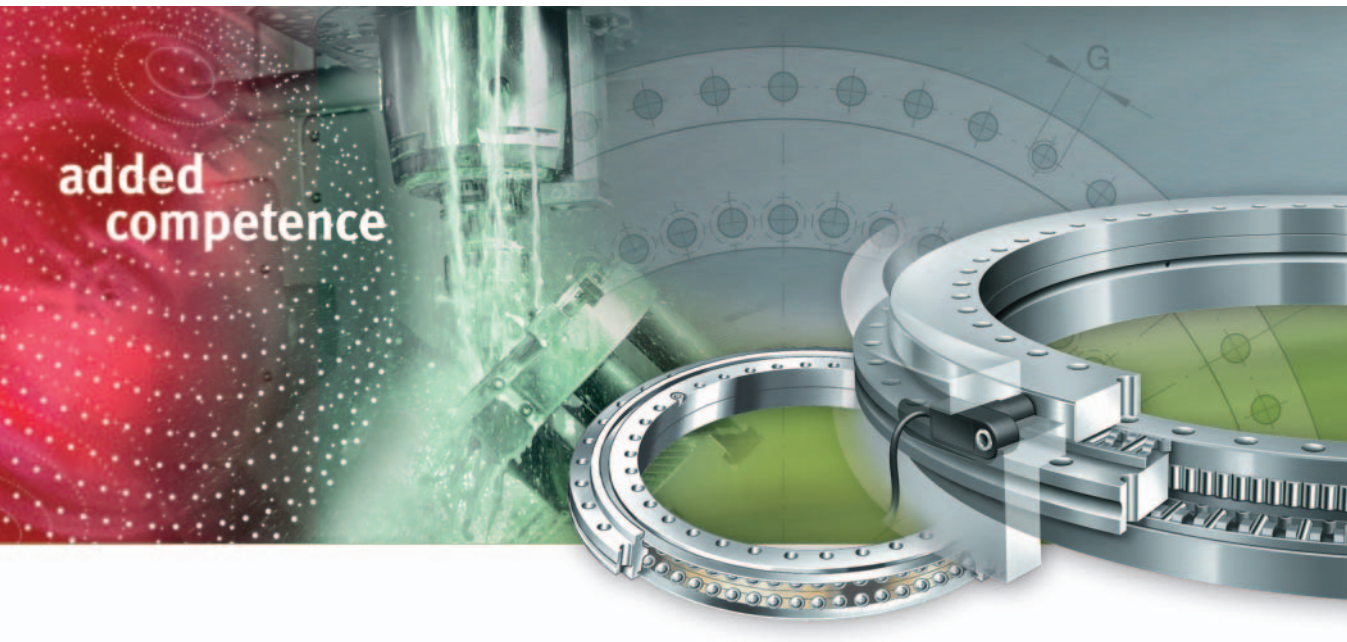

Axial/radial bearings with integral angular measuring system

Teach-In and diagnosis manual

SCHAEFFLER GROUP
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The right product for every application

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Optimum benefit for you

With its forward-looking bearing arrangement solutions for feed spindles, main spindles, rotary tables and linear guidance units, the Schaeffler Group has been at the forefront of the world market for decades. The bearing components alone, however, are often no longer the decisive factor for these machine subsystems.

Our customers have of course benefited directly from significant performance improvements and unique selling propositions thanks to our "ready-to-fit" products; these compact, ready-to-fit bearings are used in accordance with the simple principle: unpack, screw mount, use. In order to optimise the entire machine tool system, however, it is becoming ever more important to integrate functions such as measurement, sealing, lubrication, braking etc. in the components themselves. This intellectual approach is fulfilled comprehensively by the new concept **added competence** in the Production Machinery Sector since it attaches central importance to systems solution thinking for the bearing, bearing position and entire system. This means that you can now access a product range that gives optimum coverage for all your applications in the machine tool.

Since direct drives and mechatronic solutions are used ever more frequently in machine tools, we have incorporated a further strong partner in the form of IDAM – INA Drives & Mechatronics – in our spectrum of capabilities. In this way, we can now supply you from a single source with bearing elements and the appropriate drive system to give complete systems that are precisely matched to each other. This opens up completely new technical and economic design possibilities for your requirements as well as significant advantages in the time and process chain.

In terms of products, we offer you a comprehensive, precisely balanced range, precision technology and top product quality. In order to match the pulse of your developments as closely as possible, furthermore, we have a worldwide network of engineers, service and sales technicians working for you and ensuring that we maintain close contact with you at your own location.

In conclusion, we are convinced that we will always have the right product for your application. Just contact us to see what we can do for you.

added
competence

Axial/radial bearings YRTM with integral angular measuring system

Axial/radial bearings YRTM with integral angular measuring system

Introduction

This manual describes the fitting and Teach-In of the measuring system MEKO/U for axial/radial bearings YRTM.

Any information in previous editions that does not concur with the data in this edition is therefore invalid.

Caution!

The content of this fitting and Teach-In manual must be communicated to the end user.

The Schaeffler Group accepts no liability for loss or damage arising from:

- incorrect fitting
- incorrect or inadequate maintenance
- incorrect communication of the content to third parties or a failure to do so.

If the measuring system is used in applications with safety implications, additional measures must be taken in order to ensure safety and prevent loss or damage.

The sequence of operations depends on the design of the adjacent construction. It is therefore not possible to provide a single description that includes all the fitting variants.

Before fitting the measuring system, the adjacent construction must be prepared appropriately.

Before the measuring heads are fitted, it must be ensured that the fitting space for the measuring heads is dimensionally accurate, free of burrs and clean, see TPI 120.

Preparations for fitting

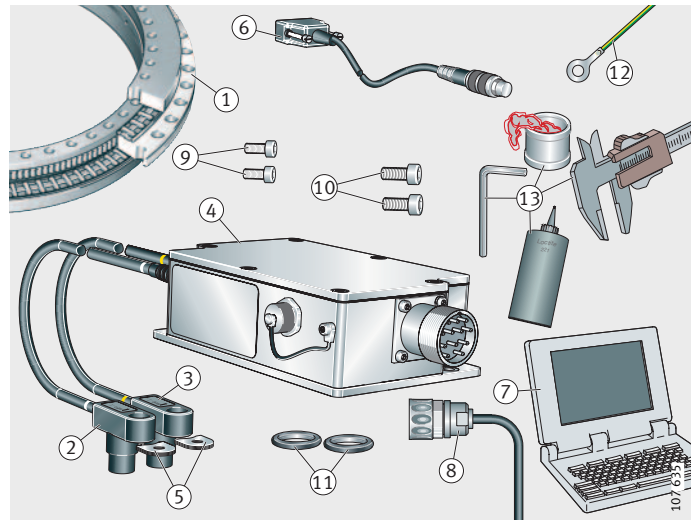
The fitting of axial/radial bearings YRTM is described in Technical Product Information TPI 103, for further information see TPI 120. The components required for correct fitting and Teach-In are shown in *Figure 1*.

Scope of delivery:

- Bearing with integral dimensional scale YRTM
- Electronic measuring system MEKO comprising:
  - measuring head with white marking (wh), including connection cable
  - measuring head with yellow marking (ye), including connection cable
- Electronic evaluation system
- Shims (two stacks)
- Interface cable for serial interface between PC and electronic evaluation system including Teach-In and diagnosis software (MEKOEDS).

