PulsoTest Comfort (V 1.2)

Test unit for pulsation and vacuum measurements in milking installations

Instruction Manual
(Translation of the original operating instructions)

7037-9001-031
09-2013

Contents

1 Preface

1.1 About this manual

The manufacturer reserves the right to make changes due to technical developments in the data and illustrations in this manual.

Reproductions, translations and copies of any kind, even of extracts, require written authorization from the manufacturer.

Abbreviations, units, technical terms, special names or industry-specific terminology used in this manual are explained in more detail in the "Appendix".

These instructions are part of the supply.

- They should be kept close at hand and remain with the equipment even if the equipment is sold.
- This manual is not subject to an amendment service. The most recent version at any time can be obtained through the technical dealer or directly from the manufacturer.

Required documents:

- Instructions on components connected with the product:
  (not a complete list)

Part number	Description	
7037-90 . . -032	Air flow meter	AFM 3000L

Pictograms used

This pictogram indicates information that will help towards better understanding of a procedure or operation.

A correction bar in the margin indicates changes to the previous edition. The character string "!!" in the search field of the PDF document locates the correction bar.

Refers to another document or chapter.

If a manual number is given, the middle 4 figures indicate the language, as follows:

	Language		**Language**		**Language**
-9000-	German	-9013-	Dutch	-9032-	Serbian
-9001-	English (United Kingdom)	-9015-	English (America)	-9034-	Slovakian
-9002-	French (France)	-9016-	Polish	-9035-	Chinese
-9003-	Italian	-9018-	Japanese	-9038-	Portuguese (Brazil)
-9004-	Romanian	-9021-	Danish	-9036-	Lithuanian
-9005-	Spanish	-9022-	Hungarian	-9039-	French (Canada)
-9007-	Swedish	-9023-	Czech	-9040-	Latvian
-9008-	Norwegian	-9024-	Finnish	-9041-	Estonian
-9009-	Russian	-9025-	Croatian	-9043-	Spanish (North America)
-9010-	Greek	-9027-	Bulgarian		
-9012-	Turkish	-9029-	Slovenian		
Not all of the above languages may be available.					

1.2 Manufacturer's Address

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Siemensstraße 25-27
D-59199 Bönen

☎ +49 (0) 2383 / 93-70
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✉ contact@gea.com
@ www.gea-farmtechnologies.com

1.3 Customer services

Authorised Technical Dealer

If necessary, please contact your nearest authorized GEA WestfaliaSurge Inc. dealer.

There is a comprehensive dealer Internet search function on our website at the following address:

www.gea-farmtechnologies.com

European Contact Information:

GEA Farm Technologies GmbH
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D-59199 Bönen

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1.4 Declaration of conformity

Declaration of conformity in accordance with the machinery directive:
2006/42/EC - Annex: II A

Manufacturer:	**GEA Farm Technologies GmbH** **Siemensstraße 25-27** **D-59199 Bönen**
Product description:	**Test unit for pulsation and vacuum measurements in milking installations**
Type of product:	**PulsoTest Comfort**

The named product is in conformity with the requirements of the following European directives:

2006/95/EC	Low Voltage Directive
2004/108/EC	Responder settings

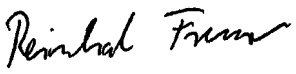
Conformity with the requirements of these directives is testified by complete adherence to the following standards:

- Harmonized European standards

EN 61000-6-1 (2007-10)	Electromagnetic compatibility (EMC) Basic technical standard on testing the immunity of devices in the domestic, business and commercial field
EN 61000-6-3 (2007-09)	Electromagnetic compatibility (EMC) Basic technical standard on measuring the interference emitted by devices in the domestic, business and commercial field

Person responsible for compiling the relevant technical documents:	Josef Schröer GEA Farm Technologies GmbH Siemensstraße 25-27 D-59199 Bönen ☏ +49 (0) 2383 / 93-70

Bönen, 24thJune2010



Reinhard Frenser
(Head of Module and Technology Management)

The undersigned is acting by virtue of power of attorney from the management of:
GEA Farm Technologies GmbH, Siemensstraße 25-27, D-59199 Bönen

This declaration certifies compliance with the guidelines indicated, but does not establish any guarantee in the sense of paragraphs 443, 444 of the BGB.
This declaration of conformity becomes invalid if design changes are made which affect the technical data given in the instructions and the correct use of the product, thereby significantly altering the machine!

2 Safety

2.1 Owner's duty of care

The product has been designed and constructed taking account of a potential risk analysis and after careful selection of the compliant harmonized standards and other technical specifications. It therefore ensures a maximum level of safety.

This safety can only be achieved in practice on the farm however when all of the necessary measures have been taken. It is part of the farmer's obligation of care to plan these measures and check that they are carried out.

The owner must ensure the following:

- Anyone who performs work or activities relating to the machine must carefully read the manual and sign to confirm that they have understood it and will act accordingly!
- A full set of legible instructions is always kept by the product so that anyone who has to carry out work on the product can look at the instructions at any time.
- Everyone who has to perform activities on the product must be able to view the manual at any time.
- The legal requirements must be observed.
- The product may only be used for its intended purpose.
- The product may only be used if it is in perfect working condition.
- The work to be carried out may only be performed by a suitably qualified person.

2.2 Explanation of safety symbols

The safety symbols draw attention to the importance of the adjacent text.

They are based on ISO 3864-2 and ANSI535.6.

Safety symbols and signaling word

Warning:
The indication "Warning" signals danger to life or health of personnel. Death or serious injury may result if the danger is not avoided.

Attention!
The indication "Attention" signals important information on risks for the product or the environment.

3 Description

3.1 Correct applications

The product described has been designed for use in agricultural (mainly milk producing) environments.

PulsoTest Comfort is intended only for testing milking machines.

Applications which are not listed here are not part of the intended purpose and are therefore considered as improper use!

The manufacturer/supplier is not liable for any resulting damage. The user alone bears the risk

Correct use also includes reading the instructions and observing the inspection and maintenance conditions.

- We would specifically like to point out that parts or accessories not supplied by ourselves and setting instructions not provided by the manufacturer/supplier are not checked or released by us either.
- The installation or use of products from other manufacturers may affect the specified properties of the original parts and lead to injury to people and animals.
- The manufacturer does not accept any liability for injury to people or animals, or damage to the product, caused by the use of products from other manufacturers.

3.2 Changes to the product

Unauthorized changes to the product may adversely affect the safety, service life or operation of the product.

Any modifications not described in the product documentation are deemed to be prohibited.

For safety reasons, do not carry out any unauthorized changes!

Any changes to the product must be approved in writing, by the manufacturer.

Unauthorized, unapproved changes to the product will invalidate the warranty and might also invalidate the manufacturer's declaration or declaration of incorporation.

3.3 Technical specifications

General data

Processor	16 Bit, 25 MHz
LCD display	240 x 128
Keys	18
Memory	4 MB
Measuring range	+40 bis -60 kPa
Measuring accuracy	<0,6 kPa
Measuring solution	0,1 kPa
Power supply	4 x AA - NiCd / NiMH
Interfaces	RS232, 0-5 V Sensor (2)
Degree of Protection	IP65
Dimensioning	220 x 130 x 30 mm
Operating Temperature	5-40 °C
Storage temperature	-20 - +60 °C
Weight	1000 g (excluding batteries)
Tests	EN 61000-6-3, EN 61000-6-1

External sensors

External sensors	Pressure	Temperature	Voltage	Speed
Measuring range	+40 - -50 kPa	-20 - +140 °C	0-30 V	0-9999
Measuring accuracy	<0,6 kPa	±1,5 %	±1 %	±1 % + 1 Digit
Measuring solution	0,1 kPa	0,5 K	0,1 V	1 U/min

4 First Start

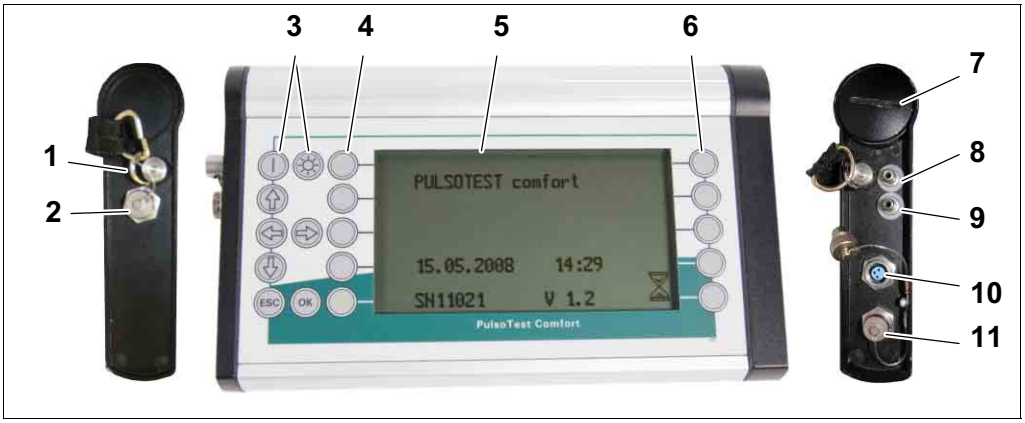
Before using the tester for the first time, insert either four new 1.5 V batteries (AA) or rechargeable batteries (NiCd or NiMH) in the battery compartment, as follows:

- Remove the battery compartment cover by turning in the anticlockwise direction with a coin or screwdriver.
- Place a hand beneath the battery compartment and tip the tester to the right so that any batteries already inside slide out into your hand.
- Tip the tester to the left.
- Insert four new batteries, positive pole first, into the battery compartment.
- Close the battery compartment cover by turning in the clockwise direction and tighten securely with a coin or screwdriver.

Attention!
The power supply may fail if the battery compartment cover is not closed tightly enough.
This may lead to loss of data and may damage the tester.

5 Operation

5.1 Description of the operating elements



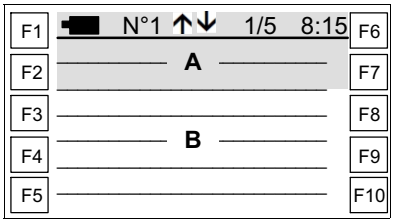
Item	Description	
1	Retaining eye	
2	Serial interface	
3	Keys	
4	Function keys	F1 - F5
5	LCD display	LCD
6	Function keys	F6 - F10
7	Battery compartment	
Connections		
8	CHANNEL 1	(internal)
9	CHANNEL 2	
10	CHANNEL 3	(external)
11	CHANNEL 4	

5.1.1 Keys

Key	Function		LCD
	Device	• on • off	
	Navigation keys	• Moving in the menu (same as the arrows in the LCD display)	↑ ↓ ← →
	ESC	• Go back • Stop action	
	Backlight	• on • off	
	OK	• Confirm action	

5.1.2 Structure of the LCD display

The structure of the LCD display is essentially the same in all of the programs.

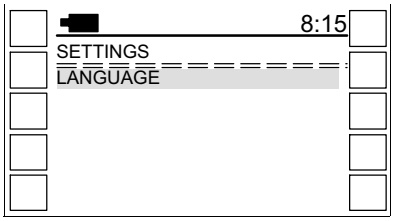


A	**Top line** General Information ● Charge status ● Record number (N°1) ● Hidden lines / more display ● Number of screens (1/5) ● Time Title line ● Menu ● Program ● Menu point ● Program data
B	**Body** ● Top line ● Data lines
F1-F10	**Function keys** There are five frames on each side of the LCD display. These symbolize the function keys next to them. These frames will contain different symbols depending on the program and function.

Text in the LCD display

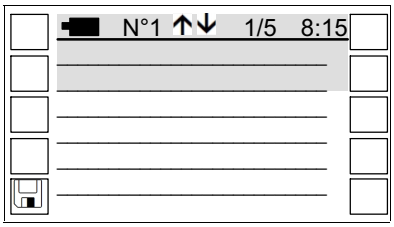
The program texts in the LCD display are not available in all languages and may vary from the language of these instructions.

- The languages available are displayed in the menu shown.



5.1.3 Function keys

- The function keys are allocated according to the program.
- The functions of the keys are shown by symbols.
  - The key next to the symbol performs the corresponding function.
    Example:
    The values of most measurements can be saved by pressing the function key next to the diskette symbol.



  - If there is no symbol, the key in question does not have any function.

Symbol	Functions		LCD
	Open limit value database		
	Previous record		N°2
	Next record		N°5
	Scroll within a record	• Previous screen	(2/5)
		• Next screen	(4/5)
	Start measurement manually		
	Interrupt or end measurement		
§	Open limit value database		
✓	Confirm or continue action (e.g. deleting data)		
✕	Cancel action		
	Edit heading (designation)		
←A B→	Change global limit value database The global limit value database is a master template for creating local limit value databases. Program: PULSATION		
	Change view More information in the description of the corresponding sub-program.		
	Zoom in on measurement curve 2-screen display		
	Linear function Shift the 0-line		
	Print current measured values or stored data		
	Save the current measured values		
	Delete stored data The deleted memory location can be used again with the same designation.		
❄	Freeze display and interrupt measurement		
M	Set marker These markers appear as vertical lines when stored measured values are displayed on the tester or computer.		
	Display		
PC	Send stored data to the computer		
i	Show help		

5.2 Operation

5.2.1 Switch on tester and backlight

Perform the following steps to switch on the tester:

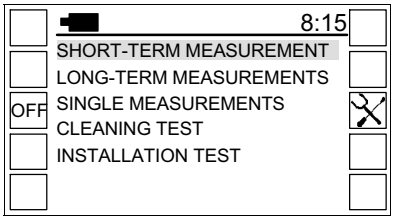
- Remove any connected accessories such as external sensors, airflow meters, printers or data cable.
- Remove any measuring hoses connected to the instrument glands.

Attention!
Switching the test unit on with the pressure or vacuum source connected will cause measuring errors.

Switch tester on

- Press

- The measuring system will be calibrated to the current ambient air pressure.
- Main menu appears



Switch light on/off

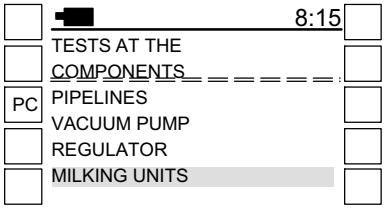
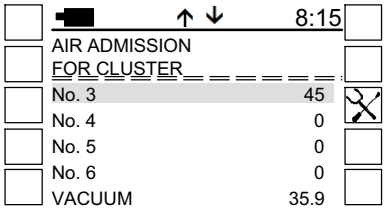
- Press

Note!
Switching off the backlight saves battery power.
The backlight requires an adequate supply of voltage. If it is too low, the tester can still be used for a time without lighting the display.

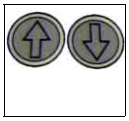
5.2.2 Navigation in the menus and measuring screens

The tester's programs can be reached through various menus.

Selected or active fields are highlighted in the menus and measuring screens.

Menu	Measuring screen
	

Select menu point or data field



- Press
  - Cursor is on the required line

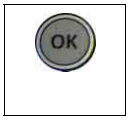
    If a menu contains more than nine lines, the content can be shifted vertically with the arrow keys shown so that the hidden lines become visible.

    Hidden lines are indicated by arrows in the top line

Open submenu / start program

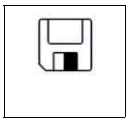
- Press

Close program
(depending on the active program)



- Press

or



- Press function key
  - measured or entered data will be saved

End measurement (without saving)
Press ESC to end without saving or to go back to the previous menu.

- Press

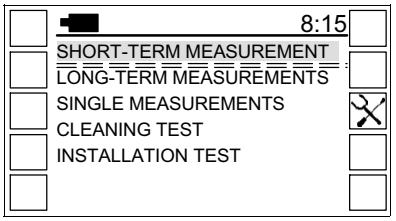
5.2.3 Entering data with the keypad

In some sub-programs data can be entered with the keypad.

The standard procedure in all programs is described with the example of entering user data.

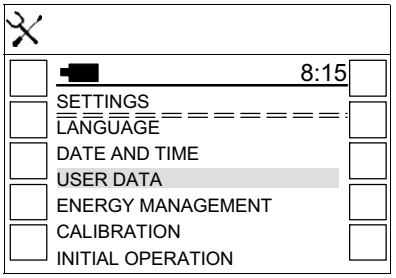
Entering user data

- Display:
  Main menu



Open "Settings"

- Press function key
  - Menu appears



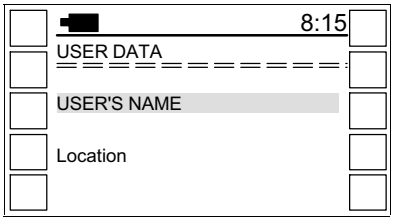
Select menu point
(USER DATA)

- Press

Activate menu point

- Press

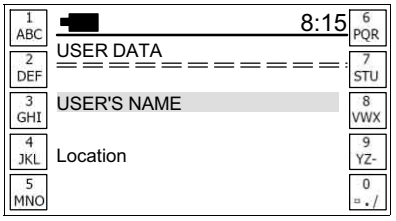
  - Entry screen appears



Activate entry

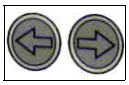
- Press

  - Cursor flashes
  - Keypad appears



Enter data

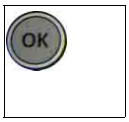
- Keep pressing the key until the required character appears.
  - Then wait until the cursor moves one character to the right.
  - The cursor position can also be moved with the keys shown.



