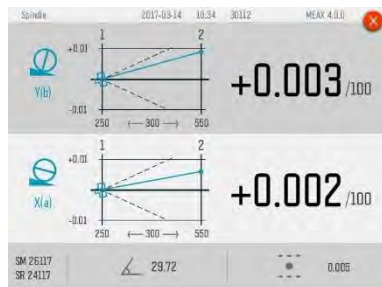


Level screen



Switch to Straightness page.

SPINDLE DIRECTION



The screen displays measurement results, positions, distance, machine bed slant, tolerance, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.

COAXIALITY

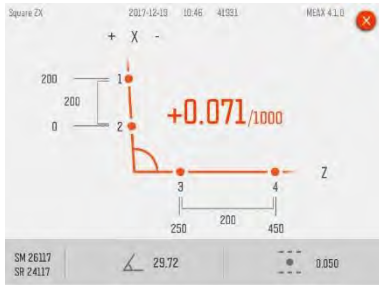


The screen displays measurement results, distances, machine bed slant, tolerances, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.

SQUARENESS



The screen displays measurement result, positions, distances, machine bed slant, tolerance, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version.

The measurement result is shown as deviation from squareness.

The diagram and the color of the values show if the values are inside the selected tolerance

or not. The direction of the deviation is also shown.



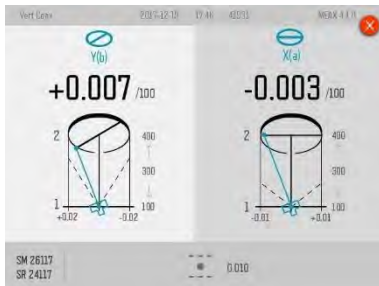
Close.



VERTICAL SPINDLE DIRECTION



Close.



The screen displays measurement result, positions, distance, tolerance, directions names, file name, date and time, serial number of the display unit and the sensors, program and program version.

The diagram and the color of the values show if the values are inside the selected tolerance or not. The direction of the deviation is also shown.



VERTICAL COAXIALITY

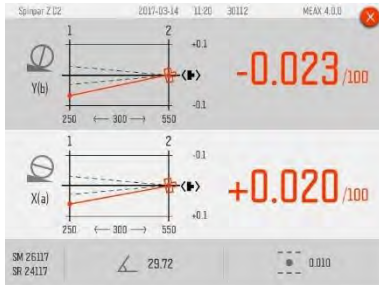


The screen displays measurement results, distances, tolerances, directions names, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.

SPINDLE PARALLELISM

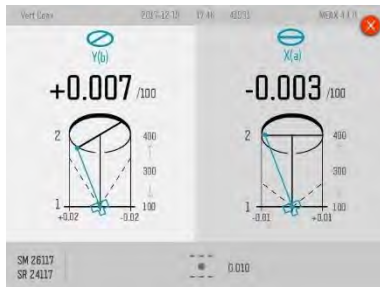


The screen displays measurement results, positions, distance, machine bed slant, tolerance, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.

VERTICAL SPINDLE PARALLELISM



The screen displays measurement results, positions, distance, machine bed slant, tolerance, axes names, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.

SENSOR DISPLAY LEVEL




t(s)	Ra	Rb	Ma	Mb	M-Ra	M-Rb (/1000)
0.0	0.000780	0.001410	0.003500	-0.001440		
0.002720	-0.002850					
0.0	0.000780	0.001410	0.003500	-0.001440		
0.002720	-0.002850					
0.5	0.000780	0.001410	0.003600	-0.001240		
0.002820	-0.002650					
0.5	0.000780	0.001410	0.003600	-0.001240		
0.002820	-0.002650					

The screen displays recorded values with a time stamp for each sampling.



Close.

SENSOR DISPLAY POSITION



t(s)	Rb(mm) Mr(deg)	Ra(mm)	Rr(deg)Mb(mm)	Ma(mm)	
0.0	-0.000880	0.000470	329.953520	0.000340	→
0.000480	330.222237				
0.0	-0.000880	0.000470	329.953520	0.000340	→
0.000480	330.222237				
0.4	-0.000780	0.000670	329.953520	0.000540	→
0.000480	330.222237				
0.5	-0.000780	0.000670	329.953520	0.000540	→

The screen displays recorded values with a time stamp for each sampling.



