

# Falling Number 1900

## Operation Manual



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# FALLING NUMBER 1900

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## INSTALLATION INSTRUCTIONS

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### THIS DELIVERY CONTAINS

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Part No.	Ref	Description
1 x 1900		Falling Number Apparatus with water bath, cooling lid and control module, 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
4 x 10.07.00	C	Rubber stoppers
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 17.19.22	G	Control module cable
1 x 16.08.10	H	Cassette stand
1 x 16.04.20	I	Cassette for holding tubes
2 x 16.04.00	J	Viscometer-Stirrer
3m 10.09.00	K	Plastic tubing for cooling system
1 x 39.11.10		Poster Falling Number Method
1 x		Operation Manual Falling Number 1900



Figure 1. Falling Number apparatus model 1900 with accessories. L=Plastic cover

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### SPARE PARTS SUPPLIED

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2 x 90.16.50	Spare fuse T5AL 250V (5 x 20 mm, 230 V ~),
or	
2 x 90.19.00	Spare fuse T10AL 250V ceramic (6.3 x 32 mm 115 V ~)
1 x 17.19.18	Printer paper (5 rolls)

Retain all packing materials for future possible service transport.

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### 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. The apparatus water bath must only be filled with distilled water or water of equivalent purity.
3. **WARNING.** The water bath and cooling lid become hot during operation. See figure 4. Do not touch the water bath or cooling lid surfaces during operation.
4. **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.
5. **CAUTION.** Note that stirring starts automatically after 5 seconds if the plastic cover has been pulled down. See figure 1.



Figure 2. Power module.  
The fuses are located in the power module. For exchange see "Replacement of fuses".



Figure 3. Water bath label

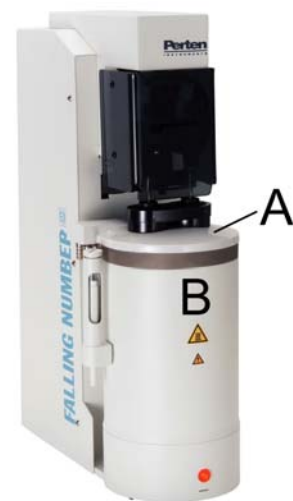


Figure 4. Hot surfaces: A=cooling lid, B=water bath

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## INSTALLATION INSTRUCTIONS

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

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### CONNECTION OF WATER BATH AND CONDENSING SYSTEM

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1. Lift up the plastic cover and put the water bath in place. Fit the contact and slide in the water bath so that it is properly secured. Check against the mark on the bottom plate. Figure 5 and 6.



Figure 5. Fit the contact and slide in the water bath so that it is properly secured.



Figure 6. Check against the mark on the bottom plate.

**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.

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2. Place a glass beaker or similar under the water level control on the left of the apparatus. Fill the water bath with distilled water, or water of equivalent purity, to the top edge of the water level control.
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. Figure 7. Ensure that the plastic tubing is properly fixed. Turn on the water and check that it flows at a minimum of 400 ml per minute.

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



Figure 7. Connect plastic tubing securely to the cooling lid nozzles.

## 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.

1. Connect with the supplied cable the Control module to the Stirrer unit.
2. After verifying main voltage, connect the apparatus to mains power.

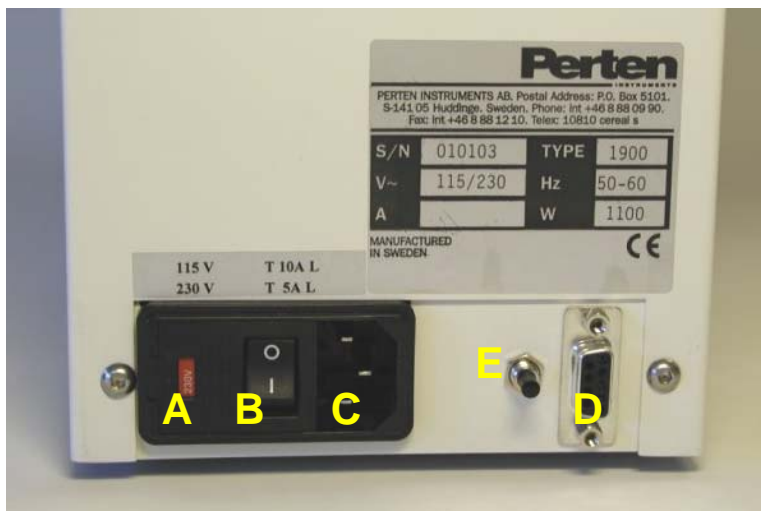


Figure 8. Backside of stirrer unit with name plate.