Not included in delivery:

- Teach-In PC with serial interface or corresponding USB adapter, page 9
- Signal cable for connecting electronic evaluation system and machine controller, shielded, for pin allocation see TPI 120
- Fixing screws for electronic evaluation system and measuring heads
- O rings if measuring heads are to be sealed
- Earth cable if earthing is not possible via the fixing screws of the electronic evaluation system
- Fitting accessories such as Allen keys for fixing screws, grease for fitting of O rings, verniers (for measuring shims), low strength thread locker (e.g. Loctite 221).



① Bearing YRTM
②, ③ Measuring heads; white, yellow
④ Electronic evaluation system
⑤ Shims
⑥ Interface cable MEKOEDS
⑦ Teach-In PC
⑧ Signal cable for connecting electronic evaluation system and machine controller
⑨ Screws for electronic evaluation system
⑩ Screws for measuring heads
⑪ O rings 12,5 mm×1,8 mm
⑫ Earth cable, ∅ ≧ 10 mm²
⑬ Fitting accessories

Figure 1
Preparations for fitting

Fitting

In order to apply these fitting guidelines, the bearing YRTM must have been fitted in compliance with the guidelines in TPI 103.

Caution! Fitting of electronic components must also be carried out in accordance with the guidelines in TPI 103.

Fitting the electronic components

Caution! Capacitive and inductive coupling of measure noise must be prevented. The electronic evaluation system and cable must be fitted at an adequate distance from any sources of interference.

Sources of interference include:

- strong magnetic fields due to transformers and electric motors
- relays, contactors and solenoid valves
- high frequency equipment, pulse devices and magnetic stray fields due to switched-mode power supply units
- supply mains and leads to the equipment mentioned above.

Fitting the electronic evaluation system

The housing of the electronic evaluation system, *Figure 3*, page 8, must be rigidly screw mounted using fixing screws to the earthed machine body, using both fixing holes. The earth connection is via the fixing screws. If the screw mounting surfaces are not electrically conductive (for example cast mineral), an electrically conductive connection must be made between one of the fixing screws and the machine body by means of a separate earth cable (cross-section $\geqq$ 10 mm^2). Ensure that all the plug connections are easily accessible.

Caution! Long earth cables may act as antennae and introduce interference into the system. The earth cable must therefore be connected to the machine body by a short route.

The electronic evaluation system is protected to IP65 when the plug connections and closing plugs are firmly in place. It must be protected against long term contact with oils and cooling lubricants.

Connecting the measuring heads

Remove the measuring heads from their packaging, but do not remove the protective covers from the sensors yet.

Lay the cables, observing the minimum bending radius R $\geqq$ 40 mm. Lay the cables such that the measuring heads can be removed from the measuring head seat in order to add or remove shims. The cables are suitable for rigid laying without forces or torsion. If other requirements apply, please contact us. Then connect the connection cables for the measuring heads, *Figure 3*, page 8, to the electronic evaluation system, observing the colour coding.

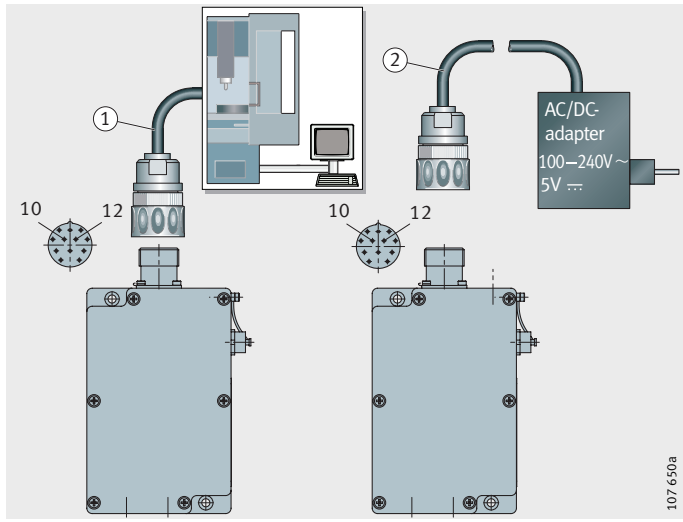
Caution! Protect the measuring heads against impacts. Lay the cables such that the function of the measuring system is not influenced by sources of electrical or mechanical interference. Do not screw mount the measuring heads to the adjacent construction yet – this should only be done once the measurement gap has been set.

Power supply to electronic evaluation system

The power supply, *Figure 2*, is provided via the signal cable between the machine controller and the electronic evaluation system.
If the machine controller is not available for Teach-In, a suitable conventional power pack can be used as an alternative.

Caution!

The necessary connection values (5 V ±10%, for allocation see TPI 120) must be ensured at this time and throughout operation.



① Power supply via signal cable
② Power supply via power pack

Figure 2
Power supply to electronic evaluation system

Machine controller

Caution! Activate the safety functions of the machine controller.

Parametrising the machine controller

If a machine controller is used for Teach-In, the bearing data, table Technical data, must be entered in the machine controller in accordance with the manufacturer's data. For special bearings and measuring systems, enter the data from the quotation and delivery drawing.

Technical data

Bearing	Pulse rate	Bearing	Pulse rate
YRTM150	2 688	YRTM325	5 184
YRTM180	3 072	YRTM395	6 096
YRTM200	3 408	YRTM460	7 008
YRTM260	4 320	–	–

The dimensional scale has 24 pitch-coded reference marks with a reference mark pitch of 30°. The differential pitch between two reference marks is 2 signal periods. If the input value for the differential pitch of the reference marks mus be calculated, the value must be entered to at least 15 decimal places.

$$\text{Differential pitch} = \frac{2\,(\text{signal periods})}{\text{Pulse rate}_{\text{YRTM}}} \cdot 360°$$

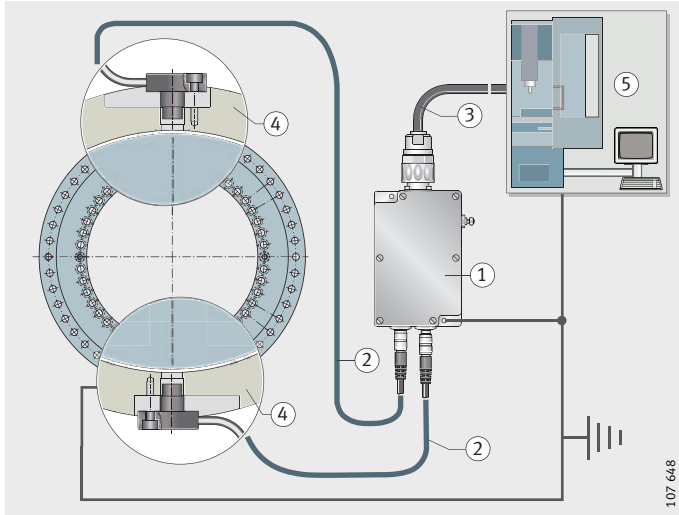
- $\text{Differential pitch}_{\text{YRTM260}} = 0{,}166666666666667°$.

When continuous reference mark monitoring is activated, the limiting speeds for the reference travel must be observed, see TPI 120.

Parametrising the machine controller

Connect the electronic evaluation system using a shielded signal cable with a 12 pin round plug to the machine controller, *Figure 3*. The cable is not included in delivery, for pin allocation see TPI 120.

Caution! If vibrations occur, the cable must be rigidly laid. Lay the signal cable at a sufficient distance from sources of interference. Avoid using a signal cable of excessive length.



