MilkoTest MT52

The new, forward-looking measuring device for extensive measurements with:

- Vacuum pumps
- Milking equipment
- Pulsators

Operating Instructions
We congratulate you on the purchase of MilkoTest MT52, which originates from the firm BILGERY/BEPRO AG in CH-8594 Güttingen, and which is the result of a systematic development of Pulsotest devices that for over 20 years have been proven to work excellently in practice.

A high quality standard, based on the know-how gained over many decades, specially in the field of measurement systems for milking equipment, combined with practical functions and the most modern construction methods, distinguish this measurement device of the latest generation.

With our MilkoTest MT52 you are in possession of a measuring instrument with a wide field of individual applications, which you can adapt to your personal needs. MilkoTest MT52 allows you to accomplish all measurements required by and according to ISO standards that are requested for the examination of a complex milking plant, with one single and handy device.

**Field of application**

MilkoTest MT52 serves for the examination of vacuum pumps, milking installations and pulsators.

**Functions**

- **Protocol** (Protocol measurements according to ISO 6690 standards)
- **Manometer** (continuous measurement and display of vacuum values)
- **Pulsation** (measurement and evaluation of pulsation)
- **Fluctuation** (measurement/recording of vacuum/pressure and electric signal)
- **Milking Time Measurement** (head measurement during milking in the head piece of teatcup liner)
- **Micro Air-Flow** (Air flow measurement with the TSO-40241 mass flow meter)
- **Air Flow Meter** (fully automatic airflow measurement with BILGERY Air-Flow-Meter)
- **Speedometer** (contactless measurement of rotor speed)
- **Thermometer** (measurement, recording and display of a temperature through external probe)

**Special Features**

- highest quality and reliability of measurement values
- small dimensions; is therefore light and handy
- durable case for use in rough environment
- Pressure sensors insensitive to water
- clear and large graphic display
- measurement accuracy of vacuum typical < 0.5%
- data-storage capacity of 1 MByte (extendable to 4 MByte)
- infrared interface for direct and wireless printing
- fully automatic airflow measurement instrument (optional)
- direct evaluation of Milking Time Test
- economical adaption of tubus for head measurement
- with practical, robust suitcase for device and accessories
- multifunctional measurement programs
- very user-friendly to operate thanks to modern menu structure
- insensitive to ammonia and water (stable environment)
- rinsing function of the in- and external pressure sensors (optional)
- operating time up to 20 hours
- high scan frequency up to 2kHz (0.5ms) possible
- software updates through computer interface possible
- two additional connection possibilities for pressure sensors
- possibility of measurement and recording of electric signals: 0-28 V
- CE compliant
- good price-performance ratio

Before starting up and using the MilkoTest MT52, carefully read these operating instructions and go through the individual programs step by step at home, in order to become acquainted with your MilkoTest MT52. This way you will soon come to appreciate the valuable and various functions, the time saving and user-friendliness provided by your MilkoTest MT52.

A lot of fun wishes you

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⚠️ Attention!
This symbol indicates a warning or danger. In case of noncompliance, heavy damage or injury may occur.

⚠️ Notes
This symbol indicates a warning including danger.
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A General

A.1 Connections

- Infrared interface for printer
- Infrared tachometer

Extension port for:
- Air-Flow-Meter (AFM)
- Micro Air Flow Meter (MAF)
- Voltage Measurement
- Digital inputs

Button to trigger the rinsing system (option)

Vacuum measurement channels 3 + 4 (external)

USB interface to the PC

Charging device port (charging socket)

A.2 Key pad design

Key C:
- Back to the menu
- Stop measurement program

Key FNC:
Call-up special functions (e.g., print)

Number field:
For data inputs

Key OFF:
Switch device off

Key ON:
Switch device on

Key ENT:
- Select menu item
- Start measurement program
- Close / confirm input

Arrow keys:
- Move the cursor
- Marker keys
A.3 First steps

Before working with your MilkoTest MT52 it might be necessary to change the language from German to English as follows:

Press the ON key. Press the key several times until you arrive at SYSTEM. Then press the ENT key. EINSTELLUNGEN appears. Press the ENT key. “Betrieb etc.” appears. Scroll down with the key to “Sprache” and change “0” to “1”. After that, confirm with the ENT key and exit by the OFF button. Your MilkoTest MT52 is now ready for use.

To help you get used to the way this device is operated, this chapter describes the step-by-step procedure of a fluctuation measurement as an example.

On this occasion you will become acquainted with the device’s basic functions.

Step 1: Switching the device on

Press the ON key. For a couple of seconds the startup display appears, showing the current device information. Then the main menu is displayed.

Step 2: Selecting a menu item

With the keys and , move the two arrows up or down in the menu. The menu item marked this way is selected as soon as you confirm the selection with the ENT key.

Once a menu item is selected in the main menu, a submenu appears. Submenu items can be selected the same way as the main menu items. The current main menu item is then displayed in the top line for purposes of information.

Select the submenu item Fluctuation and confirm with ENT.

Step 3: Performing a measurement

Start the measurement program Start 10sec/200Hz by selecting it and confirming with the ENT key.

The measurement will now be taken.

The current measurement is being displayed continuously as a graphic display.

At the end of the 10-second measurement period, the measurement’s result is displayed:
Step 4: Displaying a measurement result

You will find a detailed explanation for the evaluation of fluctuation measurements in the chapter B.4 Measurement program: Fluctuation (zooming, scrolling through measurements, printing out etc.)

The C key takes you back to the menu.

You can display all measurements performed at any time by selecting the menu item Fluctuation -> Display.

Step 5: Switching the device off

Press the OFF key to switch off the device immediately. However, the device will also switch off automatically after a programmable period of time (Further information in chapter C.1 Settings). Exceptions: During the measurement programs Manometer, Tachometer, AFM manual and Thermometer, the device will not switch off automatically.

Further steps:

You have now performed a complete measurement. In doing so, you have seen the device’s basic operator control concept.

Make a few further measurements on your own and find out how easily your MilkoTest MT52 is operated.

Detailed information on the individual measurement programs can be found in the following chapters of these operating instructions:

- Section A General provides further general information on the device.
- Section B Measurement programs describes the individual measurement programs in detail.
- Section C System describes the settings that apply in general to the complete device.
- Section D PC Program describes how to install and operate the PC program.
- Section E ISO 6690 Protocol describes how to execute measurements that apply to the ISO 6690 Protocol (optional).
## A.4 Menu overview

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<td>Maintenance</td>
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<td>Display</td>
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<tr>
<td></td>
<td>Settings</td>
<td></td>
<td></td>
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<td>Settings</td>
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<td></td>
<td>Set all to default</td>
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<td></td>
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<td>AFM-Setup</td>
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A.5 Important additional information

A.5.1 Battery charger
You can use the same charging device for the MT52 and the DPU-S445 printer. This power supply is designed
for an AC input voltage of 100 to 240V.
We recommend charging the batteries fully prior to their first usage.

Charging the MilkoTest MT52 battery:
Plug the charging device into a power socket and connect it to the charging connector of the MT52.
A flashing arrow appears on the device’s display, which indicates that the charging device has been detected.
The charging process takes about 3 hours. You will know that the charging is complete, when a small OK
appears underneath the battery sign.
During the charging process, the device can be used normally, as it will not be switched of automatically.

Charging the printer battery:
Plug the charging device into a power socket and connect it to the charging connector of the printer.
Hold down the power key (I) for five seconds. The charging process starts as soon as the green POWER light
begins to flash.
During the charging process, the printer cannot be used for printing, nor can it receive data.
If you wish to use the printer powered directly by the power supply, press the printer’s power key (I) only for a
short time, so that the POWER light does not start flashing.

Note: We recommend removing the battery pack if the printer is not in use for more than a week.

A.5.2 Optional channels
Optional channels are available for the following measurement channels:
- Channels 3 and 4:  External vacuum- and temperature sensor
- Channel 5:  0-24V input and 2 digital inputs (for fluctuation measurements)

A.5.3 Output to printer
Please refer to the printer’s operating instructions for information on its starting up and maintenance.
The data from the MT52 to the printer is transferred wireless via the infrared interface.
A print command can be given by pressing the FNC key on the device and selecting the printer from the
displayed options.
During the data transfer, hold the device in a distance of 10 cm to 1 m to the printer. The infrared windows of
printer and device should be on a more or less even level to each other.
During the charging process, the printer cannot be used for printing, nor can it receive data.

A.5.4 Memory organization
The MT52’s internal data memory is not distributed among the individual measurement programs.
Each measurement program could require the entire memory for itself.

This principle has the advantage that measurements which are accomplished seldom and which have a high
memory requirement (e.g. fluctuation measurement with a high sampling rate) do not occupy the memory
unnecessarily.

Displaying the number of measurements in the menu
Prior to the selection of the measurement programs pulsation, fluctuation, MilkingTimeTest and thermometer, on
the bottom line you will find indications that show the number of measurements which are left with the
respective measurement program if the entire remaining memory would be filled with it.
Example:

**Fluctuation**
- Start 10sec/200Hz
- Start 15min/20Hz
- Measure extended
- Display
- Memory for 44 Measurements

- With the measuring program for quick measurement of fluctuation: *(Start 10sek/200Hz)* you would still be able to execute 44 measurements.

**Note**
- As soon as there is not enough memory left for the selected measurement program, a note appears on the bottom line of the menu: *Insufficient Memory*.
- As soon as the entire memory is ‘used up’, *MEMORY Full* appears on the bottom line of the menu.
  - **Important**: In this case, the measurement can be continued. This way, the oldest measurements will be overwritten by the current measurement.
- If you wish to delete the entire memory, use the function *Clear Memory* in the main menu *System*. This is recommended when you take up work at a new place.
  - See also chapter C.3 Clear memory on page 30.

**A.5.5 Automatic zero-calibration**

The device carries out an automatic zero-calibration whenever no vacuum is recognized for a longer time. If you get the impression that the device does not show a zero value (without vacuum), you can force calibration by disconnecting all vacuum lines, switching off the device and waiting for several seconds. If the problem cannot be solved this way, force a complete calibration by using the function “Clear memory”. See Chapter C.3 Delete, page 28. The automatic calibration of the zero point can be turned off in the system settings, see section C.1. It is then still possible to do a correction manually using the system function “Zero-calibration”, see section C.2.
B Measurement programs

B.1 Measurement program: ISO 6690

This program assists you to fill out a report form according to ISO 6690 standards. It is available as an option.

For the complete description, see Chapter E ISO 6690 Protocol on page 53.

