

VI. Inspection program QM-THREAD



VI.1. *Characteristics of the program QM-THREAD*

The QM-THREAD program has been designed as a support system for the computer aided inspection for screw threads and screw thread gauges.

All thread nominal values can be generated through this program in accordance with the following standards:

- Threads and thread gauges according to ANSI/ASME B1.1/ B1.2
- ISO metric screw threads according to DIN ISO 1502 (DIN 13)
- Gauges for Metric M Screw Threads according to ANSI/ASME B1.16M-1984
- NPSM pipe threads according to ANSI/ASME B1.20.1
- Screw taps according to DIN 802
- Pipe threads and gauges according to DIN ISO 228 (DIN 259)
- Steel conduit threads according to DIN 40431
- ISO metric trapezoidal screw threads according to DIN 103
- Parallel screw threads of Whitworth form according to B. S. 84 (BSW-and BSF- series)
- HELICOIL threads according to Boellhoff factory standard
- Knuckle threads according to DIN 405
- Buttress threads according to DIN 513 / factory standard
- Threads for valves according to DIN 7756 and ETRTO V.7

Attention: Some of the standards are optional available - call your local dealer!

The measurement process can be done according to VDI/VDE/DGQ 2618 guidelines or any other you wish to apply. Before starting up the program, the user should be familiar with the guidelines being applied as well as the measurement procedure for the inspection of screw thread gauges.

Only a basic knowledge of computers is necessary in order to use the QM-THREAD program.

Measurement data can be entered through an on-line connection of the measurement device or on the keyboard. If the former is the case, the measurement device must be connected to the serial interface of the PC (V.24, RS 232) or by a PC interface card (Heidenhain IK121), TRIMOS WinDHI indication program or SIP LMC program including interface unit.

For more information see the manual of the related indication program.

The QM-THREAD program can be started directly from the gauge data management system QM-MANAG. The primary function of the program is to calculate all of the required gauge sizes and tolerances according to the thread standards and type of gauge being applied (for example: Screw thread GO ring gauge). Any limitations of the applied standard will be pointed out.

After selecting the QM-THREAD standard, the type of gauge, (for example: Screw thread GO ring gauge) and entering the thread designation, for example: M20x1, all of the required gauge nominal values and tolerances will be calculated automatically. The limitations and restrictions of the norms being applied will be indicated.

The program supports the nominal value generation and the measurement process for all types of thread gauges being standardised and also for all types of plain gauges used to check the minor or major diameter of screw threads.

The results of the evaluation can be produced on the screen and/or on the printer and/or in a file. The nominal values of the gauge will be processed in the calibration certificate according to the inspection requirements and the measurement results. Tolerance excesses will be noted and identified.

VI.2. Starting the program QM-THREAD

You can start the QM-THREAD program directly from the QMSOFT-command-Shell (click the corresponded symbol in the shell). The other way is to start the program through the Windows-file manager or the Windows95 Explorer.

Before working with the program you have the possibility to customise some things according your individual needs and wishes.

The following program settings you have to do:

- Configuration of the On-line Interface:

If you use a direct linkage between the computer and your measuring machine to transfer measuring values, at first you should start the indication program required (RS232DRV, IK102021 or SIDDRV depended on the device and the interface connection you use) and set the correct parameters for the Online Interface (see also the manual of the used program).

- Program settings and inspection conditions:

Here you can set some general things for the program environment; for example: the default way to transfer measuring values (machine or keyboard) or the unit used for the evaluation. See section V.3 for this.

Attention: An incorrect selection of the parameters for the online connection (e.g. for the serial port) can produce a system crash while measure data input ! Make sure that you are informed about your computer system and the correct name of the serial port for on-line interface. For settings of the serial interface see also Appendix D.

VI.3. Program settings

Before starting the measurement itself, you have to set few parameters to define the program environment and describing the inspection conditions.

VI.3.1. "Settings | General settings"

Using this option you have the following registers to change program settings:

Register "General"

Here you can choose the program language, set the default unit for the gauges and select the default data input device (keyboard of the computer, online connection to an indication device).

If you set "Online" as the default device the Online connection to the device installed (see page "Directories" – "Indication program") will be started automatically if a gauge measurement will start.

Using the option "Save certificates as RTF File" any calibration certificate will be saved into the "Certificate directory" (see register "directories"). The file name will be created using the first 8 characters of the gauges identity number.