① Electronic evaluation system
② Connection cables for measuring heads
③ Signal cable to machine controller
④ Adjacent construction
⑤ Machine controller (CNC)

Figure 3
Shielding and electronic post-processing systems

Teach-In

Teach-In PC

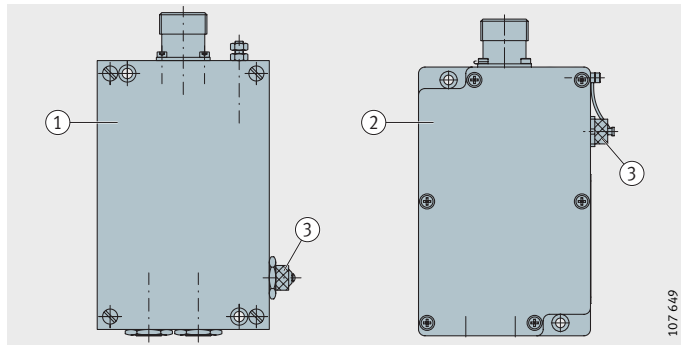
For Teach-In, in a Windows PC should be used.

Minimum requirements

- Windows 95,
  recommended: Windows 98, 98SE, ME, NT4, 2000, XP
- Graphics card with resolution 800×600, 256 colours,
  recommended: 1 280×1 024, millions of colours
- Processor: Pentium 166 MHz
- Working memory: 32 MB RAM
- Free serial interface (RS232C), alternatively free USB interface and conventional adapter for USB serial interface.

Connecting the Teach-In PC

Unscrew the closing plug, *Figure 4*. Insert the interface cable (included in delivery of MEKOEDS) in the plug socket of the electronic evaluation system and screw into place. Connect the interface cable to the serial interface of the PC. If using a USB adapter, malfunctions cannot be ruled out with certain configurations. In this case, use another USB adapter or contact us.



① As-delivered condition prior to 1 January 2005
② As-delivered condition after 1 January 2005
③ Closing plug

Figure 4
PC connection to electronic evaluation system

Software

The measuring heads are adjusted (the measurement gap is set) and Teach-In of the measuring system is carried out using our Teach-In and diagnosis software. We make the current version of the software available (licence-free) on the Internet, page 32.

The software can be started:

- directly from the data medium
- after installation on the hard disk of the teach-in PC.

Installation

Create a folder on the hard disk of the teach-in PC, for example C:\Programs\meko. Copy all the files from the diskette or download into this directory.

Starting the software

Start the program by double clicking on mekoeds.exe. Alternatively, highlight mekoeds.exe using the right mouse key and, in the menu that opens, select “Send to” and “Desktop”. The program can now be started by double clicking the left mouse key on the icon (on the desktop).

System setup

When the Teach-In and diagnosis software is started, the window System setup will appear, *Figure 5*.

Setting the bearing type

Select the bearing type. This will set the pulse rate. If special bearings (type designation F-....) are used, select “User defined” and enter the pulse rate from the quotation and delivery drawing in the field Pulse rate.

Setting the position display

The selection influences only the display in the teach-in and diagnosis software, not the output signals such as the display on the CNC controller.

Select the unit for the position display:

- $^{1}/_{10\,000}$ °
- Deg/Min/Sec
- Deg/Min/Sec (resolution: $^{1}/_{10}$ Sec)
- Microns on the circumference.

Setting the PC serial port

Select the serial port to which the interface cable is connected.

Confirming setup

Confirm setup using “OK”.

Changing the values

The values can be changed using the button “Change setup” in the selection window, *Figure 6*, page 12.

① Bearing type
② Pulse rate
③ Serial port
④ Unit for position display
⑤ “OK”, confirm setup
⑥ Language selection

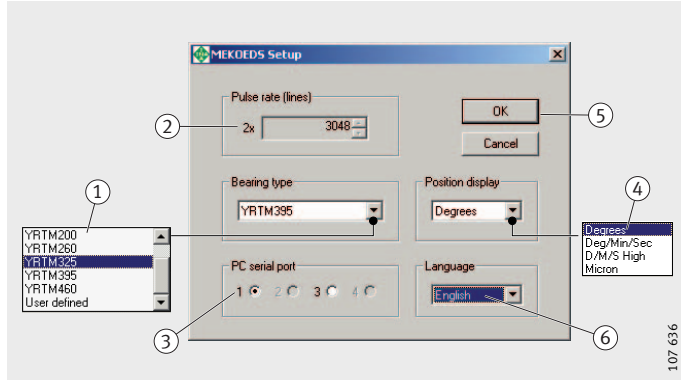


Figure 5
System setup

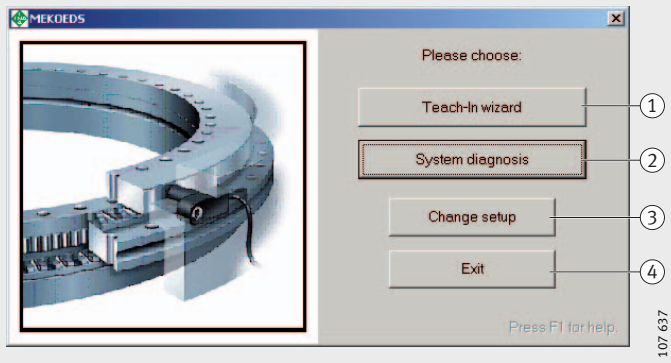
Teach-In wizard

Caution! The Teach-In wizard assists in Teach-In of the measuring system (initial Teach-In or after replacement of a component). The setup and Teach-In items required for reliable functioning are processed consecutively. The next step cannot be processed until the current Teach-In item has been successfully completed.

Call up the Teach-In wizard in the selection window, *Figure 6*.
If Teach-In has already been carried out using the electronic evaluation system, a warning is displayed, *Figure 7*.

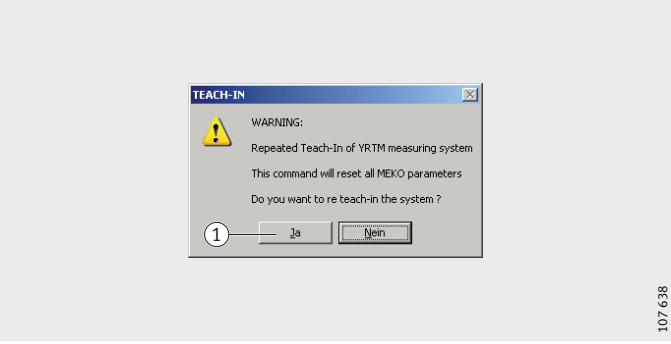
Caution! Before confirming with “Yes”, remove the axis from the control system in order to prevent damage to persons or objects. Confirmation using “Yes” will cause a defective output signal for a short period.

When confirmed with “Yes”, *Figure 7*, the electronic evaluation system is reset and can then be put back into operation.



① Calling up the Teach-In wizard
② Calling up System diagnosis
③ Changing the setup, window System setup
④ Exit

Figure 6
Selection window



① “Yes”, reset the electronic evaluation system

Figure 7
Warning

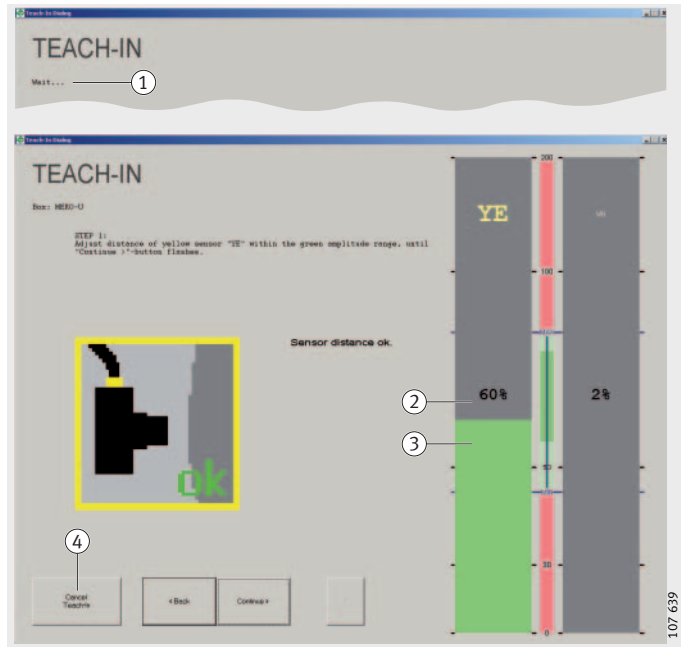
The window Teach-In will appear, *Figure 8*, with the instruction to set the measurement gap of the yellow measuring head.