B.2 Measurement program: Manometer

The Manometer measurement program serves to continuously measure and display a vacuum value.

This measurement program is started directly from the menu item in the main menu.

<table>
<thead>
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<th>Manometer Channel: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.4 kPa</td>
</tr>
<tr>
<td>minimum: 40.3kPa</td>
</tr>
<tr>
<td>maximum: 45.9kPa</td>
</tr>
</tbody>
</table>

• Remember to stop the measurement by pressing the C key. (The device does not switch off automatically in this measurement program.)

Key functions:

Use the and keys to change to a different channel:

- Vacuum channels 1 and 2 (internal)
- Vacuum channels 3 and 4 (external)
- Channel 5: Voltage 0-24V (external voltage input. Optional sensor, connected at AUX connector.)

Use the FNC to display the following menu:

<table>
<thead>
<tr>
<th>Manometer Channel: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Print Value</td>
</tr>
<tr>
<td>2: Print all today</td>
</tr>
<tr>
<td>3: Save Value</td>
</tr>
<tr>
<td>4: Hold Value</td>
</tr>
</tbody>
</table>

Keys:

1. The currently measured value will be printed.
2. All today saved values will be printed.
3. The currently measured value will be stored to be printed by 2.
4. ‘Freeze’ (and unfreeze) the currently displayed value.
B.3 Measurement program: Pulsation

Two evaluation programs are available for pulsation measurements:

- Evaluation as per ISO
  The limit values prescribed by ISO over 5 pulse cycles are strictly adhered to.

- Extended evaluation
  Further limitations can be programmed in addition to the limit values required by ISO.

It is possible to save up to 230 pulsators with graphic or 6200 without graphic.

The phases of a pulsation curve according to ISO 3918:

Once a measurement is completed, it can be evaluated under the desired criteria. It is possible to switch between "Evaluation as per ISO" and "Extended evaluation" at any time.

B.3.1 Measurement

The pulse is measured via the device’s internal vacuum channels 1 and 2.
The pulse is recognized via the vacuum channel 1. Vacuum channel 2 does not necessarily need to be connected.
Once a measurement is completed, a pulsator number can be entered with the help of the device’s key pad. This makes it easier to find this particular measurement at a later date.
B.3.2 Display

Evaluating and displaying a recorded pulse curve as per ISO or as per extended limit values.

Key functions:

- **and**: Scroll between measurements. The last measurement performed is the first in the list. On the top right of the display appears the pulsator number that had been entered after the measurement.

- **and**: Change the display:
  - Display 1: Graphic curve representation.
  - Display 2: Numerical values general (pulse count, balance, etc.).
  - Display 3: Numerical values channel-related as percentages.
  - Display 4: Numerical values channel-related in ms.

- **FNC Function-key menu**:
  - 1 Print: A detailed protocol of the current measurement is printed out.
  - 2 Print all: Print all pulsators in a table form or with graphics.
  - 3 Curve as master: The values of the current measurement are taken on as master instructions (where possible) and accepted into the settings.
  - 4 Delete measurement: The current measurement is deleted.

**Graphic curve representation**

- The first thing to appear after a measurement.
- The message: **Errors** indicates that at least 1 limit value was not complied with. Use **and** to jump to the other displays to localize the error.

**Numerical values general**

- No error in this display example.
- Balance %: SIMULTAN appears here when inphase pulsators are measured, as the degree of asynchrony is not calculated in this case.

**Numerical values in ms**

- Vacuum drops in phase B or D of duration longer than 2ms are marked by an arrow (in printouts).

**Numerical values in %**

- Error values are marked inversely:
  - The value of AB% in channel 2 exceeds the tolerance limit.
  - A message is displayed in the bottom line, identifying the cause of the error.
B.3.3 Settings

The limit values for evaluations can be set here. This limit values can still be changed after the measurement, as evaluations are always made according to the currently set limit values. (Exception: Number of pulse cycles. The pulse recognition is made according to this setting.)

- **Target values:** These values can be adopted automatically from a master pulsator.
- **Band values:** These values state the maximum permissible deviation from the target value (band width).
- **Max. and min. values:** These values can obviously not be adopted automatically from the master pulsator.

**Settings for “Evaluation as per ISO”**

ISO 6690 prescribes the following limit values. That is why they cannot be changed in the evaluation as per ISO:

- Number of pulse cycles: 5
- Minimum for B%: 30.0%
- Minimum for D%: 15.0%
- Minimum for D: 150ms
- Maximum for balance: 5.0%
- Band for the AB% within several pulsators: 10.0% (±5.0%)
- Band for the pulse count with several pulsators: 6 (±3 cycles)

When measuring several pulsators, a maximum deviation (band width) is therefore prescribed for the pulse count and the value of AB%.

For this reason, a target value (e.g. optimum value) should be stipulated for each to allow these values to be monitored by the MT52 as well:

<table>
<thead>
<tr>
<th>Puls.ISO Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Puls rate</td>
</tr>
<tr>
<td>Target AB-Phase %</td>
</tr>
</tbody>
</table>

**Settings for “extended evaluation”**

<table>
<thead>
<tr>
<th>Puls.Erw Einstellungen</th>
</tr>
</thead>
<tbody>
<tr>
<td>cycles to record</td>
</tr>
<tr>
<td>target puls rate</td>
</tr>
<tr>
<td>band puls rate</td>
</tr>
<tr>
<td>target AB% 1</td>
</tr>
<tr>
<td>target AB% 2</td>
</tr>
<tr>
<td>band AB %</td>
</tr>
<tr>
<td>targ.pulse vacuum</td>
</tr>
<tr>
<td>band pulse vacuum</td>
</tr>
<tr>
<td>max balance %</td>
</tr>
<tr>
<td>min. duration AB</td>
</tr>
<tr>
<td>Max. duration AB</td>
</tr>
<tr>
<td>Max. duration C</td>
</tr>
<tr>
<td>Min. duration D</td>
</tr>
</tbody>
</table>

- Measurement of several pulsators:
- Target values for the maximum deviation (band widths) allowed by ISO.
- Adapt the values on the right-hand side to your requirements.
- The values shown here are the default value set in the works before the device was delivered.
- AB%1 and AB%2 can be different for front and rear.
- Move the cursor down with the key to view the input lines not visible, further down in the display.

- **Number of pulse cycles:** Number of cycles recorded for the measurement. The average value from all cycles is calculated. (Range: 1 to 9 cycles)
- **Pulse count, target and band:** Target value and maximum deviation. (Range: 30 to 200 per minute)
- **AB% phase, target and band AB%:** Target value and maximum deviation.
- **Pulse vacuum, target and band:** Target value and maximal deviation.
- **Max. balance:** Maximum degree of limping. (Range: 0.1 to 0.5%)
- **Min. duration AB, max. duration AB, max. duration C, min. duration D:** Stated in ms.
B.4 Measurement program: Fluctuation

3 measuring programs are available for fluctuation measurements:

- Short measurement lasting 10 seconds at a sampling frequency of 200 Hz.
- Long measurement lasting 15 minutes at a sampling frequency of 2 Hz.
- Extended measurement with the measurement duration and sampling frequency able to be declared freely.

### B.4.1 Measurement

The measurement is made over the preselected duration. It can also be ended by pressing the C key. So-called markers can be set during the measurement by pressing the arrow keys. These serve to mark other events observed and to pinpoint these later.

During measurements with lower scan rates the values are online displayed as a graphic curve. After termination a measurement number can be entered for better identification in evaluation.

### B.4.2 Display

A measurement made beforehand can be analysed in the display program:

Key functions:

- \( \downarrow \) Zoom in: Doubles the zoom factor for the display, i.e. the display is enlarged. It can be enlarged until the sampling rate corresponds to one dot on the display. After a zoom key has been used, the top line shows the time frame spacing (e.g. 0.100 s/Division) and the entire duration of measurement (e.g. T=3.000s).
- \( \uparrow \) Zoom Out: Halves the zoom factor for the display, i.e. the display is reduced. It can be reduced until the entire measurement is visible on the LCD.
- \( \langle \) and \( \rangle \): Move the cursor (arrow). The currently measured value at the cursor position is displayed in the bottom line. If the key is held down, the speed of the cursor increases. The cursor can then be moved beyond the current window.
- 1, 2 to 5 activate and inactivate the display of channels recorded:
  When one of these keys is pressed, the corresponding channel is activated, i.e. the representation is through-going. The remaining channels are represented in dot form. The other channels are blended in/out by pressing the key of the activated channel.
- **FNC Function-key-menu:**
  - \( \langle \): Marker forward: Search forwards for the next marker
  - \( \rangle \): Marker back: Search backwards for the previous marker
  - \( \uparrow \) and \( \downarrow \): Scroll between various measuring curves, i.e. those made beforehand.
  - 1: Print the curve
  - 2: Delete the current curve.
Title line in the display:
The title line in the display program appears in two forms:

** Variant 1:** (On first time display or after the zoom factor is changed)
Resolution e.g. 1.000s/Div
Total measurement duration e.g. T=10.00s

** Variant 2:** (as soon as a key is pressed)
Minimum e.g. \(\downarrow -0.1\text{kPa}\)
Maximum e.g. \(\uparrow 38.3\text{kPa}\)
Average e.g. \(\# 38.3\text{kPa}\)

### B.4.3 Settings for ‘extended measurement’

<table>
<thead>
<tr>
<th>Measure extended---&gt;Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan-frequency (Hz) 1000</td>
</tr>
<tr>
<td>duration (sec.) 0020</td>
</tr>
<tr>
<td>CH1 active 1</td>
</tr>
<tr>
<td>CH2 active 0</td>
</tr>
<tr>
<td>CH3 active 1</td>
</tr>
<tr>
<td>CH4 active 0</td>
</tr>
<tr>
<td>0-28 Volt active 0</td>
</tr>
</tbody>
</table>

- Number of measurements per second (Range 1 to 2000Hz)
- Activate or deactivate measuring channels:
  0=inactive, i.e. do not measure
  1=active, i.e. measure and record values
- Electric: 0-28V analogue input (option for AUX connector)
  (See F.2 Layout of AUX connector)

**Notes:**

Avoid unnecessarily large volumes of data:
- Set a reasonably low scanning frequency (e.g. 10 instead of 1000 measurements per second)
- Set a reasonably short measurement duration.
- Only activate the channels with which you want to measure.
- Use the marker keys if you need to record a larger volume of data. You can then search for markers afterwards without having to display the entire measurement.
- When stating the measurement’s duration, the bottom line shows the maximum measurement duration possible, which would fill the complete data memory storage place. The maximum measurement duration possible depends on the number of active channels and the scanning frequency set.