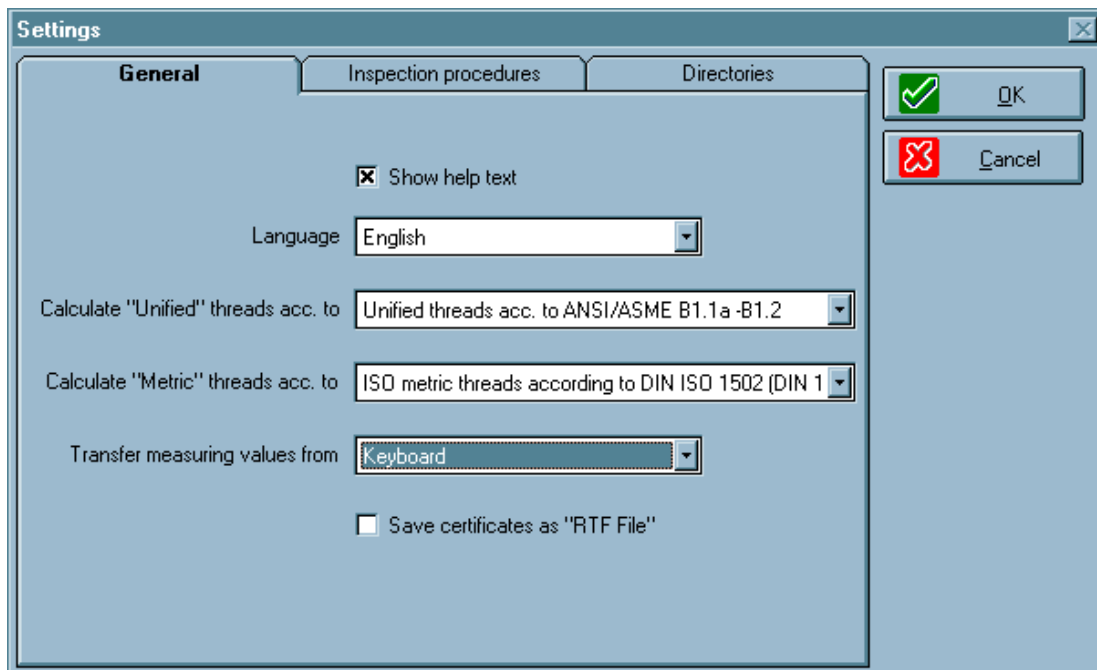


Figure: General program settings

IMPORTANT: For unified threads and also for metric threads of each there are two options to calculate the gauge tolerances. For unified threads you can use the ANSI/ASME B1.2 or the BS919 standard. For metric threads the DIN ISO 1502 and the ANSI B1.16M are available. In case that the thread designation does not differ, please select here the default standard should be used to calculate the gauge tolerances.

Register "Inspection procedures"

Here you can enter for each gauge type a reference to a corresponded text file including the inspection procedure as a text. Note that this "inspection procedure" does not influence the inspection process. It will be set using the option "Inspection conditions".

Register "Directories"

For some functions (indicating of measuring values; creation and edit of calibration certificates) external programs will be used. Here you can enter the directory where the corresponded program can be found. Additionally you can set a directory to save your calibration certificates.

While doing the program installation all directories will be set to a correct value !

ATTENTION: Make sure that this entries are correct. Errors may happen while operating the program caused by incorrect settings in the screen "Directories"

VI.3.2. "Settings | Inspection conditions"

Using this option you have the following registers to set "inspection conditions":

VI.3.2.1 General used conditions (Register "General")

Figure: Inspection conditions

Type of inspection:

According to VDI/VDE/DGQ guidelines, two different kinds of evaluation for the gauge inspection we have. The "incoming inspection" includes (beyond to the inspection of the gauge diameters) the inspection of hardness of the gauge. For the evaluation of gauge diameter the manufacturing tolerances of the gauge will be used. For "periodical inspection", the gauge evaluation will be done using the wear limit.

The setting of the "Algorithm of calculation" is very important !

Algorithm of calculation:

Here, you can choose the algorithm used to calculate the effective diameter. The most common algorithm is the calculation with the "Classical method (Prof. Berndt)". This means the using of the general known formulas (see also the related ISO and DIN standards). Using this formula the compensation of deformation caused by the used measuring force is included !

In US often the "simplified formula for pitch diameter" is used.

If you want to use this option, make sure the following conditions:

- use only wires which are closed to the "best size";
- be sure that the wires diameter was measured under the recommended conditions (see ANSI B1.16M, section B4).

The "simplified formula" can only be used for external measures on 60 deg. threads

For some reasons, for example threads with large pitch, it may be better to choose the real three dimensional calculation called "*Vector method*". This method is based on research results of the University Dresden, Germany and is more accurate for such types of threads.

Unit for evaluation:

Select the wished unit for the gauge evaluation.

Inspection of pitch, flank angles..

Additional to the usual inspection of the threads diameter you can also enter and evaluate the values for pitch and flank angles. If you want to do this click into the related check box to activate this option.

Unit for measuring force:

Select the unit you will use for entering the measuring force. The "measuring force" value will be used to calculate thread corrections and to compensate deformations.

Unit to show deviations on certificate:

Select if you want to print out "Deviations" in "thou.Inch" (inch/1000) or in "micro inch (µin.)". This setting does only effect the format of the related "Placeholders (Fields)" in the certificate layout file.

File name to save the certificate:

Here you can enter a default file name to save the calibration certificate. Note, if the option "Save certificates as RTF-file" is switched on (see menu "Settings|General settings") the name entered will not be used. In this case the program will create the file name using the "Identity number" (*Note:* the file name consist of the, at maximum, first 8 characters of the identity number, the file extension is "RTF");

Default certificate layout file for..:

Here, you can enter the name of the "Certificate layout" file used to create the layout of your calibration certificate. This file includes all information about the layout and the content of the record list being created. For "mm" and "inch" measurements different files are used.

NOTE: Because the program will be installed to support different languages you will find a lot of "LW2" files in the related directory. Note that the number in the file name (for example the "061" in the "METR_061.LW2") file does represent the used language (061 = English; 033 = French; 034 = Spanish; 039 = Italian; ...). Using the Windows-Explorer you can delete all certificate layout files you do not use.

