Falling Number® 1000

Operation Manual

Perten INSTRUMENTS

E11101 v1.0

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FALLING NUMBER® 1000

Operation Manual no. E11101, v1.0, May 2016.
Valid for FN 1000 from S/N 160xxxx.

FN 1000 COMPONENTS/PACKING LIST

THIS DELIVERY CONTAINS

Part No.	Ref	Description
1 x FN 1000		Falling Number® 1000 Instrument complete, including:
2 x 10.03.00	A	Viscometer tubes (2 x 10 pcs) certified for Falling Number Test
1 x 10.08.00	B	Viscometer tube rack
1 x 10.07.04	C	Rubber stoppers, pack of 4
1 x 10.06.00	D	Plastic funnel
1 x 10.05.00	E	Pipette 25 ml of glass
1 x 10.01.18	F	Mains power cable (For 230 V ~ operation), or:
1 x 10.01.19	F	Mains power cable (For 115 V ~ operation)
1 x 16.08.10	G	Cassette stand
1 x 16.04.40	H	Cassette for holding tubes
2 x 16.04.00	J	Viscometer-Stirrer
3m 30718	K	Plastic tubing for cooling system
1 x 31037		Spiral hose collector
1 x 10.65.71	L	Flow Indicator
1 x 30099	M	Hose clamps for cooling tubing
1 x 30690	N	Bottle for WB refill water
1 x 31105	O	Hose kit for WB refill system
1 x 39.19.10		Poster Falling Number Method
1 x		Operation Manual set

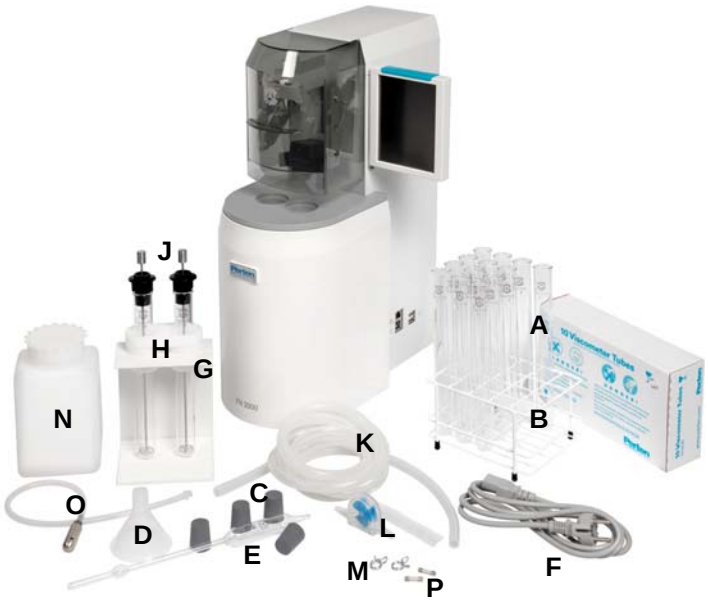

Figure 1. Falling Number® 1000

SPARE PARTS SUPPLIED

2 x 30949	P	Spare fuse T6.3AH 250V (230 V ~),
or		
2 x 30950	P	Spare fuse T10AH 250V (115 V ~)

Retain all packing materials for future possible service transport.

CHECK YOUR DELIVERY FOR ANY OPTIONAL ACCESSORIES DELIVERED

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SAFETY INSTRUCTIONS

WARNING: To prevent operator injury or damage to the apparatus, verify that the main voltage is correct, before connecting to the main power. Check that details on the apparatus power module and the water bath label agree with your main voltage. See figure 2 and 3. Also ensure the line power cable is connected to a main power outlet that is provided with a protective earth ground contact. If the power cable connector must be replaced, the replacement must only be by qualified personnel.

WARNING: The Viscometer tubes are glass and may break. Always inspect the Viscometer tube before use to ensure that it is free from defects. Never use damaged tubes.
When cleaning with the Spolett tube cleaner, **always** use the Spolett protection cover.

1. The apparatus must be placed on a stable, horizontal surface.

2. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3. The cord used or any replacement cord must be appropriately rated and approved in accordance with the regulations of the country that it is used in.

4. Verification of the safe state of the equipment must be conducted after any servicing, maintenance or repair.

5. The apparatus water bath must only be filled with distilled water or water of equivalent purity.

6. **WARNING**. The water bath becomes hot during operation. Always keep the water bath cover in correct operating position during use of the instrument. See figure 4. Do not touch the water bath surface during operation.
   Also the cooling lid may become hot if cooling water flow for any reason is too low or stopped. Always make sure that the cooling water is running at the correct flow (>400 ml/minute, see page 4).

7. **WARNING**. If the water bath or cooling lid need to be removed, emptied, cleaned or otherwise adjusted, or if the plastic tubing for cooling water needs to be replaced, or otherwise adjusted, ensure the water bath and cooling lid are at room temperature. Disconnect the apparatus from the mains supply before any such action.

8. **WARNING**. Water bath level is automatically adjusted by the instrument. Hot water may be pumped out of the bath when the instrument is in operation.

9. CAUTION. Note that stirring starts automatically after 5 seconds if the plastic visor has been pulled down.

Figure 2. Power module. The fuses are located in the back of the instrument. For exchange see Appendix XI "Replacement of fuses".

Figure 3. Water bath label and connector.

Figure 4. Hot surface: cooling lid sitting on water bath without protection cover

Figure 5. Instrument base plate with sliding rale (A) and connector (B).

INSTALLATION INSTRUCTIONS

WARNING: To prevent operator injury or damage to the apparatus, the apparatus should be disconnected while connecting the water bath and cooling lid system.

CONNECTION OF WATER BATH AND COOLING LID SYSTEM

1. At delivery the water bath is sitting in the instrument. It slides on a rail on the base plate (see figure 5), and has a distinct final position when sitting properly in the instrument. Lift up the plastic visor and remove the cooling lid for removal of the bath or to put water into the bath.

NOTE: The Water Bath and Cooling Lid are individually adjusted for each instrument and shall not be shifted between instruments. If water baths or cooling lids are shifted between different instruments the Falling Number result may be affected.

2. Fill the water bath with distilled water, or water of equivalent purity, to approx. 4 cm (1.5 inch) below the top of the water bath (approx. 2.9 litres).

3. Connect the plastic tubing supplied, from a cold water tap to a nozzle on the cooling lid and arrange for a waste line to run to a suitable drainage point. Installed the included flow indicator in the inlet tubing where it is visible for the operator. Ensure that the plastic tubing is properly fixed with the supplied hose clamps. Figure 7. Alternatively connect to a recirculation cooler. Turn on the water and check that it flows at a minimum of 400 ml per minute.

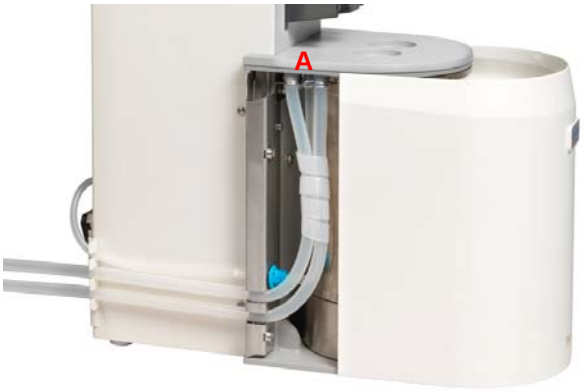


Figure 6. Connect plastic tubing securely to the cooling lid nozzles using the hose clamps (A).

4. Also make sure the refill water tubing is properly fitted from the cooling lid via the frame connection to the pump on the back of the instrument. Figure 6 and 7.

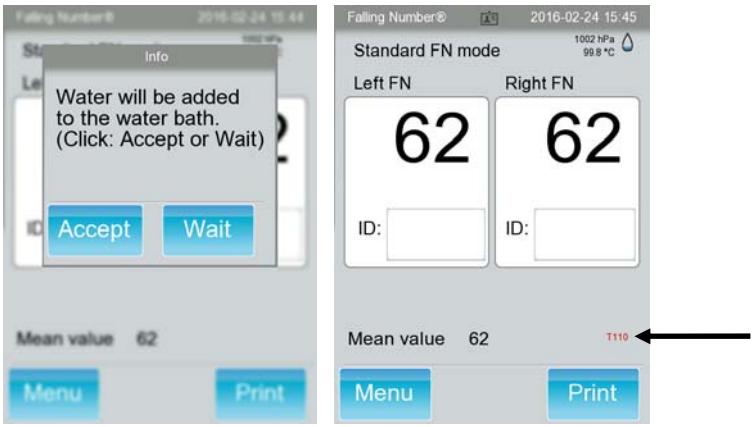
5. Fill the WB refill water bottle with distilled water, or water of equivalent purity, to approx. 75% of its volume (approx. 0.7 litres). Connect the supply tube to the left connection on the pump and place the other end of the tube with the metal filter in the refill water bottle. Figure 7.

WARNING: When the water level control pump is pumping out any excess of water in the water bath, this water is hot, up to 100 °C. Be careful to have the outlet tube properly fitted in the refill water bottle.

WATER BATH REFILL SYSTEM

The pump on the back of the instrument is controlled by the water level control in the water bath. If a low water level is detected it will pump water into the water bath, and if a high water level is detected it will pump out water from the water bath.

During normal operation of the instrument, the water level will slowly go down due to minor amounts of water and steam leaving the bath with the test tubes. At some point of operation the instrument will detect a low water level and initiate a refill of water. When this happen the message “Water will be added to the water bath. (Click: Accept or Wait)” will appear in the screen.

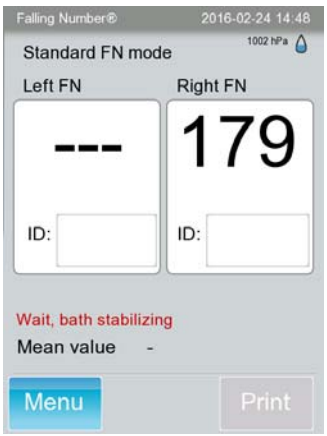


After clicking Accept or Wait, a timer is shown in the lower right corner. **W**xxx indicates a waiting time and **T**xxx indicates that water is pumped to the bath.

Wait
If you are just in the preparation of a new sample to be tested or for any other reason want to delay the addition of water to the bath, click “Wait” and the addition of water will be delayed up to 5 minutes. In the meantime you can finalize the preparation and then start analysis of the new sample. During analysis the addition of water to the bath is always deactivated. At the end of the analysis, or after the waiting time of 5 minutes has elapsed, the pump will start to add water to the bath until the correct level is reached.

Accept
If “Accept” is clicked, the system will directly start pumping water to the water bath until the correct level is reached.

When correct water level is reached, the pump will stop and a waiting time of 3 minutes is started to let the water bath temperature stabilise before next analysis is started. However if temperature in the bath goes below 95°C (or 5 degrees below water boiling temperature according to set altitude) or below 85°C when the instrument is in Fungal FN mode, the system goes into normal heat up mode and there will be a 5 minutes waiting time when temperature goes above 95°C (85°C for Fungal FN).



SYSTEM CONNECTION AND WARM-UP

WARNING: To prevent operator injury or damage to the apparatus, verify that the main voltage is correct before connecting to the main power. Check that details on the apparatus power module and the water bath label agree with your line voltage. See figure 2 and 3. Also ensure the main power cable is connected to a main power outlet that has a protective earth ground contact.

Figure 7. Backside of the instrument with the name plate, pump and mains power. At the bottom you will find to the left the ON/OFF switch and the contact for the mains power cable (A) and to the right the fuse holders (B).

Figure 8. The Ethernet and the four USB connections on the right hand side of the instrument.

1. After verifying main voltage, connect the apparatus to mains power.

2. Turn on the cooling water and verify that it flows at a minimum of 400 ml per minute.

NOTE: Cooling water MUST flow the entire time the apparatus is switched on.

3. Pull down the plastic visor.

4. Press the on/off button on the rear panel to switch on the apparatus. Both water bath elements will turn on automatically until the water is boiling (approx. 20 minutes). If the plastic visor is not closed at switch on of the instrument the display will show Please close visor. In this case, close the visor before continuing the procedure. The heating elements will not be turned on before the visor is closed.

When the instrument is started the first time, the user **must set the correct altitude** of the laboratory where the instrument is installed. This is done under Local settings, see chapter “Set up of the instrument”.
If no altitude is set under local settings, this message will show every time the instrument is powered on.

5. During heat up the display will show Wait, bath cold. The temperature in the water bath will also be displayed in the upper right corner of the display.

When the temperature reaches 95°C or 85°C for Fungal FN mode, the display will show Wait, stabilizing and the right counter counts down from 300 to 0. This indicates that 300 seconds (5 minutes) heat up time remains.