This also enables measurement curves to be displayed more rapidly and cuts the time needed to transmit data to the PC. What is more, a larger number of measurements can be taken, and stored.
B.5 Measurement program: Milking Time Test

This program measures during an entire milking cycle on an animal’s teat.

Two vacuum measurement channels are evaluated during this measurement:
- Channel 1 (internal vacuum sensor) at the pulsator (as for a pulsation measurement)
- Channel 3 (external vacuum sensor) by means of a head probe at the mouthpiece of the teat rubber.

Channel 1 serves for pulse detection. 3 measured values are stored per pulsation:
- Vacuum at the mouthpiece A phase (measurement of channel 3)
- Vacuum at mouthpiece D phase (measurement of channel 3)
- Current pulse count

A maximum of about 140 measurements can be executed and recorded.

Effects on the animal in case of a too high vacuum in the mouthpiece
If the in the range of the mouthpiece lining part of teat is exposed to a too high vacuum, or also over short time a much too high vacuum, this zone will not be massaged for a longer time. This can result in ring oedemas. The cause thereby often is the relationship between udder, form of teat and teatcup rubber liners.

Discharge phase
The rubber presses onto the teat and causes thereby a back push of the dammed up body fluid (massage).

Suck phase
Because of the developing vacuum, blood and body fluid pushes to the surface of the teat. The teat swells on; the line channel is narrowed.

With a little experience, the graphic representation of the measured data allows various conclusions.
B.5.1 Preparation for measurement

Use of the sensor and tube developed particularly for this purpose:
The stainless steel manufactured tube can be used with all common rubber or silicone mouthpieces. The volume in the tube, the holding wire and the sensor is very small, so that an influence of the vacuum process can be neglected.

1) The tube is pierced with the put on point of needle inside and through the teatcup liner.

2) The tube will be pulled from outside to the flange, and trough the teatcup liner. Afterwards, the put on point is removed.

3) The pressure sensor is fastened to the teatcup and is to attach over the short holding wire at the tube.

4) Connection to MilkoTest MT52:

   CH1: Pulsation of the appropriate teat
   CH 3: External sensor for the collection of the head vacuum

   The tube is designed in way that that makes falling out or hurting of the teat and animal impossible.

After measurement the tube is removed again, the small puncture caused by the tube closes automatically; the teatcup liner can be used again.

B.5.2 Measurement

- Connect the holding wires as described above to CH1 and CH3.
- Prepare the animal and the milking installation for milking.
- Start the measuring program. It waits now, until a pulsation is detected.
- Start the milking procedure.
- The measured curve will be displayed continuously on the LCD.
- Use the marker keys to indicate special occurrences.
- The measuring program will automatically stop, as soon as no more pulsation is detected.
- Subsequently, a number (e.g. number of animal) can be entered, so that you will be able to clearly identify the measurement later.
B.5.3 Display and printing

<table>
<thead>
<tr>
<th>MilkingTimeTest</th>
</tr>
</thead>
<tbody>
<tr>
<td>time:</td>
</tr>
<tr>
<td>no of cycles:</td>
</tr>
<tr>
<td>puls rate:</td>
</tr>
<tr>
<td>puls vacuum:</td>
</tr>
<tr>
<td>head vacuum:</td>
</tr>
<tr>
<td>I: Print</td>
</tr>
</tbody>
</table>

Key functions:
- Key 1: Printing out a diagram
- Key ▼ und ▼: Scrolling between different measurements.

The last measurement accomplished is indicated as the first in the list.

The values stated are average values over the entire measurement.

B.5.3.1 Evaluation of the measurement

This measurement program makes it possible to register for each animal the relation between human, animal, and machine over the entire milking duration. Thereby, the head vacuum, the pulsation, as well as visual perceptions of the observer can be registered at the same time.

After an effected measurement, the stimulation, the active milking phase, the backup milking, as well as the milking end can be recognized well on the printed out diagram:

Evaluation example of measurement program „MilkingTimeTest“
**Assistance for the evaluation of the Milking Time Measurement**

1. **Stimulation**
   Did the stimulation take place correctly?
   After the change of the pulsation from preparing- to normal pulsation, the head vacuum must come to the optional range of < 10 kPa. If the vacuum constantly remains too high, problems will arise.

   Possible reasons:
   - The milking machine was not set carefully.
   - Stimulation was not sufficient

2. **Milking phase**
   Is the band of head vacuum appropriate within the optimal range under 10 kPa during the active milking phase?
   If the maximum head vacuum is higher than 10 kPa during the active milking phase over a longer time, problems can arise; e.g. ring oedemas.

   Possible reasons:
   - Unfavourable suction phase relation or unfavourable frequency of pulsation
   - **Head vacuum band is narrow**: Rubber of teat probably too tight.
   - **Head vacuum band is broad**: Rubber of teat probably too big.
   - Used rubber of teat does not fit to the animal
   - Composition of the herd is not homogeneous

3. **Milking End**
   Is the milking end recognized correctly?
   After the end of the active milking phase, the head vacuum rises steeply during a few seconds. If the milking end is not recognized in time, blind milking, what is a burden to the animal, will take place.

   Possible reasons:
   - Milk lack function does not switch with the intended milk flow
   - Milking end was not recognized correctly by the machine
   - Operator did deduct the milking equipment too late

4. **Observations**
   Are other disturbances involved?
   During the entire milking procedure, visual perceptions can be made by the observer, which can be registered over the four indicator keys (markers).
   This gives you the possibility to recognize on graphics, at which point during the milking procedure the animal made problems.

   We recommend to assign one concrete meaning to each of the 4 indicator keys (marker); e.g.

   **Marker 1:** The animal is beating against the milking equipment
   Sensation of pain by high vacuum load due to unfavourable stimulation, mismatching form of teat etc.

   **Marker 2:** The animal behaves jerkily / nervous
   Leak streams are present, annoyance by flies, noise, vibration; in consequence, the animal cannot be milked appropriately/normally.

   **Marker 3:** Milking end:
   Does the milking end recognized by the installation correspond with the curve?

   **Marker 4:** Other observations
B.6 Measurement program: Micro Air-Flow (optional)

The optional Micro Air-Flow (MAF) measurement program allows you to measure small airflows to a maximum of 300l/min.

Before use, make sure to read the operation instructions of the TSI 40241 sensor and note the safety regulations.

B.6.1 MAF-Meter

There is a program for evaluation of the measured data. It is started over the main menu under "Micro Air-Flow". As usual, you can use the function keys for hold, print, and save. If another MT52 accessory than the MAF sensor is connected to the MT52 via the AUX interface during the measurement, the read value cannot be interpreted correctly.

<table>
<thead>
<tr>
<th>MAF on Channel: 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.0 l/min</td>
</tr>
<tr>
<td>Minimum: 00.0 l/min</td>
</tr>
<tr>
<td>Maximum: 00.0 l/min</td>
</tr>
</tbody>
</table>

B.6.2 Milking Units

The milking units' air flow can be measured by using the MAF-Meter. To do so, select the value you want to measure in the form "ISO Report -> Measure -> Milking Units" and confirm by pressing the ENT key.

<table>
<thead>
<tr>
<th>Milking units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number: 01</td>
</tr>
<tr>
<td>✔ Leak shut-off: 00.0</td>
</tr>
<tr>
<td>✔ Total air adm.: 00.0</td>
</tr>
<tr>
<td>✔ Leakage cluster: 00.0</td>
</tr>
<tr>
<td>✔ E-&gt;vent admission: 00.0</td>
</tr>
<tr>
<td>✔ ACR-flow rate: OK</td>
</tr>
<tr>
<td>✔ AF at cluster: 000</td>
</tr>
</tbody>
</table>

Now, the measurement program "Micro Air-Flow" starts. The measured value can be directly inserted and saved into the Milking Units form by pressing the ENT key again. If you wish to fill in this form manually, set in the menu “System -> Settings” the option “Rep. with MAF” to “No” (default settings).

B.6.3 Activate this option

To use the Mikro Air-Flow Meter, you need to activate this option with a license key, see chapter D.8.1.
B.7 Measurement program: Air-Flow-Meter (optional)

The optional air flow meter (AFM) allows the flow of air to be measured fully automatically.

---

**Attention!**
Do not reach into the hood/cover! Do not hold any objects in the opening! Do not try to brake the cover when it is closing!

**Notes:**
- The AFM must be prepared for operation (set-up) before an AFM measurement can be performed for the first time. Further information on AFM set-up is given in section C.2.3.

B.7.1 Preparation and connection

Insert the AFM-connection-lead in the AUX port of the MilkoTest MT52. The lead must **not** be disconnected and reconnected during the measurement.

Connect pressure tube of AFM measuring pipe to the MilkoTest MT52 Channel 1 (CH1). If the reference vacuum is not removed at the AFM measuring pipe, the vacuum must be attached at another, more suitable place and be connected to CH1 of the MilkoTest MT52. This must be adjusted at the MilkoTest MT52 before measuring (See **B.7.3 Pre-settings at the start of the measurement** on page 23).

**Attention!**
Before measuring with deactivated regulator:
Make sure, that the **AFM cover is not closed** when you connect the AFM to the system and switch on the vacuum pump.
The milking installation could be damaged by too high a vacuum (implosion of the receiver!).

B.7.2 Settings

Use this menu point to define the following:

**Air-Flow>Settings**
- Atmospheric pressure K2
- Bypass 0000
- Altitude (m) 0850
- Sys. volume Pa=97.5kPa Ps= 90kPa

**Absolute pressure**
The Milkotest MT52 has an absolute pressure sensor (displays the current ambient atmospheric pressure, Pa=…), which allows one to automatically convert the pump performance to the normal atmospheric pressure at the altitude of the local site, or to the reference atmospheric pressure of 100kPa.

**Conversion to normal atmospheric pressure at this altitude:**
So that the measurement results can be compared with previous measurements (e.g. measurements made in the previous year).
According to ISO 6690 a correction is necessary if the current ambient pressure deviates by more than 3kPa from the normal atmospheric pressure at this altitude.
The conversion is done according to the ISO 6690 standard and follows this formula:
\[
K_2 = \frac{p_{\text{max}} - p}{p_{\text{max}} - p_a}
\]

\(p_a\): atmospheric ambient pressure
\(p_{\text{max}}\): \(p_{\text{max}} = p_a \times 0.9\), volumetric efficiency of 90% assumed
\(p\): vacuum at pump inlet pipe

Select “K2” to automatically correct the measured value using the factor \(K_2\).

