



IV. Inspection program QM-DIAL

The program QM-DIAL is used for computer aided inspection of dial gauges, dial indicators and dial test indicators. It was designed to support the inspection of this gauges according to the worldwide mostly used standards. So the QM-DIAL program does include a module to carry out the inspection according to the German standards (**DIN 878**, **DIN 879**, **DIN 2270**) inclusive the rules according to the **VDI/VDE/DGQ-standard**, the American standard **ANSI/ASME B89.1.10M-1987**, the British standards **BS 907 / BS 2795** and the Australian standard **AS 2103-1978**, the Korean and Japanese standards **KS B 5206**, **KS B 5207**, **KS B 5238**, **JIS B 7503**, **JIS B 7533** and the standard **JMAS 2001** and also the french standard **NF E 11-050**.

The program also permits the inspection of non-standardized values of the above mentioned gauges and the inspection under non-standardized conditions (works standard specifications). The usage of the program requires only small knowlegde on computer technologies because special attention was paid to design a user-friendly human interface.

Measure data input can be realized either by an on-line measuring device, by the computer keyboard or by a data file, thus a coordination with the individual situation of the user is possible. The contact between measuring device and computer can be realized by one of the serial ports of the computer (V.24, RS-232, see annex D) by the SIP LMC program, by the TRIMOS WINDHI program or with a Heidenhain Interface card (IK220 or IK102021) .

In coordination with the inspection strategy and the selected standard the program computes the deviation range f_e , the deviation range f_t of the sub measure range, the total deviation range f_{ges} , the repeatability f_w and the discrimination error f_u . For the evaluation according the British or Australian Standard the calibration errors over the several standardized intervals (e.g.: any one-tenth revolution, any half revolution ...) will be calculated. The input parameters necessary for the evaluation are inspected on plausibility according to the usage purpose of the standards.

The output of the inspection results are numerical data lists and graphics showing the deviation course - either on the screen or via a printer.

The program QM-DIAL can be started directly out of the database program QM-MANAG - also offered by L&W GmbH - and provided with initial data (such as ID-number, measuring range and graduation of the product to be inspected etc.), in this case the inspection results are directly transmitted back to the database.

IV.1. Program start

You can start the QM-DIAL program directly from the QMSOFT-command-Shell (click the corresponded symbol in the shell) or by executing a "Gauge inspection" in the QMSOFT Gauge Management system.

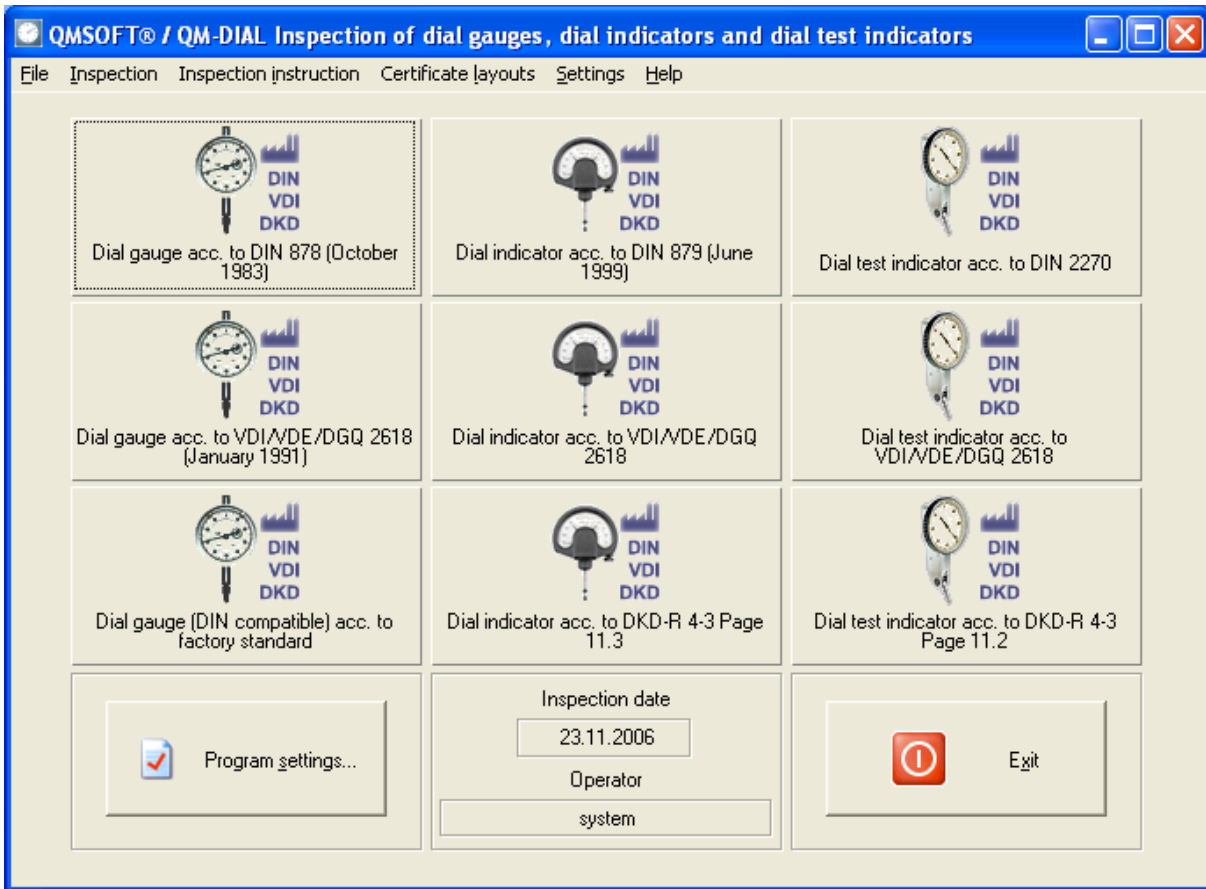


Figure: QM-DIAL main screen

Starting the program you get the start screen with different buttons, where you can start the inspection related to the selected gauge type or standard directly. The reservation of this buttons depends on the installed language.

