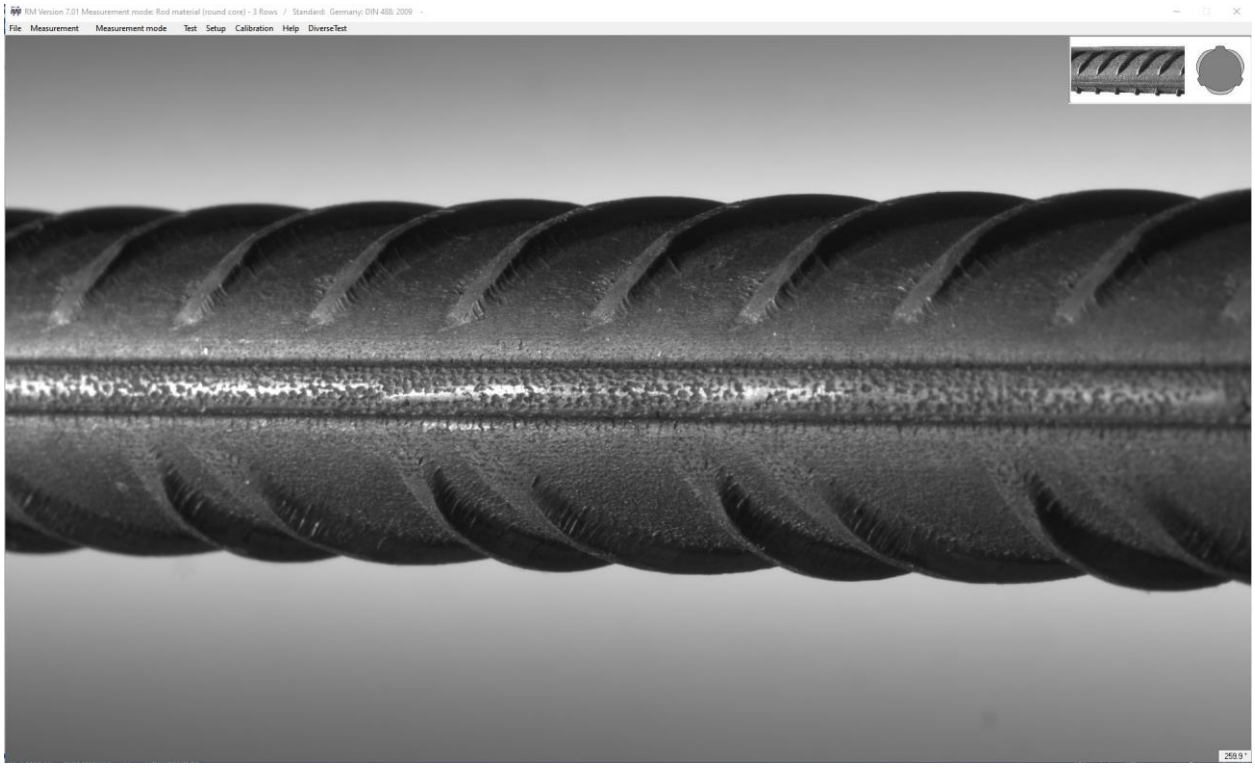
ECM DATENSYSTEME GMBH

OPTICAL MEASURING MACHINES

Rib Measurement System Type

RM 20X/30X/60X



Version 7.01, January 2022

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1. Description of the Device

1.1. Task Definition

The task of this device is defined as the automated geometric measurement of hot- and cold-rolled concrete steel in accordance with DIN 488, with two, three or four rows of ribs, for the purposes of quality assurance and in-factory self-testing.

1.2. System Description

The concrete steel rod to be tested (length: approximately 200 mm for the RM20x/30X and 400mm for RM60X) is clamped horizontally (RM20X/RM30x) or vertical (RM60X) in the measurement unit, which is mounted on a work bench; it is illuminated at high contrast by means of rotation, using vertical lighting or back lighting depending on the measured variable. The test piece is optically recorded at high resolution by two or three black and white CMOS cameras from various angles, and is presented in a window on the computer monitor. A computer and an image processing unit digitize each image. The measurement principle is based on a search for black-to-white transitions, and the object boundaries are determined from the gray stages using a gradient process.

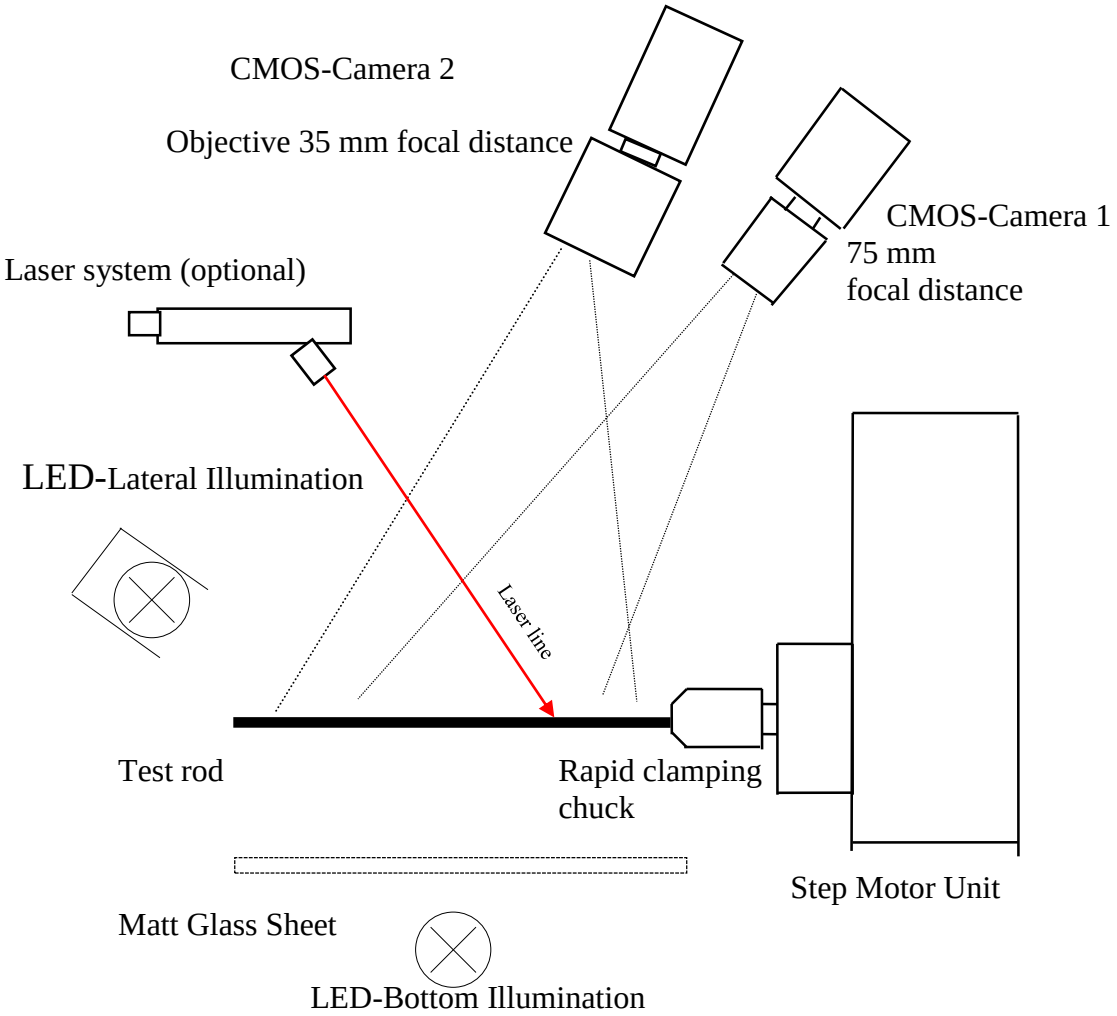
The device is calibrated with the use of tested round rods, which have incisions at precisely defined intervals. Calibration takes place automatically and can be repeated at any given time.

1.3. Measurements Obtained

The rib measurement system determines the following measurements:

- rod cross-section and diameter
- rib height at the centre and at the quarter-points
- centre distance of the ribs
- headwidth of the ribs
- inclination of the ribs to the rod axis
- distance between rows of ribs
- specific rib area: determination of difference in respect of the DIN standard specifications according to DIN 488, Part 2 and other european and international standards.

1.4. Measurement Principle



The test rod to be measured is clamped into the rapid clamping chuck, or for larger dimensions, into the triple-jaw clamping chuck on the step motor unit.

The measuring process is divided into three main sections:

1. Aligning the rod, determining the row position and the row distances;
2. Determining the headwidth and the angle of inclination for each row ; and
3. Determining the rib distance and the rib heights at the centre and the quarter-points of each row.

The way the rod is illuminated depends on exactly which of the main sections of the measurement process is active. Hence when the row distances, the headwidth and the rib inclination are being determined, both the bottom illumination and the lateral illumination are switched on; but when the rib heights are being determined, only the bottom illumination is switched on.

The choice of cameras for the measurement depends on the diameter of the rod, the number of rows and the rib inclination. Accordingly, to determine the row position and the rib inclination where the dimensions are less than 10 mm, the camera system with the large focal length is used, but for larger rods, the system with the 25 mm focal length is chosen.

All of these decisions are taken automatically during the measurement process, which means that the user does not need to make them consciously.

Please notice: Please use the shadow frame always for calibration (protocol) and for the measurement of probes up to 22 mm Diameter. For Probes with nominal diameter of more than 22 mm please remove the shadow frame.

1.5. Data Transmission and Management

There are various possibilities for the data output:

1. The test data can be transmitted to a host computer via a serial interface. The transmission parameters can be adjusted by means of the configuration for the device.

2. A result can be outputted to a connected printer after each measurement.

3. The program was developed in Windows. The measurement results can be incorporated directly into an application which you have compiled. This application can run on the computer as a separate task, parallel to the measurement program. It is also possible to incorporate the device into a local network, and to use a common file to make the data accessible to programs on other computers in the network.

4. Furthermore, the device is supplied with its own data management program. The data from the measurement program are transferred via this program, and are then stored according to criteria which you have selected. At any time, it is possible to select measurement values and then output them to a printer or a file.