Repeat until the required text has been entered.

End entry

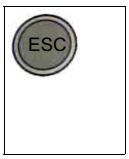
- Press
  - The data will be saved



or

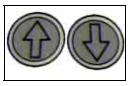
Abort entry

- Press
  - The data will not be saved



Move to the next line

- Press



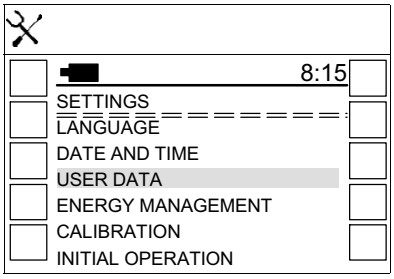
- Enter data
- End entry

5.2.4 Changing the basic settings

Note!
The tester's basic settings can only be changed from the main menu.

Open "Settings"

- Press function key
  - Menu appears



Select menu point

- Press

  - The entry screen will appear
    For all menu items, the settings are changed and data is entered in a separate entry screen.

- Entering data

Menu point	Functions	
LANGUAGE	• Select language for the text displayed	
	• Save	
DATE AND TIME	DATE • Set date and time	
	TIME • Set time	
	• Calibrate clock Function key opens a separate screen	
	Clock slow - Correct with function key	+ (F3)
	Clock fast - Correct with function key	- (F8)
	Save correction - Press function key	
USER DATA	• Enter user data (two lines)	
ENERGY MANAGEMENT	AUTO-OFF [min] • Set the time after which the tester will switch off automatically if no key has been pressed.	
	BATTERIES • Select battery type	
CALIBRATION	• May only be set by trained service personnel with a PIN number • Close submenu	
INITIAL OPERATION		

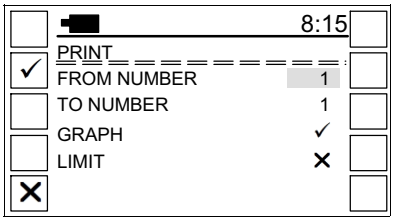
5.2.5 Processing data

All measured values and additional information may be printed, sent to a computer or deleted.

- Press corresponding function key.

Print current measured values or stored data	
Send stored data to the computer	PC
Delete stored data	

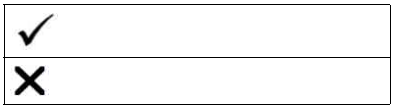
- An entry screen might appear for setting the data range.



Set print option
(GRAPH / LIMIT)
Settings only in menu:SHORT-TERM MEASUREMENT

- Press

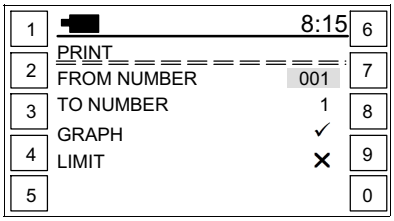
- The data will be printed
- The data will not be printed



Setting the data range

Open data field
- Press

Enter lower value
- Press function keys



Save entry
- Press

Select data field
- Press

Enter upper value
- Same as for "Enter lower value"

Perform action
- Press function key
  - The data will be printed, sent or deleted.

Cancel action
- Press function key
  - The action will be aborted

Printing

Graphs, tables and test reports can be printed as follows:

- Connect printer to the tester's serial interface.

Attention!
Only use the interface cable supplied with the printer. Failure to do so may cause operating faults or damage the printer or tester.

- Switch on printer and set to Online if necessary.
(see printer operating manual)

Print data
- Press function key

Note!
The data range might have to be set.
See section on "Setting the data range"

- Press function key
  - The data will be printed

Deleting

Delete data
- Press function key

Note!
The data range might have to be set.
See section on "Setting the data range"

- Press function key
  - The data will be deleted

5.2.6 Measuring with external instruments

Special accessories available

- AIR-FLOW METER
- External measuring sensors for:
  - VACUUM
  - PRESSURE
  - REVOLUTIONS
  - TEMPERATURE
  - VOLTAGE

Note

Note the following instructions for all external measuring instruments:

Attention!

- Save all current data before connecting an external measuring instrument.
- External measuring instruments should be connected first to the tester described here and then to the corresponding measuring point.
- Only connect measuring instruments to the tester interface provided for them (detailed instructions in the following sections).
- When connecting external measuring devices make sure that the data cable connector is securely screwed to the connector on the measuring device. Otherwise data transmission faults and damage to the devices might result otherwise.
- Disconnect all external sensors from the tester as soon as the measurement has ended.
  Otherwise the batteries will continue to discharge even when the tester has been switched off.

Note!
If the optional rev. counter is used, the following instructions should also be observed and everyone who is in the proximity of the rev. counter should be made aware of these instructions.

Attention! Class 2 laser
Do not look into the laser beam.
Observe standards, safety requirements and the warnings about lasers provided.

Specific instructions on the use of external measuring instruments are given in the following sections together with an explanation of the corresponding measuring program.

5.2.7 Air flow measurements with additional air flow orifices

For testing large installations, in an installation from the milking installation standard, it is recommended that the high air flow be distributed as evenly as possible to the milking installation.

To do this, in addition to the actual air flow meter, other air flow orifices should be connected to the various test nozzles on the installation.

When measuring air flow with additional air flow orifices, the additional air inlet has to be set before the measurement is performed.

- The setting screen is opened in the corresponding measuring programs with the function key. 

Attention!
Only use additional air flow orifices that have a display referring to a measuring vacuum of 50 kPa because the tester described here makes an automatic vacuum correction on the air flow values.

5.2.8 Switching off the tester

- Disconnect all accessories from the tester.

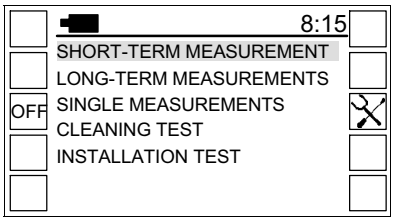
Attention!
Otherwise the batteries will continue to discharge even when the tester has been switched off.

Accessories:
- external sensors
- airflow meters
- micro printers

Switch off the tester

Note!
The tester can only be switched off in the main menu.

- Press function key (OFF)
  - Tester switches off



5.3 Menu structure

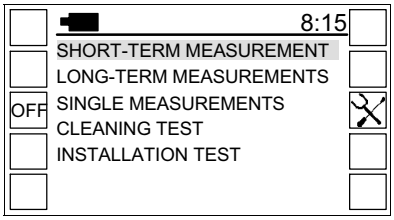
Main menu Submenu ● Menu point - Menu point
SHORT-TERM MEASUREMENT
PULSATION
FLUCTUATION
RANGE
LONG-TERM MEASUREMENTS
ABSOLUTE VALUES
MAXIMUM
MARGINS
SINGLE MEASUREMENTS
VACUUM
PRESSURE
AIR ADMISSION
AIR FLOW
REVOLUTIONS
TEMPERATURE
VOLTAGE
REGULATOR
CLEANING TEST
OUTLET TEMPERATURE
RETURN TEMPERATURE
CONDUCTANCE
WATER SLUG

INSTALLATION TEST
TEST STANDARD
SITE DATA
INSTALLATION DATA
● IDENTIFICATION NUMBER
● TYPE
● DEVICES
● VACUUM PUMP
● CONNECTION POINT A2
● Vacuum tap
● MILKING UNITS
● ANCILLARY EQUIPMENT
MEASUREMENT PROGRAMS
● PIPELINES
- SYSTEM VACUUM
- WORKING VACUUM
- BACK PRESSURE *
- TEST VACUUM
- AIR FLOW
● VACUUM PUMPS
● REGULATOR *
- ATTACHMENT TEST
- FALL OFF TEST
● Vacuum tap *
● MILKING UNITS
- PULSATION
- AIR ADMISSION
- AIR FLOW *
- AIR CONSUMPTION *
TEST RESULTS
● PIPELINES
- VACUUM CONDITIONS
- AIR FLOW RATES
● VACUUM PUMPS
● REGULATOR *
- ATTACHMENT TEST
- FALL OFF TEST
● Vacuum tap *
● MILKING UNITS
- PULSATION
- AIR ADMISSION
- AIR FLOW *
- AIR CONSUMPTION *

*	Submenu not available for all standard versions or installation types

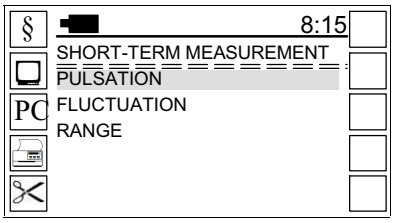
5.4 Menu:SHORT-TERM MEASUREMENT

- Display:
  Main menu



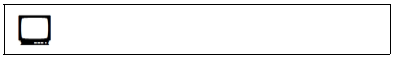
Call up menu
- Press

- The content of the menu is displayed
  The menu contains the programs shown for analysis and graphical representation the vacuum conditions in clusters.



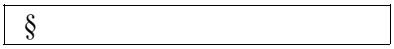
Function keys in the display

- Display data



All measured values can be stored and displayed.
(200 Datensätze für je vier Kanäle)
See section on: View saved measured values

- Open database



Global limit values can be set for pulsators in a database
See section on: Global limit value database

5.4.1 Program:PULSATION

This program tests pulsators according to the specifications on the milking installation standard ISO 6690.

The cyclical pressure variations caused by the pulsator are measured and analyzed in the teat cups.

According to ISO 5707, a pulsation cycle includes the following phases

PHASE		**pulsraumvakkum**	
		from	**to**
A	EVACUATION PHASE	4 kPa	Maximum vacuum in pulsation chamber - 4 kPa
B	VACUUM PHASE	Higher than maximum vacuum in pulsation chamber - 4 kPa	
C	VENTILATION PHASE	Maximum vacuum in the pulsation chamber - 4 kPA	4 kPa
D	PRESSURE PHASE	lower than 4 kPa	

Global limit value database

Following a pulsator test and with the stored data display, the measurement results are compared with previously defined limit values.

First of all the tester uses global limit values, although these can then be changed individually for each pulsator tested and therefore be made into local limit values.

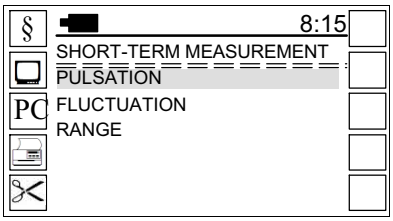
The global limit values should be entered in the database provided when the tester is commissioned.

- The database contains 20 databases
- Each database defines the limit values of one pulsator or operating mode.

Examples		
Pulsator	• TYPE A • TYPE B	
Operating mode	• TYPE A • TYPE A	Stimulation Milking

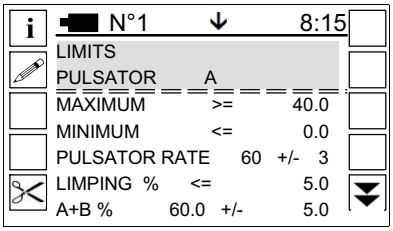
Enter limit value

- Display:
  Menu SHORT-TERM MEASUREMENT



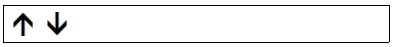
Open database
- Press function key

- The database is displayed
  Example: N°1



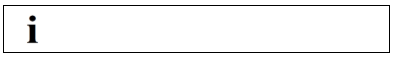
Information displayed

- Indication of more data



Function keys in the display

- Display units used

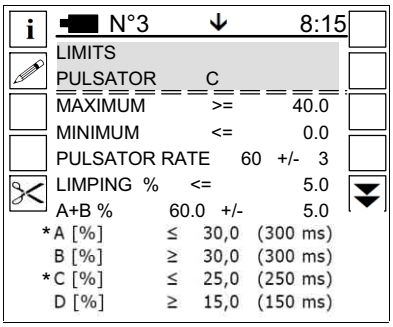


- Change database name
  Keypad appears

- Delete limit values
  When values have been deleted the tester puts standard values in the database.

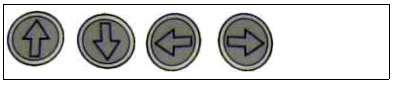
Select database
- Press function keys

- The database is displayed
  Example: N°3



Limit values	
MAXIMUM >= 40.0	Maximum vacuum
MINIMUM <= 0.0	Minimum vacuum
PULSATOR RATE 60 +/- 3	Pulsation rate / permissible deviation
LIMPING % <= 5.0	Permissible drift (percentage difference in the suction phases of the two pulsation channels)
A+B % 60.0 +/- 5.0	Suction phase proportion / permissible deviation
A [%]	A phase (*)
B [%]	Settings for B phase
C [%]	C phase (*)
D [%]	Settings for D phase
(*)	No entry required! The value is calculated automatically from pulse count, B and D phase

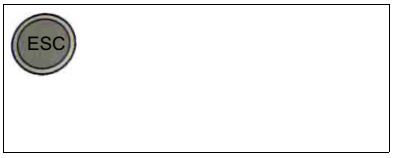
Select data field
- Press



Open data field
- Press
  - Keypad appears

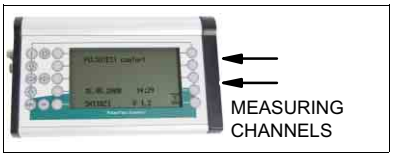
Enter value
- Press function keys

Save entry
- Press
  - The data will be saved
  - End entry

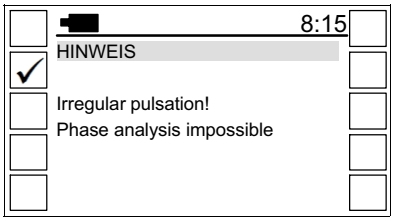


Checking pulsators

- Close the teat cups on all clusters with teat cup stoppers
- Start the milking installation and all milking units
- Connect measuring channels 1 and 2 with a T-piece and the measuring tubes, each with a short pulsation tube, to the cluster to be tested.



- Start the program
  PULSATION
  - Vacuum conditions are measured in the teat cups
  - The pulse counts and phase ratios are calculated automatically from the measured values.
  - A corresponding warning appears if pulsation is not correct.
    Acknowledge the message with function key (F2)

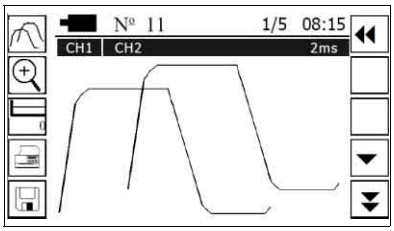


  - The tester then continues to display the measured values, but without calculating pulsation phases.

See section:
Measured value display

Measured value display

- At the end of the test the measured value display appears.
  Screen: 1/5



Information displayed

- Record number — N°11

  The record number automatically increases by 1 after saving.
- Measuring channels / measuring interval — CH1 CH2 2ms

Function keys in the display

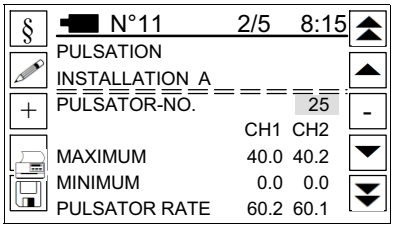
- Change record displayed

  If the function keys are held down for more than 5 seconds a data field will open and the keypad appear.
  See section on: Entering data with the keypad
- Save measured values

  Measured values are saved under the record number specified.
- Change view
  Shift X-axis for channel 2 upwards
  Press key: 1x = +10 kPa
  Press key: 2x = +30 kPa

Move to next screen
- Press function key

- The measured value display will appear
  Screen: 2/5



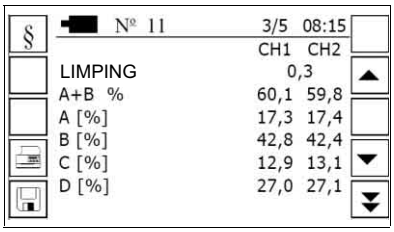
Function keys

- Change name of measured value display
  Keypad appears
- Edit limit values
  The entry window will appear
  See section on: Local limit values
- Set number
  (e.g. of the pulsator being tested) — + / -

  The number must not be the same as the record number (N°11)
  The default setting is the last saved pulsator number +1.

