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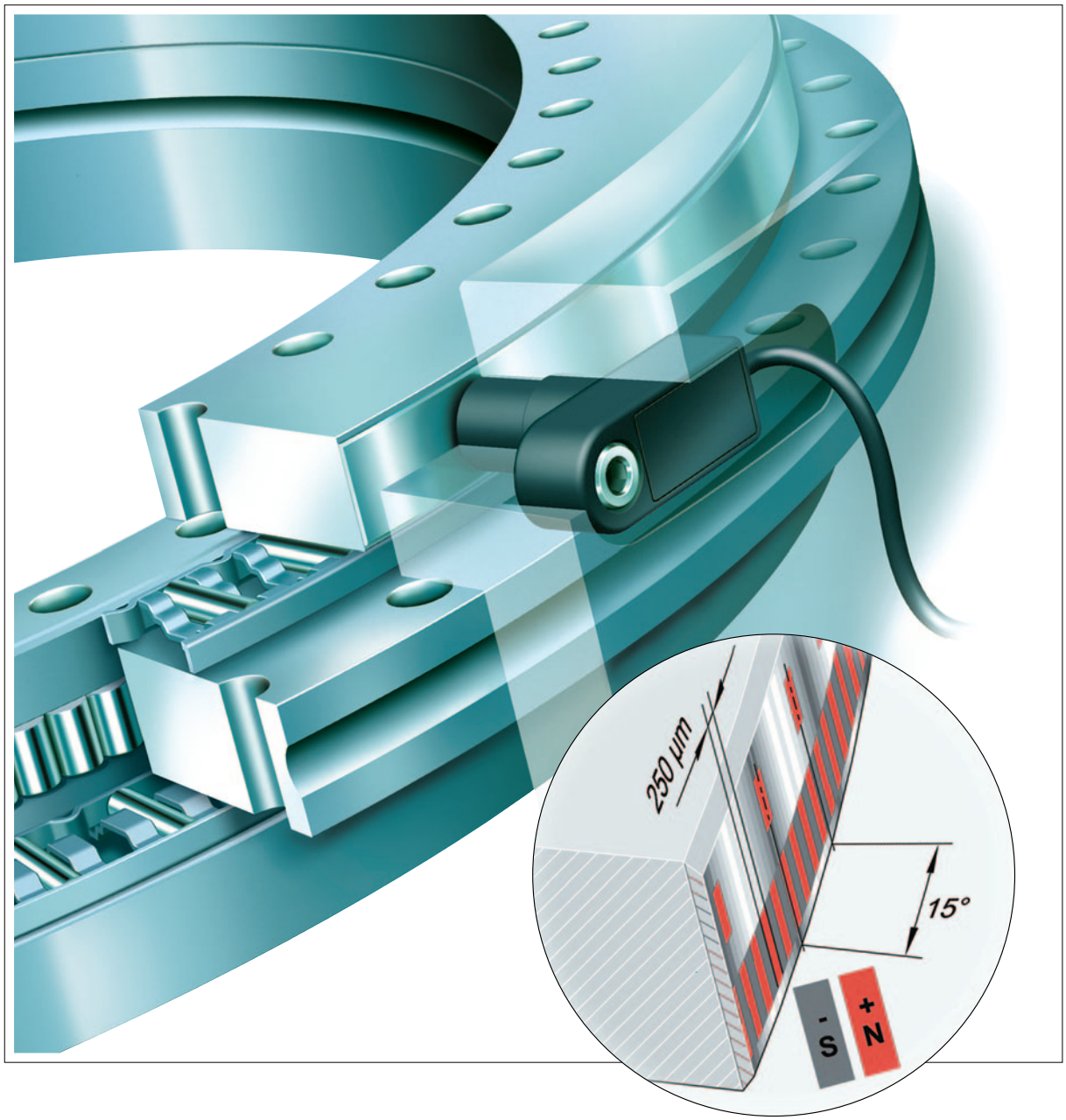

Axial/radial bearings with integral measuring system

Initial operation and diagnosis

Fitting and maintenance instructions MON 18

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⚠ Product pictures are for illustrative purposes only and must not be used for design work.

Designs must only be prepared in accordance with the technical information, dimension tables and dimension drawings in this edition. In case of doubt, please consult the INA engineering service.

Due to constant development of the product range, we reserve the right to make modifications.

The sales and delivery conditions in force are those which form the basis of the invoices and contracts.