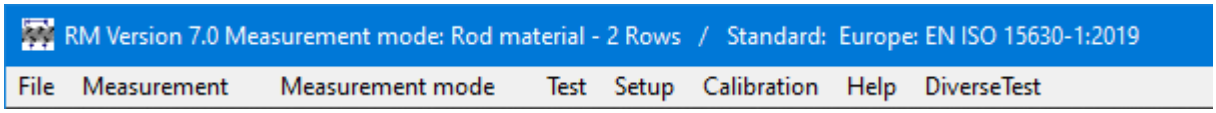
2. Measurement:

2.1. Starting the Program

Start the measurement program from the Windows surface, using the “Rib Measurement” button. After you have done this, the program automatically initialises all the device’s units, and immediately displays the working surface for you (as shown in the illustration on the title page).

2.2. The Main Menu

You can call up all the device’s options from the Main Menu of the program:

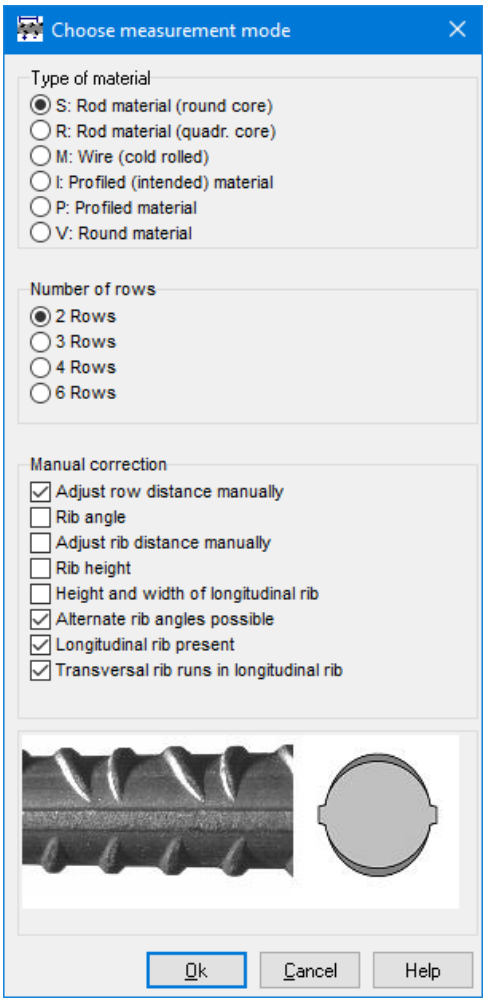


This is what the menu items mean in detail:

File	Save, search or print results
Measurement	Start the measurement process
Mode	Select the measurement rules: number of rows of ribs, and semi-automatic or fully automatic process.
Test	View the rod, determine the diameter and horizontal lengths, test measurements.
Setup	Set the port addresses, type of results output, configuration and maintenance of data bank, input of calibration rod dimensions.
Calibration	Start the calibration process or make a calibration protocol.
Help	Start the online help.

2.3. The Measurement Rules

You use the Measurement Rules to enter the number of rows of ribs on the test rod, and whether the measurement should proceed fully automatically or semi-automatically:



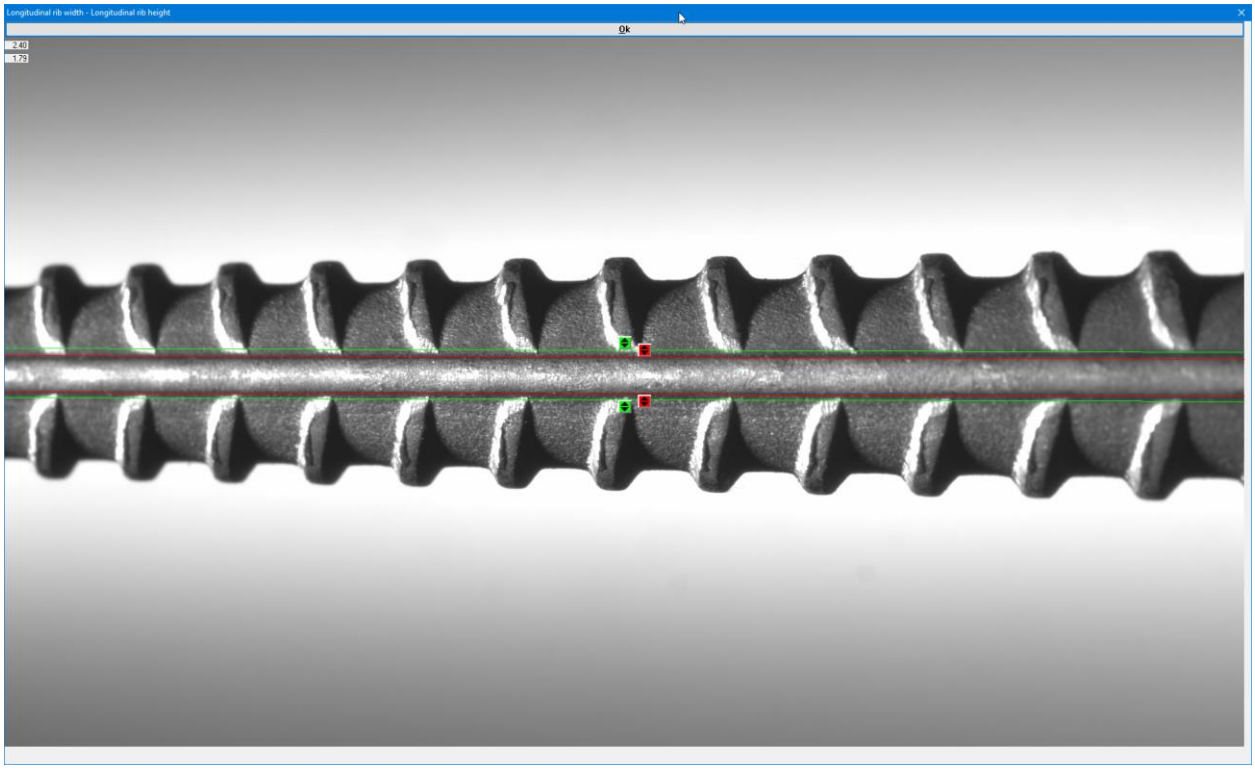
So that you can keep a check, the Measurement Rules you have selected are displayed in the program title bar.
A distinction is made between rods with 2, 3, 4 or 6 rows of ribs, and in the first three options, it is assumed that the rows are visibly separated from one another by distances.
The Measurement Rules entitled “Rod material with quadr. core” refer to concrete steel with four rows, where two rows merge into another in each case.
You can also choose whether the measurement sequence is to run fully automatically or semi-automatically. The semi-automatic measurement method gives you the option of manually correcting the position of the rows which the measuring unit has found, and the distance between rows.

2.4. Measuring

Clamp the test rod into the measuring device. When you do this, please ensure that the rod is more or less straight, and that it is not too dirty. You should also make sure that no manufacturer’s markings are present in the measuring area (directly to the left of the rapid clamping chuck), because this could falsify the measurement result.

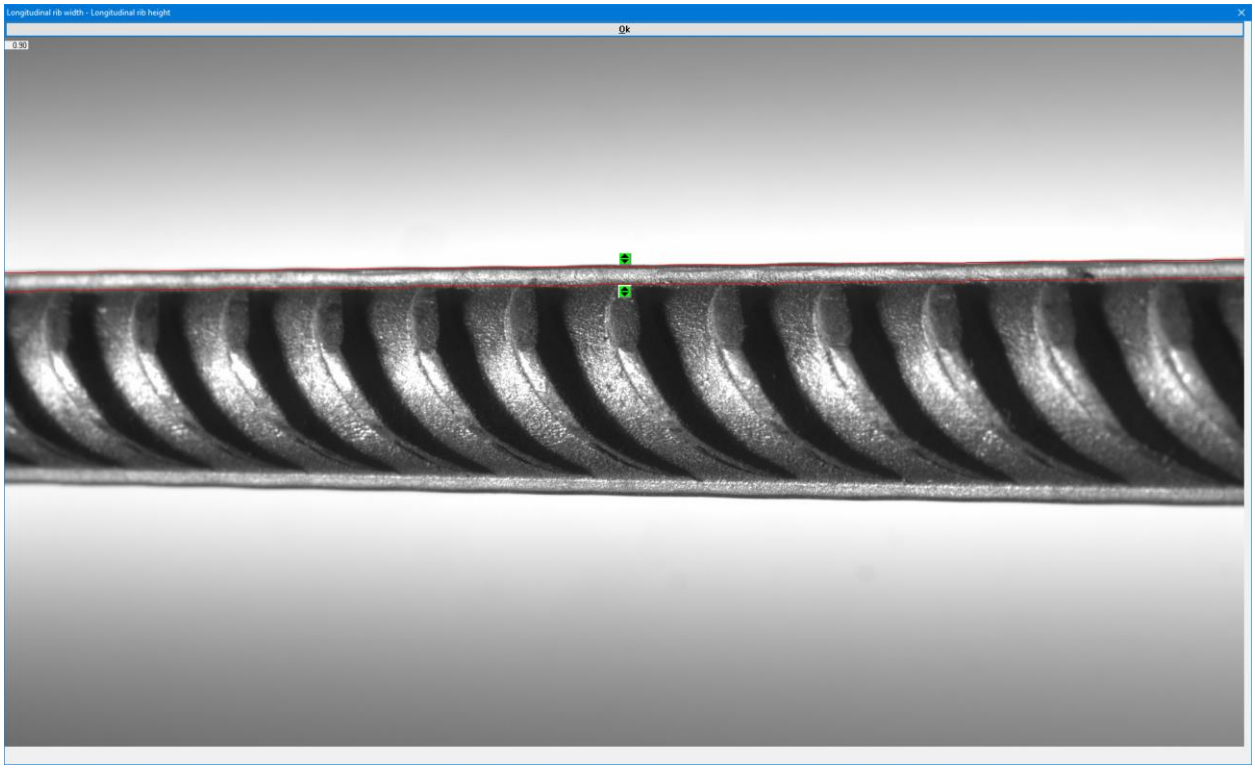
When you have done this, start the measurement process by selecting the “Measure” item from the menu.

