Operating Instructions

VMF 1000

Contents

Oct. 30th, 2008 These operating instructions apply for the software version 2.12.

1 Introduction

The measuring and control instrument VMF 1000, in combination with either one or two transducers, is used for acquiring thickness.

Measuring values or calculated results are output as exact numerical values on a seven-digit display and, in addition, as scale values on a dial-type indicator. This results in optimum read-off possibilities for all sorts of application:

For reading off measuring values, the numerical display is favorable,
for recognizing trends and reversing points, the analogue indicator is ideally suited.

This instrument features a great variety of measuring and evaluation possibilities. They reach from the simple indication of the directly acquired value, over sum and differential measurements with two transducers to the statistical evaluation of complete measurement series including mean value, standard deviation and range. In addition to the standard measuring range with a resolution of 0.1 µm, there is a fine measuring range with the high resolution of 0.01 µm.

Tolerances can be set and precisely monitored. The built-in pilot lamps which arrange the test pieces into the groups "Accept", "Rework", and "Reject" are used for the visual indication. The corresponding information on the test piece can also be transferred via the interfaces to external instruments.

The VMF 1000 features 2 serial (RS232) interfaces where a printer and a host computer may be connected. Host computers can not only receive data sent by the VMF 1000, they can also control many of its functions. Control units, recorders, indicating instruments, etc. can be connected to the analogue output the parameters of which can be set thus enabling the instrument's complete integration into the production process.

This instrument also features numerous auxiliary functions, e.g. symmetry and adjusting the sensitivity of the transducer. The function "blanking out disturbances" with its adjustable parameters can be used for largely suppressing interferences on the measuring signal.

Naturally, not all instrument functions will be used to the same extent. Therefore, you can tailor the user interface to suit your special demands. The possible evaluations can be restricted to the indication of the actually necessary results. If for some special application a not directly accessible function is required, the function in question may be assigned to a function key. The function can now be called up at any time by simply pressing this key.

In spite of its many functions, the VMF 1000 is easy to operate, such that even non-specialists and temporary users can work with this instrument without any difficulties.

2 Operating elements

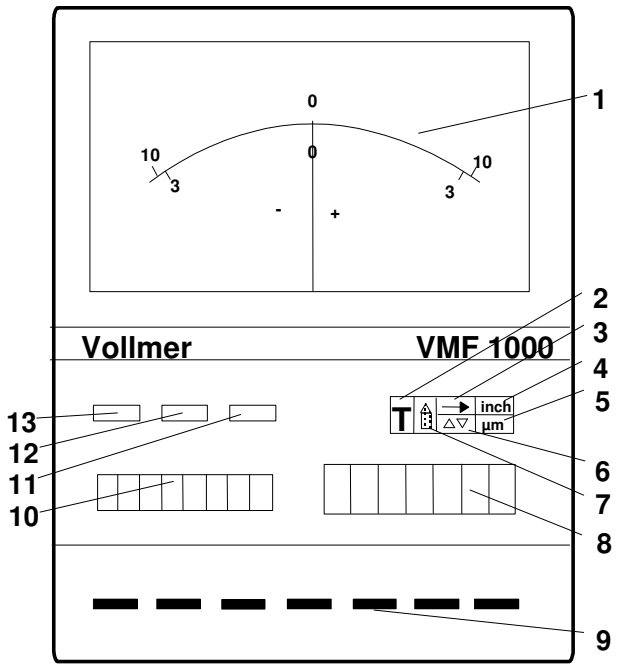


Fig. 1
Front panel

1 Analogue Instrument
2 Start/Stop indicator
3 Overflow indicator
4 Inch indicator
5 µm indicator
6 Setting/Configuration indicator
7 Change-over indicator
8 Numerical display (6 digits + sign)
9 Keys
10 Text indication (8 digits)
11 Pilot lamp, yellow
12 Pilot lamp, green
13 Pilot lamp, red

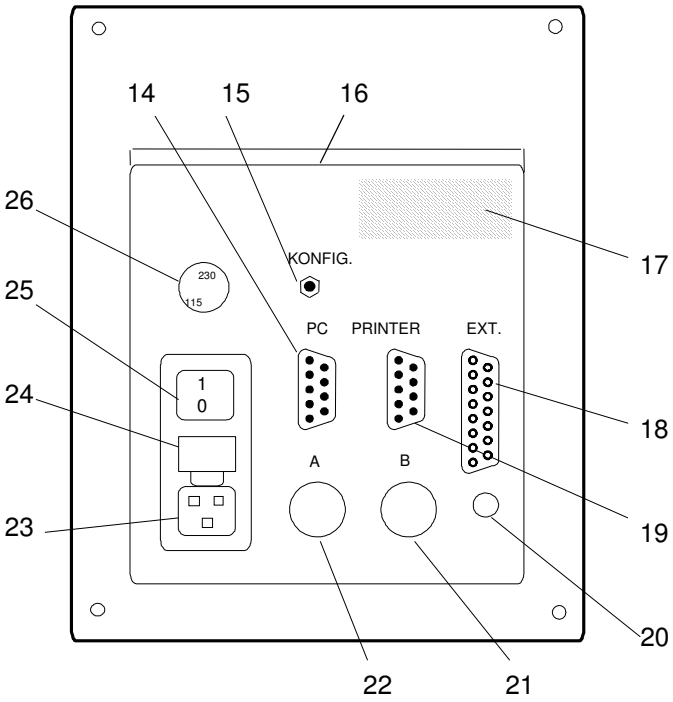


Fig. 2
Rear panel

14 RS232 Interface „PC“
15 „Konfig“ key for changing the instrument configuration
16 Recessed grip for transport
17 Type plate
18 Analogue output and digital I/O
19 RS232 Interface “Printer”
20 Analogue output
21 Socket for connecting transducer B
22 Socket for connecting Transducer A
23 Mains connection
24 Mains fuse 315 mA, time-lag
25 On/Off switch
26 Voltage selector

To each key, three function levels are assigned:

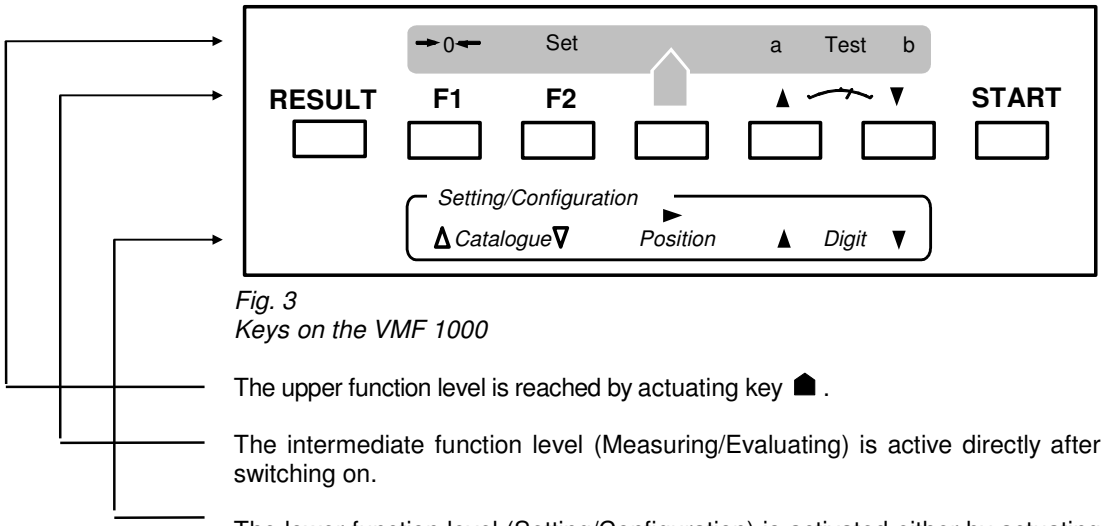


Fig. 3
Keys on the VMF 1000

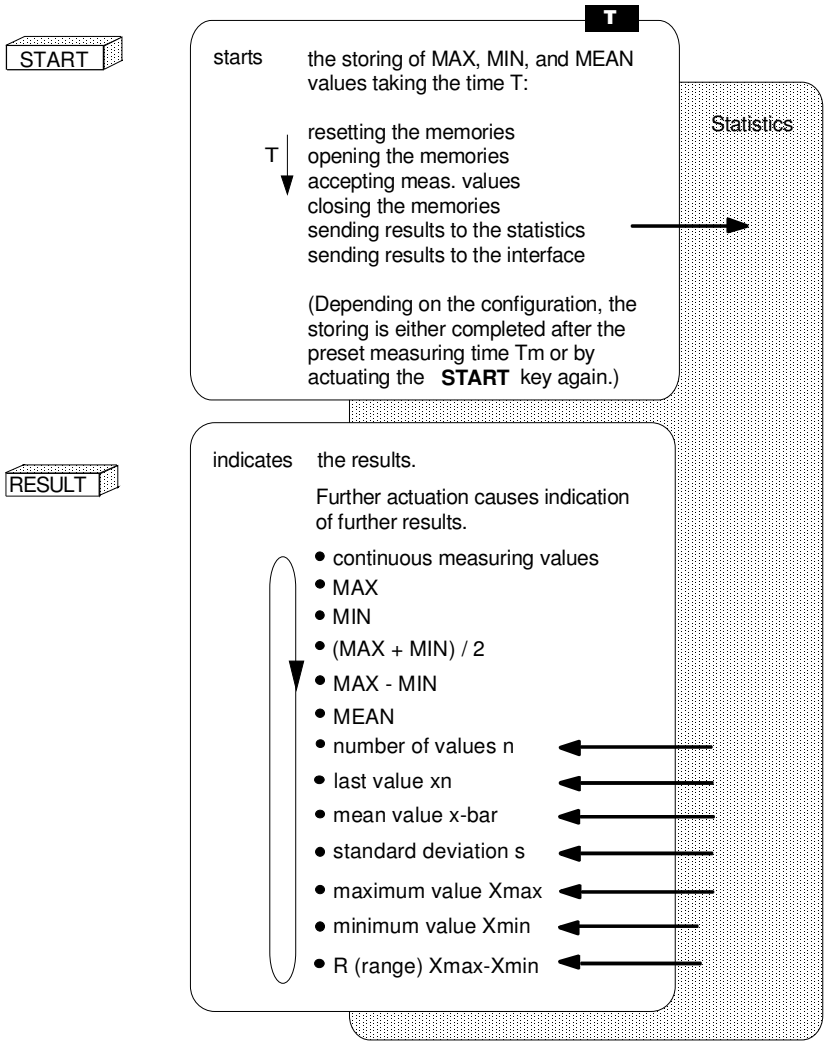
The upper function level is reached by actuating key ⌂ .

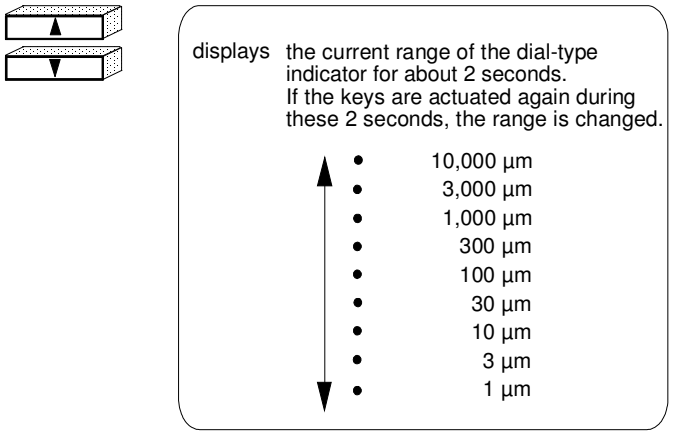
The intermediate function level (Measuring/Evaluating) is active directly after switching on.

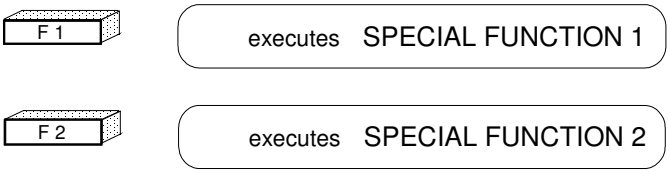
The lower function level (Setting/Configuration) is activated either by actuating the keys ⌂ and **SETTING** or by actuating the **Konfig.** key (cf. fig. 2 point 4) on the rear side of the instrument. The setting/configuration indicator (cf. fig. 1 point 6) starts to light up.

As a rule, the keys of the VMF 1000 are actuated by only slightly touching them.

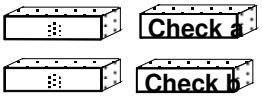
The functions of the individual keys will be presented graphically on the following pages. By repeatedly pressing certain keys, the parameter catalogue will be scrolled. The lower function level can be abandoned at any time with **RESULT**.


START
T
starts
the storing of MAX, MIN, and MEAN values taking the time T:
T
resetting the memories
opening the memories
accepting meas. values
closing the memories
sending results to the statistics
sending results to the interface
(Depending on the configuration, the storing is either completed after the preset measuring time Tm or by actuating the START key again.)
Statistics
RESULT
indicates
the results.
Further actuation causes indication of further results.
• continuous measuring values
• MAX
• MIN
• (MAX + MIN) / 2
• MAX - MIN
• MEAN
• number of values n
• last value xn
• mean value x-bar
• standard deviation s
• maximum value Xmax
• minimum value Xmin
• R (range) Xmax-Xmin


displays
the current range of the dial-type indicator for about 2 seconds.
If the keys are actuated again during these 2 seconds, the range is changed.
• 10,000 µm
• 3,000 µm
• 1,000 µm
• 300 µm
• 100 µm
• 30 µm
• 10 µm
• 3 µm
• 1 µm


F 1
executes SPECIAL FUNCTION 1
F 2
executes SPECIAL FUNCTION 2

sets **the current measuring value to the value (master value) or**



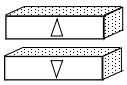
indicates the individual probe value directly,
- without master value 

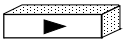
- without "Factor A
- without combination
- without nominal

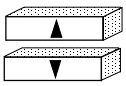
return with 

or 

starts setting of measuring conditions.


Scrolling the catalogue


Selecting desired position


Changing individual digits

- "Master actual value" -199,999.9 ... + 199,999.9 µm
- "Nominal value" 0 ... +1,999,999 µm
- Upper tolerance -199,999.9 ... +199,999.9 µm
- Lower tolerance -199,999.9 ... +199,999.9 µm

return with 

or 

3 Putting into operation

Before putting into operation for the first time, by all means check whether or not the voltage was adjusted correctly. The set voltage has to agree with the local mains voltage!