6. When the display has counted down to 0 and both counters show “ - - - “, pull up the plastic visor.

7. The instrument is now ready for use.

If an error message is displayed, see Appendix X, Error messages for further information.

NOTE: If the FN apparatus is used at an altitude higher than 610 metres (2000 feet) above sea level, refer to Appendix IX, Altitude correction.

DESCRIPTION OF DISPLAY USER INTERFACE

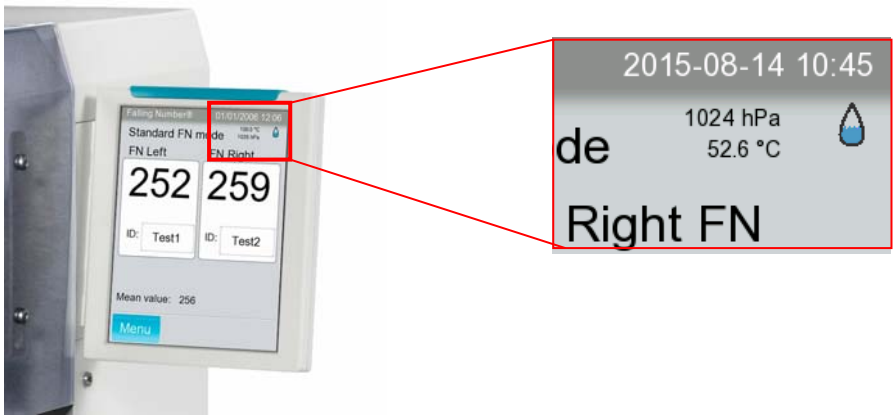


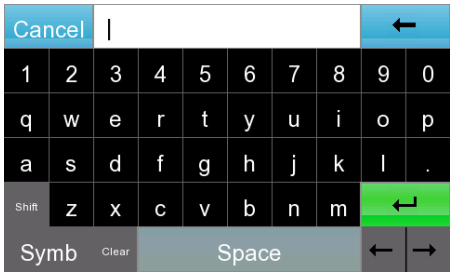
Figure 9. Display with User Interface.

The FN 1000 is operated through its color touch screen. Technology is resistance-type and is intended to be used by pressing the keys with your fingers. It is possible to use it when wearing gloves and it is also possible to use with a stylus pen. Multi-touch is not supported, and you can only press one key at a time. A click sound acts as feedback for a key press. The volume can be adjusted as a parameter setting in the Local settings.
At the upper right corner of the display you will see, in addition to the date and time, information about the air pressure, the water bath temperature and the bath water level.

1024 hPa	Atmospheric pressure. If pressure is indicating an altitude that requires Altitude Correction of FN a message will be seen on the screen.
52.6 °C	Water Bath temperature. Displayed during heat up when instrument is turned on and during change between classical and Fungal FN operation.
	Water Bath level indication. When droplet is half filled (see picture) level is correct. If droplet is full or empty, this indicates high or low water level in the Bath. Instrument will automatically pump out or fill up the Bath when required.

The picture above shows a typical screen of the FN 1000. The grey field at the top of the screen is the Menu name field, which shows you which menu you are currently in. You will also see date and time at the top right of this field.

To press one of the blue buttons, simply touch it. You will hear a clicking sound when you press it. The white fields in the example above display the current setting, and the text to the left explains which setting each field is for. By pressing the white fields you can change the setting. When you press it, the content of the field will change or a pop-up keyboard (see below) allows you to enter a new value. To save your change you need to press “Save”. To go to the next (or previous) screen, press the right or left arrow button.



Pop-up keyboard.

To change to caps lock, press the shift button twice rapidly. Press the “Symb” button if you want to enter other characters than letters and numbers. Press the “Clear” button if you want to erase all the present ID characters.
“Enter” button is the green line feed button to the right.

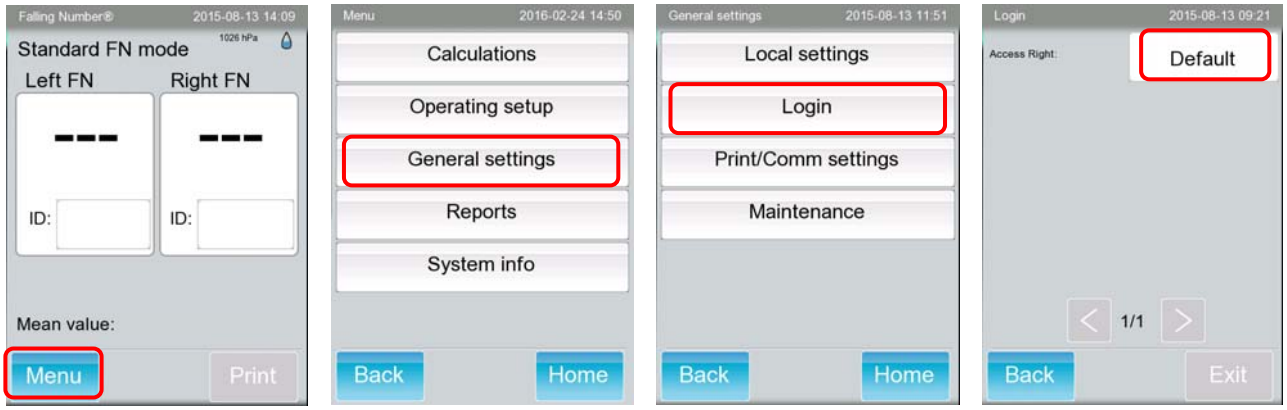
In other screens white buttons are used to step to the next menu. By pressing you will be brought to the next menu selected (See below for examples).

SET UP OF THE INSTRUMENT

During installation the internal date format, date and clock and other settings should be set before operation of the instrument. To be able to change the settings you must Login as Administrator.

Login as Administrator

When the instrument is switched on, the access right is set to Default, which means no adjustments or configuration changes are allowed.

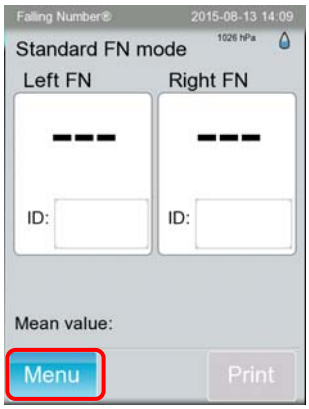


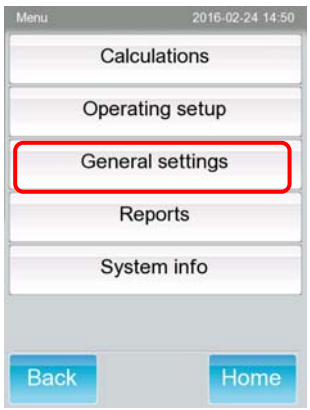
Press ”Menu”, ”General settings” and ” Login” to reach the Login window.

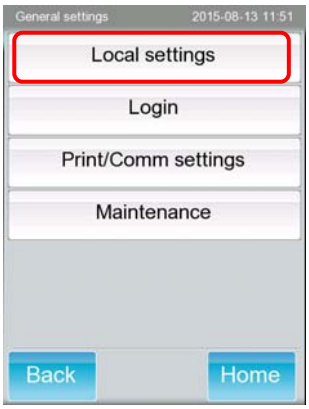
To log in as Administrator, press the top field, which says “Default”. You will now see the pop-up keyboard and can enter the Administrator password 142857. Then press Enter and you will be logged in as Administrator. You will also see name tag icon (see below) in the middle of the field at the top of the display as long as you are logged in as Administrator.

To log out from Administrator access level, use the feature again, but leave the field blank when the pop-up keyboard appears and only press “Enter”. Default is now shown again in the field.

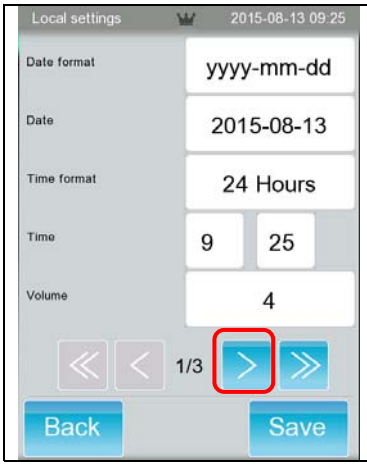
Local settings



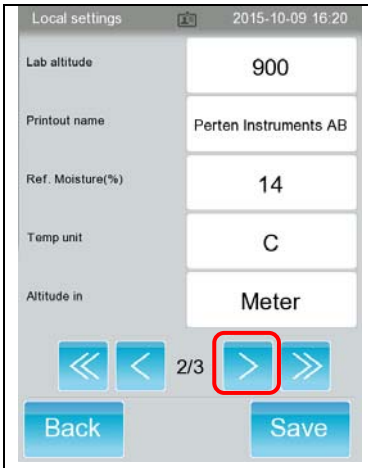


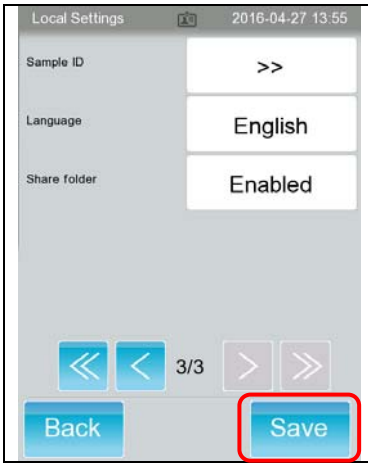


Make sure you are logged in as an Administrator before going to the Local settings screen. Then press ”Menu”, ”General settings” and ”Local settings” to reach the local setting screen.



Date format:	Toggle between yyyy-mm-dd and mm/dd/yyyy.
Date:	Set correct date.
Time format:	Toggle between am/pm and 24 hours
Time:	Set correct time.
Volume:	Volume of speaker (0 to 5)
	Step to next page by pressing the “**>**” arrow.

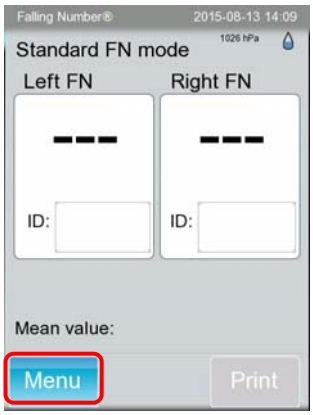
	Lab altitude: Printout name: Ref. Moisture: Temp unit: Altitude in:	Set correct altitude in meter or feet (as selected below). See also Appendix IX. Name or other info for printout. Up to 20 characters can be entered. Toggle between 14% and 15% Toggle between C and F Lab altitude can be set in Meter or Feet. Step to next page by pressing the **>** arrow

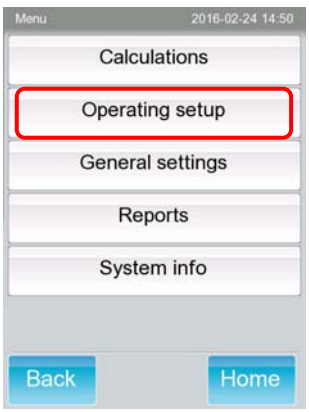
	Sample ID Language: Share folder: Save:	Go to Sample ID set-up, see Appendix IV. Toggle between the available languages. Enabled/Disabled. For use with external communication and service. Press “Save” to save the selected settings

After saving the selected settings, press “Back” to go back to the operating screen.

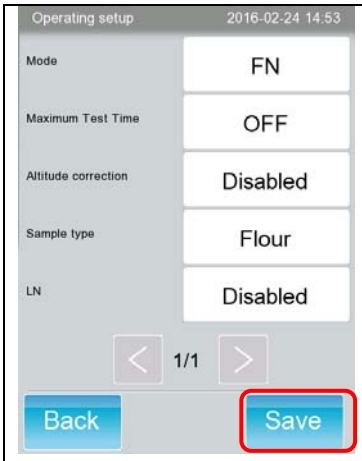
Selecting classical or Fungal Falling Number operation

At delivery the FN 1000 is set for classical Falling Number operation according to international standards ICC 107/1, AACCI 56-81.03 and ISO 3093. The instrument does also have the Fungal Falling Number method available as alternative operating mode. To set the instrument for requested operation one should follow the below procedure.





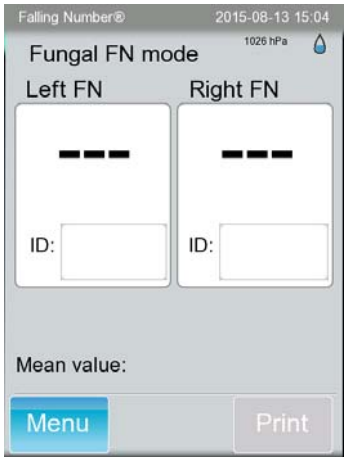
Make sure you are logged in as an Administrator before going to the Operating setup screen. Then press ”Menu” and ”Operating setup” to reach the settings screen.