Depending on the setting chosen for the Measurement Rules (see above), the rod measurement will now proceed either fully automatically or semi-automatically. For a precise measurement of the rib heights at the quarter points, the position and width of the intervals between the rows needs to be determined exactly; however, exact recognition of the row ends is one of the most difficult procedures of all. So for difficult samples - i.e. those where there is no clear boundary between the rib rows and the seam between the rows - you can check the position found by the device, and correct it if necessary. For this purpose, you are given the Checking and Correction Window shown below for each row interval:



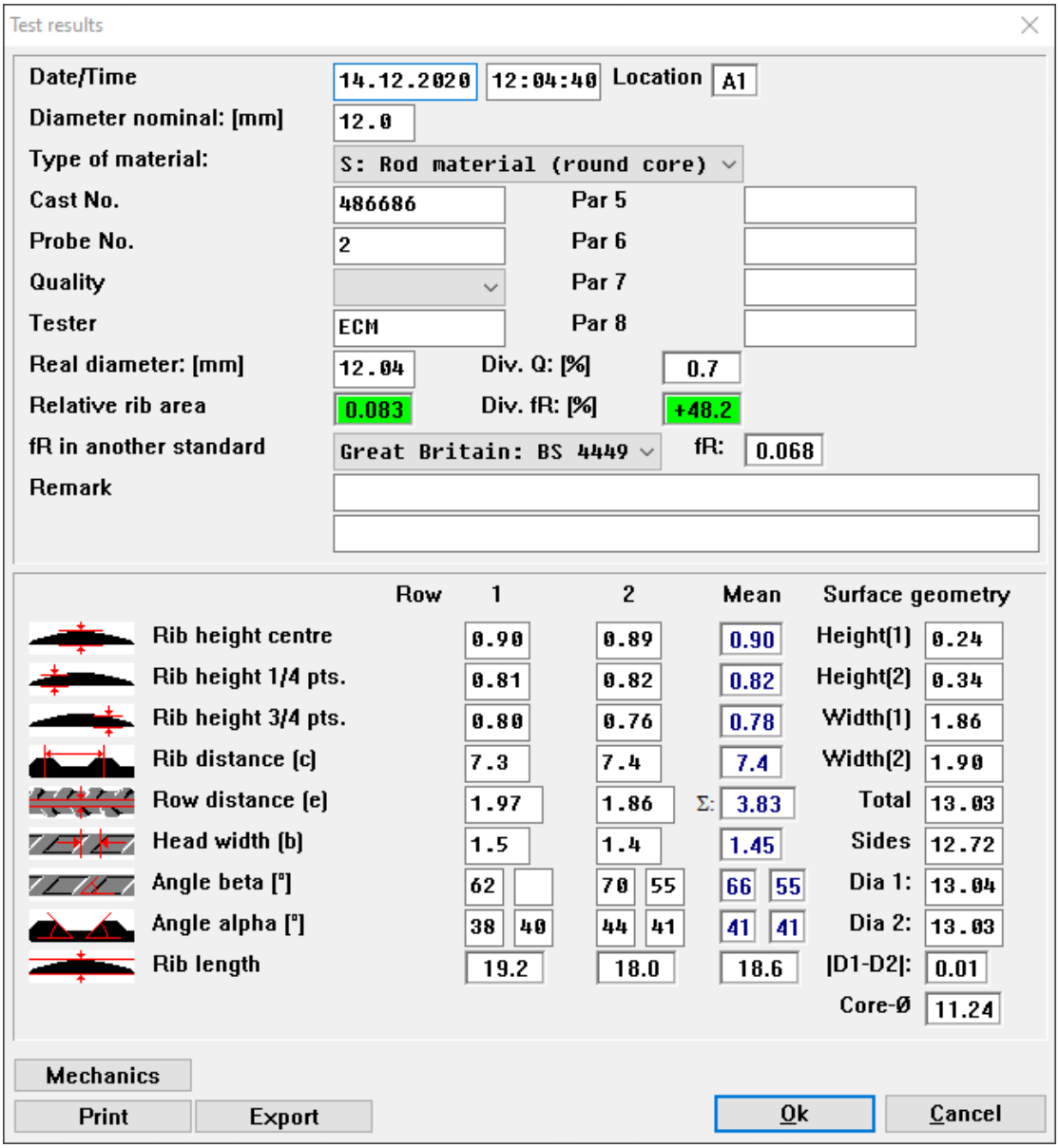
You can correct the row boundaries, which are marked with a green line by clicking the line on the slide switch with the mouse and then moving it to the actual row boundary. In addition, you can also correct the widths of the longitudinal ribs marked with a red line. Then press the "Ok" button to continue the measurement.

The height of the longitudinal ribs can also be corrected manually:



Simply move the measurement limit up or down using the slide switch to adjust the measurement. The red line marks the height of the longitudinal ribs and serves to locate the exact measuring points.

Once the measurement is completed, the measurement results are displayed in a window:



Now you can make entries to classify the measurement, or else you can repeat the measurement. If you press the “OK” button in the result window, the results are saved to the disk. If desired, output to the printer or transferred to a remote host computer. The type of reaction depends on the setting that you have entered under the menu item "Settings / Transfer of results" (see above).

3. Calibration:

Two calibration rods are supplied with the device, and you use these to calibrate it. These rods have an identical and precisely defined diameter throughout their entire length, with incisions at regular intervals. The dimensions of these rods need to be entered once only, when the device is being configured (see below). This installation normally is factory-made.

Die calibration rods are calibrated by a German DKD calibration institute. It is recommended to recalibrate the rods in intervals of 5 years.

The inspection of the accuracy of measurement device should be made at regular intervals (approximately four times a year). For this purpose please execute the function “Calibration => calibration protocol”. You will get a protocol, in which the results will be summarized at the bottom of the document in the following way:

Mean Deviations

Camera 1	Mean Standard Deviation	0.001 0.001		0.00 0.01
Camera 2	Mean Standard Deviation	0.002 0.003		-0.00 0.03
Camera 3	Mean Standard Deviation	0.002 0.005		-0.00 0.05

max. 0.010 mm **max. 0.10 mm**

The measuring accuracy is sufficient according to all program known standards, if the maximum value for the measurement of heights (“vertical”) for mean value and for standard deviation is less than 0.010 mm and for the measurement of the length (“horizontal”) is less than 0.10 mm.

If one of these values is extended, a new calibration of the device is necessary. In any case, you must execute a new calibration if:

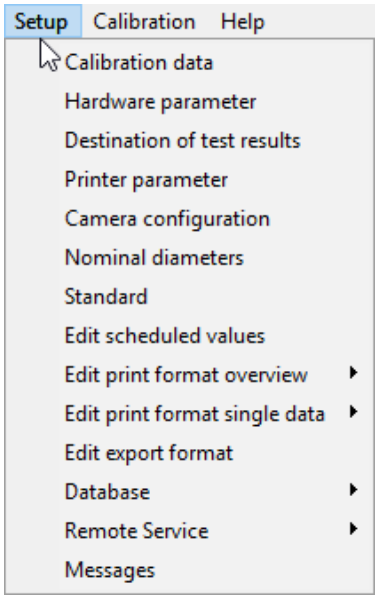
- you have changed the position of one (or more) cameras
- you have corrected the setting (distance and stop) of a camera
- Or you have changed the position of the lateral illumination.

Start the new calibration by executing the function "Calibration –> calibrate"). The program will then ask you to clamp in the measurement rods one after another. Other than this, the calibration is performed automatically.

With the calibration process the measurement system will be traced back to the measurement of exactly calibrated measuring standards. The accuracy of measurement therefore directly can be validated. A separate calibration of cameras and other parts of the measuring system is not necessary.

4. Configuration

To configure the device, use the “Settings” item on the Main Menu. The meanings of the menu sub-items are shown in detail below:

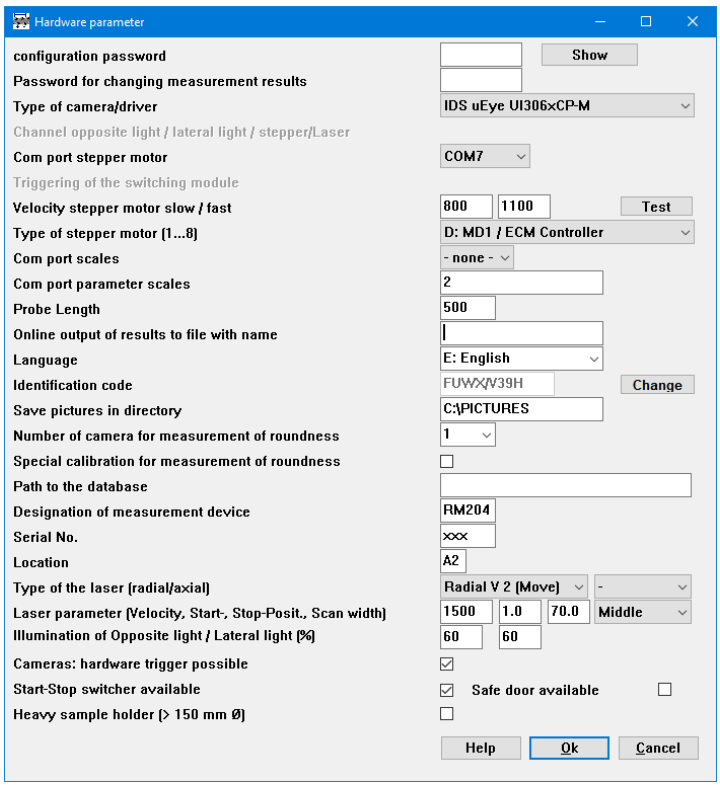


→ Dimension of the calibration rods
→ Input of port addresses and parameters and etc.
→ Transmission goals of the results
→ Input of letterhead and dimensions
→ Orientation and position of the cameras
→ Entry of the possible nominal dimensions
→ Selection of the standard
→ Specification of the set points for special standards
→ Format of printouts - overview
→ Format of the printouts - individual data
→ Format of the export
→ Configuration and maintenance of the database
→ Remote maintenance functions

All the menu items listed here are protected by a password. You can change the password as you wish: to do this, use the “Machine Parameters” input mask.
For a description of the settings which are possible for the integrated data bank, please see Section 5.