ATTENTION: If you want to change the function of a button selected, move the mouse cursor to it and press the **Right mouse key**; now you can select the wished function from the shown list of standards.

Especially at the first start of the program you should set different parameters for the program environment.

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, IK121DRV, IK220DRV or SDDRIV 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.

IV.2. Program settings

Working with the program you should make different settings to define the program environment and especially program conditions.

IV.2.1. “Settings | Program settings...”

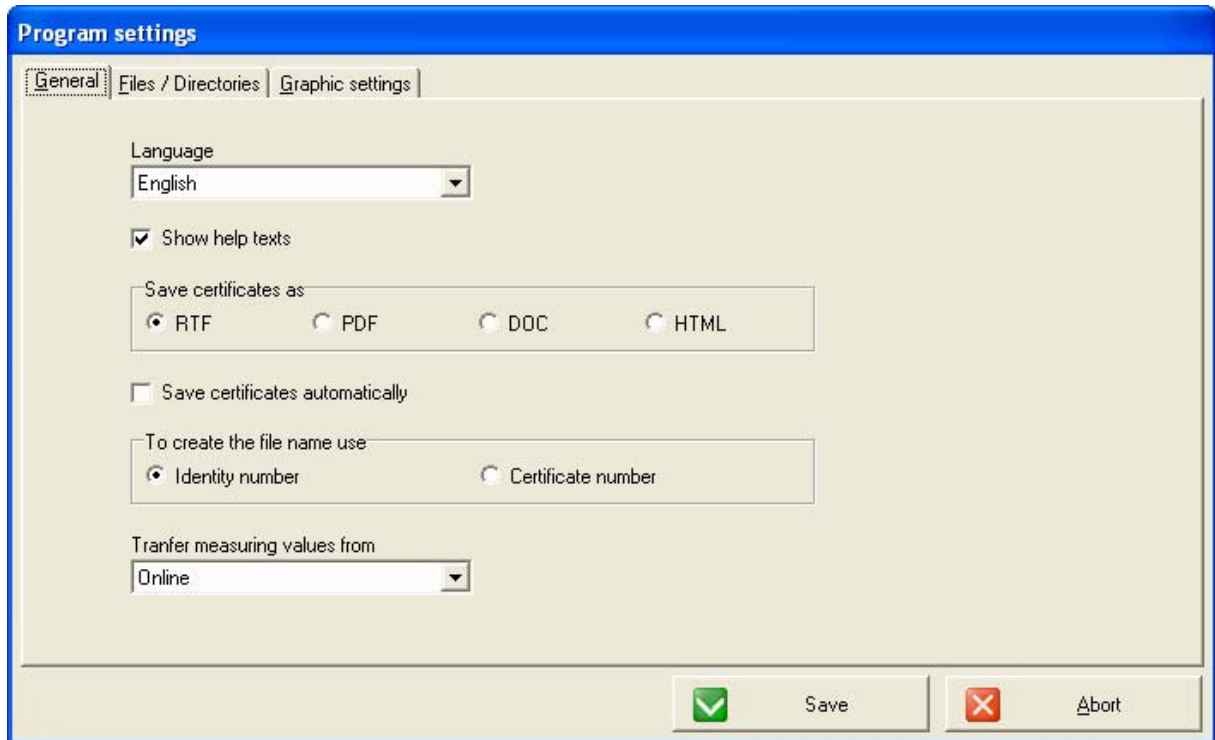


Figure: General program settings

Using this menu you have different registers (see the left side in Figure 2) to change program settings.

Register „General“

Here you can choose the program language, switch on/off the help text and select the default data input device (keyboard of the computer, on-line measuring machine). If you set “Online” as the default device the Online connection will be started automatically if a gauge measurement starts.

Using the option “Save certificates automatically” any calibration certificate will be saved into the “Certificate directory” (see register “directories”). The file name will be created by the gauges identity number or the entered certificate number. You can set if you want to save the certificate as “RTF”, “PDF”,... file format.

Register „Files / Directories“

For some functions (indicating of measuring values; creation and edit of certificate layouts) external programs will be used. Here you have to enter the directory where the corresponded program can be found. Also you can enter the position and the name of the files which contain the tolerance tables and the settings for the inspection positions.

Please note: when working in a network environment with these settings you can make sure that the same tolerances, inspection positions and certificate layouts will be used on any workplace!

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

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

Register "Graphic settings ..."

With this option you have the possibility to set different parameters for the representation of the calibration curve as well for the "screen" as the "print out".

Pay attention, that you set the parameters for the wished device, it is divided into the colors for the "screen" and the "print out"!

IV.2.2. "Settings | Inspection conditons"

Here you can define parameters which are directly dependent from the related standard or the Gauge type and it's related inspection procedure defined by the standard.