Close.

SENSOR DISPLAY PEN



The screen displays recorded values with a time stamp for each sampling.



Close.

MAX MIN PEN



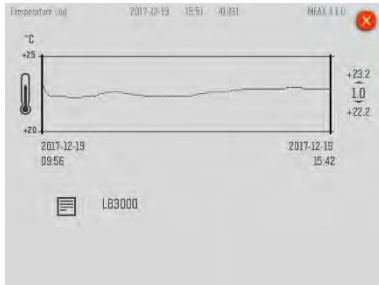
The screen displays measurement results, file name, date and time, serial number of the display unit and the sensors, program and program version.



Close.



TEMPERATURE LOG



The screen displays temperature log, file name, date and time, serial number of the display unit, program and program version.



Close.





GLOBAL SETTINGS



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

For most of the settings, the current selection is shown beside the icon.

The program version and serial number of the display unit is also shown on this screen.

Date and time



Open window for date and time settings.

Measurement unit



Open window for selection of measurement unit, mm or inch.

Bluetooth settings



Open window for Bluetooth settings.

Battery status



Open window for battery status information.



Backlight



Decrease Backlight.



Increase Backlight.

Service settings



Open service settings.
Requires access code.

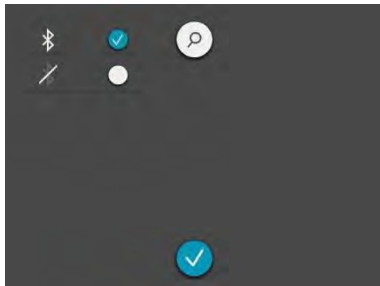
Home



Home.



BLUETOOTH SETTINGS



Bluetooth communication



Bluetooth activated.



Bluetooth deactivated.

Pairing Bluetooth units

Touch the search icon to search for units that are pair able.



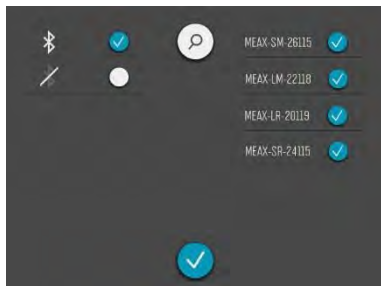
Search for Bluetooth units.



Pair able units appear in the list to the right.



Touch the white icon beside the units to pair.



To unpair, touch the check mark icon beside the unit.

Paired units are marked with a check mark.



Confirm.

DISPLAY UNIT MEAX DU 01



1. 6.5" Touch screen
2. On button with status LED
 - a. Continuously green – ON
3. Battery Status button – press to instantly show the battery status when the unit is switched off.
4. Display Unit battery status
 - a. Continuously green – battery capacity
 - b. Rolling green – charging
 - c. First LED flashing red - <10% capacity
5. Measurement Unit battery status*

*) Will only work when the Display Unit is turned on and communicating with measurement units. If more than one measurement unit is used the LEDs will show the battery status of the measurement unit with the least charge.



- 6. USB master (IP 67)
- 7. External power (IP 67)

OPERATING MODES

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



To turn on the unit, press the ON button.



To turn off the unit, touch the Off icon in the Home Menu.

In case the system fails to respond, it is possible to turn it off by pressing down the ON button for more than 15 seconds.

CONNECTIONS

The main connection for the Display Unit is the built in Bluetooth connection. See chapter “Global settings” for instructions on how to pair measurement units.

The USB master can be used with USB flash drives to transfer files to a PC for storage.

POWER SUPPLY

MEAX DU 01 is powered by a high-capacity rechargeable Li-Ion pack in the display unit, or by the external power unit.

The operating time of the batteries is approximately 8-10 hours when the system is used for a typical measurement work (continually on with 50% backlight).