4.1. Specify Hardware Parameters

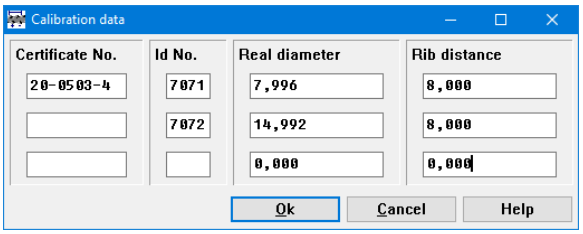
You use the “Machine Parameters” input mask to specify the form of communication between the program and the hardware:



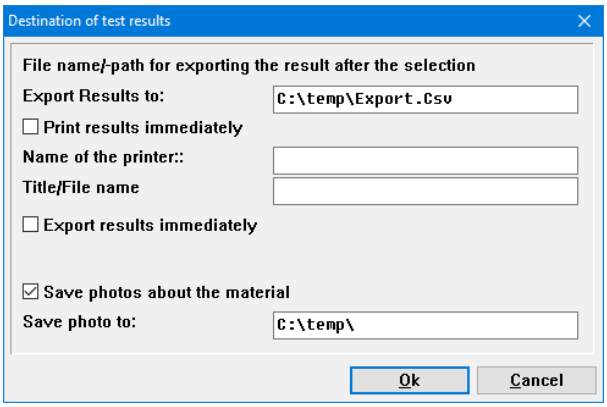
Password	This is used to protect the settings against interventions by unauthorized persons.
Channel ...	System parameter for switching hardware devices. Please do not change.
Com port stepper motor	The Step Motor is used to rotate the rod around its axis, thus allowing it to be measured from various angles of observation. The Controller for the Step Motor is itself controlled via a serial interface. Please: only change these parameters if the hardware is modified.
Velocity...	Velocity or stepper motor.
Type of stepper motor.	Please do not change.
Com port for output results	Port Number for output results by serial interface.
Language	This is where you enter the language for the program.
Ident number	Machine dependent ident number. Please do not change.
Type of the laser	None / Radial V1 (H3) / Radial V2 (Move).
Laser parameters	Option for Laser Radial V2.

4.2. Enter Calibration Data

To calibrate the device, the program has to be told the precise dimensions of the calibration rods. Please find these dimensions from the measurement protocol in the Appendix. And please: only enter data for the rods which are actually available to you.



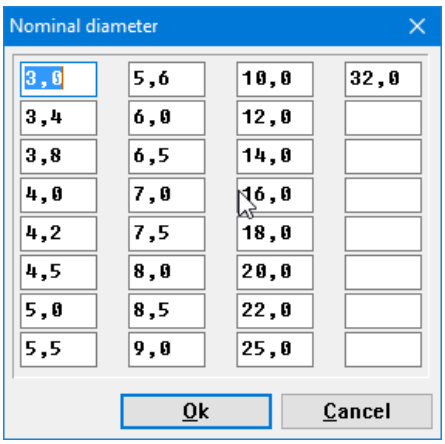
4.3. Destination of test results



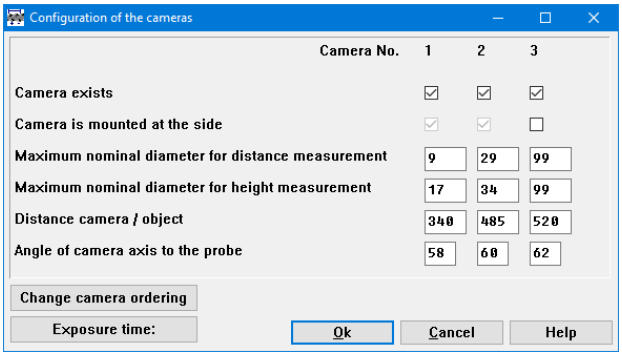
With the dialogue „Destination of test results“ you can manage, if after each measurement and press of the “OK”-Button in the result dialogue the results are written into an export file in the format you have configured. You can save the files in a different folder, e.g. Export instead of saving in the standardized RM folder, but make sure that the Export folder already exists before you export or print the files.

4.4. Enter Nominal Dimensions

This is where you enter the nominal dimensions for the samples which are being tested on the device. During the measurement, a real diameter will be determined: this value is then used to determine the relevant nominal diameter. The value which most closely corresponds to the measured real diameter is chosen from this list.



4.5. Camera configuration



With the dialogue „Camera Configuration“ the program gets information, in which way it can use the cameras for measurement

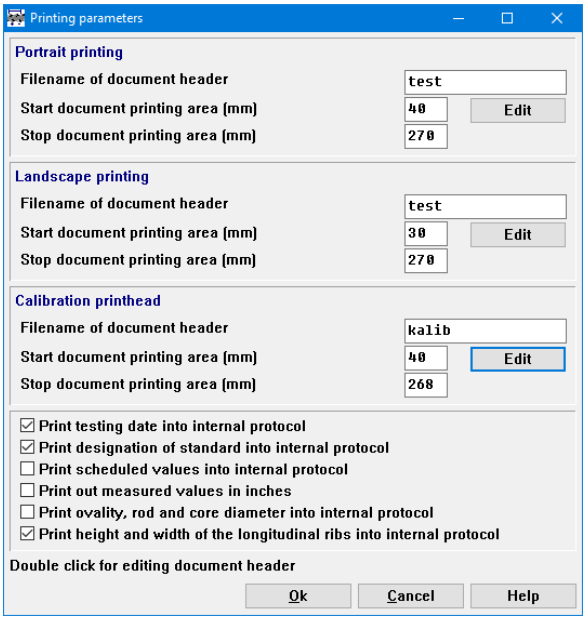
In the first line of the dialogue it is marked, if the camera exists or not. At the device RM 20Xare two cameras build in, at the device RM 30X you will find three cameras.

In the second line it is marked, if the camera is mounted directly above or installed at an angle. The cameras at standard devices RM20X and RM 30X are mounted at an angle.

In the third and the fourth line you find, how then program has to use the cameras for probes with different nominal diameters. In the third line you can tell the program, up to what nominal diameter the camera has to be used for measure the distance between the ribs, in the fourth line for measure the height of the ribs and the distance between the rows.

In then fifth and the sixth line you can find the distance of the camera to the probe and the angle of the camera axis to the probe. This needs the program for internal corrections.

4.6. Design of letter head



With the graphic module implemented in this program an individual letter head for the documents to be printed can be created by easy handling. The place where writing, lines, rectangles, circles or ellipses shall be printed on the paper can be determined.

The input for all size and position details have to be in mm and are counted in the system of ordinates with the origin at the upper left margin of the paper (minus ca. 5 mm, depending on the printer).

An instruction extends for exactly on line and starts with a letter which is characterized by the instruction and a colon, e.g.:

T:
for text instruction or

F:
for font selection (*font*).

A list of parameters, each separated by a comma has to follow. So for example with an input of

T:20,10,Hallo

the text *hallo* will be written 20 mm from the left margin and 10 mm from the upper margin.

List of possible instructions:

Font (font):

F:<font>,<size>,<character>,<orientation>

<font>: can be any kind of implemented type in your window system, e.g. *Times New Roman, Courier* etc.
<size>: size of letter type in mm
<character>: typing character:
normal = 0
bold = 1
italic = 2
underlined = 4
bold and italic = 3
bold and underlined = 5
italic and underlined = 6
or bold, italic and underlined = 7
<alignment>: setting alignment
left aligned = L,
right aligned = R

or center aligned = Z

Before entering the first text instruction the first type instruction should be entered, otherwise the result of the text instruction is not defined.

Text instruction:

`T: <X>, <Y>, Text`

a text is written
`<X>:` position of text in mm off left margin
`<Y>:` position of text in mm off upper margin
`<Text>:` any text

Selection of a pencil for lines (*pen*);

`P: <width>, <colour>`

A pencil for drawing of lines, rectangles, circles and ellipses is selected.

`<width>:` width of the line in mm
`<colour>:` colour of the pencil
0 = black
1 = white

Selection of a brush for areas (*brush*);

`B: <colour>`

A brush for drawing of lines, rectangles, circles and ellipses is selected.

`<colour>:` colour of the brush
0 = black
1 = white

Line:

`L:<from X>,<from Y>,<to X1>,<to Y1>,<to X2>,<to Y2> ...`

A straight line is drawn:

`<from X>:` start of the line in mm off left margin
`<from Y>:` start of the line in mm off upper margin

<to X1>: end of the line in mm off left margin
<to Y1>: end of the line in mm off upper margin
...

Polygonon:

P:<from X>,<from Y>,<to X1>,<to Y1>,<to X2>,<to Y2> ...

A polygonon (closed line curve) is drawn, with internal area filled in with the selected brush:

<from X>: start of the line in mm off left margin
<from Y>: start of the line in mm off upper margin
<to X1>: end of the line in mm off left margin
<to Y1>: end of the line in mm off upper margin
...

Rectangle:

R:<from X>,<from Y>,<to X>,<to Y>,<filling colour>

A rectangle is drawn with the selected pencil and is filled with the selected colour:

<from X>: start of the rectangle in mm off left margin
<from Y>: start of the rectangle in mm off upper margin
<to X>: end of the rectangle in mm off left margin
<to Y>: end of the rectangle in mm off upper margin
<filling colour>: Definition of filling colour of the rectangle:
0 = black
1 = white

Ellipse and circle:

E:<from X>,<from Y>,<to X>,<to Y>,<filling colour>

An ellipse is drawn with the selected pencil and is filled with the selected colour:

<from X>: start of the ellipse in mm off left margin
<from Y>: start of the ellipse in mm off upper margin
<to X>: end of the ellipse in mm off left margin
<to Y>: end of the ellipse in mm off upper margin
<filling colour>: Definition of filling colour of the ellipse:
0 = black
1 = white

In case that the distance between *from X* and *to X* is identical to the distance between *from Y* and *to Y*, a circle will be drawn.

Example:

```
F: Stop, 11, 0, R
T: 190, 7, Test GmbH
P: 0.4,0
L: 20, 20, 190, 20
F: Times New Roman, 3 ,0 ,L
T: 20, 21 , Test GmbH, Test road 34, 12345 Test town
L: 20 , 265, 190, 265
T: 20, 266, Test GmbH, Test road 34, 12345 Test town
T: 20, 270, Managing director: Mr. Testman
F: Times New Roman, 3, 0, R
T: 190, 266, Tel.No: 01234/123456
T: 190, 270, Fax.No: 01234/124680
```

4.7 Define print formats for single data

By using the dialog *define print formats* special formats can be defined for printing of individual data. These formats can be used for selecting an individual formating of the print-output of the individual data. One print format can be defined for each different number of rows.