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Axial/radial bearings with integral measuring system

Initial operation and diagnosis

Bearings of these series correspond in their mechanical aspects to axial/radial bearings of series YRT. A measuring system is integrated in the bearing, however, that can detect rotational movements of just a few angular seconds by magneto-resistive means. The measuring system operates to very high accuracy, without contact and measures irrespective of tilting and position.

In order to ensure correct and reliable functioning, the bearings must be fitted and put into operation correctly. The fitting of axial/radial bearings YRT is described in *INA Technical Product Information "TPI 103"*.

This manual describes the initial operation and diagnosis of the measuring system. Any information in previous editions that does not concur with the data in this edition is therefore invalid. This manual must either be enclosed with the end product or the guidelines contained therein relating to initial operation and diagnosis must be communicated in writing to the end user!

The measuring system must only be put into operation:

- in accordance with this manual
- with the Windows software *MEKOEDS*.

The work must only be carried out by personnel who have undergone the appropriate training.

INA accepts no liability for loss or damage arising from:

- incorrect fitting
- incorrect maintenance
- incorrect forwarding of the contents to third parties and/or a failure to do so!

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Initial operation of the measuring system

⚠ The measuring system must only be put into operation:
- in accordance with this section
- with the Windows software *MEKOEDS*!

Attaching the connection cables (Figure 1)

- Attach the plugs on the cables for the measuring heads ① to the electronic evaluation system ②
  - pay attention to the arrangement of the coloured rings (white ⓐ and yellow ⓑ).
- Connect the round plug ③ to the electronic evaluation system ② and the machine controller ④.
- Connect the RS 232 (three pole) cable ⑤ to the electronic evaluation system ② and to a serial interface on the computer ⑥
  - the Windows software *MEKOEDS* must be installed on the computer.

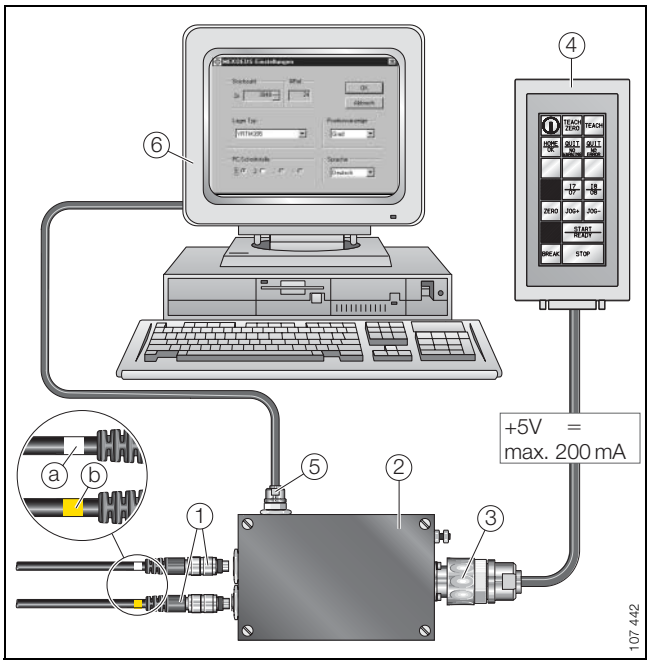

Figure 1 · Attaching the connection cables

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Activating the setup menu (Figure 2)

- Start the *MEKOEDS* software on the computer and select the data for the bearing in the setup menu
  - description of the setup interface: see Table 1.

Note

The settings can be changed while the program is running by calling up *Menu*. The last setting applied is taken as the default setting when the program is closed down (this applies to the program display only, not the measuring system). In order to do this, the program generates the additional configuration file *MEKOdata.cfg*.

Table 1 · Interface of the setup menu

No.	Description
①	Number of reference marks[1)]
②	Actual line pulse rate[1)]
③	Select the bearing size
④	Serial port, enter ports actually used
⑤	Language selection
⑥	Positional display, optionally in 1/10 000 degrees, degrees/minutes/seconds, degrees/minutes/seconds with 1/10 sec. resolution or in microns on circumference
⑦	Cancel on first call-up: – end program Call up from terminal interface: – continue working with existing settings
⑧	Confirm selection, continue

[1)] Only editable under *User defined*.