Adjusting the mains voltage:

1. Disconnect the mains plug.

2. Select the right mains voltage (fig. 2 item 26) by means of a screw driver

An incorrectly set mains voltage may cause instrument defects which might endanger life and health of the operator!

Exchanging fuses:

Disconnect the mains plug and pull out the fuse holder. Defective fuses may only be replaced by fine wire fuses (5 x 20 mm) of the below type, irrespective of the mains voltage:

315 mA, time-lag

Make sure when connecting the probes to the VMF 1000 that the plugs are always screwed firmly to the corresponding socket on the rear side of the instrument.

The On/Off switch serves for switching on and off the instrument.

The text indication successively displays:

the instrument designation	"VMF 1000",
the version number, e.g.	"Rev. 2.12"
and	"Check".

While these texts are being indicated, a self-test is performed. After approx. 15 s, the instrument is ready for operation. The text indication now shows the master value stored last. The numerical display and the dial-type indicator display the corresponding measuring result.

4 Adjusting the measuring conditions

The measuring conditions can be adjusted after having pressed the keys ☗ and **SETTING**.

In accordance with the measuring problem, the operator may adjust:

- the master value "Master"
- the nominal value "Nom. val."
- the upper tolerance "up. Tol."
- the lower tolerance "low. Tol."

The standard routine for adjusting the measuring conditions is as follows:

1 Activating the measuring condition adjustment with ☗ and **SETTING.** Indicator (6) lights up.

2. Selecting the parameter with △ and ▽.

3. Selecting the digit with ▶.

4. Setting the numerical value with ▲ or ▼.

5. Concluding the measuring condition adjustment with **RESULT** or selecting further parameters with △ or ▽.

Steps 3 and 4 have to be repeated for each digit of the numerical value.

The adjustment of measuring conditions is concluded by pressing the key **RESULT**.

4.1 Master value

During a master measurement, the instrument can be set to a defined master value (master deviation) by means of the function . Via the function SETTING, this master value can be selected and entered. On activating the function , this value will be displayed. The master value to be entered is the deviation of the master actual value from the nominal value.

Master value to be entered = Master actual value – Nominal value

Proceed as follows:
Use the function SETTING to select the parameter "Master" and enter the deviation of the master actual value from the nominal value. Place the master into the measuring unit and actuate the keys and .

The master value will be displayed.

All subsequent workpiece measurements are now referred to this master value.

Example:
Given are a nominal value of 122.050 mm and a master actual value of 121.010 mm. The master value to be entered is calculated as follows:

121.010 mm - 122.050 mm = -1.040 mm

Thus -1,040 µm is the master value to be entered.

The master value may also be entered via the BCD inputs or the RS232 interface.

4.2 Nominal value

In case actual values instead of relative ones are to be indicated, nominal values in a range between 0 and 2 m, i.e. 0 and 1,999,999 µm, can be entered. Here, only positive values are allowed.
The nominal value will be added to the measuring result. The sum will only be indicated on the numerical display, but not on the dial-type indicator, which continues to indicate the deviation from the nominal value. Please note that the tolerance indication and the tolerance limits are also referred only to the deviation from the nominal value.

"Nom. val." (nominal value) is to be selected and entered (0 ... 1,999,999 µm) via the function **SETTING**.

Example:
Given are a nominal value of 122.050 mm and an indicated measuring result of 85 µm. Use the function **SETTING** to select parameter "Nom. val." and enter the nominal value in micrometers, i.e. 122,050 µm.
The numerical display now indicates the real actual value of the workpiece, namely 122,135.0 µm, while the dial-type indicator continues to display the deviation from the nominal value, i.e. 85 µm.

NOTE
The range of indication of the numerical display is limited to ±1,999,999 µm. In case this range is exceeded, "+1" or "-1", respectively, will be indicated. This is the reason why for large absolute values the resolution must be reduced to 1 µm.

4.3 Tolerance monitoring

Tolerance monitoring means that all measuring values are compared with the tolerance limits. Differently colored pilot lamps indicate whether the measuring value

- exceeds the upper tolerance limit,
- lies within the tolerance zone,
- exceeds the lower tolerance limit.

For tolerance monitoring, one of the measuring results below may be chosen:

- **COMBINE** current measuring value acc. to probe combination
- **MAX** maximum value during a measuring series
- **MIN** minimum value during a measuring series
- **(MX+M)/2** arithmetic mean value of MAX and MIN
- **MAX - MIN** difference between MAX and MIN
- **MEAN** mean value of all measuring values gathered in a measuring series

The tolerance limits, which can be adjusted in a range between
-199,999.9 µm and +199,999.9 µm,

are selected via the parameters
"up. Tol." (upper tolerance limit) or
"low. Tol." (lower tolerance limit).

The smaller value is always assigned to the lower tolerance limit.
The larger value is always assigned to the upper tolerance limit.
If the measuring result lies within the preset tolerances, the green pilot lamp (see fig. 1 point 12) starts to light up, thus classifying the workpiece into the "Accept" group.

In case the upper or lower tolerance limits are exceeded, the yellow (see fig. 1 point 11) or red (see fig. 1 point 13) pilot lamps light up. These lamps indicate

"Reject" components (red lamp), for which too much material was taken off, and "Rework" components (yellow lamp), for which not enough material was removed.

Which of the two lamps in question will light up depends on the type of measurement carried out, i.e. an internal or external measurement. The type of measurement to be carried out must thus be stated in the configuration settings beforehand.

Hysteresis of tolerance monitoring

Under adverse measuring conditions (e.g. vibrations), pilot lamp flickering in case of close-to-tolerance measuring results is possible. In order to avoid this, a switching hysteresis can be established. Here, the preset tolerance limit is extended symmetrically by a certain, selectable value. If the measuring results now lie within the hysteresis range of the tolerance limits, the state of the pilot lamps does not change.

Basic principle of hysteresis:
With a switching hysteresis selected, the current and the preceding measuring result determine whether or not a result lies within the tolerance limits. Thus, the following is valid for measuring results in the range of the hysteresis:

Any result within the hysteresis range is considered to be within limits, if it and the directly preceding result are within limits. In case the preceding result was off limits, the current result in the hysteresis range is considered off-limits as well.

The switching hysteresis can be adjusted in a range between 0 and 99.99 µm after calling up parameter "Hystere." in the configuration level.

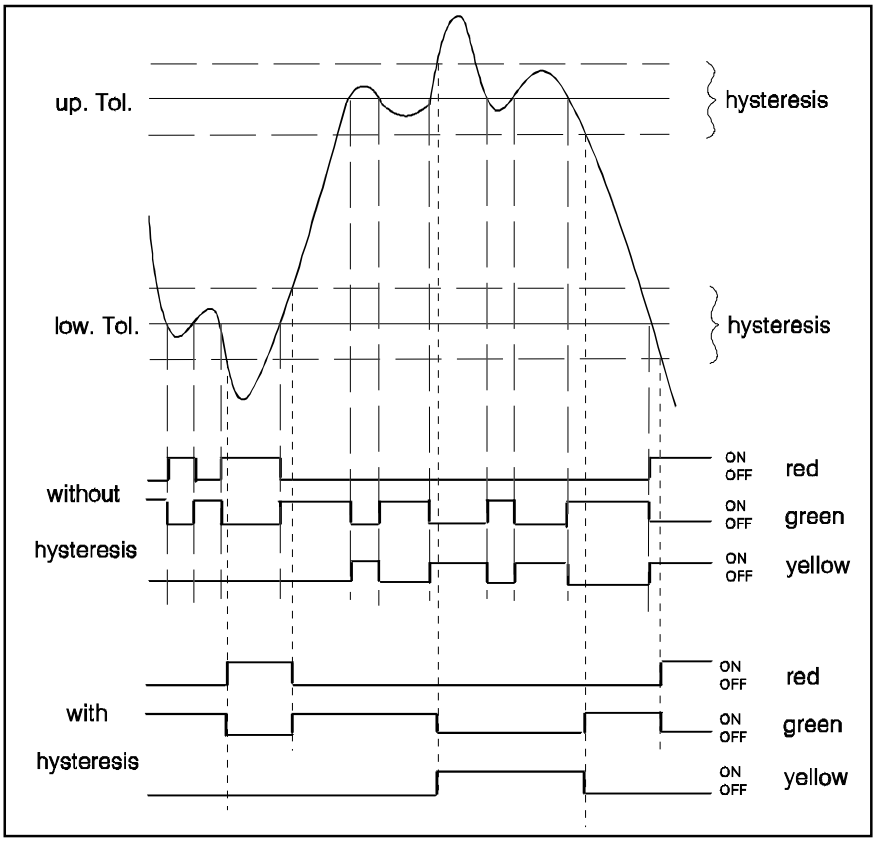


Fig. 5
Influence of the switching hysteresis on tolerance monitoring. The present example shows the course of the measuring values during an external measurement together with the tolerance monitoring results. (For reasons of improved illustration, the hysteresis is represented superproportionally large.)

4.4 Classification

The classification always refers to the measuring result which was selected for tolerance monitoring (with "Sel.tol"). Whenever the control signal "accept value into statistics" is released or the measuring time Tm ended, the results are sorted into groups according to their numerical values.

Classification, i.e. adjusting the class limits, is carried out automatically. The range between the upper and lower tolerance limit is divided into classes of equal width.

The number of classes has to be set in the instrument configuration level.

After having actuated **Konfig.** on the rear of the instrument, use the key △ or ▽ to set the indication to "Classes" and actuate the keys ► and ▲ or ▼ to enter the desired number of classes (1 ... 30).
By entering "0", classification will be switched off.

The class limits are adjusted after leaving this menu point.

Example for automatic classification:
In case there are 5 classes between - 2,000 µm (lower tolerance limit) and +2,000 µm (upper tolerance limit), a class width of 800 µm and the following class limits will result for automatic classification:

Cl.l. 0:-2,000.00		
Cl.l. 1:-1,200.00	(from	-2,000 µm to<-1,200 µm)
Cl.l. 2:-400.00	(from	-1,200µm to<-400 µm)
Cl.l. 3:400.00	(from	- 400 µm to<+400 µm)
Cl.l. 4:1,200.00	(from	+400 µm to<+1,200 µm)
Cl.l. 5:2,000.00	(from	+1,200 µm to<+2,000 µm)

Please note that due to the chosen hysteresis, the reversing points between the individual classes are extended.
A measuring result which is in the range of the hysteresis is automatically assigned to the lower class, provided that the directly preceding result was also assigned to the lower class. If it was grouped into the higher class, the current result will be assigned to the higher class as well.

Printing out the classification results:

When printing out individual values, the class is printed out in the column following the classified measuring result.

When calling up the function "Prnt stat" (= print statistics), a table is printed out which contains the class limits, the number of individual values in this class and a histogram with the graphical representation of the distribution function.

This histogram is deleted on deleting the statistics completely ("Clr stat").

Whenever changing the tolerance limits, the function "Clear statistics" has to be called up since otherwise totally wrong classification results will be printed out.

4.5 Correction factors

The measuring values supplied by the transducers A and B are multiplied individually by an adjustable factor. On doing so,

- sensitivity errors of the transducers are compensated for,
- the lever factors of the reversing levers inside the measuring unit are taken into consideration,
- the multipliers for the measuring result are taken into account.

Note: For compensating for sensitivity errors of the transducers, the VMF 1000 offers two auxiliary functions (see "Adjusting the sensitivity" and "Symmetry"

Adjusting the correction factors:

1. Actuate the key **Konfig.** on the rear of the instrument.
2. Select "Factor A" or "Factor B" with △ or ▽ .
3. Set the numerical value with ►, ▲ and ▼ .
   (Range 0 ... 99.9999; only positive values are allowed. Negative values have to be entered via the probe combination adjustment.)
4. Select further parameters with △ or ▽ or conclude with **RESULT**.

For both factors, the default setting is 1.0000.

If several correction factors are at hand for one transducer, these are multiplied with each other and then entered as one common "Factor A" or "Factor B".

Examples for adjusting the correction factor

Example 1
Transducer A features a sensitivity error of + 0.5 %.
The correction factor ("Factor A") then amounts to (1 : 1.005 =) 0.9950.

Example 2
A reversing lever mounted in front of transducer B causes a demultiplication of 0.75. The value to be entered for "Factor B" is (1 : 0.75 =) 1.3333.

Example 3
The measuring result of transducer A divided by two is to be indicated. The value of "Factor A" then is (1 : 2 =) 0.5.

Example 4
In a measuring set-up, the following transducer factors have to be considered in common:

- Correction factor due to the sensitivity error of the transducer = 0.9950
- Correction factor due to the error caused by the reversing lever = 1.3333
- Correction factor due to the conversion of the measuring result = 0.5

The common correction "Factor A" then is (0.9950 * 1.3333 * 0.5 =) 0.6633.

4.6 Measuring range

The instrument features two measuring ranges, namely

±2,000 µm (resolution 0.1 µm) and
± 200 µm (resolution 0.01 µm)

After actuating the key **Konfig.** on the rear side of the instrument, select the measuring range by either calling up the indication

"MR. ± 2000"

by means of the keys △ or ▽ or changing it to

"MR. ± 200"

by means of the keys ▲ or ▼.

In case the measuring range is clearly surpassed, the overflow indicator (see fig. 1 point 3) starts to light up. No more measurements are possible thereafter.*

The measuring range is not dependent on the indication range of the numerical display. The resolution of all indicated and output values, however, is determined by the selected measuring range.

* Moreover, the overflow indicator takes into account the selected correction factor, i.e. if the correction factor is <1, the overflow indicator already starts to light up within the measuring range and vice versa.

4.7 Start, stop, measuring time, pause, delay

The measuring time is the time during which the memories for maximum, minimum and mean value are open. The open state of the memories is indicated by "T" being displayed. Before new measurements over the measuring time Tm are started, the memories are cleared to enable the storing of new values. Whenever the measuring time Tm is ended, the result selected via the instrument configuration setting "Sel.stat" is accepted into the statistics memory and the results selected via "Sel.Prnt" are printed out.

The measuring time can be started and ended in three ways:

Manual

1. Manual control of the measuring time via Start/Stop
Press the key **Konfig.** on the rear of the instrument and select the parameter
"**STRT man**".

The measuring time is started by simply pressing the **START** key and ended whenever wanted by pressing the **START** key again.

Preset

2. Measurement over a certain preset period of time
Press the key **Konfig.** on the rear of the instrument and select the parameter

"STRT Tm".