If the message “Wait...” appears for longer than approx. 30 seconds in this window, there is no connection between the measuring system and PC.

In this case, check the following:

- Is the necessary power supplied to the electronic evaluation system?
- Is the correct port selected in the system setup?

If problems occur, click the button “Exit”, confirm the next message with “Yes”, click the button “Change setup”, *Figure 6*, page 12, change the port selection if necessary and call up the Teach-In wizard again.



① Message “Wait...”
② Amplitude display, numerical value
③ Amplitude display, coloured bar
④ Cancel

Figure 8
Display for setting the measurement gap

Setting the measurement gap

The measurement gap is set by inserting shims (thin pieces of metal film, supplied). One packet comprises nine shims. Five shims have a thickness of 0,1 mm and four shims have a thickness of 0,025 mm. The shims are held together by a wrapping of paint and can be separated by hand or by using a sharp object.

The display in the window for setting the measurement gap, *Figure 8*, page 13, helps in setting the measurement gap.

Setting guidelines

The amplitude value is an indicator of the distance (measurement gap) between the measuring head and the dimensional scale and is represented as a numerical value as well as by the bar colour, *Figure 8*, page 13.

A change in amplitude of 1% corresponds approximately to a change in distance of 0,001 mm. A thin shim (0,025 mm) will thus give a change in amplitude of approx. 25%.

Setting values for amplitude range

Range	Display %	Colour
Optimum	55 to 75	Green
Permissible	45 to 80	Light green

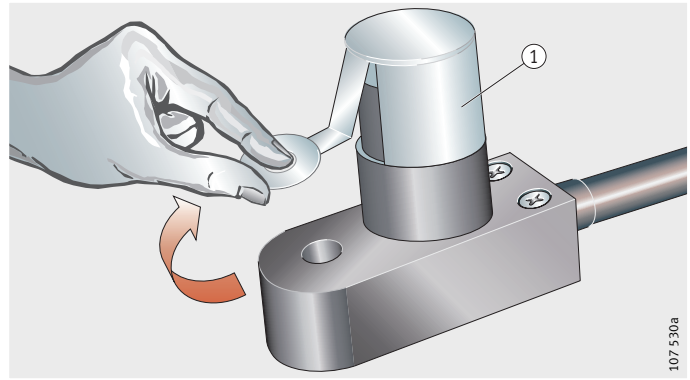
Caution! Setting the amplitude has no influence on the measurement accuracy if the amplitude range is within the working range of 45% to 80%. In setting of the measurement gap, a safety range should ideally be sought to allow for changes in the measurement gap, for example due to non-uniform heating.

Fitting the measuring heads

Caution!

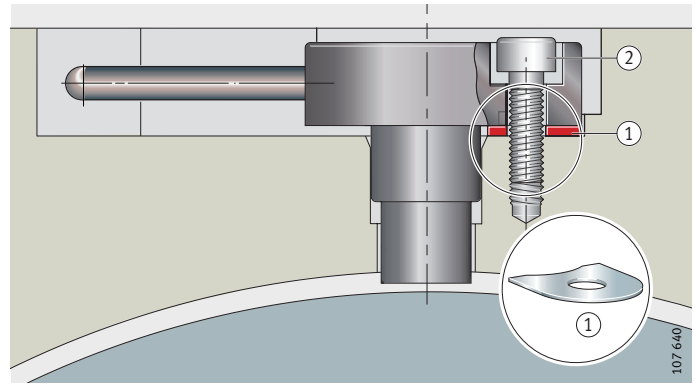
The sensitive sensor surface of the measuring head must be protected against pressure and impacts. Do not fit the O ring, *Figure 12*, page 17, yet. Do not tighten the fixing screw yet.

Remove the protective cap by tearing off the tab by hand, *Figure 9*. Remove one of the two packets of shims from the packaging. Split the shim packet in two and insert one half, *Figure 10*, under the screw mounting surface of the measuring head. Depending on the fitting position, improve adhesion of the shims to the measuring head by means of a thin film of grease and/or use a threaded rod M5 to insert the measuring head. Insert the measuring head in the measuring head seat. If necessary, screw the fixing screw in lightly.



① Protective cap

Figure 9
Removing the protective cap



① Shims
② Fixing screw

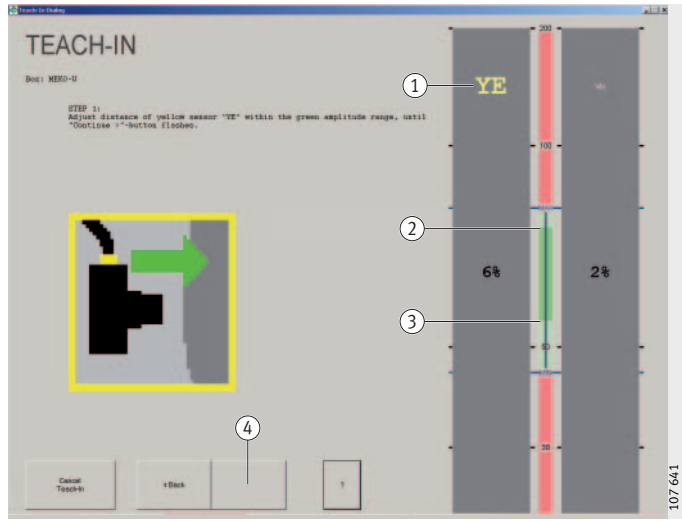
Figure 10
Fitting the measuring head

Setting the yellow measuring head

Press the measuring head on by hand in the area of the fixing hole and read off the amplitude display in the window Teach-In, *Figure 11*. If no movement can be seen in the amplitude display or the amplitude is <55%, reduce the measurement gap by removing shims. If the amplitude is >75%, increase the measurement gap by inserting further shims.

Caution! Do not exceed the maximum tightening torque (6 Nm) of the fixing screw.

If pressing on the measuring head gives a result close to the green range (55% to 75%), screw the fixing screw in carefully while continually monitoring the amplitude display. If the amplitude increases above 75% while carefully tightening the fixing screw, increase the measurement gap by inserting additional shims. Repeat the process until the value is >55% and <75% when the screw is fully tightened.



① Colour coding yellow (YE: yellow)
② 75%
③ 55%
④ Button “Continue”

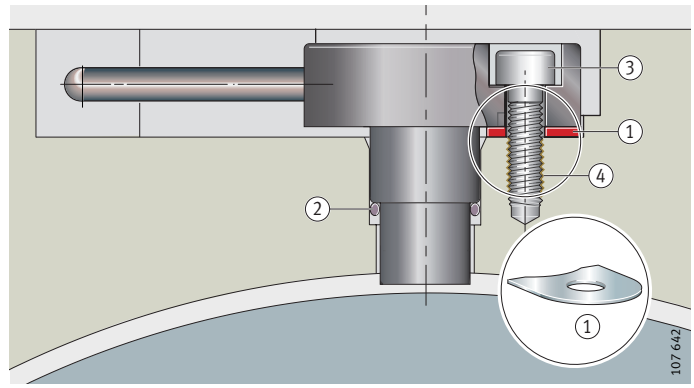
Figure 11
Setting the measurement gap of the yellow measuring head

Locating the measuring head

Caution! Do not exceed the maximum tightening torque (6 Nm) of the fixing screw.