VI.3.2.2 Gauge type depended settings

Before starting the measuring process a series of parameters you can change. The parameters you have to set are depended on the type of gauge you have to inspect. Use the related register screens to set the inspection conditions.

Register "Thread plug gauges"

Note: You can not access to this page before selecting a "Threaded plug" in the main menu !

The screenshot shows a software window titled "Inspection conditions" with a close button (X) in the top right corner. The window has a tabbed interface with four tabs: "General", "Plain ring gauges", "Plain plug gauges", and "Thread ring gauges". The "Thread plug gauges" tab is currently selected. Inside this tab, there are two columns of settings. The left column is for "Effect. diameter" and the right column is for "Major diameter". Each column has two sub-columns: "GO side" and "NO GO side". The settings are as follows:

	Effect. diameter		Major diameter	
	GO side	NO GO side	GO side	NO GO side
No. of meas. planes	2	2	2	1
Meas. for each plane	1	1	1	1
Measuring method	Three wires method			
Used series of wire diameter	Best size diameter			
Inspection of major diameter	<input checked="" type="checkbox"/>			
Order of measurements	Effect.-Major-Major-Effect.			
Inspection period	1	Year(s)		

At the bottom of the window, there are two buttons: "Cancel" (with a red X icon) and "OK" (with a green checkmark icon).

Figure: Inspection conditions for thread plugs

The following two parameters are divided in "GO" and "NO GO" side of gauge.

Number of measuring planes: Type the number of measuring planes for the effective diameter and, if "Inspection of major diameter" is switched on, for the major diameter measurement.

Measures for each plane: Type the number of measuring values per each measuring plane.

Measuring method: Here, choose the measuring method for measurement of external threads. You can choose either the "Three-wire method" or the "Two-wire method".

Used series of wire diameter: Select the table with thread wires should be used for the automatically selection of a thread wire diameter. Measuring a external thread the wire will be selected from the chosen table. You can also select a thread wire diameter manually if you set the specific measuring conditions. Using the "best wire" option the calculated "best wire" diameter will be set automatically.

Inspection of major diameter : Marking this field, you can decide if you want to measure the major diameter additionally to the effective diameter.

Order of measurement: If you want to inspect the major diameter, here you can select the wished order of the measurement.

Inspection period: Enter an "Inspection period" if you want to calculate a "Next inspection date" for the certificate.
Starting the program through the QM database this parameter will not be used because the "Inspection period" will be managed in the database system.

Register "Thread ring gauges"

Note: You can not access to this page before selecting a "Threaded ring" in the main menu !

The screenshot shows the 'Inspection conditions' dialog box with the 'Thread ring gauges' tab selected. The dialog has several input fields and checkboxes:

- General** (selected tab)
- Plain ring gauges**
- Plain plug gauges**
- Plain snap gauges**
- Thread plug gauges**
- Thread ring gauges** (selected tab)

Fields within the 'Thread ring gauges' tab:

- GO ring gauge**: 2 (spin box)
- NO GO ring gauge**: 1 (spin box)
- Minor diameter**: 1 (spin box)
- No. of meas. planes**: 2 (spin box)
- Meas. for each plane**: 1 (spin box)
- Measuring method**: "Three balls" method (T-probe) (dropdown menu)
- Used series of ball diameter**: Table T-shaped ball probes (dropdown menu)
- Inspection of minor diameter**: ☒ (checkbox)
- Inspection period**: 1 (spin box) and Year(s) (dropdown menu)

Buttons at the bottom: Cancel (red X icon) and OK (green checkmark icon).

Figure: Inspection conditions for "Thread rings"

Number of measuring planes: Type the number of measuring planes for the effective diameter and, if "Inspection of minor diameter" is switched on, for the minor diameter measurement.

Measures for each plane: Type the number of measuring values per each measuring plane.

Measuring method: Here, choose the measuring method for measurement of internal threads. You can choose either the "Three ball method", the "Two-ball method" or the "Cone-V-method".

Note: In the program context the "Three ball" method means the internal thread measurement using a T-shaped ball probe and contacting three points on the threads surface to calculate an effective diameter. It is different from the "Three ball method" described in the ANSI/ASME standards. See also the section "VI.4.2.2 – Internal thread measuring" where the measuring methods are illustrated.

Used series of ball diameters: Choose here, from the list provided, the table with the balls should be used for the automatic selection of a ball diameter. Measuring an internal thread the ball diameter (or the related probe) will be selected from the chosen table. Otherwise you can enter a ball diameter manually if you set the specific measuring conditions.

Note: A “Three ball” measurement in the programs meaning can be done only with a “T probe”.

Inspection of minor diameter : Marking this field, you can decide if you want to measure the minor diameter additionally to the effective diameter.

Inspection period: Enter an “Inspection period” if you want to calculate a “Next inspection date” for the certificate. Starting the program through the QM database this parameter will not be used because the “Inspection period” will be managed in the database system.

Other registers for the inspection conditions of plain gauges

In case that the program does also support the inspection of plain gauges used for thread gauging there are additional registers to set the related parameters for this type of gauge.

The parameters are comparable to the things described in the sections for “Thread plugs” and “Thread rings”.

VI.3.3. "Settings | Probes"

Using this option you can start the probe and masters management program TASTER4W. Here you can insert new probes to a list and calibrate this.