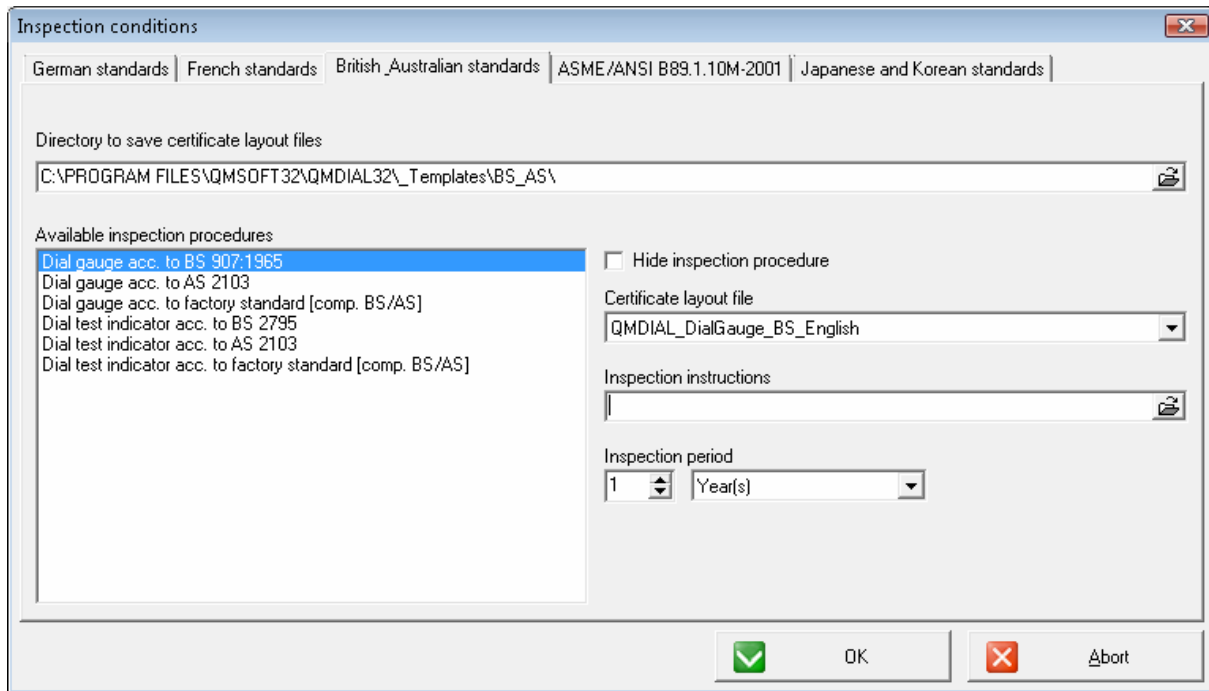


Figure: Settings for a gauge type selected

For each group of standards (see the example "British and Australian standards" in the figure) implemented in the program you can set the following parameters:

"Directory to save certificate layout files"

Select the directory where your certificate layout files are located.

For each available "Inspection procedure" you can set:

Hide inspection procedure

Using this option you can "Hide" a procedure if you never need it. So you can reduce the number of selections when doing an inspection.

„Inspection period“

Set the default "inspection period" for the selected gauge type. This may be used to calculate the next inspection date and to print it on the calibration certificate. If you start the dial gauge inspection from the QMSOFT database program the "inspection date" and "Inspection period" is taken over from the database will be used.

„Inspection instruction“

Here you can enter a reference to a corresponded text file including the inspection procedure as a text. You can use this function to refer to a text file including your individual inspection instruction.

“Default certificate layout file”

Here you can enter the name of the „Certificate layout file“ used to create your calibration certificate. This file includes all information about the layout and the content of the certificate being created. If the selected gauge type is available with „mm“ and „Imperial“ readings you have to enter two different file names.

NOTE: Because the program will be installed to support different languages you will find a lot of “L32” files in the related directory. Over the file names (e.g. ..DIALGAUGE_English..) you will find the related files which is usable for your language. Using the Windows-Explorer you can delete all certificate layout files you do not use.

IV.2.3. “Settings | Tolerance tables (factory standards)”

The program QM-DIAL can define tolerance values of dial gauges, dial indicators and dial test indicators which do not correspond to the used standard. This can be the case if the inspection conditions mentioned in the standards (inspection range, inspection methods) can not be fulfilled or non-standardized quantities of the measuring devices that shall be inspected (measuring range, graduation), are to be taken into consideration.

For the valuation of gauges according your factory standard a tolerance table have to be created. The input of the tolerance values and their permanent saving will be supported by the option „Settings | Tolerances tables (factory standards)“. Using this option you get a list with the related “basic standard” or program modul for which you want to enter the tolerance values (see figure). This is necessary because this standards defines very different gauge parameters.

After selecting the menu "Settings | Tolerance tables" the following screen, containing all existing tolerance tables, will appear. Now you can create new tables or change entries in an existing table.

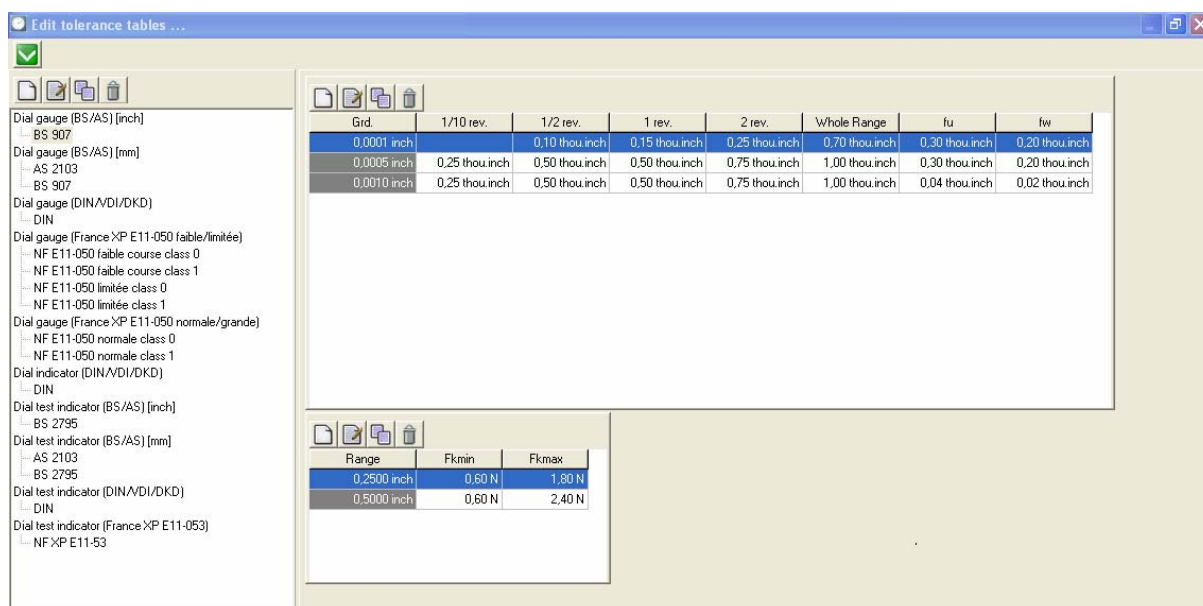


Figure: Entering of factory tolerances

Pay attention that you have to manage different tolerance tables where you can enter the values either for the gauges with “imperial readings” or for “mm” readings.