Fitting the O ring

Once the measurement gap has been successfully set, remove the measuring head and, if stipulated in the design, insert the O ring, *Figure 12*, in order to prevent lubricant escaping from the bearing and/or liquids entering the bearing. In order to make fitting easier, lightly grease the O ring. Reinsert the measuring head with the shims, coat the fixing screw with thread locker (for example low strength Loctite) and tighten the screw fully. While doing this, monitor the amplitude display, which should reach approximately the previous value.



① Shims
② O ring 12,5 mm×31,8 mm
③ Fixing screw (M_A maximum 6 Nm)
④ Thread locker

Figure 12
Locating the measuring head

Setting the white measuring head

Once the measurement gap is correctly set, the button “Continue” will flash, *Figure 11*. Click on this button and set the measurement gap of the white measuring head (WH).

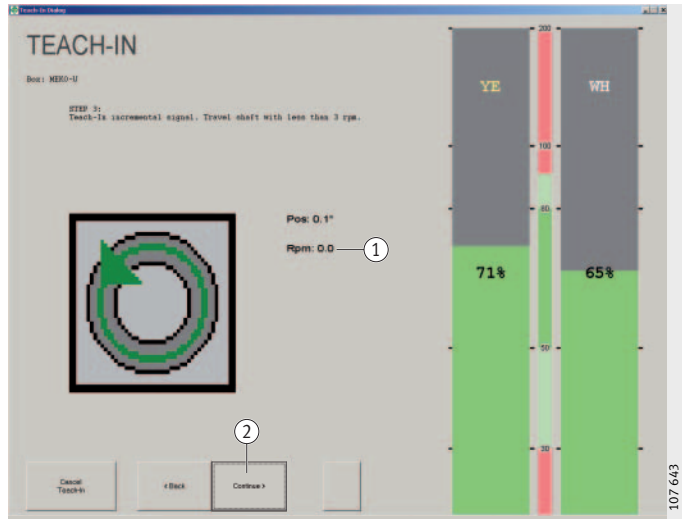
Once the measurement gap is set successfully, the measuring system will transmit signals to the machine controller.
These signals are sufficiently accurate for travel of the axis.
Through the subsequent teaching process, the components of the measuring system are matched, which optimises the signal quality.

Teaching the measuring system

Caution!

During teaching, always move the whole travel range of the machine axis (in the case of rotary tables at least 360°) in one direction of rotation. Observe the maximum rotation speed (n_{max} = 3 min^{-1}). The teaching mode is automatically terminated after 5 minutes.

In the Teach-In window, monitor the display of the rotation speed, *Figure 13*, and rotate the bearing using the axis drive or by hand. Click the button “Continue”. Confirmation of successful Teach-In will appear, *Figure 14*. Confirm using “OK”. Teach-In of the measuring system is now complete. Close the Teach-In and diagnosis software and switch off the power supply to the measuring system (set the main switch of the machine to OFF).



① Display of rotation speed
② Button “Continue”

Figure 13
Teaching

① Button ”OK”

Figure 14
Confirmation

Caution!

Teach-In must be repeated after any replacement of a component or removal of the measuring heads.

Checking the function

Caution! Once Teach-In is completed successfully, check the function.

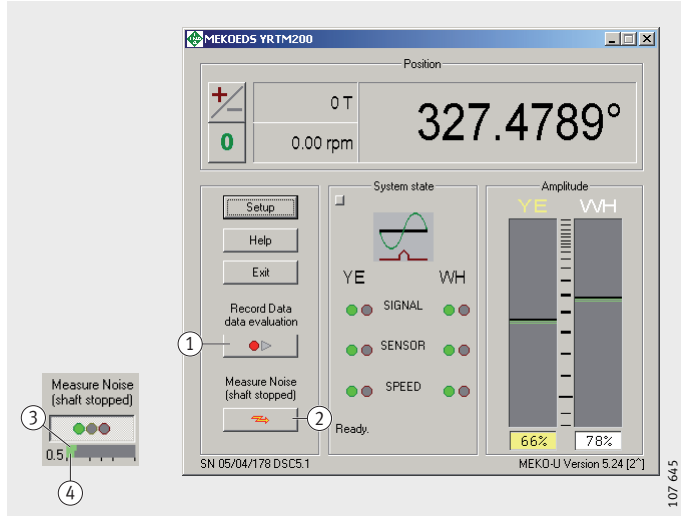
Function checking and documentation of the setting values is carried out by the Teach-In and diagnosis software.

Start the Teach-In and diagnosis software.
Check the current system setup and confirm with “OK”, *Figure 5*, page 11. Call up System diagnosis, *Figure 6*, page 12.

Switch on the machine and run the drives with current in the position controller or by using the test program. The axis to be checked must remain still.

Checking the shielding

Click on the button “Measure Noise”, *Figure 15*. After a few seconds, two coloured bars will appear (in electronic evaluation systems supplied before 1 January 2005 only one bar is displayed).
Both bars must be green; if yellow or red bars appear, check the shielding and laying of cables. For further information, see the section Troubleshooting, page 22. If no bars are shown, ensure that the axis being checked remains still.

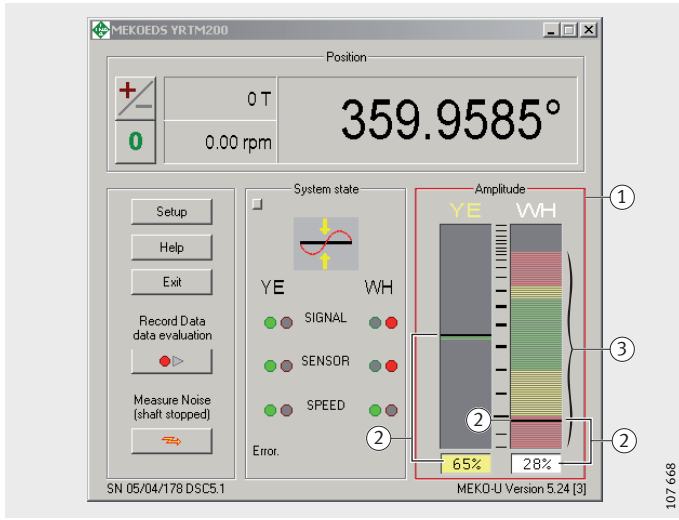


① Button “Record Data”
② Button “Measure Noise”
③ Upper bar,
measure noise from white measuring head
④ Lower bar,
measure noise from yellow measuring head

Figure 15
System diagnosis

Amplitude display in System diagnosis

The amplitude display (measurement gap), *Figure 16*, helps in detecting errors. The black line and the numerical value show the current amplitude value. The coloured lines (green/yellow/red) represent the amplitude values occurring during travel of the axis. The allocation of colour to range is shown in table Amplitude range in System diagnosis.



① Amplitude display
② Black line = current amplitude value
③ Coloured lines = all amplitude values detected during one revolution

Figure 16
Amplitude display

Note!

In diagnosis, the amplitude ranges (normal, maximum permissible) are somewhat wider than those during Teach-In (optimum, permissible), see table Setting values for amplitude range, page 14.