Remember that “T-shape ball probes” and “Single (stylus) ball probes” used for internal measurements should be calibrated before you can use it.

See the manual for the probe management program (Appendix E) for more detailed information.

VI.3.4. Certificate layouts

The program QM-THREAD gives you the possibility to customise the layout of your calibration certificate. The layout of the calibration certificate is based on the so called "Certificate layout file". This file contains all information about the form of the certificate and the values should appear in this. By editing this certificate layout file you can change the layout. Saving this file with another file name give you the possibility to work with different certificate layouts.

All this certificate layout files you have created will be saved in the working directory of the QM-THREAD program. The files have the extension ".**LW2**".

Using the option "**Certificate layouts | Show/edit..**" you can load a certificate layout file into the QMSOFT editor program.

NOTE:

- Do *never* open a "**LW2**" certificate file outside of the program. In this case you will loose all "placeholders" representing the "actual values" when the certificate will be created !
- If you want to open a certificate layout file you will see a lot of such files. The number in the file name (e.g. xxx**061**.LW2) is representing the Windows country code. "061" = English; "033" = French, "034" = Spanish; "039" = Italian ... Using the Windows-Explorer you can delete all "LW2" files you do not need.

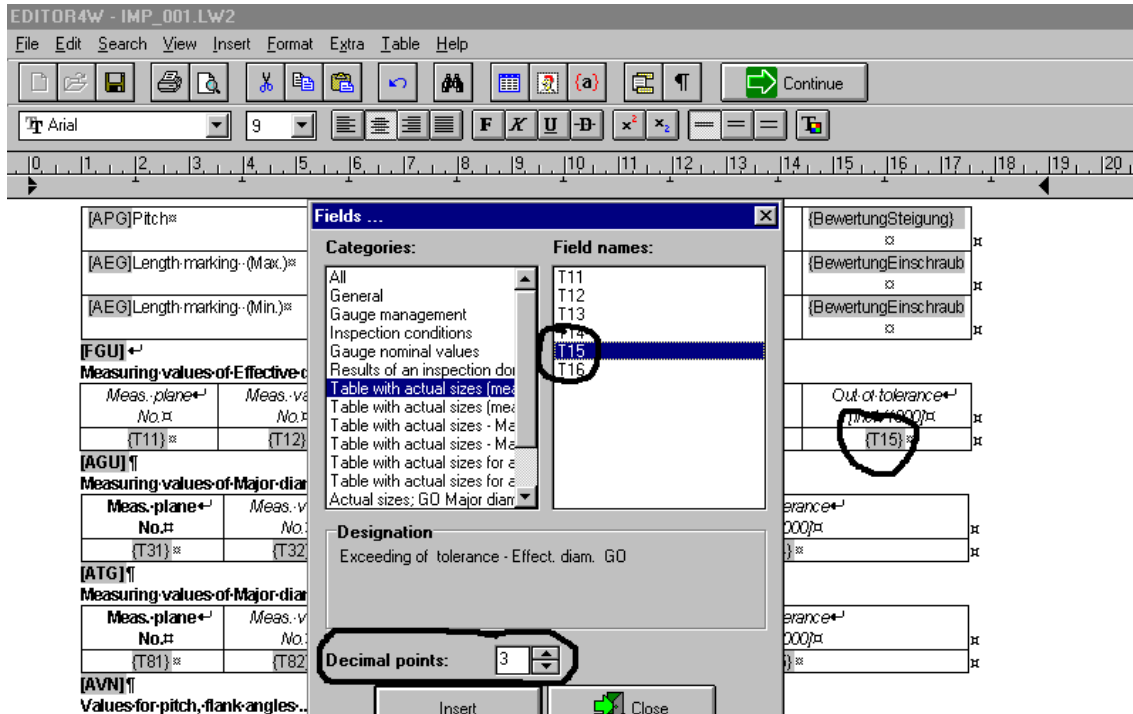
A certificate layout file is consisting of three different types of information:

- **standard text**: is text information just like in a known text processing application; you can change the text as you want and you can set the different text parameters;
- **"Placeholders" ("Fields")**: a "Field" is including a variable information about the gauge, the measuring process or the measuring environment. A "field" will be fulfilled with the actual information while executing the program. While editing a certificate layout file you can change "field" positions, delete "fields" (if you do not need the related information) and insert new "fields".
- **"Line conditions"**: A line condition gives you the possibility to control the certificate layout in dependence of different program situations. A text or field following to an line condition will be print out on the certificate only if the condition is "true". For example you can print a special text only if an "External measurement" was done. Please open an existing certificate layout and see the comments for the "Line conditions" available.

VI.3.4.1 The usage of "Place holders" (fields):

To insert a new "Place holder" in your certificate layout use the menu "**Insert | Fields**". Using this menu you can also see all available "Place holders" (Fields) and the related information. The fields are grouped to different categories (e.g. Gauge nominal values). If you select a field (click on it) you can see the field designation.

For numerical fields you can set the number of decimal points (see Figure).