The entered tolerance values will (divided for dial gauge, dial indicator; dial test indicator and gauges according) be saved. If you make an inspection according factory standard the corresponding values will be read. The entered values of measuring range and graduation of your inspected gauge have to correspond to an existing entry in the tolerance table. Otherwise a valuation of the gauge is not possible.

IV.2.4. Certificate layouts

The program gives you the possibility to customise the layout of your calibration certificates. The layout of these certificates is based on the so-called "certificate layout file" (template). This file contains all information about the form of the certificate and the values that should appear in it. By editing this certificate layout file, you can change the layout. Saving this file with another file name gives you the possibility to work with different record layouts.

All certificate layout files you have created will be saved in the working directory of the QM-DIAL program. The files have the extension ".L32".

Using the option "**Certificate layouts / Show / edit a certificate layout**" you can load a certificate layout file into the editor program (see figure).

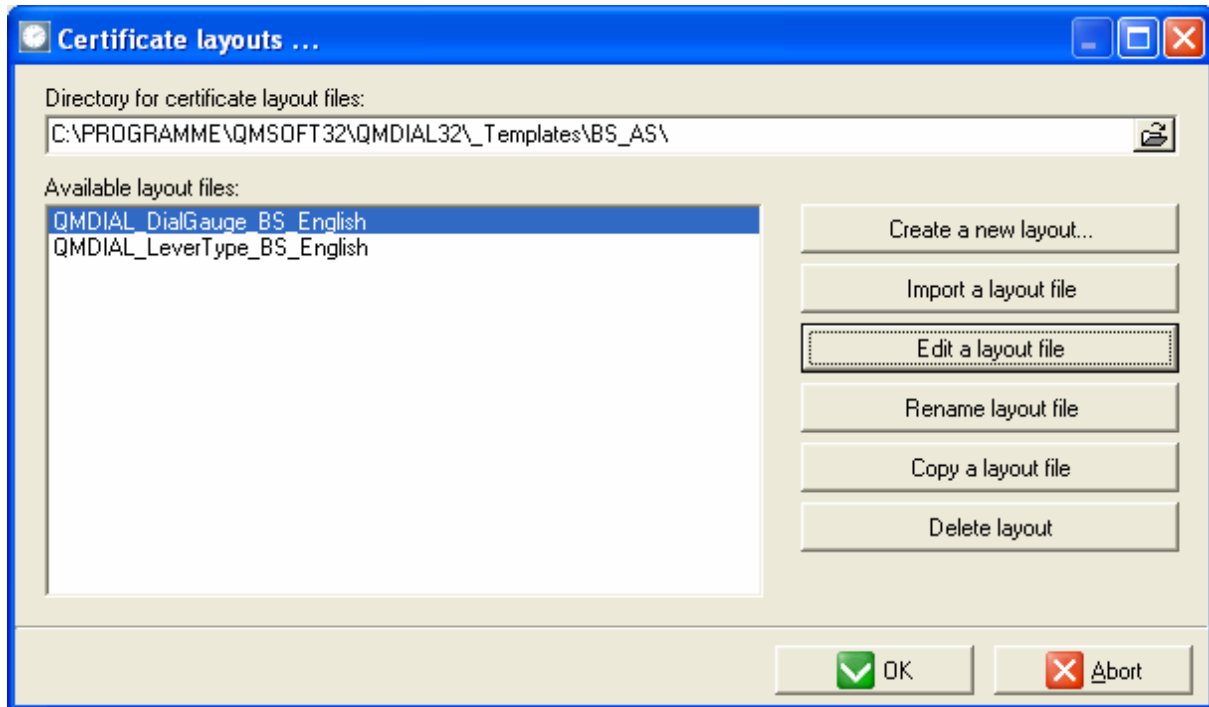


Figure: Certificate layouts

ATTENTION: Do not open a certificate layout file (".L32" extension) directly with the QMSOFT editor or any other program. In this case the program-dependent fields will be removed !!

A certificate layout file consists of three different types of information:

- "normal" 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. Editing a certificate layout file you can change "field" positions, delete "fields" (if you do not need the related information) and insert new "fields". To insert a new "field" in your certificate layout use the menu "Insert | Fields". Using this menu you can also see all available "Fields" and the related information. For numerical fields you can set the number of decimal points using the menu "Insert | Fields".

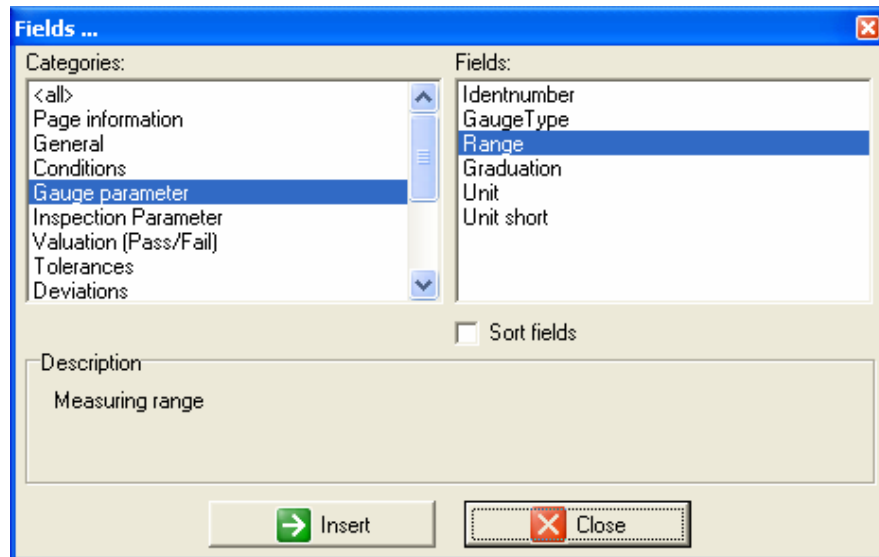


Figure: Insert „Fields“ with Gauge information in to the Calibration certificate

- "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.