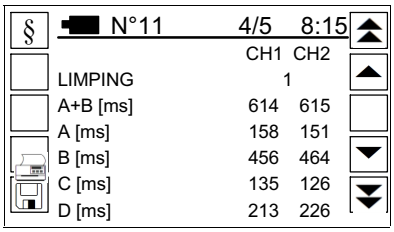
Move to next screen
- Press function keys

- The relative suction phase proportions [%] will be displayed
  Screen: 3/5



Move to next screen
- Press function key

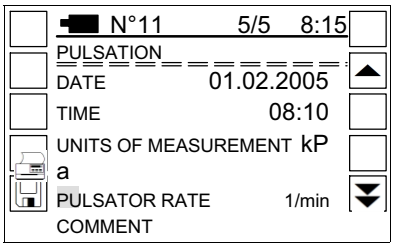
- The absolute phase proportions [ms] will be displayed.
  Screen: 4/5



Notes on the screens: 3/5 + 4/5
- All measured values that are outside of the limits are indicated by a dark cursor.
- It is not possible to enter data.

Move to next screen
- Press function key

- The measured value display will appear
  Screen: 5/5
- The cursor is in the comments field
  Any number can be entered.
  (e.g. the place number of the pulsator being tested)



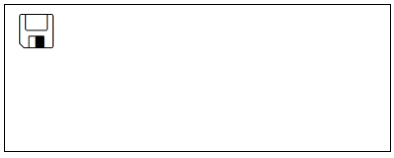
Enter comments

Open data field
- Press
  - Keypad appears

Enter text
- Press function keys

Confirm entry
- Press

Save entry
- Press
  - The data will be saved
  - End entry



Local limit values

A local limit value database is automatically created after a pulsator test.

- The template is one of the 20 databases in the global limit value database.

See section:
Global limit value database

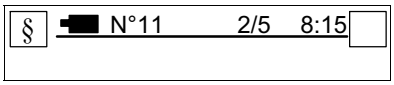
- The tester always uses the database that was last used as a template.

Edit limit value database

Open measured value display (screen 2, 3 or 4)

- Press function key

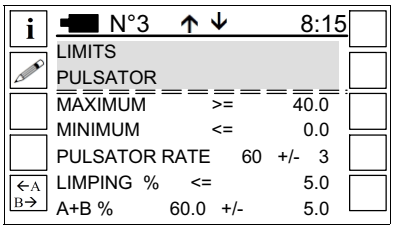
- The measured value display will appear
  Screen: 2/5



Open entry window

- Press function key

- The entry window will appear
  (example)



Function keys in the display

- Select new template

  Select another of the 20 global limit databases as the new template

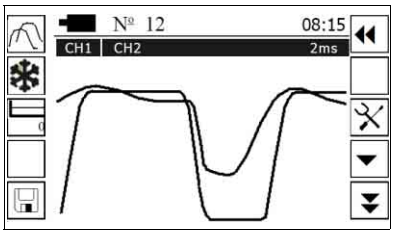
- Edit values

See section:
Global limit value database

5.4.2 Program: FLUCTUATION

This program is suitable for testing quickly changing vacuum conditions. These occur in the pulsation chambers of a cluster, for example during the pre-stimulation phase or during the main milking phase.

- Once the program starts, the measuring screen shown will appear.

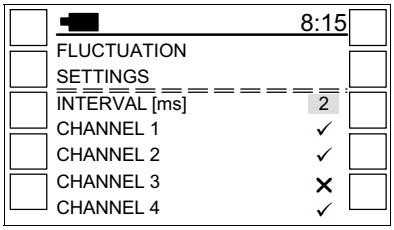


Changing the measurement settings

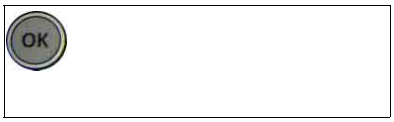
The tester uses the measurement settings last used.

Open "Settings"
- Press function key

- The entry window will appear
- Cursor is on the first data field



Open data field
- Press
  - Keypad appears



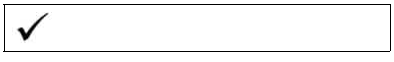
- Set measuring interval
  Set-up range: 1 - 99 ms
  - The smaller the value set the finer the resolution of the graphs.
  - The length of the period shown for each window decreases at the same time (see appendix).

Save the setting
- Press

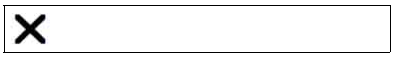
Select measuring channel
- Press

Activate / deactivate measuring channel
- Press

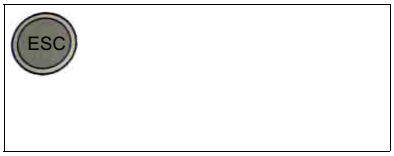
  - Measuring channel activated



  - Measuring channel deactivated

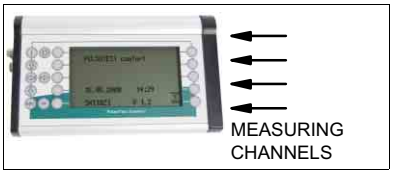


End set-up
- Press
  - The data will be saved
  - The previous window will appear



Taking the measurement

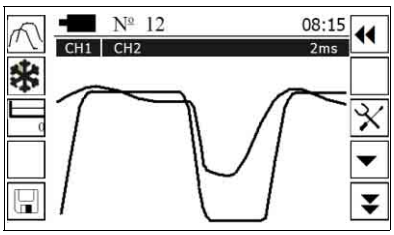
- Connect measuring channels to the vacuum sources to be tested.



Note!
Make sure that the graphical representation of the measured values is aligned according to the vacuum conditions on channel 1.

The pulsation chamber should therefore always be connected to channel 1 when the vacuum conditions are measured during milking or in a stimulation phase.

- Start the program
  - The measuring screen appears
  - Start measuring
  - The measured value curves will be recorded.



  - When the measured value curves reach the right-hand edge of the screen, the curves will be recorded again and the display updated.

Information displayed

- Record number — N°12

  The record number automatically increases by 1 after saving.

- Measuring channels / measuring interval — CH1 CH2 2ms

Function keys in the display

- Change record displayed

  If the function keys are held down for more than 5 seconds a data field will open and the keypad appear.
  See section on: Entering data with the keypad

- Change view

  In the measuring screen or when the stored measured values are displayed, you can change between the following views by repeatedly pressing this function key.
  - All curves on a base line
  - X-axis for channel 2 is 10 kPa above the base line
  - The curve for channel 2 is displayed in the top half of the screen
    The values of channel 1 and channels 3 and 4 (if used) are displayed in the bottom half of the screen
  - Shared base line for channel 1 and 2 with digital display of maximum, mean value, minimum and pulsation rate at the top of the screen

- Freeze display 

  Continuous restructuring of the measured value curves can be prevented while a measurement is running.
  Press the function key again to start measuring and recording the curves again.

- Linear function 

  The 0-line can be shifted if several curves are displayed at different heights.
  - Function only available in the FLUCTUATION menu during a measurement and in view mode.
  - The height indicated refers to the lower 0-line
  - Range: 0-50 kPa

  Apply function:
  - Press function key
    The function key is shown inverted 
  - Adjust the height 

- Set marker 

  Particular events can be documented by pressing a key
  (e.g. the cluster falling off)
  - Up to five such markers can be set for each measurement.
  - Markers are shown as vertical lines when stored measured values are displayed on the LCD display or on the computer screen.
  - Markers can only be added with a measuring interval of at least 20 ms.

- Save measured values 

  Measured values are saved under the record number specified.

- Display table of measured values 

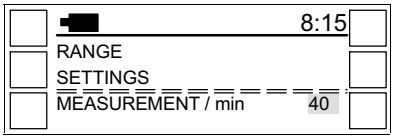
  When the key is pressed again, a window with additional information will appear.
  - Date
  - Time
  - Units of measurement
  - Comments

- Previous / next screen 

5.4.3 Program: RANGE

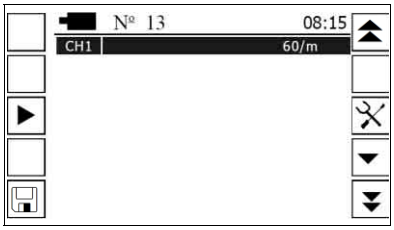
This program continuously measures the vacuum on a channel that can be selected.
However, as permanent measured values, it only records the maximum and minimum values of the individual measuring intervals.

The length of these is taken from the measuring frequency to be set before measurement begins.



With the measuring process applied, for example the vacuum conditions in the head of a teat liner can be analyzed over a whole milking process.

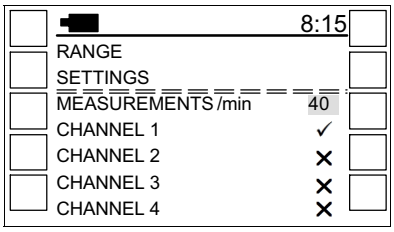
- Once the program starts, the measuring screen shown will appear
  It does not contain a graph however because the measurement has to be started manually.



Changing the measurement settings

Open "Settings"
- Press function key

- The entry window will appear
- Cursor is on the first data field



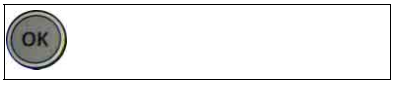
Open data field
- Press

  - Keypad appears

- Set measuring frequency
  Set-up range: 40 - 400 / min
  - The smaller the value set the finer the resolution of the graph.
  - The measurement duration decreases at the same time.

  Refer to Section: Appendix.

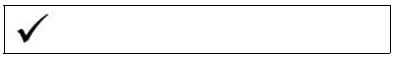
Save the setting
- Press



Select measuring channel
- Press

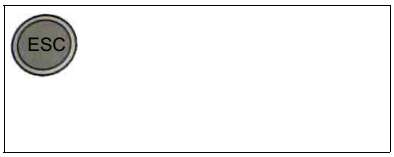
Activate measuring channel
- Press

  - Measuring channel activated



  - The other channels are automatically deactivated

End set-up
- Press
  - The data will be saved
  - The previous window will appear

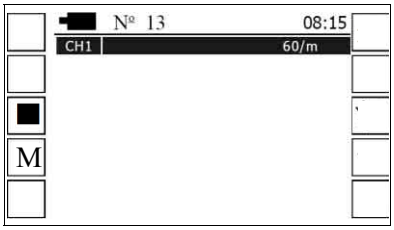


Take measurement

The tester uses the measurement settings last used.

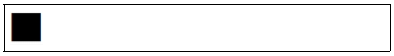
Start measurement
- Press function key

- The display changes
- Maximum and minimum curves are recorded



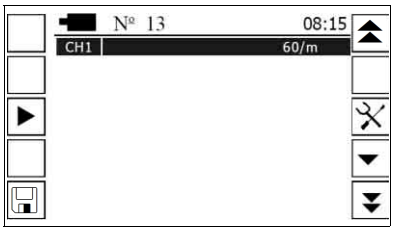
Function keys in the display

- Stop / continue measurement



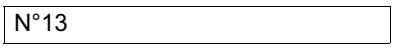
- Set marker
  For a description, see section:FLUCTUATION

After the measurement, the display changes



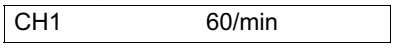
Information displayed

- Record number



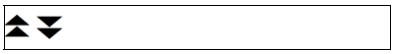
The record number automatically increases by 1 after saving.

- Measuring channel / Measurements per minute



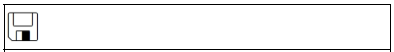
Function keys in the display

- Change record displayed

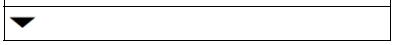


If the function keys are held down for more than 5 seconds a data field will open and the keypad appear.
See section on: Entering data with the keypad

- Save measured values



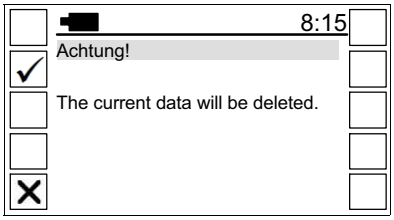
- Display table of measured values



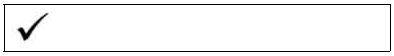
Save measured values
- Press function key

End measurement (without saving)
- Press

  - Query appears



- Confirm delete



- Decline delete
  - The previous window will appear

5.4.4 Display measured values

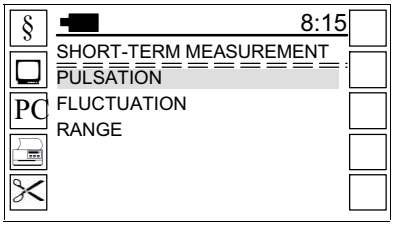
Stored measured values can be shown on the LCD display.

> **Note!**
> Measurement settings cannot be changed in the display function.

- Menu: SHORT-TERM MEASUREMENT
- Program: PULSATION

This description also applies to the programs:

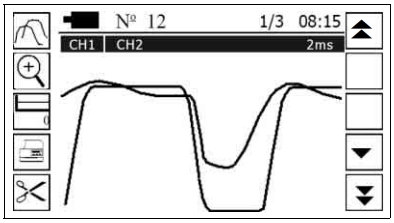
- RANGE
- FLUCTUATION



Display measured values

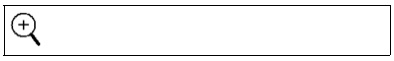
- Press function key

- The last saved record will be displayed.



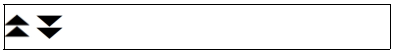
Function keys in the display

- Enlarge measured value curve



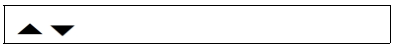
Measured value curves can only be enlarged in the display function if there is no measurement running.

- Change record displayed

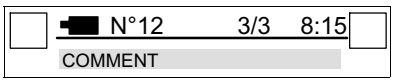


If the function keys are held down for more than 5 seconds a data field will open and the keypad appear.
See section on: Entering data with the keypad

- Change screen



Comments can be entered in screen 3.

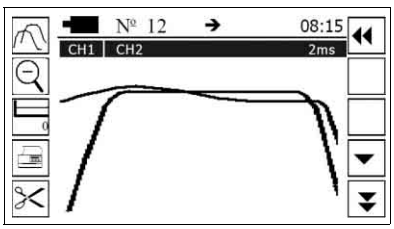


See section on:
Operation / SHORT-TERM MEASUREMENT / PULSATION

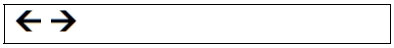
Enlarge view of measured value curve

- Press function key

- The curve is enlarged and shown in two views



- An arrow indicates the second view



Change view

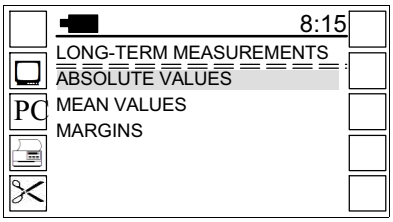
- Press

5.5 Menu: LONG-TERM MEASUREMENTS

The program has been designed for testing the pressure and temperature conditions in pipelines.

With the ability to measure simultaneously on four channels and a measuring duration of up to about five hours, it is particularly suitable for testing the cleaning settings of a milking installation.

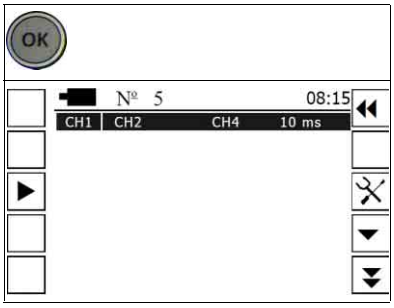
- Once the program starts, the measuring screen shown will appear.



ABSOLUTE VALUES	The measured values are recorded in the intervals set without further processing.
MEAN VALUES	The mean values and the maximum and minimum values are calculated for each measuring interval. These values are then saved as measured values.
MARGINS	

If one of the subprograms is activated, the measuring screen shown in the following image will appear:

Start function
- Press
  - Once the program starts, the measuring screen shown will appear.



Information displayed

- Record number — N°5

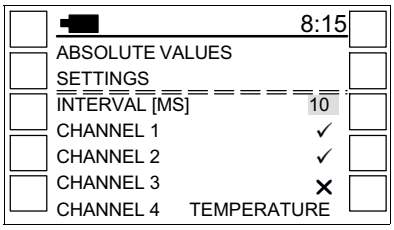
  From the record number shown, the following long-time measurement is saved.
  - Long-time measurements naturally include several records.
  - Maximum number of records: 199
  - It is possible to save different long-time measurements one after the other
    Example:
    Measurement 1: Records 1-80
    Measurement 2: Records 81-124
- Measuring channel / Measurements per minute — CH1 CH2 CH4 60/min

Function keys in the display

- Change record displayed

Open "Settings"
- Press function key

- The entry window will appear
- Cursor is on the first data field



Open data field
- Press

  - Keypad appears

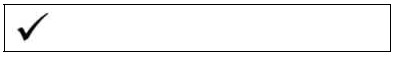
- Set measuring interval
  Set-up range: 10 - 500 ms
  - The smaller the value set the finer the resolution of the graphs.