A graphic description language, into which pre-defined variables for the different measuring values can be embedded, is the basis for the formatting. The print format is identical to the format for creating of letter heads (see above).

Due to the possibility of positioning of different individual measurements on one sheet, the first instruction has to be the print size of a sample via:

H=<print size>

e.g.:

H=42

for a print size of 42 mm, which means that individual samples will be printed on the paper with a distance of 42 mm.

The vertical positioning is always relative to the upper edge of an individual sample.

The output of measuring values can be done via text instructions in which the measuring value itself is defined as a variable. Variables are notified by squared brackets. E.g. by using the instruction

T: 20,5 [RH.1]

the rib height of the first row will be printed at the position 20 mm off the left margin and 5 mm of the printing start of the actual sample. The abbreviation *RH* notifies the rib height and the

appendix 1, which is appended by a point to the variable abbreviation, notifies the row number. A further appendix which can be used for averages is the *M* and the *S* for sums.

List of variables:

DATE : Probe date
TIME : Probe time
PAR1 : Parameter 1
PAR2 : Parameter 2
PAR3 : Parameter 3
PAR4 : Parameter 4
PAR5 : Parameter 5
PAR6 : Parameter 6
PAR7 : Parameter 7
PAR8 : Parameter 8
REM : Remark
NR : Number of Row
NRX : Number of Row with material type
DI : Nominal diameter
DR : Real diameter
RH : Rib height
RX : Maximum Rib height
RQA : Rib height 1/4 pts
RQB : Rib height 3/4 pts
RQM : Rib height ¼ pts mean
RD : Rib distance
RO : Row distance
HW : Head width
RA : Rib angle
RAB : Rib angle B, if there are alternate inclinations
AL : Angle alpha
AR : Angle alpha B
FRA : fR absolute
FRR : fR relative
FRS : Scheduled value
RP : Tensile strength
RM : Yield point
A5 : Elongation A5
A10 : Elongation A10
AGL : Elongation Agl
OV : Ovality
QR : Cross section deviation
CD : Core diameter

LO : Location
STD : Standard
W1 : The height of longitudinal rib1 for the rod material with 2 rows
W2 : The height of longitudinal rib 2 for the rod material with 2 rows
W3 : The width of longitudinal rib 1 for the rod material with 2 rows
W4 : The width of longitudinal rib 2 for the rod material with 2 rows
W5 : Total
W6 : Sides
W7 : Dia. 1
W8 : Dia. 2

List of appendices

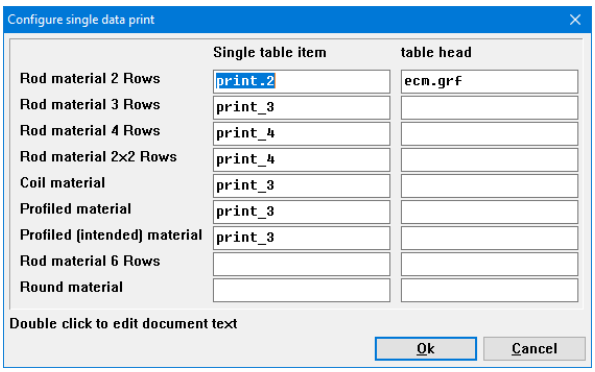
1 : Row 1
2 : Row 2
3 : Row 3
4 : Row 4
5 : Row 5
6 : Row 6
M : Mean value over all rows
S : Sum over all rows

It is also possible to change the pre-defined formating of the print output. For numerical outputs the length of the numeral string and the number of decimals can be selected. For string outputs a partial string by defining the start position and the length can be defined.
To do so please add the two required numerical values in the squared brackets, each separated by a colon.

Example:

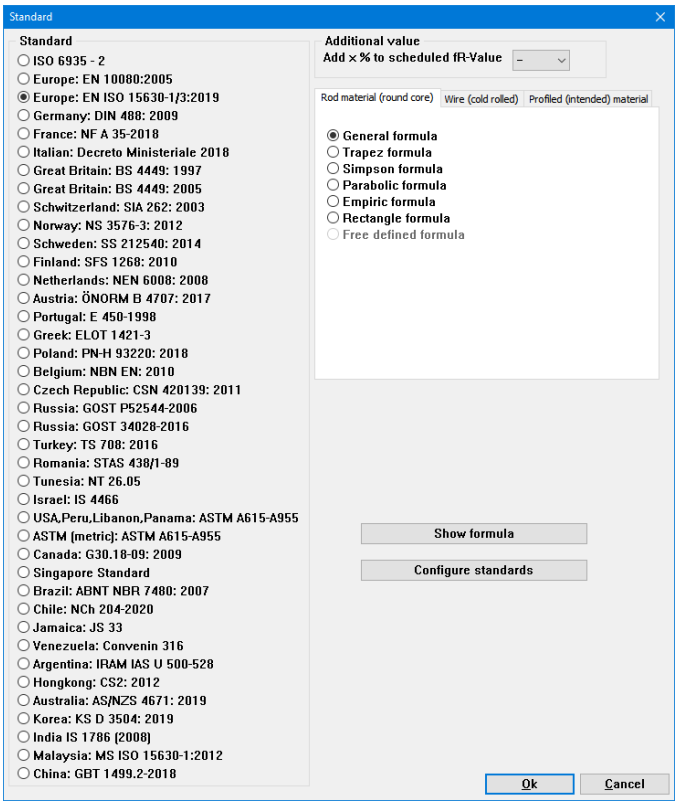
Date:	[DATE]
Sum of the row distance:	[RO.S]
First parameter:	[PAR1]
First parameter, 1. to 5. letter	[PAR1:1:5]

The print templates are entered via an input dialog, which can be accessed via the menu item Setup / Print format for single data. Two different print formats are compatible with each material.

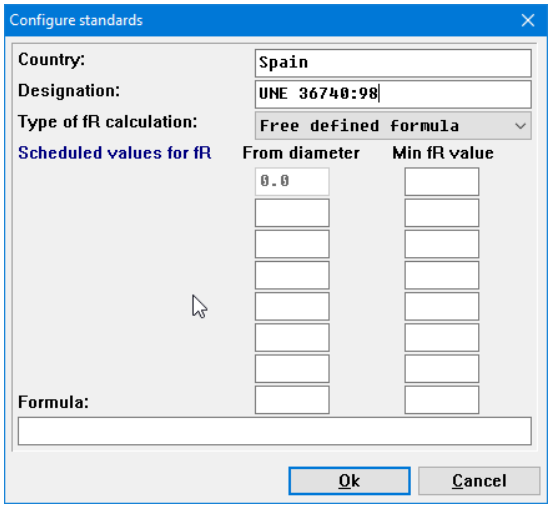


The individual entries provide a print format for each material that is stored in a text file with the above format. To edit these templates, please place the mouse cursor on a field and double-click. A text editor opens with which you can edit the print previews.

4.8. Setting of the actual standard



The actual standard for the print out and the calculation of the fR-Value can be set by this dialogue. Additionally to the presetted standards it is possible to install some new standards. By pressing the button „Configurate standards“ you will get the following dialogue.:

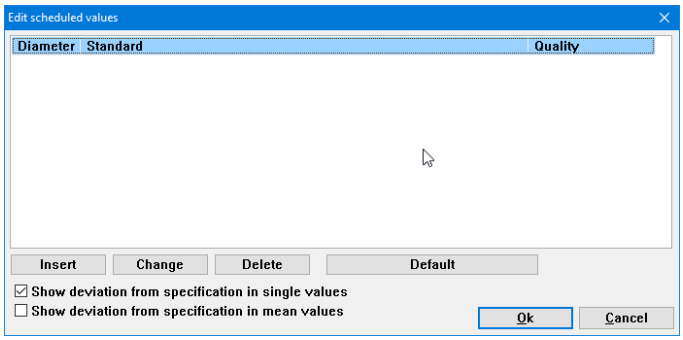


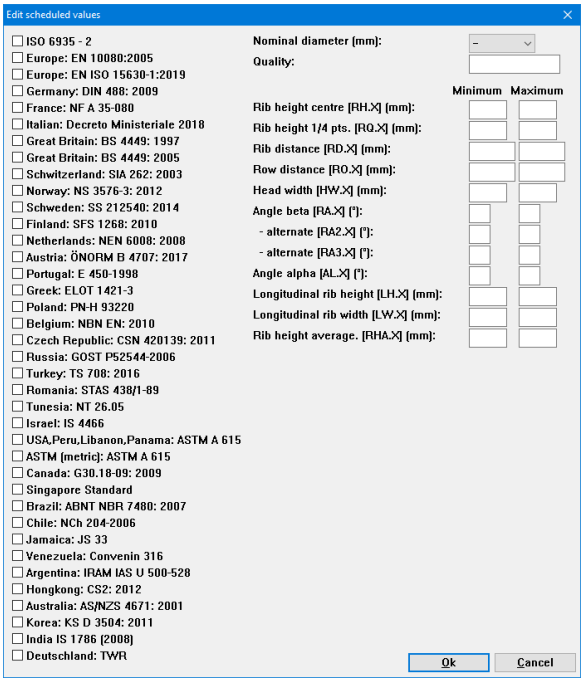
It is now possible for you, to enter the country and the designation of the standard and the type of fR

calculation. If there is no fR-calculation, please choose „none“. Furthermore it is possible to enter the scheduled values for fR calculation if calculation is needed. To insert the reference values for rib height, distance etc. please choose the configuration function as described in section 4.7.

4.9. Configurate scheduled values for standards

With the function „Edit scheduled values it is possible to enter several reference values related to nominal diameter for standards. You will get the adjoining list. You can insert, change or delete items for scheduled values within the list. Furthermore you can decide if values that are out of spezification should be marked.