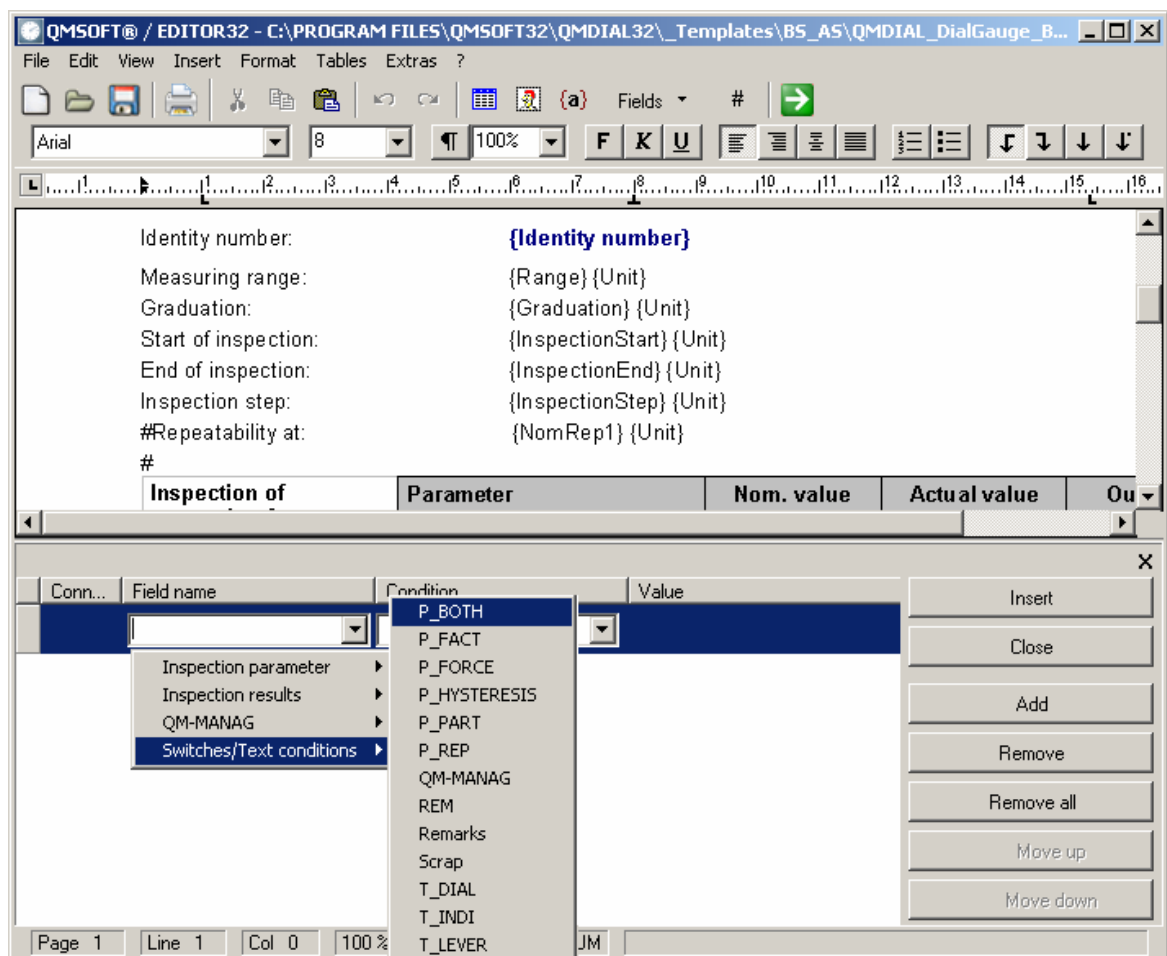


Figure: Setting of conditions for the output on the calibration certificate

IV.3. Inspection

After finishing the starting phase of the program and the optional input of the user's name you get the program main window on the screen (see also section IV.1). Here you have nine different buttons with a gauge graphic usable to carry out the inspection for the related gauge type. For starting an inspection click the wished button. You can also use the menu "Inspection" to start the inspection of a gauge.

Please see section IV.1. how to change the function of a button.

IV.3.1.Entering of the gauge data

After clicking one of the start buttons - or when you start the program through the Gauge management system - you will get the following screen to enter your gauge parameters:

Figure: Entering of parameters for a Dial gauge according to BS 907

At first you can select the "Inspection procedure" and the used "Tolerance table". Both parameters are already set by the "Button" in the main menu but nethertheless you can change it here. Please note also that you may have different "Factory tolerance" tables for one type of gauge.

Enter also the following parameters:

Identity number:

Enter the identity number of the inspected gauge. The number may be printed in the inspection certificate.

Unit:

Select the unit ("mm" or "inch")

Measuring range:

Enter the value of the total measuring range.

Meas. range start:

Enter the value where the measuring range does start. In the most cases it may be "0.0" but there does also exist gauges with a "+/- XX" range.

Graduation:

Select the value for the graduation out of a given list. The list will show you only the graduations which are valid for the selected standard.

Type of dial:

Select the "Type of dial" as "mechanical" or "digital".

Range / revolution:

Enter the range of one turn of the gauges pointer (the movement per one revolution). This value will be pre set to 100*graduation. This value is necessary for the settlement of the inspection positions. The parameter is only available for "mechanical" gauges.