Save the setting
- Press

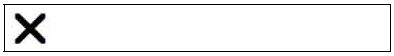
Select measuring channel
- Press

Activate / deactivate measuring channel
- Press

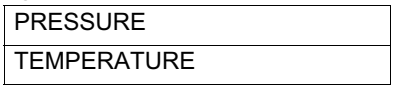
  - Measuring channel activated



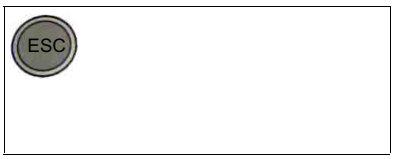
  - Measuring channel deactivated



  For channel 3 and 4 activation should be assigned.
  - Vacuum sensor
  - Thermometer



End set-up
- Press

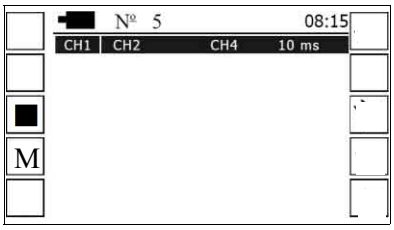


  - The data will be saved
  - The previous window will appear

Take measurement

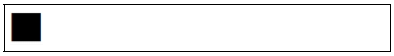
Start measurement
- Press function key

- The display changes
- Measurement curves are recorded



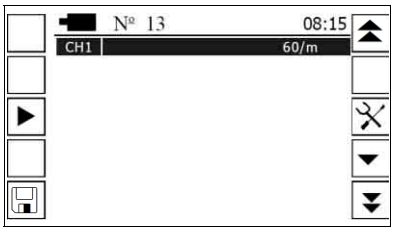
Function keys in the display

- Stop / continue measurement



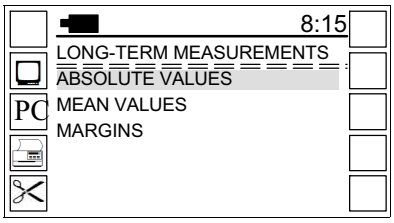
- Set marker
  For a description, see section: FLUCTUATION

After the measurement, the display changes



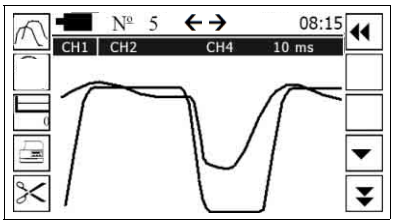
5.5.1 View of stored measured values

- Menu: LONG-TERM MEASUREMENTS



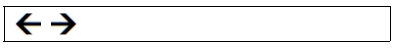
Display measured values
- Press function key

- The last saved record will be displayed.



Information displayed

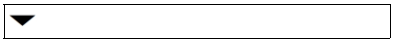
- Reference to other views / records



Function keys in the display
Not possible to enlarge the view!

- Scroll forward / back

- Display table of measured values



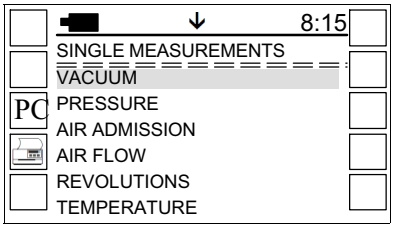
For further information, please refer to section:
- SHORT-TERM MEASUREMENT

5.6 Menu: SINGLE MEASUREMENTS

5.6.1 Take measurement

Basic measurement sequence

- Once the program starts, the measuring screen shown will appear.

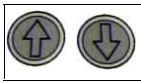


Measurement program	Function
VACUUM	● continuous measurement ● only individual measured values are saved ● To document snapshots, up to 20 separate measured values can be saved. Example: Nominal vacuum in a milking installation after a repair to the control valve
PRESSURE	
AIR ADMISSION	
AIR FLOW	
REVOLUTIONS	
TEMPERATURE	
VOLTAGE	
REGULATOR	● continuous measurement ● a series of successive measured values is saved

- Prepare for the measurement

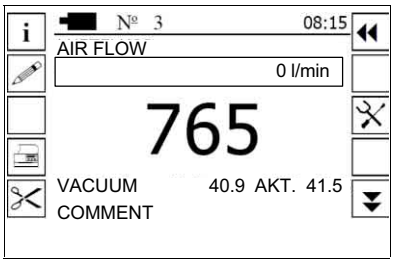
See measuring in the corresponding paragraph of section: Individual measurement sequence

Select measurement program
- Press



Start measurement program
- Press

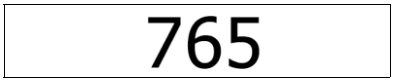
- The measuring screen shows the current measured value
  Example: AIR FLOW



Note!
- The structure of the measuring screen is, to the greatest possible extent, the same in the different programs.
- Each record is shown separately.

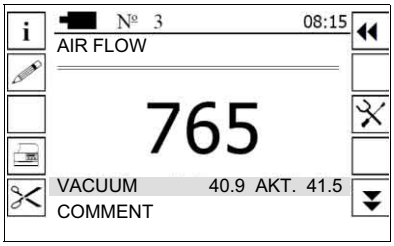
Information displayed

- The measured value is displayed in the middle of the window



- Measurement settings
  (only if available)

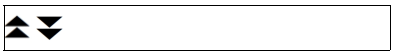
- Additional information line
  Only in programs:
  - AIR ADMISSION
    Vakuum zu Beginn und während der Messung}
  - AIR FLOW
    zuletzt gespeichertes und aktuelles Vakuum}
  - REVOLUTIONS
    zuletzt gespeichertes und aktuelles Vakuum}



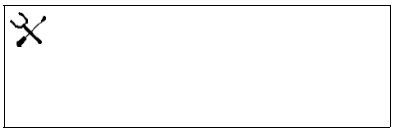
Function keys in the display

- Enter comments
  Keypad appears

- Change record displayed



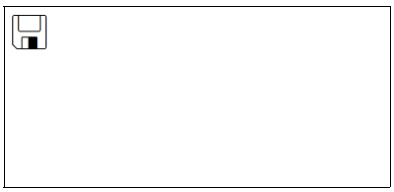
- Change measurement settings
  Only in programs:
  - AIR ADMISSION
  - AIR FLOW



Start measurement
- Press

Abort measurement (without saving)
- Press

Save measured value at the end of the measurement
- Press function key
  - The data will be saved
  - The previous window will appear



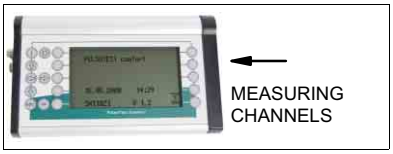
5.6.2 Individual measurement sequence

Measurement: VACUUM / PRESSURE

This program individually measures the vacuum / pressure in milking installation pipelines.
So, for example, the status before and after maintenance work can be documented.

Measuring sequence

- Start milking installation
- Connect measuring channel 1 to the measuring point to be tested.



- Open measuring screen and select the required record
- Start measurement
- Wait until the measured value is stable and save

Measurement: AIR ADMISSION

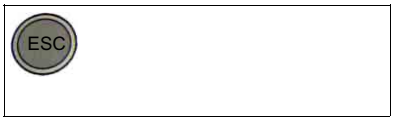
Measuring sequence

- Open measuring screen and select the required record

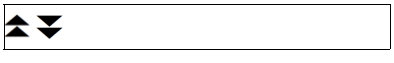
Change measurement setting
- Press function key

  - Setup window is displayed
- Set values
  - Elevation (0-2200 m)
  - Current air pressure (953-1053 hPa)
    The current air pressure can be read from a barometer, or taken from a newspaper or the Internet.
  - Volume of the measuring container (10-30 l)
    Lower or higher entries are not possible because, according to ISO 6690, the measurement must be performed with a container with a volume of approx. 20 l. Any significantly different volume would lead to measuring errors.

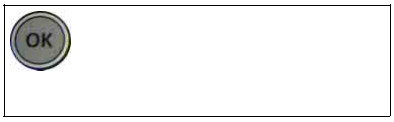
End set-up
- Press



  - The measuring screen appears
- Select record



Start measurement
- Press



Carry out the measurement as described.

For further information, please refer to section:
Appendix / Air admission measurements

Measurement: AIR FLOW

Note!
Air flow measurements are only possible in conjunction with an air flow meter which is available separately.

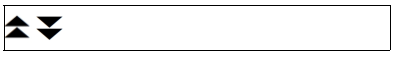
Measuring sequence

- Connect the air flow meter to the serial interface on the tester

- Connect measuring channel 1 and the air flow meter to the test nozzle on the milking installation
- Open measuring screen

Set air admission
- Press function key

  - Setup window is displayed
- Set value
  - If there are additional air flow orifices, enter the air flow
    See section on:
    Air flow measurements with additional air flow orifices
- Select record



Start measurement
- Press

- Open the air admission opening in the air flow meter until the current vacuum is the same as the required vacuum.
  (see "additional information line" on the display)
- Save measured value

Measurement: REVOLUTIONS

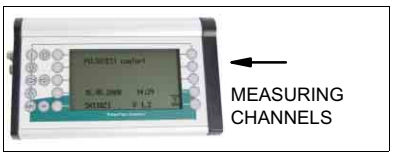
This program measures the speed of vacuum pump motors.

Accessories required

- External infrared sensor
- Reflectors

Measuring sequence

- Switch off vacuum pump
- Fasten a reflector with a minimum width of 20 mm to the rotor shaft on the pump motor
- Connect speed sensor to the serial interface
- Connect measuring channel 1 to the vacuum measuring point on the vacuum pump



- Switch on vacuum pump

Warning: Risk of injury!
Parts of the body (e.g. hair), items of clothing and other objects must not come into contact with the rotating drive shaft!

- Open measuring screen

Select measurement line
- Press

Start measurement
- Press

- Aim the infrared beam at the rotating reflector.
  Distance from the reflector: 20 - 30 cm

Attention! Class 2 laser
Do not look into the laser beam.
Observe standards, safety requirements and the warnings about lasers provided.

- Wait until the measured value is stable and save

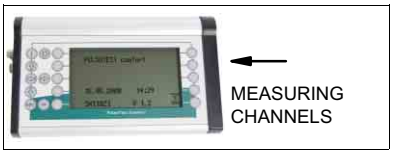
Measurement: TEMPERATURE

Accessories required

- Temperature sensor

Measuring sequence

- Connect the temperature sensor to measuring channel 4.



- Bring the tip of the temperature sensor into contact with the measuring point.

Warning: Risk of injury!
Never touch hot or cold surfaces or fluids!

- Open measurement screen and select the required record
- Start measurement
- Wait until the measured value is stable and save

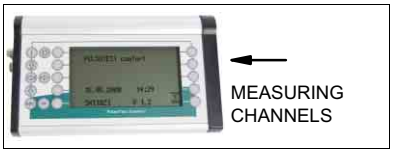
Measurement: VOLTAGE

Accessories required

- Sensor for measuring direct voltages (maximum 30 Volts)
  Example:
  Checking the operation of electrical pulsator valves

Measuring sequence

- Connect the voltage sensor to measuring channel 4.



- Attach the red sensor cable to the positive pole on the item being measured

Warning: Risk of injury!
To avoid injury or damage, the sensor must only be connected to direct voltage with a maximum of 30 Volts.

- Attach the black sensor cable to the negative pole on the item being measured
- Open measurement screen and select the required record
- Start measurement
- Wait until the measured value is stable and save

Measurement: REGULATOR

Testing a vacuum control unit in accordance with the international milking installation standard ISO 6690:2007 outside of the INSTALLATION TESTING menu.

Measuring sequence

- Take measurement
  (same as for installation testing)

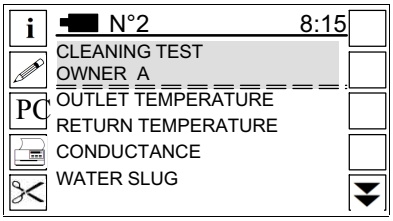
For further information, please refer to section:
Menu: INSTALLATION TEST

5.7 Menu: CLEANING TEST

This program checks the settings for conventional milking installation cleaning processes.

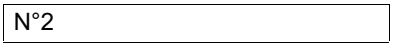
There may be data from up to ten milking installations.

- Once the program starts, the measuring screen shown will appear.



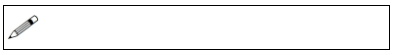
Information displayed

- Record number

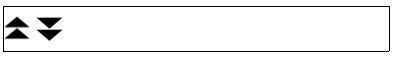


Function keys in the display

- Change title



- Change record displayed



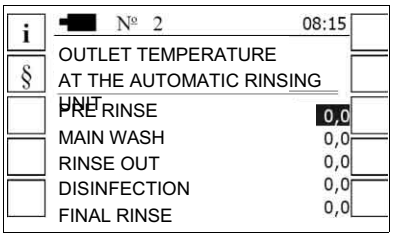
5.7.1 Program: TEMPERATURE

This program checks the temperatures at the beginning and end of the cleaning cycle.

- OUTLET TEMPERATURE
- RETURN TEMPERATURE

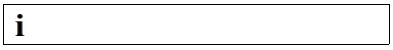
The measured values should therefore be recorded at the outlet or return from the automatic cleaning unit.

- Once the program starts, the measuring screen shown will appear.



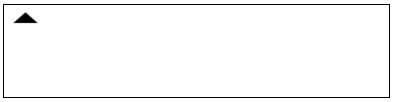
Function keys in the display

- Display units of measurement



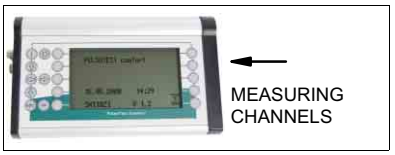
- Edit limit values
  The entry window will appear

- Switch screen
  - OUTLET TEMPERATURE
  - RETURN TEMPERATURE



Testing

- Connect the temperature sensor to measuring channel 4.

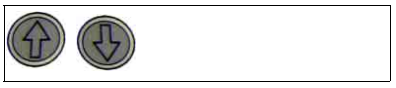


- Dip the tip of the temperature sensor in the outlet or return from the automatic rinsing unit into the cleaning solution.

Warning: Risk of injury!
Never touch hot or cold surfaces or fluids!

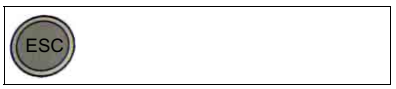
- Open measurement screen and select the required record
- Start measurement
- Wait until the measured value is stable and save

Select rinsing phase
- Press

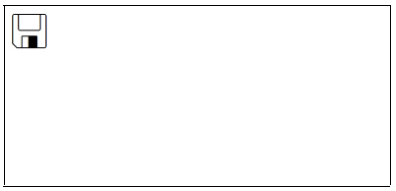


Start measurement
- Press

Abort measurement (without saving)
- Press



Save measured value at the end of the measurement
- Press function key
  - The data will be saved
  - The previous window will appear



5.7.2 Program: CONDUCTANCE

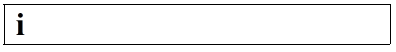
This program can be used to key conductivity values into the cleaning test report.
The conductivity values will previously have been measured with an external sensor.

Enter data

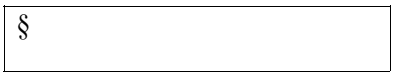
- Open program screen

Function keys in the display

- Display units of measurement



- Edit limit values
  The entry window will appear



- Select input line
  - Alkali or acid

Activate data field
- Press
  - Keypad appears

- Enter values
  See section on: Entering data with the keypad

5.7.3 Program: WATER SLUG

This program checks whether a conventional water plug is formed during cleaning of the milking installation.

- It is designed mainly for testing in milking installations with time-controlled air injectors and large milking lines.

  It is especially in these kinds of installation that the cleaning effect has to be ensured by the abrupt formation of large water plugs.

- The program is also designed for plug speeds of 7-10 m/s at intervals of 10-30 seconds because these values have to be to observed in accordance with the international milking installation standard.

  Values outside of the aforementioned range are also determined.

- As part of the test, the vacuum conditions are measured during cleaning at several points in the milking line.

  From the measured values thus obtained, the tester deduces the speed and time intervals of the water plugs.

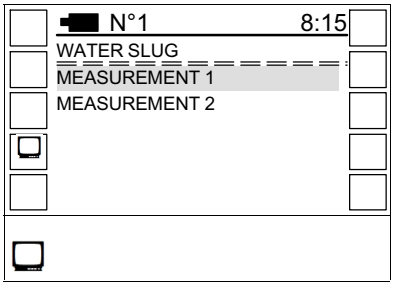
  At suitable measuring points it can also be determined whether the water plugs remain right until the end of the milking line.

- Perfect analysis results require suitable measuring points and evenly occurring vacuum fluctuations of adequate intensity and duration.