To prolong the operating time the backlighting of the screen should be used moderately.

If the system turns off due to low power, the resume function will save the data. When the system is turned on again after battery recharge or connection of external power, you will be prompted to choose whether to return to the state when the unit was turned off (i.e. resuming operation without loss of data) or start the Home Menu.

The external power unit is connected to the external power connector on the display unit and to a wall socket with 110 - 240 Volts.

21.4

When the external power supply is connected, the unit will automatically start charging the batteries. This will be indicated by the battery status LED. The charging time is approximately 5-6 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 2-3 years before needing replacement. Contact your sales representative for battery replacement.

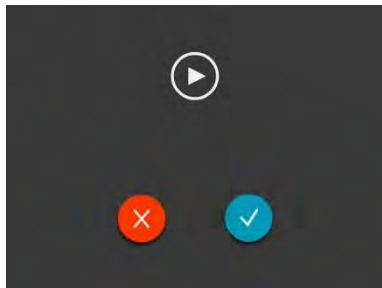
The batteries contain safety circuitry to operate safely with the display unit. The unit can therefore only be used with the Li-Ion batteries supplied by MEAX. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter on safety for further instructions.

AUTO-OFF

In the Home Menu, the Display Unit will turn itself off automatically after 60 minutes inactivity.

RESUME FUNCTION

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



When the system is turned on again after charging the batteries, 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 Home Menu.



Resume.



Close and start the Home Menu.

UPGRADING THE SOFTWARE

Upgrades to the software will be sent out or made available for download on our website. The upgrade will be in a compressed zip-file, there is no need decompress it.

Put the zip-file on a USB stick. Insert the USB stick in the display unit. The upgrade file will be automatically detected by the software and the following screen will appear.



You can choose between exiting (and not upgrading) or installing the new software version. The version numbers of the existing and the new software are displayed above the icons.

To proceed with the installation, perform the following:

- Touch the confirmation icon to upload the new software.
- The box will turn itself off and reboot.
- The new software will be uploaded from the USB stick during the start up. This will take several minutes.

DO NOT REMOVE the USB stick during the installation.

- When the upgrade is finished the system starts the MEAX application automatically.

DO NOT REMOVE the USB stick until the application has started up.

NOTE: If, after several minutes, the unit has not booted up and started the MEAX application, please check if the light from the status LED on the USB stick is flashing or constant.

- If it is flashing files are being transferred - this is OK, wait until the display unit starts.
- If there is no flashing the display unit will need to be manually rebooted. Turn the unit off by pressing the on/off button for more than 15 seconds. Turn the unit on with a short press on the on/off button. Wait for several minutes until the display unit starts.

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

If you have a USB stick with another software version than the current inserted in the display
21.8

unit, the upgrade window will appear every ten seconds. Remove the zip-file from the USB stick to prevent this.

FLASH

MEAX software contains
Macromedia® Flash™ technology by Adobe
Systems, Inc.

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and Macromedia Flash Lite are trademarks or
registered trademarks of Adobe Systems, Inc.
in the United States and other countries.

CALIBRATING THE TOUCH SCREEN

In order to make the touch screen to respond to the icons on the display, it may be necessary to recalibrate it from time to time.

Screen calibration procedure:

- Start the system.
- Wait until the Home Menu appears.
- Press down on the screen somewhere outside of the icons for 10 seconds.
- The screen calibration function should start.
- Touch and hold down on the target displayed until it moves.
- Repeat the step above on the 4 new positions of the target.
- When the target disappears, touch somewhere on the screen to finish and store the settings. (If, after the calibration

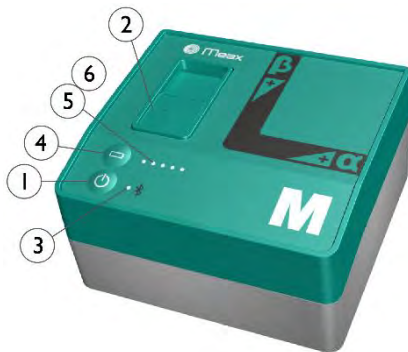
procedure, you don't touch the screen to confirm within 30 seconds the calibration procedure will start again.)