To the left the power module with fuse holder (A), ON/OFF button (B) and contact for main power (C). To the right the RS 232 contact for PC data loading (D). The black pushbutton (E) is only for service purposes.

3. Lift up the Printer cover and check that the printer paper is installed. See Appendix XI for details.
4. Pull down the plastic cover.
5. 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 cover is not closed at switch on of the instrument the display will show CLOSE THE COVER. In this case, close the cover before continuing the procedure.
6. During heat up the display will show WAIT XX °C, BATH COLD. XX is the temperature in the water bath. When the temperature reaches 95 °C, the display will show WAIT 300, STABILISING. This indicates that 300 seconds (5 minutes) heat up time remains.

7. When the display has counted down to 0, pull up the plastic cover. After 3 seconds the start arm lamp will show a steady green light and the display will show FN LEFT 0, FN RIGHT 0.
8. The instrument is ready for use.

If an error message is displayed, see Appendix IX, 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 VIII, altitude correction.



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## DESCRIPTION OF KEYBOARD

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Figure 9. Control module with keyboard.

LEFT ID & RIGHT ID	Prepares input of sample identification (ID) of the left respectively the right sample. A sample ID of up to 24 alphanumerical characters can be entered from the keyboard. See Appendix IV for details.
MALT & MIX	Calculations of flour malt additions and blending ratios can be made automatically. See Appendix V for details.
MOIST GRAM & MOIST FN	Calculation of moisture corrected sample weight and moisture corrected Falling Number result. See Appendix VI for details.
PRINT COPY	Provides a printed copy of the last result.
FEED	Advances the printer one line. See Appendix XI for details about the printer.
CODE	Activates special functions. These functions include setting the date and time etc. See below, set-up of instrument and Appendix VII for details.
◀ & ▶	Used to step between different alternatives when selecting different functions under CODE option.
“0” to “9”	Numerical keys are used for sample ID’s and functions inputs. Can under certain circumstances also be used for alphanumerical use, see Appendix VII for details.
ENTER	Is used to end keyboard inputs.

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## SET UP OF THE INSTRUMENT

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The internal date format, date and clock and the printer settings should be set before operation.



Figure 10. Setting date and time.

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### Selecting language version

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Press CODE 0. The display shows CODE 0, LANGUAGE. Press ENTER.

The display shows:

LANGUAGE	
ENGLISH	* >

Step between the available languages using the ◀ and ▶ pushbuttons. Select the language with the CODE pushbutton. An “\*” displayed to the right of the selected language will confirm the selection. Leave the selection mode with the ENTER pushbutton.

---

### Setting the date format

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Press CODE 2. The display shows CODE 2, DATE FORMAT. Press ENTER.

The display shows:

DATE FORMAT	
DD.MM.YY	>

There are 3 different date formats available:

DD.MM.YY or  
MM/DD/YY or  
YY-MM-DD

Step between the three formats using the ◀ and ▶ pushbuttons. Select the date format with the CODE pushbutton. An “\*” displayed to the right of the selected date format will confirm the selection. Leave the selection mode with the ENTER pushbutton.

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### Setting the date

---

Press CODE 5. The display shows CODE 5, DATE. Press Enter.

The display will show:

SET	YY MM DD
DATE	0 <u>1</u> - 08 - 18

The year digits will have a cursor under the second digit.

Write the year with two digits, i.e. “01”, and press ENTER. The cursor will move to the month digits. Write the month with two digits, i.e. “08”, and press ENTER. The cursor will now move to the day digits. Write the day with two digits, i.e. “18” and press ENTER. The system will automatically go back to operation mode when the day digits are set with the ENTER pushbutton.

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### Setting the time

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Press CODE 6. The display shows CODE 6, TIME. Press Enter.

The display will show:

SET	hh mm ss
TIME	0 <u>9</u> -11-45

The hour digits will have a cursor under the second digit. Write the hour with two digits, i.e. “09”, and press ENTER. The cursor will move to the minute digits. Write the minute with two digits, i.e. “11”, and press ENTER. The cursor will now move to the second’s digits. Write the second’s with two digits, i.e. “45” and press ENTER. The system will automatically go back to operation mode when the second’s digits are set with the ENTER pushbutton.

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### Setting the printing format

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Press CODE 3. The display shows CODE 3, PRINTOUT. Press ENTER.