  The vacuum must always return to close to the starting level after a fall caused by a plug.

- Recommendation:
  If several water plugs will probably be formed at the same time (e.g. in large milking installations with only one central milking line) a measurement should be taken at the start and at the end of the milking line.

  The tester therefore has two identical measuring programs.



Function keys in the display
- Display data

The following sections contain detailed instructions on the practical performance of the measurements and a comprehensive explanation of the measured value display.

Installation of the measuring nozzles

☞ **Note!**
Install the measuring nozzles required before starting cleaning of the milking installation.
These nozzles must not be used to connect clusters.

Measuring nozzles in stub lines

In large milking installations with a central milking line (stub line), two measuring nozzles should be installed next to each other at both the beginning and end of the milking line (two sub-measurements).

- The distance between two such adjacent nozzles should not be too small in order to ensure adequate time delays between the vacuum drops caused at these nozzles by one and the same plug.
- On the other hand, the measuring nozzles should not be too far apart because otherwise the necessary length of the measuring hoses would cause excessive attenuation of the measured values.

☞ **Note!**
There are currently no generally recognized guide values for the ideal distance between measuring points or the maximum length of the measuring hoses.

Recommended distance: 3 - 5 metres
It may however be necessary to select other distances, depending on the design of the installation.

Measuring nozzles in a ring line

Installation of the necessary measuring nozzles is easier to arrange in installations with a ring milking line.

Normally, a total of only two nozzles is installed in these installations because the measured values can be recorded in one step without overly long measuring hoses.

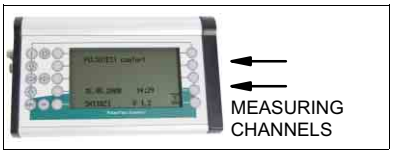
- One nozzle should installed on each of the two sides of the milking line.
- The two nozzles should preferably be close to the milk separator so that it can also be checked whether the water plugs remain from the beginning to the end of the milking line.
- On the other hand, the nozzles must not be directly on the milk separator as this might cause measuring errors.

☞ **Note!**
There are currently no generally recognized guide values.

In milking installations with a ring line as well, it might also be necessary to carry out two measurements.
Example: if several water plugs occur at the same time

Taking the measurement

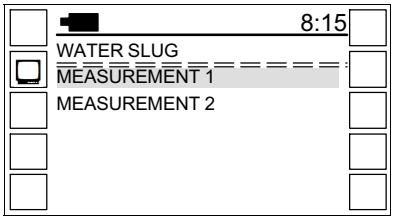
- Connect the measuring hoses to the two internal measuring channels (1+2) and the two measuring nozzles.



Do not use needles or unnecessarily long or thin measuring hoses.

Attention!
To enable analysis of the measured values, channel 1 of the tester should always be connected to the measuring nozzle at which the water plug will occur first.

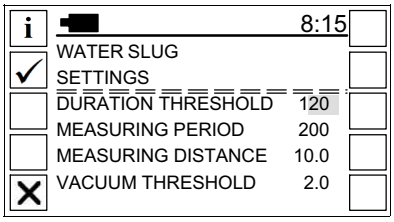
- Start the program
  - Once the program starts, the measuring screen shown will appear.



Start the measurement program

- Press

  - The entry window will appear
  - Cursor is on the first data field

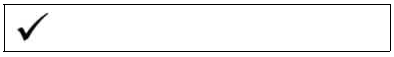


- Set values
  (A description is given in the "Values" table)

Note!
The settings entered are saved separately for both measuring programs. If a measurement has to be repeated, however, the tester always uses the settings for the most recent measurement (regardless of which measuring program was used to perform the measurement)

Start measurement

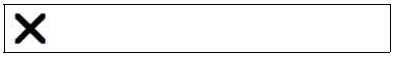
- Press function key



  - The tester will then immediately start recording the vacuum values.

Abort measurement

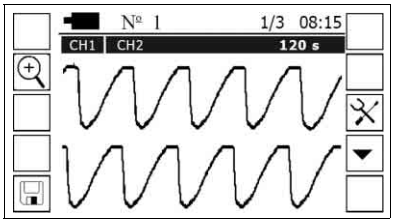
- Press function key



Settings
MEASURING PERIOD The value is selected so that approx. 5 plugs are recorded. Example: Enter 100 if a plug interval of 20 seconds is expected. ● Plug interval: time between two plugs ● Set-up range: 20 s - 300 s If there is an extremely long distance between the measuring points increase the time it takes for a water plug to flow from one measuring point to the other. So set a longer measuring time. Example: +5 seconds for a 50 m flow distance and an estimated flow speed of 10 m/s
MEASURING DISTANCE Distance a water plug has to travel between the measuring points. (flow distance between the two vacuum measuring points, including all bends and cross-connections) ● Set-up range: 100 cm - 9999 cm
VACUUM THRESHOLD A plug is acknowledged when the vacuum has dropped by at least the set value. If the value falls below the vacuum threshold then another vacuum drop is insignificant. ● Set-up range: 1 kPa - 30 kPa
DURATION THRESHOLD A plug is acknowledged when the vacuum has dropped by the vacuum threshold for at least the time set. If the vacuum has dropped by the vacuum threshold for at least the time set, then a subsequent rise in the vacuum is insignificant. ● Set-up range: 0,1 s - 9,9 s

Measured value display

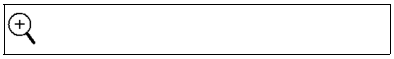
- Once the measurement has ended, the measured value curves for the whole measuring time are displayed.
  (Channel 1 bottom, Channel 2 top)



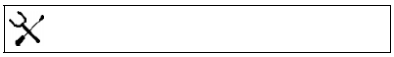
In the two sections of the screen, measured values below 20 kPa and above 50 kPa are plotted as a horizontal base line or headline in order to ensure an adequate curve resolution for the relevant vacuum range.

Function keys in the display

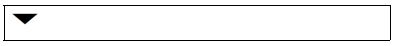
- Enlarge / reduce view



- Open set-up screen



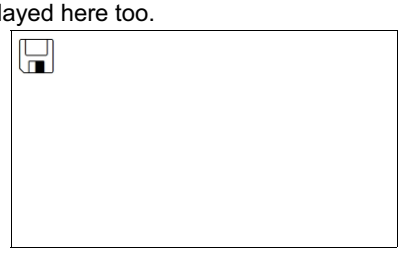
- Display / switch tabular curve analysis



Display tabular curve analyses

- Press function key
  - Speed table
    Display the speeds [m/s] for the first three water plugs found (A - C)
    The values concern the vacuum fluctuations measured and the measurement settings
    A value of zero means that no water plugs could be determined.
    In this case, the measurement settings in the set-up window should be checked and the threshold values changed if necessary.
  - Plug interval table
    This analysis refers only to the first measurement point (Ch1).
    The results for a maximum of three plugs are displayed here too.

Save measured value at the end of the measurement



- Press function key
  - The data will be saved
  - The previous measurement will be overwritten

5.8 Menu: INSTALLATION TEST

The program described here can be used to test milking installation in accordance with the specifications of the milking installation standard ISO 6690.

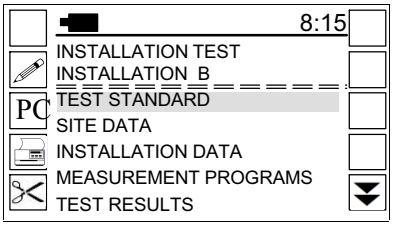
- The program package also includes measuring programs for testing milking installations that were designed in accordance with older versions of that standard.
- Milking installation tests can also be performed in accordance works standards (with special program versions only) and with the Dutch KOM standard.

The complex tests are supported by useful program features:

- clear measuring screen
- optional display of working instructions
- automatic calculation of all vacuum values to be observed during the measurements

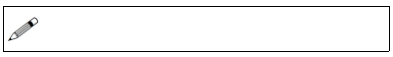
However it is essential to familiarize yourself with the basic technical aspects of testing milking installations.
Example: position of the measuring points

- Once the program starts, the measuring screen shown will appear.

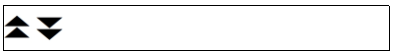


Function keys in the display

- Change title

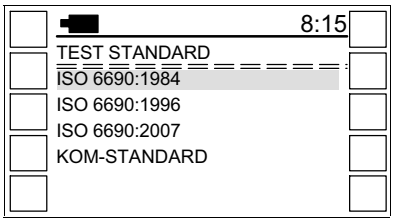


- Change record displayed



5.8.1 Submenu: TEST STANDARD

- Structure of the menu point



Select version of the standard
- Press

Start measurement
- Press

5.8.2 Submenu: SITE DATA

- Once the menu point has been selected an input screen will appear.

- Enter values

  The values entered will be used to produce the test report and support the automatic vacuum correction of the measured air flow values.

Location data required for installation testing			
Line	**Location data**	**Unit**	**Setting range**
4 + 5	Any text (e.g. name, city)		
6	Height above sea level	Metre	0-2200
7	Current air pressure	Hectopascal	953-1053
8	Current date		

5.8.3 Submenu:INSTALLATION DATA

The menu point consists of the submenus shown, leading to a set-up screen for test-relevant installation data.

Submenu	Settings	Setting range
IDENTIFICATION NUMBER		
TYPE	● Installation construction	MILKING PARLOUR
		PIPELINE (STANCH.BARN) (for stanchion barns only)
		BUCKET MILKING MACHINE
		CAN MILKING MACHINE
DEVICES Number of fittings	● Vacuum pumps	1-3
	● Milk transfer units	1-4
	Corresponds to the number of milking parlours in large installations or air measuring point A1 according to ISO 6690.	
	● Pulsator air lines	1-4
	● Milking units	1-100
VACUUM PUMPS Nominal power of vacuum pumps	● Air flow [l/min] at 50 kPa	≥0
	● Speed of the motor	≥0 U/min
	● Dynamic pressure in the exhaust line	0-9,9 kPa
▲▼	There is a separate input screen for each vacuum pump Use the function keys to change between input screens	
CONNECTION POINT A2	● Position of the air flow measuring point in the main line (see ISO 5707)	REGULATOR
		VACUUM PUMP
STALL TAPS	● Airflow	0-999 l/min
	Vacuum connection's air flow capacity according to the manufacturer	
MILKING UNITS Characteristics of the milking units	● Pulsation rate [cycles/min]	50-180
	● Suction phase	50-75 %
	● Airflow	≥0 l/min
	Airflow capacity of the long milk tube according to the manufacturer	
	● Air consumption	≥0 l/min
	Maximum amount of air that, according to the manufacturer, may flow through a cluster that has fallen off into the installation.	
	● Shut-off valve	yes/no
ANCILLARY EQUIPMENT	● Additional air flow from accessories	≥0
	Requirement of vacuum-operated devices which are usually running during milking but which are not in operation during the test. When producing the test report, the total of the entries made here is deducted from the reserve flow measured in order to determine the effective reserve flow.	

5.8.4 Submenu: MEASUREMENT PROGRAMS

The breakdown of the test programs is based on the components in typical milking installations.

Submenu	Menu point	Measuring screen
MEASUREMENT PROGRAMS	TESTS AT THE COMPONENTS	
	PIPELINES	
		• SYSTEM VACUUM
		• WORKING VACUUM
		• BACK PRESSURE *
		• TEST VACUUM
		• AIR FLOW
	VACUUM PUMPS	
	REGULATOR *	
		• ATTACHMENT TEST
		• FALL OFF TEST
	STALL TAPS *	
	MILKING UNITS	
		• PULSATION
		• AIR ADMISSION
		• AIR FLOW *
		• AIR CONSUMPTION *
* Menu point / measuring screen is not always displayed		

☞ **Recommendation!**
Carry out the tests in the sequence of the menu structure.
Otherwise, the tester might not display the required vacuum values needed during the measurements.

Menu point: PIPELINES

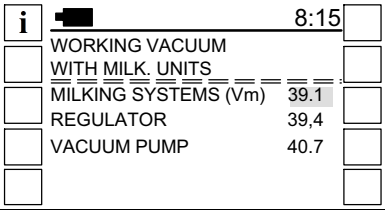
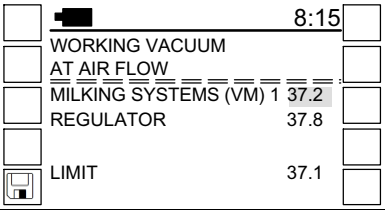
- Take vacuum and air flow measurements on the pipe network.

  The corresponding programs are explained below.

SYSTEM VACUUM / WORKING VACUUM / TEST VACUUM

The structure and use of the individual vacuum measuring screens are essentially the same, although the different versions of the standard call for different vacuum measurements.

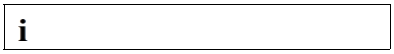
The following figure shows two typical examples:

Measuring screen in resting mode	Measuring screen during a measurement
	

Information displayed
In the top part of the screen
- Description of the measurement
- Milking installation setting required

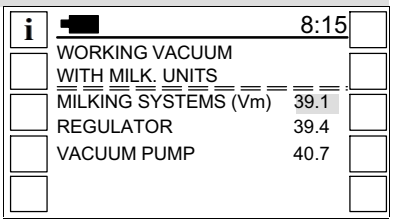
In the bottom part of the screen
- Measurement points
- Measurement lines
  Displayed in resting mode: last measured value saved
  Displayed during a measurement: current measured value
- Line:LIMIT
  The value is only displayed for measurements of the so-called test vacuum.
  The value indicates the vacuum value that must be achieved by changing the inlet opening in the air flow meter.

Function keys in the display
- Display required settings

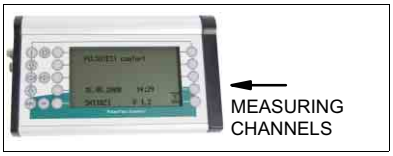


Measurement sequence:

- Open the required measuring screen
  - Display will appear
    (Example)

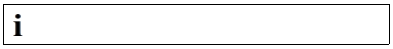


- Connect measuring channel 1 to the measuring point on the installation.
  (see information in the lower part of the screen)

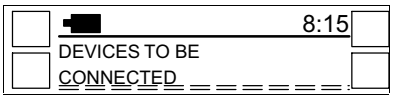


- Compare the installation settings with the display
  Example: WITH MILK. UNITS
  Display detailed information with the function key shown.

- Press



  - The required settings will be displayed



- Put installation into operation if necessary (e.g. start milking units)
  See section on: INSTALLATION DATA

Select measurement line

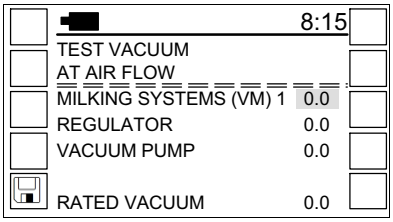
- Press

Start measurement

- Press

Note!
When testing the installation vacuum meter, instead of a vacuum measurement, the procedure for entering figures is activated.
Read the value from the vacuum meter display and enter using the keypad.

- Open the air inlet on the air flow meter until the current vacuum corresponds to the required vacuum
  Only when measuring the test vacuum in the milk system (Vm)



Save measured value

- Press function key
  - The data will be saved

Abort measurement (without saving)

- Press

BACK PRESSURE

The test described here is only specified in the versions of the standard that were published in the years 1996 and 2007.

As part of this test, the pressure in the vacuum pump exhaust line is measured while the milking installation is in normal operation.

The measured values should therefore be recorded with operating vacuum.

The corresponding measuring screen contains a separate measurement line for each vacuum pump entered (see installation data).

Measurement sequence:

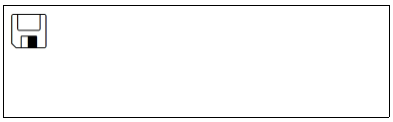
Open measuring screen
- Press

- Connect measuring channel 1 to the pump's exhaust line.

Select measurement line
- Press

Start measurement
- Press

Save measured value
- Press function key
  - The data will be saved



Abort measurement (without saving)
- Press

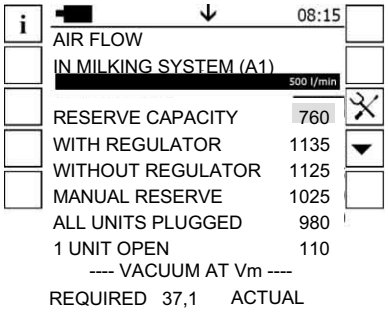
AIR FLOW

Depending on the version of the standard, the airflow measurements are performed in one (ISO 6690:1984) or in two measuring screens.