	Mode: Maximum test time: Altitude correction: Sample type: LN: Save:	Toggle between FN and Fungal FN. *See description below.* *See Appendix IX, Altitude correction.* *See Appendix IX, Altitude correction.* Enabled/Disabled to see LN on screen. See also Appendix VI. Press “Save” to save the selected settings

Select Mode: Fungal FN and “Save” before going “Back” to the operating screen.

To re-select classical FN operation, select Mode: FN and “Save” before going “Back” to the operating screen.

When Fungal FN mode is selected the display will show “Fungal FN mode” and above the results will be shown Left FFN and Right FFN, see below.



System functions

- The system will inform when the water bath temperature is different from the set temperature. At heating up the display will show Wait, bath cold until reaching 5°C below the set temperature, i.e. 85°C for Fungal FN or 95°C for classical FN. After reaching this temperature the display will show Wait, stabilizing while the right counter counts down from 300 seconds to 0 before the instrument is ready for running a test.

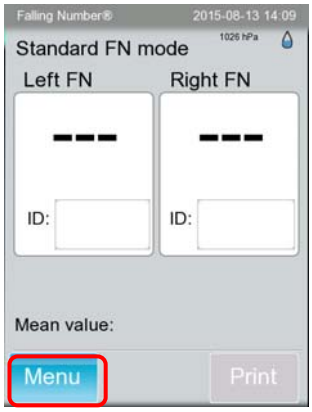
- If the selection of Fungal FN method is done from classical FN operation (water is boiling) the display will show Wait, high temp until reaching 93°C. After reaching below 93°C the display will show Wait, stabilizing while the right counter counts down from 300 seconds to 0 before the instrument is ready for running a test. It will

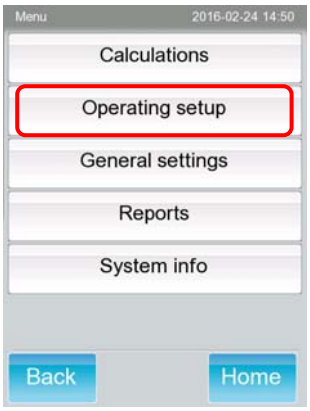
take approximately 15 minutes to go from classical FN boiling water to 90°C temperature for the Fungal FN method.

- When changing from Fungal FN operation (with 90°C water in the water bath) to classical Falling Number, the display will show Wait, bath cold until reaching 95°C. After reaching above 95°C the display will show Wait, stabilizing while the right counter counts down from 300 seconds to 0 before the instrument is ready for running a test. It will take approximately 7-8 minutes to go from Fungal FN 90°C temperature to boiling water for the classical FN method.

Activating the Maximum Test Time function

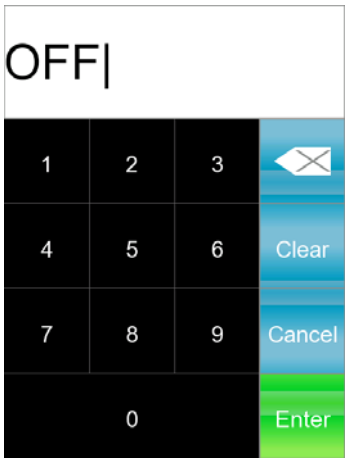
The Maximum Test Time function offers a posibility to stop the FN test when a required minimum Falling Number result is reached. If the function is activated, the FN test will be running with the normal process until the Maximum time is reached. At that time the instrument will push down the stirrers and the test will be stopped. If the Maximum time is reached, the result will be given in RED on the screen, but if the FN result is lower than the set Maximum Test Time, the result will be presented in the normal black color. The Maximum Test Time can be set to any time higher than 100 seconds. If a lower value is entered, this will turn off the function, see below.





Make sure you are logged in as an Administrator before going to the Operating setup screen. Then press ”Menu” and ”Operating detup” to reach the settings screen.

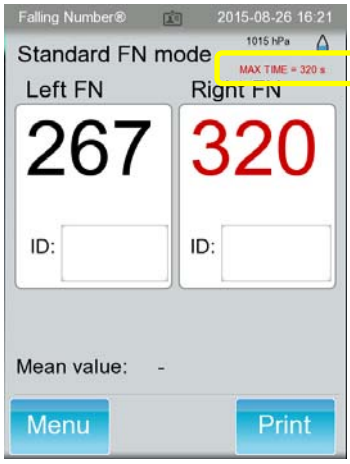
	Maximum Test Time: Save:	Press the “OFF” field to open the pop-up numeric keyboard (see below). Press “Save” to save the selected settings.



Pop-up numeric keyboard

To set a maximum test time, a number of 100 (seconds) or higher shall be set using the pop-up numeric keyboard. (Press “Clear”, enter the required Max time and press “Enter”).

Press “Save” before going “Back” to the operating screen.



Above is the operating screen after an analysis is made. At the top right the information “MAX TIME = xxx s” is shown as long as the max time operation mode is active.

The results in the example above shows the left side FN is lower than the set limit but right side FN was stopped at the limit and this result is shown in red. No mean value is calculated when one or both samples reach the Max Time set.

To deactivate the Maximum Test Time function, enter a value lower than 100 or press only “Clear” and “Enter” and the function will be set to OFF. Press “Save” before going “Back” to the operating screen.

DETERMINATION OF FALLING NUMBER (ACCORDING TO PERTEN - HAGBERG) AS A MEASURE OF ALPHA-AMYLASE ACTIVITY IN GRAIN AND FLOUR

ICC Standard Nr. 107/1 (1995), AACCI Method 56 – 81.03 (1999)

GENERAL DESCRIPTION

The Falling Number (FN) method is an internationally standardized method for the determination of the level of alpha-amylase in grain, flour and other starch containing products, in particular wheat and rye. It determines alpha-amylase activity using the starch in the sample as substrate.

The method is based upon the rapid gelatinisation of a suspension of flour or meal in water using a boiling water bath and the subsequent measurement of the liquefaction, by alpha-amylase, of the starch contained in the sample. Falling Number values bear a complex inverse relationship with the quantity of alpha-amylase in the sample. This relationship is known as the Perten Liquefaction Equation.

APPLICATION OF FALLING NUMBER

Falling Number results are used to segregate grain into good quality for making bread or other products, and poorer grades suitable only for feedstuffs, or controlled mixing. Falling Number results are used by the grain trader to establish the quality of the grain, for export or the local trade.

Falling Number results can be used at the flour mill to monitor grain reception, processing and finished products. It may also be used to calculate optimum milling blends or flour blends for better product control. (See Appendix VI)

Falling Number results can be used at the bakery to determine the quality of the flour supplied, and to optimise flour blends to suit individual products.

Falling Number results can be used at the malt house to determine the optimum time for modification of the malting process, and the strength of the malt produced.

Falling Number results can be used to monitor the ripening process of grain to determine the optimum harvesting date, especially in areas that are subject to rain during the harvest period.

EQUIPMENT REQUIRED FOR A TEST

1. Falling Number Apparatus
2. Balance with an accuracy of +/- 0.05 g
3. Perten Instruments Laboratory Mill 3100 or 120 (Falling Number Mill)
4. Moisture Meter for meal and flour (e.g. the Inframatic 9500 with Flour module can be used).

SAMPLING

Sampling of cereal grains or flour should be as representative as possible, and comply with normal recommended practices.

PREPARATION OF GRAIN SAMPLE

Remove dust and coarse impurities from the laboratory sample. This can be done by hand or preferably using a laboratory grain cleaning machine. A 300 g grain sample should be prepared for grinding. If less than 200 g of grain is ground, misleading results may be obtained, due to sampling errors.

GRINDING OF GRAIN

The Falling Number Values are influenced by the particle size of the ground grain. Therefore, a uniform particle size is required. The ground grain should pass through sieves with the following aperture sizes (ICC 107/1):

100 %	- through a sieve with an aperture size of 710 microns
95 % - 100 %	- through a sieve with an aperture size of 500 microns
80 % or less	- through a sieve with an aperture size of 210 microns

This uniform fine grind is obtained when using a Perten Instruments Laboratory Mill 3100 or 120, equipped with a sieve with 0.8 mm holes. The mill should be fed carefully with grain to avoid overloading. Grinding should continue 40-60 seconds after the last of the sample has entered the mill, to clean out the milling chamber. Up to 1% bran particles remaining on the sieve may be discarded. Refer to your Laboratory Mill manual. The ground grain should be carefully mixed.

NOTE: It is essential that only an approved standardized grinding method is used

PREPARATION OF FLOUR SAMPLE

Flour may be sifted through a 0.8 mm sieve to break up lumps. Mix well before sampling. The Falling Number value determined on flour is generally 0-30 units higher than for the corresponding grain.

MOISTURE CONTENT OF SAMPLE

The required sample weight depends on the moisture content of the ground sample.
The method has been standardized for a sample weight of 7.00 grams with 14% moisture content (ICC, AACCI). See Appendix I. The amount of added water (25 ml) does not change.
Determine the moisture content of the prepared sample before weighing out the test sample. A moisture meter for meal and flour (e.g. the IM 9500 with Flour module) can be used.

DIRECTIONS FOR DETERMINING THE FALLING NUMBER VALUE - CLASSICAL FALLING NUMBER TEST

PREPARING AND STARTING THE TEST

1. For the Classical Falling Number test, the display will show “Standard FN mode” to the left above the two counters. The distilled water in the water bath must boil vigorously during the whole test period. Check water level in the water refill bottle and the cooling system (water flow) regularly, at least daily. Place the cassette in the stand and place clean dry viscometer tubes into the cassette.

   If a sample ID is desired, this should be entered before the sample is mixed with water for the analysis. See Appendix IV for further details about sample ID function.

   It is also possible to use just one viscometer tube at a time. The instrument will automatically detect that only one tube is placed in the instrument.

2. Weigh two samples of 7.00 g +/- 0.05 g of the flour or ground grain – adjusted for appropriate moisture content basis according to the tables in Appendix I & II - and transfer the samples into the viscometer tubes using the funnel.

WARNING: The Viscometer tubes are made of glass and may break. Always inspect the Viscometer tube before use to ensure that it is free from defects. Never use damaged tubes.

   Add 25.0 ml +/- 0.2 ml distilled water (or water that fulfils "grade 3" according to ISO 3696) at 22°C +/- 2°C into each clean and dry viscometer tube.

3. Fit clean, dry stoppers into the top of the viscometer tubes and shake vigorously 40 +/- 10 times or more, if necessary, to obtain a homogeneous suspension. Alternatively, use the Shakematic to shake the tubes. Verify that no dry sample pockets are present at the bottom of the Viscometer tube. If the Shakematic is used, special stoppers supplied with the Shakematic shall be used. See also the manual for the Shakematic. Remove the stoppers, scraping any residues into tube rim (see figure 11). Using a clean dry viscometer-stirrer, scrape any residues adhering to the sides of the tube into the suspension (See figures 12 and 13).

Figure 11. Scraping residues into tube rim.

Figure 12. Scraping residues into suspension.

Figure 13. Tube ready for testing.

Figure 14. Place the cassette with tubes into the water bath.

4. Place the tubes, with stirrers in the cassette. Place the cassette with the tubes and stirrers into the holes in the cooling lid, within 40 +/- 10 seconds after mixing. See figure 14.

CAUTION: Steam may escape when putting the cassette with tubes and stirrers into the water bath.

Figure 15. Pull down the plastic visor.

5. After placing the tubes in the boiling water bath, IMMEDIATELY lower the plastic visor. See figure 15. The test will start automatically.

APPARATUS FUNCTIONS

1. When the cassette is inserted the display counters are automatically reset and start counting, in seconds. At 5 seconds stirring is started, at a rate of two strokes per second.

   If the plastic visor is not pulled down before the counter reaches 4 seconds the message Visor not closed within 4 seconds and Please remove samples are displayed. The procedure must be started again. Lift up the plastic visor and repeat the analysis using new samples, new clean viscometer tubes etc. To reset the instrument pull down the plastic visor and wait until the hooks have reached top position and the start arm is in back position. Lift the visor to make the instrument ready for the next test.

2. At 60 seconds, the pick up arm stops at the top position and the viscometer stirrers are released to sink, under their own weight, through the gelatinised suspension.

3. From 62 seconds, the counter will stop when the stirrers have fallen the prescribed distance. Detection of the stirrer end position causes the counter to stop.

4. When the stirrers are detected, the beeper sounds to indicate that the test is complete and the message Please remove samples is shown.

5. The results of the analysis will be shown on the display. At the same time results are sent to external communication ports for printout or collection by external LIMS system if used.

6. Raise the plastic visor. This will turn off the beeper.

Remove the cassette with the tubes and place it in the stand. Remove the tubes and the viscometer stirrers and put them in cold water for cleaning.

CAUTION: Steam may escape when removing the cassette, with tubes and stirrers, from the water bath. The test tubes are also hot.