The measuring time starts after actuating the **START** key and ends automatically after the preset time Tm.
For adjusting the measuring time (in seconds), set the parameter

"Tm [s]"

in the instrument configuration to a value in the range between 0.01 s and 999.99 s by means of the keys ►, ▲ , or ▼.

Intervals

3. Given measuring time, cyclical repetition of measuring run (measurements in intervals)
Press the key **Konfig.** on the rear of the instrument and select the parameter

"STRT Tp".

Pause

The measurement starts after having actuated the key **START** and ends after the preset time Tm. After a pause time Tp, the measuring run starts again. The cyclical repetition of the measuring time Tm and the pause time Tp is ended on actuating the key **START** again.

The length of the pause **"Tp [s]"** is entered in the same way as the measuring time Tm (0.01 ... 999.99 s).

Delay

By entering a delay time Td, between 0 and 99.99 seconds, the start of the measurement will be delayed. Td is entered in the same way as Tm.

Interruption

The measurement can be interrupted on actuating the keys ☗ and **START** and continued by actuating these keys again (☗ , **START**).

Adjusting the parameters Tm and Td is also necessary for the measuring/reference function.

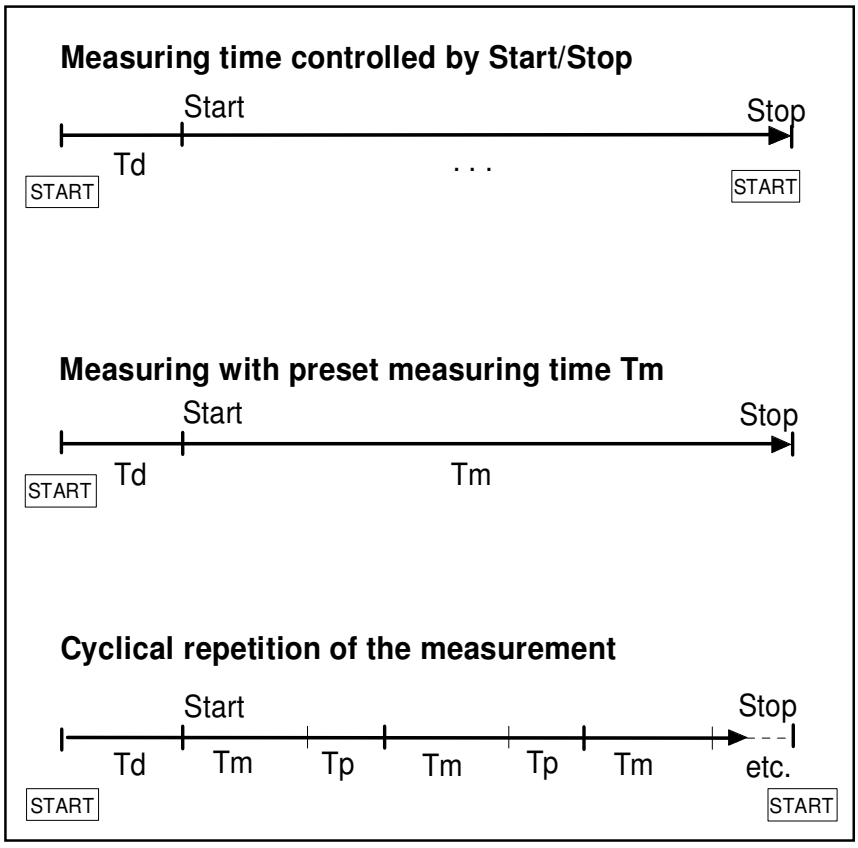


Fig. 6
Measurements with differing measuring time control
Tm = measuring time
Td = (initial) delay time
Tp = pause time

4.8 Storing the settings permanently

Changed measuring conditions and instrument settings are deleted on switching off the instrument. When switching on again, the instrument presents the settings that have been stored last.

However, all settings can be stored permanently by means of the function "Save". For this, select "Save" in the instrument configuration and press ►. The following safety inquiry must be answered by pressing ▼ or aborted by pressing any other key.
Each time the instrument configuration is stored, the version number of the software is also stored. When switching on the VMF 1000, the version number stored in the EPROM is compared to the stored version number. If the version numbers differ, e.g. after having exchanged the EPROM, the instrument indicates "Rev-Fehl". The VMF 1000 may no longer function correctly. Load the standard configuration "S.config" and store it by means of the function "Save".

There is one permanently stored standard setting for measuring conditions and instrument settings to which the instrument is adjusted on delivery. This standard setting can be recalled at any time although the user may have permanently stored further settings. The measuring conditions and the instrument configuration entered and stored permanently by the user, however, will only be overwritten (and deleted!) if the standard setting is stored again by means of the function "Save". Otherwise, the permanently stored user-specific settings continue to be valid after switching off and on again. Thus, intermediate work with standard settings does not automatically entail the deletion of customer-specific settings.

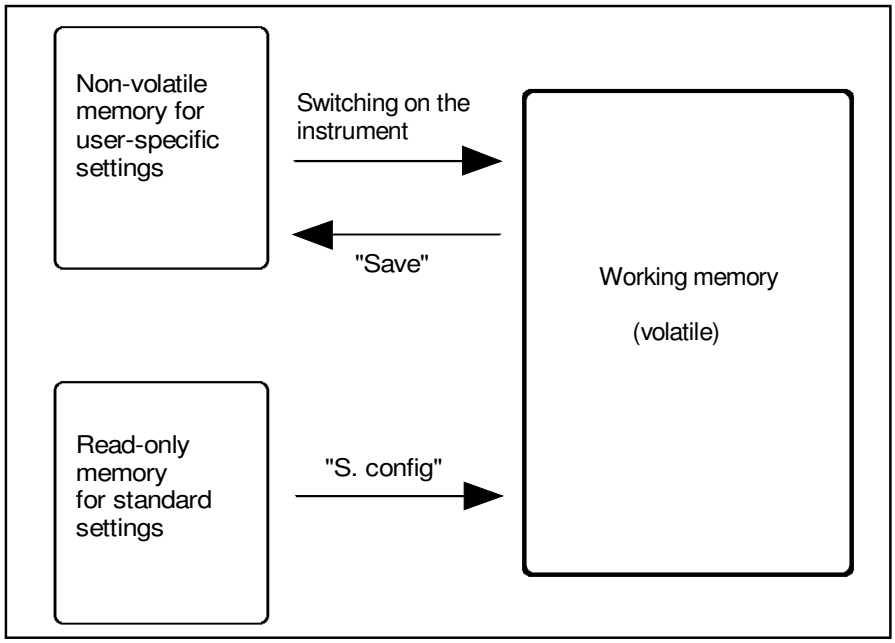


Fig. 7
Storing instrument settings in the volatile working memory, the non-volatile memory, and the standard-settings memory. The settings in the working memory are always the ones which are used.

5 Measurement and evaluation

After switching on, the instrument is in its basic condition. The transducer value is determined continuously and indicated according to the selected transducer combination. In case the instrument is not in its basic condition, this condition can be re-established by actuating either **RESULT** or **START**.

5.1 Checking the transducer signal indication

For checking purposes (e.g. during setting-up), the actuation of key **Check a** or **Check b** results in the indication of the current probe value,

- without transducer combination,
- without correction factor,
- without master value,
- without nominal value.

i.e. as an unprocessed raw value.

In this case,  (accept master value) has no function!

Usually, these keys are only used during setting-up for checking correct transducer clamping or ensuring perfect transducer functioning. The zero position indicated here marks the electrical zero point of the transducer.

The transducer signal check is ended on pressing the key **RESULT**.

5.2 Indication ranges of the analogue instrument

When monitoring measuring runs, the fast and reliable determination of trends and reversing points is decisive. The dial-type indicator and the possibility to choose among several indication ranges makes allowance for the above demand.

Usually, the dial-type indicator and the numerical display provide equal readings. Exceptions to this rule are formed by the setting "Sel. ins 2" as well as the output of statistical results and nominal values. The following indication ranges can be selected independently of the measuring range:

±	10,000	µm
±	3,000	µm
±	1,000	µm
±	300	µm
±	100	µm
±	30	µm
±	10	µm
±	3	µm
±	1	µm

The numerically displayed values are not influenced by the indication range setting of the dial-type indicator.

The resolution of the displayed value is determined by the adjusted measuring range (see measuring range).

In case the instrument is in its basic condition, the actuation of one of the keys ▲ or ▼ causes the valid indication range to be displayed for about two seconds.
If during these two seconds the keys are pressed again, the subsequently smaller or larger indication range is selected. Continue pressing these keys until the desired range is adjusted.

It is no longer possible to change the indication range via the keyboard if the configuration locking is activated (Lock on).

5.3 Measuring results

By repeatedly pressing the key **RESULT**, the following measuring results can be indicated ("measuring result" here describes the result of a dynamic measurement, i.e. a number of individual measuring results):

- **COMBINE** current measuring result as per selected transducer combination
- **MAX** maximum result during measurement (maximum value)
- **MIN** minimum result during measurement (minimum value)
- **(MX+M)/2** arithmetic mean value of maximum and minimum result
- **(MAX-MIN)** difference between maximum and minimum result
- **MEAN** mean value of all individual measuring results assessed during the measuring time Tm

Provided that the statistical evaluation was activated by the function "Stat. on", the statistical results of a measuring series can be indicated as well:

- **n** number of measurements or results
- **xn** last measuring result
- **x (x/)** x-bar, mean value of all results of all measurements
- **s** standard deviation of these values from the mean value
- **Xmax** maximum individual measuring result
- **Xmin** minimum individual measuring result
- **R** range, difference between the largest and smallest result of all measurements (Xmax - Xmin)

The measuring results to be indicated have to be selected beforehand in the instrument configuration.

For all statistical evaluations it is necessary to beforehand set "Stat. on" in the instrument configuration and select a measuring result, e.g. (MAX - MIN).

5.4 Statistics

One of the results

Combine, **MAX**, **MIN**, **(MX + M)/2**, **MAX - MIN** or **MEAN**

can be evaluated statistically.

The statistics can be run for a maximum of 25,000 measurements. After the end of the measuring time Tm or the activation of input "Accept value into statistics", the result will be accepted into the statistics. The number of the already acquired results "n" will be indicated for about two seconds.

Select

Actuate the key **Konfig.** on the rear of the instrument and select the configuration parameter "Stat. on". Afterwards, choose "Sel.stat" and depress the ► key. Now use ∇ to single out the measuring result for which the statistics is to be run and set it to "1" by means of the keys ▲ and ▼.

Restrict

With parameter "n max" it is possible to restrict the number of measurements for which the statistics is to be run.
As soon as the preset number of measurements is reached, no more results will be accepted into the statistics. Moreover, it is no longer possible to start a measurement. Only after having deleted the statistics completely or at least the last result, may commence the next measurement.

Depress the key **Konfig.** on the rear of the instrument and call up the parameter "n max". Establish the number of measurements to be evaluated statistically (0 to 25,000) by means of the keys ►, ▲ and ▼. In case "0" is input, the number of measurements to be evaluated statistically will not be restricted, i.e. 25,000 measurements will be taken. After having assessed the 25,000th measuring result, the instrument does not prevent the acquisition of further results. The statistics, however, will not be carried on.

Print

Actuate the key **Konfig.** on the rear of the instrument and select the parameter "PrntStat". The statistical record printout can now be started with ►.

Delete

It is possible to delete the **last** result or the complete statistics.
The last result x_n is deleted as follows:

- Select "Clr xn" in the instrument configuration and press key ►.
- After answering the safety inquiry "n-1?↓" by actuating the ▼ key, the ultimate result will be deleted.

The complete statistics will be cleared as follows:

- Select "Clr stat" in the instrument configuration and press key ►.
- After answering the safety inquiry "n=0?↓" by actuating the ▼ key, the statistics will be deleted completely.

The clear functions are executed directly. After the deletion, the instrument is in its basic condition.

The above-mentioned functions can also be assigned to function key **F1** or **F2** for making them directly available (see section 6.8).

The statistical results can also be deleted and printed out by means of control input signals (see section 6.2).

5.5 Printouts

It is possible to print out measuring results, statistical values and histograms in the form of a measuring record. All Epson or Epson-compatible printers with serial interface can be used for this purpose.

The printer is connected to the RS 232 C interface (via the cable, order no. 6860215). For this, set the instrument configuration parameter "PrntPara" to "1". Also check the baud rate and the transmission format.

Then, start the measurement by pressing the key **START**.

The measuring results Combine, MEAN, MAX, MIN, (MX+M)/2, and MAX-MIN (depending on the presetting) will be printed out directly after the measurement.

- **START** starts the measuring run the results of which will be stored.
- The measuring run ends either after the preset time Tm or after actuating the **START** key again.
- The results are printed out as one line of a table.

Provided that classification and statistics have been activated, it is possible at any time (i.e. during or after a measuring series) to print out the histogram and the statistics.*
For this.

"Prnt stat" has to be set (△ and ▽) and confirmed with ►

in the instrument configuration. As soon as the printout is complete, the measuring series can be continued.

If only statistical results are to be printed out, we recommend to set all results of the instrument configuration menu "Sel.Prnt" which are not required to "0". This is particularly useful for transferring lots of data. In case of short measuring times and pauses, it may be that the printer receives the data too quickly. This essentially depends on the printing speed and the selected transfer (Baud) rate. If the printer receives the data too quickly, the VMF 1000 indicates the error message "Printer!" and individual characters or lines can be lost.

The printing mode is switched off by setting the instrument configuration parameter "Printer" to "0".

- If histograms or statistics are to be printed out quite frequently, we recommend to assign this function to one of the function keys.

6 Annex

6.1 Analogue output

The analogue output can be used in two different modes. One of the two modes “DAC-fix” or “ DAC-rel.” is selected in the configuration menu. The sensitivity factor “Fac.DAC” has different meanings depending on the mode.

6.1.1 Mode “DAC-fix”

The output voltage is independent of the range of the analogue instrument.

The parameter “Fac-DAC” sets the sensitivity in mV/µm. The range is 0…999.99 mV/µm.

Example: Fac.DAC= 100 (mV/µm).

With a reading of 75 µm the output voltage at the analogue output will be
75,0 * 100,0 mV = 7.5 V.

6.1.2 Betriebsart “DAC-rel”

The output voltage depends on the setting of the range of the analogue instrument.

The parameter “Fac.DAC” sets the output voltage in “V” at the full scale of the analogue output. The range is 0…999.99 V / full scale.

Example: Fac.DAC = 8.0 (V / full scale)

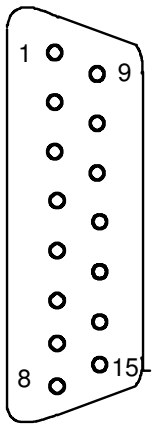
With a reading of 75 µm the ouput voltage at the analogue output will be

75.0 / 100 * 8 V = 6 V.