IV.3.2. Setting the "Inspection conditions"

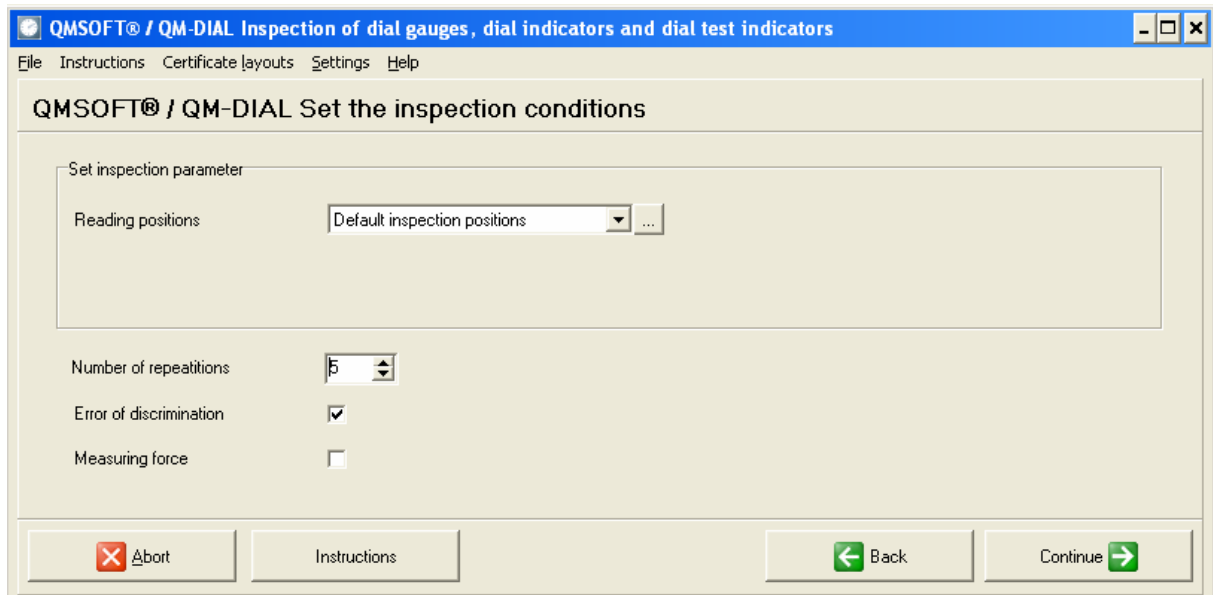


Figure: Setting the inspection conditions

Measure plunger going out:

Select this option if you want to take readings during the gauges plunger is coming out (or back for dial test indicators). In this case, you have to made readings on all measuring positions used with incoming plunger. This values will be used to calculate the "Error of Discrimination" (Hysteresis). If you choose "no", you have to inspect the discrimination in a other way (see the BS or AS standard how to do this).

Measuring force:

Select this option if you want to evaluate the measuring force of the dial gauge.

File to save measures:

Here you can enter the name of a file which will store all your readings while inspecting the gauge. You can recall this stored values using the menue "Inspection|Repeat an inspection".

The button “**Reading positions**”:

Inspection a gauge according to British standard with more than three turns a special pattern for the reading positions is used. Press the button “Reading positions” to see the selected reading positions.

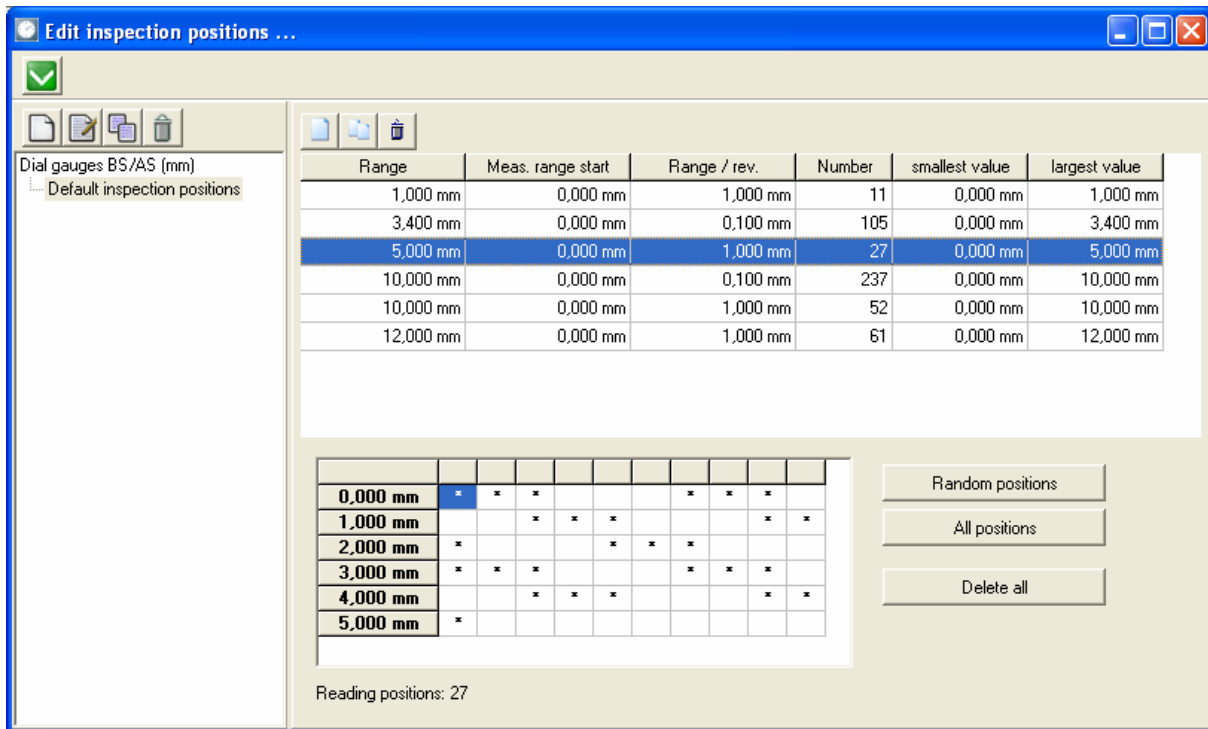


Figure: Setting of reading positions for BS inspection

In the shown window you can see the pre defined reading positions. For dial gauges with a larger range you can change the numbers of the “Read tree / miss three” cycles according to the recommendations of the British (Australian) standard.