NOTE: The test may be stopped any time by Pressing “STOP” on the display. This stops the motor, counting and stirring. If so the display will show Measurement stopped and Please remove samples.

NOTE: The test may be stopped any time by raising the plastic cover. This stops the motor, counting and stirring. If so the display will show Measurement has been interrupted and Please remove samples. When the cassette with tubes and stirrers has been removed, close the visor to reset the instrument before the next test can be started.

It is also possible to stop the stirring by pressing the rear mains ON/OFF switch. If the components are jamming, the procedure should be stopped at once.

Look for the fault and rectify before further use.

DEFINITION OF THE FALLING NUMBER VALUE

The Falling Number is defined as the total time in seconds, from the immersion of the viscometer tube into the water bath, until the viscometer stirrer has fallen the prescribed distance through the gelatinised suspension. Thus the stirring time is included.

PRECISION OF DETERMINATION

Repeated tests on the same sample within the same laboratory, should as a “rule of thumb” give results within +/- 5% of the average Falling Number value. For more details on reproducibility and repeatability see ICC Standard No. 107/1 (1995).

The importance of correct sampling cannot be over emphasized. Differences in alpha-amylase activity can occur when sub-sampling from a sample that is not well mixed.

NOTE! The Falling Number method was developed for, and has its most accurate results, when used for detection of sprout damage. This means that the 5% “rule of thumb” is valid primarily for results up to around 300 seconds. In accordance with the statistics in ICC Standard 107/1, both repeatability and reproducibility can be expected to increase for higher Falling Number results.
When the Falling Number results start to get up to around 400 seconds and higher, the amount of alpha-amylase in the sample is so low that other factors in the sample may influence the results more than the different levels of alpha-amylase in different samples. In the AACCI Method 56-81.03, Note 2, it is also written: “Since there is so little alpha-amylase in a wheat or flour sample that exceeds a (sea-level corrected) value of FN 400, it is of little value to continue a test past that point”.

INTERPRETATION OF RESULTS

Typical results for wheat and rye grain.

Wheat

Falling Number	Indicates
Below 150	High amylase activity, sprout damaged wheat. Bread crumb is likely to be sticky.
220	Limit for EU intervention wheat (year 1999)
200 – 300	Optimal amylase activity, wheat. Bread crumb is likely to be good.
Above 300	Low amylase activity, sound wheat. Bread crumb is likely to be dry, and loaf volume reduced.

Rye

Falling Number	Indicates
Below 100	High amylase activity, sprout damaged rye.
120	Limit for EU intervention rye (year 2000)
Above 120	Low amylase activity, rye. Minimum for crisp bread production.

These figures are only intended as guidelines. Different standards may apply in different countries or for special grades, or products.

For the calculation of mixtures with a desired Falling Number (FN) value, see Appendix VI.

CLEANING OF VISCOMETER TUBES AND STIRRERS

Clean the viscometer stirrers carefully using cold water and a brush ensuring that all solid material is removed. Dry the stirrers before the next test. Clean the tubes using cold water and a brush ensuring that all solid material is removed and that the tubes are clear and sparkling. Invert tubes in a rack to dry.

NOTE: The viscometer stirrers and tubes should be dry and at room temperature before use.

The Spolett rapid tube cleaner (available as an optional accessory) makes the laborious task of tube cleaning very easy. When cleaning with the Spolett tube cleaner, ALWAYS use the protection cover.

WARNING: The Viscometer tubes are made of glass and may break. Always inspect the Viscometer tube before use to ensure that the tube is free from defects. Never use tubes that are damaged.

When cleaning with the Spolett tube cleaner, **always** use the Spolett protection cover.

NOTE: Do not use enzyme-based detergents to clean tubes, as enzyme residues may cause erroneous results.

CLEANING OF THE APPARATUS

Clean the apparatus regularly using a soft, damp cloth and a mild household detergent. Do not use other cleaning liquids. If you spill water over the apparatus, disconnect from power and allow it to dry before any further use.

BIBLIOGRAPHY

The following articles can provide additional information. Copies are available free of charge, upon request.

H. Perten - Application of the Falling Number Method for Evaluating Alpha-Amylase Activity - Cereal Chemistry 41: 127-140 (1964)

H. Perten - Factors Influencing Falling Number Values - Cereal Science Today Vol 12: 516-519 (1967)

DIRECTIONS FOR DETERMINING THE FALLING NUMBER VALUE - FUNGAL FALLING NUMBER TEST

PREPARATION OF BUFFER SOLUTION

The following reagents are required to prepare the buffer solution for the Fungal Falling number test:

1. Distilled water (or water of equivalent purity).
2. Acetic acid glacial 100% (CH_3COOH, >99,8%, analytical grade).
3. Calcium acetate monohydrate ($Ca(CH_3COO)_2$*H2O, analytical grade).

Weigh 12.0 gram of the calcium acetate into a 1 litre volumetric flask (0.07M) with approx. 500 ml of distilled water. Add glacial acetic acid 1.2-1.4 ml and dilute with distilled water to the 1-litre mark. The pH should be 5.20-5.40.

Do not keep the prepared buffer solution for more than 3 days.

PREPARING AND STARTING THE TEST

1. Make sure that the instrument is set-up for Fungal FN operation. The display will show “Fungal FN mode” when the system is set for Fungal FN. (See “Set up of instrument – Selecting classical or Fungal Falling Number operation” above.) Check water level in the water refill bottle and the cooling system (water flow) regularly, at least daily. If OK, place the cassette in the stand and place clean dry viscometer tubes into the cassette.

NOTE! For Fungal Falling Number analysis we recommend running only one sample at a time since the time between adding sample and potato starch substrate to the buffer solution and starting the test is important to keep as short as possible.

2. Pipette 30.0 ± 0.2 ml of buffer solution (22 ± 2°C) into a dry and clean viscometer tube.

WARNING: The Viscometer tubes are glass and may break. Always inspect the Viscometer tube before use to ensure that it is free from defects. Never use damaged tubes.

3. Weigh nominally 5.00 g (14% mb) of the potato starch substrate and then 5.00 g (14% mb, see table in Appendix III) of the flour and transfer the starch and the sample into the viscometer tube using the funnel. Do not add any part into the tube until both starch and sample have been weighed.

4. Fit a clean, dry stopper into the top of the viscometer tube and shake vigorously 40 +/- 10 times or more if necessary to obtain a homogeneous suspension. Alternatively, use the Shakematic to shake the tube. Verify that no dry sample

pockets are present at the bottom of the Viscometer tube. If the Shakematic is used, special stoppers supplied with the Shakematic shall be used and if only one tube is used a counter balance tube must be sitting in the Shakematic. See also the manual for the Shakematic. Remove the stopper, scraping any residues into tube rim (see figure 11). Using a clean dry viscometer stirrer, scrape any residues adhering to the sides of the tube into the suspension (See figure 12 and 13).

5. Place the tube with stirrer in the cassette. Place the cassette with the tube and stirrer into the holes in the cooling lid, within 40 +/- 10 seconds after mixing. See figure 14. After placing the tube in the water bath, IMMEDIATELY lower the plastic visor. See figure 15. The test will start automatically.

APPARATUS FUNCTIONS

1. When the cassette is inserted the display counters are automatically reset and start counting, in seconds. At 5 seconds stirring is started, at a rate of two strokes per second.

   If the plastic visor is not pulled down before the counter reaches 4 seconds the message Visor not closed within 4 seconds and Please remove samples are displayed. The procedure must be started again. Lift up the plastic visor and repeat the analysis using new samples, new clean viscometer tubes etc. To reset the instrument pull down the plastic visor and wait until the hooks have reached top position and the start arm is in back position. Lift the visor to make the instrument ready for the next test.

2. At 60 seconds, the stirrer will be held in the top position and there will be a 1-minute pause. During the pause the counter will count downwards from 59 to 0. Thereafter the timers are reset to 0 and a second stirring cycle, identical to the first one, is started. The result for the Fungal Falling Number is counted from the start of the second stirring cycle.

3. At 60 seconds of the second stirring cycle the pick up arm stops at the top position and the viscometer stirrer is released to sink under its own weight through the gelatinised suspension.

4. At 62 seconds, the electronics is set to stop the counter when the stirrer has fallen the prescribed distance. Detection of the stirrer end position stops the counter.

5. When the stirrers are detected, the beeper sounds to indicate that the test is complete and the message Please remove samples is shown.

6. The results of the analysis will be shown on the display. At the same time results are sent to external communication ports for printout or collection by external LIMS system if used.

7. Raise the plastic visor. This will turn off the beeper.

Remove the cassette with the tube(s) and place it in the stand. Remove the tube(s) and the viscometer stirrer(s) and put them in cold water for cleaning.

NOTE: The test may be stopped any time by Pressing “STOP” on the display. This stops the motor, counting and stirring. If so the display will show Measurement stopped and Please remove samples.

NOTE: The test may be stopped any time by raising the plastic cover. This stops the motor, counting and stirring. If so the display will show Measurement has been interrupted and Please remove samples. When the cassette with tubes and stirrers has been removed, close the visor to reset the instrument before the next test can be started.

It is also possible to stop the stirring by pressing the rear mains ON/OFF switch. If the components are jamming, the procedure should be stopped at once.

Look for the fault and rectify before further use.

TECHNICAL SPECIFICATIONS

Power requirement:	230 V ~, 50-60 Hz, or 115 V ~, 50-60 Hz 1050 VA (refer to apparatus name plate)
Fuses:	230 V~: (2x) T6.3AH 250V, or 115 V~: (2x) T10AH 250V
Environmental conditions:	Indoors use. 5-40°C ambient temperature. (See note below). Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C ambient temperature.
Acoustic noise emission:	<70 dB(A), operator position, normal operation
Dimensions:	(HxDxW) 515 x 390 x 290 mm
Net weight:	19 Kg

Note: Ambient temperature range only refers to the temperature range in which the apparatus can be safely used. Temperature variations may affect the analysis result. For example the water used in the viscometer tube should be 22 +/- 2°C. See "Directions for determining the Falling Number value".

DECLARATION OF CONFORMITY (CE)

DECLARATION OF CONFORMITY

Manufacturer: Perten Instruments AB

Address: P.O. Box 9006
SE-126 09 Hägersten, SWEDEN

Declare that the products: FN 1000

Complies with the CE directives and requirements stated below

LVD directive 2006/95/EC

- EN 61010-1:2010 (Electrical equipment for measurement, control and laboratory use.) General requirements
- EN 61010-2-081:2002/a1:2003 (Particular requirements for automatic and semiautomatic laboratory equipment for analysis and other purposes)

In addition requirements for the US & Canada

- UL61010-1, 2004 second edition / CAN/CSA C22.2 No. 61010-1, 2004 second edition
- FCC part 15 subpart B, class B

EMC directive 2004/108/EC

- EN 61326-1:2006 (Electrical equipment for measurement, control and laboratory use – EMC requirements.)

Place and date:

Hägersten 2015-11-13

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Development Manager

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APPENDICES

I. CORRECTION OF SAMPLE WEIGHT TO 14% MOISTURE BASIS

(ICC Standard No. 107/1, 1995 and AACCI Method 56-81.03, 1999)

The following table shows the required sample weight, at different moisture contents, corresponding to 7.00 g at 14% moisture - no change is made in the quantity of water used. For example at 13.4% moisture the required sample weight is 6.95 grams.
Calculation of moisture corrected sample weight can also be done on the instrument, see Appendix VI.

Correction of sample weight to 14% moisture basis (ICC, AACCI)					
Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)
8.0	6.54	11.4	6.80	14.8	7.07
8.2	6.56	11.6	6.81	15.0	7.08
8.4	6.57	11.8	6.83	15.2	7.10
8.6	6.59	12.0	6.84	15.4	7.12
8.8	6.60	12.2	6.86	15.6	7.13
9.0	6.62	12.4	6.87	15.8	7.15
9.2	6.63	12.6	6.89	16.0	7.17
9.4	6.64	12.8	6.90	16.2	7.18
9.6	6.66	13.0	6.92	16.4	7.20
9.8	6.67	13.2	6.94	16.6	7.22
10.0	6.69	13.4	6.95	16.8	7.24
10.2	6.70	13.6	6.97	17.0	7.25
10.4	6.72	13.8	6.98	17.2	7.27
10.6	6.73	***14.0***	***7.00***	17.4	7.29
10.8	6.75	14.2	7.02	17.6	7.31
11.0	6.76	14.4	7.03	17.8	7.32
11.2	6.78	14.6	7.04		

NOTE: This refers to the moisture content of the sample after grinding, not the moisture content of the whole wheat. The moisture loss during grinding varies with the moisture content and is typically 5 - 10% over the 10 - 20% moisture range. The actual moisture basis used may vary according to national standards.