The display will show:

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PRINTOUT
RESULT      * >

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The RESULT is the first information in the list of the different printouts that can be selected for the printer. The “\*” indicates that RESULT is selected for printout. To step through the list of possible information for printout, use the ◀ and ▶ pushbuttons. The CODE pushbutton is used to select or disable each individual printout information.

After selecting the required printout setup, leave the selection mode with the ENTER pushbutton.

The following list describes the printout selections.

RESULT	Printing the result after each analysis.
DATE, TIME	Printing the date and time with each analysis.
NAME	Printing the name (see Appendix VII, code 1) with each analysis.
ID	Printing the ID number with each analysis if ID has been entered.
LN	Calculates and prints the Liquefaction Number for each analysis.
ALTITUDE CORR.	Printing the result after each analysis when altitude correction is activated.
MEAN VALUE	Calculates and prints the mean value after each double analysis. Will not be calculated if only analysing one sample or if different ID number have been set for left and right sample.
MALT	Printing the result after a “MALT” calculation. See Appendix V.
MIX	Printing the result after a “MIX” calculation. See Appendix V.
MOIST G	Printing the result after a “MOIST G” calculation. See Appendix VI.
MOIST FN	Printing the result after a “MOIST FN” calculation. See Appendix VI.

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### Selecting classical or Fungal Falling Number operation

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At delivery the FN 1900 is set for classical Falling Number operation according to international standards ICC 107/1, AACC 56-81B and ISO 3093. The instrument does also have the Fungal Falling Number method available as alternative operation. To set the instrument for requested operation one should follow the below procedure.

Press CODE 8. The display shows CODE 8, FUNCTION. Press ENTER.

The display shows:

FUNCTION	
FN	* >

The “\*” after the FN indicates that classical Falling Number operation is selected. To step through the list of possible operation modes, use the ◀ and ▶ pushbuttons. Under the Function code there are 5 different possible operation modes for the instrument.

FN	Classical Falling Number according to ICC 107/1, AACC 56-81B, ISO 3093.
FN, ALT.FLOUR	Classical Falling Number with automatic altitude correction calculation for flour samples. See Appendix VIII for details.
FN, ALT.MEAL	Classical Falling Number with automatic altitude correction calculation for meal samples. See Appendix VIII for details.
FUNGAL (90C)	Fungal Falling Number operation.
FX (XX.XC)	Alternative test function with water bath setting between 30-90 °C.

To select the Fungal FN operation mode, step to the FUNGAL (90C) line and press CODE. The asterisk "\*" will appear on the FUNGAL (90C) line confirming the selection. Press ENTER to leave the function selection mode. When Fungal FN mode is selected the display will show FFN LEFT and FFN RIGHT in front of the previous results.

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### System functions

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- The system will inform when the water bath temperature is different from the set temperature. At heating up the display will show WAIT XX°C, BATH COLD until reaching 5°C below the set temperature, i.e. 85°C for fungal FN. After reaching above 85°C a 300 seconds (5 minutes) counter will start to count down and the display will show WAIT xxxs, STABILISING where xxx is the counter counting down to zero. After the 300 seconds the instrument is ready for Fungal FN operation and the screen will show FFN LEFT 0, FFN RIGHT 0.
- If the selection of Fungal FN method is done from classical FN operation (water is boiling) the display will show WAIT XX°C, HIGH TEMP until reaching 95°C. After reaching below 95°C a 300 seconds (5 minutes) counter will start to count down and the display will show WAIT xxxs, STABILISING where xxx is the counter counting down to zero. After the 300 seconds the instrument is ready for Fungal FN operation and the screen will show FFN LEFT 0, FFN RIGHT 0.
- When changing from Fungal FN operation to classical Falling Number, go in under CODE 8 and select FN as described above. The display will show WAIT XX°C, BATH COLD until reaching 95°C. After reaching above 95°C the 300 seconds (5 minutes) counter will start to count down and the display will show WAIT xxxs, STABILISING where xxx is the counter counting down to zero. After the 300 seconds the instrument is ready for Classical FN operation and the screen will show FN LEFT 0, FN RIGHT 0.

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

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ICC Standard Nr. 107/1 (1995), AACC Method 56 - 81B (1992)

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### **GENERAL DESCRIPTION**

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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 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.

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### **APPLICATION OF FALLING NUMBER**

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Falling Number results are used to segregate grain into good quality for bread making, and poorer grades suitable only for feedstuffs, or controlled mixing.

Falling Number results can be used at the flourmill 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 V)

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 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.