**Conversion to the reference atmospheric pressure of 100 kPa**

To compare the measured air flow to the nominal value indicated on the vacuum pump. A correction is needed if the current ambient pressure deviates by more than 3kPa from the nominal pressure 100 kPa. The conversion is done according to the ISO 6690 standard and follows this formula:

\[
K_1 = \frac{p_{\text{max}} - p_{\text{nom}}}{p_{\text{nom}} - p_{\text{in}}}
\]

\(p_{\text{atm}}\): atmospheric ambient pressure
\(p_{\text{max}}\): \(p_{\text{max}} = p_a \times 0.9\), volumetric efficiency of 90% assumed
\(p_{\text{nom}}\): nominal atmospheric pressure (100kPa)
\(p_{\text{in}}\): nominal vacuum at pump inlet pipe (50kPa)
\(p\): vacuum at pump inlet pipe

Select “K1” to automatically correct the measured value using the factor \(K_1\).

The correction using \(K_1\), or \(K_2\) is only done when the current ambient atmospheric pressure deviates from the prescribed value by ±3kPa. When a correction is made \(p_{\text{atm}}=90\text{KPa}\) is marked with a black background.

**Bypass**

To measure pump capacities higher than 3400 lt/min, we recommend using a bypass.
In this case you can enter the bypass-capacity and all measurement results will be corrected by this amount.

**Altitude (m above sea level)**

Enter the altitude here, in metres above sea level, of the vacuum pump to be measured.

**Sys. volume**

Leave this at the standard setting “----”!

This setting relates to the control behaviour of the Air-Flow Meter measuring program. One can distinguish here between the standard setting “----”, “small” and “large”.

The standard setting is chosen so that an AFM measurement can be made in a convenient period of time. For very small or large system volumes, the vacuum that is being regulated may respond in different ways. This can affect the measurements, in the worst case a measurement might not be possible. Then you can adjust the setting to “small” or “large”, according to the vacuum system that is being measured.
B.7.3 Pre-settings at the start of the measurement

Select automatic or manual measurement. The AFM runs its initialisation procedure if this is the first measurement taken after switching the device on. This also changes the diaphragm opening slightly!

Then a menu appears in which you can change a number of default values:

<table>
<thead>
<tr>
<th>AFM Automatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>target vacuum</td>
</tr>
<tr>
<td>measure at AFM</td>
</tr>
<tr>
<td>open diaphragm</td>
</tr>
<tr>
<td>close diaphragm</td>
</tr>
<tr>
<td>start</td>
</tr>
</tbody>
</table>

On the bottom line you can see the actual diaphragm position:

- 0% opened: -> closed
- 100% opened: -> open

- **Target vacuum**: This is the vacuum by which the air flow is to be measured.
  - In the case of fully automatic measurements, the AFM sets its diaphragm opening after start-up this way that the vacuum prevails after the measurement has been taken.
  - In the case of manual measurements, the display continuously shows the direction in which the diaphragm opening must be adjusted.

- **Measurement on the AFM**: (Yes / No): The vacuum measurement at the AFM pipe is influenced slightly by the air flow (venturi effect, non-laminar flow). If you state YES here, this influence is corrected automatically. If the vacuum is not measured at the AFM pipe, you should state NO here. Nevertheless, make sure that there is a laminar flow at the vacuum measuring point as far as possible.

- **Open diaphragm**: Press ENT here to open the diaphragm before starting the measurement.
- **Close diaphragm**: Press ENT here to close the diaphragm before starting the measurement.
- **Start**: Connect the AFM to the required point in the milking equipment and subsequently press ENT here to start the measurement.

B.7.4 Automatic AFM measurement

1. Select the **Automatic measure** menu item with ENT.
2. Change the settings if necessary. (See B.7.3 Pre-settings at the start of the measurement)
3. Select **Start**.

-> The measurement process is started. The diaphragm opening is controlled automatically.

Display at the start of the measurement:

<table>
<thead>
<tr>
<th>AFM Automatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target vacuum</td>
</tr>
<tr>
<td>Actual vacuum</td>
</tr>
</tbody>
</table>

- **Current action** displayed in the bottom line e.g.:
  - Closing diaphragm
  - Opening diaphragm
  - Wait to be settled

Display at the time when the target vacuum has more or less been reached:

<table>
<thead>
<tr>
<th>AFM Automatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target vacuum</td>
</tr>
<tr>
<td>Actual vacuum</td>
</tr>
<tr>
<td>~1493 lt/min</td>
</tr>
</tbody>
</table>

- The approximate measured value is displayed in advance
Display after conclusion of measurement:

<table>
<thead>
<tr>
<th>AFM Automatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target vacuum: 48.0kPa</td>
</tr>
<tr>
<td>Actual vacuum: 48.0kPa</td>
</tr>
<tr>
<td>1500 lt/min</td>
</tr>
<tr>
<td>Measurement done!</td>
</tr>
</tbody>
</table>

### B.7.5 Manual AFM measurement

The diaphragm opening is set manually over the key pad in the manual measurement program. This may be necessary in rare cases where the automatic measurement program cannot be deployed, such as with heavy vacuum fluctuations.

1. Select the **Manual measurement** menu item with ENT.
2. Change the settings if necessary. *(See B.7.3 Pre-settings at the start of the measurement)*
3. Select **Start**

Display during the measurement:

<table>
<thead>
<tr>
<th>AFM Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target vacuum: 48.0kPa</td>
</tr>
<tr>
<td>Actual vacuum: 46.0kPa</td>
</tr>
<tr>
<td>~1493 lt/min</td>
</tr>
</tbody>
</table>

- Remember to end the measurement by pressing the C key! (The device does not switch off automatically in this measurement program)

The bottom line in the display tells you how to open or close the diaphragm using the < and > keys:

- Hold key down
- Hold key down for approx. 2 seconds
- Press key once
- OK

**Exact target vacuum value reached**

### B.7.6 Maintenance and cleaning of the Air-Flow-Meter

Remove hood with measuring pipe by opening the three quick-locking mechanisms. Clean the aperture with a damp rag. The drive unit requires no maintenance and also shall not be opened (possibility of damp air-entering).

**Attention!**

Do not reach into the hood/cover! Do not hold any objects in the opening! Do not try to brake the cover when it is closing!
B.8 Measurement program: Speedometer

The Speedometer (Tachometer) integrated in the MilkoTest MT52 allows the rotor speeds to be measured without contact.

The device thereby emits invisible infrared light and evaluates the light pulses reflected from the object being measured. There should be a place on the rotor on which the reflection changes. This enables the device to better evaluate the light pulse.

B.8.1 Measurement

Start the measurement program and hold the device approx. 20cm from the object to be measured.

As soon as a signal is received that can be evaluated, this is indicated by a rotating symbol and the measured value is displayed.

- The measured value remains displayed, even if you now remove the device from the object of measurement again to read it off.
- Remember to end the measurement by pressing the C key! (The device does not switch off automatically in this measurement program)

Use the FNC-key to display the function-key menu. This allows you to print out and store values.

B.8.2 Problems during measurement

Unfavourable reflection conditions can mean that no measurement can be made. Improve the bright/dark contrast by sticking a tape marking onto the rotor.

A couple of relevant examples:

<table>
<thead>
<tr>
<th>Rotor-Shaft</th>
<th>Marking</th>
<th>Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Become dark</td>
<td>• Bright</td>
<td>⬇️ Weak</td>
<td>Marking hardly distinguishable from rotor shaft!</td>
</tr>
<tr>
<td>• Dark paint</td>
<td>• Reflective</td>
<td>⬆️ Good</td>
<td>Marking has different reflection characteristics to the shaft</td>
</tr>
<tr>
<td>• Rusty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bright paint</td>
<td>• Dark</td>
<td>⬆️ Good</td>
<td>Marking has different reflection characteristics to the shaft</td>
</tr>
<tr>
<td>• Metallic shine</td>
<td>• Dull</td>
<td>⬇️ Weak</td>
<td>Marking does not disappear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⬆️ Good</td>
<td>Improvement by covering a side</td>
</tr>
</tbody>
</table>
B.9 Measurement program: Thermometer

The measurement program thermometer serves to measure, record and display temperatures.

Connect the temperature sensor available as option to port CH3 or CH4 of the MilkoTest MT52. It is possible to use two sensors together at the same time.

The measurement program is started directly by selecting the menu option \textit{Measure} in the thermometer menu.

- Remember to end the measurement by pressing the \textit{C} key! (The device does not switch off automatically in this measurement program)

**Key functions:**

If two temperature sensors are connected: use the keys \(\uparrow\) and \(\downarrow\) to change to the other channel.

Use the FNC key to display the function-key menu. This allows you to print out and store values:

**Keys:**

- 1: The currently measured value will be printed.
- 2: All today saved values will be printed.
- 3: The currently measured value will be stored to be printed by 2.
B.9.1 Recording temperature

With this program you can record temperatures over a longer period of time to be displayed or printed in a diagram.

**Recording**

After selecting \{Start\} in the sub menu \{Record Temperature\} the recording will be started. It will continuously be displayed during the recording.

On the bottom line you will find the actual temperature and also some statistic values: maximum, minimum, and average. In case you connected two sensors: use any key to display the actual value of the other channel.

The recording stops automatically after the programmed time. But it can be stopped earlier by pressing the C key.

**Display**

Diagram of temperature record:

Use the FNC key to display the function-key menu. This allows you to:

- Jump to another curve
- Print out and erase the actual displayed curve

**Settings**

Settings for temperature recorder:

- Scan interval: time difference between measurements. Range: 1 to 9 seconds.
- Duration: The recording will be stopped after this time. Range: 1 to 999 minutes
C System

C.1 Settings

The basic settings for the device can be made here. The values set in the works before delivery nevertheless enable the device to be operated.

- Adapt the values on the right-hand side to your requirements.
- The values shown here are the default values set in the works before the delivery of the device.
- Use ▼ and ▲: to change the language then press ENT
- Move the cursor down with the ▼ key to view the input lines not visible in the display.