II. CORRECTION OF SAMPLE WEIGHT TO 15% MOISTURE BASIS

NOTE: ICC Standard No. 107/1, 1995 and AACCI Method 56-81.03, 1999 prescribe the use of 14% moisture basis correction. This table is in accordance with ISO 3093:2010.

The following table shows the required sample weight, at different moisture contents, corresponding to 7.00 g at 15% moisture - no change is made in the quantity of water used. For example at 13.4% moisture the required sample weight is 6.85 grams.
Calculation of moisture corrected sample weight can also be done on the instrument, see Appendix VI.

Correction of sample weight to 15% moisture basis					
Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)
9.0	6.40	12.4	6.75	15.8	7.10
9.2	6.45	12.6	6.75	16.0	7.10
9.4	6.45	12.8	6.80	16.2	7.15
9.6	6.45	13.0	6.80	16.4	7.15
9.8	6.50	13.2	6.80	16.6	7.15
10.0	6.50	13.4	6.85	16.8	7.20
10.2	6.55	13.6	6.85	17.0	7.20
10.4	6.55	13.8	6.90	17.2	7.25
10.6	6.55	14.0	6.90	17.4	7.25
10.8	6.60	14.2	6.90	17.6	7.30
11.0	6.60	14.4	6.95	17.8	7.30
11.2	6.60	14.6	6.95	18.0	7.30
11.4	6.65	14.8	7.00	18.2	7.35
11.6	6.65	***15.0***	***7.00***	18.4	7.35
11.8	6.70	15.2	7.00	18.6	7.40
12.0	6.70	15.4	7.05	18.8	7.40
12.2	6.70	15.6	7.05		

NOTE: This refers to the moisture content of the sample after grinding, not the moisture content of the whole wheat. The moisture loss during grinding varies with the moisture content and is typically 5 - 10% over the 10 - 20% moisture range. The actual moisture basis used may vary according to national standards.

III. CORRECTION OF FUNGAL FALLING NUMBER SAMPLE WEIGHT TO 14% MOISTURE BASIS

The following table shows the required sample weight, at different moisture contents, corresponding to 5.00 g at 14% moisture - no change is made in the quantity of buffer solution used. For example at 13.4% moisture the required sample weight is 4.97 grams.

Correction of Fungal Falling Number sample weight to 14% moisture basis					
Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)	Moisture Content (%)	Weight (g)
8.0	4.67	11.4	4.85	14.8	5.05
8.2	4.68	11.6	4.86	15.0	5.06
8.4	4.69	11.8	4.88	15.2	5.07
8.6	4.70	12.0	4.89	15.4	5.08
8.8	4.71	12.2	4.90	15.6	5.09
9.0	4.73	12.4	4.91	15.8	5.11
9.2	4.74	12.6	4.92	16.0	5.12
9.4	4.75	12.8	4.93	16.2	5.13
9.6	4.76	13.0	4.94	16.4	5.14
9.8	4.77	13.2	4.95	16.6	5.16
10.0	4.78	13.4	4.97	16.8	5.17
10.2	4.79	13.6	4.98	17.0	5.18
10.4	4.80	13.8	4.99	17.2	5.19
10.6	4.81	***14.0***	***5.00***	17.4	5.21
10.8	4.82	14.2	5.01	17.6	5.22
11.0	4.83	14.4	5.02	17.8	5.23
11.2	4.84	14.6	5.04	18.0	5.24

NOTE: This refers to the actual flour sample. If whole meal is analysed, table moisture refers to moisture content of the sample **after grinding, not the moisture content of the wheat kernels.** The moisture loss during grinding varies with the moisture content and is typically 5 - 10% over the 10 - 20% moisture range.

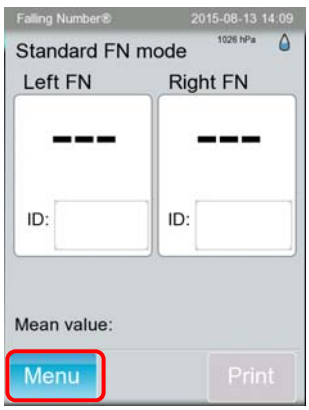
IV. SAMPLE ID

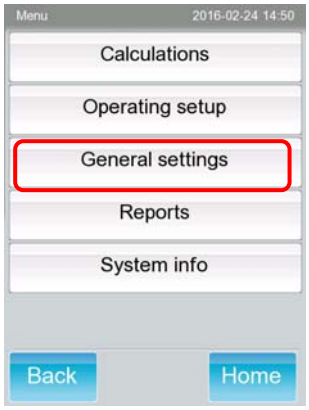
Sample Identifications can be entered to the system in two different ways. The ID can be entered directly on the display or it can be entered with an optional bar code reader or external keyboard. Sample ID can be entered before the test is started or while the test is in progress.

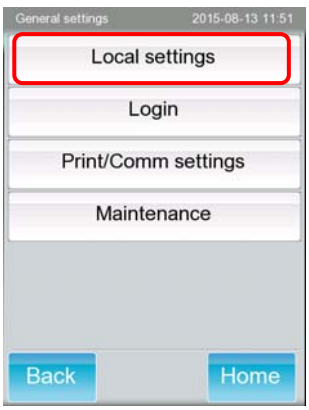
Optional, Mandatory or Auto-increment Sample ID setting

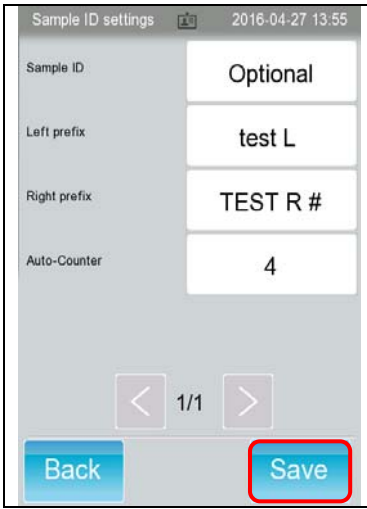
The instrument can be set up to have the ID as Optional or Mandatory information, or to let the instrument set the ID by an Auto-increment function.

To set the instrument to the requested ID function, press “Menu”, “General settings”, “Local settings” and “ > > “ to reach the set-up page.



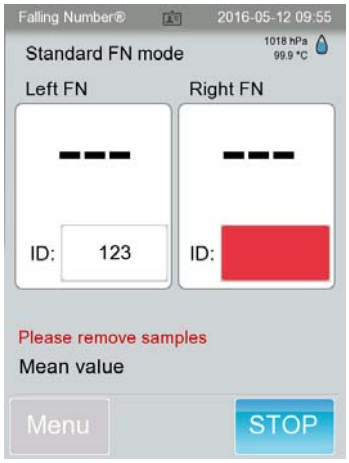




	Sample ID:	Toggle between Optional, Auto-increment and Mandatory function.
	Left prefix:	Left sample ID prefix for Auto-increment.
	Right prefix:	Right sample ID prefix for Auto-increment.
	Auto-Counter:	Starting/present number for Auto-increment.
		Press “Save” to save the selected settings.

Auto-increment ID
If Auto-increment is selected the ID prefix is defined in the Sample ID set-up (see above). ID will automatically step up 1 number for each analysis performed in the instrument.

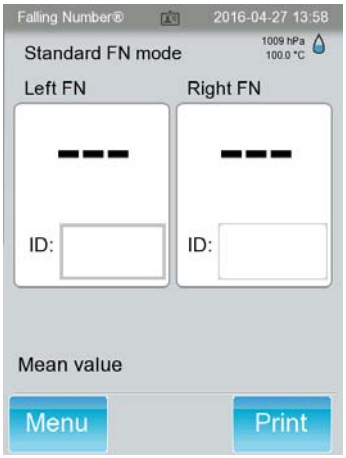
Mandatory ID
If Mandatory ID is selected, the ID box in the operating screen will turn red at the end of the test if no ID is set. The results of the analysis will not be seen until an ID has been entered.



NOTE: If the ID box turns red due to missing ID, the ID must be entered **before** the visor is lifted or the samples are removed. Otherwise the result from the performed analyses will be lost.

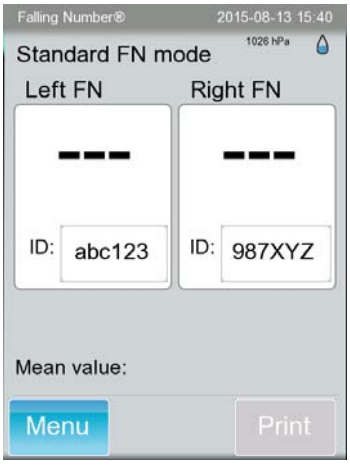
Sample ID on display for Optional or Mandatory ID setting

To enter an ID, press the left or right ID box. The frame of the box will now be darker (see left box in the picture).
The ID can now be entered with an external bar code reader, see below.



Press in the high-lighted box once more and a pop-up keyboard will be activated on the screen. The new ID can now manually be entered. The blue left arrow button on the pop-up keyboard will erase the last ID character and the Clear button will erase all the characters in the field if needed before the new ID is entered. Repeat for both left and right ID.

Sample ID can be entered before the test is started or while the test is in progress.

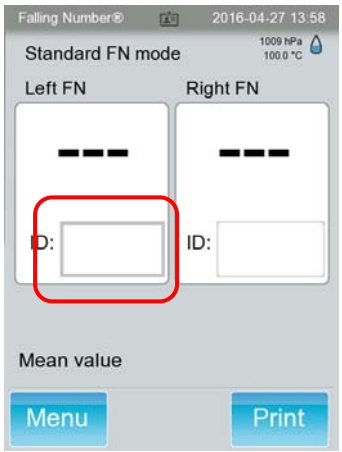


The ID's are now saved and the FN test can be started. The ID will be shown under respective result until a new ID is entered.

Sample ID with barcode reader or external keyboard for Optional or Mandatory ID setting

Figure IV:1. USB and Ethernet connections on the FN 1000 instrument.

On the FN 1000 instrument there are four USB connections. Any of these USB connections can be used to connect a barcode reader and/or a keyboard.



Barcode reader
Press the ID box in the Left FN screen once so the frame of the box becomes darker. Scan the ID number with the barcode reader. The scan will replace the old ID. Repeat for the Right FN ID.

External keyboard
Press the ID box in the Left FN screen once so the frame of the box becomes darker. Use the external keyboard to enter the ID (and erase part of or the entire old ID). Repeat for the Right FN ID. The external keyboard can also be used when the pop-up keyboard is open on the screen.

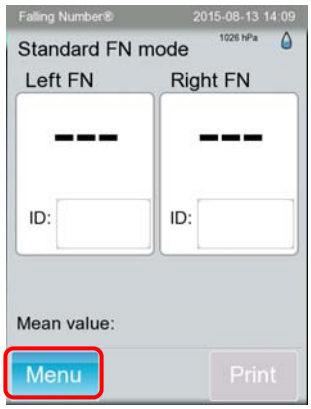
The ID's are now saved and the FN test can be started. The ID will be shown under the respective result until a new ID is entered.

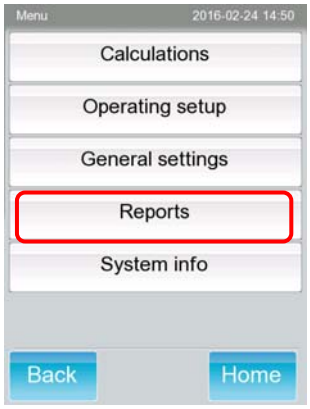
V. REPORTS and CHANGE LOG

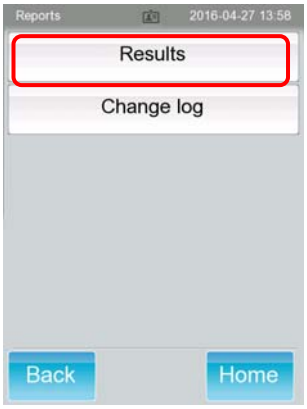
The FN 1000 instruments stores all analysis results as well as all changes. To access this information, see below.

Reports

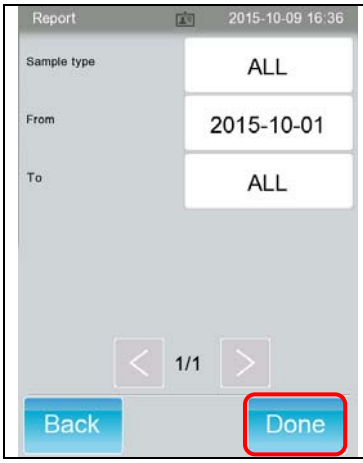
Old results can be viewed and exported in the Reports section.



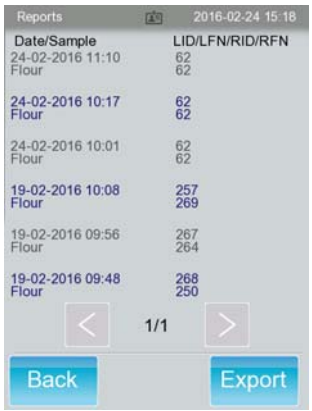




Press ”Menu”, ”Reports” and ”Results” to reach the Results window.