NOTE!

For best results please use a stylus for calibration.

SENSORS MEAX LM 201 AND LR 201



High precision 2-axes level sensors.

1. ON/OFF button with status indication LED
 - a. Continuously green – On
2. Mini USB for charging
3. Bluetooth indication LED
 - a. Continuously blue – paired and ready.
 - b. Flashing blue – searching/ready to pair
 - c. No light – Bluetooth disabled.
4. Battery status button – press to instantly show the battery status (also works when the unit is switched off).

- 5. Battery status LED
 - a. One LED flashing red – less than 10% charge left.
 - b. One LED double flashing red – less than 5% charge left.
 - c. One LED continuously orange – charging
 - d. One LED continuously green – fully charged.
- 6. Battery status LED when battery button is pressed
 - a. Continuously green – battery status
 - b. Rolling green – battery charging
- 7. Reference plane

8. Hole pattern for spindle holder

9. α reference



OPERATING MODES

MEAX LM 201 and LR 201 units has 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

Bluetooth connection

The main connection for LM 201 and LR 201 units is the built in Bluetooth connection.

See Bluetooth settings in the chapter “Global Settings” for instructions on how to pair measurement units.

POWER SUPPLY

The LM 201 and LR 201 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 measurement work (continuously on).

The LM 201 and LR 201 units can be charged with the supplied combined charger.

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. By pressing the battery status button, the exact charging status can be monitored.

The charging time is approximately 8 hours for fully drained batteries. (Charging to 50% takes approximately 2 hours.) 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 2-3 years before needing replacement. Contact your sales representative for battery replacement.

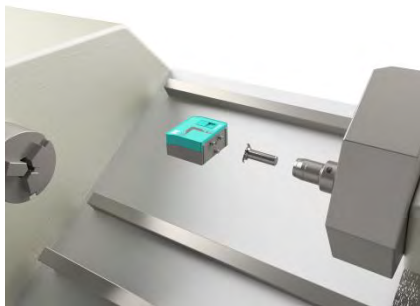
The batteries contain safety circuitry to operate safely with the unit. The unit can therefore only be used with the Li-Ion batteries supplied by MEAX. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter on safety for further instructions.

AXES

MEAX LM 201 and LR 201 measures the axes α and β .



MOUNTING



Mounting of the sensors are made by shafts $\varnothing 16$, fitting made for hydraulic chucks. In the spindle you must use a protective collet if the jaws are hardened.

You can either use the supplied protective collets with outer diameter of 25 mm, or you can use your own collets.

The LM and LR sensors can also be placed on their reference planes.

HANDLING

Warm up the sensors for 30 minutes before starting the measurement.

Do not measure with external power connected.

SENSORS MEAX SM 201 AND SR 201



Sensors with 2-axes detector, inclinometer and laser transmitter.

1. ON/OFF button with status indication LED
 - a. Continuously green – On
2. Mini USB for charging
3. Bluetooth indication LED
 - a. Continuously blue – paired and ready.
 - b. Flashing blue – searching/ready to pair
 - c. No light – Bluetooth disabled.
4. Battery status button – press to instantly show the battery status (also works when the unit is switched off).

- 5. Battery status LED
 - a. One LED flashing red – less than 10% charge left.
 - b. One LED double flashing red – less than 5% charge left.
 - c. One LED continuously orange – charging
 - d. One LED continuously green – fully charged.
- 6. Battery status LED when battery button is pressed
 - a. Continuously green – battery status
 - b. Rolling green – battery charging
- 7. Laser status LED

- 8. Laser button (SR 201 only)
- 9. Hole pattern for spindle holder
- 10. Horizontal reference surfaces



OPERATING MODES

MEAX SM 201 and SR 201 units has 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

Bluetooth connection

The main connection for SM 201 and SR 201 units is the built in Bluetooth connection.