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### **EQUIPMENT REQUIRED FOR A TEST**

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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 8xxx can be used).

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## SAMPLING

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

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## PREPARATION OF GRAIN SAMPLE

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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.

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## GRINDING OF GRAIN

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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 be continued 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***

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## PREPARATION OF FLOUR SAMPLE

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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.

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## MOISTURE CONTENT OF SAMPLE

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Determine the moisture content of the prepared sample before weighing out the test sample quantity. A simple electronic moisture meter is sufficient.

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, AACC). See Appendix I. The amount of added water (25 ml) does not change.

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

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### PREPARING AND STARTING THE TEST

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1. The distilled water in the water bath must boil vigorously during the whole test period. Check water level and condensing 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 set to the instrument 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.

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.

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**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.

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Add 25 ml +/- 0.2 ml distilled water (or water that fulfils "grade 3" according to ISO 3696) of 22°C +/- 2°C into the clean and dry viscometer tubes.

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. 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 figure 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.

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**CAUTION:** The water bath and condensing lid are hot. Steam may escape when putting the cassette with tubes and stirrers into the water bath.

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Figure 15. Pull down the plastic cover.

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

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## APPARATUS FUNCTIONS

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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 cover is not pulled down before the counter reaches 4 seconds the message “COVER NOT CLOSED WITHIN 4 SEC” is displayed on the control module. The result may be erroneous and the procedure must be started again. Lift up the plastic cover and repeat the analysis using new samples, new clean viscometer tubes etc. To reset the instrument pull down the plastic cover and wait until the hooks have reached top opposition and the start arm is in back position.*

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. At 62 seconds, the electronics is set to stop the counter 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.
5. The results of the analysis will be shown on the display and at the same time printed according to the printer setting.
6. Raise the plastic cover. This will turn off the beep signal.

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.

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

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**NOTE:** The procedure may be stopped any time by raising the plastic cover. This stops the motor, counting and stirring.

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.

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## DEFINITION OF THE FALLING NUMBER VALUE

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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.

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## PRECISION OF DETERMINATION

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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.

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## INTERPRETATION OF RESULTS

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Typical results for wheat and rye grain.

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### Wheat

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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.

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### Rye

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Falling Number	Indicates
Below 100	High amylase activity, sprout damaged rye.
120	Limit for EU intervention rye (proposal 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 III.

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## CLEANING OF VISCOMETER TUBES AND STIRRERS

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Clean the viscometer stirrers carefully using cold water and a brush ensuring that all solid material is removed. Dry 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 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.

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**WARNING:** The Viscometer tubes are 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.

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

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

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## CLEANING OF THE APPARATUS

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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.

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## BIBLIOGRAPHY

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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, No 12 (1967)

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

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### PREPARATION OF BUFFER SOLUTION

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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<sub>3</sub>COOH, >99,8%, analytical grade).
3. Calcium acetate monohydrate (Ca(CH<sub>3</sub>COO)<sub>2</sub>\*H<sub>2</sub>O, 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 FFN LEFT 0, FFN RIGHT 0 when the system is set for Fungal FN and ready for analysis. (See chapter “Set up of instrument – Selecting classical or Fungal Falling number operation” above.) Check water level and condensing 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 to run 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 ± 0.2 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 thereafter 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 is 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. 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 boiling water bath, IMMEDIATELY lower the plastic cover. See figure 15. The test will start automatically.

---

**CAUTION:** The water bath and condensing lid are hot. Steam may escape when putting the cassette with tube and stirrer into the water bath.

---

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## APPARATUS FUNCTIONS

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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 cover is not pulled down before the counter reaches 4 seconds the message "COVER NOT CLOSED WITHIN 4 SEC" is displayed on the control module. The result may be erroneous and the procedure must be started again. Lift up the plastic cover and repeat the analysis using new samples, new clean viscometer tubes etc. To reset the instrument pull down the plastic cover and wait until the hooks have reached top opposition and the start arm is in back position.*

2. At 60 seconds, the stirrer will be kept in the top position and there will be a 1-minute pause. During the pause the counter will count downwards from 0:59 to 0:0. 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 stirrer is detected, the beeper sounds to indicate that the test is complete.
6. The results of the analysis will be shown on the display and at the same time printed according to the printer setting.
7. Raise the plastic cover. This will turn off the beep signal.

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:** The water bath and cooling lid are hot. Steam may escape when removing the cassette, with tubes and stirrers, from the water bath.