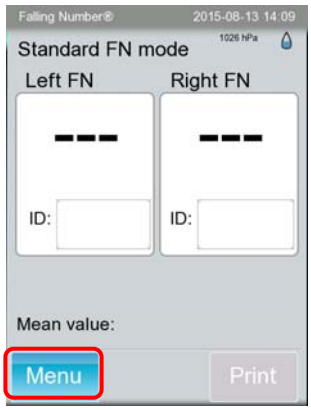
Sample type:	ALL, Flour or Meal can be selected.
From:	ALL samples or from a set defined date.
To:	ALL samples or to a set defined date.
	Press “Done” and the results will be displayed on the screen.

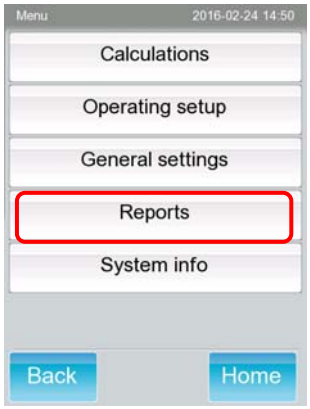


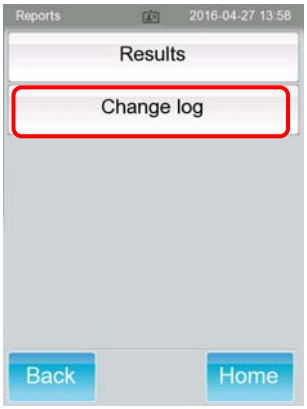
The last result is shown at the top of the list. Step through the pages of results with left and right arrows.

For export of the results, fit a USB memory stick to one of the USB contacts on the instrument and then click Export. A .tab file is now available on the memory stick. This file can be opened in e.g. Notepad or Excel.

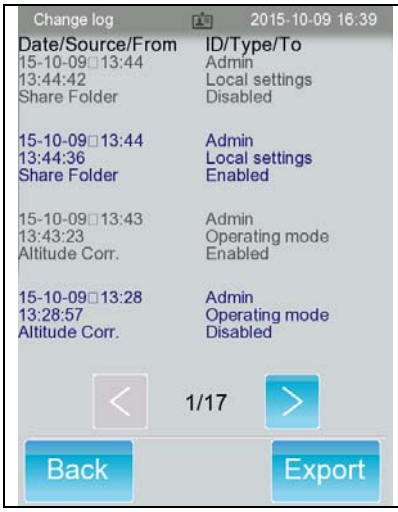
Change log







Press ”Menu”, ”Reports”, and “Change log” to reach the lists of changes made in the instrument.



The Change log will store all changes made in the instrument. The last change is shown at the top of the list. Step through the pages of events with left and right arrows.

For export of the Change log, fit a USB memory stick to one of the USB contacts on the instrument and then click Export. A .tab file is now available on the memory stick. This file can be opened in e.g. Notepad or Excel.

VI. CALCULATION OF BLENDS AND MALT SUPPLEMENT

The linear relationship between the Perten Liquefaction Number (LN) and alpha-amylase makes it possible to arithmetically or graphically calculate the composition of blends to optimise the quality of flour or grains for bread making and other purposes.

The formula for LN is: LN= 6000/(Falling Number value –50)

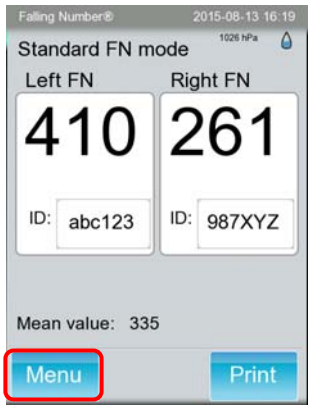
In the equation 6000 is an empirical constant. The number 50 is also an empirical constant, approximating the time in seconds required for the starch to gelatinise sufficiently to make it available for attack by alpha-amylase. FN is the Falling Number value. In general the formula is used to calculate wheat blends, although flour mixtures and blends with rye can also be calculated.

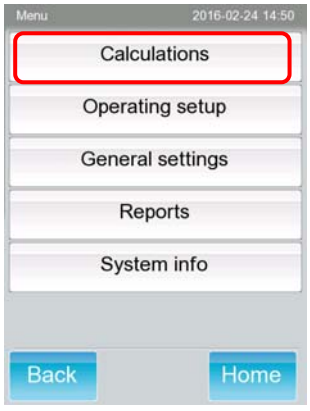
Wheat harvested in warm and dry conditions, is often too low in natural alpha-amylase for optimum bread baking performance. A common way to overcome this problem is to add malt to increase the alpha-amylase activity. Malt addition also has a linear relationship to Perten Liquefaction Number, which makes it easily possible to graphically or arithmetically calculate the quantity of malt to add to a flour to achieve the desired Falling Number value.

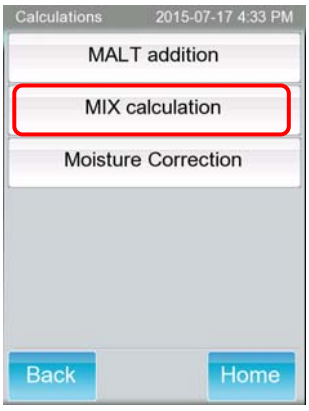
These calculations are further described in "Application of the Falling Number method for Evaluating Alpha-Amylase Activity" by Harald Perten, Cereal Chemistry, Vol. 41 (3): 127-140, (1964), copies of which are available upon request.

Calculation of blends

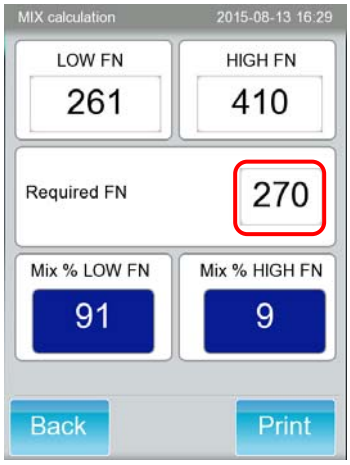
Blends can be automatically calculated with the MIX calculation function. The two different samples to be mixed are run in the instrument simultaneously, one in the left position and the other in the right position.







When the analysis is ready, press ”Menu”, ”Calculations” and ”MIX calculation” to reach the MIX calculation screen.



The MIX calculator automatically picks the low and high FN result from the last results on the operating screen. Alternatively enter the actual low FN and high FN values by pressing the respective box and enter the value with the pop-up keyboard. Enter the required Falling Number of the mix. Press in the box and the pop-up keyboard is opened on the screen. Write the required FN and press enter.

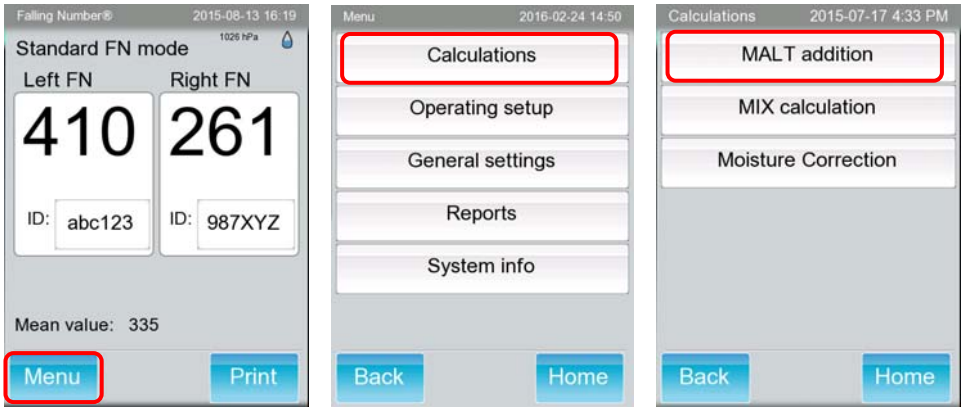
The required FN value must be between the two values to be mixed. The message Required FN is not within the range will otherwise appear.

The result will now be given on the display. If a printer is connected (See Appendix XII) pressing “Print” will give a printout of the calculation.

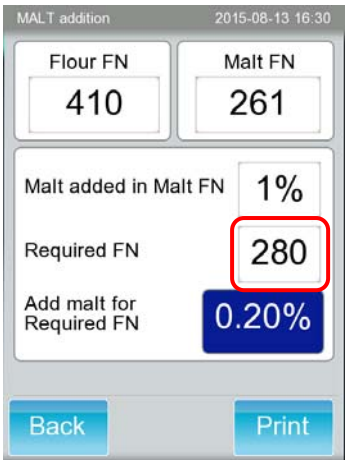
Press “Back” to leave the MIX calculation screen.

Calculation of malt supplement

Two different samples, one with 7.00 g pure flour and one with 1 % malt addition, i.e. 6.93 g of flour and 0.07 g of malt are run in the instrument simultaneously. The pure flour must be run in the left position and the 1% malt mixture should be run in the right position.



When the analysis is ready, press ”Menu”, ”Calculations” and ”MALT addition” to reach the MALT addition screen.



The results from the last analysis are seen in the respective box on the MALT addition screen. Alternatively enter the Flour FN and Malt FN values by pressing the respective box and enter the value with the pop-up keyboard.

Enter the required Falling Number of the final flour. Press in the Required FN box and the pop-up keyboard is opened on the screen. Write the required FN and press enter. The required FN value must be between the Flour FN and Malt FN results. The message Required FN is not within the range will otherwise appear.

By default the calculator expects that the Malt FN result is from a sample with 1% malt added. If 1% malt is not enough to reach the required FN value, repeat the procedure above but adding 2% malt to right sample and change to 2% in the calculation above.

The result will now be given on the display. If a printer is connected (See Appendix XII) pressing “Print” will give a printout of the calculation.

Press “Back” to leave the MALT addition screen.

Errors in connection with use of MIX or MALT functions

Required FN is not within the range
If the required FN value entered to the calculation is higher than the high FN value for the mixing or higher than the pure flour FN value in the malt calculation, or if the required value is lower than the low FN value for the mixing or lower than the malt added flour in the malt calculation, the display will show Required FN is not within the range Change the required FN to a value between high and low FN values and press ENTER to start the calculation.

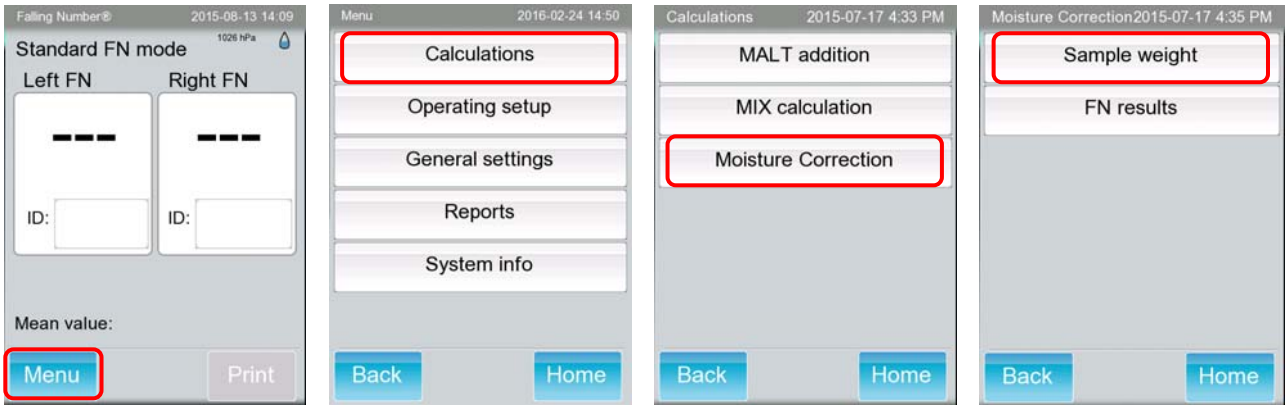
Minimum possible FN value is 62
If a FN value lower than 62 is entered in any of Low FN, High FN, Flour FN or Malt FN boxes, the display will show Minimum possible FN value is 62. Change the input to a correct value above 62.

Difference between FN values should be greater than 2
To be able to calculate the mix proportions or the malt addition, the difference between the two results bust be at least 2 units.

VII. MOISTURE CORRECTION CALCULATIONS

In the FN 1000 calculations of moisture corrected sample weight as well as moisture corrected FN results can be calculated.
As default the system is set up for correction to 14% moisture basis. Under Local Settings it is possible to switch to 15% moisture basis, see “Setup of Instrument – Local settings” for details.