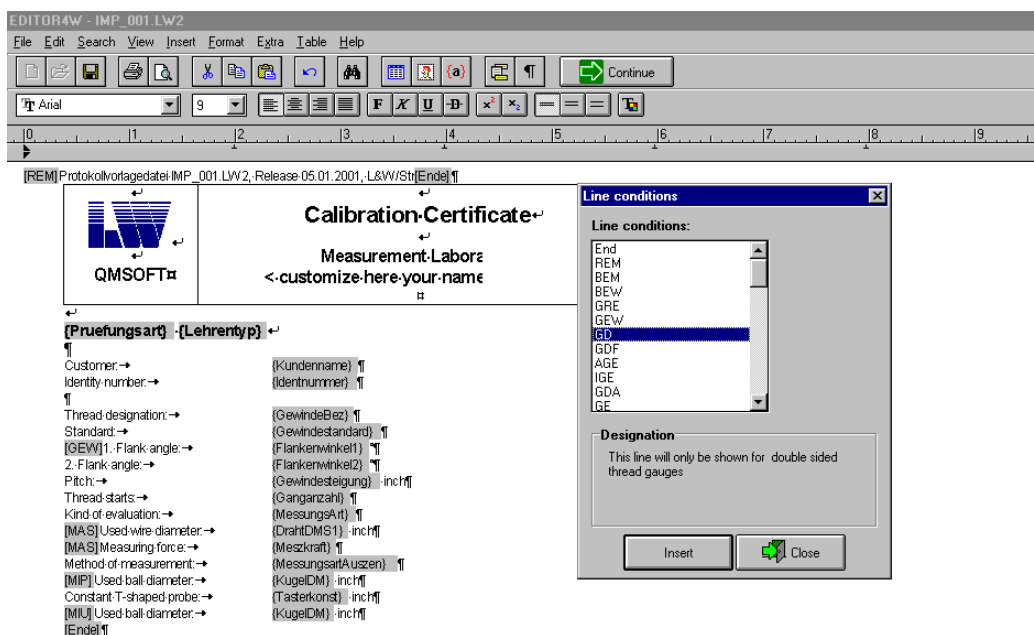
VI.3.4.2 The usage of "Line conditions":

Use the menu "**Insert | Fields**" to show the "Line conditions" available (see figure).

Select a line condition in the shown list to get there description.

Use the "Insert" button to insert the selected condition in your certificate layout.

Note: A "Line condition" is not restricted to one line in your layout. The condition is active until a new "Line condition" is defined or an "END" condition is set. The text after an "END" condition will appear on your certificate in any cases.



VI.4. Doing a gauge inspection

VI.4.1. Entering gauge nominal data

To create a measurement record it is necessary to take the measuring values of the thread and to compare this actual values with the thread nominal values and it's tolerances. This nominal values and tolerances can be generated in the QM-THREAD program for all Thread standards listed in section VI.1 of this manual.

After choosing the type of gauge to be inspected (using the related button **or the menu "Inspection"**), a dialog box will appear on your screen corresponding with your selection in which the gauge nominal values are to be entered (see Figure, dialog for a double sided GO/NO GO screw plug gauge).

The fields in this dialog box should be filled with the corresponding values. If the program is started up from the gauge data management system **QM-MANAG** this possibility is blocked and the nominal values of the gauge will be transferred from the database.

Figure: Entering of gauge designation, calculation of gauges nominal values

Following is a description of the fields in the nominal data dialog box:

Identity number:

This field is used as a label for the gauges using an identity number. This ID number will appear in the calibration certificate.

Thread designation:

Enter here the standardised designation of the thread you want to inspect. The program is checking this designation and will calculate all related sizes and tolerances. In case that the designation is not valid for the standard selected it may be that you get back an different (but valid) designation. This may happen especially for Unified threads because there are only defined "diameter / pitch" combinations are allowed.

Automatic standard recognition:

Marking this option the program recognise the thread standard automatically based on the entered designation. Necessary for this is, that the designation includes the required characters (e.g. "Tr" means trapezoidal thread acc. to DIN 103).

VI.4.2. The Measuring Process

Measurement values are always entered in a sequence of measurement values 1 to n for gauge position 1 (corresponding with measuring plane 1 to n), measurement value 1 to n for gauge position 2 etc. If the "1" is given as the number of measurement values in the inspection conditions, only one effective diameter will be determined. Measuring double sided GO/NO GO screw thread plugs is done first on the GO - side of gauge and then on the NO GO side. It is up to the program user to administer a measurement value sequence that fits into an overall scheme (it is not possible to check this through the program).

No. of plane	No. of meas.	Meas. value	Effective diameter	Tolerance field
1	1	0,51667 inch	0,45003 inch	x-----
2	1	0,51668 inch	0,45003 inch	x-----

Measuring method: Three wires method

"best" thread wire diam.: 0,04440 inch

Current wire diameter: 0,04440 inch

Measuring force: 1,50 N

Wires/Balls

min max

Reading limits 0,51665 inch 0,51695 inch

Gauge limits 0,45000 inch 0,45030 inch

Online

Back Continue

Figure: Entering of measurement values

While executing the measurement the current probe parameters are shown on the screen. If you want to change the probe or to calibrate or recalibrate it use the "Wires/Balls" button to do this.

The measuring will be supported by a graphic display showing the calculated effective diameter in the gauge tolerance field. The tolerance limits of the effective diameter as well as any limits of readings over wires/balls will also be shown. For the limits of the readings over wires/balls, known reference gauges or setting ring diameters are taken into consideration so that even before the measurement values are taken over, a check if the value is inside the tolerance is possible.

