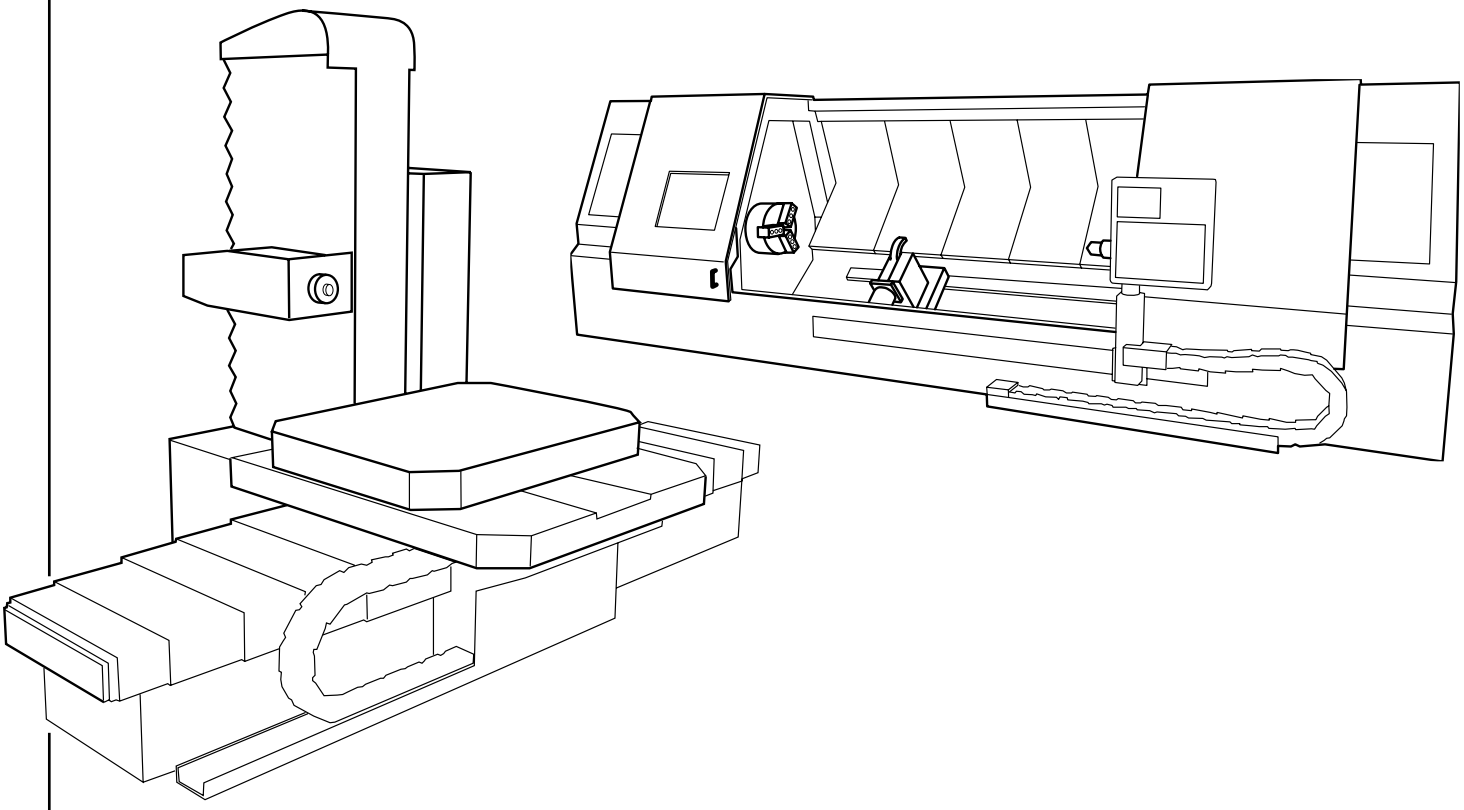

MACHINE TOOLS GUIDE

Lathes and milling machines

EASY-LASER®

05-0686 Revision 4.2
English

CONTENT

INTRODUCTION

Easy-Laser AB

Easy-Laser AB develops, manufactures and markets Easy-Laser® measurement and alignment equipment based on laser technology.

We have more than 25 years of experience from measurement tasks in the field and product development. We also provide measurement service, which means that we ourselves use the equipment we develop, and continuously improve it. Because of this we dare to call ourselves measurement specialists.

Do not hesitate to contact us about your measurement problems. Our expertise will help you solve it in an easy way.

Declaration of conformity

Equipment: Easy-Laser® product range

Easy-Laser AB declares that the Easy-Laser® product range is manufactured in conformity with national and international regulations. The system complies with, and has been tested according to the following requirements:

CE

EMC Directive	2014/30/EU
Low Voltage Directive	2014/35/EU
Laser Classification	Europe: SS_EN 60825-1 USA: CFR 1040.10/11
RoHs Directive	2011/65/EU
WEEE Directive	2012/19/EU
R&TTE Directive	1999/5/EC

The calibration of the equipment fully complies with ISO9001:2008 #7.6

For wireless devices: This 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

(2) this device must accept any interference received, including interference that may cause undesired operation.

Disposal of old electrical and electronic equipment (Applicable throughout the European Union and other European countries with separate collection programs)

This symbol, found on product or on its packing, indicates that this product should not be treated as household waste when disposed of.

It should be handed over to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed correctly, you will help to prevent potential negative consequences to the environment and human health. For more detailed information about the recycling of this product, please contact your local city office, household waste disposal service or the retail store where you purchased this product.

Quality certificate

Easy-Laser AB is ISO 9001:2008 certified. Certificate number 900958.

Easy-Laser AB confirm, that our products are produced according to applicable national and international regulations and standards. All components are checked before assembly and final products are tested in functionality and visually checked before delivery

The calibration of the equipment fully complies with ISO9001: 2008 #7.6

Limited warranty

This product is manufactured under Easy-Laser's strict quality control system. Should the product fail within three (3) years from the date of purchase under normal usage conditions, Easy-Laser will repair or replace the product free of charge.

1. Using new or refurbished replacement parts.
2. Exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product.

Proof of purchase date should be confirmed, and sent together with a copy of the original purchase document.

Warranty is valid under normal usage described in the user's manual appended with the product. The warranty comprises failure on Easy-Laser® product that could be related to material and/or fabrication errors. The warranty is valid only in the country of purchase.

The warranty is not valid in the following cases:

- If the product is broken due to mishandling or incorrect operation
- If the product has been exposed to extreme temperature, calamity, chock or high voltage.
- If the product has been modified, repaired or disassembled by unauthorized personnel.

Compensation for possible damage due to failure on Easy-Laser® product is not included in the warranty. Freight cost to Easy-Laser is not included in the warranty.

Note!

Before delivery of the product for warranty repair, it is the responsibility of the buyer to backup all data. Data recovery is not included in the warranty service and Easy-Laser is not responsible for data that may be lost or damaged during transit or repair.

Lithium Ion battery limited warranty

Lithium ion batteries inevitably lose power during their lifetimes, depending on usage temperatures and the number of charging cycles. Therefore, the internal rechargeable batteries used in the E-series are not included in our general 2-year warranty. There is a 1 year warranty for the battery capacity not to fall below 70 % (a normal change means that the battery must have more than 70 % capacity after more than 300 charging cycles). A 2 year warranty applies if the battery becomes unusable because of a manufacturing fault or factors that Easy-Laser AB could be expected to have control of, or if the battery displays abnormal loss of capacity in relation to use.

Safety precautions

Easy-Laser® is a laser instrument in laser class 2 with an output power normally less than 1 mW, which requires the following safety precautions:

- Never stare directly into the laser beam
- Never aim the laser beam at anyone else's eyes.

Note!

Opening the laser units can result in hazardous radiation, and will invalidate the manufacturer warranty.

If starting the machine to be measured would result in injuries, the possibility to unintentionally start it must be disabled before mounting the equipment, for example by locking the switch in the off position or removing the fuses. These safety precautions should remain in place until the measurement equipment has been removed from the machine.

Note!

The system should not be used in explosive risk areas.

Service and calibration

Our Service centres will quickly assist you if your measurement system need to be repaired or when it is time for calibration.

Our main Service centre is located in Sweden. There are several local Service centres that are certified to carry out limited service and repair. Contact your local Service centre first before sending your equipment for service or repair. All Service centres are listed on our web site under Service and Calibration.

Before sending your measuring system to our main Service centre, please fill in the online Service and Repair report.

Manuals as PDF

You can download our manuals in pdf format from our website. The pdf's are also available on the USB memory stick that is delivered with most systems.

EasyLink

The new version of our database program EasyLink is available on the USB memory stick that is delivered with most systems. You can always download the latest version from easylaser.com>download>software.

Travelling with your measurement system

When travelling by airplane with your measurement system we strongly recommend that you check which rules apply for each airline company. Some companies/countries have limitations for checked baggage when it comes to items including batteries. For information about Easy-Laser® batteries, please see system unit details in the end of this manual. It is also good practice to remove the batteries from the equipment, when possible, e.g. D22, D23 and D75.

Specifications for built-in rechargeable batteries

Easy-Laser Part No.	Type	Voltage	Output	Capacity	Included in Part No.
03-0757	Li-Ion	3.7 V	39.22 Wh	11600 mAh	12-0418, 12-0700, 12-0748
03-0765	Li-Ion	3.7 V	2.5 Wh	660 mAh	12-0433, 12-0434, 12-0509, 12-0688, 12-0702, 12-0738, 12-0752, 12-0759, 12-0758, 12-0799, 12-0846
03-0971	Li-Ion	3.6 V	9.36 Wh	2600 mAh	12-0617, 12-0618, 12-0823, 12-0845
03-1052	Li-Ion	3.7 V	1.22 Wh	330 mAh	12-0746, 12-0747, 12-0776, 12-0777, 12-0791, 12-1054
12-0953	Li-Ion	3.7 V	7.4 Wh	2000 mAh	12-0944, 12-0943, 12-1028, 12-1029
12-0952	Li-Ion	7.4 V	39.22 Wh	5300 mAh	12-0961 (2 pcs)

Compatibility

The E-series is not compatible with previous analogue units from the D-series. You can however continue to use previous brackets.

Disclaimer

Easy-Laser AB and our authorized dealers will take no responsibility for damage to machines and plant as a result of the use of Easy-Laser® measurement and alignment systems.

Copyright

We might change and correct the manual in later issues without further information. Changes to the Easy-Laser® equipment may also affect the accuracy of the information.

December 2017

Fredrik Eriksson
Quality Manager, Easy-Laser AB

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Phone: +46 31 708 63 00, E-mail: info@easylaser.com
Web: www.easylaser.com

MACHINE TOOLS

In order to meet quality requirements and minimise the number of waste workpieces, the checking and alignment of machine tools is essential. The most important thing to check is the geometry of the machine; not even a precisely calibrated linear motion can compensate for a crooked movement or uneven surface. The correct machine geometry is the basis for being able to produce parts that remain within the tolerances.

Easy-Laser® makes work much faster

Compared to conventional methods, such as dial gauges together with stones and shafts, work can be carried out much more quickly with the use of a laser measurement system. There are many reasons why:

Laser measurement system

- Easy to learn and use
- Light and handy equipment = shorter time for preparations and measurements
- Possible to measure and align at long distances = greater accuracy
- Possible to measure both X and Y (Z) directions at the same time = saves time
- The reference (laser beam) is always 100% straight
- Live adjustment
- Possible to create documentation of the measurement results via printer and to PC

Conventional methods

- Often heavy and ungainly equipment like stone and shaft
- Require more skill
- The equipment can be difficult to set up = prolongs measurement time
- Possible changes or wear on fixtures = the reference is not straight
- Handwritten documentation only

Manufacture more and at higher quality

Being in full control of your machine has many advantages:

- Less downtime
- Better use of machine time
- Higher quality of manufactured parts
- Fewer waste workpieces
- Better material use
- Faster deliveries
- Longer service life for the machine tools

ISO tolerances

We use the ISO tolerance to evaluate the measurement results.

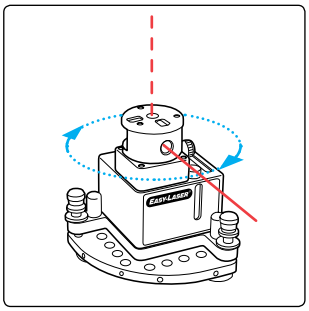
- ISO 10791-1 for horizontal machines.
- ISO 10791-2 for vertical machines.

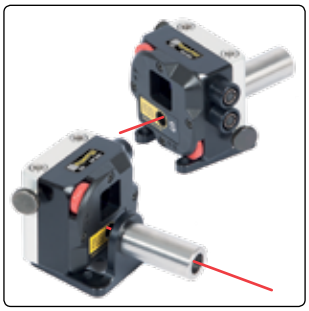
E940 Machine tool system

Our geometry measurement systems can handle most tasks in this field, despite the fact that there is considerable variation as regards to machine design: boring machines, vertical, horizontal and portal milling machines, lathes, vertical lathes, drilling machines, automatic drills, water cutting machines, presses, etc.

Bluetooth® POWERED by ENDURIO™ 40 m /132' 2 AXIS PSD

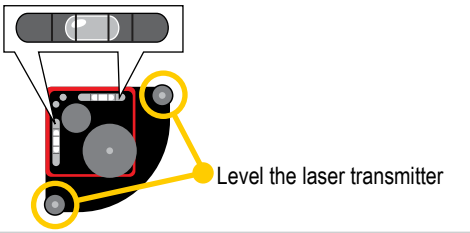
HyperPSD™ BARCODE SYSTEM





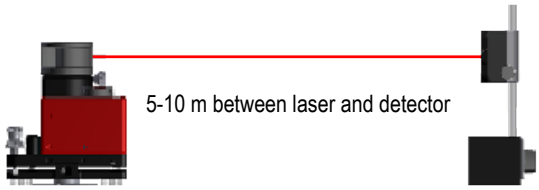
Calibrate the spirit levels on D22

You can calibrate the spirit levels on the D22 laser transmitter. This is done at factory, but should be redone prior to a job. The spirit levels are scaled to 0.02 mm/m [4 arc sec.]. By calibrating the spirit levels and then use them to level the laser transmitter, you can achieve an absolute levelling of the laser plane of approximately 0.01 mm/m [2 arc sec.].



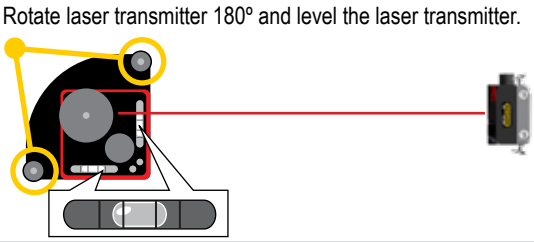
Level

1. Place the D22 laser transmitter on a flat and stable surface.
2. Level the laser transmitter according to the spirit levels. Use the tilting screws.



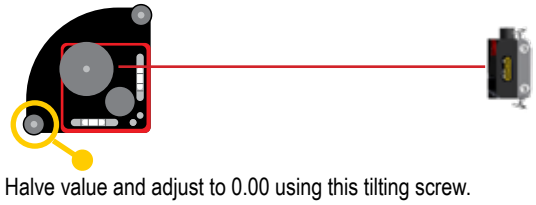
Zero set

3. Place the detector at a distance of 5-10 metres. Make sure that the laser beam hit the detector target.
4. Select V 0.00 H 0.00 to open the program Values.
5. Select 0 to zero set.



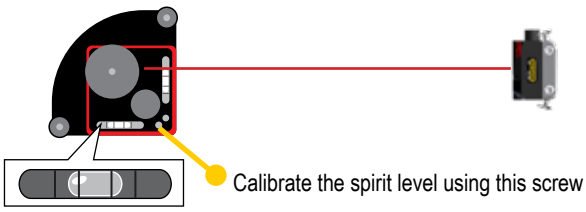
Index and level

6. Rotate the D22 180° and turn the laser beam to the detector.
7. Level the laser transmitter according to the spirit levels. Use the tilting screws.



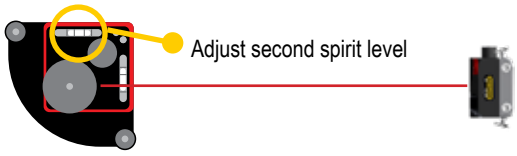
Adjust value

8. Select ½ to halve the value.
9. Adjust the V-value to 0.00 using the tilting screw.



Calibrate spirit level

10. Calibrate the spirit level using a hex key.
11. Repeat step 6–9 to control.

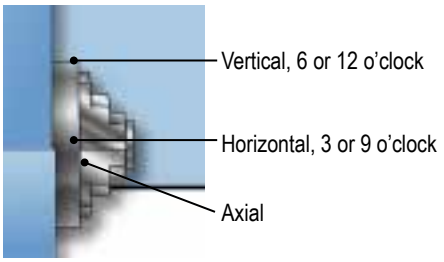


Calibrate second spirit level

12. Rotate the D22 90° and turn the laser beam to the detector.
13. Repeat step 4–12.

Spindle bearing condition

Measurement of bearing condition on the spindle bearings.



Equipment to use

Vibrometer probe

Bearing condition value

Bearing condition value is used for trend analysis. If the bearing condition value increases over time, it can be a sign of that the bearing is poorly lubricated, overloaded due to misalignment or has a damaged surface. A high bearing condition value can however appear in gearboxes, converting machines with cutters and similar machines without any bearing fault. This is because this type of machinery naturally produces high frequency vibrations that are similar to the vibrations produced by a machine with a bearing fault.

The bearing condition value is the quadratic mean, RMS value, of all high frequency vibrations between 3200 Hz to 20000 Hz. This value is an acceleration average measured in multiples of the standard gravity constant, g.

Note!

A high bearing condition value should always be used as a request to make frequency analysis. Do not change bearings before this is done.

When measuring vibration level, Easy-Laser® Vibrometer is measuring the effective velocity (mm/s or inch/s RMS) in the frequency range between 2 and 3200 Hz. This range covers most of the frequencies that will occur for the majority of mechanical malfunctions and imperfections, for example unbalance and misalignment.

When used to measure bearing condition the Easy-Laser Vibrometer is measuring the effective acceleration (RMS) in the frequency range between 3200 and 20000 Hz. Trend analysis of the bearing condition value can be used to determine wear and tear of machine bearings.

Measure

1. Place the probe firmly against the measurement point.
2. Make measurements on a vertical, horizontal and axial measurement point. Try to hold the probe as vertical, horizontal or axial as possible.
3. Use the M6 stud for high frequency measurements, and mount the probe directly to the machine.

For most spindle bearing, your “g” value should be lower than 0.7 g.

Mount directly on machine

It is possible to remove the magnetic tip and mount the probe directly to the machine, using the M6 threaded stud.

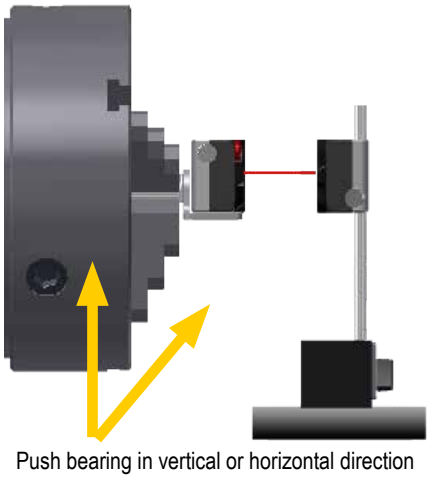
Measuring tip

For measuring points that are hard to reach, use the measuring tip. Simply unscrew the magnetic tip and replace with the measuring tip. When measuring with the measuring tip, place it firmly against the measurement point and hold it as vertical, horizontal or axial as possible. When the measuring tip is used the frequency range is reduced to about 800 to 1500Hz.

Spindle bearing movement

To measure the vertical and horizontal play you check the spindle bearing movement.

1. Select V 0.00 H 0.00 to open the program Values.
2. Push the bearing in vertical or horizontal direction.
3. Read value.