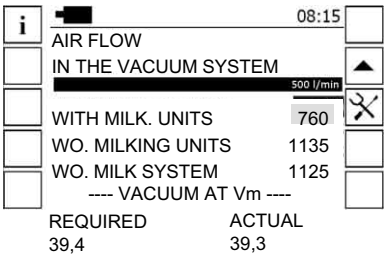
The structure of this screen is shown in the following figure:

Measuring screen in resting mode

Measuring screen 1



Measuring screen 2



Information displayed

In the top part of the screen

- Measuring point to which the air flow meter is connected.
  (measuring point A1 or measuring point A2)
- Air admission through additional orifices — 500 l/min

  Air admission that is admitted though the additional air flow orifices in addition to the air admitted by the actual air flow meter.
  The milking installation tester must be informed of this additional air before the measurements begin.

In the middle part of the screen

- Measurement lines
  Displayed in resting mode: last measured value saved
  Displayed during a measurement: current measured value

In the bottom part of the screen

- Vacuum measuring point during the air flow measurement
- Required vacuum to be achieved by admitting air — REQUIRED 39,4
- Actual vacuum on channel 1 — ACTUAL 39,3

Function keys in the display

- Open set-up screen
- Change between the measuring screens
- Display required settings — i

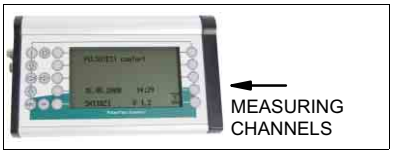
Measurement sequence:
(with optional air flow meter)

Open measuring screen

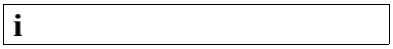
- Press

- Attach air flow meter to the measuring point
  (see top part of the screen)
- Connect air flow meter to the tester's serial interface

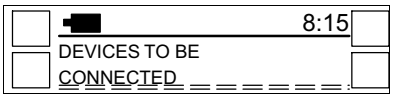
- Connect measuring channel 1 to the measuring point
  (see lower part of the screen)



- Compare the installation settings with the display
  Example: IN MILKING SYSTEM (A1)
  Display detailed information with the function key shown.
- Press



  - The required settings will be displayed



- Put installation into operation if necessary
  (e.g. switch on vacuum pump and connect vacuum control unit)
  See section on: INSTALLATION DATA

Set air admission through additional orifices

- Press function key

- Enter value
  Enter the total air admission of all additional air flow orifices connected (with reference to 50 kPa)
  See section on: Air flow measurements with additional air flow orifices
  - Measurement lines will be displayed

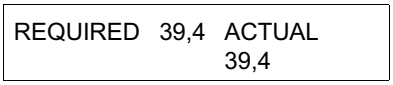
Select measurement line

- Press

Start measurement

- Press

- Set the air inlet opening of the air flow meter so that the vacuum values correspond.



  (see air flow meter operating manual)

Save measured value

- Press function key
  - The data will be saved

Abort measurement (without saving)

- Press

Alternative measuring sequence:
Air flow measurements with purely mechanical meters

- Read measured values from the meter's scale.

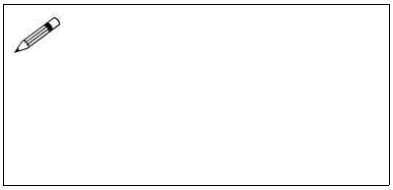
Enter measured values using the keypad

Select measurement line
- Press

Start measurement
- Press

Enter measurement values
- Press function key
  - Keypad appears

  See section on: Entering data with the keypad



Save measured value
- Press function key
  - The data will be saved

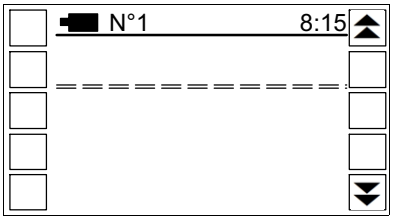
Menu point: VACUUM PUMPS

Vacuum pump testing includes the following measurements:

- Air delivery at operating vacuum (operating air).
  - WORKING CAPACITY
- Air delivery at nominal vacuum of 50 kPa (test air).
  - TEST CAPACITY
- Motor speed at nominal vacuum of 50 kPa

The arrangement and use of the measuring screen is essentially the same as for the air flow measurements in the pipe network.

- Once the program starts the structure shown will appear.

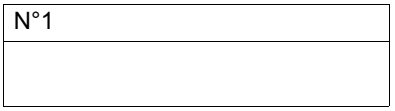


Information displayed

- Record number

Measurement lines

- The last measurement value saved



Function keys in the display

- Select vacuum pump
  (only if there is more than one vacuum pump)

Measuring air flow

- Attach the air flow meter tot he test nozzle on the vacuum pump.
- Connect air flow meter to the tester's serial interface

- Connect measuring channel 1 to the test nozzle on the pump

Open measuring screen
- Press

Select vacuum pump
- Press function keys

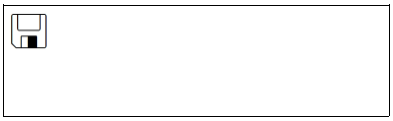
Set air admission through additional orifices
- Press function key

Select measurement line
- Press

Start measurement
- Press

- Set the air inlet opening on the air flow meter so that the two vacuum values in the last line of the measuring screen are the same.

Save measured value
- Press function key
  - The data will be saved



Abort measurement (without saving)
- Press

After the air flow measurements the speed should be measured.

Measure speed

For further information on this subject, please refer to the section: Operation / SINLGE MEASUREMENTS

Menu point: REGULATOR

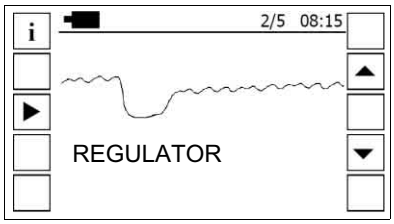
The routine testing to be performed in accordance with ISO 6690:2007 includes two sub-tests.

The tests determine the behaviour of the vacuum control unit in the case of sudden admissions of air.

- ATTACHMENT TEST
  In the application test one of the teat cups in a cluster is suddenly opened and suddenly closed again.
- FALL OFF TEST
  In the drop-off test all of the teat cups in a cluster are suddenly opened and suddenly closed again.

Both sub-tests take place in five sequential phases.

There is a separate measuring screen for each phase.



Information displayed

- Number of the current phase — 2/5

Function keys in the display

- Change between the measuring screens
- Start / abort measurement
- Display information — i

When a screen is opened, the last saved graph will be displayed.

Test procedure

ATTACHMENT TEST

- Close off one teat cup with a teat cup stopper.

FALL OFF TEST

- Close off all teat cups with teat cup stoppers.
- Start the milking installation and all milking units.
- Connect measuring channel 1 to the vacuum measuring point Vm.
  This is generally the milk system's milk separator.

- Open measuring screen

  PHASE 1 (3, 5):
  - Wait until the operating vacuum has stabilized (see installation vacuum meter)
- Start measurement
  - Wait until measurement ends

PHASE 2:

- Start measurement
- Immediately open the required number of teat cups at the same time.

  Information according to: ISO 6690:2207
  ATTACHMENT TEST
  - 1 teat cup on every 32nd milking unit

  FALL OFF TEST
  - All teat cups on every 32nd milking unit

  Press function key to display the number of teat cups to be opened 

- Start measurement
  - Wait until measurement ends

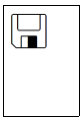
PHASE 4:

- Start measurement
- Immediately close the open teat cups at the same time.
  - Wait until measurement ends

End of measurement

- Normal end of measurement is indicated by the symbol opposite. 

Save measurement curve

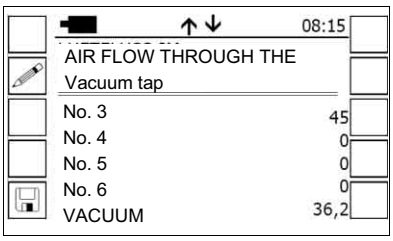
- Press function key
  - The data will be saved 

Menu point: STALL TAPS

This test is specified for milking parlour and pipe milking installations when testing to ISO 6690:2007.

The amount of air that can flow through a vacuum connection until the operating vacuum at the measuring point drops by 5 kPa is measured.

- Once the program starts, the measuring screen shown will appear.
  The data from up to 50 vacuum connections can be saved in this measuring screen.



Test procedure

- Connect measuring channel 1 and the air flow meter to the vacuum connection to be tested, instead of the pulsator.

- Start milking installation
- Open measuring screen

Select measurement line
- Press

Start measurement
- Press

- Open the air inlet into the air flow meter so wide that the vacuum falls by 5 kPa.

Save measurement curve
- Press function key
  - The data will be saved

Abort measurement (without saving)
- Press

Note!
Alternatively, the air flow values can be read from perforated orifices and entered in the measuring screen using the keypad

Testing the vacuum connection

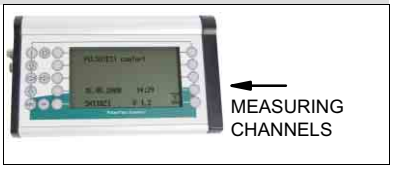
Vacuum taps are only tested in the case of bucket and churn milking installations.

The vacuum drop in the vacuum tap is measured with an air flow of 120 l/min.

The measuring screen is essentially the same as that for the test on vacuum connections.

Test procedure

- Connect the air flow meter and measuring channel 1 to the vacuum tap to be tested.
- Connect measuring channel 2 to the adjacent vacuum tap



- Open measuring screen

Select measurement line
- Press

Start measurement
- Press

- Set the air inlet opening to the air flow meter so that the actual air flow is the same as the required air flow.
  (120 bzw. 150 l/min)
  - The air flow will be constantly displayed.

Save measurement curve
- Press function key
  - The data will be saved

Abort measurement (without saving)
- Press

Menu point: MILKING UNITS

Depending on the version of the standard, the milking unit test includes two to three sub-tests.

All versions of the standard specify a pulsator test and measurement of the air admitted into a cluster, although the details of the test and the limit values differ in parts.

PULSATION

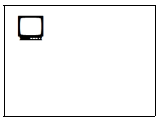
- In all versions of the standard, the procedure and representation of the measured values in the pulsator test are the same as for the short-time measurements.

For further information, please refer to section:
SHORT-TERM MEASUREMENT / PULSATION

Differences from short-time measurements

- The milking installation standard does not require any individual limit values connected with the type of pulsator, but allows standard software for all pulsator types.
- Furthermore, in the versions published after 1996, not only the drift within the individual pulsators, but also the drift between all of the pulsators in an installation is examined.

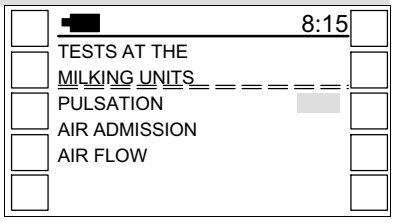
  - In the pulsator test report the corresponding values can be brought up by pressing a function key.
    (Screens 2 to 4)

    The vacuum drop in the worst pulsator is also shown against the operating vacuum.

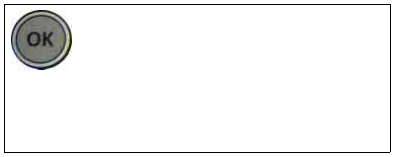
Test procedure

- Once the program starts, the measuring screen shown will appear.



Start test
PULSATION

- Press

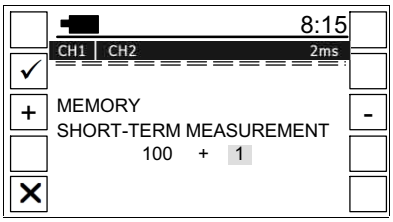
  

  - Wait until the test ends

Save result

- Press function key

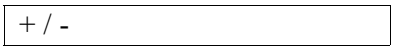
  - An input window might open.

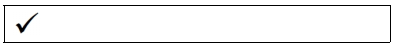


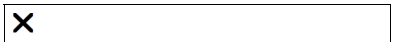
> **Note!**
> According to ISO 3918, pulsation rates above 200 cycles/minute are assessed as the stimulation phase testing of which, according to ISO 6690, is not envisaged in the test report.
> The measured values are therefore saved in the memory for the SHORT-TIME MEASUREMENT program.
> A record number must be allocated therefore.

- Allocate record number

Function keys in the display

- Set number 

- Confirm entry 

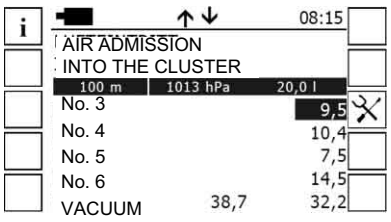
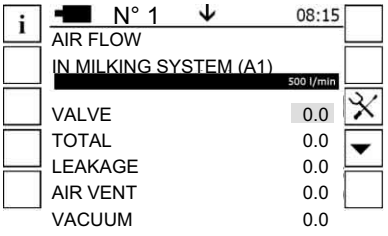
- Abort entry 

AIR ADMISSION
Air admission into a cluster

According to ISO 6690:1984, only the total amount of air entering a cluster is measured. More recent versions of the standard also measure the air leaking from the shut-off valve and clawpiece.

- Measuring screen according to test standard:

Air admission into a cluster

Testing to ISO 6690: 1984	Testing to ISO 6690: 1996
	

Information displayed

- Location data relevant to the measurement
  See section on: INSTALLATION TEST

100 m	1013 kPa	20,0 l

- Volume of the measuring container

100 m	1013 kPa	20,0 l

- Vacuum: start of the measurement

VACUUM	38.7	32.2

- Vacuum: during the measurement

VACUUM	38.7	32.2

- Number of the current cluster

N° 1

Function keys in the display

- Open the submenu in which the volume of the measuring container has to be recorded before the measurement.

  Specification range: 10 - 30 l
  Lower or higher entries are not possible because, according to ISO 6690, the measurement must be performed with a container with a volume of approx. 20 l. Any significantly different volume would lead to measuring errors.
- Change between the measuring screens

Differences in the structure of the measuring range

- Testing to: ISO 6690:1984
  The measured values of different clusters are shown in one screen.
- Testing to: ISO 6690:1996/2007
  The measured values of different clusters are displayed in separate screens.

Test procedure

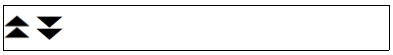
- Start the program
  AIR ADMISSION

Enter the volume of the measuring container

- Press function key

Open the measuring screen for the required cluster
Only when testing to: ISO 6690:1996/2007

- Press function keys



  - The number will be displayed.

> **Note!**
> The air admission values for a maximum of 50 milking units can be saved for each installation.

Select measurement line

- Press

Start measurement

- Press

Carry out the measurement as described.

> For further information, please refer to section:
> Appendix / Air admission measurements

AIR FLOW
Air flow in the long milk tube

In the measurement presented here, which is not envisaged in accordance with ISO 6690:1984, the air flow meter is connected to the long milk tube instead of a cluster.

The amount of air that causes a vacuum drop of 5 kPA compared to the operating vacuum should then be determined.

The arrangement of the measuring screen is the same as the screen for testing the vacuum connections (see figure in the section "Vacuum connections").

Test procedure

- Remove cluster from the milk tube to be tested.
- Connect the air flow meter and measuring channel 1 to the long milk tube.

- Open measuring screen

Select measurement line
- Press

Start measurement
- Press

- Set the air admission to the air flow meter so that the vacuum drops by 5 kPa.

Save measurement curve
- Press function key
  - The data will be saved

Abort measurement (without saving)
- Press

Note!
Alternatively, the air flow values can be read from perforated orifices and entered in the measuring screen using the keypad

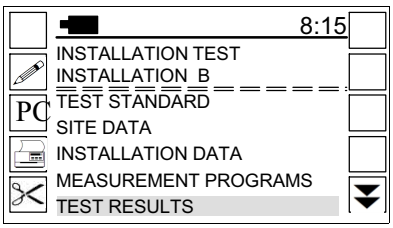
5.8.5 Submenu: TEST RESULTS - Test report

The tester automatically produces a comprehensive test report using the location and installation data entered together with the measured values.

- According to the specification of the version of the standard selected, it automatically calculates all limit values and correction values for air flow rates.
- The report shows all of the measured and calculated values.
- Measured values and results that are outside of the permitted limits, or which are not plausible, are marked.
  They are indicated on the LCD display by a dark bar while, in the printout, a question mark is used for this purpose.

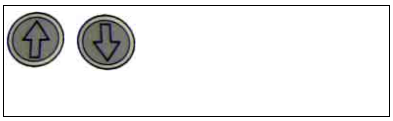
Display or print report

- Once the program starts, the measuring screen shown will appear.