Amplitude range in System diagnosis

Colour	Range	Display %
Green	Normal	50 to 80
Yellow	Maximum permissible	30 to 90
Red	Not permissible	<30 and >90

Data recording

During data recording, the bearing is moved and the signal data from the measuring system are recorded. Two .txt files are created and immediately displayed in graphic format, *Figure 17*.

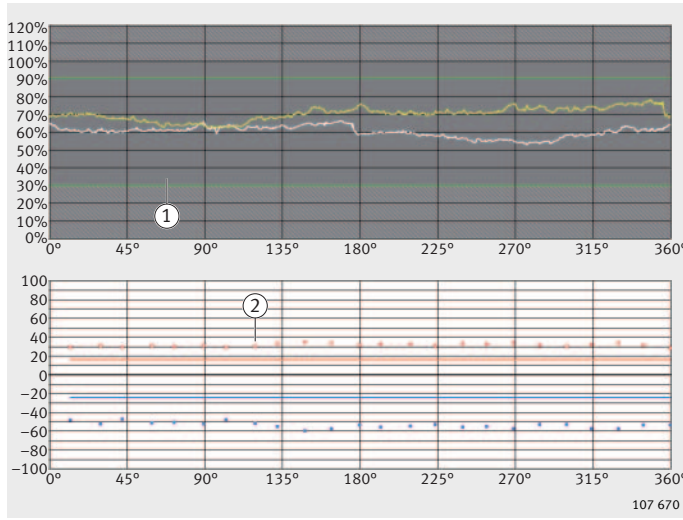
Click on the button “Record Data”, *Figure 15*, page 19, and assign a file name (recommended: serial number of the bearing shaft washer).

Caution!

Always move the whole travel range of the bearing in both directions. Observe the maximum rotation speed (n_{max} = 0,5 min^{-1}).

Move the bearing. To end data recording, click on the button “Record Data” again, *Figure 15*, page 19.

The amplitudes, *Figure 17*, must be in the range 30% to 90% (optimum 55% to 75%). The reference marks must be represented each by 24 blue and red reference mark symbols. If different results are obtained, see section Assessment of data recording, page 26.



① Graphic display of ...amp.txt (amplitudes)

② Graphic display of ...ref.txt (reference marks)

Figure 17

Amplitudes and reference marks

Graphic display of data recording

The software MEKOVIEW (for download see page 32) can be used for graphic display of the saved .txt files at any time.

Troubleshooting

Our consultancy service is available to carry out troubleshooting, hotline, page 32. In order to achieve efficient detection and diagnosis of defects, we require information that can be determined using the Teach-In and diagnosis software.

Error messages from electronic evaluation system

The electronic evaluation system will detect if, after Teach-In:

- the amplitude values (measuring head) are above or below the limits
- a measuring head is not giving a signal.

A zero signal is then generated that can be recognised by the machine controller as an error message. This zero signal remains active in the electronic evaluation system until the system is disconnected from the power supply (main switch OFF).

Caution! Teach-In must be repeated after any replacement of a component or removal of the measuring heads.

Starting troubleshooting

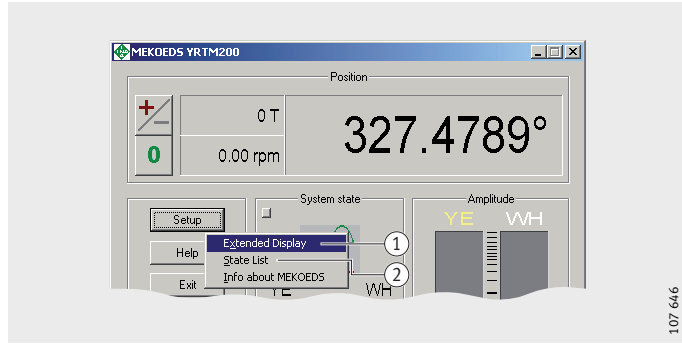
Switch on the machine. Connect the Teach-In PC to the electronic evaluation system, page 9. Then start the Teach-In and diagnosis software. Check the current system setup and confirm with “OK” , *Figure 5*, page 11. Call up System diagnosis, *Figure 6*, page 12.

Extended display

Position the mouse cursor in the diagnosis window, press the right mouse key and select “Extended Display” in the context menu, *Figure 18*. The extended display of the diagnosis window will appear, *Figure 19*, page 23.

System State window

Position the mouse cursor in the diagnosis window, press the right mouse key and select “State List” in the context menu.
The System State window will be displayed, *Figure 19*, page 23.



① Context menu – Extended Display
② Context menu – State List

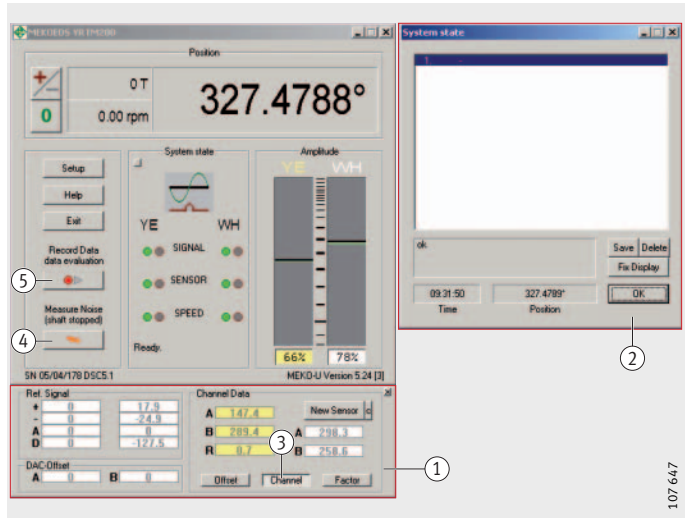
Figure 18
System diagnosis –
Extended Display, State List

Querying of measure noise

Run all the axis drives with current in the position controller or using the test program. The axis to be checked must remain still.
In the extended display, click on the button “Channel”, *Figure 19*.
Query the measure noise by clicking the button “Measure Noise”.
The measure noise will be displayed after a few seconds.
Create a screenshot of this display.

Storing the System State

Then move the axis until a defect occurs. Stop the axis, store the State List or create a screenshot of the System State window.



① Diagnosis window – Extended Display
② System State
③ Button “Channel”
④ Button “Measure Noise”
⑤ Button “Record Data”

Figure 19
Diagnosis and status window

Recording data

Record data, page 21.

Sending data

Send the recorded data to us for assessment, page 32. The volume of data will depend on whether the axis to be checked can be moved.

In all cases, provide the following:

- screenshot “Measure Noise”
- text of the error messages on the machine controller.

If the axis can be moved, provide the following in addition:

- screenshot “System State” or State List
- file of amplitudes (...amp.txt)
- file of reference marks (...ref.txt).