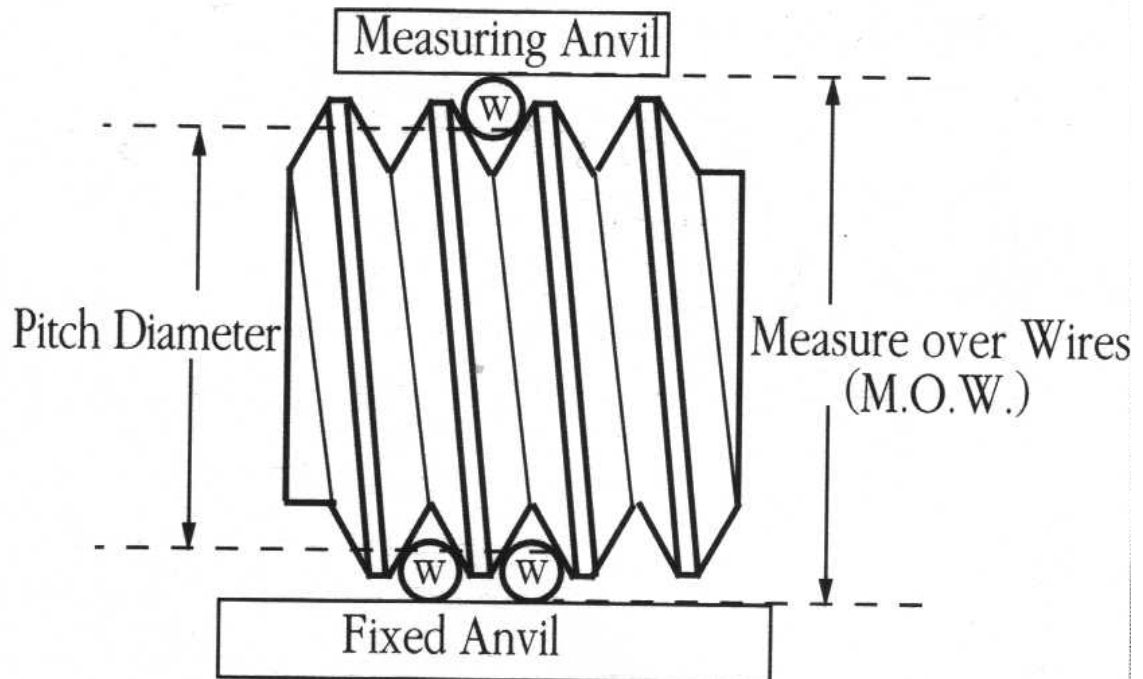
If you want to take over measuring values from an Online connected measuring machine, press the "Online" button to start the indication program.

Note: Use the menu option "**Settings | General Settings**" to set the "Transfer measuring values from.." (Register "General") to the option "Online".

Please check, that in the register "*Directories*" the correct "*Indication device*" is selected.

VI.4.2.1 External Thread Measurement

The measurement of the effective diameter of external threads is relatively simple. According to the known measurement procedure, three or two wires will be used. After searching the point of declination, the measurement value that is used for the effective diameter calculation can be transferred or entered. Depending on the chosen measuring force and the known wire diameter, the calculated effective diameter includes the compensation of deformation.



Attention: Depended on the selected list of thread wires (see the menu "*Settings | Inspection conditions*") the wire with the smallest difference to the calculated "best" wire diameter will be set automatically. This selection will also activated in the indication program. If you want to change the pre set values use the button "Wires/Balls" to select an other wire from the defined lists.

VI.4.2.2 Internal Thread Measurement

For the internal thread measurement, two measurement methods are applicable that are seen differently by the required measurement procedure. For two-point measuring requires only minimal technology and is a quicker measurement procedure. Three-point internal measuring requires a special measuring application and is commonly used for small Screw thread ring gauges in which a ball support bracket cannot be inserted. Additionally, with this procedure there is smaller room for errors (smaller measurement circle, no deformation of brackets, etc.).

a) "Two Ball" - Internal measurement

As we have already mentioned, this measurement is done between two ball support brackets and is analogous to the measurement of a plain ring gauge. You should make sure that both brackets have suitable thread balls with comparable diameters for the thread inspection (depending on the pitch). Before measuring the Screw thread ring, the brackets have to be calibrated on a plain master setting ring. Normally, the indication device of the measuring machine (check the machine specific operation instructions) should be set to "Zero" or to a "Preset" value equal the master rings size. Then the measuring values can be entered on the keyboard or transferred from your machine.

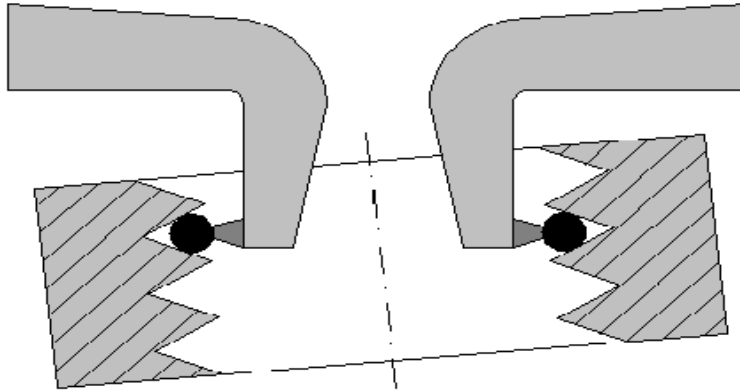


Figure : Two-ball-method for internal thread measurement

b) "Three Ball" - Internal Measurement

"Three-ball" internal measuring is done using a special internal measuring application and "T-shaped" ball probes.