<table>
<thead>
<tr>
<th>System &gt; Settings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>farm</td>
<td>FARM</td>
</tr>
<tr>
<td>user</td>
<td>USER</td>
</tr>
<tr>
<td>clock: year</td>
<td>2013</td>
</tr>
<tr>
<td>clock: date</td>
<td>01.01</td>
</tr>
<tr>
<td>clock: time</td>
<td>12:00</td>
</tr>
<tr>
<td>language</td>
<td>ENGL</td>
</tr>
<tr>
<td>vacuum unit</td>
<td>kPA</td>
</tr>
<tr>
<td>temperature unit</td>
<td>°C</td>
</tr>
<tr>
<td>ISO-Report</td>
<td>ISO</td>
</tr>
<tr>
<td>Report order</td>
<td>No</td>
</tr>
<tr>
<td>Rep. Ph. 1,3,5</td>
<td>05</td>
</tr>
<tr>
<td>Rep. Ph. 2,4</td>
<td>15</td>
</tr>
<tr>
<td>Rep. with AFM</td>
<td>Yes</td>
</tr>
<tr>
<td>Rep. AFM correct.</td>
<td>Yes</td>
</tr>
<tr>
<td>Rep. AFM manual</td>
<td>Yes</td>
</tr>
<tr>
<td>FullScale MAF</td>
<td>050</td>
</tr>
<tr>
<td>Rep. with MAF</td>
<td>No</td>
</tr>
<tr>
<td>LCD-contrast</td>
<td>10</td>
</tr>
<tr>
<td>Switch off time</td>
<td>10</td>
</tr>
<tr>
<td>Light off time</td>
<td>10</td>
</tr>
<tr>
<td>Save puls. graphics</td>
<td>1</td>
</tr>
<tr>
<td>Autom. zero</td>
<td>Yes</td>
</tr>
<tr>
<td>Calibr. at start</td>
<td>No</td>
</tr>
<tr>
<td>Service code</td>
<td></td>
</tr>
</tbody>
</table>

- **Farm:**
  Alphanumeric input: name of customer. (For output to printer)
- **User:**
  Alphanumeric input: name of the service technician or service office. (For output to printer)
- **Clock: Year, Clock: Date, Clock: Time**
  Set the system clock. The system time is saved with each measurement stored.
- **Language:**
  Select language for the user interface. DEUTSCH, ENGLISH, SPAIN, FRENCH
- **Vacuum Unit**
  Default value for displaying the unit of pressure: kPa, mBar, cmHG, PSI, cm H₂O, InHG, InH₂O
- **Temperature Unit**
  Default value for displaying the unit of temperature: °C (Celsius), °F (Fahrenheit)
• **ISO-Report:**
  Presetting for different types of report:
  - ISO (strictly following ISO 6690)
  - CH (Swiss ART regulations)
  - OPTI: according to OptiTraite
  - WGM: according to WGM
  - ISOa: following ISO-6690, but using the conventional order

• **Report order:**
  If this is set to Yes, the user can choose his own order/sequence for the ISO report

• **Rep. ph. 1,3,5 (duration of phases 1, 3 and 5)**:
  This value corresponds to the duration of measurement of phases 1, 3 and 5 of the control characteristic.

• **Rep. ph. 2,4 (duration of phases 2 and 4)**:
  This value corresponds to the duration of measurement of phases 2 and 4 of the control characteristic.

• **Rep. with AFM**:
  Set this value to “Yes” to use the report function with the Air-Flow Meter.

• **Rep. AFM correct**:
  Set this value to “Yes” to automatically correct the measuring points “Reserve flow” and “Air flow of the vacuum pump at 50kPa” by the corresponding factors.

• **Rep. AFM manual**:
  If this value is set to “Yes”, the automatic AFM measuring program is called up instead of the manual one.

• **FullScale MAF (measuring range of Micro AirFlow Meter)**:
  Set the end-of-range value of the Micro Air-Flow Meter here. Note: this value must match the setting in the Micro Air-Flow Meter. The standard value is 50l/min.

• **Rep. with MAF (report measurements with Micro AirFlow Meter)**:
  Set this value to “Yes” to record the measured values of the milking units using the Micro Air-Flow Meter. Set this value to “No” to enter the measured values manually.

• **LCD-contrast**:
  Alter the LCD contrast (0 = dark, 20 = bright)

• **Switch-off time**:
  The device switches off automatically if no key is pressed during the time stated here. Entry in minutes.
  Exceptions: The device is not switched off automatically during battery charge and in the manometer, AFM manual and tachometer measurement programs.

• **Light off time**:
  The device switches into an energy-conservation mode if no key is pressed during the time stated here.
  The LCD background illumination is also switched off in energy-conservation mode. Entry in seconds.

• **Save pulse graphics**:
  If you enter a 0 here, the pulsation values measured are stored without the associated graphic representation.

• **Autom. zero**:
  The MT52 periodically carries out a zero-calibration of the vacuum channels, see section A 5.5. This corrects any shifts in the zero point that may have happened. Set this value to “No” to turn off the automatic zero-calibration.

• **Set zero at start-up**:
  When this value is set to “Yes”, the program zero point is calibrated when the MT52 is switched on. See section C.2 Zero calibration.

• **Service code**:
  Service code for internal use.

Settings marked with an * are related to functions that first need to be activated with a license code.
C.2 Zero calibration

In this program you can manually calibrate the zero point of the vacuum channels. Start this program via System -> Zero calibration. Please note the following:

- Make sure that the MT52 is not connected to any vacuum
- To be able to set the zero point, the value must lie between ±8kPa. You can see if it does because then the respective channel will NOT be marked in black.
- If the sensors are missing, for channels 3 and 4, no correction can be made either, the message “no sensor!” is displayed

Exit from the program by pressing the ENT key. The vacuum values shown will be entered as zero point if the respective line is not marked in black. If you do not want to save the zero point, exit the program by pressing the C key.

C.3 Clear memory

All measurement data is deleted.
Recommendation: Delete all old measured values each time before starting measurements in a new farm.

C.4 Reset to default values

All default values are restored to the factory settings.
C.5 AFM set-up

The automatic Air Flow Meter must be prepared for operation before measurements can be taken for the first time with the automatic Air-Flow Meter:

Procedure:
1. Connect the AFM to the device.
2. Transmit the values from the AFM data sheet at this place in the device:

<table>
<thead>
<tr>
<th>AFM Immatriculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFM serial no 21048</td>
</tr>
<tr>
<td>RP Offset 49039</td>
</tr>
<tr>
<td>checkcode 37628</td>
</tr>
</tbody>
</table>

3. After leaving the entries by pressing the C key, the device will be synchronised and tested with the connected AFM. This takes some minutes.
4. This AFM is then ready to take the measurements.

This set-up needs to be repeated if you use a different AFM device.

C.6 MAF Offset

To correct the offset of the Micro Air-Flow Meter, proceed as follows:

1. Connect MAF to the MT52
2. Ensure that the MAF is being operated without air flow
3. Start the measuring program
4. Using the cursor keys, move the zero point until the display is at 0
5. Save the offset by using the functions menu and key 3.

If the measuring program is exited without being saved by pressing the C key, the correction will only be saved temporarily. The zero point will be set back to its original value the next time the MT52 is started up.
C.7 Report order

Using this program the user can specify a custom sequence for the arrangement of the ISO report.

This menu item is only shown if you have set Rep. order to “Yes” in the system settings.

If the record type in System->Settings->ISO report is changed, the order has to be typed in again.

1. Start the program under System > Rep.order

2. Move the cursor using the arrow keys ↑ and ↓ a to the measuring point that you want to move.

1. Select this one by pressing ENT

2. Now move the measurement to the desired position and confirm again using the ENT key.

The measurements are partly dependent on each other and cannot be moved freely. If you try to move a measurement down, but the next one depends on it, the system displays a message.

3. Save the order via the FNC menu and the key 1.

C.8 Manufacturer tests

For factory checks by the the manufacturer.
D PC Program

With the help of the MilkoTest MT52 PC Program (on CD) you can transfer measurement data from your MT52 to a PC, where the data can be processed further.

- Transferring measurement data from MT52 to PC
- Good display and evaluation possibilities, as well as printing options
- Saving measurement data to a file
- Exporting measurement data as text tables or into a Microsoft Excel table
- Printing of measurement values directly from a Microsoft Word document
- Transferring measurement values into a ISO 6690 Protocol form

The new user interface of the PC Software MT52 V2.0 appears in a completely redesigned look. This new user interface allows a fast, flexible and easy way of navigation within the software. All functions can be called up over the context menu (appears after a right-click) and/or the toolbar. For a better overview, the individual evaluation programs are now organized in individual tabs.

Pulsation and fluctuation measurements can now be transferred to a Microsoft Word Document with a few mouse-clicks. The user has the possibility to create and use Word templates with individual formatting, such as headers and footers, logos, etc.

For this function, Microsoft® Word® 2003 or higher is required!

D.1 Installation

D.1.1 Downloading the software

The latest version of the PC program can be downloaded at the following link:
http://www.bepro.ch/messtechnik_download.html

Please take notice of the instructions on the download page.

For the proper operation of the PC Software V2.0, the MT52 firmware version 2.11 or higher is required!

D.1.2 System Requirements

<table>
<thead>
<tr>
<th></th>
<th>Minimum System Requirements</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Pentium III 866 MHz</td>
<td>Pentium 4/M or higher</td>
</tr>
<tr>
<td>RAM</td>
<td>256 MB</td>
<td>1 GB</td>
</tr>
<tr>
<td>Display</td>
<td>1280 x 1024</td>
<td>1280 x 1024</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows XP</td>
<td>Windows XP</td>
</tr>
</tbody>
</table>
### D.1.3 Installation

If you work with an installation CD, start with the installation in point 3.

1. Download the software’s latest version.
2. Unpack the zip file.
3. Run the program “setup.exe”. Follow the instructions given by the installation program.
4. After the installation has been completed, restart your computer.
5. Under Start -> Programs -> MT52 you will find the installed software.

6. When you run the MT52 PC Software for the first time, the following Windows Security Alert window appears: Press "Unblock" to stop this warning appearing and to start the program.

7. Enter the license key delivered with the device under System -> Options (see section D.8.1 License keys)

### D.1.4 Install the USB Driver

#### System Requirements

1. The pc program was successfully installed
2. A MT52 USB device is available.

#### Installation

1. Open the device manager
2. Connect the MT52 by the usb cable. The MT52 appears as an unknown device in the device manager console. Open the property window by double clicking on the icon.
3. press Update Driver button

4. Choose the second option, „Browse my computer for driver software“

5. Navigate to the following directory:
   32Bit Windows: C:\Programme\MT52\USB Driver
   64Bit Windows: C:\Programme (x86)\MT52\USB Driver

   and proceed with continue.
6. Windows Security alert appears. Continue with „Install this driver software anyway.“

7. After successfully updating the driver

the MT52 Com Port appears in the device manager:
8. The MT52 is now available under the assigned port number
D.2 Main program

The following graphic shows the PC program's interface:

The PC program is divided into six evaluation programs:

1. MT52 data
2. Pulsation
3. Pulsation Overview
4. Fluctuation
5. Milking Time Test
6. Thermometer

Each function can be called up by clicking on the tab bearing the name of the respective function. This way, the user has the possibility to switch between the individual tabs at any time. A detailed description of each function is given in the following chapters.
D.2.1 Readout of MT52 data

The software version 2.0 or higher provides a kind of explorer with the help of which all measurements stored on the MT52 can be represented. They are represented in a hierarchic structure. Measurements of the same type are summarized in a single directory. Measurements that were assigned to a particular farm, such as measurements for the ISO protocol, are organized according to the type of measurements and represented under the respective farm.