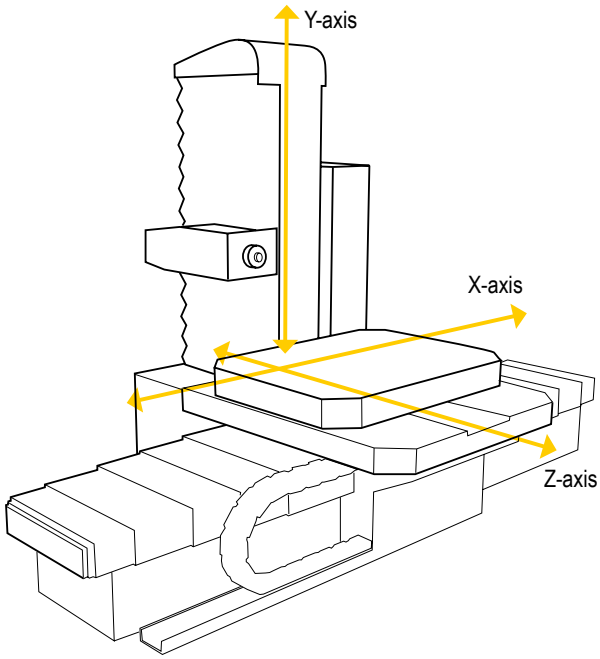
Push bearing in vertical or horizontal direction

LATHE WITH TOOL SUPPORT

What to check

Check straightness, spindle direction, spindle to spindle, squareness and flatness. All of these can be measured with Easy-Laser®. Resolution of 0.001 mm and a maximum measuring distance of up to 40 m. Using our software EasyLink™, the results are presented both digitally and graphically.

In this chapter we describe methods for measuring a traditional lathe with tool support. *See also chapter Lathe with turret.*



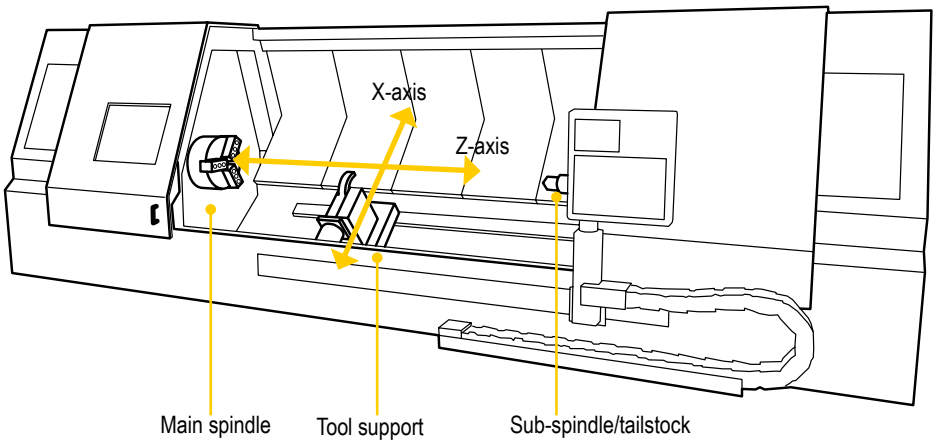
What to do first

For best result, measure and adjust the machine in the following order.

1. Straightness of all machine axis.
2. Check bearing play.
3. Main spindle direction.
4. Main spindle towards sub-spindle/tail stock.
5. Squareness of Z- and X-axis.
6. Spindle bearing condition.

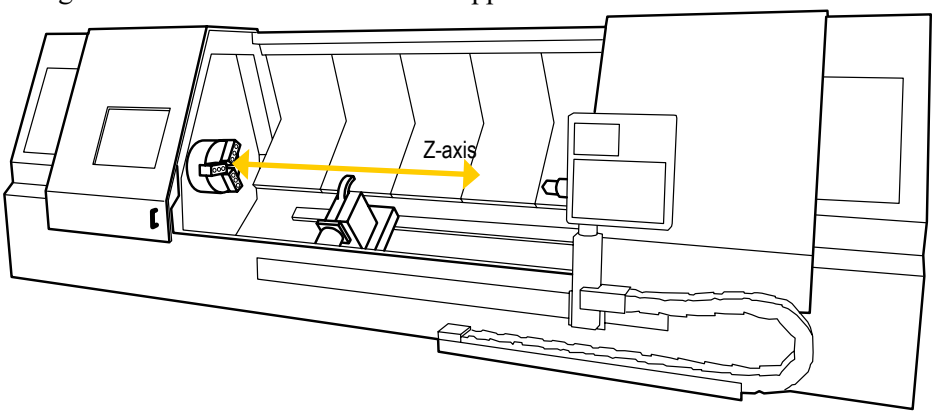
Machine set up

1. Mount the D22 on a tripod.
2. Set the D22 to spirit level. See *"Calibrate the spirit levels on D22" on page 7.*
3. Select  to open the program Flatness.
4. Register live readings over the adjustment points of the machine bed.
5. Adjust the points to 0.00.
6. Select  to save the measurement.



Straightness of Z-axis

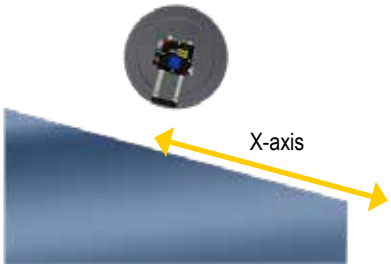
Straightness measurement of the tool support's Z-axis.



Equipment to use

- Laser transmitter D22 or ESH-unit (or D146).
- Detector EMH-unit mounted on a magnet base.

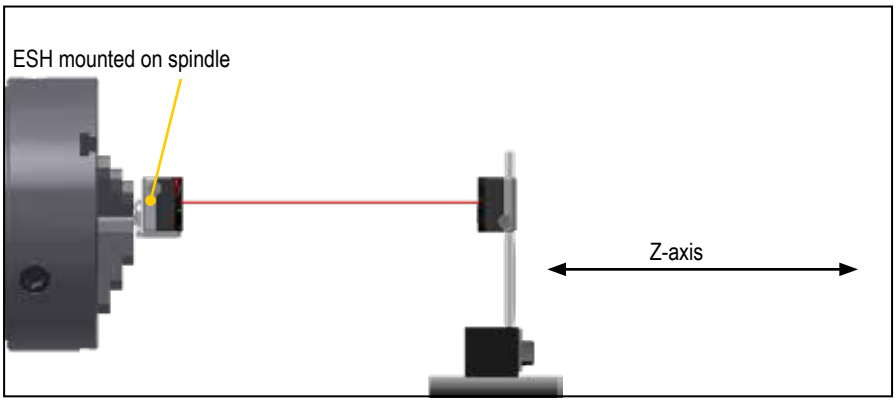
Preparations



1. Mount the laser transmitter in the chuck or on the spindle.
2. Mount the detector on the tool support. Make sure that the detector corresponds with the side movement of the tool support.
3. Place the detector close to the laser transmitter.
4. Select  to open the program Straightness.
5. Select  and  to open the target.
6. Select  to zero set the value.
7. Move the tool support with the detector far away from the laser transmitter.
8. Adjust the laser beam to zero (0.00), both H and V values.

Note!

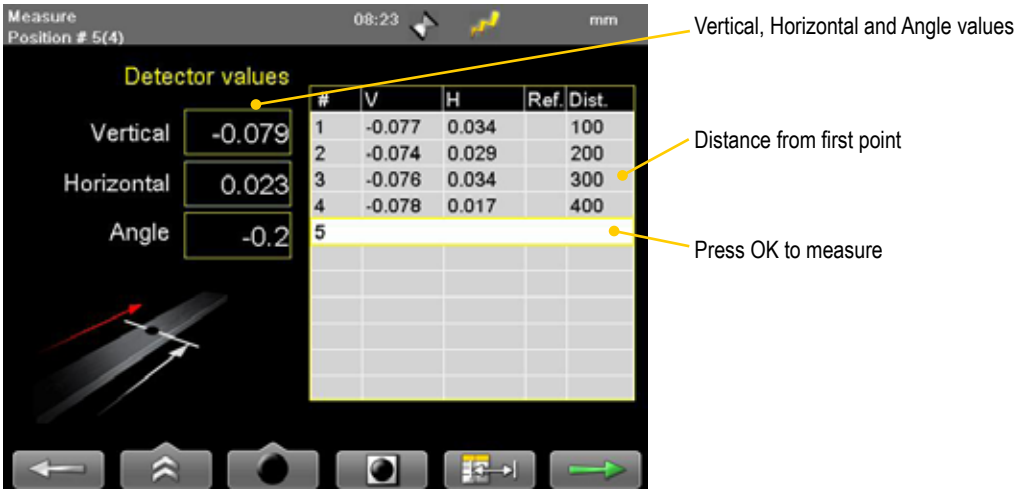
For this measurement the sideway result (H) is the most important, as you put a force on the bar from the tool.



Measure

Make sure the reference points are still zero before measuring.

1. Press . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
2. Press to register a value. An hourglass is displayed while the value is registered.
3. Select to continue to Result view.



Result

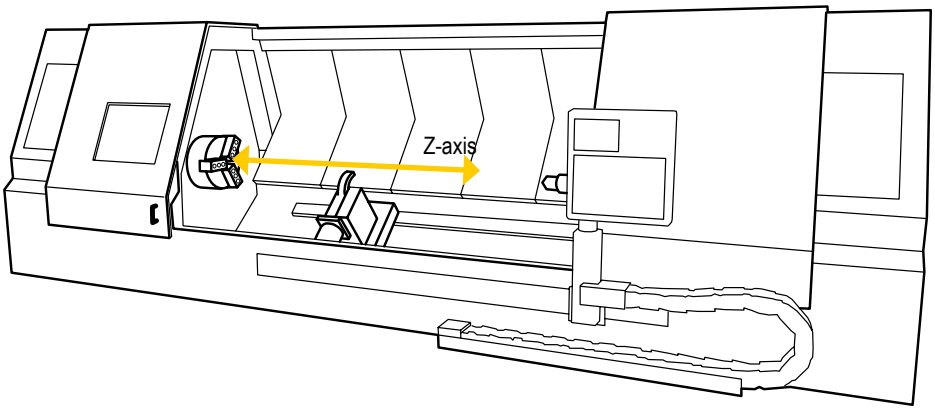
The result can be displayed as graph, table or a 3D view.

Save measurement

Save the measurement by selecting and . A pdf report is automatically generated.

Spindle direction Z-axis

Spindle direction measurement of the main spindle's Z-axis. Measurement on a lathe with tool support.



Equipment to use

Laser transmitter ESH-unit or D22 (or D146).

EMH-unit mounted on a magnet base.

Note!

When using D146, we recommend a rotation speed of 1000-1500 rpm. Also make sure to use filter 10 and to have a minimum distance to the EMH unit of 100 mm.

Preparations

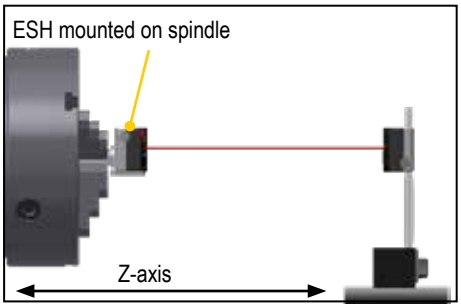
Note!

Before measuring spindle direction, make sure that the Z-movement is absolutely straight. Otherwise this measurement is useless.

1. Mount the laser transmitter in the chuck. For large machines you can mount it on the middle of the spindle.
2. Mount the detector on the tool support.

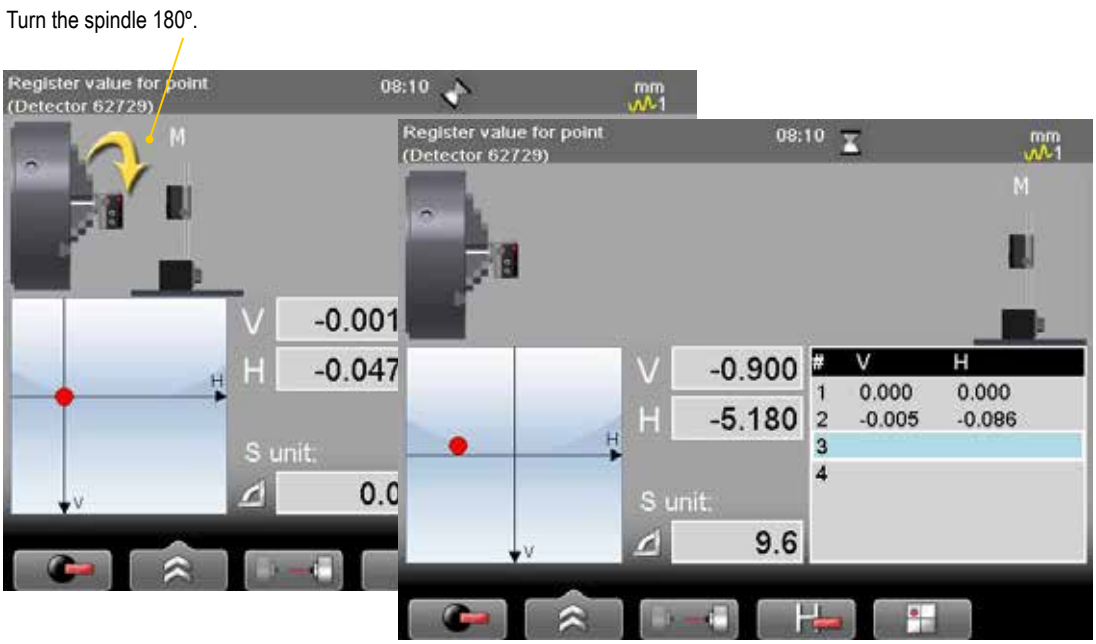
Coning the laser beam

1. Select  to open the program Spindle.
2. Select  and  to open the target.
3. Select  to zero set the value.
4. Turn the spindle 180º.
5. Select  to half the value.
6. Adjust the laser beam to zero (0.00), both H and V values.



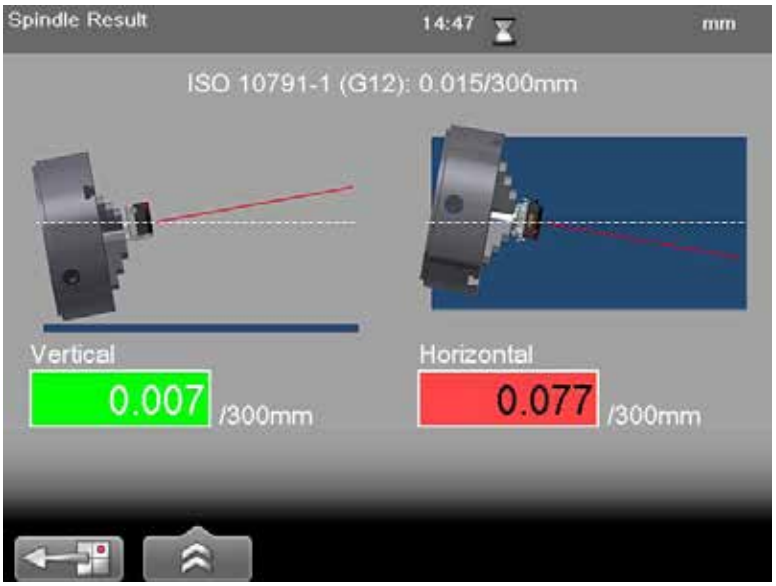
Measure

1. Place the detector close to the spindle. Press to register the first position.
2. Turn 180º and press to register the second position.
3. Move the detector far away from the spindle and press to register the third position.
4. Turn 180º and press to register the fourth position.



Result

Values within tolerance are green.

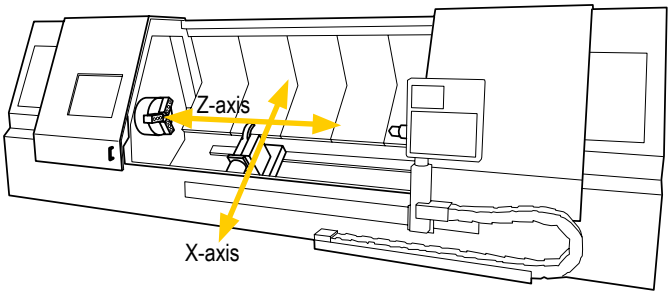


Save measurement

Save the measurement by selecting  and  . A pdf report is automatically generated.

Straightness of X-axis

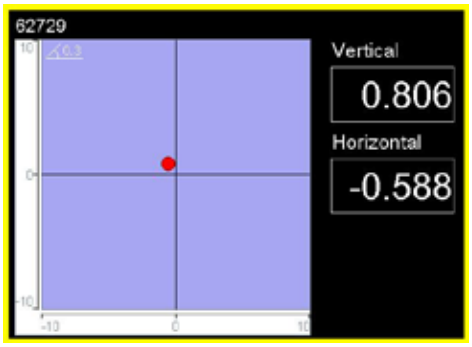
Straightness measurement of X-axis of the tool support.



Equipment to use

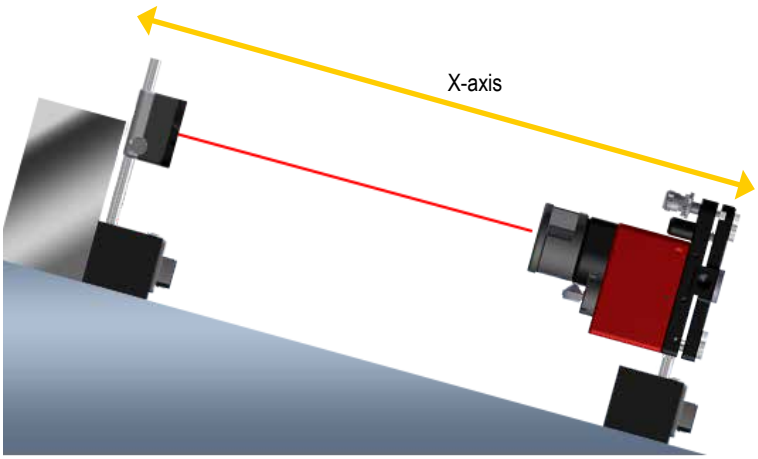
Laser transmitter ESH-unit or D22.
EMH-unit mounted on a magnet base.

Preparations



Target

1. Mount the laser transmitter on the guide.
2. Mount the detector on the tool support.
3. Place the detector close to the laser transmitter.
4. Reset the X scale on the machine to zero.
5. Select  to open the program Straightness.
6. Select  and  to open the target.
7. Select  to zero set the value.
8. Move the tool support with detector 100-500 mm, to reference point number two. Move as far away from the transmitter as possible.
9. Adjust laser beam to zero (0.00), both H and V values. Adjust by using the tilting screws.



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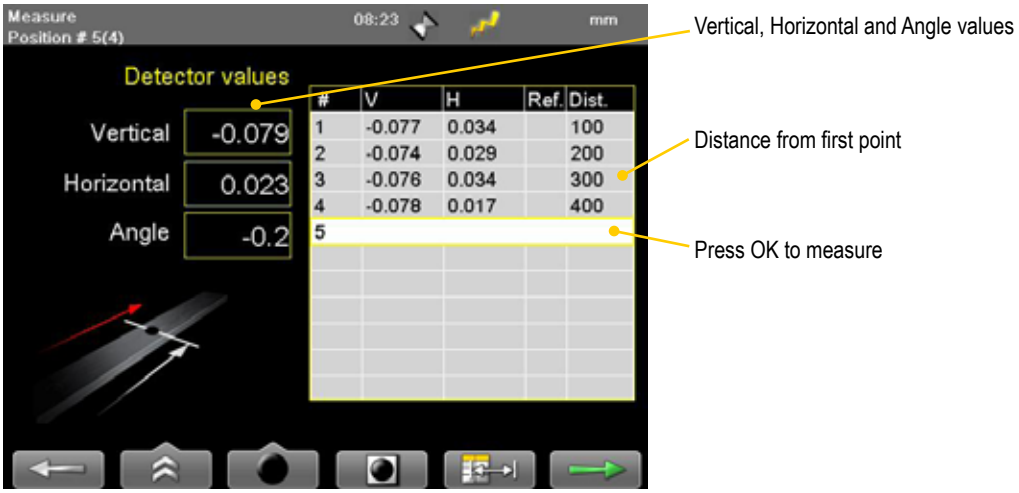


Result

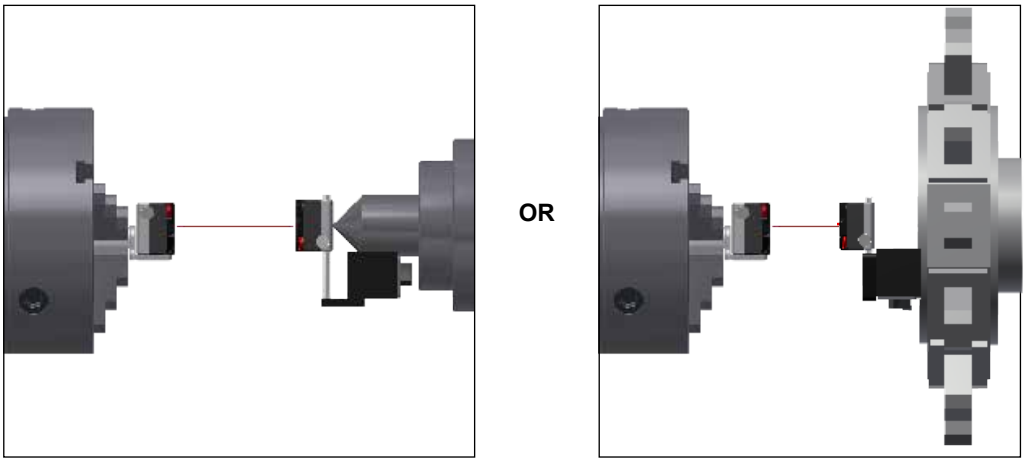
The result can be displayed as graph, table or a 3D view.