---

**NOTE:** The procedure may be stopped any time by raising the plastic cover. This stops the motor, counting and stirring.

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.



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## TECHNICAL SPECIFICATIONS

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Power requirement:	230 V ~, 50-60 Hz, or 115 V ~, 50-60 Hz 1100 W (refer to apparatus name plate)
Fuses:	(2x) T5AL 250V, 5x20 mm (230 V ~) or (2x) T10AL 250V ceramic, 6.3x32 mm (115 V ~)
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:	Stirrer unit (HxDxW) 570 x 370 x 210 mm Control unit (HxDxW) 95 x 295 x 145 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".

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## DECLARATION OF CONFORMITY (CE)

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<b>Manufacturer:</b>	Perten Instruments AB
<b>Address:</b>	P.O. Box 5101 S-141 05 Huddinge, SWEDEN
<b>Declare that the product:</b>	Falling Number apparatus, Model FN 1900
<b>Fulfils the requirements in the following product specifications:</b>	
<b>Safety:</b>	EN 61010-1: 1993
EMC emission	EN 55022 "RE" class B EN 55022 "CE" class B EN 61000-3-2 EN 61000-3-3
EMC immunity	IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-11

The product thus fulfils the requirements in the following directives and has been CE labelled according to:

EMC directive 89/336/EEC  
Low Voltage Directive 73/23/EEC.



## APPENDIX

### I. CORRECTION OF SAMPLE WEIGHT TO 14% MOISTURE BASIS

(ICC Standard No. 107/1,1995 and AACC Method 56-81B, 1992)

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 with the keyboard, see Appendix V.**

Correction of sample weight to 14% moisture basis (ICC, AACC)					
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	<b>14.0</b>	<b>7.00</b>	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 AACC Method 56-81B, 1992 prescribe the use of 14% moisture correction.**

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 with the keyboard, see Appendix V.**

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	<b>15.0</b>	<b>7.00</b>	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	<b>14.0</b>	<b>5.00</b>	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 keyboard or it can be entered with an optional bar code reader.

---

### Sample ID with keyboard

---

Press LEFT ID pushbutton. The display will show LEFT ID and a cursor is blinking. The 0 to 9 keys can now be used in alphanumerical mode to enter up to 24 characters as the sample ID. Press ENTER to set the ID. Proceed with the RIGHT ID in the same manner.

After the analysis only the eight last characters of the ID will be shown on the display but the full ID will be printed on the printer.

Display will show:

FNL 12345678 250
FNR 87654321 245

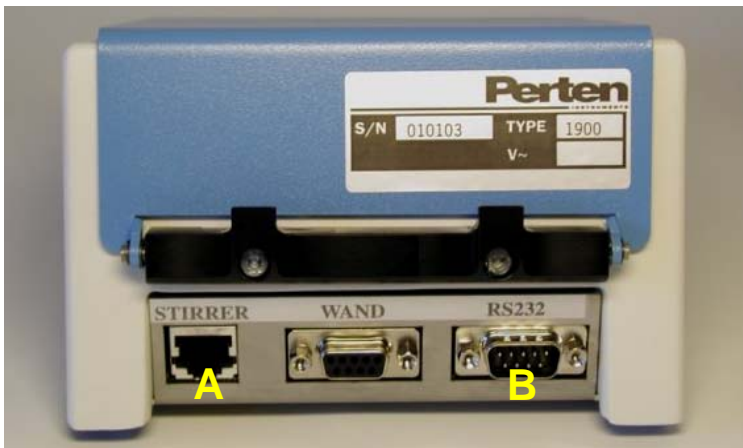
Printout will show:

	DKFMOE12345678
L	FN 250
	SDMFKJ87654321
R	FN 245

---

### Sample ID with bar code reader

---



*Figure IV:1. Backside of Control Module.  
To the left the connection for cable to stirrer unit (A) and to the right the RS 232 connection for bar code reader (B). The WAND contact is only for internal Perten use.*

On the Control module there is a RS 232 connection for bar code reader. The connection can handle both bar code pens and scanning type readers. Enter the ID number the following way.

Press LEFT ID pushbutton.

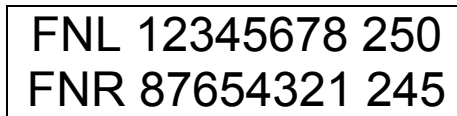
Display will show:



Read the ID number with the barcode reader. Press ENTER to set the ID.  
Proceed with the RIGHT ID in the same manner.

After the analysis only the eight last characters of the ID will be shown on the display but the full ID will be printed on the printer.