To read out the measurement data from the MT52, do as follows:

1. Connect the MT52 to your computer, using the data cable delivered with the device. If the computer does not have a serial interface, a USB-RS232 converter is needed.

2. The connection is set by clicking on the button or on „MT52 – Connect to MT52“ in the menu bar. Choose the interface over which the MT52 is connected to the PC.

3. Now you can read out all measurements stored on the MT52 over „MT52 – Read MT52 content“ or by clicking on the button.

Only the information part of each measurement, and not the measurement itself will be saved to the PC this way.
The measurement data directory is organized as follows:

- **MT52 Data**
  - **ISO Report**
  - **PULS**
  - **FLUKT**
  - **....**

  Head directory of all measurements
  Directory of the ISO protocol farms. Four farms are listed here with their names.
  Directory of the pulsator measurements. The pulsators that do not belong to an ISO report are listed here.
  Directory of the fluctuation measurements. The fluctuation measurements that do not belong to an ISO report are listed here.
  An individual directory and an entry for its measurements will be created for each additional type of measurement.

The user has the possibility to select one or several measurements at the same time. This function can be used, if the user, for example, wishes to represent the selected measurements in a Word document, or to save them to the computer.

The measurements appear in the same order as they have been selected!

Only elements on the same level, i.e. measurements of the same type, can be selected at the same time.

**D.2.2 Saving the measurements**

The measurements can be selected and saved via the MT52 data tab. Here you can choose between various file formats.

- Save the measurement in a file. This can then be opened in the program later.
- Export the measurement to a Microsoft Word document.
- Export the measurement to a text file.
- Export the measurement to a Microsoft Excel file.
D.2.3 The toolbar

a) Read MT52 content
   By clicking on this symbol, all information belonging to the measurements stored on the MT52 will be read out.

b) Connect to MT52
   The user chooses the interface over which the MT52 is connected to the PC.

c) Open
   By clicking on this symbol, you can open and display saved measurements.

d) Save
   Saves the currently selected measurements to a file.

e) Create a report in Microsoft Word
   Creates a Microsoft® Word® document with the currently selected measurements.

f) Export to Microsoft Excel
   Exports a selected measurement to a Microsoft® Excel® document.

g) Export to text file
   Exports a selected measurement to a text file.

h) Jump to left marker
   The cursor jumps to the next left marker.

i) Jump to right marker
   The cursor jumps to the next right marker.

j) Set zoom factor to 1
   To display an entire graphic, click on this button.

k) Display in % or ms
   For the display of the pulsation values, you can choose between % and ms.

l) Read out graphic data
   If this checkbox is activated, the pulsation measurements with their graphics are transferred from the MT52 to the computer.

m) Transferring ISO protocol from PC to MT52

n) Transferring a farm’s ISO protocol to a PC

o) Save ISO report of a farm as a Logimat file

p) Calculate the pressure total from a fluctuation measurement

Depending on the type of measurement and tab selected, different operations are available on the toolbar.
D.2.4 Legends and functions for graphics

For the graphics of pulsation, fluctuation and MilkingTime, measurements the following functions and legends are available:

**Magnifying glass:** The various zooming functions can be found here: select zoom area, horizontal zoom, vertical zoom, reset zoom (same function as ), zoom in, zoom out.

**Cursor symbol:** This symbol must be activated to move the cursor in the graphic. The cursor follows the assigned curve.

**Hand:** The graphic can be moved in horizontal and vertical direction at will.

<table>
<thead>
<tr>
<th>Cursors</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 1</td>
<td>20</td>
<td>41.9</td>
</tr>
<tr>
<td>Channel 2</td>
<td>100</td>
<td>49.3</td>
</tr>
</tbody>
</table>

All cursors extant in the graphic are listed in the cursor legend with their position values. X corresponds with the time axis (time[ms]), whereas Y corresponds with the vacuum values (vacuum[kPa]).
D.2.5 Creating a cursor

Move the cursor over the cursor legend and click the right mouse button to create a new or change an existing cursor.

Over “Create Cursor -> Free” a cursor can be created that is not assigned to a curve. It can be positioned freely in horizontal and vertical direction. This function can be used, for example, to position a note within a graphic. Over “Create Cursor -> Single-Plot” a cursor is created that can be assigned to a plot over the context menu: “Snap To -> Channel X”.

A cursor’s attributes define its color, line and line width. These attributes can be adapted at will.
D.3 Pulsation

The pulsation tab shows the pulsation graphics. Here you have the possibility to examine the graph thoroughly and recognize detail information.

A pulsation graphic can be transferred and displayed as follows:

1. Readout of MT52 content, see Chapter D.2.1.
2. Displaying the measurement either by
   a) Double-clicking on a pulsation measurement
   b) Selecting a measurement by right-clicking → "Show this measurement"
   c) Double-clicking on a measurement in the tab “Pulsation Overview”, see chapter D.4.
D.4 Pulsation overview

In Chapter D.3 you learned about how to read out and display individual pulsators. This can be important in the case of a fast decision on which measurements are interesting and should be evaluated further.

If you want to summarize only a couple of pulsators, for example all pulsators of an individual farm, and save to a single file, it is recommended to do as follows:

1. Choose the pulsator in question in the data directory (tab MT52 Data)
2. Position the mouse cursor on the selected pulsators and select “show this measurement” after right-clicking
3. The pulsators will be transferred to the PC and displayed in the overview.

The pulsation graphic can now be displayed by clicking on the respective entry in the list.

To transfer the graphic data of a pulsation from the MT52 to the PC, the checkbox must be activated.
D.5 Fluctuation

After the transfer of the fluctuation data, the fluctuation measurements are displayed in the form of a diagram. The cursor can now be moved with the mouse to analyze individual parts of a measurement more thoroughly.

Details about how to operate a graphic can be found in chapter D.2.3.
D.6 Milking Time Test

This measurement program allows you to record and analyze the relation between animal and milking plant during the entire milking period. Head vacuum and pulsation are thereby recorded at the same time. The user can integrate visual perceptions into the measurement’s display with the help of the marker keys.

Details about how to operate a graphic can be found in chapter D.2.3.
D.7 Thermometer

After the fluctuation data have been transferred, they are shown in a diagram. Now you can move the cursor using the mouse, to analyse specific parts of the measurement in more detail.

See section 0 for details about how to use the diagram.
D.8 General

D.8.1 License keys

If you have bought the PC program, you have received a six-figure license key with which you can activate the individual modules of MT52 and PC program.

The MT52 must be connected to the PC.

1. Choose "Settings -> Options".
2. Enter the six-figured license key in the correspondent line.

Note: As long as the license key is not entered correctly (the green light next to "online" stays dark), the program only runs in demo mode. In demo mode you cannot save any measurements.
3. To finish this operation and save the keys, choose the menu "File -> Exit".

It is possible to connect more than one MT52 to a single PC. To do so, you need to repeat these steps for each device.
D.8.2 Firmware update

Bepro AG provides its MT52 customers with software updates, so that your MT52 device always applies to the latest developments in technology. Under [www.bepro.ch/messtechnik_download.html](http://www.bepro.ch/messtechnik_download.html) you will find the latest MT52 device software (firmware) ready to download at any time.

🎉 Note!
With a failed firmware update a MT52 can be put out of action.

1. Switch on the MT52. Make sure that power supply will be available during the entire update process.
2. Connect the MT52 to the computer and start up the MT52 PC Program V2.0
3. Choose „Settings -> Firmware Update“.
4. Select the firmware file:
   e.g. MT52-211-A1.bin
   and press the OK button
5. The firmware is now transferred to the MT52.
6. Then the device will be programmed. This process can take several minutes.
7. The MT52 starts with the freshly installed software after the programming is completed. The download process is finished.
D.9 Microsoft Word documents

The MT52 PC Software Versions 2.0 or higher provide a connection to Microsoft Word. This allows the user to transfer measurement values and graphics to a Word document with only a few mouse-clicks.

For this option, Microsoft® Word® 2003 or higher is required. You will find information on the Microsoft® Office® package at [http://office.microsoft.com](http://office.microsoft.com).

D.9.1 Create a Microsoft Word report

To create a Word Report document, do as follows:

1. Connect the MT52 to the computer and read out the content, see chapter D.2.1.
2. Select the measurements you wish to include in the report.
3. Click on the button “create a report in Microsoft Word” or after a right-click “Create report”.

The measurement values and their graphics appear in the same order as they have been selected!

4. Chose between a 1-column layout (maximal two measurements per page), or a 2-column layout (maximal four measurements per page).

5. After you have chosen the layout, a Word document will open and the measurement values as well as the corresponding graphics will be inserted into the Word document.
6. As soon as the transfer of the measurement data to the Word document is completed, you will be asked to name the file and if you want to print out the report.
D.9.2 Create individual Word report templates

You have the possibility to adapt the Word report document to your individual wishes. Basically there are no limits of how to design this document. Headers and footers, logos and individual text passages can be defined at will in a *.dot template.

The following files are required to create a Word report. They are stored in the directory C:\MT52:\:

- Report_1Column.dot  This is the template for a 1-column report file
- Report_2Column.dot  This is the template for a 2-column report file
- MT52.ini  In this file, path and file name of the templates are listed

Make sure to save a security copy of the above-mentioned files.

The *.dot templates are Word templates that are needed when a report is created. The templates can entirely be adapted to the user’s needs and wishes.

Important: The following text markers are required in the Word template (case sensitivity!):

- Titel  Placeholder for the report’s title
- Betrieb  Placeholder for the farm’s name
- User  Placeholder for the user’s name
- Serial  Placeholder for the MT52’s serial number
- SWVersion  Placeholder for the MT52’s software version
- Datum  Placeholder for the actual date
- Zeit  Placeholder for the actual time

In Word, text markers can be created and changed in the tab Insert, Field Hyperlinks, create text mark. Read Word help for more detailed information.