Save measurement

Save the measurement by selecting and . A pdf report is automatically generated.

Main spindle towards sub-spindle/tailstock

Measurement of main spindle towards the sub-spindle or tail stock.



Equipment to use

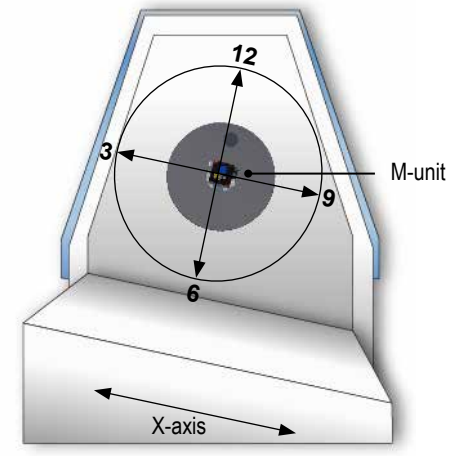
ESH- and EMH-units.

Preparations

1. Mount the ESH-unit in the main spindle, using the spindle bracket.
2. Mount the EMH-unit in the sub-spindle, using a magnet base.
3. Place the sub-spindle close to the main spindle, approx. 500 mm.

9, 3, 12 position

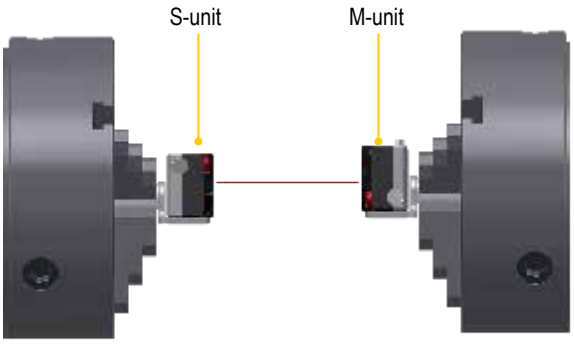
The positions 9, 3 and 12 corresponds to the X-axis, the side movement of the tool support.



Positions corresponds to the X-axis

Spindle to spindle

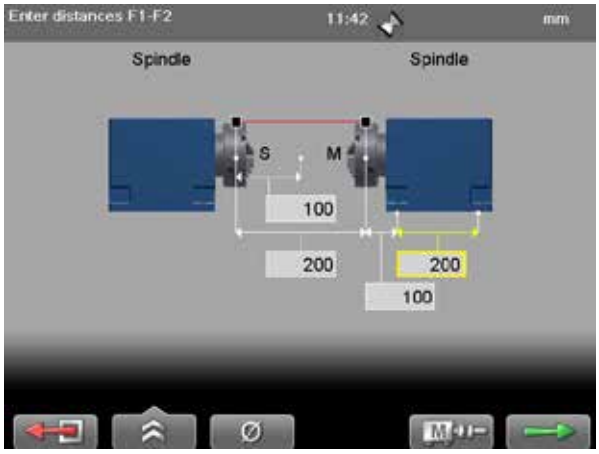
You can use spindle brackets to mount both units.



Measure

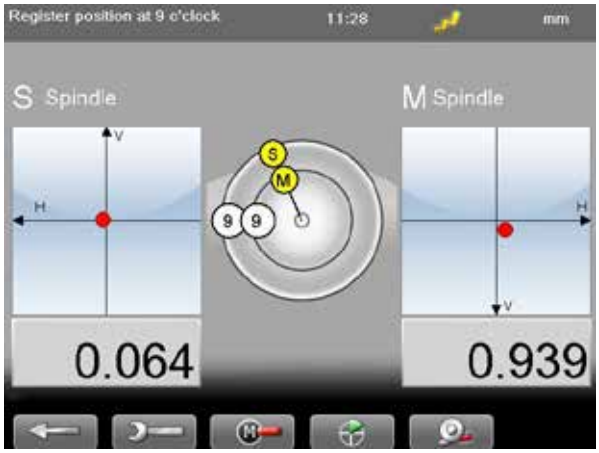
Before measuring the sub spindle/tail stock position you must make sure that the main spindle is pointing correctly. *"What to do first" on page 11.*

1. Select to open the program Horizontal. Select machines.
2. Enter distances and select to continue to Measure view.

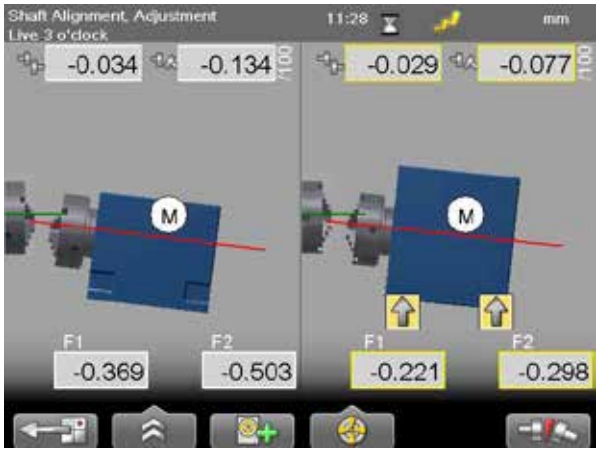


Enter distance

3. Select to switch to 9-12-3.
4. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
5. Turn shafts to 9 o'clock.
6. Press to register first position. The first position is automatically set to zero.
7. Turn shafts to 12 o'clock.
8. Press to register second position.
9. Turn shafts to 3 o'clock.
10. Press to register third position.



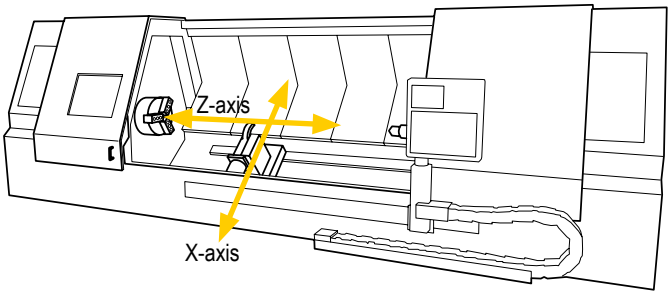
Measure



Result

Squareness of Z- and X-axis

The squareness measurements of the movements of the tool support. Before proceeding with this measurement, make sure both Z- and X- axis are straight by measuring straightness on both Z- and X-axis.



Equipment to use

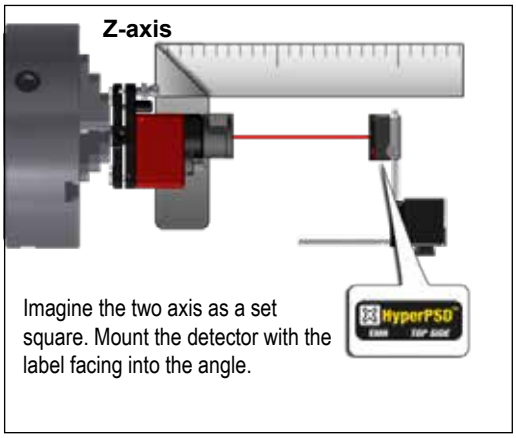
Laser transmitter D22

EMH-unit mounted on a D45 magnet base with turnable head.

Preparations

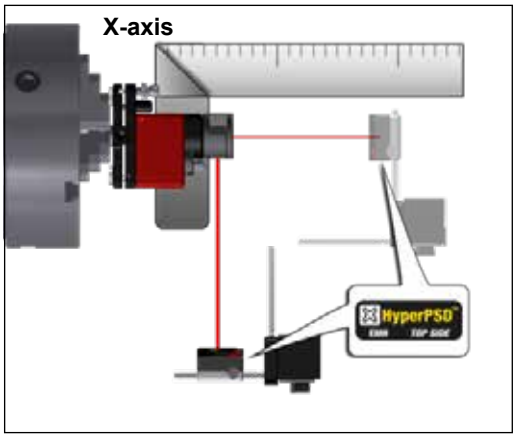
Z-axis

1. Mount the laser transmitter in the chuck of the main spindle.
2. Mount the detector on the tool support. Mount the detector with the label facing into the angle, see image.
3. Place the detector close to the laser transmitter.
4. Select  and  to open the target.
5. Select  to zero set the value.
6. Move the tool support with detector furthest away from the transmitter.
7. Adjust both V and H values to 0.00 mm. This is reference point number two.



X-axis

1. Switch the prism 90° to show the X-axis.
2. Move the detector to the X-axis position on the rods. Mount the detector with the label facing into the angle, see image.
3. Place the detector close to the laser transmitter.
4. Select  to zero set the value.
5. Move 100-300mm.
6. Read value. The displayed value is the angular error at that distance.

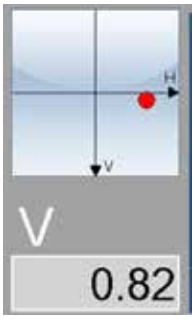


Measure

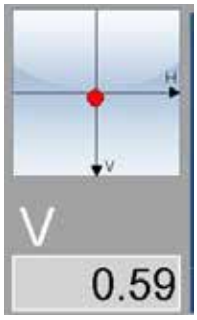
Make sure the reference points are still zero before measuring.

Note!

Adjust the laser beam to the centre of the vertical line in the target before measuring, otherwise the measurement could fail.

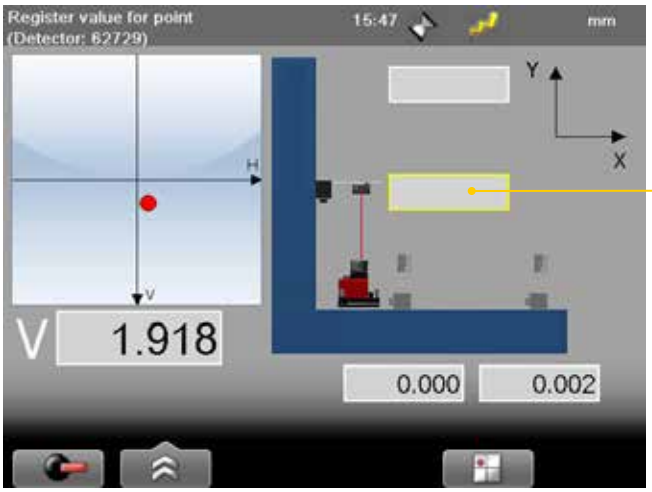


Not good



Good!

1. Place the detector close to the laser transmitter. Press to register the first position.
2. Move detector to second position and press .
3. Move detector to position three and deflect the laser beam upwards.
4. Press to register the third position.
5. Move detector to fourth position and press .



Active measurement point

Result

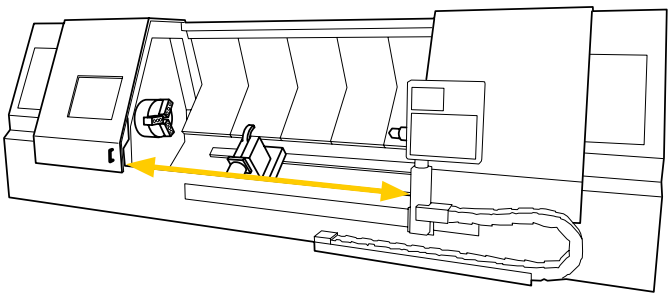
The measurement values are converted into an angular value, showing any deviation from 90° in the second object.

Selected tolerance

Values outside of the tolerance is marked with red.

Machine bed

Adjustments of a machine bed on a lathe.



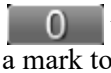
Note!

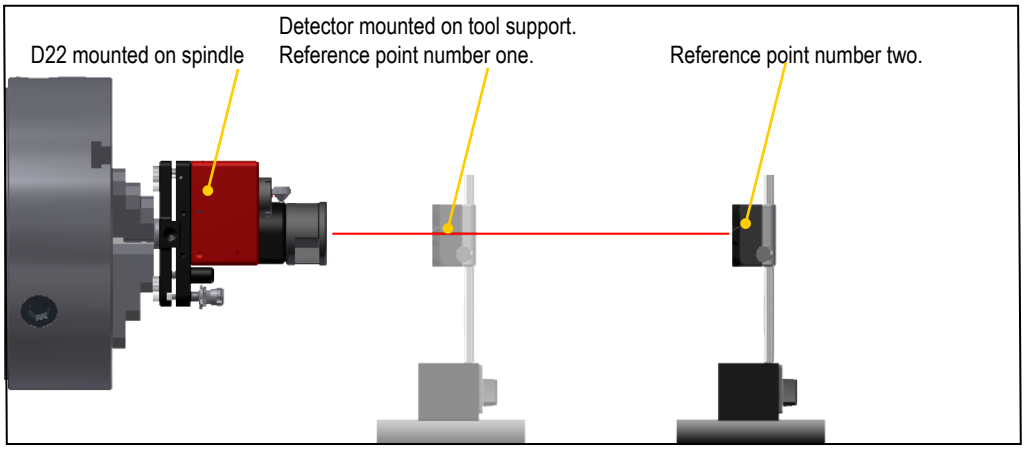
This is only possible when the spindle foundation and machine bed are separate.

Equipment to use

Laser transmitter D22 (is preferred as you have stable adjustment screws).
EMH-unit mounted on a magnet base.

Preparations

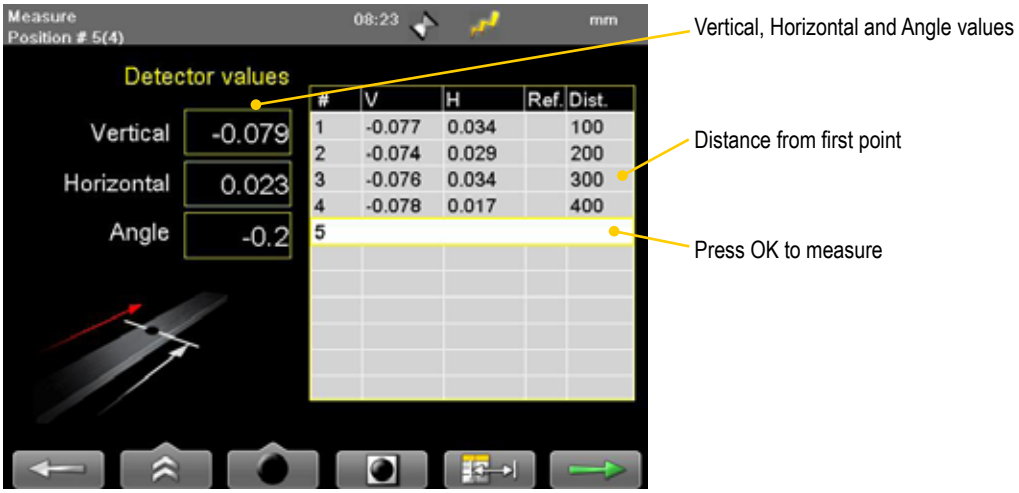
1. Mount the laser transmitter in the chuck or just on the main spindle.
2. Mount the detector on the tool support.
3. Place the detector close to the transmitter (10-20 mm).
4. Select  and  to open the program Straightness.
5. Select  and  to open the target.
6. Select  to zero set the value. This is now reference point number one. Make a mark to be able to place the detector exactly right every time.
7. Move the detector to the end of the machine bed or end of normal working area.
8. Adjust the laser beam to zero. This is now reference point number two. Make a mark.
9. Check and repeat until both reference points are zero.



Measure

Register the measurement values over the adjustable points of the machine structure. Measure all positions, adjust where necessary and remeasure.

1. Select  to open the program Straightness.
2. Press  . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.



Result

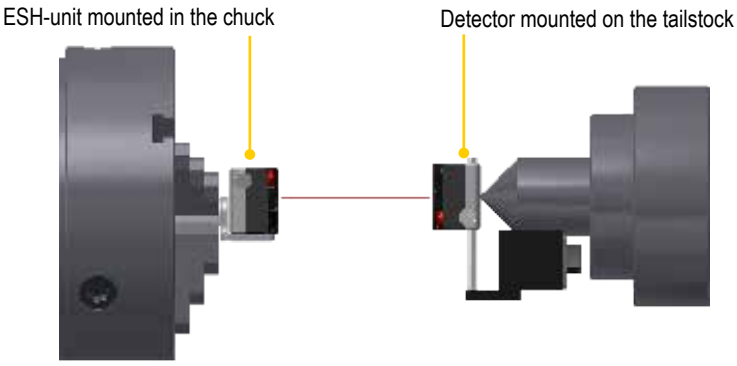
The result can be displayed as graph, table or a 3D view.

Save measurement

Save the measurement by selecting  and  . A pdf report is automatically generated.

Spindle to tail stock centre, fast check

For checking that the main spindle and the tail stock are pointing straight towards each other.



Equipment to use

Laser transmitter D22 or ESH-unit

EMH-unit mounted an offset bracket.

Preparations

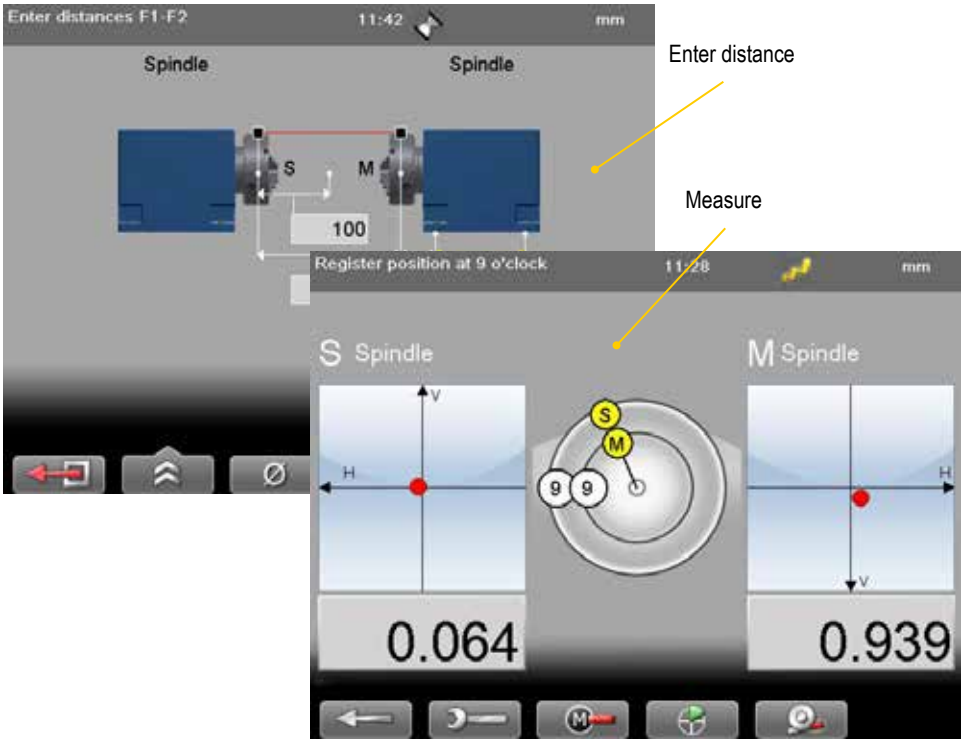
1. Mount the laser transmitter in the chuck of the main spindle.
2. Mount the detector on the tail stock.
3. Place and lock the tail stock approx. 500 mm from the spindle.

Measure, alternativ A

1. Select V 0.00 H 0.00 to open the program Values.
2. Select 0 to zero set the value.
3. Turn spindle 180º.
4. Select ½ to half the value.
5. Adjust laser beam to zero.
6. Rotate tail stock with detector or slide the brackets with detector 180º.
7. Read value. The displayed value is the angular error at that distance.
8. Adjust the main spindle to ±0.00.
9. Repeat procedure.