The corresponding values of the probes (ball diameter d_k and probe constant c) must be known to program. Now all three measuring positions should be moved on and the corresponding values transferred. For the required measuring positions refer to shown figure. Once the third measurement value has been transferred, the effective diameter will be calculated and the graphic display of the results will be shown. According to the configured number of the inspected diameter value, the measurement should be repeated.

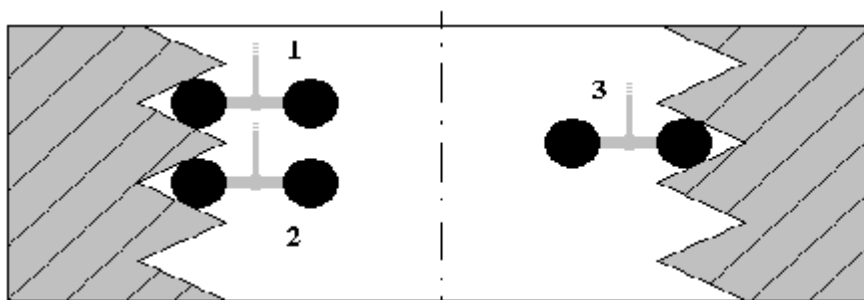


Figure : Three-ball-method for internal thread measurement

Before using a T-shaped ball probe make sure that the probe is correctly calibrated. See also appendix E: Probe management.

VI.4.2.3 Entering of additional thread parameters – pitch, flank angles ..

Additional to the inspection of the thread diameters sometimes the inspection of the pitch and/or the flank angles should be done. In this case use in the menu “*Settings | Inspection conditions*” the page “General” to activate the check box “Inspection of pitch, flank angles..” (see manual section VI.3.2). In this case after the inspection of the thread diameters the screen shown in the next figure will appear to enter the related parameters.

Using the “Check Boxes” you can switch off parameters you will not check.

Currently an Online connection to the measurement machine is not implemented because special hardware requirements has to be fulfilled for this.

	Nominal value	Actual value	Valuation
<input checked="" type="checkbox"/> 1. Flank angle	30,000 °	30.012	in tolerance
2. Flank angle	30,000 °	30.017	in tolerance
<input checked="" type="checkbox"/> Pitch	1,7500 mm	1,756 mm	in tolerance
<input type="checkbox"/> Mark for screw length			
Max. value	0,0000 mm	0,0000 mm	no inspection
Min. value	0,0000 mm	0,0000 mm	no inspection

Back Continue

Figure: Entering of parameters for pitch, flank angles ...

VI.5. Output of results

After entry of the measurement data has been completed, the screen "*End of inspection*" will appear.