![Create a text mark in Word](image)

Measurement results and graphics are always inserted at the end of the document.

After the templates have been created, the PC software must be ‘informed’ about the Word template’s names. Set the two keys:

```plaintext
SingleColumn.dot
DoubleColumn.dot
```

in the configuration file MT52.ini under section [Settings] according to your own templates. For example:

```plaintext
SingleColumn.dot="C:\MT52\template_1column.dot"
DoubleColumn.dot="C:\MT52\template_2column.dot"
```

Or in the spelling:

```plaintext
SingleColumn.dot="/C/MT52/template_1column.dot"
DoubleColumn.dot="/C/MT52/template_2column.dot"
```
E  ISO 6690 Protocol

This program helps you to do the measurements according to ISO 6690 and it fills out the report form for you.

The farm data can be entered in a comfortable way on your PC and then they will be transferred to the MT52. On farm side the MT52 leads you step by step through the measurement procedure. It helps you executing all necessary calculations of course. And it knows also the correct system settings and informs you about changes to be made for an individual measurement.

The order of measurements can be chosen freely. Except if information from a previous measurement is needed first.

Measurements can also be repeated in case of a mistake on your side. But then it might happen that the MT52 informs you that it might be necessary to repeat ‘the subsequent’ measurements as well.

After, all the measurements can be transferred to the PC to be evaluated in a Microsoft Excel © sheet. This makes it possible to make changes in the visual appearance of the form in an easy way.

Notes
- In these instructions, we describe the measurement procedure according to ISO 6690. Different adoptions have been made to meet country specific regulations. In Chapter C.1 Settings on page 28, select the adoptions you would like to work with.
- It is possible to work completely without a PC. Therefore the farm data can be entered into the MT52 directly. The measurements and results can be printed out on the MT52 printer.
- The ISO report software can only be used together with our automatic Air-Flow-Meter (AFM)
- Microsoft Excel © needs to be installed on the PC for evaluation and printout.
E.1 Preparation and entry of farm data

As a preparatory work, the general farm data and some limits have to be captured. This can be done in a comfortable way on PC or directly in MT52.

E.1.1 The template files

On your CD for the PC program, you will find several template (or sample) Excel files. They show country-specific adoptions for the visual appearance of the ISO report form. Please contact your dealer if you wish further adaptations.

You can archive your customer data saving the template by saving it under another filename. Use, for example, the customer’s name and the date as filename (Miller-2004-january-14.xls). So you can use the file next time and you don’t have to re-enter the farm data.

The excel-file contains two (visible) sheets:
- Preparation: To enter farm data and limits
- Evaluation and results: Measurement results will be transferred into this sheet.

The fields where no changes or entries are allowed are protected.

E.1.2 Entry of farm data on PC

- Start Microsoft® Excel® and open the template file (or the farm’s last year file). See also above: The template files
- Save the file by a meaningful name.
- Fill in the sheet ‘Preparation’ with farm data and farm-dependant limits.
- Connect MT52 and PC by the serial link cable
- Switch on MT52
- Start the PC-Program and read out the MT52 data, see chapter D.2.1. Select one of the four farms where you want the prepared data be written to.

- Select the Icon to transfer from PC to MT52
- You will be asked for the Excel file into which you entered the farm data. Take the file you previously saved.
- The data will be transferred to the MT52 now.

- It is possible to save up to 4 different farms on MT52 at the same time.

- Attention! This particular farm data will be erased and overwritten!
E.1.3 Entry or change of farm data on MT52

After the transfer, the farm data can be modified on MT52. It is even possible to work without any PC, entering all data directly in MT52:

**Farm data:**

<table>
<thead>
<tr>
<th>Farm data</th>
<th>MILLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm</td>
<td>MILLER</td>
</tr>
<tr>
<td>Technician</td>
<td>J.BUCK</td>
</tr>
<tr>
<td>Pipelinge milking</td>
<td>YES</td>
</tr>
<tr>
<td>Parlour</td>
<td>YES</td>
</tr>
<tr>
<td>Nr.of milk.units</td>
<td>04</td>
</tr>
<tr>
<td>Aut.shut off v.</td>
<td>YES</td>
</tr>
<tr>
<td>Ancillary demand</td>
<td>000</td>
</tr>
<tr>
<td>Nr.of milk.cooks</td>
<td>00</td>
</tr>
<tr>
<td>Nr.of vacuum taps</td>
<td>02</td>
</tr>
</tbody>
</table>

**Farm limits:**

These are limits which are mostly given by the producer of the milking equipment. Limits given by the ISO standards do not appear, since they cannot be changed.

<table>
<thead>
<tr>
<th>Farm limits</th>
<th>MILLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vac on plant</td>
<td>48.0</td>
</tr>
<tr>
<td>Max.difference+/-/</td>
<td>1.0</td>
</tr>
<tr>
<td>Cluster:Air adm.</td>
<td>04.0</td>
</tr>
<tr>
<td>Puls rate</td>
<td>60</td>
</tr>
<tr>
<td>A+B Phase % 1</td>
<td>60</td>
</tr>
<tr>
<td>A+B Phase % 2</td>
<td>60</td>
</tr>
<tr>
<td>ACR flow rate</td>
<td>000</td>
</tr>
</tbody>
</table>

- Target vacuum on plant
- Maximum difference from target
- Maximum calculated air admission
- Pulses per minute
- Different values for front and rear
- Flow rate for automatic cluster remove

E.2 Measurements

E.2.1 Vacuum- and Air-Flow measurements

Preparation:
- We recommend using separate measurement hoses from Vp, Vr, and Vm to a central point, at which the MT52 can be positioned. These lines do not have to be installed fix; they can be removed after the tests.
- An additional help is a ‘switch-box’ with manual valves, switching one of the lines to MT52’s channel 1.
- Prepare the AFM to measure at the receiver (A1) and connect the cable to the MT52.
- Select the menu point [ISO-Report>Measure>Vacuum]
- The AFM will be initialised now.
- You now have the possibility to close the diaphragm. This is necessary if you start with the first measurement point in the report. (E.1.1 No air flow at A1).

It is possible to leave the report measurements to ‘do another measurement’ and to continue later with report measurements. For this case it must be possible to leave the air flow in a certain position.

Now the overview for vacuum measurements is displayed:
Overview for vacuum- and Air-Flow Measurements

The requested measurement can be selected here:

<table>
<thead>
<tr>
<th>Vakuum</th>
<th>MILLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE ME A1 (Vm=44.6)</td>
<td>Current installation settings (see below)</td>
</tr>
<tr>
<td>1.7 Working vac. Vr</td>
<td>( ) Value with error, (?) would be illogical</td>
</tr>
<tr>
<td>1.8 Working vac Vp</td>
<td>(✓) value is ok.</td>
</tr>
<tr>
<td>1.10 Vac. regulator Vr</td>
<td>Current measurement: select using ▲ and ▼. Start by ENT</td>
</tr>
<tr>
<td>1.12 Drop Vr-Vm</td>
<td>(o) Measurement or calculation not yet possible</td>
</tr>
<tr>
<td>Stored :00.0</td>
<td>Currently in 1.11 saved value</td>
</tr>
</tbody>
</table>

Installation Settings for current measurement

On the second display line you will find instructions for the actual installation setting:

Meaning of the Symbols:

<table>
<thead>
<tr>
<th>Regulator unit</th>
<th>ME</th>
<th>Activated</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE</td>
<td></td>
<td>Not activated</td>
</tr>
<tr>
<td>Milking units</td>
<td>ME</td>
<td>Activated</td>
</tr>
<tr>
<td>Air flow entry</td>
<td>A1(Vm=44.6)</td>
<td>Example: Air entry at A1, given by a vacuum value of 44.6kPa measured at Vm</td>
</tr>
</tbody>
</table>

As soon as you save a Measurement, the MT52 expects that you did the correct corresponding installation setting!

So it is possible to instruct you always for needed changes in the system setting. As soon as something has to be changed, the symbol in the display will be flashing.

Example: RE ME A1 (Vm=44.6)
Meaning: The regulating unit (RE) stays activated, the milking units should now be switched on. And the actual air inlet at A1 should be set by the AFM to have a vacuum of 44.6kPa at Vm

By pressing ENT key, the selected measurement program will be activated:

Example: Vacuum measurement (called from the example above)

<table>
<thead>
<tr>
<th>1.11 Kontr.VH an Vr</th>
<th>Settings are ok</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE ME A1 (Vm=44.6)</td>
<td>Connect Vr to CH1</td>
</tr>
<tr>
<td>Vr at CH1!</td>
<td>Current measured vacuum value (like a manometer)</td>
</tr>
<tr>
<td>measuring: 44.7</td>
<td>Stored: 00.0</td>
</tr>
<tr>
<td>&lt;ENT&gt;=stored</td>
<td>&lt;ENT&gt;=stored</td>
</tr>
</tbody>
</table>

- Press on the ENT key to store the currently measured value.
- Change to next program by pressing the ▲ and ▼ keys
- Back to the overview by pressing the C key

Notes:

- Save value by pressing the ENT key: If it happens that you have to repeat subsequent measurements, the MT52 shows the following note: <Afterward stored values will be erased! Save anyway?>
  <C>=NO <ENT>=YES
  The corresponding values will be erased after confirmation by pressing the ENT key.
E.2.2 Control characteristic

Choose [Control characteristic > Attachment Test] to do an attachment test, or [Control characteristic > Fall Off Test] to do a fall off test. The two tests follow the same process. The measurement of the control characteristic is divided into 5 steps (phases 1 to 5).

Phase 1: stable phase with milking cluster closed.
Phase 2: milking cluster opened, undershoot of control characteristic is measured.
Phase 3: stable phase with milking cluster opened.
Phase 4: closing of milking cluster, overshoot of control characteristic measured.
Phase 5: stable phase with milking cluster closed.

Each phase must be started individually. Start with the first phase, as the subsequent phases can only be measured after the preceding phase has been captured. A blocked measurement is marked with a (o).

Choose [Control characteristic > Attachment Test > Phase 1] and confirm the measurement’s start by pressing the ENT key.

During phases 2 and 4, at least one milking cluster, respectively one teatcup, must be closed or opened. A predefined recording time is given for each action. You can define the recording time for phases 1, 3 and 5, and for the phases 2 and 4. Under “System -> Settings” you find the two entries „Rep. Ph. 1,3,5“ and „Rep. Ph. 2,4“. The recording time is set to 5, respectively 15 seconds as factory settings.