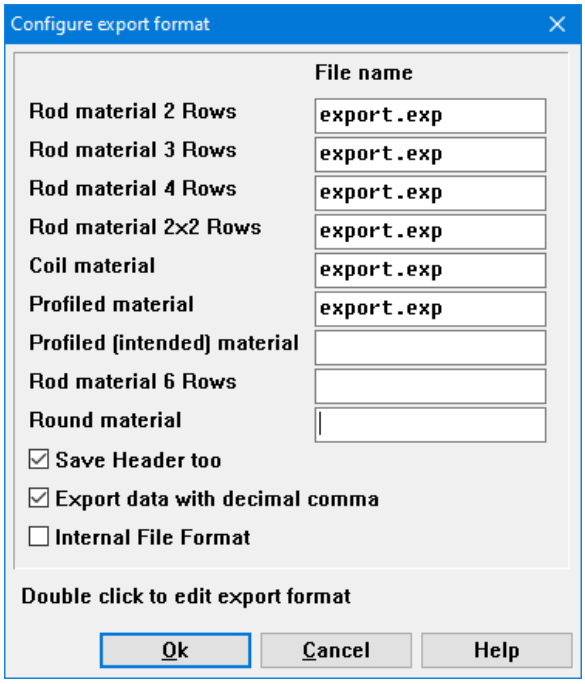




For editing single items you will got the adjoining dialogue. If you want to distinguish between differenent qualitys within one standard, please insert the quality too. Please note, that in this case you have to indicate within the configuration for the field names, what field is reseverd for the quality designation.

4.10. Configurate the Format for data export

With the function *Edit export format* it is possible to define a special format for the export of single data. It is possible to appoint for every type of material a specific output.



Configuring the export format can be done by creating an ASCII text format file that contains in the first line the format of the output. Please fill in the above dialogue for the material, you wish an export format the name and the path of the file. With a double click on the file name you can open a window for editing this file.

The export output of the measurement values will be done by text description, in which you can insert the variable names of the values. Variables are recognizable by including square brackets. The name of the variables are identical to that you can found in the print format description.

Example: The file „EXPORT.EXP“ has the following content:

[DATE];[TIME];[PAR1];[PAR2];[PAR3];[DI];[RH.M];[RQA.M];[RQB.M];[RD.M];[RO.S];[HW.M];[RA.M];[AL.M];[FRA]

Then the export of 3 data records will deliver the following output:

```
09.09.09;08:59;;;;14.0;1.20;0.86;0.91; 8.1; 5.1;1.88;50;58.5;0.086
11.09.09;10:56;;;;14.0;1.25;0.86;0.85; 8.2; 5.5;2.05;50;56.5;0.083
11.09.09;11:08;;;;16.0;1.32;0.91;0.86;11.0; 8.0;3.00;44;48.5;0.062
```

For the execution of a data export please see chapter 5.2.

If you wish to have a automatic export after each measurement, please see chapter 4.3.

5. Database Functions

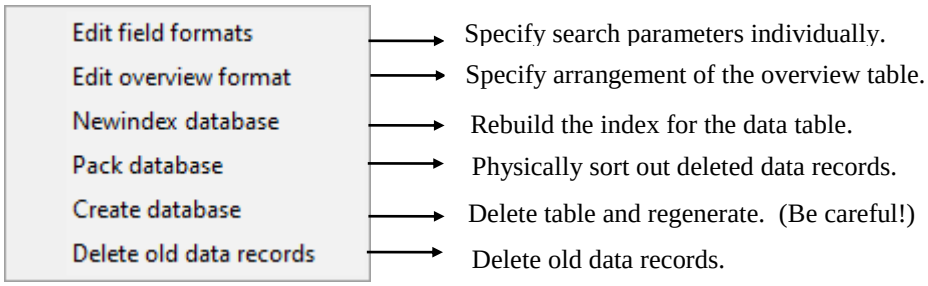
You can use the device's integrated data bank to store results temporarily or permanently, to select them according to different criteria, and to log them at a later time.

5.1 Data Organisation

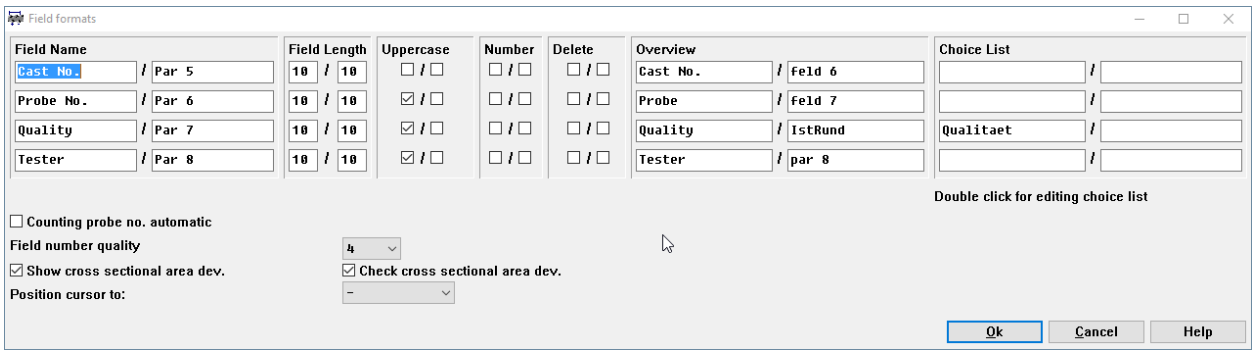
The integrated data bank contains a table which includes a data record for every result you have saved. For classification purposes, the data records contain these fields:

- measurement series and sample number
- date and time
- nominal dimension of the rod

You can also assign 4 further fields according to your own requirements. To assign these fields, use the "Settings / Data Bank" menu item. First, this will give you the sub-menu shown here:



If you choose the "Edit Field Formats" menu item, you will see the menu shown below:



You are free to choose four field parameters in all. Each one of these fields may be a maximum of 20 characters long.

At "Field Names", enter the names of the fields. This is also the term which appears in the input mask of the results dialogue. Since this only involves pure text, the field names are not tied to a specific form.

At “Formats”, enter the format of the field. You can choose between numerical fields and character fields (Number). You can choose the field length and if characters should be convert to uppercase.

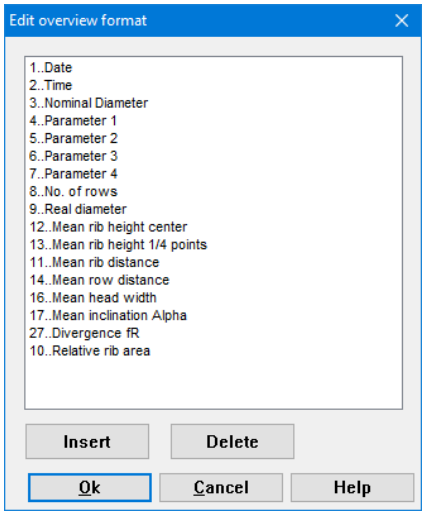
In the fifth column, enter the text which the field should carry as it is shown in the overview. When you do this, the text length should not be very much longer than the field length entered for “Formats” - otherwise space will be wasted in the overview.

In the last column you can specify choice lists for input predefined values into the fields. Choice lists are ASCII-files which contain the values for the input (each line one value). You can edit this files by double click on the choice list fields.

The data bank should be configured after the device has been set up, and this should be thought out with as much foresight as possible: when the field contents are modified at a later stage, this can lead to disharmony with data which have been already saved, if the new formats are not chosen well. For alphanumeric fields, it is in fact possible to extend the field length, but for numeric fields, the right-hand flush alignment of the numerical representations results in the loss of the values which were previously stored in this memory space.

If you also want to use the program to perform a statistical evaluation of the mechanical data, then click on the “Reserve Memory Space for Mechanical Values” checkbox: this will make it possible for the mechanical parameters relating to every measurement to be entered as well.

In addition, you can specify the arrangement of the columns in the overview table. To do this, select the “Specify Overview Format” entry in the data bank menu. You will see the input menu shown on the next page. Please use the field numbers to indicate the sequence in which you want to arrange the columns in the table.

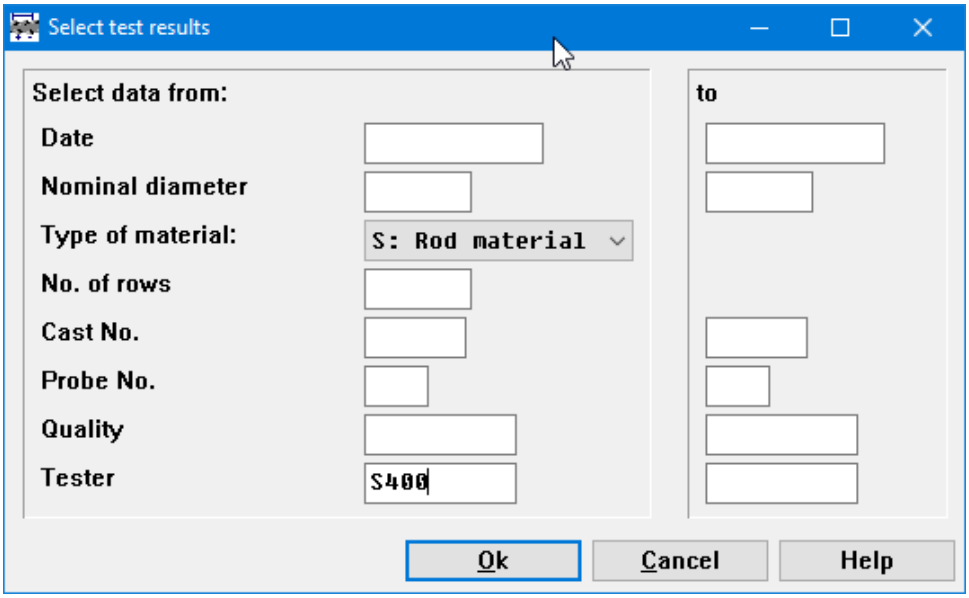


5.2 Select Data

The software for the Rib Measurement Device contains a high-performance module for data selection. You can call this module up by choosing the “Select File / Results” item on the Main Menu. You will then see (for example) the image shown on the next page:

This mask combines two displays. In the right-hand half of the image, you see an overview of the data you have selected (this is empty at first). In the left-hand half, you see the view of the data record which you have just selected: this is partially concealed at first. You can switch between the two displays by clicking on the one you want.

First, however, you have to select the data you want. To do this, click on the “Search” button. You will be shown the selection menu as below:



Now you can restrict the results you want to look at more closely, or print: you do this by entering “from” and “to” values. The convention which applies here is that when you enter a “from” value but no “to” value, only those data records will be found which comply exactly with this

characteristic. In the example given above, you will obtain all results from rod material measurement with a name of Tester S400.