6.1.3 Technical data of the analogue output

Output voltage range:	-10 V...+10 V
Max. output current:	+/- 5mA
Resolution	12 Bit (+/- 2048 steps)
Sample rate	156 Hz
Load resistance:	> 2 kOhm

Pin-Belegung der 15-pol. Buchse



Pin	name	function
1	Uv	Internal power supply 6,5...10V, 100 mA
2	I3	Input I3
3	I2	Input I2
4	O2	CMOS-Ausgang O2
5	GND	Signal ground, 0V
6	Ia	Common anode of I1...I3
7	I1	Input I2
8	O1	CMOS-output O1
9	O3	CMOS-output O3
10	N.C.	not connected
11	N.C.	not connected
12	N.C.	not connected
13	N.C.	not connected
14	0 V	Analog output: ground
15	Ua	Analog output: Signal

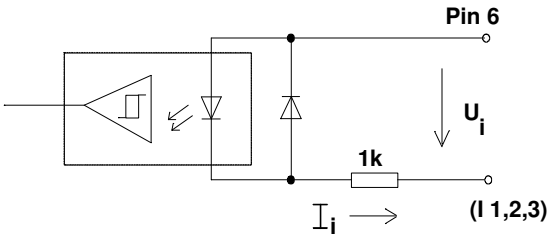
6.2 Digital inputs and outputs

Inputs:
Optocouplers with protective resistor and reverse-biased diode for reversed protection.

Limit:	I_i	< 50 mA
High:	V_i	> 4.5 V ($I_i = (V_i\text{-}1.2V)/1$ kOhm)
Low:	V_i	< 2.5 V ($I_i = V_i/1.5$ kOhm)

Note: The electrical isolation does not fulfil safety requirements, it only serves for metrological purposes (e.g. for avoiding earth loops).

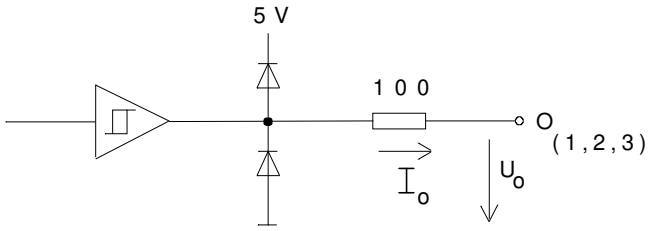
All signals have a positive logic and are "high active", i.e. an active function (= "On") causes a current to flow through the optocoupler.



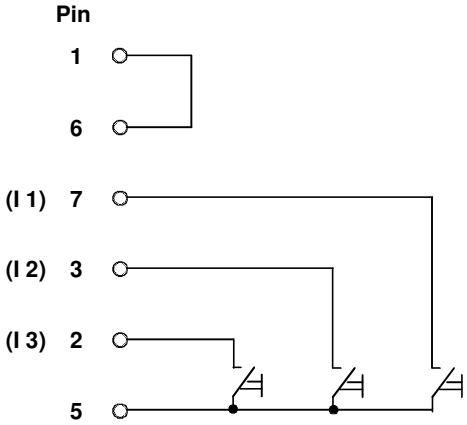
Ausgänge

CMOS output

„Off“ state	0,8 V, - 4mA
“On“ state	3,4 V, 4 mA



Adaptation of external switches to the connector „Ext“



6.3 Adjusting the sensitivity

Deviations from the nominal sensitivity can be corrected for each transducer by means of "Factor A" or "Factor B", respectively.
Besides the manual adjustment described in section "Correction factors", the VMF 1000 also enables the automatic calculation and adjustment of correction factors.
The automatic process is based on the comparison between the values assessed by the VMF 1000 (which, as the case may be, have to be corrected) and a known increment which may be given, for example, by a gauge block.

Gauge block

Before adjusting the sensitivity, it is indispensable to enter the parameter **"ΔG.block**". This may be the difference of two gage blocks that are used for the following calibration.

Adjusting the sensitivity:

1. Actuate the key **Konfig.** on the rear of the instrument.

2. Select the function "Sensit." with ∇ or △ and start it with ► .

3. Now, "G. bl. 1" will be displayed together with the value 0.0 . After having placed the first gauge block into the measuring device, the first measurement can be started with ► .

4. As soon as the measurement is complete "G. Bl. 2" is displayed together with the gage block difference as is was entered above (**"ΔG.block**"). Insert the second gage block which differs exactly by **"ΔG.block**" from the first one and start the second measurement with ► .

On the base of the two measuring results and the two nominal values, the VMF 1000 calculates a correction factor "C" with which "Factor A" and "Factor B" will be multiplied.

$$C = \frac{\text{Gauge block 2 - Gauge block 1}}{\text{Measuring value 2 - Measuring value 1}}$$

As can be seen from the equation, only the differences in size are considered. The input of the absolute gauge block values thus only serves for comfortable operation.

"Factor A" and "Factor B" will be multiplied by the above-mentioned correction factor "C":

Factor A (new)	=	Factor A (old)	*	C
Factor B (new)	=	Factor B (old)	*	C

In case of the transducer combinations +A, -A, +B and -B, only the sensitivity of the selected transducer will be corrected, i.e. either "Factor A" or "Factor B".

In case of the transducer combinations
+A +B,
-A -B,
+A -B,
-A +B,

i.e. in case sum or differential measurements are to be carried out, the sensitivity of both transducers will be corrected ("Factor A" and "Factor B").
This, however, does only render correct results, if the transducers symmetry has been balanced before the sensitivity was adjusted.

6.4 Balancing the Symmetry

Transducers and amplifier feature production-based sensitivity tolerances. These tolerances cause a system-inherent error which is proportional to the common deflection of the two transducers (above all in case of sum measurements). This error manifests itself for constant differential signals (touching transducer tips, master measurement) in the form of a continuously increasing or decreasing indication value, when moving the transducers together over the entire measuring range. This error can be corrected by adapting "Factor A" and "Factor B".

Balancing the Symmetry manually

1. Determine the stroke of the transducers. For this, select the transducer combination "+A" or "+B". Afterwards, the transducers have to be moved together from one stop to the other and the values indicated in the stop positions must be noted. On the base of these values, the stroke will be calculated.

   Example: lower stop: +A =-1,980 µm
   upper stop: -A =1,950 µm
   stroke: 1,980 µm - (-1,950 µm) = 3,930 µm

2. Adjust the transducer combination for sum measurements ("+A +B"). Together move the transducers from stop to stop and note the indicated values with the correct sign. Here, the direction of movement has to be taken into account as well. Reading off the values will be simplified, if in one stop position the indication is set to zero with the keys ☗ and ⊢⊙⊣.

Example: For a deflection of 3,930 µm, the indicated value changes by -25 µm. Here, transducer A was deflected in the positive, transducer B in the negative direction. The change of -25 µm shows that the transducer moved in negative direction, i.e. transducer B, is too sensitive. The error relative to the entire stroke is:

$$\frac{-25\ \mu m}{3930\ \mu m} = 0{,}006361$$

This means that transducer B features an oversensitivity of 0.64 % or, the other way round, transducer A features an insensitivity of 0.64 %.

Balancing can now be achieved by either changing "Factor A" or "Factor B":

$$\text{Factor A (new)} = \text{Factor A (old)} * 1.006361$$

or

$$\text{Factor B (new)} = \frac{\text{Factor B (old)}}{1.006361}$$

Balancing the symmetry automatically:

Balancing the symmetry automatically is based on the manual process. All necessary measurements, calculations and settings are automatically carried out by the VMF 1000. It only has to be made sure that the transducers are deflected simultaneously.

Balancing the symmetry automatically can be started either via the configuration catalogue function "Symmetry" or the computer interface (P53).

1. Depress the key **Konfig**. on the instrument's rear.

2. Use the key ∇ or Δ to select the function "Symmetry" and press ► to start it.

3. Repeatedly move both transducers together from stop to stop. For every second inversion of the direction of movement, a horizontal line will be indicated on the numerical display.

Throughout the first phase, the range to be balanced will be determined. The VMF 1000 recognizes the range limits by the inversion of transducer signal A (peak detector). First the positive, than the negative deflection of transducer A will be assessed. The difference between the peaks must be

>500 µm for the measuring range ± 2,000 µm or
> 50 µm for the measuring range of ±200 µm .

This process will be repeated and the largest deflection reduced by 2.5 % will then be assumed as travel limit.

In a second phase, the measuring values for determining the correction factor will be assessed. For this, the transducer signal must exceed the range limits determined before. After a 200 ms wait, the mean value of the transducer signals will be acquired for each transducer individually during the next 400 ms. These measuring values are the base of the correction factor calculation:

$$\text{Factor A (new)} = \text{Factor A (old)} * \frac{\text{(Meas. value B) max - (Meas. value B) min}}{\text{(Meas. value A) max - (Meas. value A) min}}$$

The second phase as well will be repeated and a new correction factor calculated, until "Factor A" and "Factor B" differ by less than one tenthousandth.

After successfully completing the symmetry process, the sensitivities of the two transducers are harmonized with respect to each other. The absolute sensitivities, however, are only correct, if the sensitivity of transducer B was adjusted correctly before starting the balancing process.

6.5 Linearization of transducer characteristics

The VMF1000 can linearize the characteristics of individual transducers. The linearization is valid only for one individual transducer. After a replacement of the probe it is necessary to linearize the new transducer once.

Linearization procedure

For each transducer a table is created which contains a correction value each 100 µm approximately. These correction values are subtracted from the measured transducer values at the respective position. Values in between the correction points are interpolated.

Manual entry of correction data

Each transducer has to be linearized individually. For that purpose the other transducer has to be replaced by an adjustable stop, for example a micrometer. The reference for the linearization is a gage block. Before the linearization procedure starts make sure that no offset has been introduced by the function "zeroing" and the transducer travel is from +2100 µm to – 2300 µm.

The size of the gage block has to be entered in the configuration as parameter „**G. BL. 10**" (= gage block 10).
If necessary the old linearization data has to be cleared (see: „clear linearization table)
The linearization procedure is started via the function „**AutoCorr**" in the menue „**ProbCorr**".
Next the respective channel and direction (sign) has to be selected, for example "**Corr A+**" as the linearization has to executed separately for channel A and B and separately for the „plus" and „minus" direction.
The linearization may start at any point inside the measuring range but always with the selected polarity.
It is recommended to start with the first point close to the transducers "zero" .

1. On the left side of the display appears „**M1 0**" und on the right the actual transducer position.

2. Set transducer to approx. 0.0 without gage block.

3. Accept M1 with ⇒ .

4. On the display appears „**M2 300**" (for example, if 300µm has been entered as "**Gage block 10**")

5. Insert gage block between adjustable Stop and transducer. Don't move the spindle position of the adjustable stop. Accept M2 with ⇒.

6. The inclination of the curve is calculated and all entries of the linearization table are corrected until the end of the measuring range.

7. Again in the display appears „**M1 0**" . The gage block has to be removed and the transducer touches the adjustable stop. The adjustable stop now has to be moved to that position which the transducer had before with the gage block in this example 300 µm.

8. Repeat step 3 to 6 up to the positive end of the measuring range. The correction of each step starts with the correction point following the measuring value „M1"

9. After the positive part of the curve has been linearized the same procedure has to be repeated for the negative part of the curve. Please note in case of the negative part the first measuring has to be done **with** gage block and the second measuring **without** gage block

The linearization may be repeated at any time at different points in order to touch up the correction of the curve.
The precision of the calculation of the inclination is only influenced by the difference of the two measurements with and without gage block, not by the absolute value of the measurement.

Note : **If the error-message „Error“ appears when leaving the configuration at least one table entry has been calculated „out of range“. The specific entry has to be decreased or the table has to be cleared by „Clear A+“ or „Clear A-„.**

The functions necessary for the linearization are called via the configuration menu „ProbCorr“.

ProbCorr ⇒	Entry of the linearization function
• A -xxxx.x • A -yyyy.y • ...	Correction table for channel A. With the right arrow keys ⇑ and ⇓ the correction points can be selected and if necessary changed with ⇒.
⇓	
• B -xxxx.x • B -yyyy.y • ...	Correction table for channel B
⇓	
AutoCorr ⇒	
• Korr A+ ⇒ • M1 0 ⇒ • M2 xxx ⇒ • M1 0 ⇒ • ...	Linearization of transducer A with gage block in + direction
• Korr A- • M1 0 ⇒ • M2 xxx ⇒ • M1 0 ⇒ • ...	Linearization of transducer A with gage block in - direction
• Korr B+ • M1 0 ⇒ • M2 xxx ⇒ • M1 0 ⇒ • **...**	Linearization of transducer B with gage block in + direction

- Korr B- Linearization of transducer B with gage block in - direction
- M1 0 ⇒
- M2 xxx ⇒
- M1 0 ⇒
- **...**

⇓

Clear ⇒ **Clear A+** Clears positive part of the correction table for transducer A

⇒ **Clr ? ⇓** Confirm with ⇓ or abort with „Result“

⇓

Clear A- Clears negative part of the correction table for transducer A

⇒ **Clr ? ⇓** Confirm with ⇓ or abort with „Result“

⇓

Clear B+ Clears positive part of the correction table for transducer B

⇒ **Clr ? ⇓** Confirm with ⇓ or abort with „Result“

⇓

Clear B- Clears negative part of the correction table for transducer B

⇒ **Clr ? ⇓** Confirm with ⇓ or abort with „Result“

⇓

Print ⇒ Prints the correction table for A und B via printer port

6.6 Instrument configuration

The instrument configuration level is reached by pressing the key **Konfig.** on the rear of the instrument or, provided that the settings are not blocked by means of "Code", by simultaneously actuating the keys **F1** and **F2**.

Now, the desired parameter can be selected with key △ (forward scrolling) or ▽ (backward scrolling).

There are three possibilities for setting or changing parameters:

1. Parameters with several defined adjustments.
   Adjust with ▲ or ▼ . Return with △ or ▽ .
2. Parameters to which numerical values are to be assigned.
   Adjust with ► , ▲ , and ▼ . Return with △ or ▽ .
3. Parameters with several assigned sub-parameters.
   Adjust with ▽ , ► , ▲ , and ▼ .
   Return with △ .

As a rule, the instrument configuration level is left by pressing the key **RESULT**. Directly executed functions form an exception to this rule, for they automatically entail leaving the instrument configuration.

List of configuration parameters

The following list shows the standard configuration to which the VMF 1000 is adjusted on delivery.