Measure, alternative B

1. Select  to open the program Horizontal.
2. Select machines and enter distance between the measuring units.
1. Select  to switch to 9-12-3.
2. Turn shafts to 9 o’clock.
3. Press to register first position. The first position is automatically set to zero.
4. Turn shafts to 12 o’clock.
5. Press to register second position.
6. Turn shafts to 3 o’clock.
7. Press to register third position. The Result and adjust view is displayed.

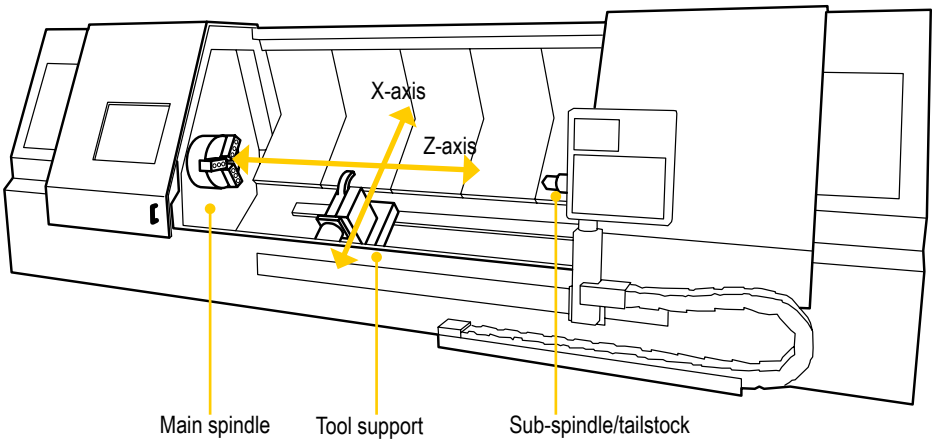


LATHE WITH TURRET

What to check

Check straightness, spindle direction, spindle to spindle, squareness and flatness. All of these can be measured with Easy-Laser®. Resolution of 0.0001 mm and a maximum measuring distance of up to 40 m.

Easy-Laser® equipment mounted on a lathe with turret.



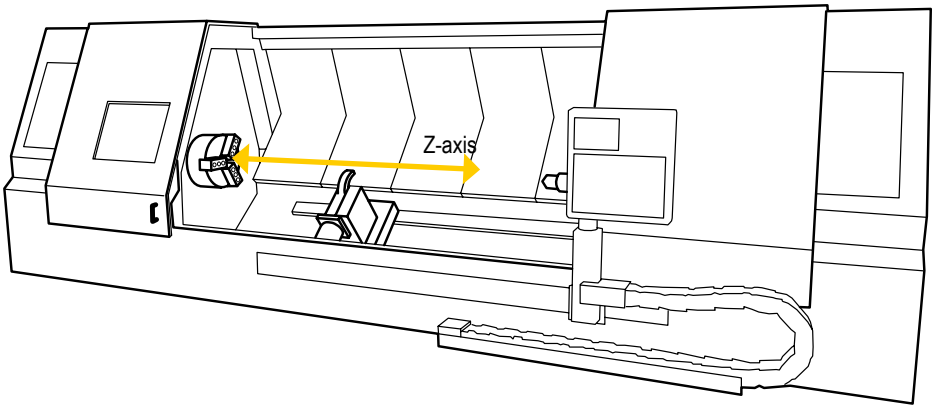
What to do first

For best result, measure and adjust the machine in the following order.

1. Straightness of all machine axis.
2. Main spindle direction.
3. Main spindle towards turret.
4. Main spindle towards sub-spindle/tail stock.
5. Squareness of Z- and X-axis.
6. Spindle bearing condition.

Straightness of Z-axis

Straightness of the turret movement in Z-axis.



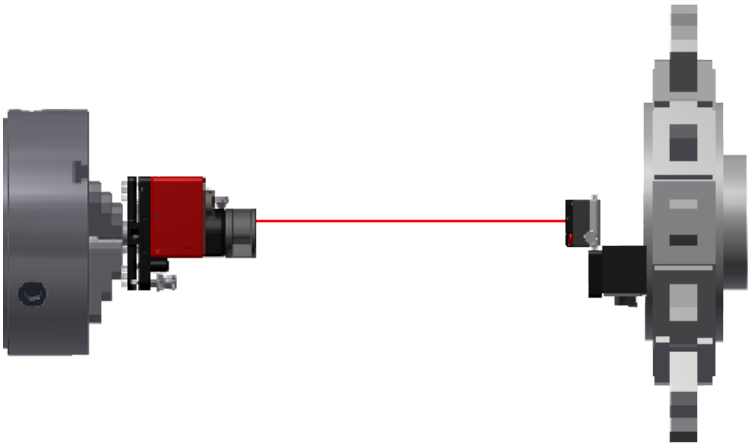
Equipment to use

Laser transmitter D22 or ESH-unit.

EMH-unit mounted on a magnet base.

Preparations

1. Mount the laser transmitter on the main spindle.
2. Mount the detector on the turret.
3. Place the turret with the detector close to the laser transmitter.
4. Select  to open the program Straightness.
5. Select  and  to open the target.
6. Select  to zero set the value. Move the detector far away from the laser transmitter.
7. Adjust the laser beam to zero (0.00), both H and V values.

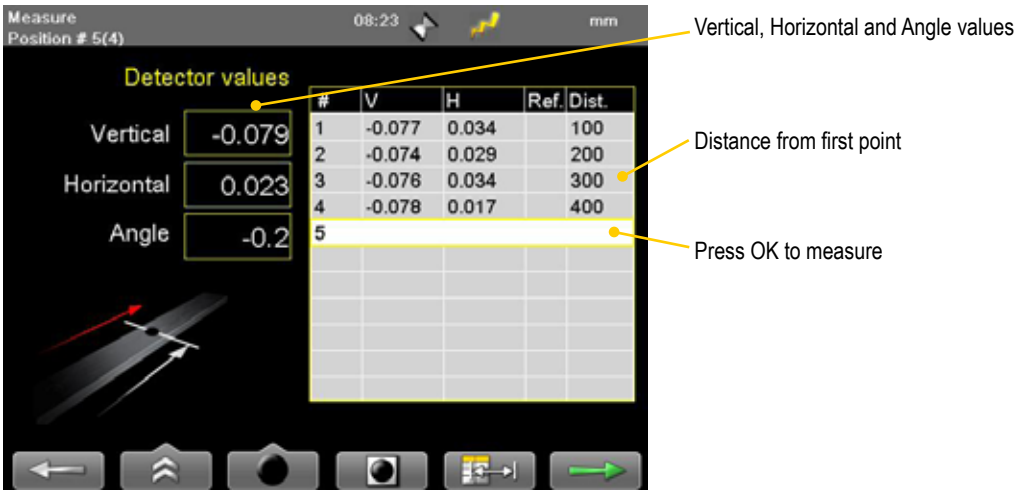


The detector can be attached to the magnet base in several different ways.
You can also use extension rods if needed.

Measure

Make sure the reference points are still zero before measuring.

1. Select  to open the program Straightness.
2. Press  . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.

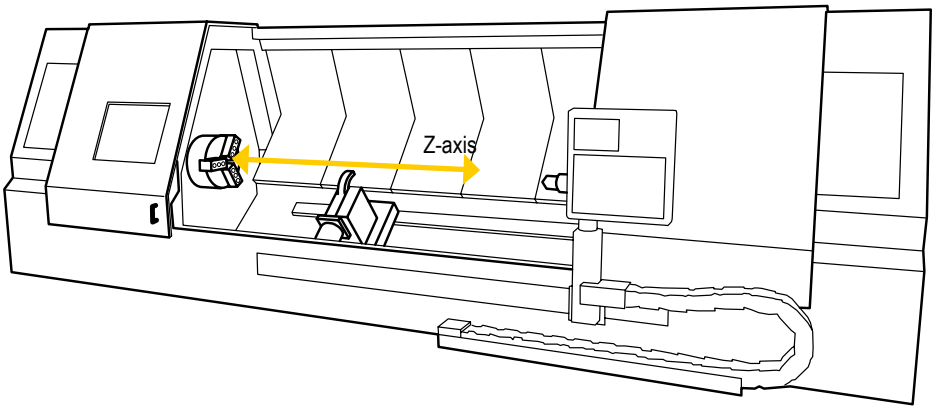


Result

The result can be displayed as graph, table or a 3D view.

Spindle direction Z-axis

Spindle direction measurement of the main spindle's Z-axis. Measurement on a lathe with turret.



Equipment to use

Laser transmitter D22 or ESH-unit (or D146).

EMH-unit mounted on a magnet base.

Note!

When using D146, we recommend a rotation speed of 1000-1500 rpm. Also make sure to use filter 10 and to have a minimum distance to the EMH unit of 100 mm.

Preparations

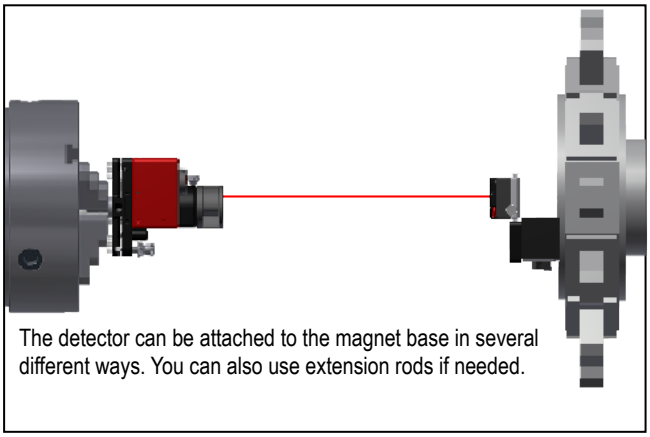
Note!

Before measuring spindle direction, make sure that the Z-movement is absolutely straight. Otherwise this measurement is useless.

1. Mount the laser transmitter in the chuck. For large machines you can mount it on the middle of the spindle.
2. Mount the detector on the turret.

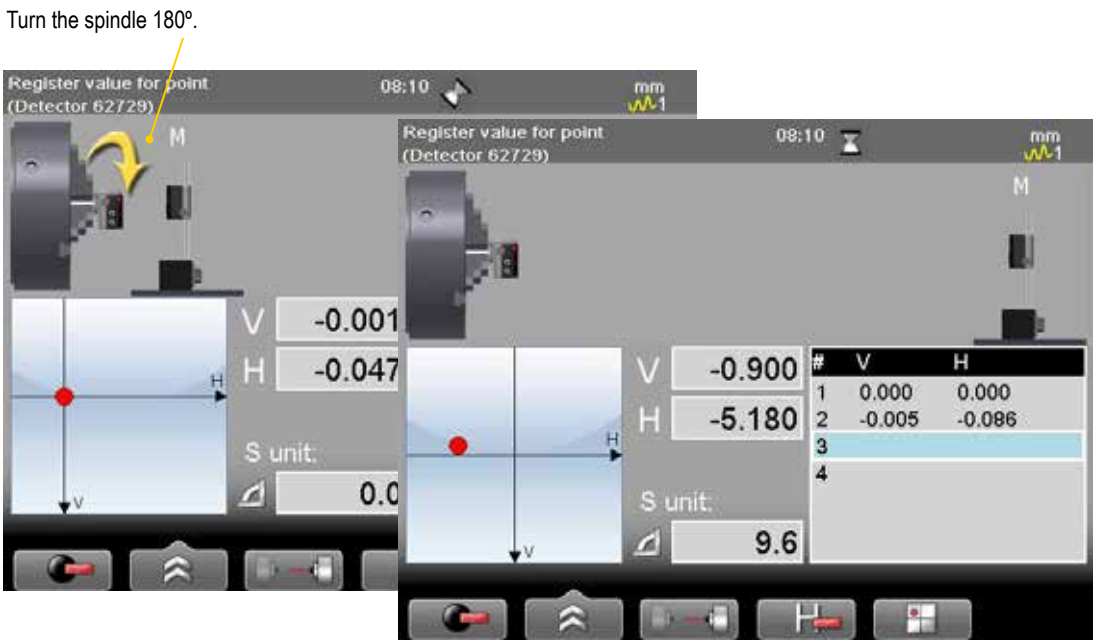
Coning the laser beam

1. Select  to open the program Spindle.
2. Select  and  to open the target.
3. Select  to zero set the value.
4. Turn the spindle 180º.
5. Select  to half the value.
6. Adjust the laser beam to zero (0.00), both H and V values.



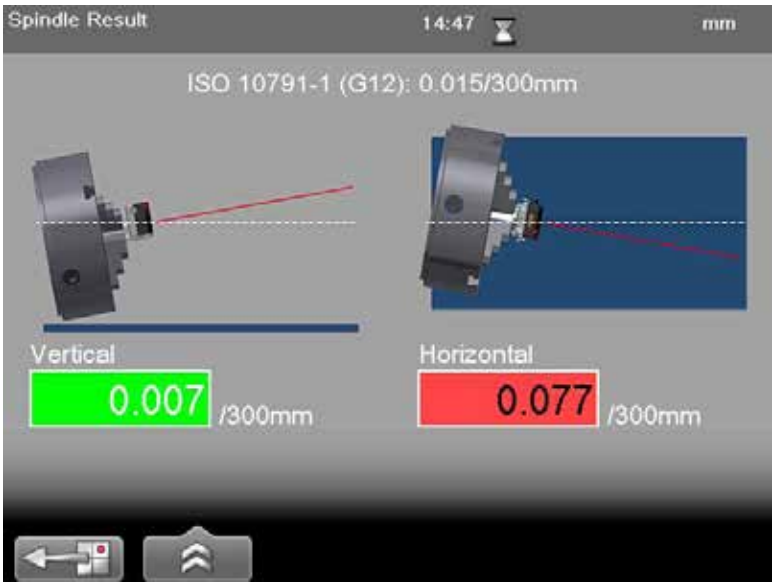
Measure

1. Place the detector close to the spindle. Press to register the first position.
2. Turn 180º and press to register the second position.
3. Move the detector far away from the spindle and press to register the third position.
4. Turn 180º and press to register the fourth position.



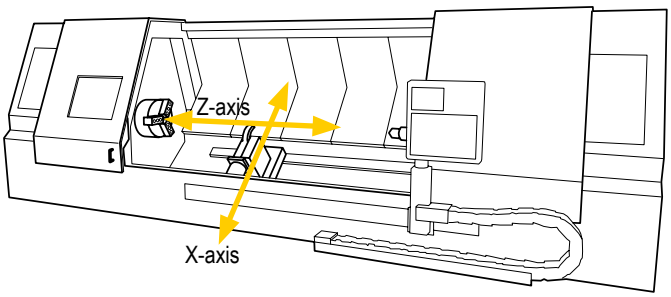
Result

Values within tolerance are green.



Straightness of turret X-axis

Straightness of the turret movement in X-axis.



Equipment to use

Laser transmitter D22.

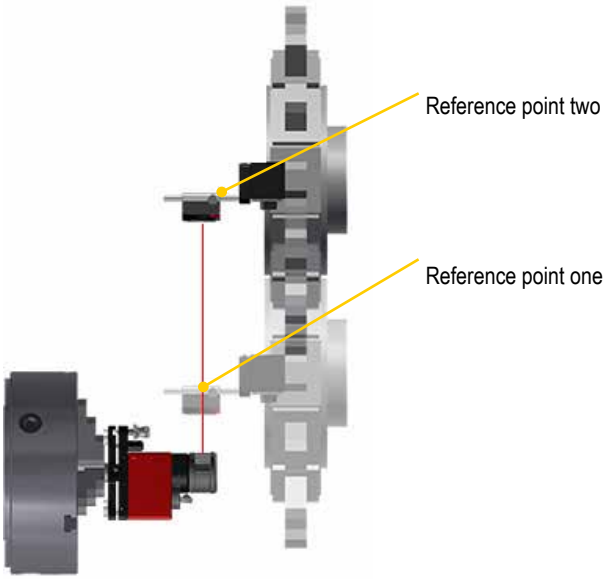
EMH-unit mounted on a magnet base.

Preparations

1. Mount the laser transmitter D22 in the chuck of the main spindle.
2. Mount the detector on the turret.
3. Place the turret with detector close to the transmitter.
4. Select 

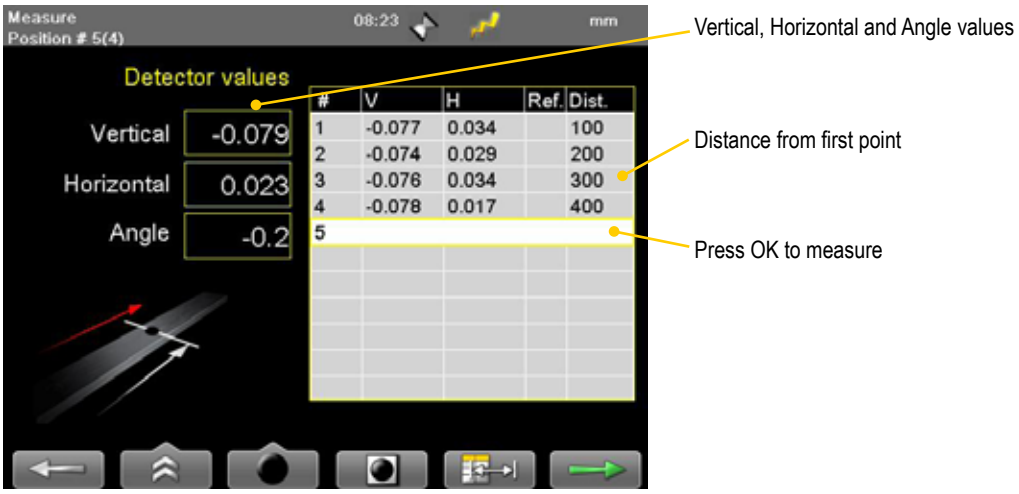
to open the program Straightness.
5. Select  and  to open the target.
6. Select 

to zero set the value and to make this reference point number one.
7. Move the turret with detector furthest away from the transmitter, to reference point number two.
8. Adjust laser beam to zero (0.00), both H and V values.



Measure

1. Select  to open the program Straightness.
2. Press . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.

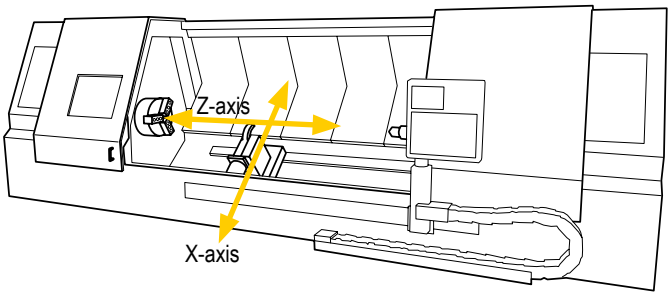


Result

The result can be displayed as graph, table or a 3D view.

Squareness of Z- and X-axis

The squareness measurements of the movements of the turret. Before proceeding with this measurement, make sure both Z- and Y- axis are straight by measuring straightness on both Z- and Y-axis.



Equipment to use

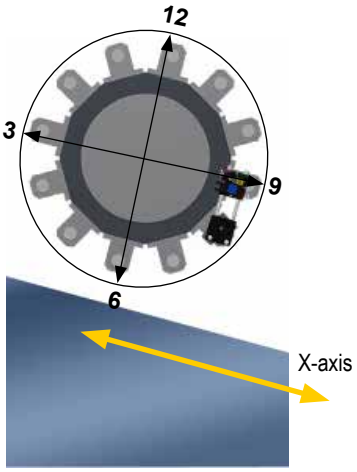
Laser transmitter D22

EMH-unit mounted on a magnet base with turnable head.

Preparations

Z-axis

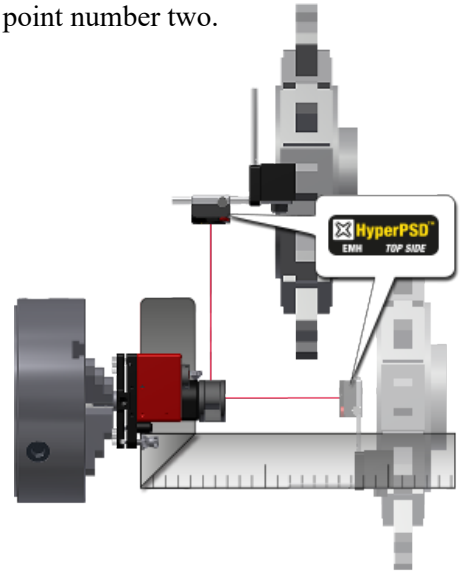
1. Mount the laser transmitter D22 in the chuck of the main spindle.
2. Mount the detector on the turret. Note the direction, see image.
3. Select V 0.00 H 0.00 to open the program Values.
4. Place the detector close to the transmitter.
5. Select 0 to zero set the value and to make this reference point number one.
6. Move the turret with detector furthest away from the transmitter.
7. Adjust the laser beam by using the tilting screws. Adjust both V and H values to 0.00 mm. This is reference point number two.