Results list

Single data | Search | Print | Export | Statistics | All | Close

Date	Time	Dia.Nom	Schmelze	Probe	Qualität	Prüfer	Rows	Dia.Re	Height	1/4	Dist.	Row	Width	Alpha	% fR	fR
17.05.18	08:59	20.0	182033	4	18-D54B	S400W	2 (S)	19.75	1.75	1.18	12.6	3.17	2.6	63	37.5	0.077
17.05.18	09:01	20.0	182033	5	18-D54B	S400W	2 (S)	19.74	1.76	1.20	12.6	3.16	2.6	63	39.3	0.078
17.05.18	09:02	20.0	182033	6	18-D54B	S400W	2 (S)	19.74	1.75	1.17	12.6	3.23	2.6	63	35.7	0.076
17.05.18	09:04	20.0	182033	7	18-D54B	S400W	2 (S)	19.74	1.76	1.20	12.6	3.27	2.6	63	39.3	0.078
17.05.18	09:05	20.0	182033	8	18-D54B	S400W	2 (S)	19.74	1.75	1.19	12.6	3.27	2.6	63	37.5	0.077
17.05.18	09:06	20.0	182033	9	18-D54B	S400W	2 (S)	19.74	1.76	1.19	12.6	3.38	2.6	63	37.5	0.077
17.05.18	09:08	20.0	182033	10	18-D54B	S400W	2 (S)	19.74	1.76	1.17	12.6	3.13	2.6	63	37.5	0.077
17.05.18	09:11	20.0	182033	11	18-D54B	S400W	2 (S)	19.75	1.75	1.19	12.6	3.23	2.6	63	37.5	0.077
17.05.18	09:12	20.0	182033	12	18-D54B	S400W	2 (S)	19.74	1.76	1.18	12.6	2.88	2.6	63	39.3	0.078
17.05.18	09:14	20.0	182033	13	18-D54B	S400W	2 (S)	19.75	1.76	1.19	12.6	3.09	2.6	63	39.3	0.078
17.05.18	09:16	20.0	182033	14	18-D54B	S400W	2 (S)	19.74	1.76	1.18	12.6	3.23	2.6	63	37.5	0.077
17.05.18	09:19	20.0	182033	15	18-D54B	S400W	2 (S)	19.74	1.75	1.15	12.6	3.09	2.6	63	35.7	0.076
17.05.18	09:39	20.0	182033	1	18-D56A-LO	S400W	2 (S)	19.74	1.82	1.26	12.3	3.17	2.5	61	50.0	0.084
17.05.18	09:41	20.0	182033	2	18-D56A-LO	S400W	2 (S)	19.74	1.82	1.25	12.4	3.06	2.5	62	48.2	0.083
17.05.18	09:43	20.0	182033	3	18-D56A-LO	S400W	2 (S)	19.74	1.83	1.26	12.4	3.20	2.5	61	48.2	0.083
17.05.18	09:44	20.0	182033	4	18-D56A-LO	S400W	2 (S)	19.74	1.83	1.25	12.4	3.16	2.5	62	46.4	0.082
17.05.18	09:46	20.0	182033	5	18-D56A-LO	S400W	2 (S)	19.74	1.83	1.24	12.4	3.02	2.6	62	48.2	0.083
17.05.18	09:47	20.0	182033	6	18-D56A-LO	S400W	2 (S)	19.74	1.82	1.24	12.4	3.20	2.5	61	46.4	0.082
17.05.18	09:48	20.0	182033	7	18-D56A-LO	S400W	2 (S)	19.74	1.82	1.26	12.4	3.24	2.5	62	48.2	0.083
17.05.18	09:49	20.0	182033	8	18-D56A-LO	S400W	2 (S)	19.74	1.83	1.26	12.4	3.20	2.5	61	48.2	0.083
17.05.18	09:50	20.0	182033	9	18-D56A-LO	S400W	2 (S)	19.74	1.83	1.26	12.4	3.09	2.5	61	48.2	0.083

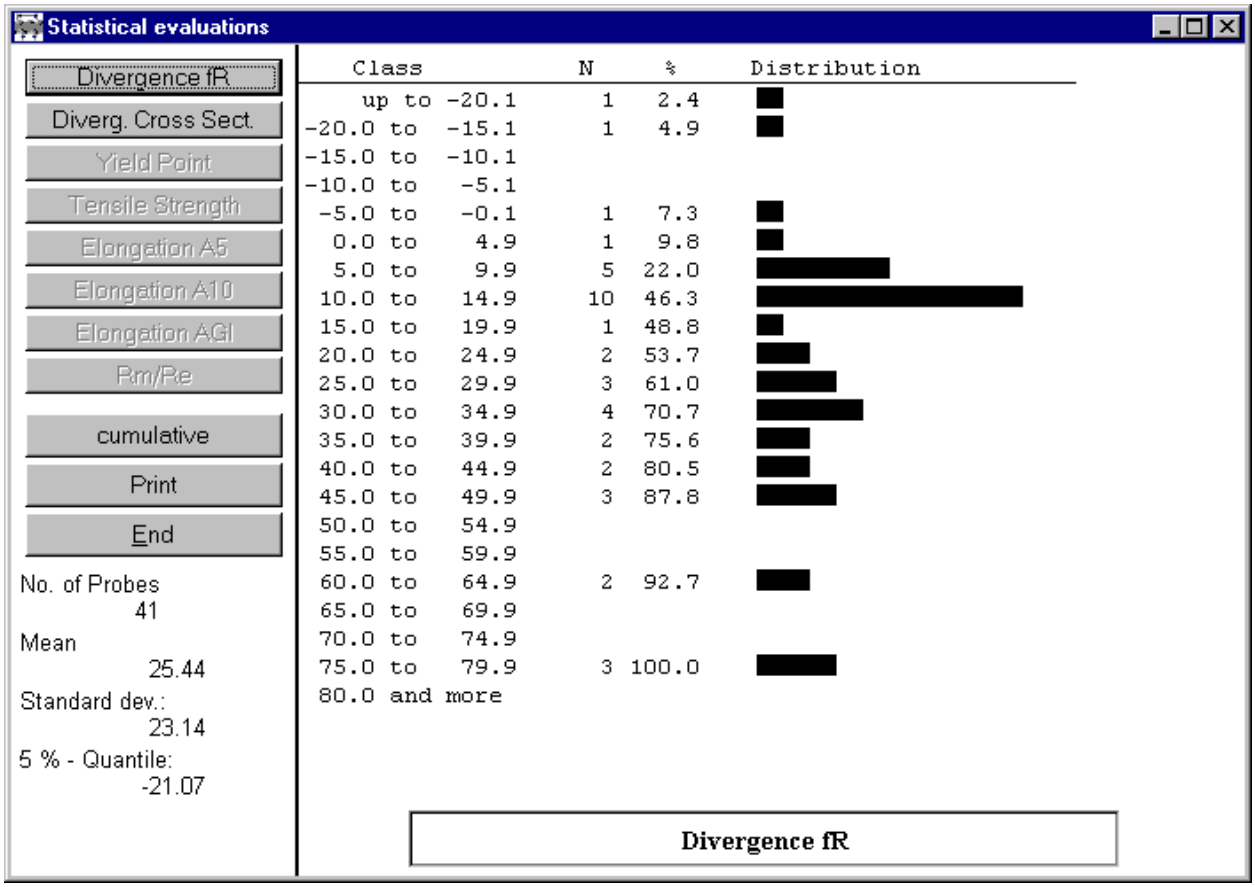
The data records which have been found will be shown in the overview. Now you can mark certain data records with the mouse (click on them), and print out the marked records together in a log. To view the measurement results, please click on the left window field. Then you will see the data in single view.

Now you can modify individual data records, start a new search run, or output precisely the record which is indicated to the printer. To scroll within the selected records, use the button which is marked with an arrow.

5.3. Statistical Evaluation

You can generate a statistical evaluation relating to the values which you have selected. To do this, click on the “Statistics” entry in the Overview Menu. First, you will be shown an empty window, which is where the statistical evaluation you want will be generated. Depending on whether you have reserved memory space for mechanical values at installation, you will now be given either the “Cross Section Divergence” or “fR Divergence” (= specific rib surface), or else the section boundary, tensile strength and extension buttons as well.

To generate an evaluation, press the corresponding button. The evaluation is generated straight away, and is displayed in the window. You can also output the evaluation to the printer immediately.



5.4 Data Maintenance

To safeguard the data stored in the data tables, you should carry out a regular data protection operation. You will find the data for the device on Drive C, under “C:\RM”.

If you receive error messages, you should first reconstruct the index file for the defective table. To do this, choose the “Index Data Bank” item in the Configuration Menu, and press “Return”.

If you cannot remedy the error in this way, you must go to your back-up copy of the table. When doing this, please remember the following tips:

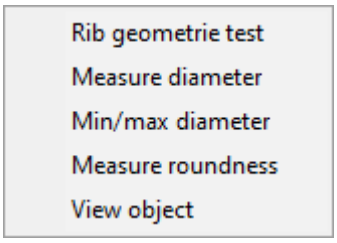
A table consists of a data file (file suffix ".DBF") and an index file (suffix ".NDX"). The data file is organised as a sequential file, containing the actual table data in coded form. The index file is used as an access path to the data records in the data file. As described above, it can be reconstructed at any time using the data from the data file.

To safeguard the data, the files are given the attribute “hidden” which means that they cannot be displayed with the normal “DIR” command. However, they can be viewed and manipulated at any time, for example by using the “Norton Commander”.

6. Test Functions

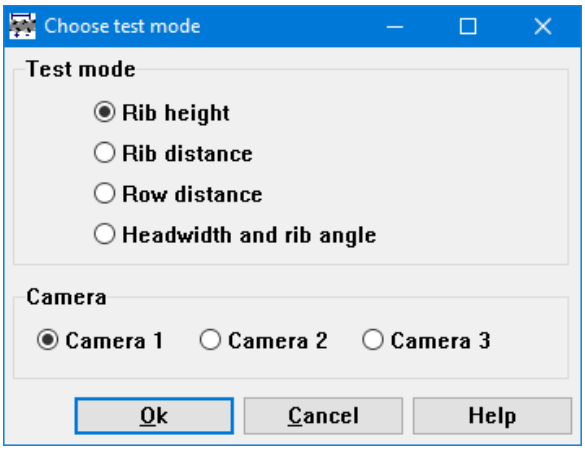
The program for the Rib Measurement Device is provided with several useful test functions. You can use these to:

1. selectively perform individual measurements of row width, rib height and rib distance, as well as headwidth and rib inclination;
2. determine the diameter of a sample at various points;
3. determine the horizontal length of an object placed in the measurement area;
4. determine the minimum and maximum diameter of a rod
5. determine the roundness of a round wire
6. or view any desired object using the manual control.