Parameter accessible by function “set”

Measuring range	MR. ± 2000
Transducer combination	C:+A+B
Adjusting the sensitivity of transducer A	Factor A
Adjusting the sensitivity of transducer B	Factor B
Master	Master
Nominal value	Nom. Val.
Delay time	Td [s]
Measuring time*	Tm [s]
Pause time betw. cyclical repet. of meas. Runs*	Tp [s]
Number of results to be evaluated statistically	n max

* The parameter Tm will only appear if the Konfiguration of the measuring time is set to “STRT Tm” or “STRT Tp”.
The parameter Tp will only appear if the Konfiguration of the measuring time is set to “STRT Tp”.

Measuring range		The instrument features two measuring ranges, namely
	MR.± 2000	measuring range ± 2,000 µm (resolution 0.1 µm)
	MR. ± 200	measuring range ± 200 µm (resolution 0.01 µm)
Transducer combination	**C: +A +B**	Select the transducer with ► and adjust the sign with ▼ . On entering "0", the transducer in question is not taken into consideration.
Adjusting the sensitivity	**Factor A**	Each probe value is multiplied with an individual factor.
	Factor B	Thus, sensitivity deviations can be corrected. On entering "0.0", the probe in question is not taken into consideration.

Parameter	Indication
Tolerance monitoring	Tol. off
Selecting the result of tolerance monitoring	Sel. tol
Hysteresis	Hystere.
Number of classes	Classes
Measuring value integration time	Ti [ms]
Selecting the result to be indicated	Sel. Res
Select display mode of instrument	Sel. ins
Resolution of the numerical display	Resol.
Unit	Unit
Language	English
Brightness of the display	Bright. 4
Calibrating the analogue instrument	Cal.inst
Statistics	Stat.off
Selecting the statistical results	Sel.stat
Statistical printout	PrntStat
Deleting the last statistical result	Clr xn
Deleting the statistics completely	Clr stat
Controlling the measuring time Tm	STRT man
Input/output parameters, computer/printer interface	C/P off
RS232 parameter, baudrate etc.	I/O para
Printer parameter	PrntPara
Parallel I/O	Ext para
Multiplier for analogue output (DAC)	Fac.-DAC
Mode of analogue output	DAC-rel
Gauge block	∆G.block
Probe correction (linearization)	ProbCorr
Sensitivity	Sensit.
Transducer symmetry	symmetry
Configuration lock	lock off
Configuration printout	PrntConf
Standard configuration	s.config
Saving the settings	Save

Configuration parameter	Menu (Indication)	Settings /Indication		Explanations Parameter settings 1 = on; 0 = off
Tolerance monitoring	**Tol. off**	Tol. off		Tolerance monitoring switched off. It is not possible to adjust upper or lower tolerance limits for tolerance monitoring.
		Tol –>I I<–		Tolerance monitoring switched on: *external measurements*
		Tol I<– –>I		Tolerance monitoring switched on: *internal measurements*
				With tolerance monitoring switched on, it is possible to adjust tolerance limits. During measurement, three different results can be output: - Reject (red pilot lamp), - Rework (yellow pilot lamp), - Accept (green pilot lamp). For tolerance monitoring, it is indispensable to determine the result to be monitored. This can be done via parameter "Selecting the result for tolerance monitoring" (Sel. tol).
Selecting the result for tolerance monitoring and classification	**Sel. tol**	Combine	0/1	Measuring result acc. to transducer combination
		MAX	0/1	Maximum value of a dynamic measurement
		MIN	0/1	Minimum value of a dynamic measurement
		(MX+M)/2	0/1	Mean of the maximum and minimum value of a dynamic measurement
		MAX-MIN	0/1	Difference between the maximum and minimum value of a dynamic measurement
		MEAN	0/1	Mean value of all individual results assessed throughout the measuring time Tm
				Only one of the listed results can be chosen. - Press ► . - Use ∇ to select the desired result. - Actuate ▲ or ▼ to switch the result to 1 (= on). - Complete the selection by pressing **RESULT** or return to the configuration catalogue by actuating Δ .
Hysteresis of tolerance monitoring and classification	**Hystere.**	0.00 ... 99.99 (µm)		Adjusting the hysteresis for symmetrically extending the class limits. The standard setting for this parameter is 1 µm.
Number of classes	**Classes**	0 ... 32		Adjusting the number of classes. The range between the upper and lower tolerance limit is divided into n classes of equal width. On entering "0", no classification will be carried out. The classification results can be printed out by activating the function "Prntstat".

Measuring value integration time	**Ti [ms]**	1.6 3.2 6.4 12.8 25.6 51.2 102.4 204.8 409.6 (milliseconds)		Every 1.6 milliseconds, a measuring value will be acquired. From these values, the instrument calculates a mean value which is related to a certain interval of time, namely the measuring value integration time Ti. The standard setting for this parameter is 102.4 milliseconds. A reduction of the integration time is reasonable if very fast updating of the measuring value acquisition is the point. Prolonged integration times stabilize the measuring value indication in case of vibrations influencing the measuring set-up, for example.
Selecting the results	**Sel. res**			Selecting the results which are to be indicated by actuating the key **RESULT**.
		Combine	0/1	Measuring result acc. to transducer combination
		MAX	0/1	Maximum value of a dynamic measurement
		MIN	0/1	Minimum value of a dynamic measurement
		(MX+M)/2	0/1	Mean of the maximum and minimum value of a dynamic measurement
		MAX-MIN	0/1	Difference between the maximum and minimum value of a dynamic measurement
		MEAN	0/1	Mean value of all individual results assessed throughout the measuring time Tm
				Statistical results
		n	0/1	Number of measurements or results
		xn	0/1	Ultimate measuring result
		x	0/1	x-bar, arithmetic mean of all meas. results
		s	0/1	Standard deviation
		Xmax	0/1	Maximum value
		Xmin	0/1	Minimum value
		R	0/1	Range, i.e. difference between the largest and the smallest result of all measurements
		Cp*	0/1	Theoretical process capability
		Cpk*	0/1	Actual process capability
				Cp* and Cpk* are calculated neglecting the normal distribution. Any number of parameters can be selected.
Selecting the mode of indication	**Sel. ins**	1		The numerical display and the dial-type indicator indicate the same value (default setting).
		2		The dial-type indicator always shows the current measuring value, while the numerical display shows the result selected with **RESULT**.
Resolution of the numerical display	**Resol.**			Reducing the number of digits after the comma for indications on the numerical display.
		0.		No digit after the comma.
		0.0		One digit after the comma.
		0.00		Two digits after the comma (only possible with a measuring range of ± 200 µm).
Unit	**Unit**	µm inch		The selected setting is indicated by the µm or µinch indicator.
Language	**English**	English		Texts are given in English.
		Deutsch		Texts are given in German.
		FRANCAIS		Texts are given in French.

Configuration parameter	Menu (Indication)	Settings /Indication		Explanations Parameter settings 1 = on; 0 = off
Brightness of the display	**Bright. 4**	Bright. 4 Bright. 3 Bright. 2 Bright. 1		Brightness 100 % Brightness 75 % Brightness 50 % Brightness 30 %
Calibrating the analogue instrument	**Cal. inst**	I–>0<–I I 0–>I I<–0 I	±0 +10 -10	Use key ► for subsequently calling up zero point, the right- and the left-hand end-scale deflection. If the pointer deflection does not agree with the scale, the pointer position can be corrected (calibrated) electronically with the keys ▲ and ▼. This calibration setting is to be stored with "Save" (see below).
Statistics	**Stat. off**	Stat. off Stat. on		The statistics is switched off. The statistics is switched on. The statistics can be run for up to 25,000 individual values.
Selecting the statistical results	**Sel. stat**			Selection of the result for which to run the statistics:
		Combine	0/1	Measuring result acc. to transducer combination
		MAX	0/1	Maximum value of a dynamic measurement
		MIN	0/1	Minimum value of a dynamic measurement
		(MX+M)/2	0/1	Mean of the maximum and minimum value of a dynamic measurement
		MAX-MIN	0/1	Difference between the maximum and minimum value of a dynamic measurement
		MEAN	0/1	Mean value of all individual results acquired during the measuring time Tm
Number of results to be evaluated statistically	**n max**			Restricting the number of measurements to be evaluated statistically. As soon as the value input for "n max" is reached, it is no longer possible to take measurements. Input range: 0 ... 25,000. (0 = no restriction)
Statistical printout	**PrntStat**			Start the printing out of the statistics by actuating the ► key. After printing out, the instrument is in its basic condition.
Deleting the last statistical result	**Clr xn**	n-1?		The last statistical result can be deleted. - Press key ►. - Answer the safety inquiry with ▼. The last value will be deleted from the statistics and the instrument will return to its basic condition.
Deleting the statistics completely	**Clr stat**	n = 0?		The statistics can be deleted completely. - Actuate key ►. - Answer the safety inquiry with ▼. The statistics will be deleted and the instrument will return to its basic condition.

Controlling the measuring time Tm	**STRT man**		The measuring run is started with **START** and ended whenever wanted by actuating **START** again.
	STRT Tm		The measurement is started by pressing the key **START** and ends automatically after the preset measuring time Tm.
	STRT Tp		Measurement starts when actuating the key **START** and ends after a preset measuring time Tm. After a pause time Tp, the next measurement is started automatically. This cycle will be repeated until the key **START** is pressed again or the number of measurements "n" equals the value entered for "n max". Tm and Tp can be adjusted to values in a range between 0.01 and 999.99 seconds.
Switch on/off computer and printer interface	**C/P off** **C/P on** **Printer** **Computer**		Computer and printer interface are switched off Computer and printer interface are switched on only printer interface is switched on only Computer interface is switched on
Input/output parameters for the serial interface	**I/O para**	computer	0/1 switches the computer interface on/off.
		Baud 9600 4800 2400 1200 600 300 150 75	Data transfer rate (Baud rate)
		Rec. XON Rec.-- Rec. DIN	Record type X ON/X OFF No record no function
		Char 8n1 Char 7n2 Char 7o1 Char 7e1	Data format/parity check: 8 data bits, no parity check, 1 stop bit. 7 data bits, no parity check, 2 stop bits. 7 data bits, odd parity check, 1 stop bit. 7 data bits, even parity check, 1 stop bit.
		Unit No.	1 no function

Configuration parameter	Menu (Indication)	Settings /Indication		Explanations Parameter settings 1 = on; 0 = off
Printer parameters	**Prnt Para**	Printer	0/1	Switches the printer interface on/off.
		Sel.prnt		Selection of the res. to be printed out from the below list:
		Num.	0/1	Result number
		Combine	0/1	Measuring result acc. to transducer combination
		MAX	0/1	Maximum value of a dynamic measurement
		MIN	0/1	Minimum value of a dynamic measurement
		(MX+M)/2	0/1	Mean value of the maximum and minimum value of a dynamic measurement
		MAX-MIN	0/1	Difference between the maximum and minimum value of a dynamic measurement
		MEAN	0/1	Mean of all individual values assessed during the measuring time Tm
		n	0/1	Number of measurements or results
		xn	0	Last measuring result (always switched off)
		x	0/1	x-bar, arithmetic mean of all meas. results
		s	0/1	Standard deviation
		Xmax	0/1	Maximum value
		Xmin	0/1	Minimum value
		R	0/1	Range = Xmax - Xmin
				It is possible to select as many results as desired. (The width of the paper to be used for printing, however, has to be taken into account).
		Cust. Tx.		Customer-specific text. By means of a terminal or a computer, it is possible to enter a text via the RS 232 C interface, which then serves as record head. The default text of the standard configuration, however, will be overwritten: - Connect the terminal or the computer to the serial interface of the VMF 1000. - Set the Printer parameters (Prnt para) to "Cust.Tx"
		Input!		- Press key ►.
		0 ... 56 Charac.		- The entered text is transferred from the computer to the VMF 1000. In the numerical display, each character of the text is counted. - Press key ►, as soon as the text was transferred completely. - Use the parameter setting "Save" to permanently store the customer-specific text. The above procedure can be aborted with **RESULT**.
		Format 0/1		Formatted output on the printer 0 = unformatted measuring record, without record head and form feed 1 = measuring record with record head and form feed (FormFeed)

Peripheral instruments	**Ext para**		Defines the signals applied to the peripheral instruments' interface "Ext.".
	Ext. mode	0…7	Input and output format: 0 =no input/output via the peripheral instruments interface "Ext." 1 =only the inputs are active 2 =inputs and outputs are active 3…6 = reserved for the connection of a classification device. 7 =reserved for a control instrument
	Prg.inp		assigns one or several of the below functions to the inputs (I1, I2, I3) of the peripheral instruments interface "Ext."
	Str/Stp	0…3	Alternate start and stop of the measuring time.
	Start	0…3	Begin of the measuring time
	Stop	0…3	End of the measuring time
	M.time	0…3	Measuring time which lasts as long as the signal is supplied.
	Clr MxMn	0…3	Deleting the MAX, MIN and MEAN value memories.
	Prn m.va	0…3	Printing the measuring value and accepting it into the statistics.
	→ 0 ←	0…3	Accept the master value.
	Clr stat	0…3	Deleting the statistics
	Prnt Stat	0…3	Printing the statistics
	Hold	0…3	Maintaining the current indication and state of the three outputs.
			For each of the above-mentioned functions, the input (I1, I2, I3) activating the function must be specified by entering one of the digits 1 to 3. If zero is entered, the activation of the function is not assigned to any of the inputs. With the VMF1000 it is also possible to assign several functions to one and the same input. Here the functions will be executed in an internally fixed order. In case the functions "Prnt Stat" and "Clr stat" are assigned to the same input, the statistics will be printed out before it is deleted.
			Example 1: Strt/Stp 1 Clr MxMn 1 Prn m.va 1 Prnt Stat 2 Clr stat 2 → 0 ← 3 When activating the input I1 for the first time, the measuring time will be started and the MAX, MIN and MEAN value memories deleted. When activating it again, the measuring time ends and the measuring result printout starts. When activating input number 2, the statistical results will be printed out before the statistical value memory is deleted. Via input I3, the acceptance of the master value is achieved.
Sensitivity of analogue output	**Fac. DAC**		Range: 0 … 999.99 mV/µm or 0…999.99 V / full scale