Sample Weight moisture correction



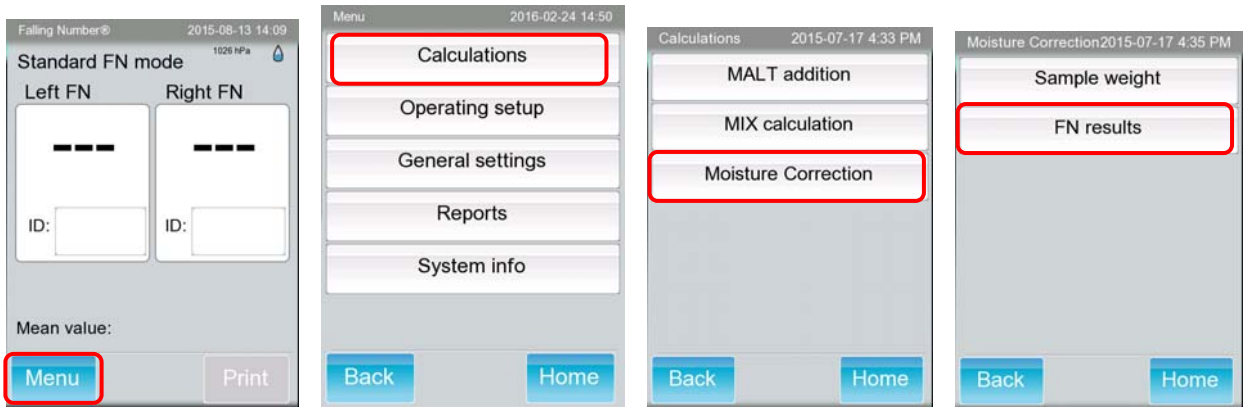
To calculate the correct amount of sample for a given moisture content, press ”Menu”, ”Calculations” and ”Moisture correction” and ”Sample weight” to reach the Sample weight screen.

The reference moisture displayed is in accordance with the local settings, but can be altered between 14 and 15% also in this screen. Press in the Actual Moisture box to get the pop-up keyboard on the screen and enter the actual moisture content in the sample to be analysed.
The result will now be seen on the display. If a printer is connected (See Appendix XII) pressing “Print” will give a printout of the calculation.

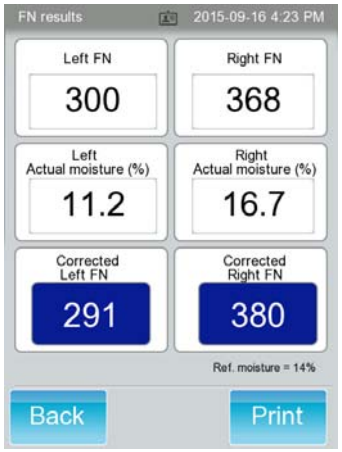
Press “Back” to leave the Sample weight calculation screen.

Sample weight correction at 14% moisture basis is calculated according to ICC 107/1 and AACCI 56-81.03. For 15% moisture basis the correction is calculated in accordance with ISO 3093:2010.

Moisture correction of FN results



To calculate moisture corrected Falling Number results, press ”Menu”, ”Calculations” and ”Moisture correction” and ”FN results” to reach the FN results screen.



The FN results calculator automatically displays the values from the last test on the screen. Alternatively enter the wanted FN values by pressing the respective box and enter the value with the pop-up keyboard. Enter the Left and Right Actual Moisture content by pressing in the respective box and write the value with the pop-up keyboard. The moisture corrected FN values will now be shown on the display. Selected reference moisture (from Local settings) is seen under the results. If a printer is connected (See Appendix XII) pressing “Print” will give a printout of the calculation.

Press “Back” to leave the FN results calculation screen.

Errors in connection with Moisture correction calculations

Sample Moisture out of range

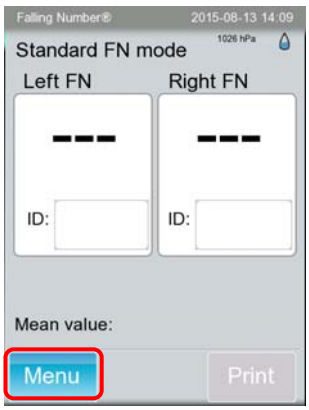
The moisture correction calculations only cover the moisture range from 5.1 to 24.9%. If moisture content value of 5.0% or lower is entered the display shows Sample Moisture out of range. The same will happen if a value of 25.0% or higher in entered.

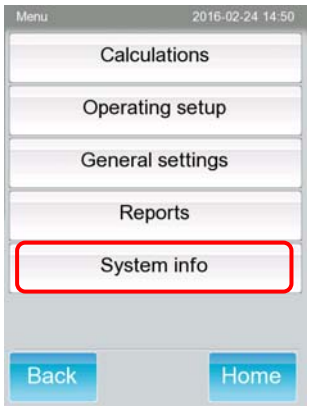
Minimum possible FN value is 62

If a FN value lower than 62 is entered in Left FN or Right FN boxes, the display will show Minimum possible FN value is 62. Change the input to a correct value above 62.

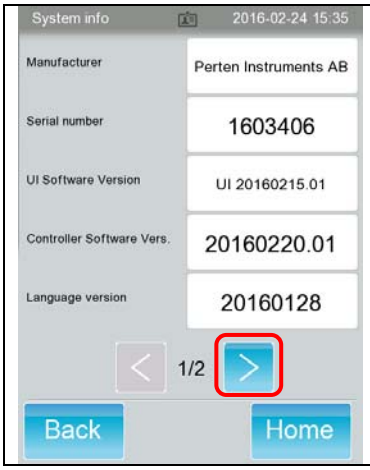
VIII. SYSTEM INFORMATION

In the system information there is information on instrument serial number, software version etc.





To reach the System information, press ”Menu”and ”System info”.



Perten Instruments AB is the manufacturer of FN 1000.

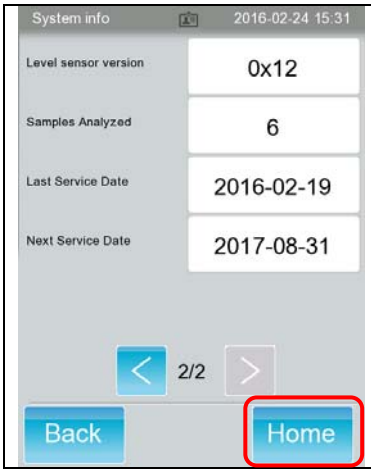
Displays the serial number of the instrument.

Displays the version of the user interface software.

Displays the version of the controller software.

Displays the language version.

Step to next page by pressing the “**>**” arrow.



For service purposes.

Number of analysis made since last service reset.

Date when an authorized service engineer last serviced your instrument.
Recommended date for the next service, and when a service message will appear on the screen.

Press “Home” to return to operating window.

IX. ALTITUDE CORRECTION

The FN value is affected by the boiling temperature of the water in the water bath, which is a function of the atmospheric pressure. Therefore, elevated locations may give FN values which are different from those determined at sea level.
No adjustment of the water bath boiling temperature should be made, as this will lead to erroneous results (ICC 107/1 (1995), AACCI 56-81.03 (1999)).

Instead do the following.

Wheat meal

If the laboratory altitude is lower than ***610*** meters (2,000 feet), FN determinations are reported without any corrections.

If the laboratory altitude is higher than 610 meters (2,000 feet), activate the apparatus altitude correction for ***meal*** (see below). The altitude correction function will correct measured FN values to the corresponding sea level value.

Wheat flour

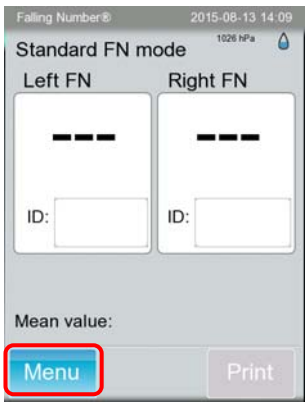
If the laboratory altitude is lower than ***760*** meters (2,500 feet), FN determinations are reported without any corrections.

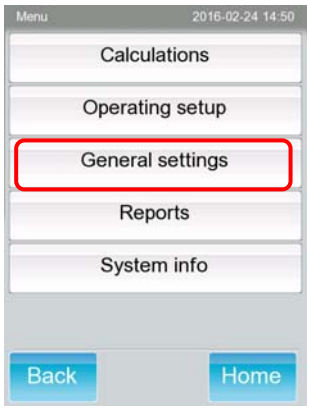
If the laboratory altitude is higher than 760 meters (2,500 feet), activate the apparatus altitude correction for ***flour*** (see below). The altitude correction function will correct measured FN values to the corresponding sea level value.

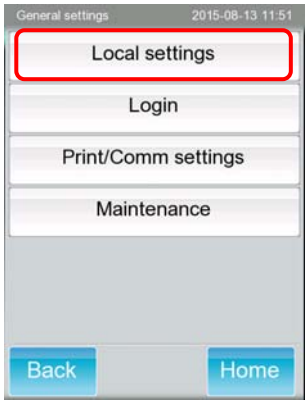
References:
Effect of Altitude on Falling Number Values of Flours. K. Lorenz and M. Wolt. Cereal Chem. 58:80-82 (1981).
Correction Equation Development for Falling Number Values from Ground Wheat Meals. M. Stone, L. Eoff, K. Lorenz, G. Häberli, and B. Allvin. Cereal Chem. 71:269-271 (1994).

Set up of altitude correction parameters

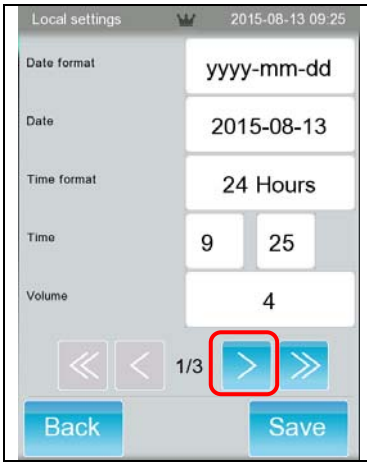
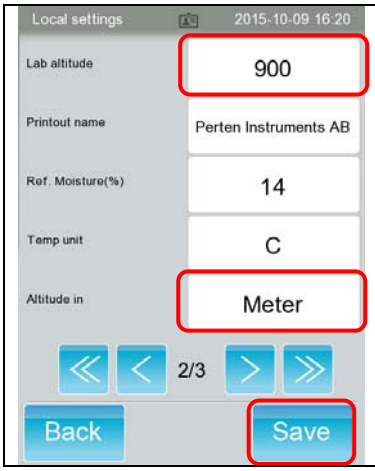
If the instrument is used in a location where altitude correction shall be applied, the altitude of the location must be set in the instrument. This is done in the local settings.







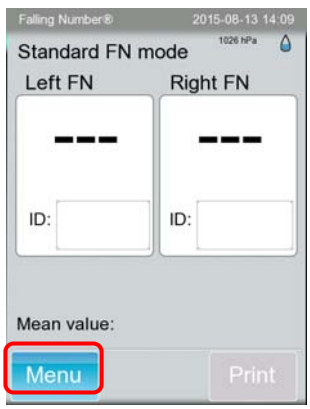
Make sure you are logged in as an Administrator before going to the Local settings screen. Then press ”Menu”, ”General settings” and ”Local settings” to reach the local setting screen.

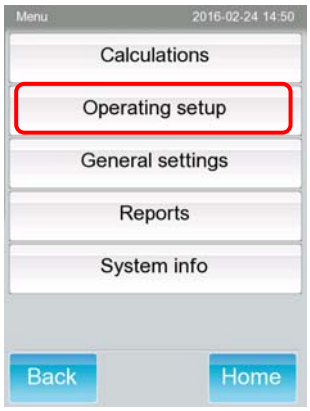
		Step to next page by pressing the “**>**” arrow.
	Lab altitude: Altitude in:	Set correct altitude of the lab location in meter or feet (as selected below). Lab altitude can be set in “Meter” or “Feet”. Press “Save” to save the selected settings

After saving the selected settings, press “Back” to go back to the operating screen.

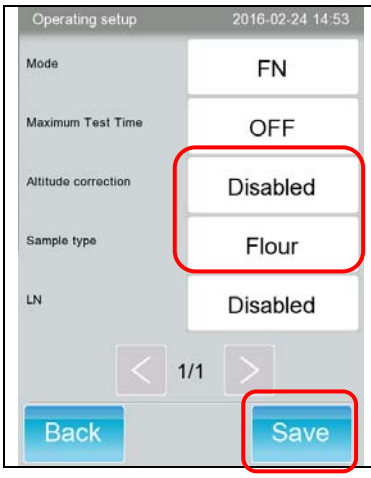
Activating the altitude correction

Activation of the altitude correction is made in the Operating setup.