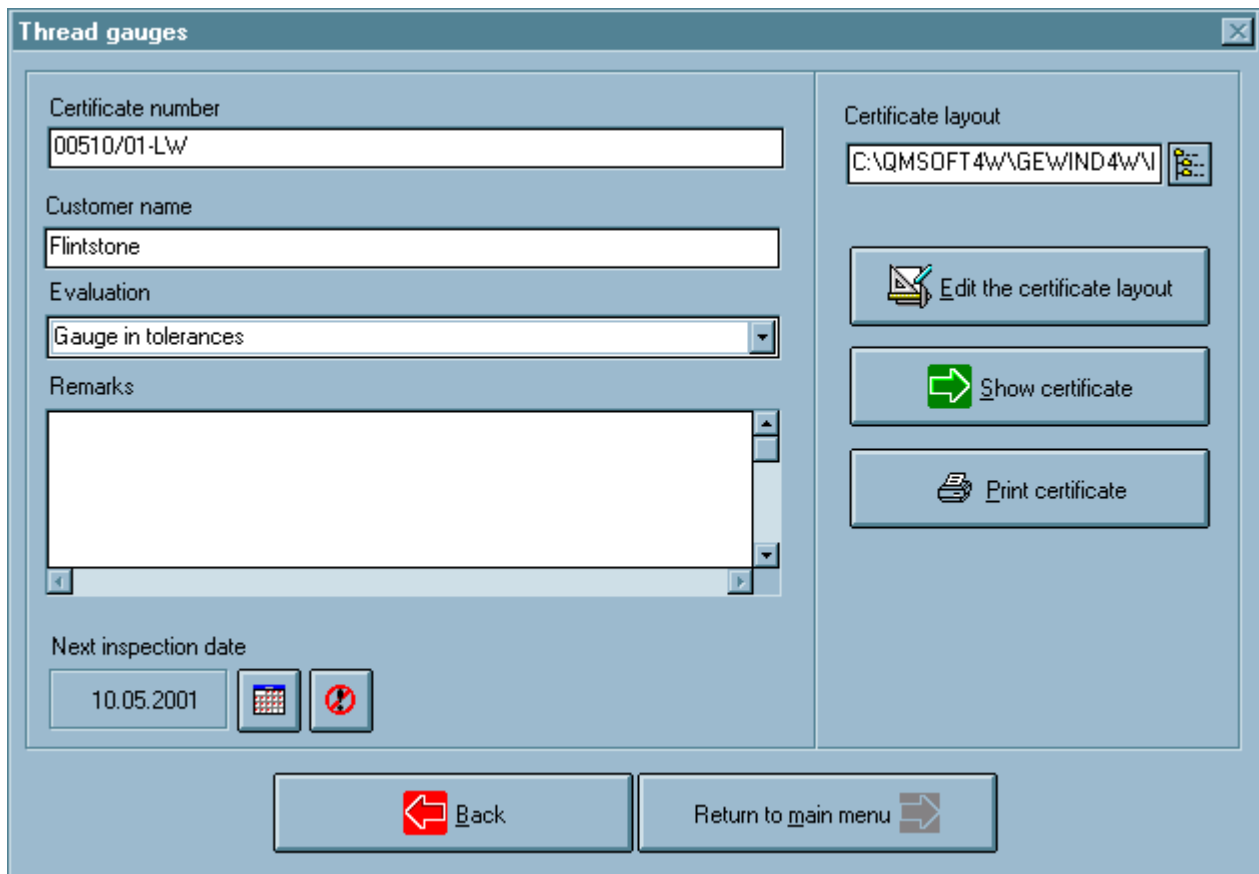


Figure: End of inspection / show certificate

If the inspection is finished you get the screen shown above. The summary result of the inspection is shown. Here you can enter the name of the customer, the date for the next inspection and also some remarks to the inspection.

Before creating the calibration certificate you can change the "certificate layout file" will be used. To start the output of the results press the "Show certificate" button.

All functions for the editing and the output of calibration certificates will be controlled by the EDITOR - program. See the manual of this program (Appendix B) to see how to operate it.

VI.5.1. Saving of certificate files:

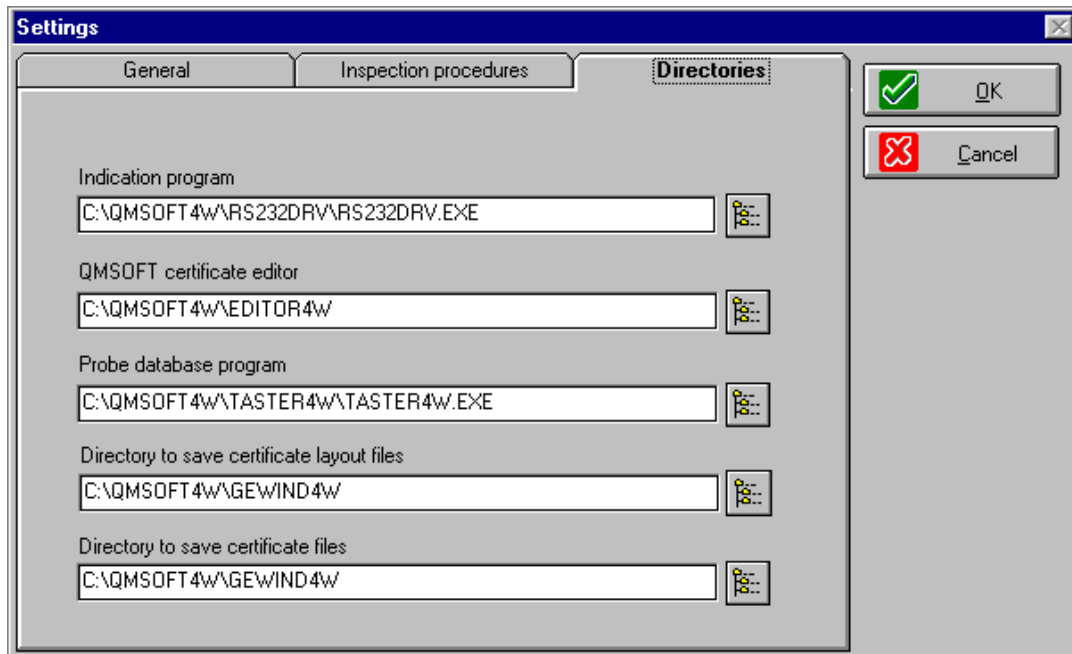
After completing a measurement you can save the inspection certificate into a file. The file extension is always „RTF“. This file format is compatible to the most common text programs (e.g. MS Word).

If you use the "**Save to..**" option you can select the directory where you want to save the file and you can enter the file name.

Using the “**Save**” Icon the directory and the file name will be set by the programs default values.
To change the default values see the following section.

1) the directory to save certificates

You can set the directory where you want to save your certificate files using the menu “Settings|General settings” in the page “Directories” (see figure / last line !)



2) the used file name

there are two options for the default setting of the used file name:

a) using a fixed file name:

the name of this file is set in the menu “**Settings | Inspection conditions**” in the page “General”; there is a field “**File name to save certificate:**”.

For the QM-THREAD program the default name is “GEWIND4W.RTF”.

Note: if you use the fixed file name the “save” dialogue will overwrite the existing certificate !

b) creating a new file name for each measurement:

using the menu “**Settings | General settings**” you will find in the page “General” a click box named

“**Save certificates as RTF file**” (see figure). if you activate this option the program will save the certificate automatically. The file name will be created either by using the first 8 characters of the gauges identity number or of the entered certificate number. You have to select the wished option.

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