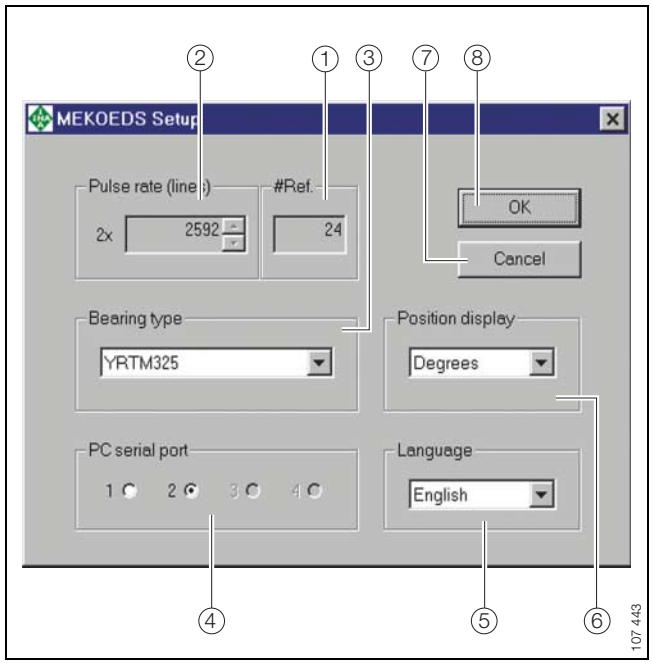

Figure 2 · Setup menu – interface

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The interface for the main program appears (Figure 3). For a complete explanation of the interface, see page 8, Figure 5 and page 9, Table 3.

Setting the distance between the measuring heads and the shaft washer

- Set the distance between the sensors and the outside diameter of the shaft washer using the amplitude display (in % ⑫ or slide bar ⑬) (Figure 3, ⑫, ⑬)
  - the amplitude of the sensor signals should be numerically between 60% and 80% (Figure 3, ⑫) (1% = approx. 1 µm distance).
  - the amplitude slide bars ⑬ are divided into three colours. The distance should preferably be set within the green range (see Table *Amplitude ranges).*
- Set the distance to the correct value using shims (Figure 4, ①).
- Execute the *New Sensor command* (Figure 3, ⑨) in the main program.

⚠ If the amplitude does not correspond to the recommended value after adjustment, reset the sensors, execute the *New Sensor command* again and repeat the adjustment process!

Amplitude ranges

Ranges	Display in %	Colour
Optimum	60% to 80%	green
Normal	50% to 85%	yellow/green
Maximum	30% to 90%	yellow
Prohibited	<30% and >90%	red

⚠ Signals outside the green and yellow ranges will lead to misleading evaluation of measurement signals in operation!

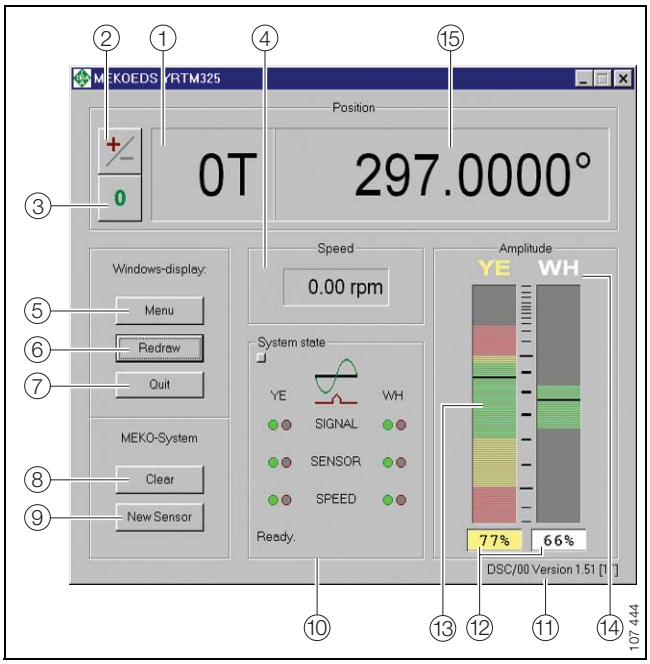

Figure 3 · Interface of main program

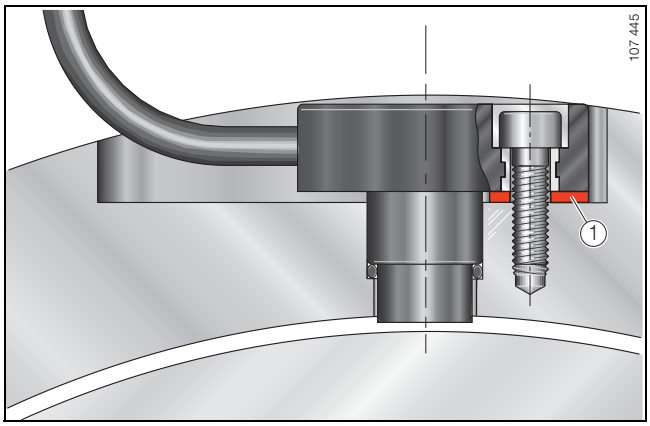

Figure 4 · Setting the distance between the measuring heads and the shaft washer, only possible using *MEKOEDS*

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Adjusting the sensors

Rotate the bearing at a speed n_{REF} in accordance with Table 2 and move the bearing forwards once and backwards once over the whole range to be used (optimum scope of movement)

- Pictogram *a* appears (page 9, Table 3, no. ⑩).