Display will show:



Printout will show:

	DKFMOE12345678
L	FN 250
	SDMFKJ87654321
R	FN 245

---

## V. 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:  $LN = 6000 / (\text{Falling Number value} - 50)$

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.

Further description of these calculations are described in "Application of the Falling Number method for Evaluating Alpha-Amylase Activity" by Harald Perten, Cereal Chemistry, Vol. 41, No. 3, 127-140, (1964), copies of which are available upon request.

---

### Calculation of blends

---

In the FN 1900 blends can be automatically calculated with the MIX pushbutton. Two different samples that should 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 the MIX pushbutton.

The display shows:

FNL LOT A	200
FNR LOT B	300

“200” is the left sample result and “300” is the right sample result. There is a cursor under the “200” value. To acknowledge that left FN value is the one to use in the mix calculation, press ENTER and the cursor moves down to “300”. If the left value is not correct, write the correct FN value with the numeric keys before pressing ENTER.

For the right value, press ENTER if the value is correct or change value with the numeric keys before pressing ENTER.

The display now shows:

DESIRED FN	250
------------	-----

“250” is the suggested desired FN in the blend. The desired FN value must be between the two values to be mixed. Accept with ENTER or change with the numeric keys before



pressing ENTER. The calculation will now take place and the result will be given on the display as well as on the printer.

The display shows:

MIX 38%A	62%B
FOR FN	250

Press ENTER when the result is ready to return to normal operation mode on the control module.

---

### 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 should be run in the left position and the 1% malt mixture should be run in the right position. When the analysis is ready, press the MALT pushbutton.

The display shows:

FNL FLOUR	350
FNR MALT 1%	200

“350” is the left pure flour sample result and “200” is the right 1% malt mixture sample result. There is a cursor under the “350” value. To acknowledge that left flour FN value is the one to use in the malt calculation, press ENTER and the cursor moves down to “1%”. Press ENTER once more. If the left value is not correct, write the correct FN value with the numeric keys before pressing ENTER twice. The cursor has now moved to “200”. For the right 1% malt mixture value, press ENTER if the value is correct or change value with the numeric keys before pressing ENTER.

The display now shows:

DESIRED FN	250
------------	-----

“250” is the suggested desired FN in the flour after malt addition. The desired FN value must be between the pure flour and the 1% malt mixture values. Accept with ENTER or change with the numeric keys before pressing ENTER. The calculation will now take place and the result will be given on the display as well as on the printer.

The display shows:

ADD 0.50% MALT
FOR FN 250

Press ENTER when the result is ready to return to normal operation mode on the control module.

If 1% malt is not enough to reach the desired FN value, repeat the procedure above but adding 2% malt to right sample and change to 2% in the calculation above. See also “USE 2% MALT ALT” message on next page.

---

## Errors in connection with use of MALT or MIX functions

---

### VALUE OUT OF LIMIT

If the desired 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, the display will show VALUE OUT OF LIMIT for 3 seconds and the display will then return to the DESIRED FN screen. Change the desired FN to a value between high and low FN value and press ENTER to start the calculation.

If the desired value is lower than the low FN value for the mixing calculation, the display will show VALUE OUT OF LIMIT for 3 seconds and the display will then return to the DESIRED FN screen. Change the desired FN to a value between high and low FN value and press ENTER to start the calculation.

If the same “out of limit” value is entered once more the system gets back to analysis mode without doing any calculation.

### USE 2% MALT ALT

If the desired value entered to the calculation is lower than the 1% malt mixture value, the display will show USE 2% MALT ALT. After 3 seconds the display will show a result with an addition of the tested malt higher than 1%, see below example.

Press the MALT pushbutton.

The display shows:

FNL FLOUR	350
FNR MALT 1%	200

Acknowledge or change the FN results as input to the calculation. Press ENTER for each value.

The display now shows:

DESIRED FN	180
------------	-----

Acknowledge or change the desired FN value.

Press ENTER.

The display shows during 3 seconds:

USE 2% MALT ALT
-----------------

The display then shows:

ADD 1.31% MALT
FOR FN 180

The result is also printed on the printer.

---

## VI. MOISTURE CORRECTION KEY FUNCTIONS

---

On the FN 1900 keyboard there are two quick function keys for moisture correction of sample weight as well as of Falling Number result. As default the system is set up for correction to 14% moisture basis. With CODE 7, SETUP it is possible to switch to 15% moisture basis, see Appendix VII for details.