After you have measured all 5 phases, undershoot and overshoot, as well as the vacuum drop between phase 1 and 3 are calculated automatically. The graphics of the 5 phases are summarized to one single graphic that is then displayed.

To look at the control characteristic at a later time, choose one of the 3 calculated values, here 1.7 Undershoot, and press the ENT key. The graphic will be displayed as showed above. The start of each phase is indicated by the marker M1. In phases 2 and 4, the extreme values (undershoot and overshoot) are indicated by the marker M2.

Marker 3 indicates the point at which the vacuum reached the average value of the following stable phase (in phases 3 and 5).
In the MT52 PC Program, the individual phases of the control characteristics are displayed as fluctuation measurements FLUKT 7 to FLUKT 11, as well as a summarized control characteristic under REGELKL12. A double-click on REGELKL12 displays the measurement of the 5 phases.

* The numbering of the measurements may vary.

E.2.3 Milking units

These measurements have to be executed by a special AFM for small amounts. The results have to be entered manually into the MT52. For automatic measurement with the MAF, refer to chapter B.6.

<table>
<thead>
<tr>
<th>Milking units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>eNumber</td>
<td>01</td>
</tr>
<tr>
<td>✓ Leak shut-off</td>
<td>02.0</td>
</tr>
<tr>
<td>✓ Total air adm.</td>
<td>06.0</td>
</tr>
<tr>
<td>✓ Leakage cluster</td>
<td>01.5</td>
</tr>
<tr>
<td>E-&gt;vent admission</td>
<td>04.5</td>
</tr>
<tr>
<td>✓ ACR-flow rate</td>
<td>OK</td>
</tr>
<tr>
<td>✓ AF at cluster</td>
<td>000</td>
</tr>
</tbody>
</table>

Unit No.
Leakage shut-off (max 2lt/min)
Total air admission (max 12lt/min)
Leakage in cluster (max 2lt/min)
Air vent admission (maximum entered in Farm limits)
Milk flow for automatic cluster remove
Air flow at cluster (min 65lt/min)

E.2.4 Pulsators

For these measurements, the MT52 uses its pulsator measurement program for extended measurements. For further information refer to chapter B.3 Measurement program: Pulsation on page 11. Limits you defined in farm limits will be adapted automatically.

E.2.5 Vacuum taps

Use this program to measure and store the vacuum drop automatically:
- Connect the 150lt cone via T-piece to MT52 and the tap to be checked.
- Close the opening at the 150lt cone by your finger tip.
- Start the measuring program. Or reset it by if it is already started.
- Remove your finger from the opening to allow a flow of 150lt/min
- The MT52 calculates the vacuum drop continuously.
- Store the value with ENT.
Vacuum Taps MILLER

<table>
<thead>
<tr>
<th>Tap Nr</th>
<th>Manometer</th>
<th>Max-Min</th>
<th>Vacuum drop</th>
<th>Stored</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>43.5</td>
<td>44.8–43.5</td>
<td>01.3</td>
<td>00.0</td>
</tr>
</tbody>
</table>

Actual tap: Enter another number to change the tap
Actual manometer reading
Measured maximum- and minimum-value
Continuously calculated difference.
By ENT saved value
Reset min. and max. with the key.

E.2.6 Maintenance

Use the and keys to choose among the following options:

- ----- not (yet) answered
- OK Is all right
- NOK Is not all right
- FIXD has been repaired
- ERS has been replaced
- NON Not available

E.3 Evaluation

E.3.1 Printout by using the MT52 printer

Start the print out in: ISO Report>Print Out

A printout is also possible if not all measurements have been executed completely.

E.3.2 Transfer to the PC

The more comfortable way for evaluation is using the PC’s Microsoft® Excel® sheet that has been used to prepare farm data:

- Start the PC-Program and read out the MT52 data, see chapter D.2.1. Select one of the four farms.
- Select the Icon to transfer from MT52 to PC
- You will be asked again for the Excel® file, where the farm data have been prepared. Take the file, where you saved the farm’s data, see chapter E.1.2.
- Afterwards, the data will be transferred to the evaluation sheet of the file. You can print out this sheet as a complete ISO 6690 Report.
## F Technical data

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vacuum-Sensors:</strong></td>
<td>Vacuum/Overpressure/AD-converter resolution/accuracy/Device-internal/External pluggable</td>
</tr>
<tr>
<td></td>
<td>60 kPa/20 kPa/12 Bit/2 sensors/2 sensors (option)</td>
</tr>
<tr>
<td></td>
<td>The sensors are resistant to water and slightly alkaline fluids.</td>
</tr>
<tr>
<td></td>
<td>The optional rinsing system enables the sensors to be rinsed with cleansing fluid.</td>
</tr>
<tr>
<td><strong>Air-Flow-Meter:</strong></td>
<td>(Option)</td>
</tr>
<tr>
<td></td>
<td>Measuring range/accuracy at 50 kPa</td>
</tr>
<tr>
<td></td>
<td>10 bis 3'500 l/Min/+/-5%</td>
</tr>
<tr>
<td><strong>Display:</strong></td>
<td>LCD module</td>
</tr>
<tr>
<td></td>
<td>Display field</td>
</tr>
<tr>
<td></td>
<td>128 x 64 Pixel graphic/71 x 39 mm illuminable</td>
</tr>
<tr>
<td><strong>Memory:</strong></td>
<td>Flash/512kB/SRAM 4 MB</td>
</tr>
<tr>
<td><strong>Additional Measuring Connections:</strong></td>
<td>Analogue entrance (Evaluation with fluctuation / manometer)</td>
</tr>
<tr>
<td></td>
<td>Measuring range/Max. voltage/50 V/50 kOhm</td>
</tr>
<tr>
<td></td>
<td>Switch on level at Switch off level at Max. Voltage/3 V/2 V/30 V/5 kOhm</td>
</tr>
<tr>
<td></td>
<td>Measuring range/Max. Voltage/5 kOhm</td>
</tr>
<tr>
<td><strong>Interfaces:</strong></td>
<td>to PC: RS-232/to printer: Infrared (IrDa 1.0)</td>
</tr>
<tr>
<td><strong>Input voltage:</strong></td>
<td>For mains power and battery charging</td>
</tr>
<tr>
<td></td>
<td>7.5 V DC (mind. 1.3 A) until 15 V DC (mind. 750 mA)</td>
</tr>
<tr>
<td><strong>Batteries:</strong></td>
<td>6 UM-3 mignon cells installed/Ni-metal hybrid 1.2V 1200 mA</td>
</tr>
<tr>
<td></td>
<td>10 to 20 hours, depending on use of illumination and operation of the air flow meter</td>
</tr>
<tr>
<td></td>
<td>3 hours</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>Operation temperature/Storage temperature</td>
</tr>
<tr>
<td></td>
<td>+ 5 until + 35 °C/-10 until + 70 °C</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td>(L x B x H)/Weight MilkoTest MT52</td>
</tr>
<tr>
<td></td>
<td>225 x 107 x 40mm/670 g</td>
</tr>
</tbody>
</table>
### F.1 Measurement programs

<table>
<thead>
<tr>
<th>Manometer</th>
<th>Display of vacuum and 0-28V-entrance</th>
<th>Current measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Pulsation</td>
<td>Measurement range number of Pulsations</td>
<td>30-450 p/min</td>
</tr>
<tr>
<td></td>
<td>Time base</td>
<td>1ms</td>
</tr>
<tr>
<td></td>
<td>Number of measurements</td>
<td>Max. 230 (with diagram)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or 6200 (without diagram)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>according to ISO standards or extended</td>
</tr>
<tr>
<td>Fluctuation</td>
<td>Measurement program „Short“</td>
<td>10 seconds / 200Hz (5ms)</td>
</tr>
<tr>
<td></td>
<td>Measurement program „Long“</td>
<td>15 minutes 20 Hz (50ms)</td>
</tr>
<tr>
<td></td>
<td>Measurement program „Extended“</td>
<td>Time of Measuring: 1 to 2 3/4 Std h</td>
</tr>
<tr>
<td></td>
<td>Evaluation:</td>
<td>Tim base: 2000Hz (0.5ms)</td>
</tr>
<tr>
<td></td>
<td>Measuring channels:</td>
<td>to 1Hz (1.s)</td>
</tr>
<tr>
<td></td>
<td>Marker</td>
<td>Diagram with zoom functions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top value, average value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 x internal vacuum (CH1 + CH2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 x external vacuum (CH3 + CH4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-28V analogue voltage (CH5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 x digital (CH6+7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 cursors</td>
</tr>
<tr>
<td>Milking Time</td>
<td>Recognizing of measurement values</td>
<td>Recognizing of pulsation over CH1</td>
</tr>
<tr>
<td></td>
<td>Marker:</td>
<td>head vacuum over CH3 (external)</td>
</tr>
<tr>
<td></td>
<td>Number of measurements</td>
<td>4 Cursors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max. 140 measurements</td>
</tr>
<tr>
<td>Micro Air-For Meter</td>
<td>Range of measurement</td>
<td>0 – 300l/min</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
<td>2% or 0.05l/min</td>
</tr>
<tr>
<td>Air-Flow-Meter</td>
<td>Range of measurement</td>
<td>50 to 3500l/min</td>
</tr>
<tr>
<td></td>
<td>Resolution</td>
<td>2 l/min</td>
</tr>
<tr>
<td></td>
<td>Precision</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Absolute-pressure recorder</td>
<td>for automatic correction of the height over the sea</td>
</tr>
<tr>
<td>Speedometer</td>
<td>Range of measurement</td>
<td>500 to 5000 min'</td>
</tr>
<tr>
<td></td>
<td>Distance</td>
<td>ca. 20 cm</td>
</tr>
<tr>
<td>Thermometer</td>
<td>Range of measurement</td>
<td>-20 to 110 °C</td>
</tr>
<tr>
<td></td>
<td>Deviation</td>
<td>2%</td>
</tr>
</tbody>
</table>

### F.2 Layout of AUX connector

<table>
<thead>
<tr>
<th>Analogue input 0-28V (CH5) (measurements with manometer and fluctuation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>(-) GND</td>
</tr>
<tr>
<td>(+) Plus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital inputs CH6+CH7 (fluctuation measurement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>(-) GND</td>
</tr>
<tr>
<td>Dig1</td>
</tr>
<tr>
<td>Dig2</td>
</tr>
</tbody>
</table>

Switch-on level at
Switch-off level at
Maximum entrance voltage
Resistance of entrance

3V
2V
30V
5kOhm