Configuration parameter	Menu (Indication)	Settings /Indication	Explanations Parameter settings 1 = on; 0 = off
Analogue output mode	**DAC-rel**		The output voltage of the analogue output depends on the range of the analogue instrument.
	DAC-fix		The output voltage is independent of the range of the analogue instrument.
Gage block	**ΔG.block**		Step (difference) of two gage blocks. Used for sensitivity calibration and transducer correction.
Transducer Correction	**ProbCorr**		Corrects (linearizes) the curve of transducer A and transducer B respectively.
		A-3036.4	View/edit correction table of transducer A. The number at the right of the "A" is the uncorrected (raw) value of the transducer. On the right large display the correction value is displayed. The correction value is edited by means of ►, ▲ and ▼
		B-3033.1	Correction value table for transducer B
		AutoCorr	► starts the automatic correction. The correction is done separately for each transducer in + and – direction.
		Corr A+	► step by step linearization of the positive direction of transducer A
		Corr A- Corr B+ Corr B-	
		Clear	Clears the linearization tables. For each transducer the + and – direction is cleared separately
		Clear A+	Key ► clears the positive direction of the linearization table for transducer A. The prompt "Clr ?" has to be confirmed by ▼, otherwise the function is aborted without clearing the table.
		Clear A-	same for the negative direction
		Clear B+ Clear B-	
		Print	► prints the correction tables via the RS232 "Printer"

Sensitivity	**Sensit.**		The transducer sensitivity is corrected by comparing with two known values and changing the factors "Factor A" and/or "Factor B". Press key ►.
		G.block 1 0.0	After having placed the first gauge block into the measuring device, the first measurement can be started with ►.
		G.block 2 xxx.x	In the display the difference (step) of the two gauge blocks (**ΔG.block**) appears. Place the second gauge block into the measuring device and start the second measurement with ►.
		OK!	By means of this confirmation, the instrument returns to its basic condition. Erroneous inputs are signaled by the message "Stop". The instrument also returns to its basic condition and the procedure must be repeated completely. **NOTE** In case one of the probe combinations +A, -A, +B, or -B was selected, only the sensitivity of the transducer in question will be corrected. For sum or differential measurements, the sensitivities of both transducers are influenced. Correct results can only be obtained, if the two transducers are deflected to the same extent.
Transducer symmetry	**Symmetry**		The sensitivity of transducer A will be adjusted to that of transducer B. Here, "Factor A" will be changed as required, while "Factor B" remains unchanged. Press key ► . Deflect the transducer over the range to be balanced. First, the VMF 1000 recognizes the range limits by the reversion of the transducer ' direction of movement. During the transducer ' deflection, measured values are assessed over this range and a correction factor is calculated for transducer A. This process is repeated until two successive correction values differ by less than 0.0001. Only then will "Factor A" be changed.
		OK!	The symmetry function is ended successfully. The instrument returns to its basic condition.

Configuration parameter	Menu (Indication)	Settings /Indication	Explanations Parameter settings 1 = on; 0 = off
Configuration lock	**Lock off**	Code	Any code number between 0000 and 9999 can be entered.
		Block?↓ →0←?↓	Safety inquiry In case key ▼ is pressed, the configuration setting is blocked and "Block zero setting?" is displayed. If the zero setting key (master) is also to be blocked, press ▼ again. Actuating the keys ∇ or △ blocks only the instrument configuration.
		Lock on	It is no longer possible to change parameters and settings. In order to guarantee configuration locking even after switching on again, it must be stored permanently by means of function "Save".
		Lock off	The configuration locking is cancelled by entering a new code number.
Printing instrument configuration	**PrntConf**		All settings of the VMF 1000 can be printed with **PrntConf.** If the printer interface is deactivated, it is activated for the duration of the printing, afterwards it is deactivated again. Start printing with ►.
Standard configuration	**S. config**		On delivery, the permanently stored standard configuration is active. This configuration can be recalled at any time, although measuring and configuration parameters could have been changed and stored permanently. In order to remain active even after switching on again, the standard configuration has to be stored by means of the function "Save". Only on doing so, will be overwritten the customer-specific configuration. If, however, the standard configuration is called up without being saved again, the customer-specific configuration is again valid after switching on. Loading the standard configuration: Press key ►.
		Yes: (↓)	If the now appearing safety inquiry is answered with ▼, all currently valid settings will be overwritten. If these settings were not stored permanently, they are deleted irrevocably. The instrument returns to the basic condition.
		Stop !	If the safety inquiry is to be answered in the negative, either **RESULT** (leaving the configuration level) or one of the keys ∇ or △ (staying in the configuration level) must be actuated.

Saving the settings	**Save**	Save	Actuate the key ▶ .
		Yes:(↓)	If the safety inquiry is answered by pressing key ▼ , all current measuring and instrument configuration settings will be stored permanently.
		OK!	All settings valid before will be overwritten, i.e. deleted. "OK!" will be displayed on the text indication.
			If the safety inquiry is to be left unanswered, either actuate the key **RESULT** to leave the configuration level or press one of the keys ∇ or Δ to call up different configuration parameters.

6.7 Function keys

Frequently used functions or settings can be assigned to one of the function keys, thus making them directly accessible.

The following functions can be assigned to the keys **F1** and **F2**:

- configuration parameter settings,
- measuring condition settings,
- indication of a certain measuring result, i.e. indication of the probe combination or a statistical result, for example.

Function key assignments can be stored as well by means of the function "Save".

Assigning a function to F1 or F2:

For assigning any function to one of the function keys, the function in question must be called up first. If, for example, the result MAX - MIN is to be assigned to **F1**, select MAX - MIN and have it indicated by pressing the key **RESULT**. Press **Konfig.** (on the rear of the instrument) and keep it depressed. Press **F1**. "Prg. F1" appears on the text indication for a short time. Now, this result is directly accessible by pressing the **F1** key.

Deleting a function key assignment:

The assignment of a function key is deleted by keeping the key **Konfig.** on the rear of the VMF 1000 depressed and actuating the keys ☗ and **F1** or **F2**.

This setting can be stored durably with "Save".

6.8 Serial interfaces

The VMF 1000 features two serial RS 232 C interfaces. Both interfaces are driven by one common interface controller (UART). If both interfaces are used at the same time, the inputs and outputs of the UART are switched between the connectors “PC” and “Printer”. This results in a quasi parallel use of the two interfaces as data can only be transferred to the computer or to the printer. Both interfaces always have the same baudrate and the same data format. For the use of both interfaces at the same time the hardware protocol is mandatory. The protocol DTR is selected automatically.

Settings of the serial Interfaces

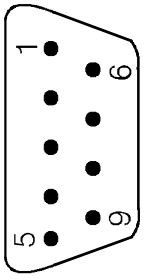
C/P off	no data is output to the computer or printer
Computer	Data transfer with computer protocol via interface “PC”
Printer	Data transfer to printer via interface “PC” (!!)
C/P on	Data transfer with computer via interface “PC” and data output to printer via interface “Printer”.

If “C/P on” is selected the software supports the computer interface (PC) with priority. If a print command is issued, the VMF1000 sets the hardware handshake line to tell the computer that no more data can be received. Then the VMF1000 switches the UART to the printer interface and sends data to the printer. The VMF1000 switches back to the computer interface automatically as soon as the printout is completed which is the case after

a) printing one line of data of a single measurement or
b) after printing the complete statistic results

At the top of a page the transmission of the header lines may be added.

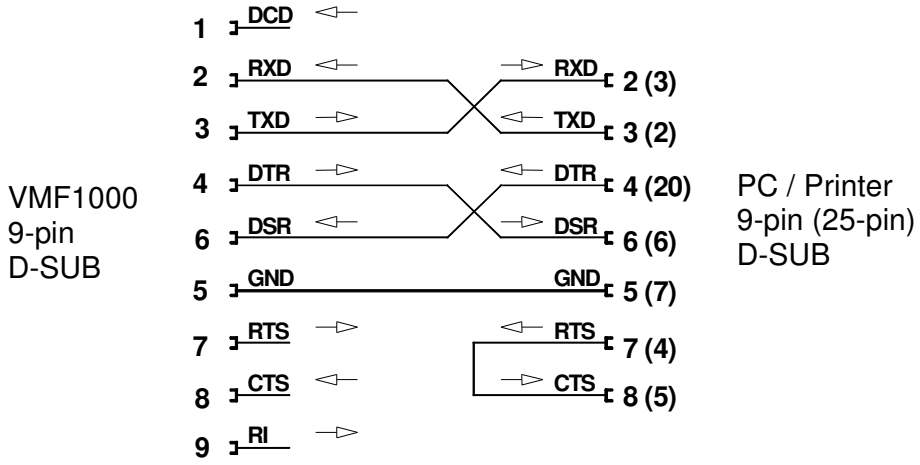
Pin assignment for the connectors “PC“ and “Printer“ (9-pin D-SUB)



Pin	Name	Function
1	Vv	internal power supply 6,5...10V*
2	RxD	Data input
3	TxD	Data output
4	DTR	Handshake output
5	GND	Gnd, 0V
6	DSR	Handshake input
7	NC	not connected
8	NC	not connected
9	NC	not connected

*** only at connector „PC“! Pin 1 of connector “PC” and Pin 1 of connector „Ext.“ are wired in parallel. The sum of the output currents must not exceed 100 mA.**

Recommended interface cable for the connection of a PC or Printer to the RS232 interfaces of the VMF1000. The Pin numbers refer to the 9-pin- connector. The numbers in parenthesis refer to the 25-pin connector.



Host computer interface

Via the host computer interface, measuring values and results can be inquired, measuring conditions and configuration parameters inquired and programmed and functions activated.

Nomenclature

In the text passages of this section, commands will be marked by quotation marks ("...") which are not part of the actual command. Those parts of the commands given in parenthesis are optional,
e.g. P10 (,xxx.x (,yyy.y)) <Tcr>.

Brackets, however, signal ASCII control characters,

e.g. <CR> means "carriage return" = hexadecimal value "D" = dec. 13.

Command structure:

- A command sent by the host computer to the VMF 1000 usually consists of an ASCII character string which must always be completed with the control character <CR>. Any other control character is ignored by the VMF 1000.

- The response of the VMF 1000 is completed with the control characters <CR> and/or <LF>. After switching on the instrument, this end mark (designated <Tcr> here) is adjusted to the control character <CR>. It can be changed by means of the parameter "P30,...".

- An inquiry command starts with a letter followed by a parameter number.

  Example: Inquiring measuring values (here: 896.3 µm)
  Host computer: M1<CR> VMF 1000: M1,896.3 <Tcr>

- An adjustment command starts with a letter followed by a parameter number and the value of the parameter. The parameter number and the value are separated by a comma.

  Example: Adjusting the measuring range to ± 2,000 µm
  Host computer: P1,2000<CR> VMF 1000: P1,2000<Tcr>

- Several functions are activated by a single letter.
  Example: Adjusting the indication to 0 or to the master value
  Host computer: Z<CR> VMF 1000: Z<Tcr>

- Parameters and measuring values are always transferred as metric values (µm), even if the instrument is adjusted to inch.

NOTE: In the provided examples, the command sequence sent by the host-computer, which is completed with <CR>, is, as a rule, given on the **left-hand** side, while on the **right-hand** side the command sequence of the VMF 1000, which ends with <Tcr>, is provided.

Activating the interface software

The command "I<CR>" activates the interface software and causes it to output an identification text, which among other data contains the version number of the software.

Example:
I<CR> I,VOLLMER GMBH,VMF1000,2.12<Tcr>

The interface software only has to be activated if it has been previously deactivated with "X<CR>".

Deactivating the interface software

After having deactivated the interface software with the command "X<CR>", the VMF 1000 ignores any information sent by the host computer. The only exception to the above statement is the command "I<CR>".

Example:
X<CR> X<Tcr>

Control commands

Synchronous/asynchronous mode of operation:
After having activated the VMF 1000 by means of the command "I<CR>", it is automatically switched to the synchronous mode of operation, i.e. the VMF 1000 does only send data if the host computer explicitly requests information.
In addition, it is possible to adjust the asynchronous mode of operation, during which the instrument sends data on own initiative, e.g. the measuring value after the measuring time Tm or changes in the instrument settings (P34,...).

A<CR> A<Tcr> Sets the asynchronous mode of operation
(= switches off the synchronous mode).
S<CR> S<Tcr> Sets the synchronous mode of operation
(= switches off the asynchronous mode).

Starting/ending the measuring time:
Starting and ending the measuring time can be accomplished in three ways. (For adjusting the measuring time, see "P10".)

F1<CR> F1<Tcr> Starts a measuring time, the end of which is known (equivalent to the setting "STRT Tm").
F2<CR> F2<Tcr> Starts a measuring time of unknown end (equivalent to "STRT man" or "STRT Tp").
F3<CR> F3<Tcr> Ends the measuring time in case of setting "STRT man" and cancels the measuring or pause time when setting "STRT Tp" is active.

Functions

R<CR> R<Tcr> Resets the VMF 1000. The instrument returns to the basic state which was active after switching on.
Z<CR> Z<Tcr> Sets the indication to zero or to the entered master value, respectively.

NOTE: In the provided examples, the command sequence sent by the host computer, which is completed with <CR>, is, as a rule, given on the left-hand side, while on the right-hand side the command sequence of the VMF 1000, which ends with <Tcr>, is provided.

Outputting a value on the numerical display

T1,xxxx<CR> T1,xxxx<Tcr> Indicates the value on the numerical display
(only numerical values with sign and decimal point).
xxxx = decimal number with decimal point
max. 6.5 digits (1999999)

T1,<CR> T1, <Tcr> Restore previous indication.

Example:
T1,123.45<CR>T1,123.45<Tcr> The value 123.45 is indicated on the numerical display.

Outputting a text on the text indication field

T2,xxxx<CR> T2,xxxx<Tcr> Indicates a text on the text indication field.
xxxx = max. 8 characters (ASCII text)
The entered text is shown left justified on the text indication field.

T2,<CR> T2,<Tcr> Restores the previous indication.

Example:
T2,Hallo<CR> T2,Hallo<Tcr> The text "Hallo" appears on the text indication field.

Inquiring measuring values and results

In the measuring range ± 200 µm two digits follow the decimal point, in the measuring range ± 2,000 µm one digit.