See Bluetooth settings in the chapter “Global Settings” for instructions on how to pair measurement units.

POWER SUPPLY

The SM 201 and SR 201 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 10 hours when the system is used for a typical measurement work (continuously on).

The SM 201 and SR 201 units can be charged with the supplied combined charger.

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. By pressing the battery status button, the exact charging status can be monitored.

The charging time is approximately 8 hours for fully drained batteries. (Charging to 50% takes approximately 2 hours.) The charging

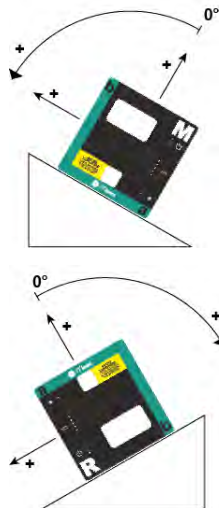
time will be longer if the unit is turned on while being charged.

When used in typical conditions the batteries will sustain good capacity for approximately 2-3 years before needing replacement. Contact your sales representative for battery replacement.

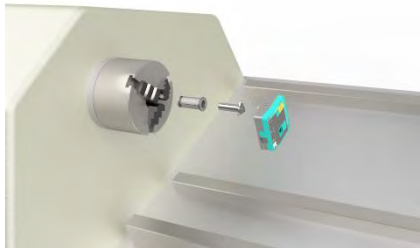
The batteries contain safety circuitry to operate safely with the unit. The unit can therefore only be used with the Li-Ion batteries supplied by MEAX. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter on safety for further instructions.

AXES

MEAX SM 201 and SR 201 measures the axes b and a, and rotational angle.



MOUNTING



Mounting of the sensors are made by shafts $\varnothing 16$, fitting made for hydraulic chucks. In the spindle you must use a protective collet if the jaws are hardened.

You can either use the supplied protective collets with outer diameter of 25 mm, or you can use your own collets.

Mount the sensor SR in the main work head spindle. (SR will represent the reference.)

Mount the sensor SM in the tool holder or in the opposite work head spindle. (SM will represent the measured value.)

If the spindles have numerical control functions you can use that to achieve the positions the program are asking for. If not, you have to turn them manually. You can set the hydraulic pressure in the chuck on a level which gives the SM sensor stability but you can still rotate it between the measurement positions.

HANDLING

Warm up the sensors for 30 minutes before starting the measurement.

Do not measure with external power connected.

ANGULAR PRISM MEAX SQ 201



Angular prism, front.

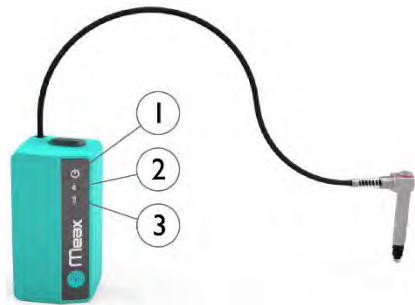


Angular prism, back.

MOUNTING

The angular prism is mounted on the SR sensor.

PEN SENSORS MEAX P 100 AND P 250



There are two types of MEAX Pen Sensors.
MEAX P 100 with a measuring range of 2 mm
and MEAX P 250 with a measuring range of 5 mm.

1. ON/OFF button
2. Bluetooth indication LED
 - a. Continuously blue – paired and ready.
 - b. Flashing blue – searching/ready to pair
3. Battery status LED
 - a. Continuously red – less than 10% charge left.
 - b. Flashing red – less than 5% charge left.
 - c. Continuously orange – charging
 - d. Continuously green – fully charged.

OPERATING MODES

P 100/250 units has two operating modes: On and Off.

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

CONNECTIONS

Bluetooth connection

The main connection for P 100/250 units is the built in Bluetooth connection. The units will automatically connect to the display unit when turned on as long as they are paired. See chapter “Global settings” for instructions on how to pair measurement units to the display unit.

POWER SUPPLY

The P 100/250 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 11 hours (continuously on).

The P 100/250 units can be charged with the supplied combined charger.