Error tables

Teach-In not possible

Cause	Remedy
Electronic evaluation system shows defective behaviour	Interrupt and then restore power supply to electronic evaluation system
Electronic evaluation system not connected to CNC or power supply	Switch on CNC or ensure external power supply
Incorrect port selected in software	Change PC port (start window of Teach-In and diagnosis software > System setup)
Interface cable not connected	Connect interface cable, if necessary use conventional USB adapter. If necessary, check interface cable and USB adapter
Secondary measuring system incorrectly connected	Connect secondary measuring system
Button “Continue” does not flash in teaching mode	During teaching, move at least 30°

Setting of measurement gap not possible

Cause	Remedy
Measuring heads fitted twisted	Fit measuring heads such that the arrow points toward the bearing outer ring
Height offset of measuring heads to dimensional scale >1 mm	Check dimensions, locate measuring heads centrally to dimensional scale
Distance to measuring head too large	Check the distance between the measuring head screw mounting surface and the centre of the bearing (TPI 120, dimension A). Corner radii too large. Burrs on the measuring head seating surfaces
Measuring head not connected to electronic evaluation system	Check cable connection
Measuring head defective	Activate Measure Noise, page 23 and contact us, page 32
Shaft washer not centred	Dismount and remount bearing, see TPI 103
Shaft washer deformed	Dismount bearing, loosen retaining screws and mount again, see TPI 103

Reference travel not possible

Cause	Remedy
Teach-In of measuring system not completely carried out	Start Teach-In wizard again and repeat Teach-In
Distance between measuring head and shaft washer too large or too small	Start Teach-In wizard again, set measurement gap and repeat Teach-In
Machine parameter incorrect or not matched to measuring system	Request parameter, hotline, page 32
Measuring heads were loosened again after Teach-In	Start Teach-In wizard again and repeat Teach-In. Do not loosen measuring heads subsequently
Allocation of measuring heads to electronic evaluation system changed after Teach-In	Start Teach-In wizard again and repeat Teach-In. Do not change electronic evaluation system subsequently
Defective shielding or earthing (measure noise)	Ensure that all measuring system components have the same potential. Check integrity of shielding from measuring head into switch cabinet. Earth electronic evaluation system. Then activate Measure Noise while stationary
Magnetic damage to dimensional scale	Carry out data recording using System diagnosis and assess, see pages starting page 26 or send to us for assessment, hotline, page 32

Measurement accuracy not achieved

Cause	Remedy
Dimensional scale extremely contaminated with metallic deposits	Contact Application Engineering, hotline, page 32
Machine parameter incorrect or not matched to measuring system	Request parameter, hotline, page 32
Defective shielding or earthing (measure noise)	All measuring system components must have the same potential. Check integrity of shielding from measuring head into switch cabinet. Earth electronic evaluation system. Query measure noise while stationary
Cable breakage	Record System State, page 23. Contact Application Engineering, hotline, page 32
Magnetic damage to dimensional scale	Carry out data recording using diagnosis assistant and send to us for assessment, page 32

Amplitude loss at one or more points

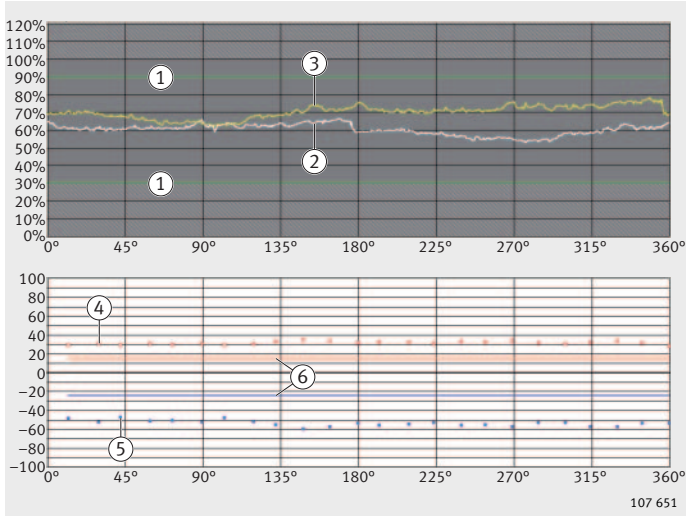
Cause	Remedy
Defective shielding or earthing (measure noise)	All measuring system components must have the same potential. Check integrity of shielding from measuring head into switch cabinet. Earth electronic evaluation system. Activate Measure Noise while stationary
Magnetic damage to dimensional scale	Carry out data recording using diagnosis assistant and send to us for assessment, hotline, page 32

Assessment of data recording

After data recording, the measuring system can be assessed on the basis of the data obtained. The following practical examples should explain the assessment of the measuring system.

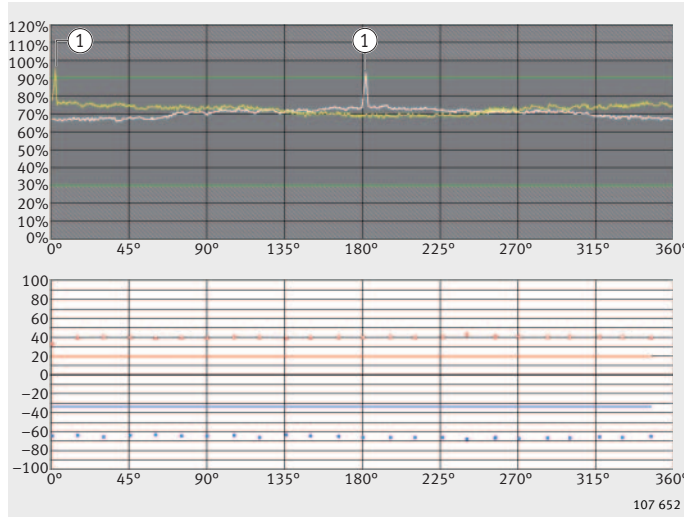
Measuring system free of errors

In an error-free system, the white and yellow amplitude curves run within the system limits, *Figure 20*. All 24 reference marks are detected in both directions (24 red and 24 blue reference mark symbols). The detection limits for the reference marks as set during teaching of the system are located approximately centrally between the zero line and the red/blue reference mark symbols. Transition through zero or a jump in amplitude is permissible if this is offset by 180° between the two curves, *Figure 21*, *Figure 22*, page 27.



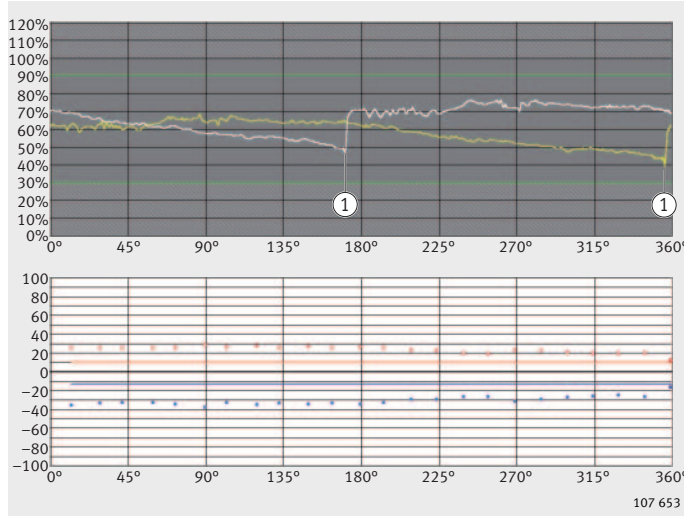
① System limits
② Amplitude curve for white measuring head
③ Amplitude curve for yellow measuring head
④ Red reference mark symbols 24 marks in “rotation direction 1”
⑤ Blue reference mark symbols 24 marks in “rotation direction 2”
⑥ Detection limits for reference marks

Figure 20
Ideal condition



① Transition through zero

Figure 21
Transitions through zero



① Jump in amplitude

Figure 22
Jumps in amplitude

Measuring system defective

If the measuring system is not capable of functioning or its function is impaired, ask our Application Engineering to carry out an assessment, hotline, page 32.

Runout defects

A non-uniform amplitude curve shows a clear change in the measurement gap width during travel of the axis. The amplitudes of the white and yellow curve are displaced relative to each other by 180°.

Cause

Runout defect of shaft washer since this is not correctly centred. The shaft washer and inner ring are held together during transport by two screws. It is possible that these retaining screws were not removed before the bearing was fitted.