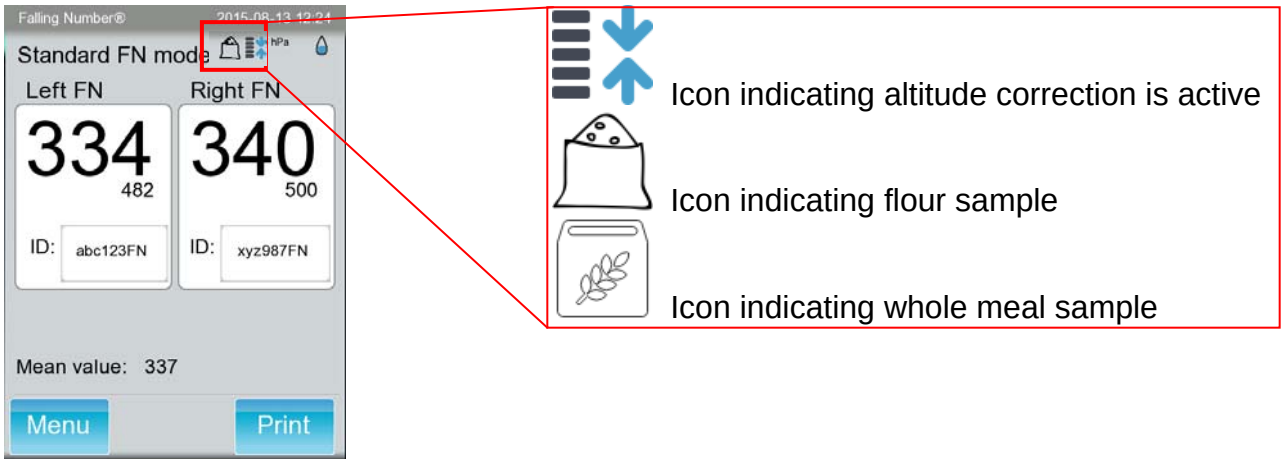


Make sure you are logged in as an Administrator before going to the Operating setup screen. Then press ”Menu” and ”Operating setup” to reach the settings screen.

	Mode: Maximum test time: Altitude correction: Sample type: Save:	“FN” must be selected to be able to activate Altitude correction. See the NOTE below. Select “Enabled” to activate the Altitude correction. Select Meal or Flour. See also below. Press “Save” to save the selected settings

After saving the selected settings, press “Back” to go back to the operating screen.

Since there are different Altitude correction formulas used for meal and flour samples, as described above, it is necessary to select correct type of sample in the set-up.



NOTE: Maximum Test Time function is possible to use in combination with altitude correction of the Falling Number result. However, it is important to understand that the set Max time is for the uncorrected time and not for the corrected result. As an example, if the Max time is set to 280 and the laboratory is at 1500 meter (approx. 4950 feet) elevation, this corresponds to a corrected Falling Number of 220 for a meal sample and 239 for a flour sample. If the target is to get a minimum corrected Falling Number of 280, the Max time can be set to 355 for both meal and flour samples.

To deactivate the altitude correction, select “Disabled” in the Altitude correction row and press “Save” to go back to uncorrected Falling Number analysis.

X. ERROR MESSAGES

WARNING: If the water bath or cooling lid need to be removed, emptied, cleaned or otherwise adjusted, or if the plastic tubing for cooling water needs to be replaced, or otherwise adjusted, ensure the water bath and cooling lid are at room temperature. Disconnect the apparatus from the mains supply before any such action.

Message	Possible cause / Remedy
Displays shows: Please close visor	The plastic visor is in the up position. There may be several reasons for this message. Pull down the plastic visor, wait for a short while and then pull it up again.
Display shows: Water bath not in place	The water bath is not correctly connected. Turn off the apparatus. Check that the water bath is correctly connected. See ”Installation instructions”.
Display shows: Wait, bath cold	During heat up of the water bath this message will be shown together with the actual temperature in the water bath.
Display shows: Wait, high temp	During cooling of the water bath, like when going from classical FN boiling water to Fungal FN 90°C water temperature, this message will be shown together with the actual temperature in the bath.
Display shows: Wait, stabilizing	When the temperature reaches 5 degrees below set temperature (95°C for classical FN or 85°C for Fungal FN) or 3 degrees above temperature (93°C for Fungal FN) a 300 seconds timer starts to count down. After the 300 seconds the instrument will be ready for operation.
Display shows: Visor not closed within 4 seconds	At the start of an analysis the plastic visor must be closed immediately after the cassette with tubes and stirrers have been placed in the instrument. If the plastic visor is not pulled down before the counter reaches 4 seconds this message is displayed. The procedure must be started again with new samples. Close the visor and wait until the hooks have reach top position and the start arm is in the back position. Open the visor and remove the cassette with the tubes. Repeat the analysis using new samples, new clean viscometer tubes etc.

Display shows: Measurement has been interrupted	If the visor is opened during an analysis this message will be shown on the display. Close the visor and wait until the hooks have reach top position and the start arm is in the back position. Open the visor and remove the cassette with the tubes. The result may be erroneous and the procedure must be started again.
Display shows: Measurement stopped	If STOP is pressed on the display while running an analysis, this message will be shown on the display. Open the visor and remove the cassette with the tubes. The procedure must be started again with new samples.
Display shows: Please remove cassette	If the start arm for any reason is obstructed and cannot reach its proper outer position when a cassette with tubes is placed in the instrument this error message will be shown on the display. If this happens: 1. Lift the visor up and push manually the start arm back so that the cassette can be removed. When the cassette is removed the message Please close visor will be shown. 2. Close the visor. The instrument will now reset the start arm and the hooks to starting position. 3. Lift up the visor and the instrument will be ready for the next analysis.
Display shows: Pump error	When the water level is low in the water bath the pump will start to pump water to fill up to the defined level. If the correct water level is not reached in the defined time, the pump stops and this message will be shown. Check that the WB refill water bottle has got water in it and that the tubing from the bottle via the pump to the cooling lid is connected properly and not blocked.
Display shows: Low level alarm	When the water level is low, and automatic addition of water has failed, water level may go down so low that safety of the heaters may be affected. If so, this alarm will be shown on the display, and the heaters will be deactivated. If this happens, instrument must be turned off before the instrument can be operated again. Check that the WB refill water bottle has got water in it and that the tubing from the bottle via the pump to the cooling lid is connected properly and not blocked. Add manually some water into the Water bath (see “Installations Instructions”) and then turn on the instrument again. It will now run

	through the normal heat up and control functions before ready to operate again.
Display shows: Sample moisture out of range	This message can be shown in connection with moisture correction functions (see Appendix VII).
Display shows: Required FN is not within the range	This message can be shown in connection with calculation of blends (MIX) and malt addition (see Appendix VI).
Display shows: Minimum possible FN value is 62	This message can be shown in connection with calculation of blends (MIX) and malt addition (see Appendix VI) and with moisture correction of FN (see Appendix VII) if input FN is below 62.
Display shows: Difference between FN values should be greater than 2	To be able to calculate the MIX proportions or the malt addition, the difference between the two results bust be at least 2 units.
Display shows: Altitude correction should be activated	The instrument controls via the atmospheric pressure sensor if the instrument is installed on an altitude where altitude correction should be used (see Appendix IX). If it detects a high altitude, and the altitude correction is not activated, this message will be shown when the instrument power is turned on.
Display shows: Altitude correction should be deactivated	The instrument controls via the atmospheric pressure sensor if the instrument is installed on an altitude where altitude correction should be used (see Appendix IX). If it detects low altitude, and the altitude correction is activated, this message will be shown when the instrument power is turned on.

XI. REPLACEMENT OF FUSES

WARNING: To prevent operator injury or damage to the apparatus, disconnect the apparatus from the mains supply before changing fuses.

1. Disconnect the apparatus. (Remove the mains power cable).

2. Use a small screwdriver to open the fuse holders (turn counter-clockwise). See figure X:1.

3. Remove the fuse (fuses) from the holder(s) and replace them with new one(s).

Figure X:1. Fuse holders removed.

230V~ instruments

Check your mains supply:

1. If your mains supply is 230V~ use a fuse marked T6.3AH 250 V. The fuse part number is 30949. Insert the new fuse (fuses) in the fuse holder(s) and fit them in the instrument.

2. Reconnect the apparatus to the mains power.

115V~ instruments

Check your mains supply:

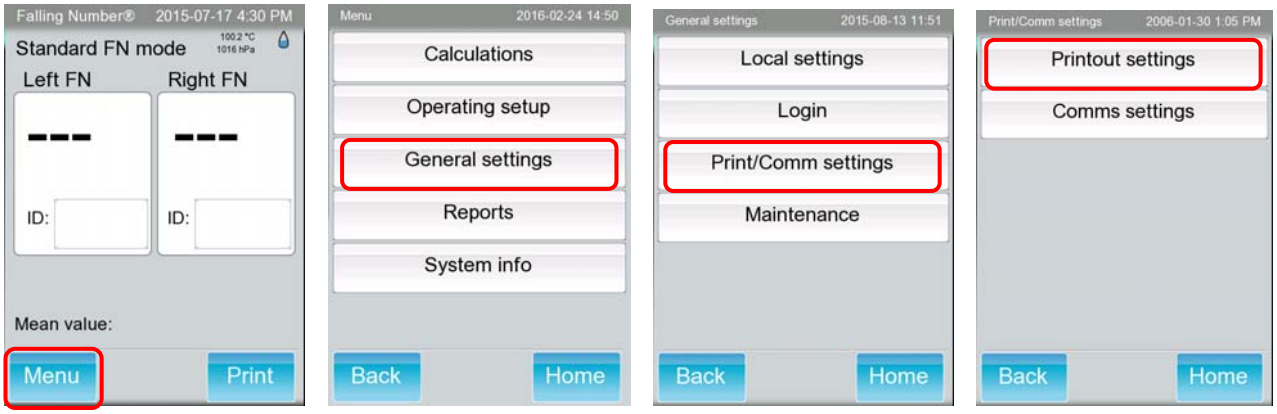
If your mains supply is 115V~ use a fuse marked T10AH 250V ceramic. The fuses spare part number is 30950. Insert the new fuse (fuses) in the fuse holders and fit them in the instrument.

Reconnect the apparatus to the mains power.

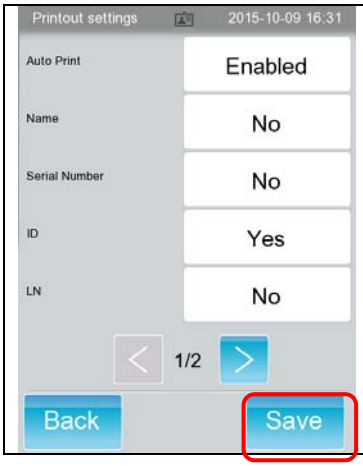
XII. OPTIONAL PRINTER

If a printout of the results is required, there is an optional printer available from Perten instruments. If the optional printer is going to be used, the printing format can be set up by the user.

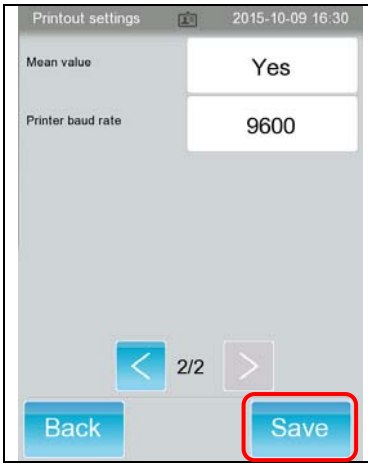
Setting the printing format



Make sure you are logged in as an Administrator before going to the Printout settings screen. Then from the operating screen, press ”Menu”, ”General settings”, ”Print/Comm settings” and “Printout settings” to reach the printout settings screen.



Auto Print:	Toggle between Enabled/Disabled. Basic printout is date, time, S/N and results.
Name:	Yes/No to print name set in Local settings.
Serial Number	Yes/No to print instrument serial number
ID:	Yes/No to print ID
LN:	Yes/No to print Liquefaction Number.
Save:	Step to second page by pressing the “**>**” arrow, or press “Save” to save the selected settings.

	Mean value: Printer baudrate: Save:	Yes/No to print mean value. Toggle between different alternatives. As default set to 9600 suitable for the optional Printer from Perten Instruments. Press “Save” to save the selected settings

When the printer settings are saved, return to the operating screen by pressing “Back” and “Home”.

Figure XI:1. USB and Ethernet connections on the FN 1000 instrument.

The printer can be connected to the FN 1000 instrument via any of the four USB contacts on the right hand side of the instrument.

More information about the Printer can be found in its manual.

XIII. EXTERNAL COMMUNICATION

Figure XII:1. USB and Ethernet connections on the FN 1000 instrument..

The FN 1000 instrument can be connected to a PC via the Ethernet connection for communicating the Falling Number results to the computer.

Contact Perten Instruments for further information regarding the external communication settings and use.