When the external power supply is connected, the unit will automatically start charging the batteries. This will be indicated by the 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 2-3 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 FIXTURLASER. Improper replacement of batteries can cause damage and risk for personal injury. Please refer to the chapter on safety for further instructions.

FIXTURES

POINTING FIXTURE

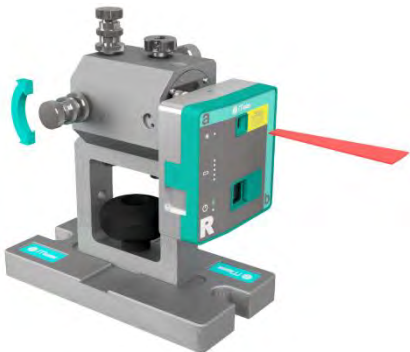
Fixture for laser transmitter with built-in micrometer screws for adjustment of the laser beam in horizontal and vertical level.



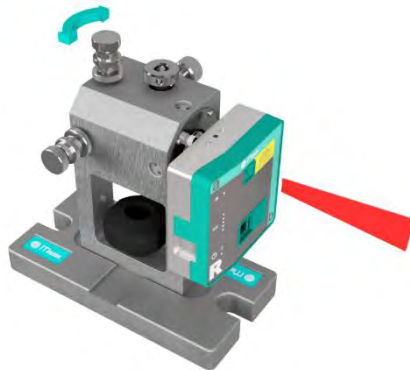
The fixture has 3 adjustment possibilities.

On top, there is a locking screw for locking the transmitter mounted with diameter 16 shaft.

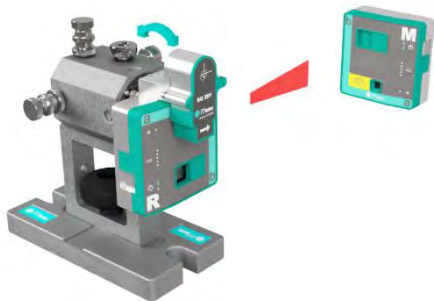
If the machine table have T-nut slots it is preferably to have the fixture centered over the slots.



The screw on the front is used for adjustments in the horizontal plane.



The screw on top is used for adjustments in the vertical plane.



The screw on the back is used for orientation around the laser beam.

Levelling - Coarse adjustment

Untighten the lock ring.



Levelling - Fine adjustment

Tighten the lock ring.



NOTE: Do not unscrew the fine adjustment further than the stop mark.

CIRCULAR PLATE

Pointing fixture and circular plate



Typical use is when pointing fixture need to be mounted in front of milling heads.

SR 201 and circular plate



For mounting SR 201 when spindle holder is removed.

Makes it possible to mount SR 201 on flat tables, on work piece holders with no removable jaws and in front of milling heads.

MAGNETIC BASE

Pointing fixture and magnetic base



INDEXING FIXTURE



Simulates a rotation in a machine.

Needed for spindle parallelism to its own motion in machines without rotation possibility.

TECHNICAL SPECIFICATION – MEAX DU 01

Part No: 1-1013

Housing material	Brushed Anodized Aluminum frame and high impact ABS plastic over molded with TPE rubber
Operating temp	-10 to 50°C (14 to 122°F)
Storage temp	-20 to 70°C (-4 to 158°F)
Battery Charging Temp, system off	0 to 38°C (32 to 100°F)
Battery Charging Temp, system on	0 to 32°C (32 to 90°F)
Relative humidity	10 – 90%
Weight	1,2 kg (2,6 lbs) with battery
Dimensions	224mm x 158mm x 49mm (8,8 in x 6,2 in x 1,9 in)
Environmental protection	IP 65 (Dust tight and protected against water jets)
Processor	1 GHz Dual core main processor with ultra-low power core for instant power management
RAM memory	256 Mb
Flash storage memory	8 Gb >100 000 measurements