After adjustment, close down the software and remove the RS 232 cable.

Note on the adjustment process

⚠ The adjustment process must be carried out before the system is put into operation for the first time!

Influencing factors: electrical tolerances of the measuring heads!

The parameters for the sensors and shaft washer, including the reference signals, are measured. Pictogram *a* appears (page 9, Table 3, no. ⑩). From this point, a time of 5 minutes is available to move the bearing forwards and backwards over the whole range to be used (optimum adjustment process).

Influencing factors:

- distance between the measuring heads and the dimensional scale
- incorrect mounting direction of the measuring head.

The system is now ready for operation.

No function – troubleshooting

The amplitude has been automatically set during adjustment to a value that is too high or too low.

In this case:

- change the distance between the sensors and the shaft washer, execute the command *New Sensor* and readjust (see page 6, Figure 4).

No green sine signal appears.

In this case:

- rotate the shaft washer further. If the display does not change
- pay attention to the warning lamps *Signal* and the size of the *YE* and *WH* indicators above the amplitude displays. A bold image indicates that the offset of the sensor has been found.

  If the measuring head is too close to the shaft washer, the *red* warning lamp will illuminate when the bearing is rotated; i.e. increase the spacing of the sensors.

  If the display remains *green* or *yellow*, align the sensor closer to the shaft washer. Then readjust using the *New Sensor command* in the main program (see *Setting the distance between the measuring heads and the shaft washer*, page 6).

Table 2 · Limiting speeds for MEKO/U measuring system[1)]

Axial/radial bearing	Limiting speeds	
	Electronic evaluation system n_G min^{-1}	Reference travel n_{REF} min^{-1}
YRTM 150	175	5
YRTM 180	155	4
YRTM 200	140	4
YRTM 260	110	3
YRTM 325	90	3
YRTM 395	75	2 to 3
YRTM 460	65	2 to 3

1) Firmware 2.x and higher.

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Initialisation

This is necessary when the measuring system is first put into operation. The system is run at a speed in accordance with Table 2 until the electronic evaluation system has detected all the operating parameters (including one reference mark).

Once the adjustment process has been successfully completed, pictogram *a* (page 9, Table 3, no. ⑩) is displayed.