---

### MOIST GRAM key

---

The MOIST GRAM key is used to calculate the correct sample weight for known moisture contents. Press MOIST GRAM.

The display shows:

MOISTURE CONTENT	12.0%
---------------------	-------

There is a cursor under the moisture value. Enter the moisture content in the sample to be analysed. The value should be entered without any decimal point. The last digit will automatically be the decimal number. If the decimal number is a “0” like in the above example the “0” must be entered with the numeric key. The value will otherwise be 1.2% instead of 12.0%.

Press ENTER to get the moisture corrected sample weight on the display and printed. To get back to analysis mode, press ENTER once more.

---

### MOIST FN key

---

With the MOIST FN key a Falling Number result made with 7.00 gram sample can be corrected for the true moisture content in the sample. Press MOIST FN.

The display shows:

MOISTURE CONTENT	12.0%
---------------------	-------

There is a cursor under the moisture value. Enter the moisture content in the sample. The value should be entered without any decimal point. The last digit will automatically be the decimal number. If the decimal number is a “0” like in the above example the “0” must be entered with the numeric key. The value will otherwise be 1.2% instead of 12.0%. Press ENTER.

The display shows:

FNL UNCORR.	240
FNR UNCORR.	245

The values are from the last analysis done with the instrument. The cursor under the upper (left) value indicates that the value shall be accepted by pressing ENTER or it can be changed with the numeric keys before pressing ENTER. The cursor now moves to the

lower (right) value. Accept the value by pressing ENTER or change the value with the numeric keys and then press ENTER.

The moisture corrected FN values will now be shown on the display and on the printout. To get back to analysis mode, press ENTER once more.

---

## **Errors in connection with MOIST GRAM and MOIST FN calculations**

---

### **VALUE OUT OF LIMIT**

The moisture correction calculations do only cover the moisture range from 5.1 to 24.9%. If a moisture content of 5.0% or lower is entered the display shows VALUE OUT OF LIMIT for three seconds and the display then gets back to the MOISTURE CONTENT screen. The same will happen if a value of 25.0% or higher is entered. If the same “out of limit” value is entered once more the system gets back to analysis mode without doing any calculation.

---

## VII. CODE FUNCTIONS

---

Pressing the CODE pushbutton, there are ten different options, “0” to “9”. The options are selected by the numeric keys or stepping with the ◀ and ▶ pushbuttons.

For CODE 0, 2-4 and 7-8 step with the ◀ and ▶ pushbuttons between the available selections. To make a selection push the CODE pushbutton. The selection will be marked with an asterisk “\*”. After the selection is made, use ENTER to get back to the analysis mode.

CODE 0: LANGUAGE	Selects language version.
CODE 1: NAME	An alphanumerical name (maximum 24 characters) can be entered. This name will be written in the printout.
CODE 2: DATE FORMAT	Selects date format for the printout.
DD.MM.YY	Day.Month.Year etc.
MM/DD/YY	
YY-MM-DD	
CODE 3: PRINTOUT	Selects printer output.
RESULT	
DATE, TIME	
NAME	
ID	
LN	
ALTITUDE CORR	
MEAN VALUE	
MALT	
MIX	
MOIST G	
MOIST FN	
CODE 4: RS-232 BAUDRATE	For setting RS-232 baudrate.
(FOR PC 4800)	Settings for computer port on the stirrer unit.
FOR PC 9600	<b>Note! Due to technical limitations baud rate 9600 must be selected for computer port!</b>
FOR PEN 4800	Settings for bar code reader ports on the control module,
FOR PEN 9600	
CODE 5: DATE	For setting the date. Each number (day, month and year) is set with the numeric key and then pressing ENTER pushbutton.
CODE 6: TIME	For setting the time. Each number (hour, minute (and second)) is set with the numeric keys and then pressing ENTER pushbutton.

CODE 7: SETUP		For setup of parameters.
ALTITUDE	FEET METERS FEET (xxxxx) or METERS (xxxxx)	Select feet or meter for the altitude correction calculation. Set altitude when feet have been selected. or Set altitude when meter have been selected.
MOISTURE CO	14% 15%	Select 14% or 15% as moisture basis for moisture correction calculations.
ALPHANUMERIC		Select if alphanumerical or only numerical characters should be able to use for the sample ID's.
CODE 8: FUNCTION		Select analysis mode for the instrument.
FN		Classical Falling Number operation.
FN, ALT.FLOUR		FN with altitude correction for flour.
FN, ALT.MEAL		FN with altitude correction for meal.
FUNGAL (90C)		Fungal FN method.
FX (XX.XC)		Test function.
CODE 9: SERVICE		For service purpose only.