IV.3.3. Notes about the inspection according to German standards (DIN/VDI)

The following functions are available in relation with german standards:

Dial gauge according to DIN 878

The inspection of the dial gauge is carried out exactly according to the DIN-standards given in the inspection conditions and chosen in the main menu. Besides this the dial gauge must correspond to standard values (measuring range, graduation, e.g. the graduation is always 0.010 mm, the measuring range can only have the values 0.4, 0.8, 3.0, 5.0 or 10.0 mm).

Dial gauge according to VDI/VDE/DGQ 2618 (part 11)

The inspection of the dial gauge is carried out according to the VDI/VDG/DGQ-standards given in the inspection conditions and chosen in the main menu. Besides this the dial gauge must correspond to standard values (measuring range, graduation, e.g. the graduation is always 0.010 mm, the measuring range can only have the values 0.4, 0.8, 3.0, 5.0 or 10.0 mm).

Dial gauge according to factory standard specifications

The inspection course of the dial gauge is carried out corresponding to DIN-standards chosen in the main menu; the tolerance values, the inspection range and the special values (graduation, measuring range) can be put in differing from the standards.

Dial indicator according to DIN 879

The inspection of the dial indicator is carried out exactly according to the DIN-standards given in the inspection conditions and chosen in the main menu. Besides this the dial indicator must correspond to standard values (measuring range 0.05, 0.1, 0.2, 0.26, 0.5, 1.0 or 3.0 mm, graduation 0.0005, 0.001, 0.002, 0.005, 0.01 or 0.05 mm).

Dial indicator according to VDI/VDE/DGQ 2618

The inspection of the dial indicator is carried out according to the VDI/VDE/DGQ-standards given in the inspection conditions and chosen in the main menu. Besides this the dial indicator must correspond to standard values (measuring range 0.05, 0.1, 0.2, 0.26, 0.5, 1.0 or 3.0 mm, graduation 0.0005, 0.001, 0.002, 0.005, 0.01 or 0.05 mm).

Dial indicator according factory standard specifications

The inspection course of the dial indicator is carried out corresponding to DIN-standards chosen in the main menu; the tolerance values, the inspection range and the special values (graduation, measuring range) can be put in differing from the standards.

Dial test indicator according to DIN 2270

The inspection of the dial test indicator is carried out exactly according to the DIN-standards given in the inspection conditions and chosen in the main menu. Besides this the dial indicator must correspond to standard values (measuring range 0.2, 0.24, 0.5, 0.8 or 1.6 mm, graduations 0.002 or 0.01 mm).

Dial test indicator according to VDI/VDE/DGQ 2618 (part 20)

The inspection of the dial indicator is carried out according to the VDI/VDE/DGQ-standards given in the inspection conditions and chosen in the main menu. Besides this the dial indicator must correspond to standard values (measuring range 0.2, 0.24, 0.5, 0.8 or 1.6 mm, graduation 0.002 or 0.01 mm).

Dial test indicator according to factory standard specifications

The inspection course of the dial test indicator is carried out corresponding to DIN-standards chosen in the main menu; the tolerance values, the inspection range and the special values (graduation, measuring range) can be put in differing from the standards.

IV.3.4. Inspection according to ASME/ANSI B89.1.10M-1987

The inspection procedure according to the American standard is similar to the one according to DIN- or VDI-inspections. But the inspection of the sub measuring range is not carried out and the integration of the measuring devices to be tested is done according to other priorities.

Inspect at each .. grad.: Select the number of graduations where you want to take over a reading. At minimum you have to take four readings per revolution. This means if your dial is graduated in 100 units you can select at maximum 25 graduations.

Number of repetitions: The number of values to inspect the repeatability must be entered (min.: 5, max.: 999 values).

Measure plunger going out: Select this option if you want to take readings during the gauges plunger is coming out (or back for dial test indicators). In this case, you have to made readings on all measuring positions used with incoming plunger. This values will be used to calculate the "Error of Discrimination".

Measuring force: Select this option if you want to evaluate the measuring force of the dial gauge.

File to save measures: Here you can enter the name of a file which will store all your readings while inspecting the gauge. You can recall this stored values using the menue "Inspection|Repeat an inspection".

IV.3.5. Inspection according to Korean and Japanese standards

Depended on the type of gauge you have choosed, the input mask to specify the gauge parameters appears on the screen. The user now has to enter the nominal and evaluation parameters which describe the gauge to be inspected more exactly. This values and parameters are similar to the parameters described before. See for example section IV.3.1. for this.

IV.4. Input / taking over of measuring values

The input of the measuring values must be done in the order: measuring value 1 to n if the measuring bolt is going in and measuring value n to 1 if the measuring bolt is going out, measuring value 1 to t if the measuring bolt is going in at sub measuring range (if the sub measuring range is included in the inspection) and measuring value 1 to w for repeated measurements. The valid inspection position is displayed. The measuring values are inspected on their plausibility and rejected in case that the deviation is more than half of the value of the valid inspection step.

Input of measuring values using the keyboard will be done directly in the shown tables for the measuring values.