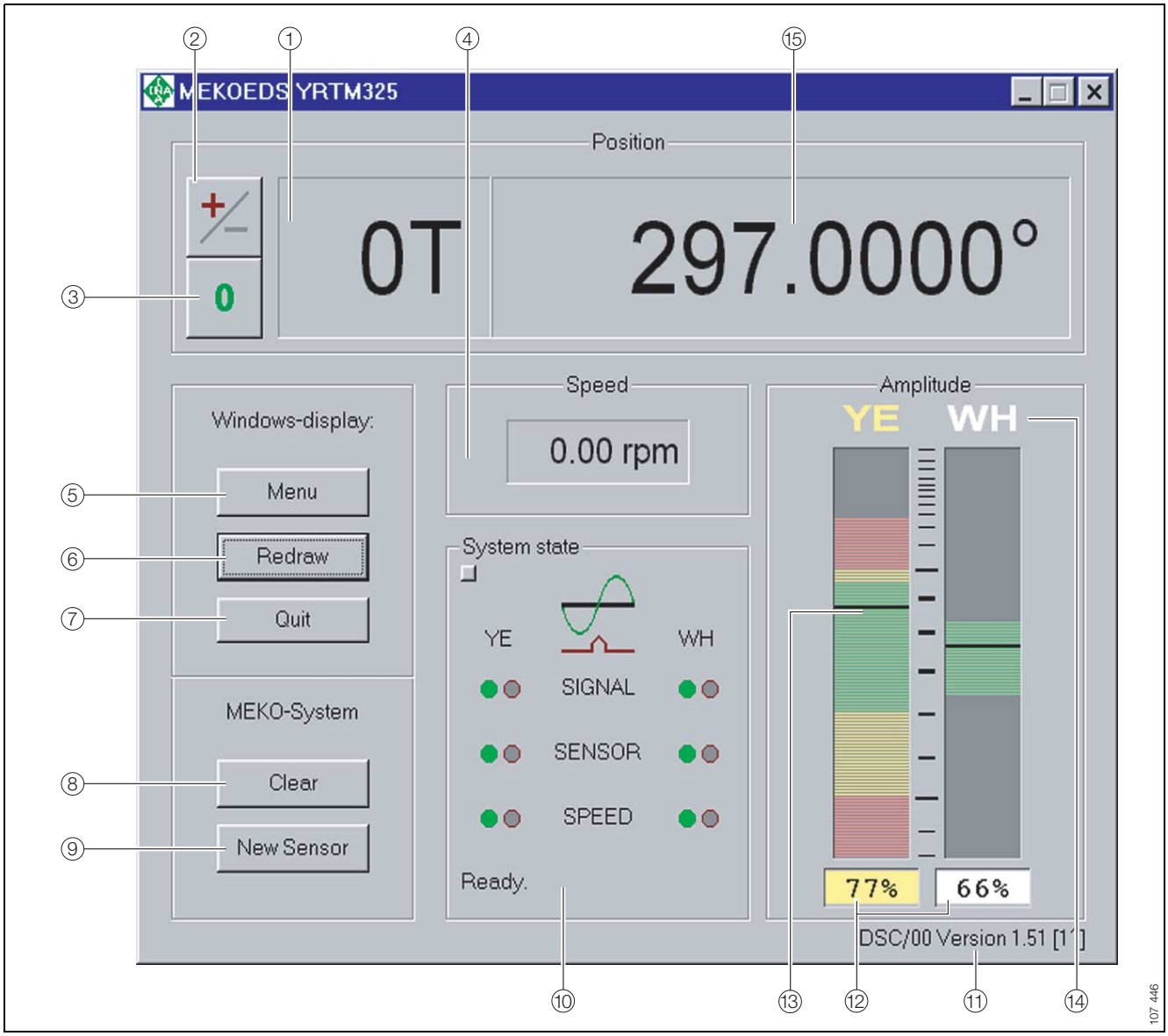

Figure 5 · Interface of main program

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Interface of main program (Figure 5)

Table 3 · Description

No.	Description	
①	Number of revolutions completed (n×360°)	
②	Change in count direction: positive or negative	
③	Positional displays:	
	0	Set positional display ⑮ to zero
	0	Reference mark has been passed
	0	Reference sensor is located on a reference mark
④	Current speed in min^{-1}	
⑤	Call up setup menu – start screen	
⑥	Reset amplitude range, redraw interface	
⑦	Close terminal program	
⑧	Electronic evaluation system: Clear error log (command to measuring system)	
⑨	Reset electronic evaluation system completely (command to measuring system) – Readjust measuring system	
⑩	Error messages from measuring system	
	Pictograms:	
	LRN!	Carry out adjustment process
a		Electronic evaluation system has detected all operating parameters (system ready for operation, adjustment completed) – standard
b		Electronic evaluation system has only found offset values, reference impulse is still to be measured (adjustment not completed)[1]
c		Output signals from electronic evaluation system switched off ■ Error message to controller ■ Sensor failure (clear error message using *Clear*)
d	?	Communication error between PC and measuring system, no serial data acquisition (e.g. incorrect port selected or no operating voltage)

No.	Description			
⑩ e	DAC	Output signal not compensated		
	ADC ?	Analogue/digital converter for sensor signals has failed (outputted signals are no longer updated or are incorrect)		
	Error display:			
		No error	**Information**	**Alarm**
	Signal	No error	No offset found	Sensor signal overcontrolled
	Sensor	No error	Reserved	Sensor failure
	Speed	Operating parameters are being updated	No updating of operating parameters	Maximum traverse speed exceeded
⑪	Version number of electronic evaluation system firmware, in square brackets []: Number of save processes performed on operating parameters 0, 1, 2 to 20 000			
⑫	Amplitude of sensor signals in % (numerical)			
⑬	Amplitude of sensor signals (graphic, 0% to 200%) and scaling (centre)			
	Black line: current amplitude			
	Coloured line: amplitude range covered			
	Opt.	60% to 80%	(green, indicated by scaling with line thickness 3)	
	Normal	50% to 85%	yellow/green	
	Max.	30% to 90%	(yellow, indicated by longer scaling with line thickness 2)	
	Prohib.	<30%, >90%	(red)	
⑭	*YE*: Yellow sensor *WH*: White sensor (small font/no offset found)			
⑮	Positional display, optionally in 1/10 000 degrees, degrees/minutes/seconds, degrees/minutes/seconds with 1/10 sec. resolution or in microns on circumference			

[1] Initialisation (see page 8).