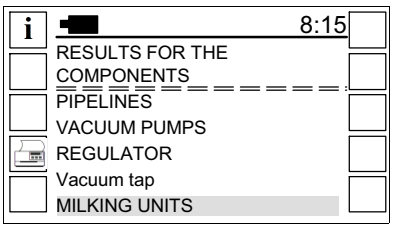


Select menu point
TEST RESULTS

- Press

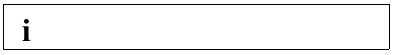


- The report menu will be displayed.
  (Breakdown according to the components in typical milking installations)

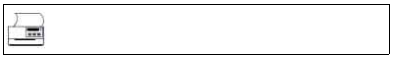


Function keys in the display

- Display units of measurement

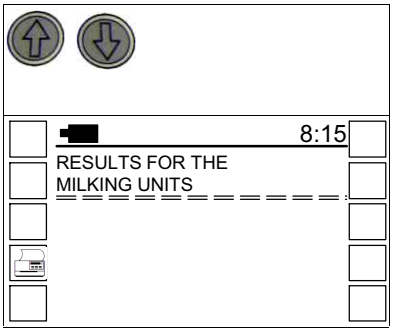


- Start printing

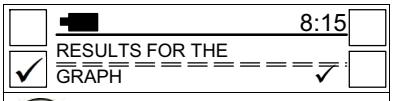


  - Function in the report menu:
    Print out the whole report
  - Function in submenus and report screens:
    Print out the corresponding section of the report

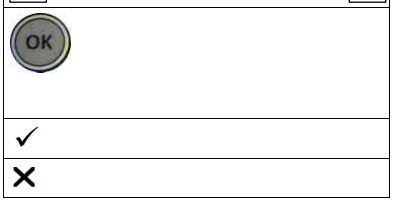
Select report
Example: MILKING UNITS
- Press
  - The report screen will be displayed



Start printing
- Press function key
  - The report will be printed
  - A print menu might appear



Activate / deactivate graph print out
(in addition to tables)
- Press
  - Graph print out activated
  - Graph print out deactivated

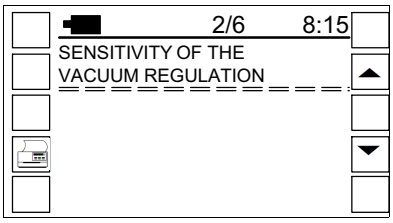


Start printing
- Press function key
  - The report will be printed

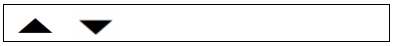
Vacuum conditions in the pipe network

Vacuum values measured in the pipe network are displayed together with the corresponding limit values and the calculated test results in several screens.

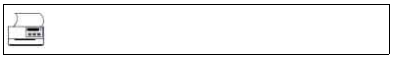
Information displayed
- Screen number (2/6)
- Indication of what has been tested (Example)
  This also applies to the printout



Function keys in the display
- Change screen



- Start printing



Example: **Test report on vacuum conditions (ISO 6690:1996/2007)**		
1/6	**ACCURACY OF THE PLANT VACUUM GAUGE**	Correspondence between the display on the installation vacuum meter and the actual installation vacuum
	READING	Installation vacuum meter displayed during the test
	MEASUREMENT	Measured value close to the installation vacuum meter
	DIFFERENCE	Difference between the above values = Display accuracy
	LIMIT	Value to be observed according to: ISO 5707
2/6	**SENSITIVITY OF THE VACUUM REGULATION**	Control sensitivity of the control unit(s)
	SYSTEM VACUUM	Installation vacuum without milking units running When testing to ISO 6690:1984, this is the installation vacuum with one milking unit running
	WORKING VACUUM	Installation vacuum with milking units running
	DIFFERENCE	Difference between the above values = Control sensitivity
	LIMIT	Value to be observed according to: ISO 5707
3/6	**WORKING VACUUM IN THE PIPELINES**	Installation vacuum with milking units running at the measuring points listed below
	REGULATOR	Value at measuring point: Vr
	VACUUM PUMP	Value at measuring point: Vp
	PULS. AIRLINE *	Operating vacuum in the pulsator air line
4/6	**TEST VACUUM IN THE PIPELINES**	Test vacuum with reserve air flow at the measuring points listed below This section is not output when testing to ISO 6690:1984
	MILKING SYSTEM	Test vacuum at measuring point: Vm n = number of the milking system or measuring point Vm (1 to 4)
	REGULATOR	Value at measuring point: Vr
	VACUUM PUMP	Value at measuring point: Vp
5/6	**VACUUM DIFFERENCE TO THE REGULATOR**	Difference in vacuum at the measuring points listed below compared to the control unit control connection (Vr) Difference between the measured operating vacuum values when testing to ISO 6690:1984 and the measured test vacuum values when testing to ISO 6690:1996/2007
	MILKING SYSTEM Vm (1)	Value at measuring point: Vm
	VACUUM PUMP *	Value at measuring point: Vp
	PULS. AIRLINE *	Value for the pulsator air line
	LIMIT	Value to be observed according to: ISO 5707
6/6	**VACUUM DIFFERENCE TO THE VACUUM PUMP**	Difference in test vacuum at the measuring points listed below compared to the air admitted to the vacuum pump (Vp)
	MILKING SYSTEM Vm (1 - N)	Value at measuring point: Vm (1 - N)
	LIMIT	Value to be observed according to: ISO 5707
*	Lines only given when testing to ISO 6690:1984	
N	Pipe number	

Air flow rates in the pipe network

Example: **Test report on air flow rates (ISO 6690:1996/2007)**	
1/6 RESERVE CAPACITY OF THE INSTALLATION	Air flow that causes a vacuum drop of 2 kPa in the milk system (compared to the operating vacuum)
MEASUREMENT	Measurement point: Vm Measured value with the vacuum control unit connected
ANCILLARY CONSUM.	Air consumption by the accessories according to the installation data See section on: Installation data
EFFECTIVE VALUE	Difference in measured values
NORMAL VALUE	Effective value corrected for weather influences When testing to ISO 6690:1984, the measuring point is not the milk system but the main air line
LIMIT	Effective value to be observed according to: ISO 5707 The correct air flow indicates the effective value that would have been given with an air pressure of 1013 hPa. Measured values recorded with different weather conditions can then be compared.
MEASUREMENT	Actual vacuum during the measurement
RATED VACUUM	Required vacuum during the measurement according to: ISO 6690
2/6 REGULATION LOSS OF THE INSTALLATION	Air admission through nominally closed vacuum control units
MANUAL RESERVE	Measurement point: Vm Measured value with the vacuum control unit disconnected
RESERVE CAPACITY	Measurement point: Vm Measured value with the vacuum control unit connected
REGULATION LOSS	Difference between the two lines above (measured values)
LIMIT	Effective value to be observed according to: ISO 5707
MEASUREMENT	Actual vacuum during the measurement
RATED VACUUM	Required vacuum during the measurement according to: ISO 6690
3/6 LEAKAGE REGULATOR	
AF WITHOUT REG.	Measurement point: Vr Measured value with the vacuum control unit disconnected
AF WITH REGULATOR	Measurement point: Vr Measured value with the vacuum control unit connected
LEAKAGE	Difference in measured values
LIMIT	Value to be observed according to: ISO 5707
MEAS. VACUUM 1 - 2	Actual vacuum during the measurement
RATED VACUUM	Required vacuum during the measurement according to: ISO 6690
4/6 AIR INLET THROUGH MILKING UNITS	
AF WITHOUT MU	Measured value with milking units inactive
AF WITH MU	Measured value with milking units active
TOTAL INLET	Air admission by all milking units = Difference in measured values
INLET PER MU	Air admission per milking unit
MEAS. VACUUM 1 - 2	Actual vacuum during the measurement
RATED VACUUM	Required vacuum during the measurement according to: ISO 6690

Example: **Test report on air flow rates (ISO 6690:1996/2007)**		
5/6	**LEAKAGE** **MILKING SYSTEM**	
	AF WITHOUT MS	Measured value after disconnecting the milk system
	AF WITH MS	Measured value with milk system connected
	LEAKAGE	Difference in measured values
	LIMIT	Value to be observed according to: ISO 5707
	MEASUREMENT	Actual vacuum during the measurement
	RATED VACUUM	Required vacuum during the measurement according to: ISO 6690
6/6	**LEAKAGE** **VACUUM SYSTEM**	Air flow at the air inlet to the vacuum pump (s)
	AF VACUUM PUMP 1 - 3	Vacuum pump: 1-3 Measured value at the air inlet to the vacuum pump (at operating vacuum)
	TOTAL	Air flow of all vacuum pumps (total)
	AF WITHOUT MS	Measured value after disconnecting the milk system
	LEAKAGE	Air leaking from the vacuum system = Difference between the two lines above
	LIMIT	Value to be observed according to: ISO 5707
	MEASUREMENT1 - N	Actual vacuum during the measurement
	RATED VACUUM	Required vacuum during the measurement according to: ISO 6690

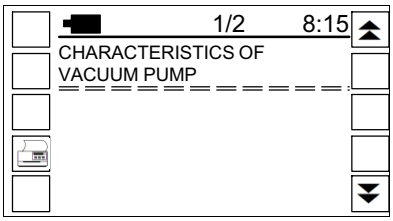
Example:
Test report on air flow rates (ISO 6690:1984)

1/5	**RESERVE CAPACITY OF THE INSTALLATION**	
	MEASUREMENT	
	NORMAL VALUE	
	LIMIT	
	MEASUREMENT	
	RATED VACUUM	
2/5	**LEAKAGE REGULATOR**	
	AF WITHOUT REG.	
	RESERVE CAPACITY	
	LEAKAGE	
	LIMIT	
	MEASUREMENT	
	RATED VACUUM	
3/5	**AIR INLET THROUGH MILKING UNITS**	
	AF WITHOUT MU	
	AF WITHOUT REG.	
	TOTAL INLET	**For description, see:**
	INLET PER MU	**Test report on air flow rates (ISO 6690:1996/2007)**
	MEASUREMENT	
	RATED VACUUM	
4/5	**LEAKAGE MILKING SYSTEM**	
	AF WITHOUT MS	
	AF WITHOUT MU	
	LEAKAGE	
	LIMIT	
	MEASUREMENT	
	RATED VACUUM	
5/5	**LEAKAGE VACUUM SYSTEM**	
	AF VACUUM PUMP 1 - N	
	TOTAL	
	AF WITHOUT MS	
	LEAKAGE	
	LIMIT	
	MEASUREMENT1 - N	
	RATED VACUUM	

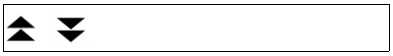
Vacuum pump performance data

The vacuum pump test report includes one screen for each pump.

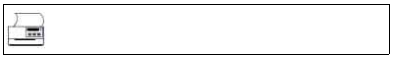
Information displayed
- Pump number (1/2)



Function keys in the display
- Select vacuum pump



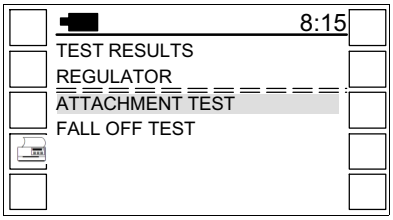
- Start printing



Example: **Test report on vacuum pump performance data**		
CHARACTERISTICS OF VACUUM PUMP		
	AIR FLOW	Measured value at the vacuum pump air inlet with a vacuum of 50 kPa
	NORMAL VALUE	Measured value corrected for weather influences The corrected air flow indicates the measured value that would have been given with a barometric air pressure of 1013 hPa. This makes it possible to compare measured values that were recorded in different weather conditions.
	NOMINAL VALUE	Measured value corrected for elevation and weather influences The nominal value indicates the measured value that would have been given with an actual air pressure of 100 kPa. This is the air pressure when a barometer displays 1013 hPa at a height of approx. 100 m. The nominal values enables a comparison between the pump performance and the rated performance according to the rating plate.
	LIMIT	Rated performance according to the manufacturer See section on: INSTALLATION TEST / INSTALLATION DATA
	MEASUREMENT	Actual vacuum during the air flow measurement
	RATED VACUUM	Vacuum required in accordance with ISO 6690 during the air flow measurement
	REVOLUTIONS	Pump motor speed measured
	LIMIT	Rated speed according to the manufacturer See section on: INSTALLATION TEST / INSTALLATION DATA
	BACK PRESSURE *	Pressure measured in the exhaust line **Note!** For frequency-controlled vacuum pumps, the dynamic pressure should also be measured at maximum pump speed.
	LIMIT *	Permissible dynamic pressure according to the manufacturer See section on: INSTALLATION TEST / INSTALLATION DATA
*	This line is not given when testing to ISO 6690:1984	

Behaviour of the vacuum control unit

- Start the program REGULATOR
  - Once the program starts, the measuring screen shown will appear.

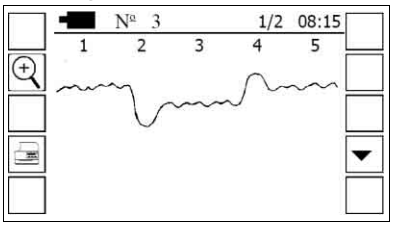


The reports are the same except for the heading.

Test report on control behaviour

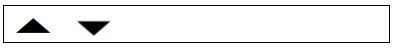
Screen: 1

- The measured value curve is displayed
- Five phases
  See also the section entitled:
  INSTALLATION TEST / REGULATOR



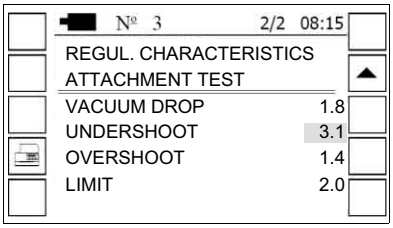
Function keys in the display

- Previous / next screen



Screen: 2

- The analysis is displayed



VACUUM DROP	=	Mean value for phase 1	-	Mean value for phase 3
UNDERSHOOT	=	Mean value for phase 3	-	Minimum for phase 2
OVERSHOOT	=	Maximum for phase 4	-	Mean value for phase 5

5.9 Program (TRANSFER.EXE)

This program can be used to send data to a computer and then save it, print it or edit it.

5.9.1 System requirements

The computer must meet at least the following system requirements.

Computer	Personal computer with a serial interface or USB 2.0 and suitable adapter Example: LogiLink USB 2.0 Serial Adapter
Processor	x86 Family, 600 MHz
Physical memory	512 MB
Virtual memory	2 GB
Operating system	Microsoft Windows 2000 Professional (SP4), XP Professional (SP3)®
Office package	Microsoft Excel 2000 (SP3), 2003, XP, 2007® **(the program is spreadsheet-based)**

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5.9.2 Installation

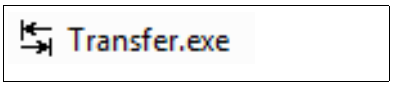
☞ **Note!**
- Administration rights on the computer required!
- The installation folder must be set up with permanent unlimited access.
  See operating system manual.

- Insert Installation CD
- Go to the folder indicated PC-SOFTWARE
- Start installation file (install.bat)
  - A query window will appear:
    Install Visual Basic Runtime Library?
- Answer YES
  (left button)
  - Input form for the installation path will appear
- Enter installation path
  Example: C:\
- Start installation
  (click on EXTRACT)
  - The program TRANSFER.EXE will be copied to the hard disk

5.9.3 Data Transfer

Data are transferred to the computer as follows:

- Start the program (TRANSFER.EXE)



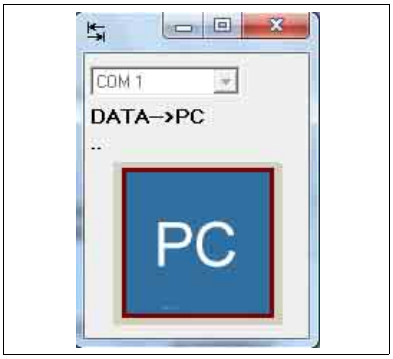
- Connect the tester to the computer's serial interface

Attention!
To avoid errors and damage to the computer and tester, only use the interface cable that was supplied with the program.

On the computer:

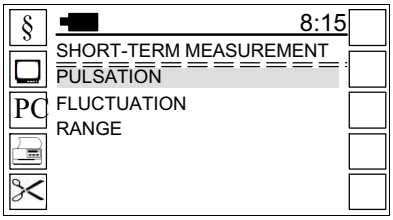
- A window will open

- Select interface (COM1-COM9)
- Press button (A)
  - Content of window changes

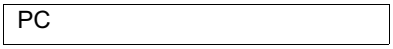


On the tester:

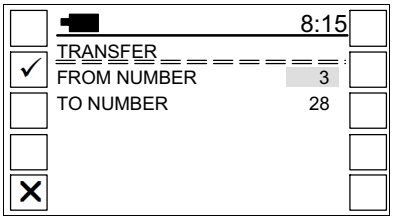
- Select menu point
  Example: PULSATION



- Press function key



- A window will open
  In the following menus only:
  - SHORT-TERM MEASUREMENT
  - LONG-TERM MEASUREMENTS



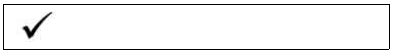
- Set the records to be transferred
  Example: 3 - 28

Note!