Positions corresponds to the X-axis

X-axis

1. Switch the prism 90° to show the X-axis.
2. Move the detector to the X-axis position on the rods.
3. Place the detector close to the transmitter. Select 0 to zero set the value.
4. Move 100-300mm.
5. Read value. The displayed value is the angular error at that distance.



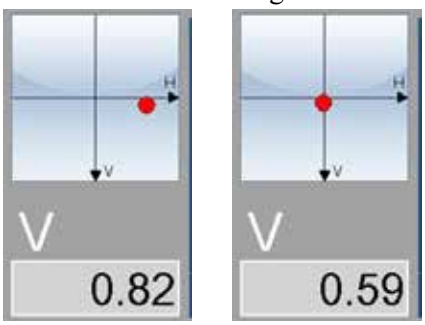
Imagine the two axis as a set square. Mount the detector with the label facing into the angle.

Measure

Make sure the reference points are still zero before measuring.

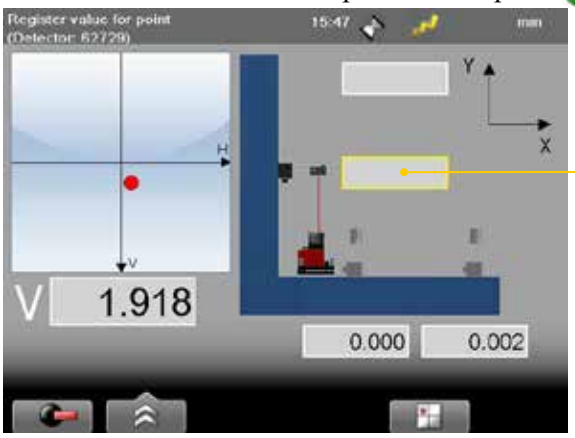
Note!

Adjust the laser beam to the centre of the vertical line in the target before measuring, otherwise the measurement could fail.



Not good Good!

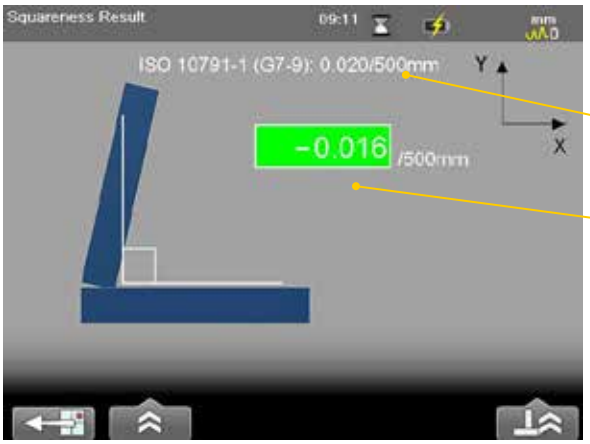
1. Place the detector close to the laser transmitter. Press to register the first position.
2. Move detector to second position and press .
3. Move detector to position three and deflect the laser beam upwards.
4. Press to register the third position.
5. Move detector to fourth position and press .



Active measurement point

Result

The measurement values are converted into an angular value, showing any deviation from 90° in the second object.

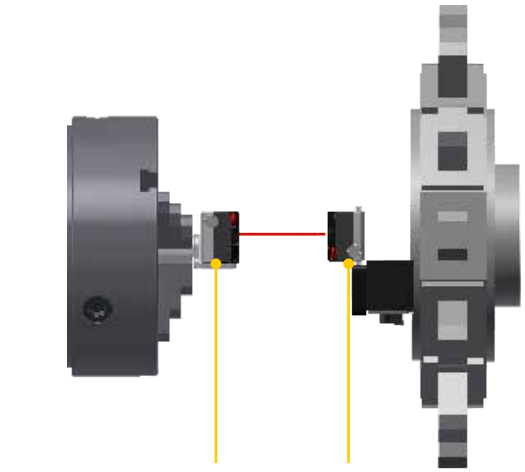


Selected tolerance

Values outside of the tolerance is marked with red.

Main spindle to turret

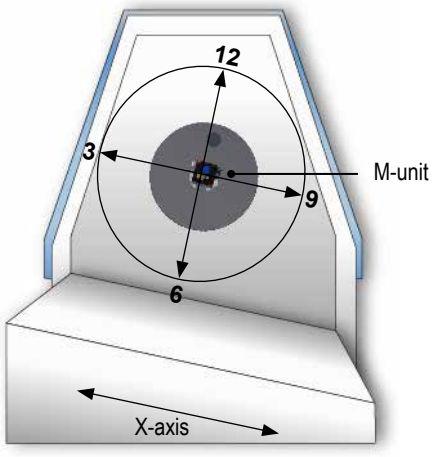
Measurement of CNC lathe with turret towards main spindle.



ESH-unit on the main spindle EMH-unit on the turret

Equipment to use

ESH-unit and EMH-unit mounted on D45 magnet base with turnable head.



Positions corresponds to the X-axis

Method one

This method is preferable, but if it impossible, try method two.

Preparations

1. Move the turret to in front of the main spindle.
2. Mount the ESH-unit on the main spindle.
3. Mount the EMH-unit roughly in the centre of the turret.
4. Place the turret close to the main spindle, approx. 500 mm.
5. Measure, see next page.

Note!

You are just interested in the angle, not the offset.

Main spindle to tools

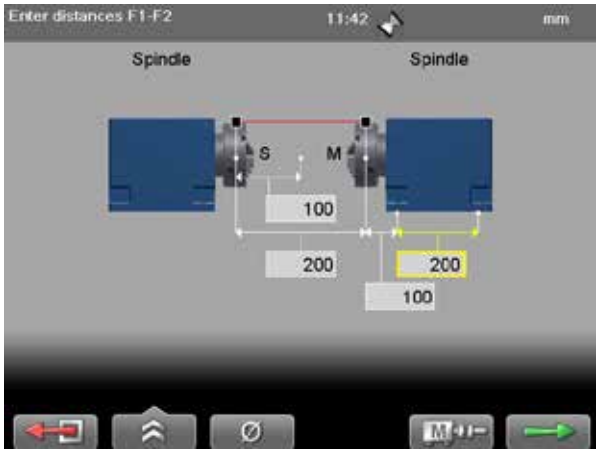
If the tools on the turret are turned towards the main spindle, you can check each tool against the main spindle.

Measure each individual tool

Measure

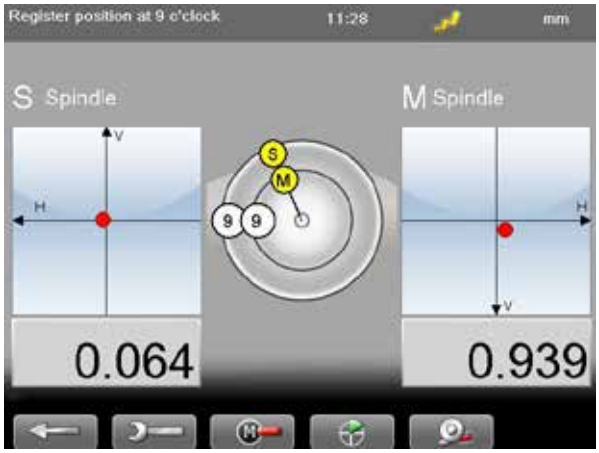
Before measuring the sub spindle/tail stock position you must make sure that the main spindle is pointing correctly.

1. Select to open the program Horizontal. Select machines.
2. Enter distances and select to continue to Measure view.

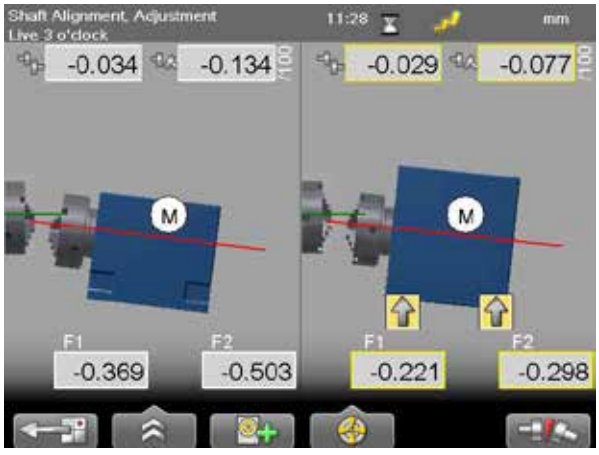


Enter distance

3. Select to switch to 9-12-3.
4. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
5. Turn shafts to 9 o'clock.
6. Press to register first position. The first position is automatically set to zero.
7. Turn shafts to 12 o'clock.
8. Press to register second position.
9. Turn shafts to 3 o'clock.
10. Press to register third position.



Measure



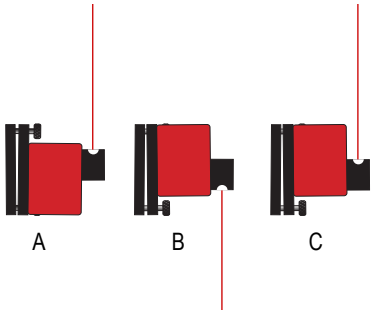
Result

Method two

Use this method if it is not possible to position main spindle and turret centre to centre.

Preparations

1. Place the turret above the main spindle.
2. Place the detector on the turret on position 6 o'clock.
3. Select V 0.00 H 0.00 to open the program Values.
4. Select 0 to zero set the value.
5. Turn the spindle 180°.
6. Turn the laser beam back towards the detector.
7. Select ½ to halve the value.
8. Adjust laser to zero (0.00) by using the tilting screws.



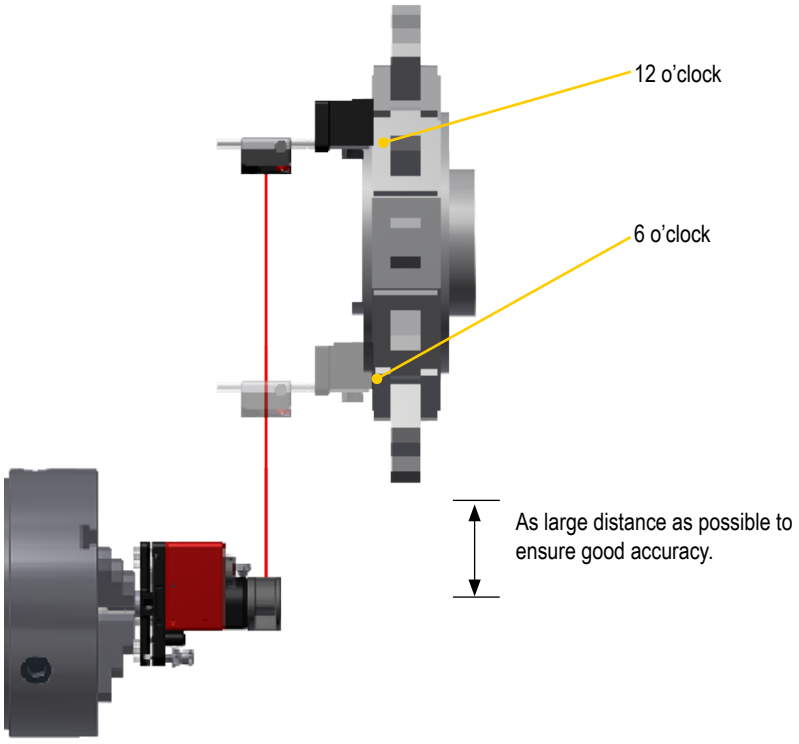
Turn spindle 180° and turn laser beam back

Measure 6 and 12 o'clock

9. Select V 0.00 H 0.00 to open the program Values.
10. Select 0 with the detector at 6 o'clock.
11. Turn the turret 180°. The detector is now in position 12 o'clock.
12. Turn detector towards the laser beam.
13. Check value.
14. Adjust turret if needed.

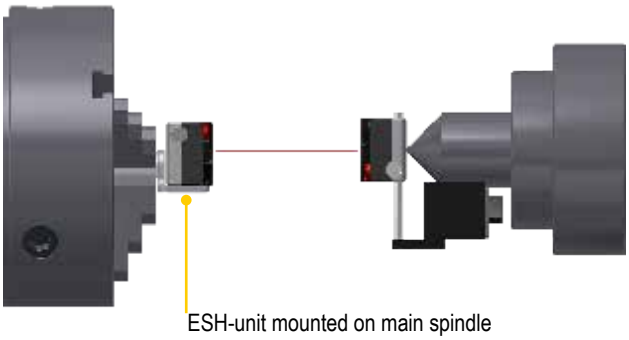
Measure 3 and 9 o'clock

15. Make the same preparations as before.
16. Select 0 with the detector at 9 o'clock.
17. Turn the turret 180°. The detector is now in position 3 o'clock.
18. Turn detector towards the laser beam.
19. Check value.
20. Adjust turret if needed.



Main spindle towards sub-spindle/tail stock

Measurement of main spindle towards the sub-spindle or tail stock.



Equipment to use

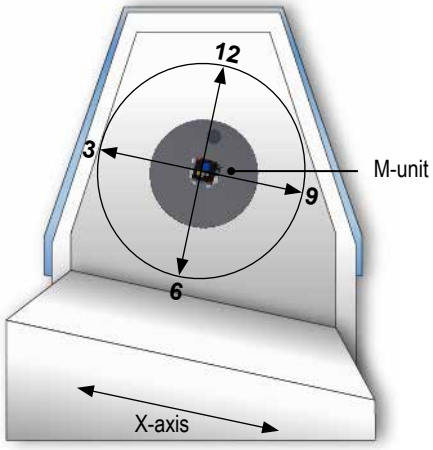
ESH-unit and EMH-unit mounted on magnet base.

Preparations

1. Mount the ESH-unit with with the spindle bracket on the main spindle.
2. Mount the EMH-unit with magnet base on the sub-spindle.
3. Place the sub-spindle close to the main spindle, approx. 500 mm.

9, 3, 12 position

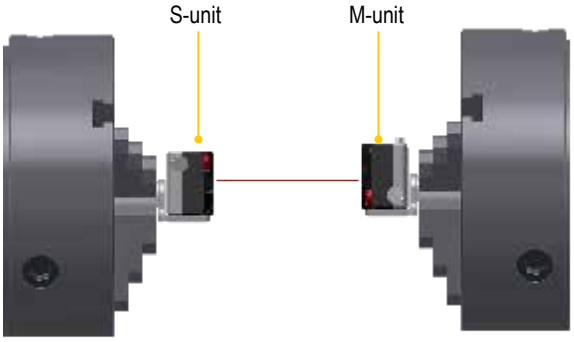
The positions 9, 3 and 12 corresponds to the X-axis, the side movement of the tool support.



Positions corresponds to the X-axis

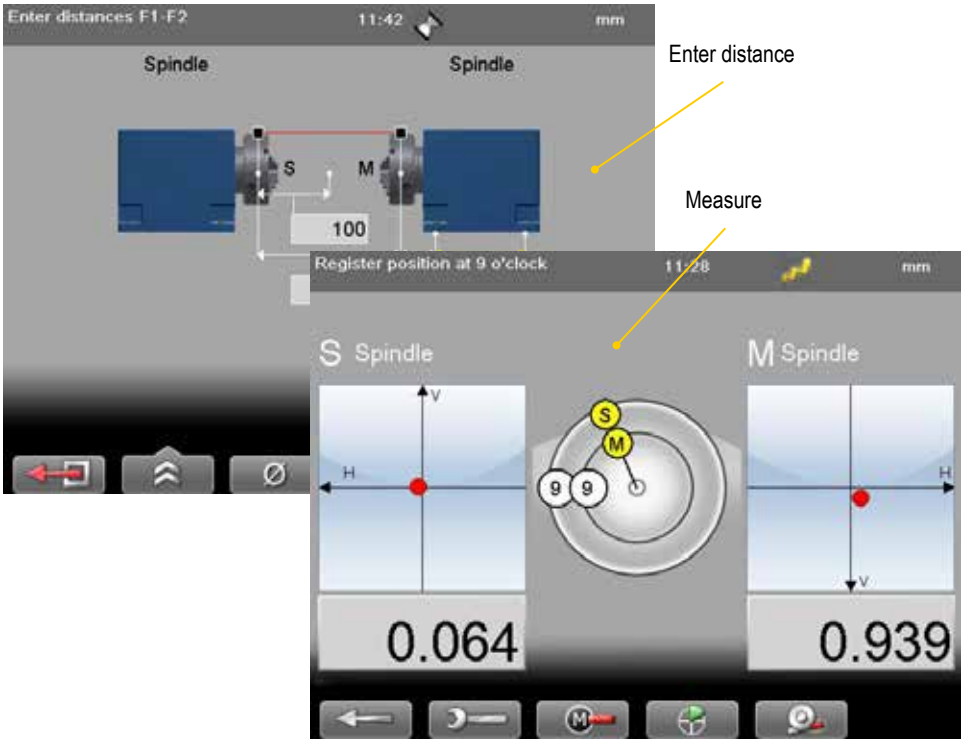
Spindle to spindle

You can use spindle brackets to mount both units.



Measure

1. Select  to open the program Horizontal.
2. Select machines and enter distance between the measuring units.
1. Select  to switch to 9-12-3.
2. Turn shafts to 9 o'clock.
3. Press  to register first position. The first position is automatically set to zero.
4. Turn shafts to 12 o'clock.
5. Press  to register second position.
6. Turn shafts to 3 o'clock.
7. Press  to register third position. The Result and adjust view is displayed.



MILLING MACHINE

What to check

Check straightness, spindle direction, squareness and flatness. All of these can be measured with Easy-Laser®. Resolution of 0.0001 mm and a maximum measuring distance of up to 40 m.

Note!

There are many different kinds of milling machines, but the principles described here are most often applicable.

What to do first

For best result, measure and adjust the machine in the following order.

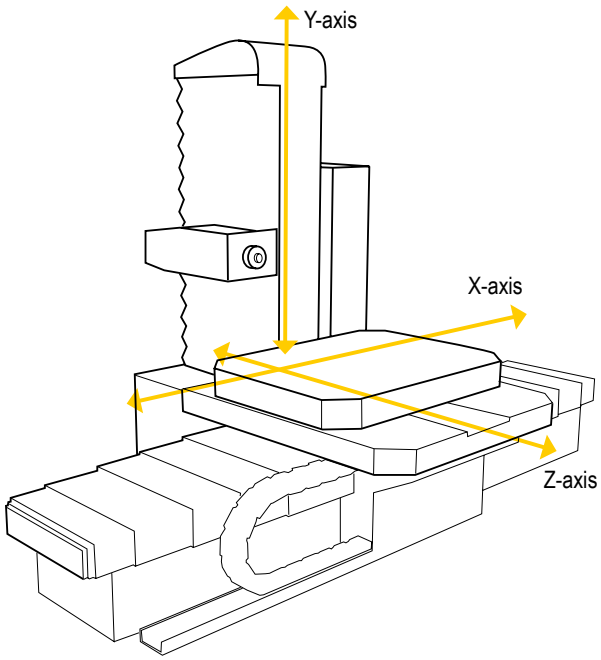
1. Straightness of all moving axis.
2. Spindle direction.
3. Flatness of the machine table.
4. Squareness measurement.
5. Spindle bearing condition.

Machine set up

1. Mount the D22 on a tripod.
2. Set the D22 to spirit level. See *"Calibrate the spirit levels on D22" on page 7.*
3. Select  to open the program Flatness.
4. Place the detector on the machine table.
5. Adjust to 0.00.
6. Register live readings over the adjustment points of the machine bed.
7. Adjust the table to 0.00
8. Select  to save the measurement.