Display	Color Reality Display, TFT-LCD backlit, sunlight readable, with wide angle viewing technology
Display size	6,5" (165mm) diagonal (133 x 100 mm)
Display resolution	Full VGA 640x480 pixels
Color depth	262 000 colors
Interface	6,5" High Impact Polyester laminated touch screen with enhanced transmission and reduced glare
Gyroscope	6-Axis MEMS Inertial Motion Sensor with drift compensation and automatic field calibration.
Connectors	1 USB 2.0 Master port (IP67) 1 Power/Charger connector 10-14V DC (IP67)
Wireless communication	Class I Bluetooth transmitter with multi-drop capability
Power supply	High performance, High Temperature rechargeable Li-Ion battery or external power supply
Peripherals – User accessible	1 USB Mini port; Charging: 5V, 0,5A
Power supply	High performance Li Ion battery or external power.

Operating time	10 hours continuous use (with 50% LCD backlight)
Battery charging time (system off, room temperature)	5 h
Battery capacity	48.8 Wh
LED indicators	Unit state and 2x5 battery state indicators with instant battery check

Specifications are subject to change without notice.

TECHNICAL SPECIFICATION – MEAX LM 201 AND LR 201

Part No LM 201: 1-0984, LR 201: 1-0985

Housing material	Anodized Aluminum and ABS plastic
Operating temp	15 to 30°C (59 to 86°F)
Storage temp	-20 to 70°C (-4 to 158°F)
Battery charging temp	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	386 g (13.6 oz)
Dimensions	77 mm x 84 mm x 45 mm (3.0 in x 3.3 in x 1.8 in)
Environmental protection	IP 65 (Dust tight and protected against water jets)
Inclinometer	High performance MEMS inclinometers
Calibrated measuring range	±50 mm/m
Internal resolution	0.001 mm/m
Displayed resolution	0.001 mm/m
Inclinometer accuracy	1% ± 0.005 mm/m
Temperature error	0.015 mm/m/°C
Stabilization time	18 s

Warming up time	30 min
Wireless communication	Class I Bluetooth transceiver with multi-drop capability. BLE Bluetooth Low Energy (BT 4.0) and Classic Bluetooth.
Communication range	10 m (33 ft)
Peripherals – User accessible	1 USB Mini port; Charging: 5V, 0,5A
Power supply	High performance Li Ion battery or external power.
Operating time	12 hours continuously
Battery charging time (system off, room temp)	8 h
Battery capacity	10.4 Wh
LED indicators	Unit state, battery status and Bluetooth status.

Specifications are subject to change without notice.

TECHNICAL SPECIFICATION – MEAX SM 201 AND SR 201

Part No SM 201: 1-0984, SR 201: 1-0985

Housing material	Anodized Aluminum and ABS plastic
Operating temp	15 to 30°C (59 to 86°F)
Storage temp	-20 to 70°C (-4 to 158°F)
Battery charging temp	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	306 g (10.9 oz)
Dimensions	82 mm x 86 mm x 33 mm (3.2 in x 3.4 in x 1.3 in)
Environmental protection	IP 65 (Dust tight and protected against water jets)
Laser	650 nm class II diode laser
Laser power	< 1 mW
Measurement distance	Up to 3 m
Detector	2-axis PSD
Detector size	16 mm x 16 mm (0.6 in x 0.6 in)
Detector resolution	1 μ m
Measurement accuracy	1% \pm 3 μ m

Ambient light protection	Optical filtering and ambient light signal rejection
Inclinometer resolution	0.01°
Inclinometer accuracy	±0.1°
Warming up time	30 min
Wireless communication	Class I Bluetooth transceiver with multi-drop capability. BLE Bluetooth Low Energy (BT 4.0) and Classic Bluetooth.
Communication range	10 m (33 ft)
Peripherals – User accessible	1 USB Mini port; Charging: 5V, 0,5A
Power supply	High performance Li Ion battery or external power.
Operating time	10 hours continuously
Battery charging time (system off, room temp)	8 h
Battery capacity	10.4 Wh
LED indicators	Unit state, laser transmission, battery status and Bluetooth status

Specifications are subject to change without notice.