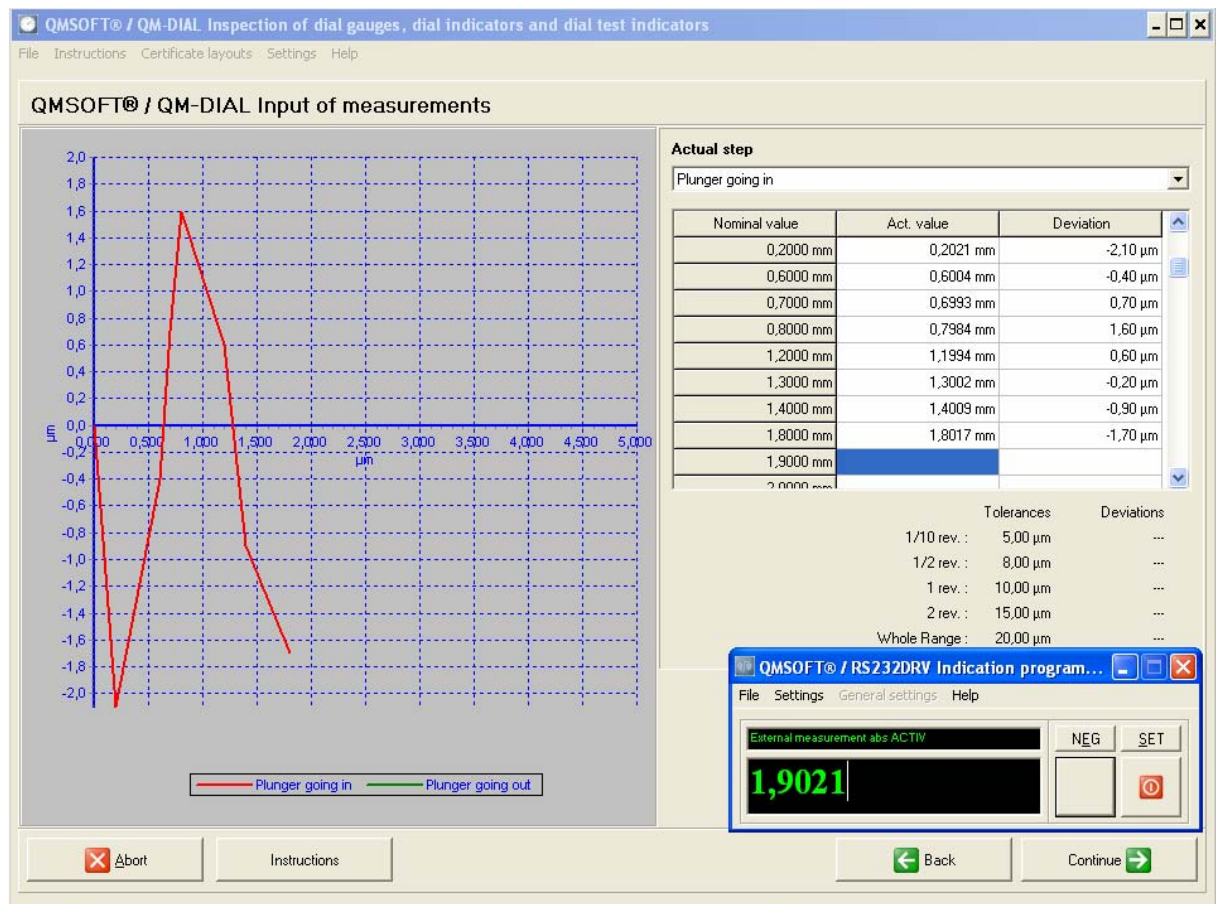


Figure: Entering of measuring values

More effective is the on-line data input via a measuring machine. Some handling actions depend on the used measuring machine (see the corresponding producer documentation).

The program QM-DIAL receives the datas via the V.24 serial port (see also annex D). The transfer of the datas has to be started at the measuring device (handle or pedal).

You can repeat each measuring value by setting the cursor to the wished line in the table of measuring values. Using the „Back“ and „Continue“ - buttons you can switch between the different tables with data inputted.

IV.5. Evaluation

The evaluation is depended on the choosen type of gauge respective the related standard.

For an evaluation according DIN, VDI or ASME/ANSI the measuring values includes the computing of the five deviation parameters f_e , f_t , f_{ges} , f_u and f_w according to the definitions given in the DIN or ANSI -standards:

- f_e deviation range as distance between the maximum and the minimum value in the deviation graphic while the measuring plunger going into
- f_t deviation range in the sub measuring range between the maximum and the minimum value in the deviation graphic, measured for a sub measuring range while the measuring plunger going into (partial measuring range at dial gauges: 0.1 mm, at others 10 or 5 graduations).
- f_u reversal measuring range as difference of indications for the same value of the measuring object while measuring with increasing or decreasing values of the indication
- f_{ges} total deviation range as distance between the maximum and the minimum value in the deviation graphic for both directions of the measuring plunger movement (includes reversal measuring range f_u).
- f_w repeatability as characteristic value of measure variations at n measurings ($n \geq 5!$) of the same measuring object within the measuring range at the same direction of the measuring plunger movement.

For an evaluation according the **British or Australian standard** the evaluated deviation parameters are depended on the type of gauge.

For dial gauges will be calculated the errors of calibration over any one-tenth revolution, any half revolution, any one revolution, any two revolutions and (if the gauge has more than two revolutions) over any larger interval. For dial test indicators the errors over an interval of any one unit division, any five divisions and any half revolution will be calculated.

The repeatability and the error of discrimination will be checked for both types of gauges. If you have take readings for the plunger "coming-out" the value for the discrimination will be calculated otherwise you have to type in this value.

For an evaluation according the **KS and JIS standard** the evaluated deviation parameters are depended on the selected standard and the type of gauge.

For dial gauges will be calculated the errors of the long range (wide range), the retrace error and the repeatability. Depended on the scale interval also the small range (narrow range) error and the small range adjacent error will be calculated.

Wether the datas are inside the tolerance range is evaluated according to the following criterions:

- at inspections according to DIN-standards the standardized tolerance ranges are obeyed concerning measuring range, graduation, (position of the gauge to be inspected)
- at inspections according to BS/AS-standards the standardized tolerance ranges are obeyed concerning the graduation of the gauge;
- at inspections according to KS/JIS-standards the standardized tolerance ranges are obeyed concerning the chosen standard the measuring range and the graduation of the gauge;
- at inspections according to factory standard specifications the tolerance range is only evaluated if measuring range and graduation of the gauge to be tested correspond to the user defined tolerance table
- if none of the obove mentioned conditions is fulfilled, no tolerance evaluation is carried out.

The result of the tolerance evaluation is printed in the result listing.

IV.6. Output of results

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

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.

Figure: End of inspection show / print certificate

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 this.

IV.7. Repeating an evaluation

This item of the main menu is used for an uncomplicated repetition of an evaluation without a new measuring. For this purpose the data file which was produced during an inspection is put in and evaluated according to the type of the device to be inspected. The data file contents besides the measuring values also the inspecting conditions and the name of the user. The name of the data file must be put in by the user.

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