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Troubleshooting table

Error, cause, remedy

Defect		Cause	Remedy
1	Controller found no reference marks	■ Measuring system not correctly adjusted[1)] ■ Distance between measuring head and shaft washer too large or too small	■ Set distance of measuring heads using Windows software to 60% to 80% of amplitude ■ Reset measuring system using the *New Sensor command* and readjust[1)]
2	Controller found reference marks in one travel direction only	■ Measuring heads were loosened again after adjustment and underwent lateral displacement	■ Reset measuring system using the *New Sensor command* and readjust[1)]
3	Controller did not find all reference marks	■ As item 2 or measuring system not correctly adjusted[1)], i.e. the whole range to be used was not travelled during adjustment	■ Reset measuring system using the *New Sensor command* and readjust[1)], travelling the range to be used 1× forwards and backwards
4	Controller found too many reference marks or marks at the incorrect position	■ Defective shielding or earthing	■ Check integrity of cable shielding between electronic evaluation system and CNC ■ Earth electronic evaluation system using short earthing strap
		■ Measuring system not correctly adjusted[1)]	■ Set distance of measuring heads using Windows software to 60% to 80% of amplitude ■ Reset measuring system using the *New Sensor command* and readjust[1)]
		■ Shaft washer damaged	■ Send data record and description of defect to INA
5	Distance coding not correctly detected	■ Controller *Siemens 840C*	■ 840C can only be operated with one reference mark or reference and cam
		■ Machine data incompletely entered (less than 14 digits)	■ Enter machine data with maximum number of digits after comma
		■ *Invers* bit for distance coding	■ Set distance coding to *Invers* in machine data ■ If this is not possible (e.g. Indramat), the A and B signals on the 12-pin round plug can be exchanged

[1)] Adjustment:
An electronic evaluation system that is new or has been reset using *New Sensor* must first detect the correction values for the measuring heads (adjustment).
A sufficiently high amplitude of the sensor signals is required.
The adjustment of sensors is carried out while moving the shaft washer.

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Error, cause, remedy

Defect		Cause	Remedy
6	No amplitude No signals	■ Distance of measuring heads too large	■ Reduce the distance between the measuring heads and the shaft washer
		■ Measuring heads fitted twisted	■ Fit measuring heads such that the arrow points toward the bearing outer ring
		■ Height offset of measuring heads (≈1 mm deviation from nominal)	■ Check dimensions, set measuring heads to correct height
7	Amplitude on one sensor only	■ Other measuring heads fitted twisted	■ Fit measuring heads such that the arrow points toward the bearing outer ring
		■ Distance of measuring heads too large	■ See item 6
8	Amplitude signal only every 15°	■ Measuring heads fitted twisted	■ Fit measuring heads such that the arrow points toward the bearing outer ring
9	Amplitude loss, peak or jump at one or more points	■ Transitional area of dimensional coding on shaft washer	■ An amplitude peak can occur intrinsically in the area of the zero mark
		■ Defective shielding or earthing	■ Check integrity of cable shielding between electronic evaluation system and CNC ■ Earth electronic evaluation system using short earthing strap
		■ Shaft washer damaged	■ Send data record and description of defect to INA
10	Irregular running	■ Defective shielding or earthing	■ See error 9
11	Positional values at standstill	■ Defective shielding or earthing	■ See error 9
12	Large positional deviations within one revolution (sine error)	■ Retention screws on bearing were not loosened during fitting of bearing	■ Fit bearing in accordance with fitting instructions

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Troubleshooting procedure

⚠ Check whether the measuring system was put into operation using the Windows software *MEKOEDS*! It cannot be put into operation without this software!

- Seek possible remedies in the troubleshooting table (see page 10).
- Prepare the necessary data records. The steps are given in the section *Data recording procedure* (see page 13).

Replacement of components
(see *Troubleshooting* table, page 10)

Table 1 · Procedure for replacement of components

Components to be replaced	Procedure			
	Initial operation without item 4	Initial operation from item 4	Complete initial operation	*New Sensor command*
Electronic evaluation system				
Measuring head				
Electronic evaluation system and measuring head				
Shaft washer				
Shaft washer and measuring head				
Electronic evaluation system, measuring head and shaft washer				

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Data recording procedure

⚠ This function is only available from *MEKOEDS 2.0*!

In order to open the expanded display, click the right mouse key and select *Expanded display* in the menu.

Measurement of disruptive impulses during standstill

Measurement is carried out while the bearing is stationary using the malfunction key (Figure 1, ①). The value ③ should be read off five seconds after pressing the key.