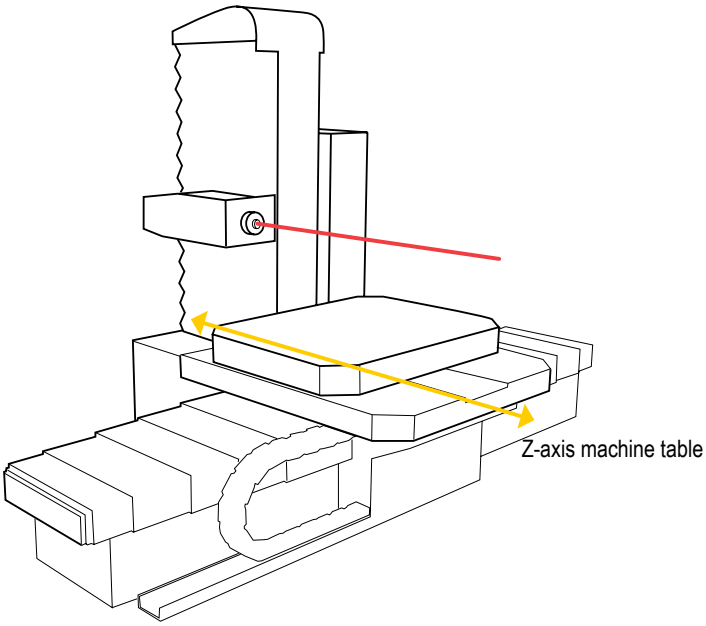
See also

"Calibrate the spirit levels on D22" on page 7



Straightness Z-axis

Measurement of the Z-axis of the machine table.

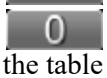


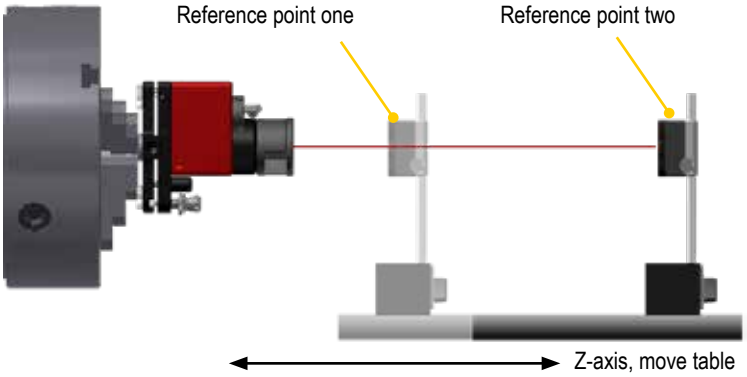
Equipment to use

Laser transmitter D22, ESH-unit or D146

EMH-unit mounted on a magnet base.

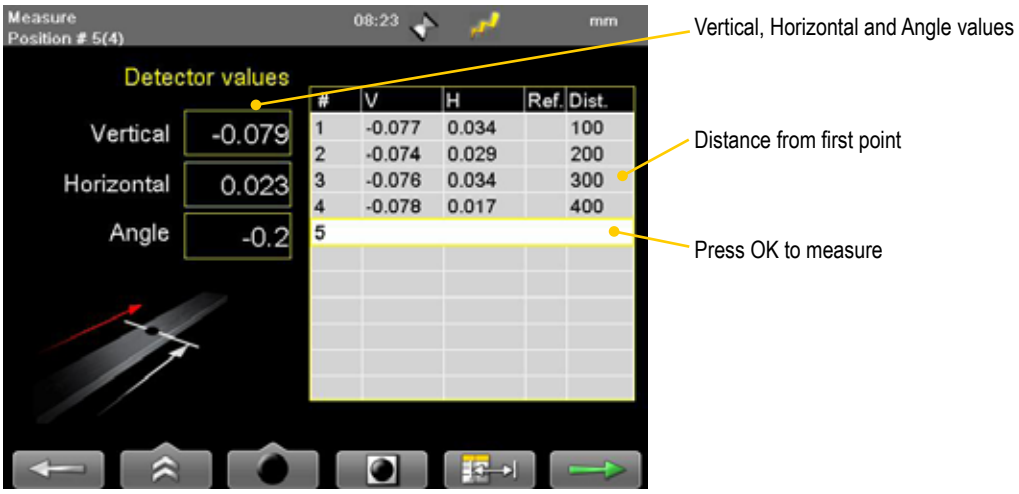
Preparations

1. Position the spindle low on the tower.
2. Mount the laser transmitter on the spindle.
3. Mount the detector on the table.
4. Select  and  to open the program Straightness.
5. Select  and  to open the target.
6. Select  to zero set the value. This is now reference point number one. Move the table with detector furthest away from the transmitter, to reference point number two.
7. Adjust laser beam to zero (0.00), both H and V values.



Measure

1. Select  to open the program Straightness.
2. Press  . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.

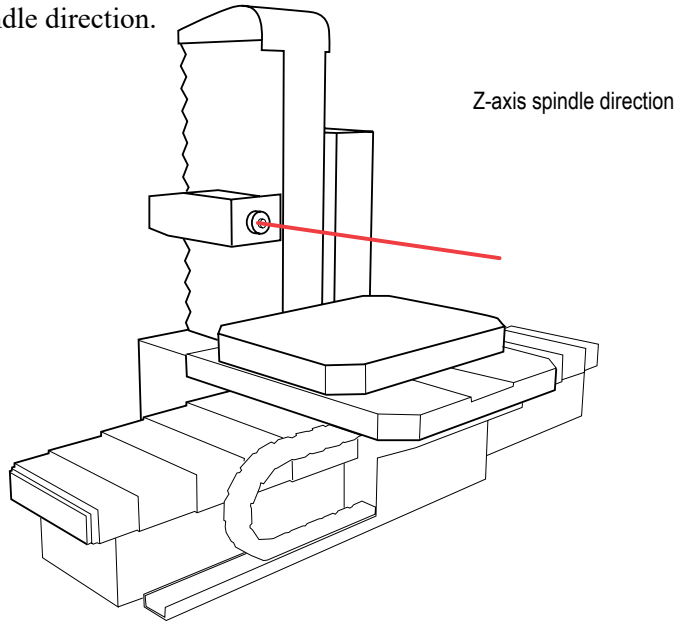


Result

The result can be displayed as graph, table or a 3D view.

Spindle direction Z-axis

Measurement of the spindle direction.



Equipment to use

Laser transmitter D22, ESH-unit or D146

EMH-unit mounted on a magnet base.

Note!

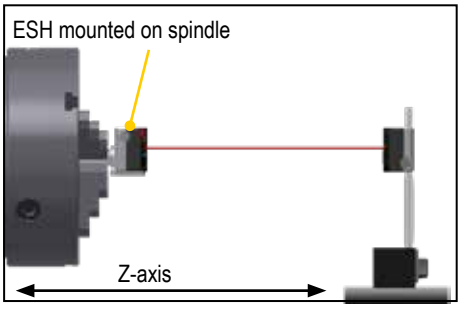
When using D146, we recommend a rotation speed of 1000-1500 rpm. Also make sure to use filter 10 and to have a minimum distance to the EMH unit of 100 mm.

Preparations

1. Mount the laser transmitter in the chuck. For large machines you can mount it on the middle of the spindle.
2. Mount the detector on the table.

Coning the laser beam

1. Select  to open the program Spindle.
2. Select  and  to open the target.
3. Select  to zero set the value.
4. Turn the spindle 180º.
5. Select  to half the value.
6. Adjust the laser beam to zero (0.00), both H and V values.

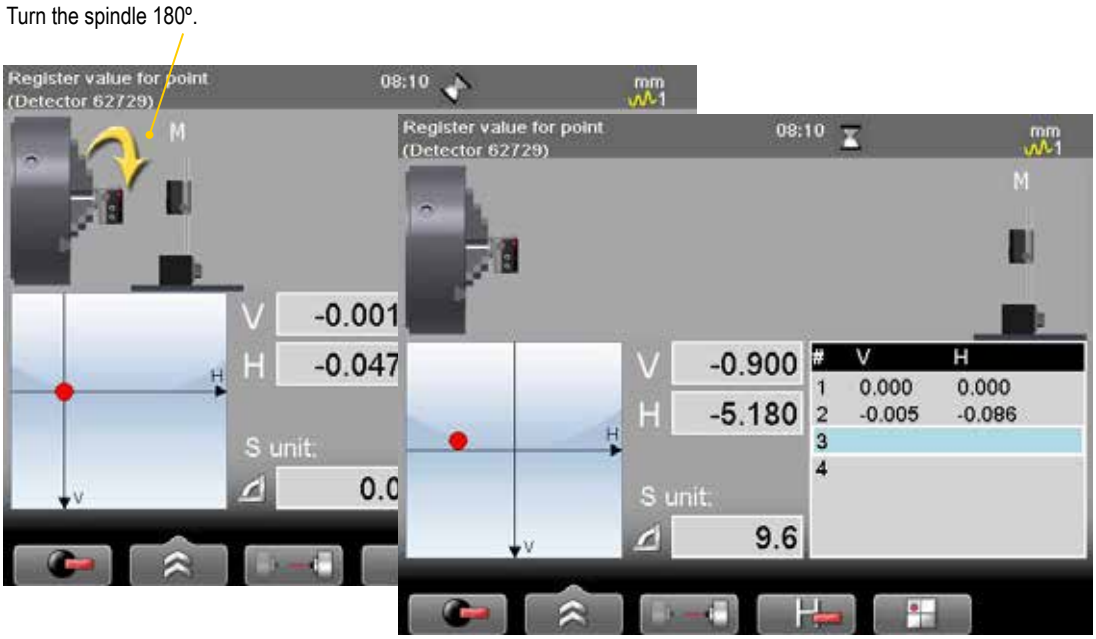


Note!

Before measuring spindle direction, make sure that the Z-movement is absolutely straight. Otherwise this measurement is useless.

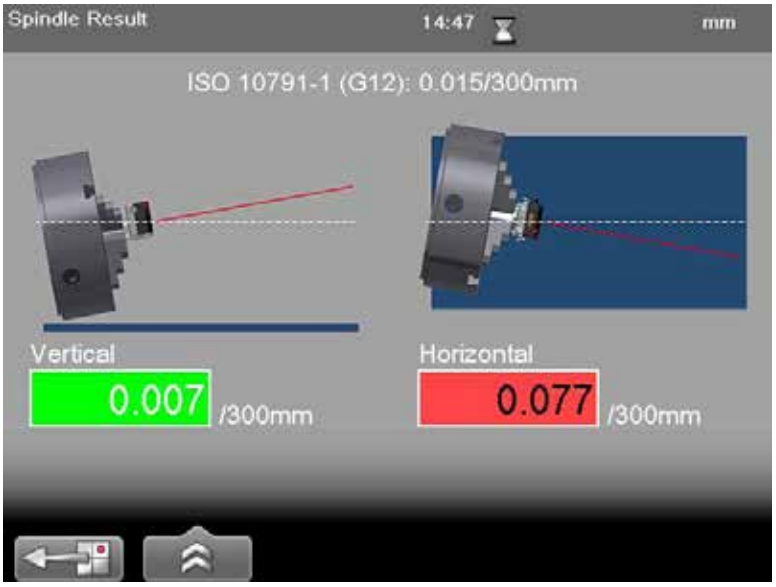
Measurement

1. Place the detector close to the spindle. Press to register the first position.
2. Turn 180º and press to register the second position.
3. Move the detector far away from the spindle and press to register the third position.
4. Turn 180º and press to register the fourth position.



Result

Values within tolerance are green.

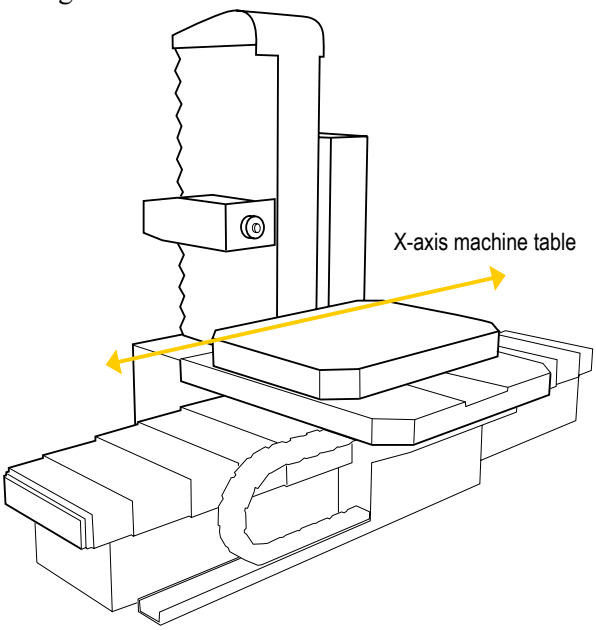


Save measurement

Save the measurement by selecting  and  . A pdf report is automatically generated.

Straightness X-axis

Straightness measurements of the machine table's movement in X-axis.



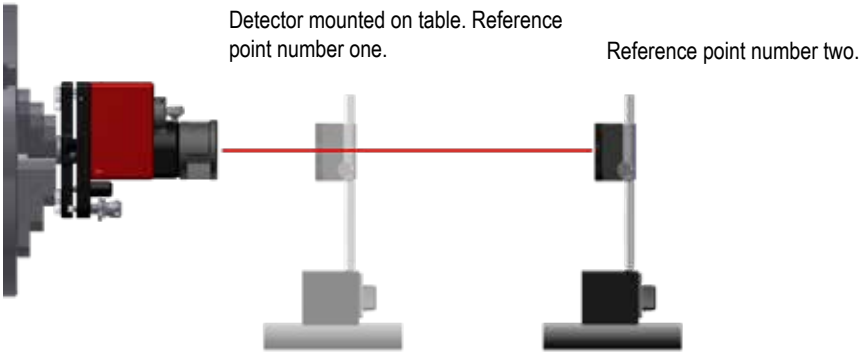
Equipment to use

Laser transmitter D22

EMH-unit mounted on a magnet base.

Preparations

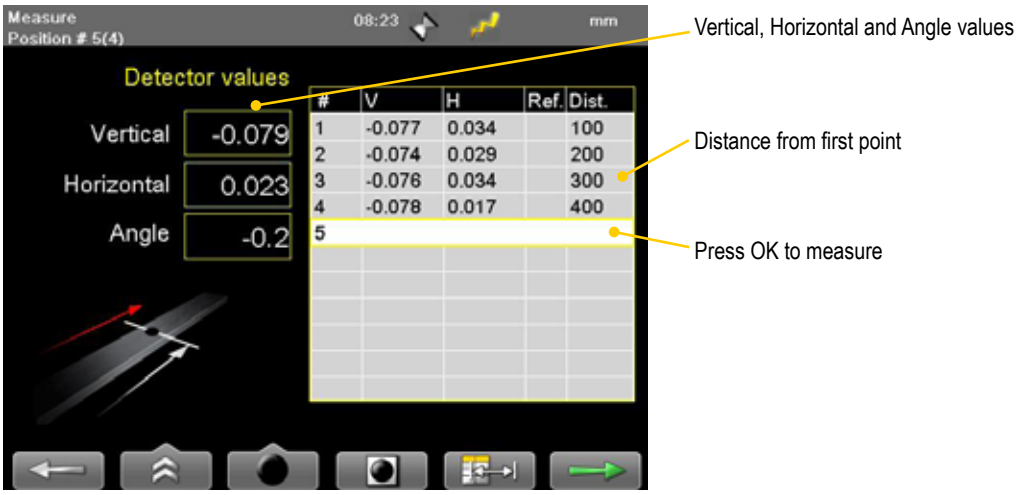
1. Mount the laser transmitter on the tower or on a tripod.
2. Mount the detector on the table.
3. Select  to open the program Straightness.
4. Select  and  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the table with detector furthest away from the transmitter, to reference point number two.
7. Adjust laser beam to zero (0.00), both H and V values.



Measure

Make sure the reference points are still zero before measuring.

1. Select  to open the program Straightness.
2. Press  . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.

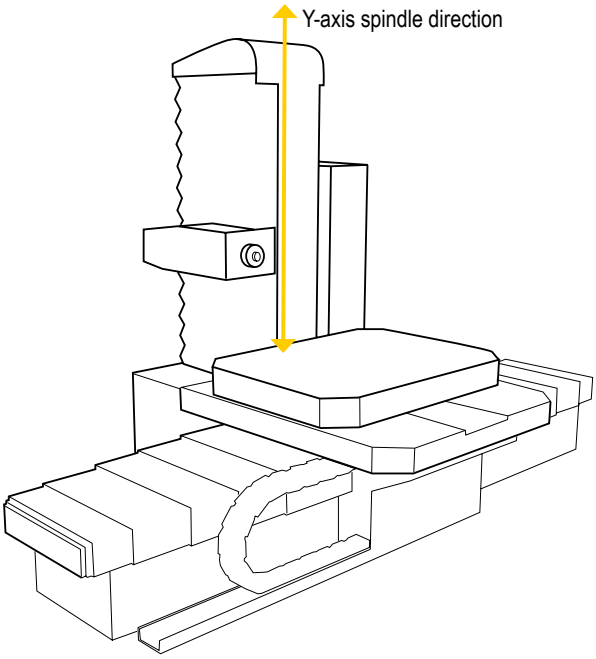


Result

The result can be displayed as graph, table or a 3D view.

Straightness Y-axis

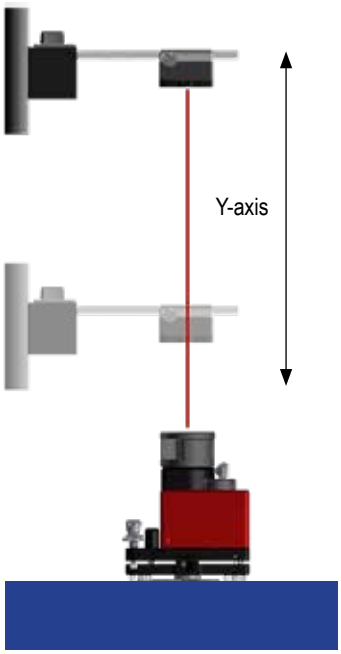
Measurement of the Y-axis of the spindle.



Equipment to use

Laser transmitter D22

EMH-unit mounted on a magnet base.



Preparations

1. Mount the laser transmitter on the table.
2. Mount the detector on the spindle.
3. Select  to open the program Straightness.
4. Select  and  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the table with detector furthest away from the transmitter, to reference point number two.
7. Adjust laser beam to zero (0.00), both H and V values.

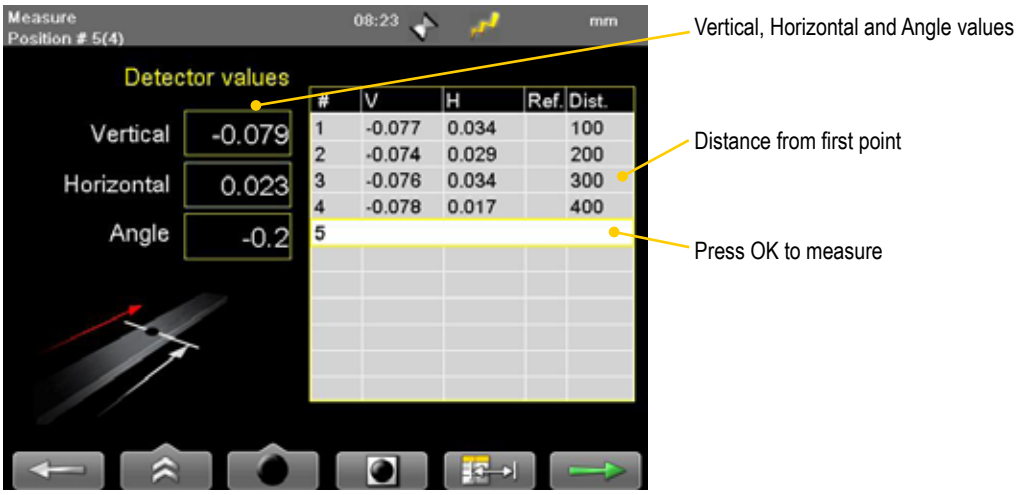
Note!

Which value that is H and V depends on how you mount the detector.

Measure

Make sure the reference points are still zero before measuring.

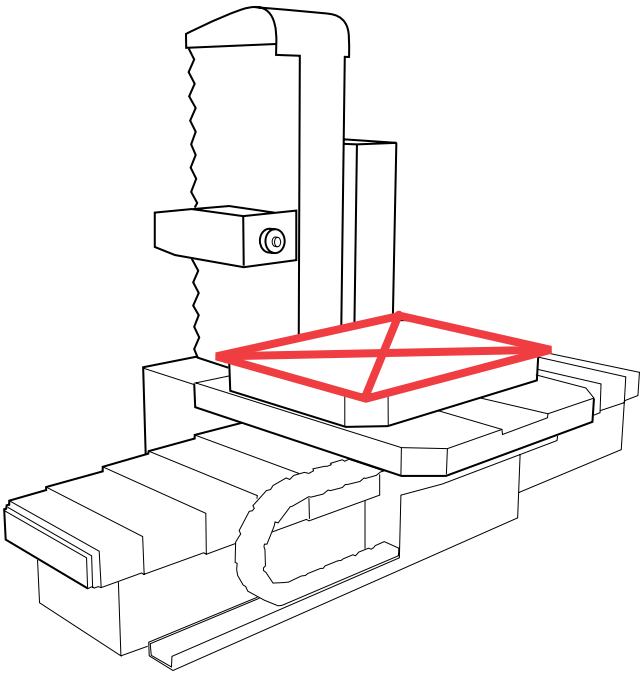
1. Select  to open the program Straightness.
2. Press  . A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
3. Press  to register a value. An hourglass is displayed while the value is registered.
4. Select  to continue to Result view.