Remedy

- Check the fit between the shaft washer and shaft
- Refit the bearing, first removing all screws.

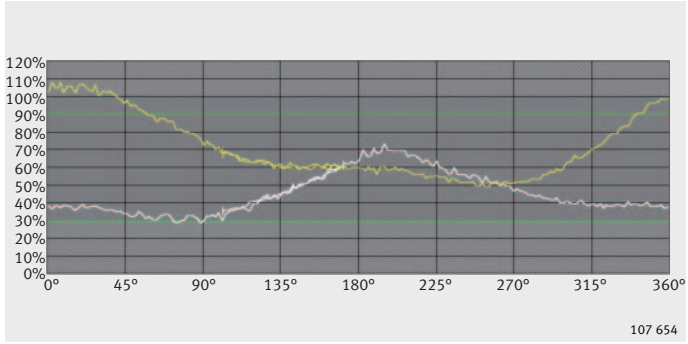


Figure 23
Shaft washer not centred

Magnetic adhering particles

Periodically fluctuating amplitude curve of the white and yellow curve.

Cause

Change in the measurement gap width due to adhering particles. These magnetisable particles are often derived from oil bath lubrication of the bearing arrangement and are metallic wear debris from gearboxes.

Remedy

Cleanliness of the oil must be ensured by the use of filters and/or a magnetic oil outlet screw.

Caution!

If a magnetic oil outlet screw is used, a sufficient distance from the dimensional scale must be ensured.

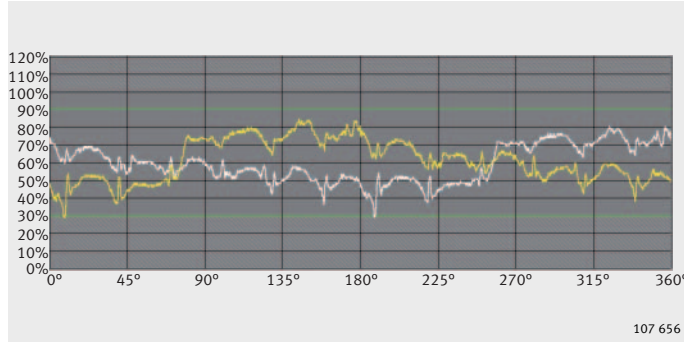


Figure 24
Metallic wear debris

Measurement gap too small/ measuring head defective

The amplitude curve of the white curve is well above the permissible range. There is an additional scatter range with signal peaks, *Figure 25*.

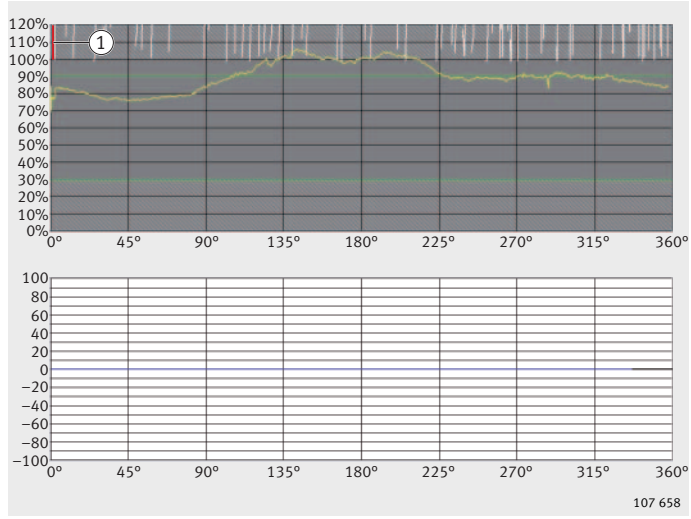
Cause

The white measuring head is too close to the dimensional scale or the white measuring head is defective.

Remedy

Loosen the relevant measuring head, leave the cable connected to the electronic evaluation system. If the amplitude decreases, replace the measuring head as a preventive measure since sensor damage cannot be ruled out. Prior damage may occur as a result of direct contact between the sensor and dimensional scale and the resulting impermissible mechanical load. Adjust the measuring head.

If the amplitude remains constant, replace the defective measuring head and adjust the replacement measuring head.



① Range above 100%

Figure 25
White measuring head defective/ measurement gap too small

Additional reference mark/ signal peak

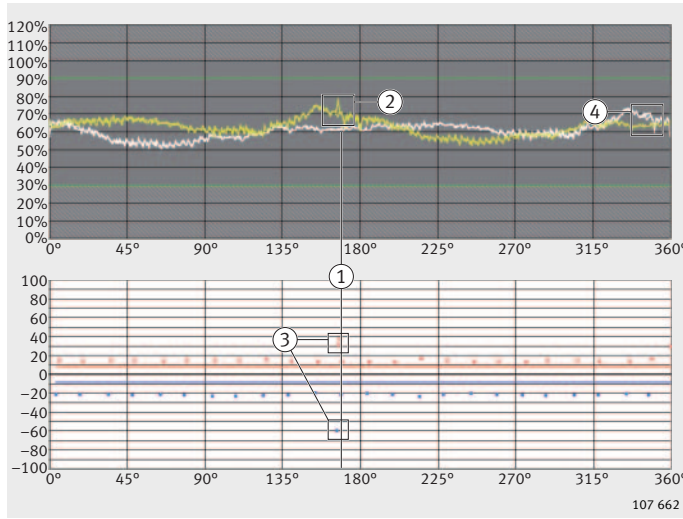
The yellow measuring head is detecting the reference marks. At one angular position, a signal peak is visible on the yellow curve, *Figure 26*. An additional reference mark is detected at this angular position in each of the two directions of rotation. Since the yellow and white measuring head are opposed, the white curve has a signal peak offset by 180°.

Cause

Magnetic damage to the dimensional scale.

Remedy

Dismount the bearing and send it to us. If the magnetic layer has no mechanical damage, we may be able to apply a new coding following inspection.



① Angular position of the magnetic decoding
② Signal peak
③ Additional reference mark
④ Signal peak, offset by 180°

Figure 26
Additional reference marks/ signal peaks

Further information

TPI 103 describes the fitting of high precision bearings for combined loads, *Figure 27*. The qualified engineers in our Application Engineering facilities and engineering service are available to assist you on issues relating to fitting and maintenance and to offer advice on the selection and application of high precision bearings.

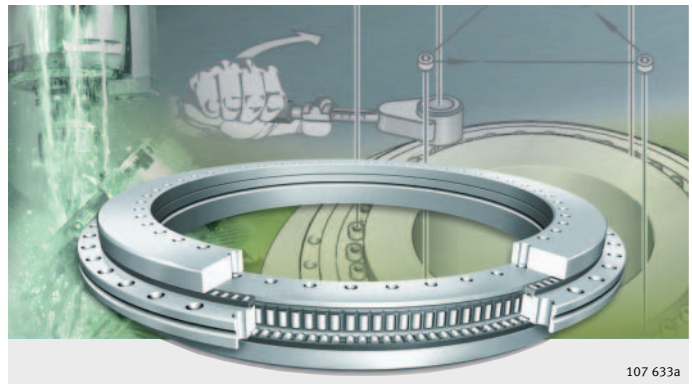


Figure 27
TPI 103

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Publication requests

TPI 103 can be requested from us.
mailto: kataloge.schaeffler@pvs-ff.com
download: http://medien.schaeffler.com

Software

We make available the teach-in and diagnosis software MEKOEDS and the software MEKOVIEW in their latest versions on the Internet.

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MATNR 0106907510000 / MON 18 / GB-D / 2007091 / Printed in Germany by Hofmann Druck

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