Read off the value ③:

- value between 0,4 and 1,0:
  – no disruptive influences.
- value >2,0:
  – check the shielding and earthing.

Recording of amplitude and reference marks

- Press the record key (Figure 1, ②).
- Enter the filename (recommended: serial number of WSM). Two files are created:
  – *filename _ref.txt*
  – *filename _amp.txt.*
- Rotate the bearing at a speed n_{REF} in accordance with Table 2, page 7 and move the bearing forwards once and backwards once over the whole range to be used (optimum scope of movement).
- To close, click the record key ② again.

⚠ The recorded data (*filename _ref.txt* and *filename _amp.txt*) can be either:
  – forwarded to the INA external sales force or
  – evaluated using the INA software *MEKOView* (see page 14)
  – *MEKOView* can be obtained free of charge.

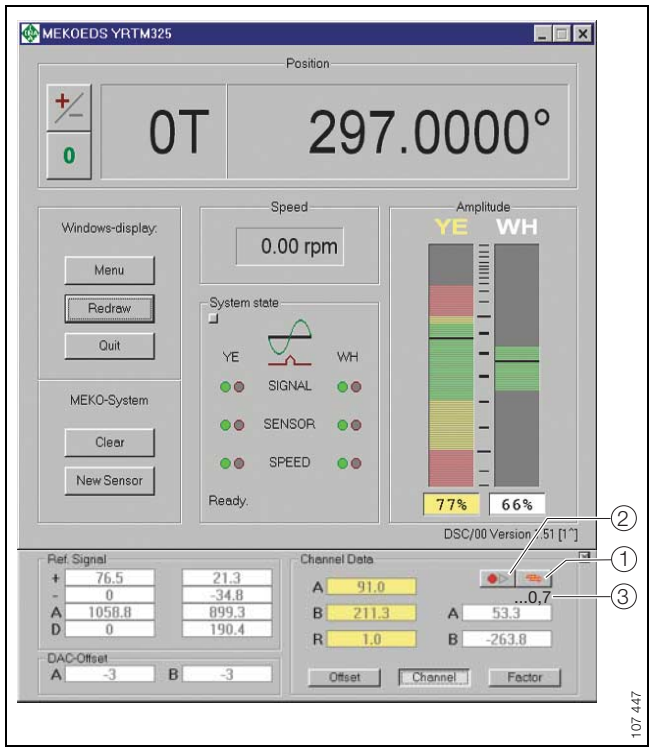

Figure 1 · Main program with expanded display

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Evaluation using *MEKOView* (Figure 2)

- Start the program *MEKOView*
- Open the file:
  - *open the file "filename_amp.txt" by double clicking* (the file "filename_ref.txt" is automatically opened as well if both files are in the same directory).

The evaluation diagrams opened can be printed out or extracted as a file.

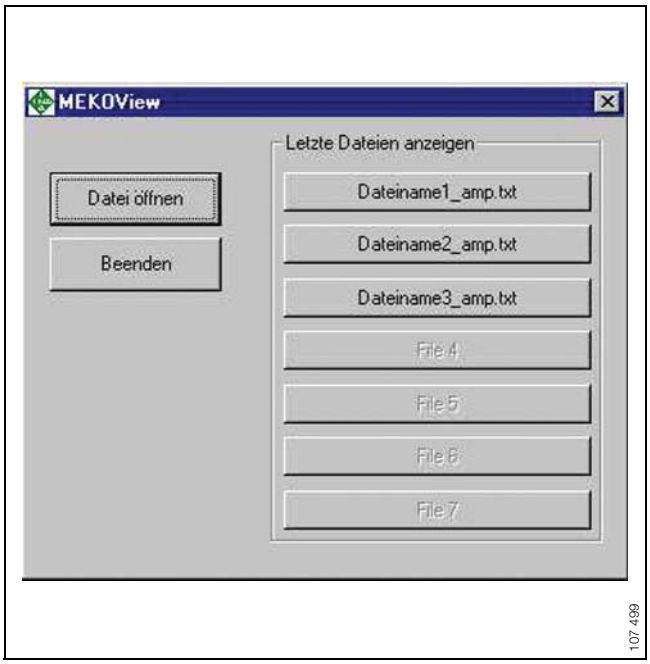

Figure 2 · Opening a data record using *MEKOView*

Checking the amplitude – no error (Figure 3, ⓐ)

- The red lines show the limits of the permissible amplitude (30% to 95%).

If these limits are exceeded for short periods up to approx. 105%, there will be no detectable influence on the accuracy, but the amplitude should always be set to 60% to 80%.