M<CR>	Mn,xxx.x<Tcr>	default result type selected with "P32,..."; here, n is the number of the chosen measuring value
M1<CR>	M1,xxx.x<Tcr>	result of the transducer combination
M2<CR>	M2,xxx.x<Tcr>	mean value over the measuring time Tm
M3<CR>	M3,xxx.x<Tcr>	minimum value during the measuring time Tm (MIN)
M4<CR>	M4,xxx.x<Tcr>	maximum value during the measuring time Tm (MAX)
M11<CR>	M11,xxx.x<Tcr>	MAX-MIN
M12<CR>	M12,xxx.x<Tcr>	(MAX-MIN)/2
M80<CR>	M80,n <Tcr>	n = number of values accepted into the statistics
M82<CR>	M82,xxx.x<Tcr>	statistical mean value
M83<CR>	M83,xxx.x<Tcr>	statistical minimum value (Xmin)
M84<CR>	M84,xxx.x<Tcr>	statistical maximum value (Xmax)
M86<CR>	M86,xxx.x<Tcr>	standard deviation
M88<CR>	M88,xxx.x<Tcr>	range
M89<CR>	M89,xxx.x<Tcr>	ultimate measuring result xn
M98<CR>	Maaaa,bbbb<Tcr>	individual values of transducer A and B. The measuring values are coded hexadecimally and have to be multiplied: in measuring range ± 200 µm by 0.01/256 µm; in measuring range ± 2,000 µm by 0.1/256 µm.
M99<CR>	Maaaaaa,bbbbbb<Tcr>	individual values of transducer A and B. The measuring values are coded hexadecimally and have to be multiplied: in measuring range ± 200 µm by 0.01/256 µm; in measuring range ± 2,000 µm by 0.1/256 µm. When the indicated value exceeds ± 3,276.7 µm in the measuring range of ± 2,000 µm or ± 327.67 µm in the measuring range of ± 200 µm, the numbers "aaaa" and "bbbb" are extended to 6 hexadecimal digits for "M98" and to 8 for "M99".

Inquiring and adjusting parameters

Measuring range:		
P1<CR>	P1,xxx.x<Tcr>	Inquires the measuring range setting. Measuring range = xxx.x µm
Example:		
P1,2000<CR>	P1,2000<Tcr>	Adjusts the measuring range to ± 2,000 µm. Note: Function "Z" (set to zero) will be cancelled. Thus, a master measurement has to be performed afterwards.
Example:		
P1,1.85E+2<CR>	P1,200<Tcr>	Adjusts the measuring range to ± 200 µm. The VMF 1000 selects the next larger measuring range.
Conversion factor, unit:		
P3<CR>	P3,xxx.x,tt<Tcr>	Inquires conversion factor and unit.
Example:		
P3<CR>	P3,1.0E-3,mm<Tcr>	Outputs the obtained measuring values in millimetres after conversion with factor 0.001.
Indication format:		
P5<CR>	P5,6.5,x<Tcr>	Inquires the resolution of the numerical display. 6.5 number of digits (not adjustable) x number of digits following the decimal point For the ± 200 µm measuring range 0 ... 2 digits can be set, for the ± 2,000 µm measuring range 0 ... 1.
P5,<CR>	P5,6.5,x<Tcr>	Adjusts the maximum resolution.
Combination indication		
P6<CR>	P6,x<Tcr>	Inquires the setting of the combination indication. x = 0 combination without master value x = 1 combination - master value
Example:		
P6,1<CR>	P6,1<Tcr>	Sets the indication of the combination value to "combination with master value".
Zero setting value		
P7<CR>	P7,x<Tcr>	Inquires the status of the zero setting value. x = 0 deactivates the zero setting value x = 1 activates the zero setting value
Example:		
P7,0<CR>	P7,0<Tcr>	Deactivates the zero setting value.
Master value:		
P8<CR>	P8,xxx.x<Tcr>	Inquires the master value.
P8,xxx.x<CR>	P8,xxx.x<Tcr>	Adjusts the master value.
Example:		
P8,530<CR>	P8,530<Tcr>	Sets the master value to 530 µm.

NOTE: In the provided examples, the command sequence sent by the host computer, which is completed with <CR>, is, as a rule, given on the **left-hand** side, while on the **right-hand** side the command sequence of the VMF 1000, which ends with <Tcr>, is provided.

Measuring and pause time, start mode:

P10<CR>	P10,(xxx.x(,yyy.y))<Tcr>	Inquires measuring and pause time. xxx.x = Tm, yyy.y = Tp In case no argument is provided, the measuring time Tm is started and stopped manually.
P10,<CR>	P10,<Tcr>	Sets the measuring time to be started and stopped manually (equivalent to setting "STRT man").
P10,15<CR>	P10,15<Tcr>	Adjusts a measuring time Tm of 15 seconds (equivalent to setting "STRT Tm").
P10,8,1.5<CR>	P10,8,1.5<Tcr>	Sets the measuring time Tm to 8 seconds and the pause time Tp to 1.5 seconds (equivalent to setting "STRT Tp").

Delay time:

P11<CR>	P11,0.1<Tcr>	Inquires the delay time, which in this case was set to 0.1 seconds.
P11,1.2<CR>	P11,1.2<Tcr>	Adjusts a delay time of 1.2 seconds.

Tolerance limits:

P21<CR>	P21,xxx.x,yyy.y<Tcr>	Inquires the tolerance limits. The smaller of the two values is always taken to be the lower tolerance limit. External measurement: xxx.x= lower tol. limit yyy.y= upper tol. limit Internal measurement: xxx.x= upper tol. limit yyy.y= lower tol. limit
P21,xxx.x,yyy.y <CR>	P21,xxx.x,yyy.y<Tcr>	Adjusts the limits for tolerance monitoring (see above).
P21,<CR>	P21,<Tcr>	switches off tolerance monitoring.

Example:

P21,1E3,-500<CR>	P21,1000,- 500<Tcr>	Adjusts tolerance monitoring for internal measurements, the lower tolerance limit to -500.0 µm and the upper one to 1,000.0 µm.

Classification, number of classes:

P26<CR>	P26,xx<Tcr>	Inquires the set number of classes. xx = number of classes
P26,xx<CR>	P26,xx<Tcr>	Adjusts the number of classes "xx" and divides the range between the upper and lower tolerance limit into xx classes of equal width.
P26,0<CR>	P26,0<Tcr>	Switches off the classification.

End mark <Tcr>:

P30<CR>	P30,xxx(,yyy)<Tcr>	Inquires the character sequence of end mark <Tcr>.
P30,xxx (,yyy)<CR>	P30,xxx(,yyy)<Tcr>	Sets the character sequence of the end mark to <Tcr>. In place of the control character <CR>, the control character sequence "xxx,yyy" is sent. "xxx" and "yyy" are the decimal equivalents of the control characters.

Example:

P30,10,13<CR>	P30,10,13<LF><CR>	Sets the end mark sequence <Tcr> to the ASCII control characters <LF> = dec. 10 and <CR> = dec. 13.

Default measuring value type:

P32<CR>	P32,n<Tcr>	Asks for the default measuring value type which is to be output in the asynchronous mode or in case of measuring value inquiries accomplished with "M<CR>".
P32,n<CR>	P32,n<Tcr>	Sets the default measuring value type. n = 1: result of the transducer combination n = 2: mean value over the meas. time Tm n = 3: MIN value over the meas. time Tm n = 4: MAX value over the meas. time Tm ... Continue as described in "Inquiring measuring values and results" (see above).

Changed parameter settings:

P34<CR>	P34,n<Tcr>	Inquires if parameters were changed by manual settings. n = : number of the changed parameter n = 0 : no parameter was changed (In the asynchronous mode, any parameter change is reported immediately.)
Example:		
P34<CR>	P34,83<Tcr>	Means that the range of indication was changed.
A<CR>	A<Tcr>	Switches on the asynchronous mode.
	P34,19<Tcr>	Means that the master value was accepted.

Transducer combination:

P50<CR>	P50,n,m<Tcr>	Inquires the transducer combination. n = 1 +A n = -1 -A m = 2 +B m = -2 -B
P50,-1,2<CR>	P50,-1,2<Tcr>	Sets the transducer combination to "-A+B".
P50,1<CR>	P50,1<Tcr>	Sets the transducer combination to "+A". Note: In contrast to function "P51", the correction factors are not influenced.

Transducer combination, correction factors:

P51<CR>	P51,(tttt)<Tcr>	Inquires transducer combination and correction factors in the form of an equation. The transducer combination is presented by the symbols X1 or X2 (for transducer A or B, respectively) and is multiplied by the related correction factors.
P51,tttt<CR>	P51,tttt<Tcr>	Adjusts transducer combination and correction factors. Note: Function "Z" (accepting the master value) will be cancelled, i.e. a master measurement must be taken thereafter!
Example:		
P51,0.5*X1<CR>	P51,+.5*X1<Tcr>	Sets the transducer combination to "+A" and the correction factor (Factor A) to 0.5.
Example:		
P51,X1-X2<CR>	P51,+1*X1-1*X2<Tcr>	Sets the transducer combination to "+A-B" and the correction factors (Factor A and Factor B) to 1.0.

Correction factors:

P52,n<CR>	P52,n,xxx.x<Tcr>	Inquires the correction factor for transducer A (n = 1) or for transducer B (n = 2).
Example:		
P52,2<CR>	P52,2,1.992<Tcr>	The correction factor for transducer B is 1.992.
P52,1,3,2,2.5<Tcr>	P52, 1,3,2,1.5<Tcr>	Sets factor A to 3.000 and factor B to 1.500.

NOTE: In the provided examples, the command sequence sent by the host computer, which is completed with <CR>, is, as a rule, given on the **left-hand** side, while on the **right-hand** side the command sequence of the VMF 1000, which ends with <Tcr>, is provided.

Balancing the symmetry:

P59<CR>	P59,x<Tcr>	Inquires the status of the symmetry function. x = 0 function has not yet been executed x = 1 function is still active x = 2 function has been terminated successfully x = 3 running error or abortion
P59,1<CR>	P59,1<Tcr>	Starts the function “balancing the symmetry”.
P59,0<CR>	P59,0<Tcr>	Aborts the function “balancing the symmetry”.

Example:

P59,1<CR>	P59,1<Tcr>	Starts the symmetry function.
P59<CR>	P59,1<Tcr>	Function is still active.
P59<CR>	P59,2<Tcr>	Function has been terminated successfully.

Selecting the results to be indicated:

P60<CR>	P60,x,y,....,z<Tcr>	Inquires the results to be indicated with RESULT. x = 1 result of the transducer combination x = 2 mean value over the meas. time Tm (MEAN) x = 3 minimum value over the meas. time Tm (MIN) x = 4 maximum value over the meas. time Tm (MAX) x = 11 MAX-MIN x = 12 (MAX+MIN)/2 Statistical results x = 80 number of measurements (n) x = 82 statistical mean value x = 83 statistical minimum value (Xmin) x = 84 statistical maximum value (Xmax) x = 86 standard deviation s x = 88 range (Xmax - Xmin) x = 89 last statistical result
P60,1,11,88<CR>	P60,1,11,88<Tcr>	With the key **RESULT**, it can be selected between indicating the combination, MAX-MIN or R.

<u>Selecting the results to be printed out:</u>

P61<CR>	P61,x<Tcr>	Asks for the result to be printed out after the end of the measuring time or after activating "Prnt Stat"(x: see "P60,...").

Complement to the selection of the results to be printed out

P61<CR>	P61,x1,x2,...xn<Tcr>	Inquires the selection of the results which are to be printed with PrntStat or after the measuring time has run out. x = 0 numbers of selected results x = 1 result of the probe combination x = 2 mean value over the measuring time (MEAN) x = 3 minimum value over the measuring time (MIN) x = 4 maximum value over the measuring time (MAX) x = 11 MAX–MIN x = 12 (MAX+MIN)/2 Statistical results x = 80 number of measurements (n) x = 82 statistical mean value x = 83 statistical minimum value (Xmin) x = 84 statistical maximum value (Xmax) x = 86 standard deviation (s) x = 88 Range (range = Xmax–Xmin)
P61,<CR>	P61,0,1,2,80,82,83,84,85,86,87,88	Adjusts the standard selection.

Example:

P61,0,1,2<CR>	P61,0,1,2<Tcr>	The measuring record includes the result number, the combination and the mean value. The statistics printout is deactivated.

Customer-specific text:

P62<CR>	P62,xxx,yyy,...,zzz<Tcr>	Inquires the customer-specific text. The ASCII characters are output as decimal numbers such that also control characters for formatting can be inserted into the text. The maximum number of characters to be entered is 56.
P62,<CR>	P62,<Tcr>	Deletes the customer-specific text.

Example:

P62,86,79,76,76,77,69,82,32,71,109,98,72,13,10<CR>
P62,86,79,76,76,77,69,82,32,71,109,98,72,13,10<Tcr>

Enters "VOLLMER GMBH"<CR><LF> as customer-specific text.

Formatted printout

P65<CR>	P65,x<Tcr>	Inquires the settings of the measuring record. x = 0 unformatted measuring record, without record head and form feed x = 1 measuring record with record head and form feed
P65,<CR>	P65,1<Tcr>	Activates the standard setting.

Example:

P65,0<CR>	P65,0<Tcr>	Sets the measuring record to "unformatted".

Analogue output sensitivity:

P70<CR>	P70,x,y,x,y,x,y,<Tcr>	Inquires the sensitivity settings of the analogue output. x = number of the analogue output (always 1) y = sensitivity (in mV/µm or V/full scale deflection, in case output is dependent on the indication range of the dial-type indicator).
P70,1,20<CR>	P70,1,20<Tcr>	Sets analogue output to 20 mV/µm,

Shifting the zero point of analogue outputs (Offset correction):

P71<CR>	P71,x,y<Tcr>	Inquires the setting of the zero offset. x = number of the analogue output (always 1) y = zero offset (has to be multiplied by 4.88 mV). Example: The analogue output features a zero point error of 74 mV. Zero offset: y = -74 mV/4.88 mV = -15.16 This value has to be added to the already adjusted zero offset:
P71<CR>	P71,1,-9<Tcr>	The adjusted zero offset is -9 * 4.88 mV. The new value to be set is: -9-15 = -24.
P71,1,-24<CR>	P71,1,-24<Tcr>	

Making analogue output 2 dependent on/ independent of the indication range:

P78<CR>	P78,x<Tcr>	Inquires the setting of analogue output 2. x = 0 dependent on the indication range x = 1 independent of the indication range
P78,1<CR>	P78,1<Tcr>	Makes the analogue output 2 independent of the indication range. The unit of the factor is mV/µm.

Selecting the results for tolerance monitoring and classification:

P80<CR>	P80,n<Tcr>	Requests the selected results.
P80,n<CR>	P80,n<Tcr>	Adjusts the result to be output. n = 1: result of the transducer combination n = 2: mean value over the meas. time Tm n = 3: MIN value over the meas. time Tm n = 4: MAX value over the meas. time Tm n = 11: MAX-MIN value over the meas. time Tm n = 12: (MAX + MIN)/2 value over the meas. time Tm
Example:		
P80,2<CR>	P80,2<Tcr>	Means that the mean value over the measuring time Tm will be output.