SHORT-TERM MEASUREMENT
Maximum number of records per transmission: 75
Recommendation!
Transfer records that do not belong with each other separately so that they are stored in separate workbooks (files).
Example:
Measured values from different installations

LONG-TERM MEASUREMENTS
In the "Long-time measurements" program the measured value graph (scaling on the time axis, channel shown) is based on the first record transferred.
So always transmit the data from different measurements separately.

- Press function key



- Data will be transferred
  Export folder: ... \ Data

On the computer:

- Content of window changes
- Wait for the data transfer to end

5.9.4 Editing transferred files

The files transferred are stored in an Export folder

- Example: C:\Programme\Transfer\Data

The file name corresponds to the name of the corresponding measurement program.

- Example: SHORT-TERM MEASUREMENT

Create final file

- End all programs that are running and close all Excel files that are open.

> **Note!**
> Programs running in the background will block system performance.
> This might result in errors or cause the program to crash.
> This applies especially when processing large files.

- Open the file in Excel

> **Note!**
> Files can only be edited if Excel allows the use of macros.
> Change the program settings accordingly if necessary.

The program will then undergo automatic checks:

- Check whether the raw data transferred are complete.
- Check whether the tester software version and the program version correspond.
- If these requirements are met, the final worksheets (spreadsheets and graphs) will be created and the amended file (workbook) will be saved.

Editing worksheets

☞ **Note!**

- All workbooks are protected against changes so that worksheets cannot be deleted accidentally.
- In addition to the workbook itself, the spreadsheets and graphs it contains are also protected.
- The protection can be removed at any time in the SHORT-TIME MEASUREMENT and LONG-TIME MEASUREMENT subprograms.
  Excel menu: Extras / Protectin (see manual)

- Remove protection from the workbook
  - Individual worksheets can be copied or deleted.
- Editing spreadsheet cells
  Only the cells listed in the table can be edited.

Program	Editable cells
SHORT-TERM MEASUREMENT	• Title above the graphs • All cells with a yellow background • Dotted lines beneath the measured values
LONG-TERM MEASUREMENTS	• Any amount of text fields can be added to each graph.
SINGLE MEASUREMENTS	• Comment fields
CLEANING TEST	• Dotted lines above and below the tables (Sheet 1) • All cells with a yellow background (Sheet 1) • Any amount of text fields can be added to each graph.
INSTALLATION TEST	• All cells with a yellow background • Any amount of text fields can be added to each graph.

Copying workbooks

The content of a table can be copied into a new workbook.

For further processing, the table on which the graphs are based can also be exported to a new workbook.

- To do this, press the following combination of keys at the same time.
  Strg + E (Ctrl + E)
  - A new workbook will be created containing the table GRAPH.
  - The original workbook will be closed without any loss of data.
- Save workbook
  The new workbook must be saved manually.

6 Operating faults

If necessary, please contact your nearest authorized technical dealer.

6.1 Troubleshooting possible faults

If there is insufficient power insert either four new 1.5 Volt batteries (AA) or four rechargeable batters (NiCd or NiMH) into the battery compartment as follows:

- Remove the battery compartment cover by turning in the anticlockwise direction with a coin or screwdriver.
- Place a hand beneath the open battery compartment and tip the tester to the right so that any batteries already inside slide out into your hand.
- Tip the tester to the left.
- Slowly place four new batteries, positive pole first, into the battery compartment.
- Close the cover by turning in the clockwise direction and tighten securely with a coin or screwdriver.

Attention!
The power supply may fail if the battery compartment cover is not closed tightly enough. This may lead to loss of data and may damage the tester.

6.2 Repairs

If a repair is necessary, the meter must be sent to the address on the application form.

For application form, see section:
Appendix

Always include the following details in the application form:

- Reason for the complaint
  (brief description of the fault)
- Contact
- Telephone number

7 Maintenance

The tester requires hardly any maintenance.

Clean the housing with a damp cloth.

The internal and external pressure sensors are not sensitive to water and slightly alkaline fluids.

If necessary they can be cleaned by applying a slightly alkaline fluid.

Remove fluid after allowing to take effect for approximately 5 minutes.

- To do this, suspend the external sensors so that the hose connectors are pointing downwards.

If the device is to be stored for a long time, remove the batteries to prevent them leaking.

7.1 Calibrating the test unit

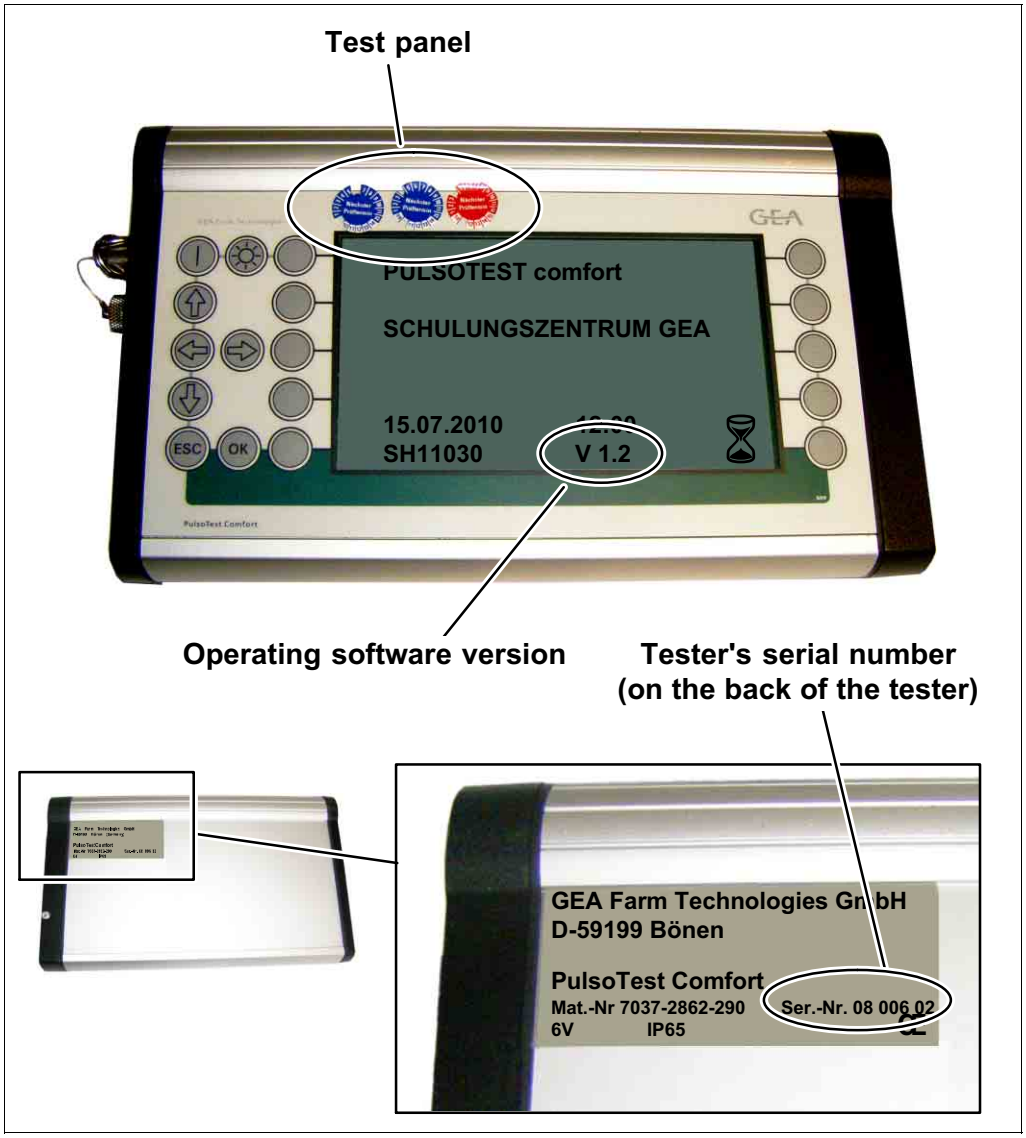
According to ISO 6690 measuring instruments must be calibrated every year.

Note!
The date for the next calibration can be seen on the test panel attached to the meter

For calibration, the meter must be sent to the address given on the application form.

For application form, see section:
Appendix

Enter the serial no. and the operating software version on the form.

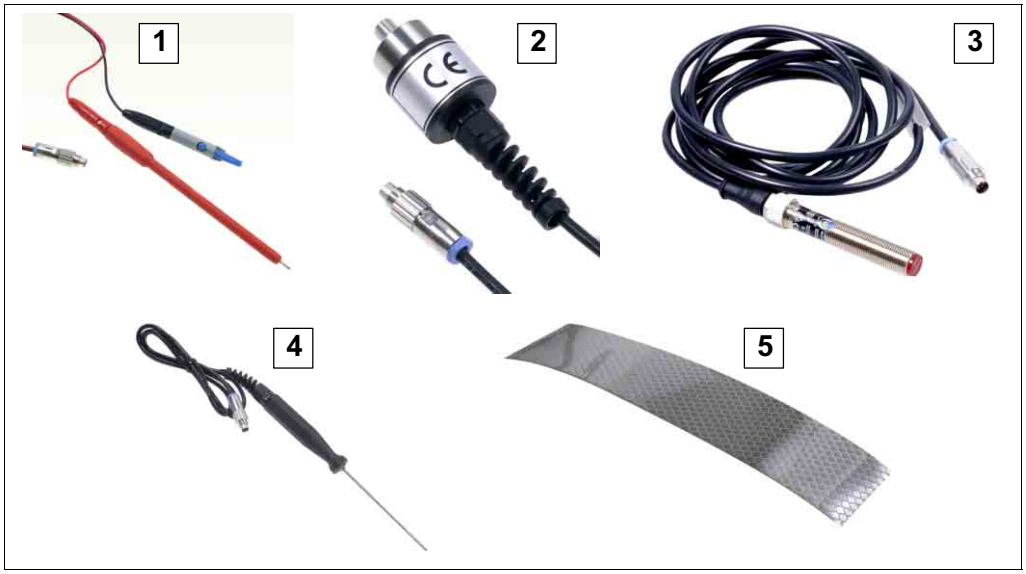


8 Spare Parts

Part number	Description	
7037-3005-480	PulsoTest Comfort Tester with transport case	without printer
7037-3005-470		with printer
7037-2375-030	Printer with cable and power pack	
6965-0133-050	Printer paper	
0018-7840-898	Measuring hose	3 x 2
7027-2635-008	Vacuum tube (sold by the metre)	7 x 3
0018-4052-820	T-piece hose connector	8-4
7037-3704-010	Test teat	

Parts

Part number	Description	
7037-9901-020	Set of accessories	
7037-3000-330	Air flow meter	
7027-9875-000	Hose removal tool	
7041-2688-000	Nozzle needle holder	
7037-2646-020	Measuring aid, complete	ISO Vm Vr Vp
7037-9910-000	Connecting hose set	ISO Vm Vr Vp
7801-1193-028	Air hose	6x1 green
7801-1193-038	Air hose	6x1 black



Item	Part number	Description	
1	7037-2339-000	Sensor	0-30 V DC
2	7037-2339-010	Sensor	Vac-Air
3	7037-2339-020	Sensor	Speed control
4	7037-2339-030	Sensor	Temperature
-	7037-2508-020	Adapter	USB - Seriell
5	7037-5901-000	Reflector	Speed control

9 Appendix

9.1 Connection between measurement interval and measurement cycle

Connection between measurement interval, measurement cycle and measurement duration

	SHORT-TERM MEASUREMENT FLUCTUATION		LONG-TERM MEASUREMENTS			SHORT-TERM MEASUREMENT RANGE	
	INTERVAL (ms)	Cycle time (s)	INTERVAL (ms)	Cycle time PT (s)	Measurement duration (h:min:s)	MEASUREMENTS /min	Cycle time PT (min)
	1	0,7	10	1,76	00:05:52	40	17:36
	2	1,4	20	3,52	00:11:44	41	17
	3	2,1	30	5,28	00:17:36	44	16
	4	2,8	40	7,04	00:23:28	47	15
	5	3,5	50	8,80	00:29:20	50	14
	6	4,2	60	10,6	00:35:12	54	13
	8	5,6	80	14,1	00:46:56	59	12
	10	7,0	100	17,6	00:48:40	64	11
	15	10,6	125	22,0	01:13:20	70	10
	20	14,1	150	26,4	01:28:00	78	9
	25	17,6	175	30,8	01:42:40	88	8
	30	21,1	200	35,2	01:57:20	100	7
	35	24,6	250	44,0	02:26:40	117	6
	40	28,2	300	52,8	02:56:00	141	5
	50	35,2	350	61,6	03:25:20	176	4
	60	42,2	400	70,4	03:54:40	235	3
	80	56,3	450	79,2	04:24:00	352	2
	99	69,7	500	88,0	04:53:20	400	01:45

Information on measurement			
Cycles per measurement	1	200	1
Measuring points per cycle	704	176	704
INTERVAL (ms)	can be selected freely 1 - 99 ms = 1000 - 10,1Hz	can be selected freely 10 - 500 ms = 100 - 2Hz	
MEASUREMENTS /min			can be selected freely 40 - 400 = 25 - 2,5Hz

Formula
The values in the tables might sometimes be rounded.
Calculate exact values with the following formulae

Periodendauer	= INTERVAL (ms) x 704 / 1000	= INTERVAL (ms) x 176 / 1000	= 704 MEASUREMENTS /min
Measurement duration		= INTERVAL (ms) x 176 / 1000 x Cycles per measurement	

Minimum measuring frequency for measurements to DIN ISO 6690

The minimum measuring frequency for the individual types of measurement may not be lower but may be higher than that specified.

Type	**Minimum measuring frequency** (Hz)	**Calculated value** (ms)	**On the Pulsotest**	
			value to be set (ms)	**Measuring frequency** (Hz)
1	24	41,67	40	25
2	48	20,83	20	50
3	63	15,87	15	66,67
4	100	10	10	100
5	170	5,88	5	200
6	1000	1	1	1000

Types of measurement	
1	for milk separators, dry parts of the milking installation
2	wet measurements or measurements in the milking line
3	wet measurements or measurements in the clawpiece
4	pulsator test
5	wet measurements or measurements in the short milk tube
6	wet measurements or measurements in the short milk tube with air admission

9.2 Air admission measurements

The tester determines the amount of air entering a milking installation through a cluster by an indirect method.

- The method is based on measuring the vacuum drop caused by the air admitted into an airtight container with a volume of approximately 20 litres for a duration of 10 seconds.
- Account is taken of the current air pressure and the elevation.

  This may lead to differences compared to the values in the tables in the international milking installation standard, which are based on an air pressure of 100 kPa.

Depending on the objective of the test (individual measurements) or the version of the standard to be applied, either the total amount of air admitted into the cluster is determined alone, or the amount of air admitted through untight shut-off valves and clawpiece is also included.

Test procedure

The test procedure is essentially the same for all three purposes.
The only differences are the adjustments that have to be made at the cluster.

- Connect the long milk tube and measuring channel 1 to an airtight container of approximately 20 litres (e.g. a milking churn).
- With a hose, connect the airtight container to the vacuum connection of a vacuum line.
- Close the vacuum connection, switch on the vacuum pump and pulsators
- Set up the cluster as appropriate for the test.

Test	**Cluster adjustments to be made**		
	Shut-off valve	**Teat cups**	**Air inlet opening**
LEAKAGE Shut-off valve	close	remove stoppers	open
AIR ADMISSION TOTAL	open	insert stoppers	open
LEAKAGE Clawpiece	open	insert stoppers	close

- Open vacuum connection
- Wait until the vacuum in the airtight churn is the installation vacuum (approx. 30 seconds)
- Open the required measuring screen and select the required record or measurement line.

See corresponding section:
- SINGLE MEASUREMENTS
- INSTALLATION TEST / MEASUREMENT PROGRAMS / MILKING UNITS

Start measurement

- Press
  - Wait until the result is displayed

9.3 Application form: Meter calibration / repair

Shipping address

Fa. Kraft & Butzke
Lindenthaler Hauptstraße 145
04158 Leipzig
Tel./ Fax: +49 341 4512010

Details on the tester

Tester owner	_____
Tester serial number	_____
Operating software version	_____

Inspection and calibration

	(please mark with a cross)	PT Comfort (Owner)	completed (Kraft & Butzke)		
Inspection and calibration	Basic device				
	External pressure sensor 1				
	External pressure sensor 2				
	Temperature sensor 1				
	Temperature sensor 2				
Check	Speed sensor				
	Voltage sensor				
Operating software update	Basic device				
Repairs	Internal pressure sensors				
	Replace display				
	Replace housing				
	Replace front panel				

Version of the updated software (Kraft & Butzke)	_____

Description of the fault

description of error /
Miscellaneous: _____

Return address

First name / Name /
Company _____

Address: _____

_____

_____

Country: _____

Contact: _____

Tel.: _____

E-mail address _____

Signature

Date: _____ Signature: _____

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