TECHNICAL SPECIFICATION - MEAX P 100

Part No: 1-1039

Housing material	ABS plastic
Operating temp	0 to 40°C (32 to 104°F)
Storage temp	-20 to 60°C (-4 to 140°F)
Long term storage temp	Room temp. 18 to 28°C (64 to 82°F)
Battery Charging Temp	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	135 g (4.76 oz)
Dimensions battery unit	44 x 91 x 33 mm (1.7 x 3,6 x 1,3 in)
Dimensions pen body	Length: 60 mm (2.36 in) Diameter: Ø 8 mm (Ø 0.31 in)
Length cable	400 mm (15.7 in)
Environmental protection	IP65
Measuring range	2 mm (0.08 in)
Mechanical travel	3 mm (0.12 in)
Measuring force	0.70 N \pm 25%
Repeatability	0.15 μ m

Thermal drift	0.25 $\mu\text{m}/^{\circ}\text{C}$
Accuracy error (K=Reading in mm)	$\pm\text{MAX}(1+ 2*K ; 7*K)$ μm
Contact type	\varnothing 3 mm (\varnothing 0.12 in) carbide
Contact thread	M2.5
Interface	Membrane Switch Keyboard
Wireless communication	Class I Bluetooth transceiver with multi-drop capability. BLE Bluetooth Low Energy (BT 4.0)
Communication range	10 m (33 ft)
Connectors	1 USB Mini micro port Charging: 5V, 0.5A
Power supply	Rechargeable Li Ion battery or external power supply.
Operating time	11 hours continuous use
Battery Charging time (system off, room temperature)	8 h
Battery Capacity	10.4 Wh
LED indicators	Wireless communication and battery status indicators.

Specifications are subject to change without notice.

TECHNICAL SPECIFICATION - MEAX P 250

Part No: 1-1058

Housing material	ABS plastic
Operating temp	0 to 40°C (32 to 104°F)
Storage temp	-20 to 60°C (-4 to 140°F)
Long term storage temp	Room temp. 18 to 28°C (64 to 82°F)
Battery Charging Temp	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	142 g (5.01 oz)
Dimensions battery unit	44 x 91 x 33 mm (1.7 x 3,6 x 1,3 in)
Dimensions pen body	Length: 85 mm (3.34 in) Diameter: Ø 8 mm (Ø 0.31 in)
Length cable	400 mm (15.7 in)
Environmental protection	IP65
Measuring range	5 mm (0.20 in)
Mechanical travel	6.6 mm (0.26 in)
Measuring force	0.70 N \pm 25%
Repeatability	0.15 μ m

Thermal drift	0.25 $\mu\text{m}/^{\circ}\text{C}$
Accuracy error (K=Reading in mm)	$\pm\text{MAX}(5+ 2*K ; 7*K)$ μm
Contact type	\varnothing 3 mm (\varnothing 0.12 in) carbide
Contact thread	M2.5
Interface	Membrane Switch Keyboard
Wireless communication	Class I Bluetooth transceiver with multi-drop capability. BLE Bluetooth Low Energy (BT 4.0)
Communication range	10 m (33 ft)
Connectors	1 USB Mini micro port Charging: 5V, 0.5A
Power supply	Rechargeable Li Ion battery or external power supply.
Operating time	11 hours continuous use
Battery Charging time (system off, room temperature)	8 h
Battery Capacity	10.4 Wh
LED indicators	Wireless communication and battery status indicators.

Specifications are subject to change without notice.

TECHNICAL SPECIFICATION - MEAX SQ 201

Part No: 1-1027

Housing material	Anodized Aluminum and ABS plastic
Operating temp	15 to 30°C (59 to 86°F)
Storage temp	-20 to 70°C (-4 to 158°F)
Relative humidity	10 – 90%
Weight	100 g (3.5 oz)
Dimensions	64 mm x 56 mm x 45 mm (2.5 in x 2.2 in x 1.8 in)
Measurement accuracy	± 0.005 mm/m

Specifications are subject to change without notice.



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