Selecting the results to be evaluated statistically:

P81<CR>	P81,n<Tcr>	Inquires the result(s) to be evaluated statistically.
P81,n<CR>	P81,n<Tcr>	Adjusts the result(s) to be evaluated statistically. n = 1: result of the transducer combination n = 2: mean value over the meas. time Tm n = 3: MIN value over the meas. time Tm n = 4: MAX value over the meas. time Tm n = 11: MAX - MIN value over the meas. time Tm n = 12: (MAX+MIN)/2 value over the meas. time Tm
Example:		
P81,2<CR>	P81,2<Tcr>	Means that the mean value is to be evaluated statistically.

Printing, deleting, switching on and off the statistics:

P82<CR>	P82,s<Tcr>	Inquires the status of the statistics.
P82,s<CR>	P82,s<Tcr>	s = 0: statistics switched off s = 1: statistics switched on s = 2: delete last x (equivalent to "Clr xn") s = 3: delete statistics completely (equivalent to "Clr stat") s = 4 print statistical results

Indication range of the dial-type indicator:

P83<CR>	P83,n,m<Tcr>	Inquires the adjusted indication range and the selected indication.
P83,n,m<CR>	P83,n,m<Tcr>	Adjusts indication range and indication. n = 1: ± 1 µm n = 2: ± 3 µm n = 3: ± 10 µm ... n = 9: ± 10,000 µm n = 0: Rel. Tol. m = 1: the numerical display and the dial-type indicator indicate the same results. m = 2: the dial-type indicator indicates the current measuring result, irrespective of the indication on the numerical display.
Example:		
P83,4,2<CR>	P83,4,2<Tcr>	Sets the indication range to ± 30 µm. The dial-type indicator indicates the measuring value according to the set combination, while the numerical display provides the result adjusted with the **RESULT** key.

Maximum number of measurements:

P84<CR>	P84,x<Tcr>	Inquires "n max".
P84,x<CR>	P84,x<Tcr>	Sets "n max" to x.

Example:

P84,50<CR>	P84,50<Tcr>	Sets "n max" to 50.

Language:

P85<CR>	P85,x<Tcr>	Inquires the adjusted language. x = 1: German x = 2: English x = 3: French

Example:

P85,3<CR>	P85,3<Tcr>	Sets the language to French.

Unit:

P86<CR>	P86,x<Tcr>	Inquires the set system of units. x = 1 : metric x = 2 : imperial

Example:

P86,2<CR>	P86,2<Tcr>	Adjusts the imperial system of units.

Brightness:

P87<CR>	P87,x<Tcr>	Inquires the adjusted brightness of the display. x = 1 ... 4 x = 4: brightness 100 %
P87,1<CR>	P87,1<Tcr>	Adjusts the brightness of the display to 30 %.

Hysteresis for tolerance monitoring and classification:

P90<CR>	P90,xx.xx<Tcr>	Inquires the hysteresis value.
P90,xx.xx<CR>	P90,xx.xx<Tcr>	Sets the hysteresis value.

Example:

P90,10.55<CR>	P90,10.55<Tcr>	Adjusts a hysteresis value of 10.55 µm.

Nominal value:

P91<CR>	P91,xxx<Tcr>	Inquires the nominal value.

Example:

P91,2E3<CR>	P91,2000<Tcr>	Sets the nominal value to 2.0 mm (2,000 µm).

Measuring value integration time Ti:

P92<CR>	P92,.xxx<Tcr>	Inquires the meas. value integration time Ti in seconds.
P92,.xxx<CR>	P92,.xxx<Tcr>	Sets the meas. value integration time Ti in seconds.

Example:

P92,1.6E-3<CR>	P92,.0016<Tcr>	Sets the measuring value integration time Ti to 1.6 ms. Note: Function "Z" (accepting the master value) will be cancelled, i.e. a master measurement must be taken thereafter !

Gauge block:

P93,1<CR>	P93,1,yyy.y<Tcr>	Inquires the adjustment of gauge block yyy.y: entered difference
P93,1<CR>	P93,1,1000.0<Tcr>	Inquires the actual gauge block difference (here, 1,000 µm).
P93,1,300<CR>	P93,1,300<Tcr>	Adjusts gauge block difference to 300 µm.

Activating dc voltage/carrier frequency:

By means of this function, the carrier frequency system can be switched off such that it is possible to measure dc voltages for test purposes.

P97<CR>	P97,x<Tcr>	Inquires the adjusted mode of operation. x = 0 dc voltage x = 1 carrier frequency
P97,0<CR>	P97,0<Tcr>	Sets the operation mode to dc voltage.

Lock:

P99<CR>	P99,n<Tcr>	Inquires the status of the keyboard lock. n = 0 not locked n = 1 all settings locked n = 2 keys locked

Example:

P99,0<CR>	P99,0<Tcr>	Switches off the lock. All instrument settings can be changed.
P99,2<CR>	P99,2<Tcr>	Locks the keys. Now, the instrument can only be controlled via the computer interface or the control inputs.

Save:

P100<CR>	P100<Tcr>	Permanently stores all settings in an EEPROM. The acknowledgement message is sent after storing the settings.

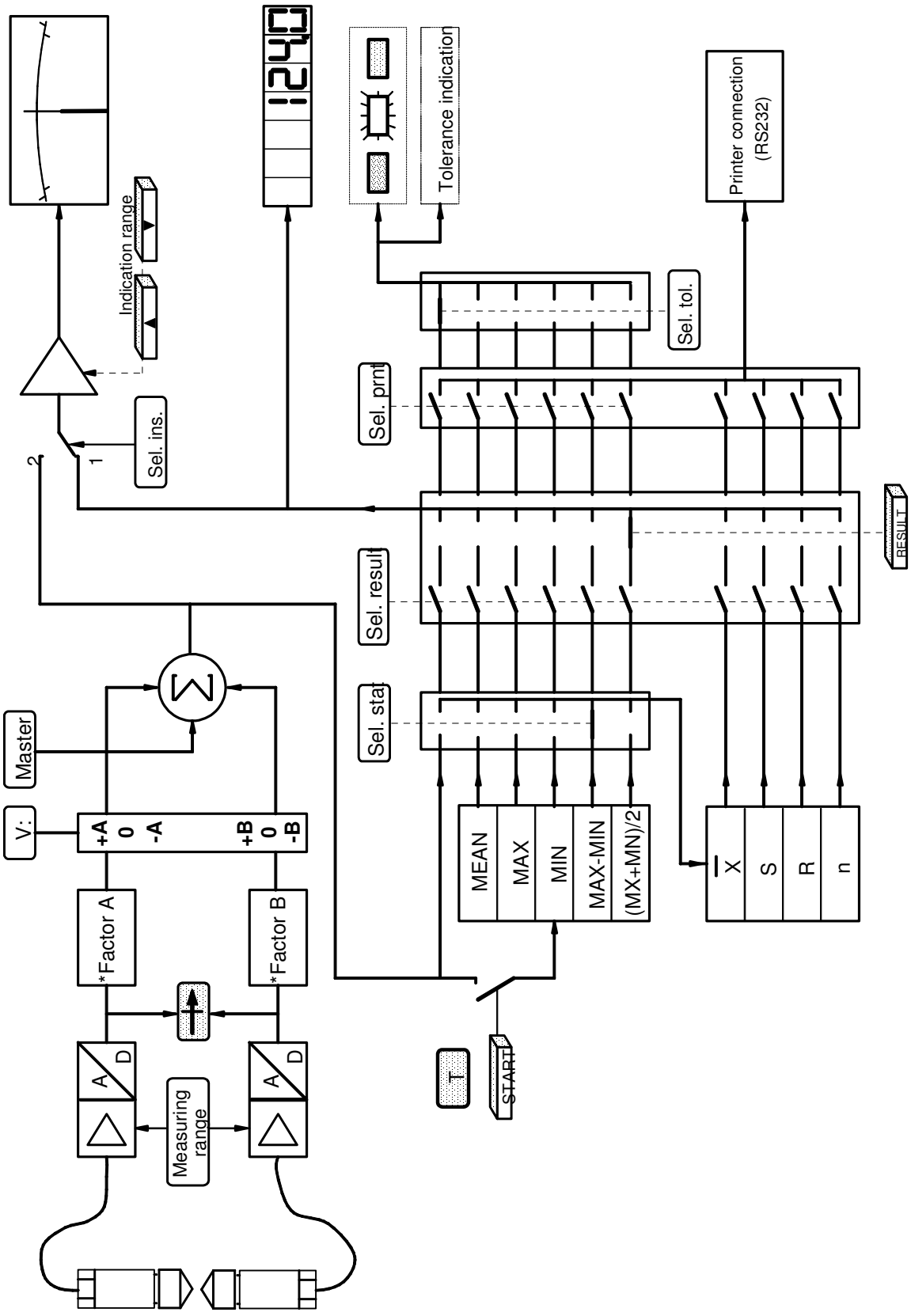
Error messages:

E1<Tcr>	Command unknown.
E2<Tcr>	Parameter not existent/adjustable.
E3<Tcr>	Parameter value exceeds admissible limits.
E4<Tcr>	Numerical format or syntax faulty.
E5<Tcr>	Error during data transfer (faulty record type, parity, baud rate, etc.).
E6<Tcr>	Received text too long.
E7,M...<Tcr>	Measuring value at probe connections exceeds admissible range.
E8<Tcr>	For the time being, the command cannot be executed (since e.g. the function was not activated in the system configuration).
E9<Tcr>	For the time being, the parameter cannot be adjusted.

Examples:

P51,X1<CR>	P51,+1*X1<Tcr>	Set the transducer combination to "+A".
M1<CR>	E7,M1,-2850.0<Tcr>	The measuring value at transducer connection A exceeds the measuring range.

6.9Functional diagram of the VMF 1000



Transducer connector: 6-pol. Tuchel, female

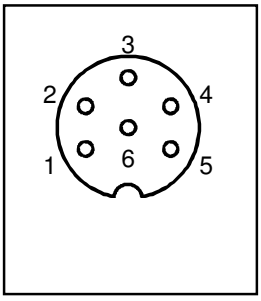


Fig. 16
Pin assignment of transducer *sockets A and B*
1 Oscillator voltage
2 Voltage input 1 mV/µm
3 Current input 1 µA/µm
4 Earthing contact (ground)
5 Oscillator voltage
6 Voltage input 0.3 mV/µm

6.10 Error list

No.	Error message	Cause	Remedy
1	"Printer" / "Computer"	The data transmission to the printer or the computer is too slow. Baud rate too small, printer/computer program is too slow.	Set a higher Baud rate on the VMF 1000 as well as on the printer/computer. Use a faster printer. Set the printer "on line". Accept less values/time ("Accept value into statistics" input).
2	Rev.-Fehl		The EPROM has been replaced. The standard configuration has to be loaded with "s.config" and saved with "save". Afterwards, the desired standard configuration can be adjusted and – if necessary – saved with "save" (see section 4.8)
3	IRam Fehl	RAM of the processor is defective.	Send it in to have it repaired.
4	Prom Fehl	EPROM is defective.	Replace EPROM.
5	ERam Fehl	Main RAM defective.	Replace the RAM-chip.
6	EEP-Fehl	EEPROM is defective.	Send it in to have it repaired.

6.11 Notes on maintenance

Cleaning:

The housing may be cleaned with a wetted piece of cloth. Acetone and acetone compounds are **never** to be used.

Exchanging fuses:

- Switch off the instrument.
- Pull the mains cable on the rear of the instrument.
- Pull out the fuse carrier by means of a screwdriver.
- Replace defective fuse by fuses of **the same** type:

  315 mA, time-lag

Opening the instrument:

For reasons of security, all modifications to and interventions in the instrument may only be carried out by trained personnel on the express written approval of the manufacturer.

6.12 Exchanging the software

The software of the VMF 1000 is stored in 2 EPROMs. Updates must be carried out by trained personnel by exchanging both EPROMs. Besides the relevant safety provisions, the following instructions must be complied with in particular:

- Before opening the unit, disconnect it from the power supply by pulling the plug from the mains socket outlet.

- EPROMs and other components in the instrument may be destroyed or damaged by electrostatic charges. It is also possible that the instrument is damaged only partially such that defects manifest themselves only after a couple of weeks or months. Therefore, when opening or repairing the unit, always use conductive pads and grounding straps for your wrist!

After exchanging the software, the standard configuration has to be loaded (with "S.config"), the instrument settings changed as required and stored with "Save".

7 Technical Data

VMF 1000	**Order no. 5312420**
Dimensions (length x width x height)	120 x 156 x 198 mm
Mass	2.3 kg
Supply voltage	230 V ± 10 % 115 V ± 10 %
Frequency range	50...60 Hz
Power consumption	10 W
Fuse	315 mA (time-lag)
Adjustable measuring ranges	± 2,000 µm ± 200 µm
Excitation voltage	5 V
Carrier frequency	20 kHz
Settling time (Ti = 1.6 ms)	
of the dial-type indicator	300 ms
of the numerical display	400 ms
of the analogue output	25 ms
to 70 % of final value	18 ms
to 99 % of final value	25 ms
of the digital outputs	
RS 232	20 ms
tolerances	5 ms
Holding time of the numerical display	200 ms
Deviation spread (related to the measuring range)	
of the dial-type indicator	1.5 %
of the numerical display	0.01 %
of the analogue output	0.05 %
of the digital outputs	(RS 232) 0.01 %
Hysteresis of the dial-type indicator (related to the measuring range)	1.5 %
Max. number of connectable probes without exceeding the deviation spreads	2
Working temperature range	+ 10 ... + 40 °C
Operating temperature range	0 ... + 40 °C
Storing temperature range	- 10 ... + 40 °C
Analogue outputs	
Voltage range	± 10 V
Sensitivity	0 ... 150 mV/µm 0 ... 150 V/indication range
Admissible load resistor	> 2 kOhm
Residual voltage ripple (related to the measuring range)	< 10 mV
Reference voltage	0 V
Cutoff frequency (Ti = 1,6ms, 3 dB)	50 Hz
Indication ranges of the dial-type indicator	± 1, ± 3, ± 10, ± 30, ± 100, ± 300,
(analogue instrument)	± 1,000, ± 3,000, ± 10,000 µm
Scale divisions	0.02; 0.1; 0.2; 1; 2; 10; 20; 100; 200 µm
Measuring value classification	max. 30 classes
Configuration memory	EEPROM
Writing cycles (Save)	> 10,000
Interfaces:	
2 serial interfaces	RS 232 C

Revision:

Oct. 30th 2008 sem	Settling time of analog output has been corrected