Result

The result can be displayed as graph, table or a 3D view.

Flatness of the machine table



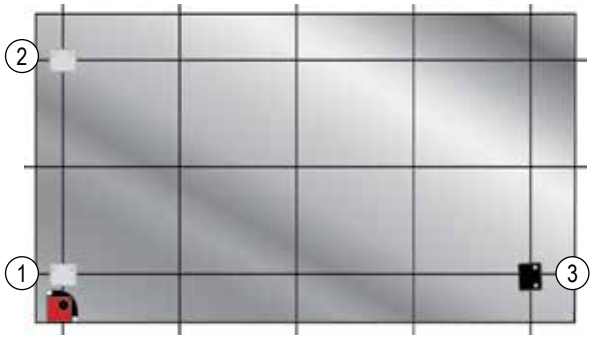
Equipment to use

Laser transmitter D22

EMH-unit mounted on a magnet base.

Preparation

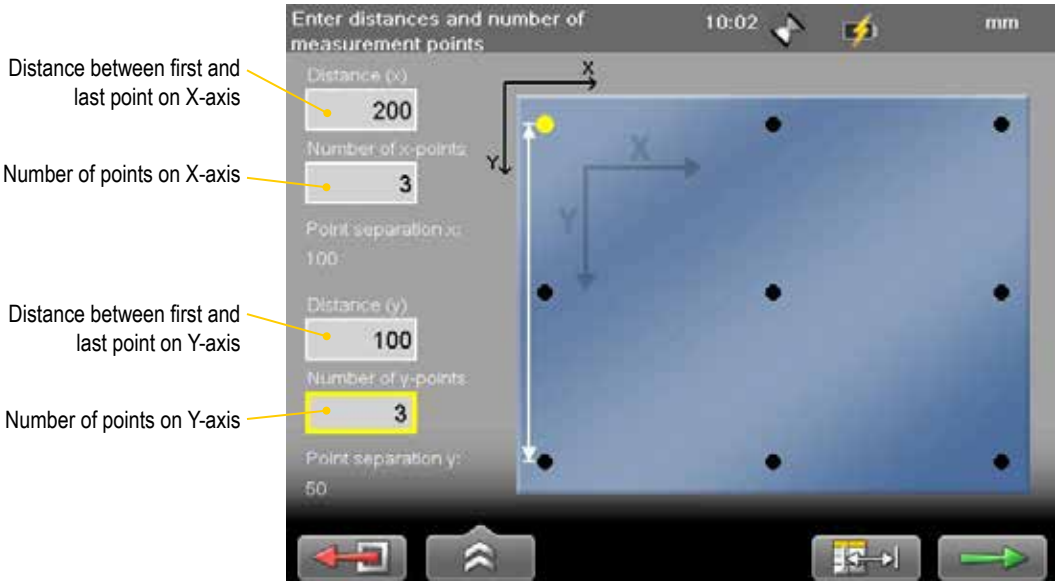
1. Mount the laser transmitter on the table.
2. Mount the detector close to the transmitter on the table.
3. Select  to open the program Flatness.
4. Select  and  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the detector to the corner of the table, to reference point number two.
7. Adjust the laser beam to zero (0.00) in V-value.
8. Move the detector to the other corner, to reference point number three.
9. Adjust the laser beam to zero (0.00) in V-value.



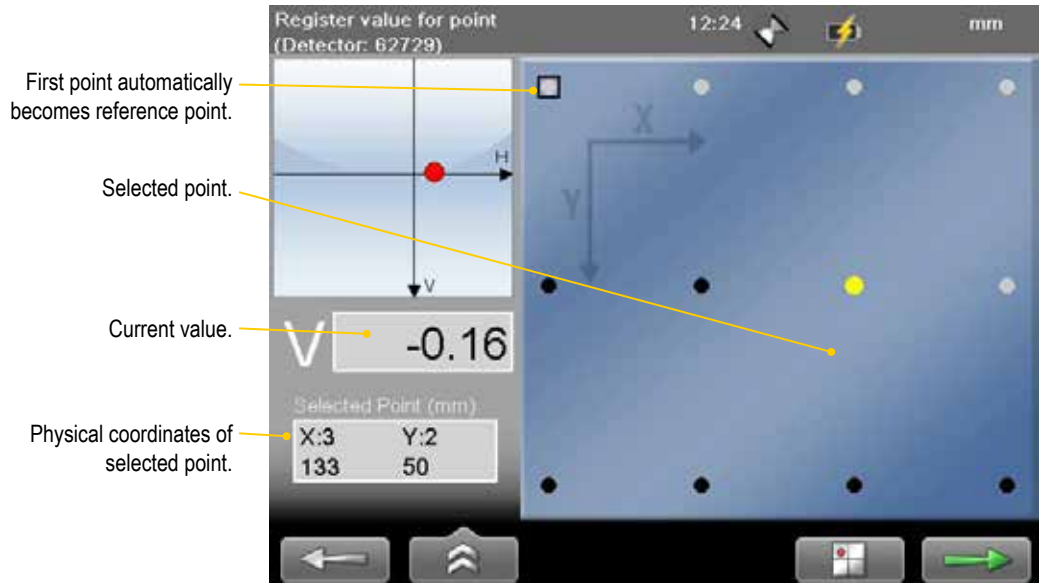
Three reference points

Measure

1. Select  to open the program Flatness.
2. Enter distances. Up to 500 measurement points can be handled.

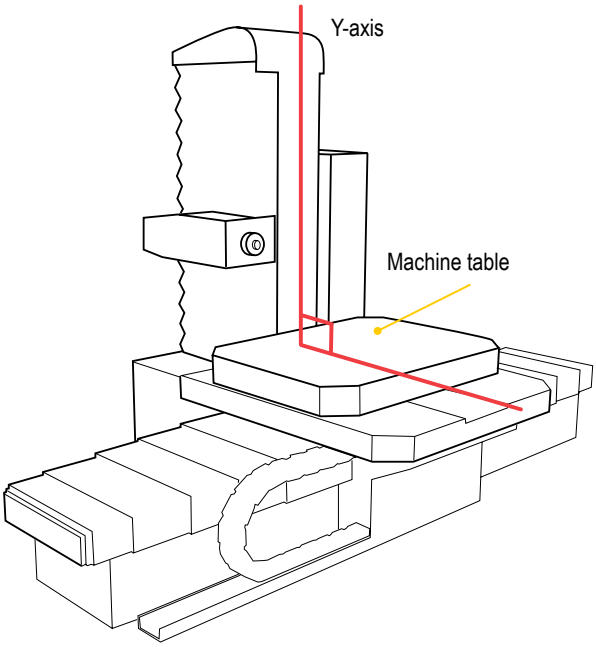


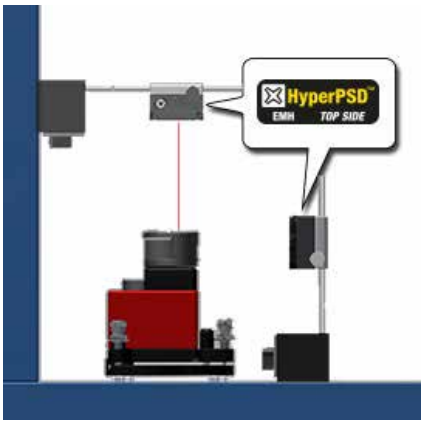
3. Press  to register values. It is possible to measure the points in any order. First measured point is set as reference point. When you have measured all points, the Result view is displayed. Select  to view the result before all points have been measured.



Squareness machine table vs Y-axis

Squareness measurement of the Y-axis movement and machine table.





Imagine the two axis as a set square.
Mount the EMH-unit with the label facing into the angle.

Equipment to use

Laser transmitter D22

Detector EMH-unit mounted on a magnet base.

Note!

Before measuring squareness, make sure that the Y-axis is straight and that the machine table is flat.

Preparations

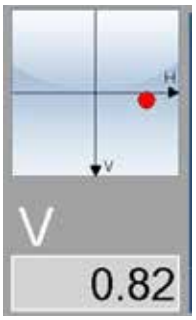
1. Mount the laser transmitter on the machine table.
2. Mount the detector on the movable table.
3. Select  to open the program Squareness.
4. Select  and  to open the target.
5. Place the detector close to the transmitter. Make a mark to be able to place the detector exactly right every time.
6. Select  to zero set the value. This is now reference point number one.
7. Move the detector furthest away from the transmitter, to reference point number two. Make a mark.
8. Adjust laser beam to zero (0.00), both H and V values.
9. Mount the detector on the spindle and move it close to the laser transmitter.
10. Select  to zero set the value. This is now reference point number three.
11. Move the spindle 500 mm to reference point number four.
12. Read value. The displayed value is the squareness error at that distance.

Measure

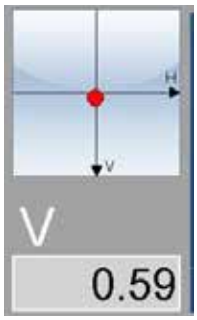
Make sure the reference points are still zero before measuring.

Note!

Adjust the laser beam to the centre of the vertical line in the target before measuring, otherwise the measurement could fail.

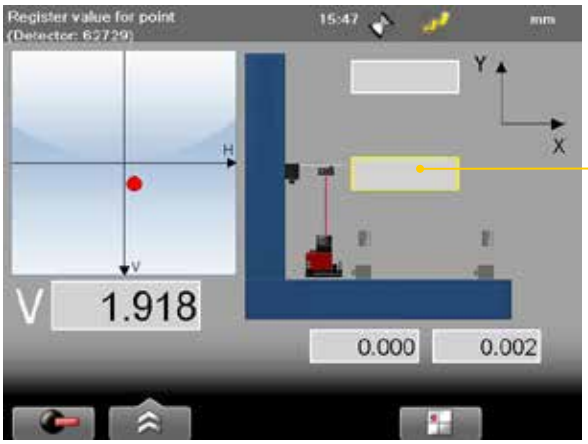


Not good



Good!

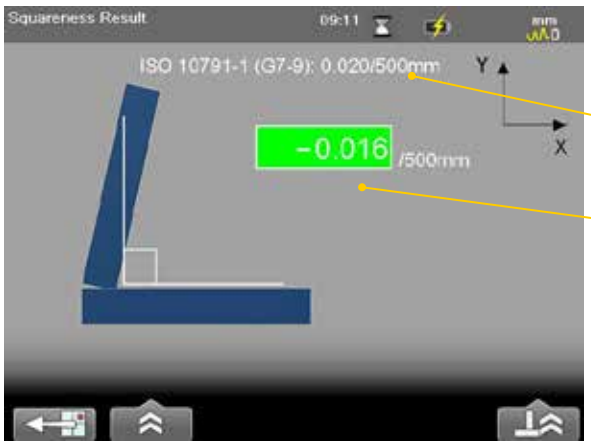
1. Place the detector close to the laser transmitter. Press ● to register the first position.
2. Move detector to second position and press ● .
3. Move detector to position three and deflect the laser beam upwards.
4. Press ● to register the third position.
5. Move detector to fourth position and press ● .



Active measurement point

Result

The measurement values are converted into an angular value, showing any deviation from 90° in the second object.

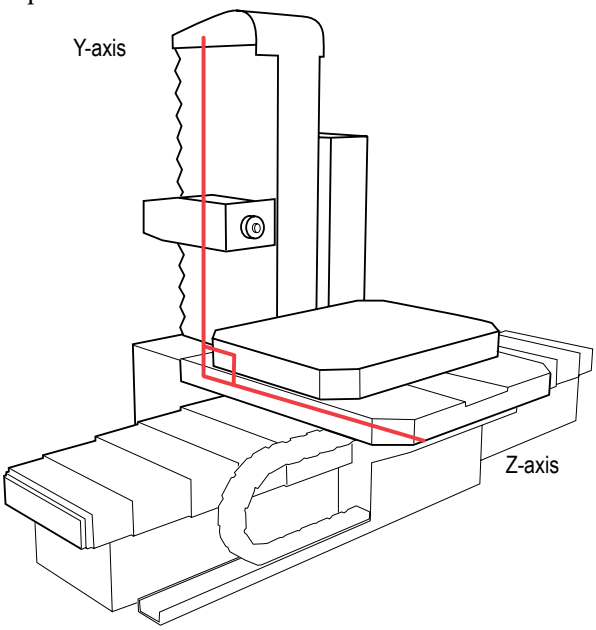


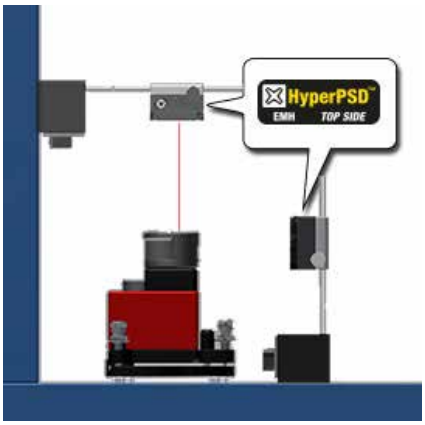
Selected tolerance

Values outside of the tolerance is marked with red.

Squareness Z-axis vs Y-axis

Squareness of the machine table movement and the Y-axis.





Imagine the two axis as a set square.
Mount the EMH-unit with the label facing into the angle.

Equipment to use

Laser transmitter D22

EMH-unit mounted on a magnet base.

Preparations

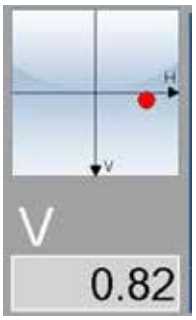
1. Mount the laser transmitter on the machine, not on the table.
2. Mount the detector on the movable table.
3. Select  to open the program Squareness.
4. Select  and  to open the target.
5. Place the detector close to the transmitter.
6. Select  to zero set the value. This is now reference point number one.
7. Move the table 1000 mm to reference point number two.
8. Adjust laser beam to zero (0.00).
9. Mount the detector on the spindle and move it close to the laser transmitter.
10. Select  to zero set the value. This is now reference point number three.
11. Move the spindle housing 500 mm to reference point number four.
12. Read value. The displayed value is the angular error at that distance.

Measure

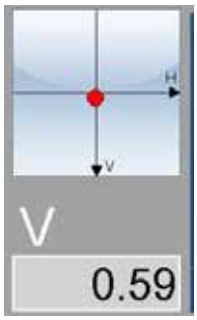
Make sure the reference points are still zero before measuring.

Note!

Adjust the laser beam to the centre of the vertical line in the target before measuring, otherwise the measurement could fail.

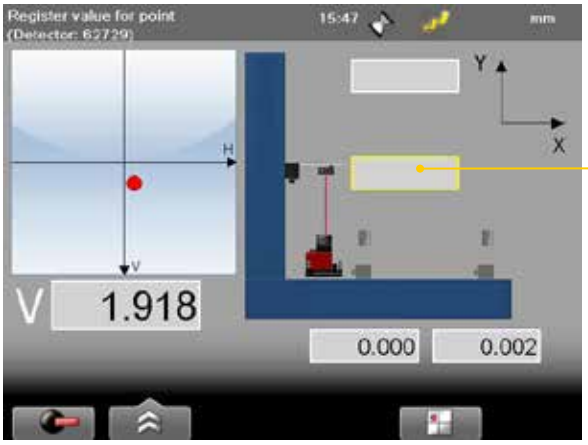


Not good



Good!

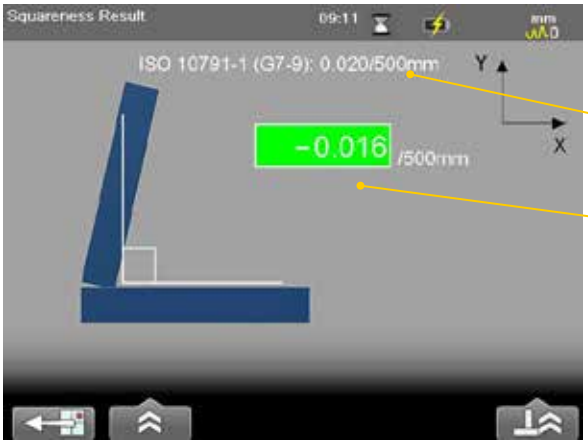
1. Place the detector close to the laser transmitter. Press ● to register the first position.
2. Move detector to second position and press ● .
3. Move detector to position three and deflect the laser beam upwards.
4. Press ● to register the third position.
5. Move detector to fourth position and press ● .



Active measurement point

Result

The measurement values are converted into an angular value, showing any deviation from 90° in the second object.

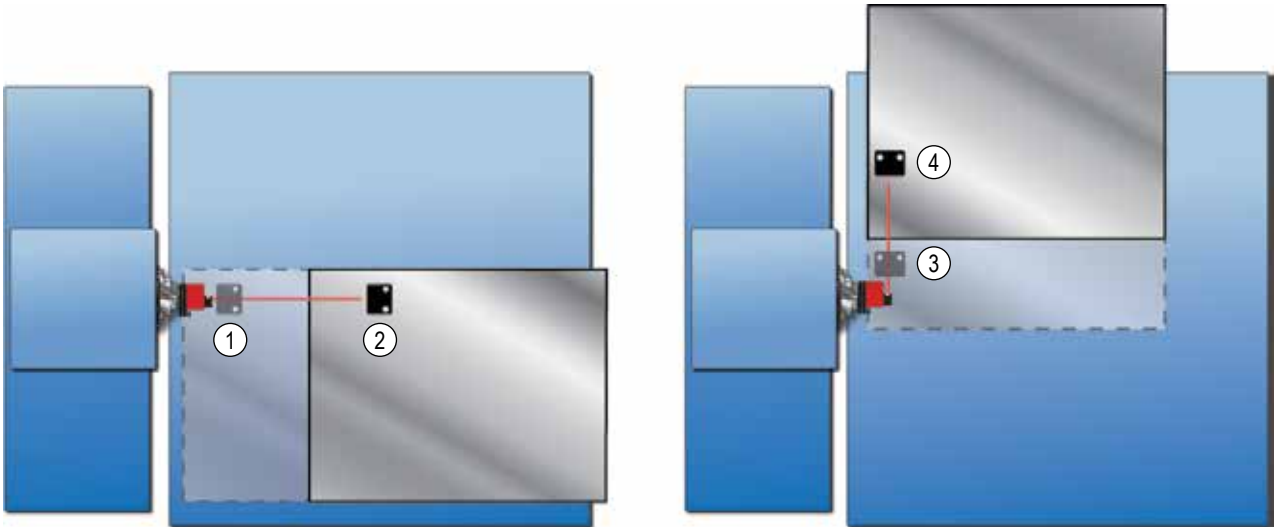


Selected tolerance

Values outside of the tolerance is marked with red.

Squareness Z-axis vs X-axis

Squareness of the machine table in the X-axis movement.



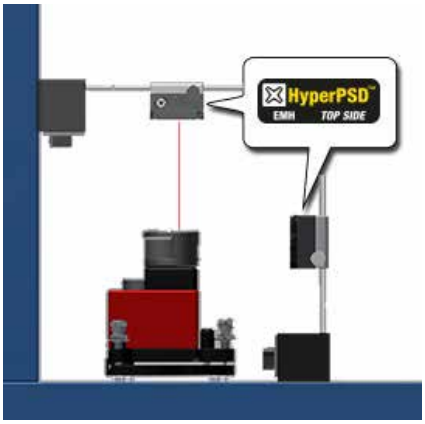
Equipment to use

Laser transmitter D22

EMH-unit mounted on a magnet base.

Preparations

1. Mount the laser transmitter on the tower.
2. Mount the detector on the table.
3. Select  to open the program Squareness.
4. Select  and  to open the target.
5. Place the detector close to the transmitter.
6. Select  to zero set the value. This is now reference point number one.
7. Move the table to reference point two.
8. Adjust laser beam to zero (0.00), both H and V values.
9. Switch laser beam 90º.
10. Select  to zero set the value. This is now reference point number three
11. Move table to reference point number four.
12. Read value at point four. The displayed value is the angular error at that distance.