6.1. Rib Geometry Test

This function is used to carry out a selective measurement on a sample rod. When you have started the module, you will first see the dialogue shown below:



Now you can select the measurement which you want to perform, and which camera should be used for it. To do this, click on the button you want, and confirm by pressing “OK”.

Immediately after you have done this, the device begins the individual measurement.

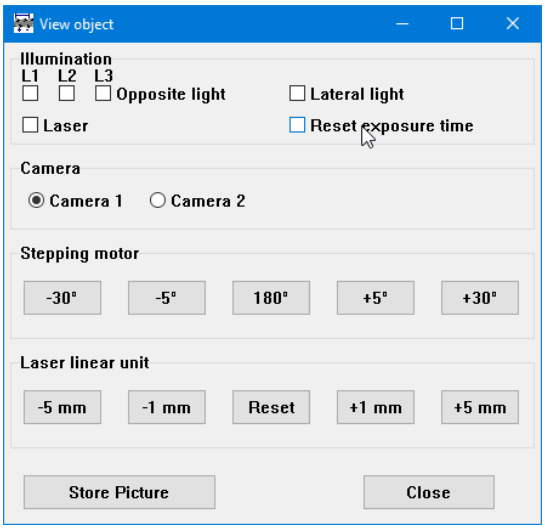
6.2. Determine the Diameter

You can use this test function to determine the diameter of a rod at various positions, in counter-illumination. To do this, clamp the rod in, and then select the test functions from the Menu.

6.3 Determine Lengths

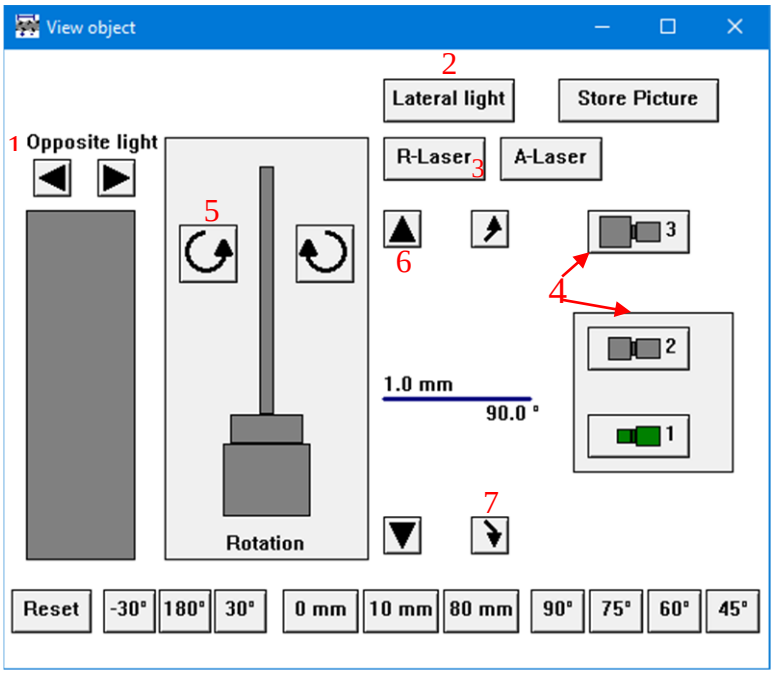
This test function is used to determine the horizontal length of an object, in counter-illumination; it should primarily be thought of as an internal factory calibration check.

6.4 View Object



The “View Object” test function is a useful module for checking the operation of the illumination, the cameras, the step motor module and the moving of laser. After the program has started up, you see the input mask shown here. Now you can switch the bottom and lateral illumination on and off as you wish, choose between any of the three cameras for the RM 304 or the two cameras for the RM 204, and run the motor at revolutions of 5 or 30 degrees. Besides, you can check the moving of the laser system, when you click on the bottom -5 / -1 or +1 / +5 mm. Please attention that this option is valid only for the device with Laser M-System.

The illustration below shows the individual test functions of "View object" for the RM 604 model.



1. The number 1 describes the opposite light of the system. When you click on the button ▶, the LED light will turn on in a sequential row of 1 to a maximum of 5 rows. In contrast, the button ◀ describes the switching off of the backlight in a row.
2. Button 2 describes the lateral light in two states: On / Off.
3. Button 3 represents the laser in horizontal direction to the vertical axis of rebar.
4. The number 4 indicates the order of the cameras in the system. You can decide the point of view by the camera number.
5. The number 5 (↺ or ↻) represents the rotation of the stepper motor. The buttons indicate the direction of rotation. If you keep the button pressed, the stepper motor is rotated permanently. Or you can alternatively select the -30 ° / 180 ° / 30 ° - buttons.
6. The number 6 (▲ or ▼) represents the vertical movement of the 1st or 2nd camera to view the length of the sample. You can also select the 0 mm / 10 mm / 80 mm – quickly buttons instead.
7. On the number 7, the view angle of the 1st or 2nd camera from 90 ° to 45 ° is displayed through the button ↗ or ↘.

If it becomes necessary to adjust the fine focus on the cameras, please use the test rod which is provided with a test image. Clamp it in, and then use the “Test/View Object” menu to switch on the lateral and bottom illumination. Change the camera objective settings until you obtain an image with optimal sharp focus and high contrast. Please do not change any of the settings on the camera itself, since these are optimally configured for the application case.

7. Maintaining the Device

This device is largely maintenance-free. You should just remove any impurities from the matt glass sheet at occasional intervals. Apart from this, the camera objectives should be cleaned with a soft cloth, about once every 2-6 months depending on the environment.

8. Specifications

Manufacturer:	ECM Datensysteme GmbH Am Siedenkamp 24 D-2160 Bliedersdorf Tel.: 04163-811566 Fax: 04163-808423
Ambient conditions	Operating temperature: -0°C bis 40° C Operation humidity: less than 90 %. 220-230 V AC / 50 Hz Power consumption: approx. 250 W max.
Connections	AC connector 220-230 V AC/ 50 Hz Step motor controller (USB)

The Manufacturer does not warrant for the correctness of the testing outcome by oblivion of the operation guide. The danger of damaging the device does not exist.

Appendix

A. Spare part list

1. PC system

    1.1. Computer with Win 10.

2. Step motor system

    2.1. Step motor controller, Trinamic TMC-5160

3. Illumination system

    3.1. Lateral light LED 24V
    3.2. Opposite light LED 24V

4. Camera unit

    4.1. B/W CMOS-Camera, Type IDS UI-3060CP-M-GL Rev. 2
    4.2. Objectiv, Type Opto Engineering EN2MP2514
    4.3. Objectiv, Opto Engineering EN2MP5018
    4.4. Objectiv, Type Opto Engineering EN2MP7528

5. AC adaptor and switching unit

    5.1. Power supply Tracopower 24V -3.2A
    5.2. Circuit board type ECM RM V2.0

6. System box

    6.1. Plexiplastic pane 290 x 100 mm, white

B. Interface Specification

B.1. Structure of the Data Telegram

An external device or another program communicates with the measuring module of the Rib Measurement Device via a data telegram, which always has the same structure. You can use this telegram to start the measuring process and transfer some key parameters at the same time, and you can receive the measurement results with the same data structure. The format of the data telegram is as shown below; all numerical values have been shown in Ascii characters here:

```
TYPE Eine_Reihe = RECORD Ripp_Mitt  : Number(4,2);
                         Viert_Pkt_A: Number(4,2);
                         Viert_Pkt_B: Number(4,2);
                         Ripp_Abst  : Number(4,1);
                         Reih_Abst  : Number(3,1);
                         Kopf_Br    : Number(3,1);
                         Ripp_Neig_A: Number(2);
                         Ripp_Neig_B: Number(2) END;

TYPE Ergebnis = RECORD Intern    : Char;
                       Sequenz   : Number(5);
                       Lfd_Nr    : Number(3);
                       PruefDat  : Date;
                       UhrZeit   : Time;
                       Abmessung : Number(4,1);
                       Durchm    : Number(5,2);
                       Param_1   : Char(20);
                       Param_1   : Char(20);
                       Param_1   : Char(20);
                       Param_1   : Char(20);
                       Bemerk_1  : Char(45);
                       Bemerk_2  : Char(33);
                       Streckgr  : Number(4);
                       Zugfest   : Number(4);
                       Dehnung   : Number(4,1);
                       AnzReihen : Number(1);
                       Bezog_R_Fl: Number(5,2);
                       Ergebnis  : ARRAY[1..6] OF Ein_Ergebnis;
                       Frei     : Char(10) END;
```

B.2. Communication via the Serial Interface

For communication via the serial interface, a telegram in the format shown above is sent to a host computer via the selected interface, after every measurement has been performed. There is no handshake.
The communication can be expanded so that a telegram containing the parameters you want for the data storage in the device is also sent to the Rib Measurement Device before the measurement is started.

B.3 Communication Using a Coupling File

For communication via a coupling file, the first character of the data telegram ("internal") is used to communicate the status of the data in the file. The file itself contains precisely one data telegram. The meanings are as follows:

Internal = "N": Information from host program to Rib Measurement Device: start new measurement!
Internal = "M": Information from Rib Measurement Device to host: measurement has started.
Internal = "R" : Information from Rib Measurement Device to host: Measurement is finished. Measurement data may be read.

To achieve communication, a host program saves a data telegram in the coupling file with the value Internal = "N" when it is desired to start a measurement. Parameters to classify the value can already be transferred at this point. The Rib Measurement Device then starts the measuring process immediately. Once the measurement is finished, the result is again saved in the coupling file with the value Internal = "R". By regular polling (e.g. every 2 seconds), the host program can read the value for "Internal" and when it obtains the value "R", it can receive and process the measurement data.

B. Circuit diagram