⚠ For production reasons, an increased voltage may occur at the zero point of the shaft washer.

Checking the amplitude – no error (Figure 3, ⓑ)

- Severe amplitude losses (defective shaft washer).

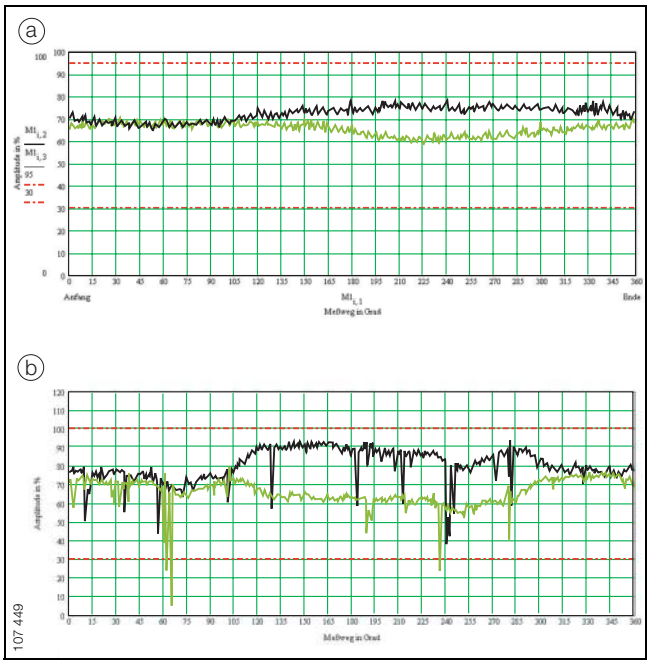

Figure 3 · Checking the amplitude – no error ⓐ/error ⓑ

Legend for Figure 3

- White sensor
- Yellow sensor
- Maximum permissible amplitude
- Minimum permissible amplitude

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Checking the reference marks – no error (Figure 4)

Switching thresholds

- In order to ensure reliable detection, the reference mark must be above (positive measurement value) and below (negative measurement value) the positive and negative detection thresholds.
- If a value is below the threshold, the reference impulse will not be outputted and represented (= leaving a gap).

Checking the reference marks – no error (Figure 5)

- Reference mark defective.

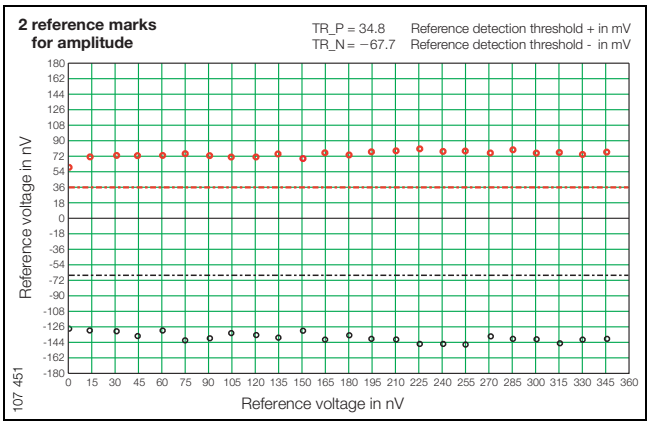

Figure 4 · Checking the reference marks – no error

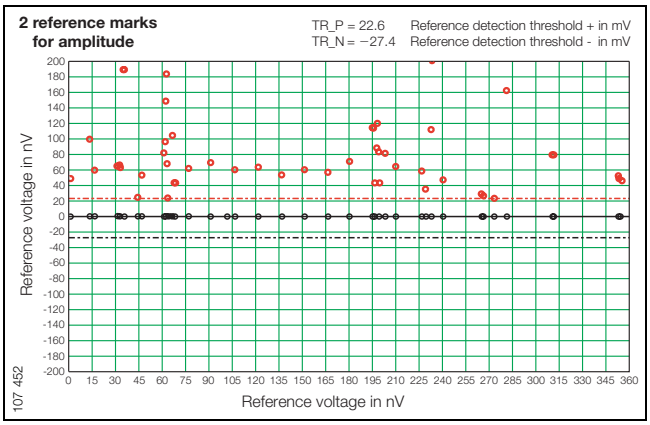

Figure 5 · Checking the reference marks – defective reference mark

Legend to Figure 4 and Figure 5

——	Zero line
ooo	Reference +: positive signal (measurement value)
-·-·-	Reference +: positive detection threshold
ooo	Reference –: negative signal (measurement value)
-·-·-	Reference –: negative detection threshold

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