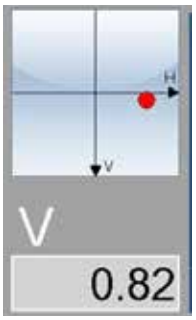
Imagine the two axis as a set square.
Mount the EMH-unit with the label facing into the angle.

Measure

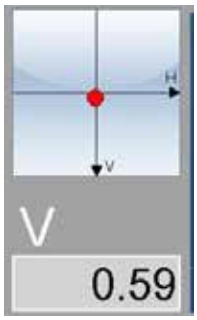
Make sure the reference points are still zero before measuring.

Note!

Adjust the laser beam to the centre of the vertical line in the target before measuring, otherwise the measurement could fail.

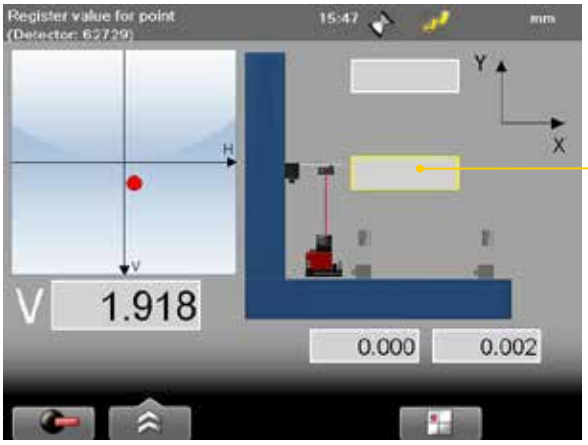


Not good



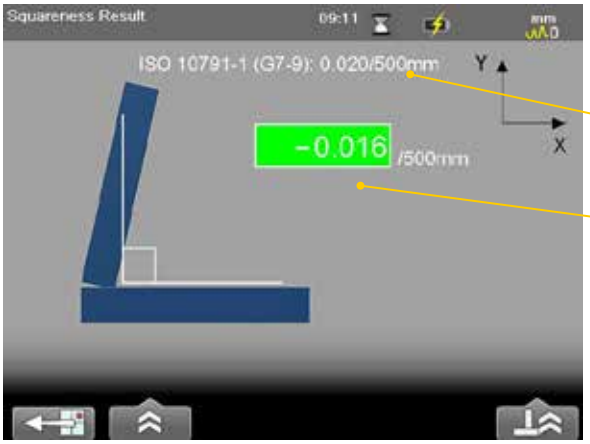
Good!

1. Place the detector close to the laser transmitter. Press ● to register the first position.
2. Move detector to second position and press ● .
3. Move detector to position three and deflect the laser beam upwards.
4. Press ● to register the third position.
5. Move detector to fourth position and press ● .



Result

The measurement values are converted into an angular value, showing any deviation from 90° in the second object.



Indexing of machine table

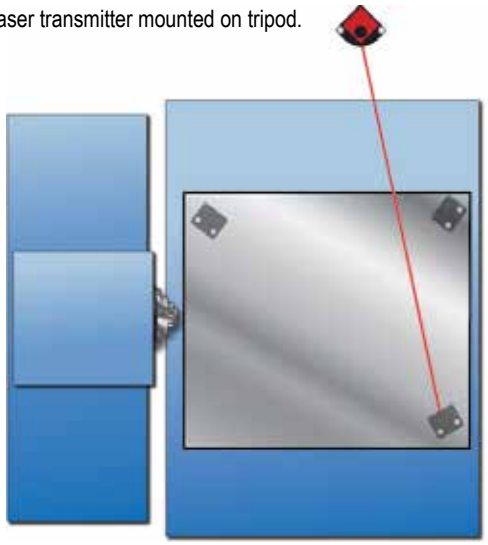
Equipment to use

Laser transmitter D22

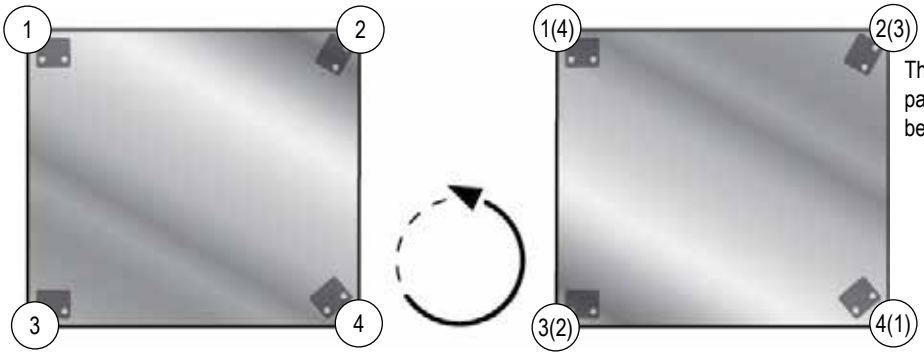
EMH-unit mounted on a magnet base.

Method one, level the laser

Laser transmitter mounted on tripod.



1. Mount the laser transmitter on a tripod.
2. Select V 0.00 H 0.00 to open the program Values.
3. Place the detector on measurement point 1, see image below.
4. Select 0.
5. Place the detector on measurement point 2 and write down the value displayed.
6. Place the detector on measurement point 3 and write down the value displayed.
7. Turn the table 180º.

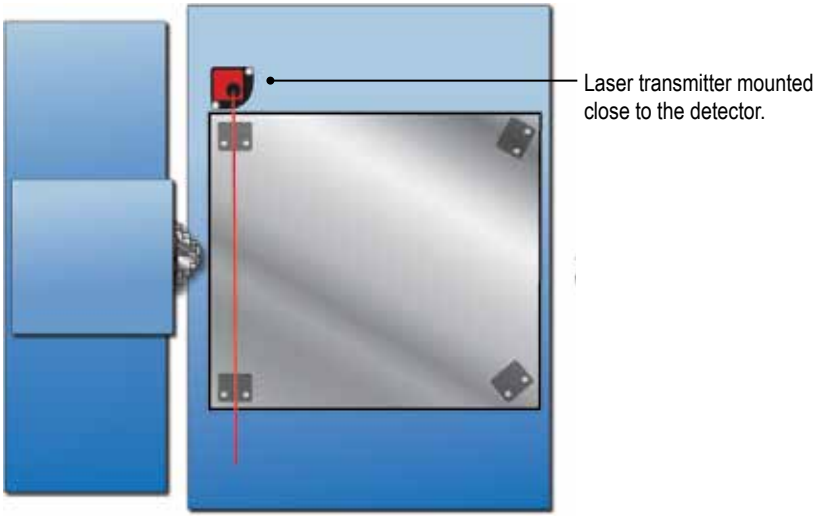


Turn the table 180º.

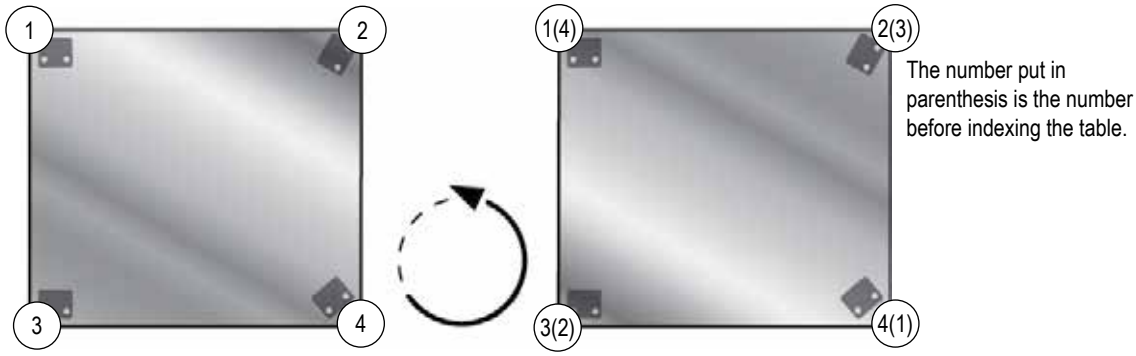
8. Position the detector on point 1(4) and select 0.
9. Compare the values on position 2 and 2(3).
10. Compare the values on position 4 and 4(1).

Method two

In this method the laser transmitter is placed on the machine.



1. Mount the laser transmitter close to the detector, see image above.
2. Select V 0.00 H 0.00 to open the program Values.
3. Place the detector on measurement point 1, see image below.
4. Select 0.
5. Place the detector on measurement point 2 and adjust laserbeam to 0.00mm.
6. Place the detector on measurement point 3 and adjust laserbeam to 0.00mm.
7. Read the value on measurement point 4.
8. Turn the table 180º.



9. Position the detector on point 1(4). The number put in parenthesis is the number before indexing the table.
10. Select 0.
11. Check value on position 2(3) and 4(1).

1. Select V 0.00 H 0.00 to open the program Values.
2. Mount the M-unit using the bar bracket on a piece of bar over the rear support of the bar feeder.

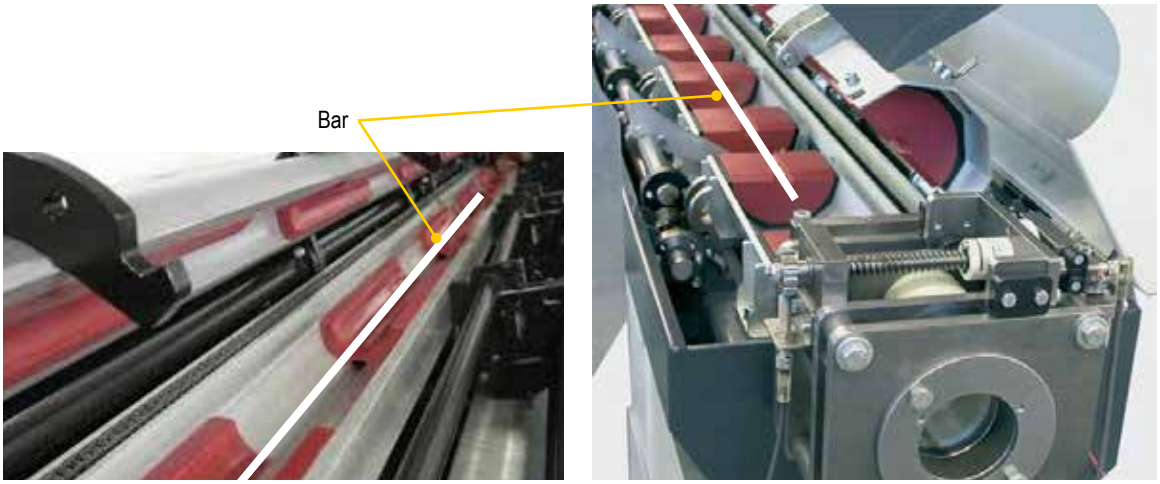
Rough setting

Cone the laser beam of the S-unit.

Mount the S-unit in the spindle using the spindle bracket with the laser beam going through the spindle, pointing against the rear of the bar feeder.

1. Place a piece of paper in front of the detector.
2. Make a mark where the laser beam hits the paper.
3. Turn the laser 180º.
4. Make a mark where the laser beam hits the paper.
5. Adjust the laser beam to the centre between the two marks. Use the adjustment screws on the laser.
6. Turn the shaft again. If the laser beam does not move when you turn, the laser beam is correctly coned.

S-unit mounted on the spindle bracket.



Adjust the bar feeder

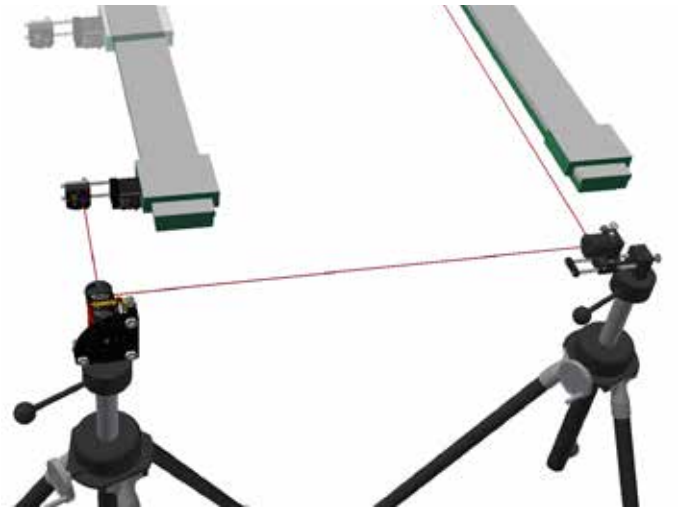
Do the same using the M-unit as detector following the steps below:

7. Select 0 and rotate the spindle 180°.
8. Select ½ to half the value.
9. Adjust the laser beam to zero (0.00), both H and V values.
10. Rotate the bar 180°.
11. Adjust the support leg of the bar feeder both V and H until you are close to 0.00mm.
12. Move bar to front support.
13. Select 0 and rotate the spindle 180°.
14. Select ½ and adjust to 0.00mm both V and H.
15. Rotate the bar 180°.
16. Adjust the support leg of the bar feeder both V and H until you are close to 0.00mm.
17. Check again the rear and front position.

M-unit mounted on bar bracket (art. no 12-0988)

PARALLELISM OF MACHINE GUIDES

Check guides for straightness, if good continue with parallelism preparations.



The two objects are far apart

Preparations

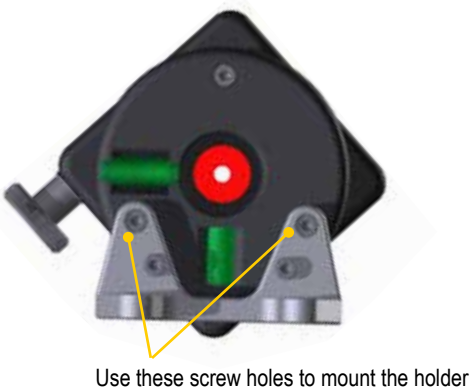
1. Adjust the laser beam parallel to guide 1 in both ends, side way measurements, within 0.05mm
2. Set the prism at the same height as the laser transmitter, using a measuring tape.

Mount the holder

The holder makes it possible to mount a measuring unit in front of the Angular prism D46.

1. Remove the rods.
2. Mount the holder on the front of the Angular prism D46. Note which holes to use on the Angular prism, see image.
3. Mount the detector on the rods.

Holder for measuring unit



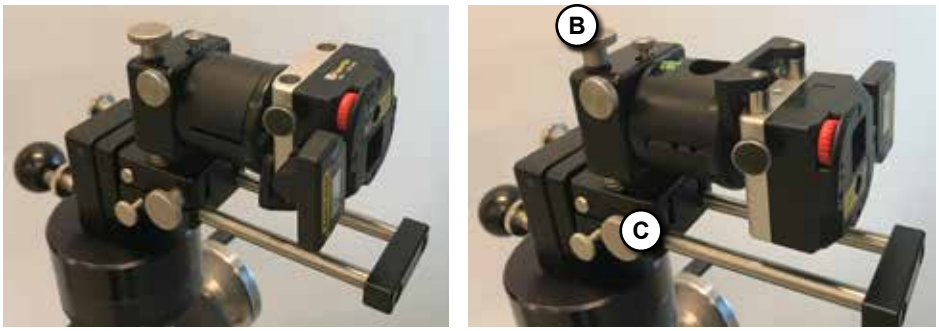
Use these screw holes to mount the holder

Position 1

Select V 0.00 H 0.00 to start the program Values.

Adjust the prism to the laser beam.

1. Slide the prism **close** to the tilting plate.
2. Lock the prism, to keep the distance stable towards the laser beam.
3. Select 0 to zero set the value.
4. Turn the prism 180º.
5. Select ½ to half the value.
6. Adjust the offset to zero (0.00), both H and V values. Adjust the prism by using the knobs B and C.

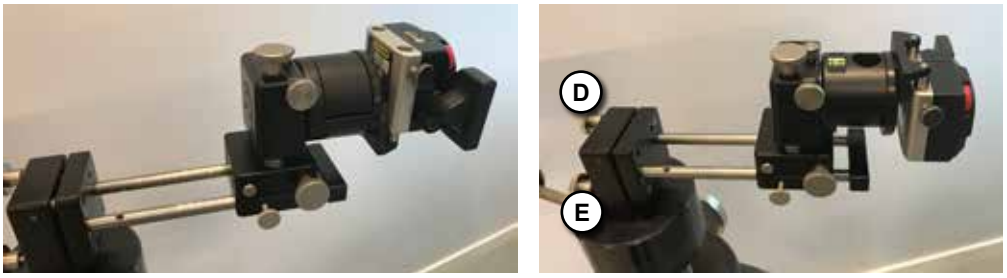


Turn the prism 180º and adjust the offset

Position 2

Adjust the prism

1. Slide the prism **away** from the tilting plate.
2. Highlight the target and select 0.
3. Turn the prism/detector 180º.
4. Select ½ to half the value.
5. Adjust the angle to zero (0.00) by moving the screws D and E. Adjust both H and V values.
6. Check position 1 and position 2 again.

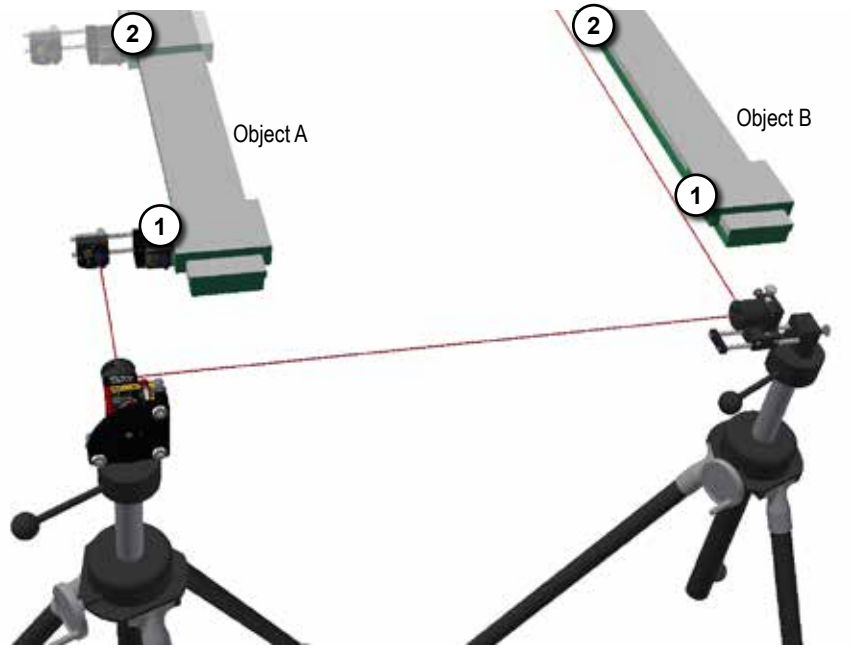


Turn the prism 180º and adjust the angle

Now you are ready to start the measurement using the software.

Measure

Select  to start the program Parallelism A. Measure two positions on each object.



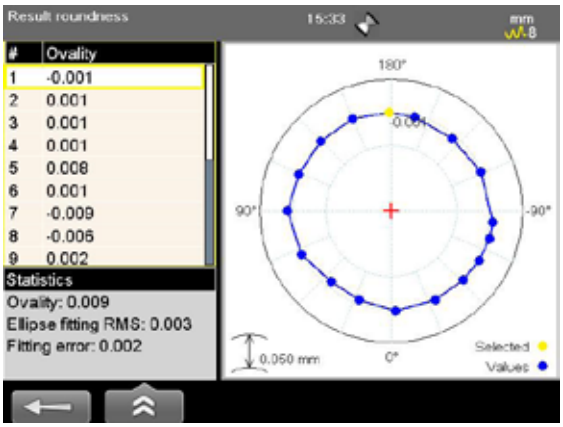
RUN-OUT

Circular runout is specified on cylindrical parts. It is measured by rotating the part 360º. It is essentially a control of a circular feature, and how much variation it has with the rotational axis. Runout can be called out on any feature that is rotated about an axis. It is essentially how much “wobble” occurs in the one part feature when referenced to another.

1. Select  to start the program Roundness.
2. Mount the M-unit in the spindle, using the spindle bracket.
3. Use the D26 laser or S-unit pointing the laser beam within 1.00 mm from the centre of the M-unit.
4. Register about 36 positions for the whole 360º circular movement of the spindle.
5. Result should be within 0.010 mm according to ISO-standard 10791.

Runout symbol

Measure



Result