---

## VIII. 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), AACC 56-81B Revised 9-23-92).

Instead make 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**. 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**. 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.  
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.

---

### Set up of altitude correction parameters

---

Press CODE 7. The display shows CODE 7, SETUP. Press ENTER.  
The display now shows SETUP, ALTITUDE. Press ENTER one more time.

The display shows:

ALTITUDE FEET <span style="float: right;">* &gt;</span>
--

Step with the ◀ and ▶ pushbuttons between the available selections. The two first alternatives are FEET and METERS. Select one of them by pressing the CODE pushbutton. An "\*" displayed to the right of the selection will confirm the selection. Step with the ▶ pushbutton to reach the line: METERS (xxxxx) (or FEET (xxxxx) if feet is

selected). Write the correct altitude with the numerical keys. When the setup is ready, press ENTER to return to the analysis mode. The instrument now needs to be activated for altitude correction, which is done with CODE 8, see below.

---

### Activating the altitude correction

---

Press CODE 8. The display shows CODE 8, FUNCTION. Press ENTER.

The display shows:

FUNCTION	
FN	* >

Step with the ◀ and ▶ pushbuttons between the available selections. If altitude correction for flour samples shall be selected, step to the line FN, ALT.FLOUR and press the CODE pushbutton. If altitude correction for whole meal samples shall be selected, step to the line FN, ALT.MEAL and press the CODE pushbutton. An asterisk "\*" will appear at the end of the line confirming the selection. Press ENTER to return to the analysis mode.

Each time a new function mode is selected as described above the instrument will go to the stabilising mode. The display will show WAIT xxxs, STABILISING where xxx is a 300 seconds counter. If the plastic cover is open during activation of a new function, the display will show CLOSE THE COVER. Close the cover and let it be closed. After the 300 seconds the instrument is ready for operation.

To deactivate the altitude correction, step to CODE 8, FUNCTION and select FN with the CODE pushbutton. The asterisk will confirm the selection as seen above. Press ENTER to return to the analysis mode.



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## IX. ERROR MESSAGES

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**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.

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<b>Message</b>	<b>Possible cause / Remedy</b>
Displays shows: CLOSE THE COVER	The plastic cover is in the up position. There may be several reasons for this message. Pull down the plastic cover, wait for a short while and then pull it up again.
Display shows: WAIT           XX°C BATH COLD	During heat up of the water bath this message will be shown indicating the temperature in the bath.
Display shows: WAIT           XX°C BATH HOT	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 indicating the temperature in the bath.
Display shows: WAIT           300s STABILISING	When the temperature reaches 5 degrees below set temperature (95°C for classical FN or 85°C for Fungal FN) or 5 degrees above temperature (95°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: ADD WATER SWITCH OFF/ON	The water level in the water bath is low. Turn off the apparatus. Add water to the water bath.
Display shows: CHECK WATER BATH	The water bath is not correctly connected. Turn off the apparatus. Check that the water bath is correctly connected. See "Installation instructions".
Display shows: VALUE OUT OF LIMIT	This message can be shown in connection with calculation of blends and malt supplement (see Appendix V) or with moisture correction key functions (see Appendix VI).

Display shows:  
COVER NOT CLOSED  
WITHIN 4 SEC

At the start of an analysis the plastic cover shall be closed immediately after the cassette with tubes and stirrers have been placed in the instrument. If the plastic cover is not pulled down before the counter reaches 4 seconds this message is displayed. The result may be erroneous and the procedure must be started again. Close the cover and wait until the hooks have reach top position and the start arm is in the back position. Open the cover and remove the cassette with the tubes. Repeat the analysis using new samples, new clean viscometer tubes etc.

Display shows:  
COVER OPENED

If the cover is opened during an analysis this message will be shown on the display. Close the cover and wait until the hooks have reach top position and the start arm is in the back position. Open the cover and remove the cassette with the tubes. The result may be erroneous and the procedure must be started again.




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## X. REPLACEMENT OF FUSES

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

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1. Disconnect the apparatus. (Remove the mains power cable).
2. Use a small screwdriver to open the left side of the lid covering the fuse holder. See figure X:1 and X:2.
3. Use the screwdriver to remove the fuse holder. Remove the fuse (fuses) from the holder.



Figure X:1. Fuse holder removed and fuse coverlid open. (230V; 5x20 mm fuse)

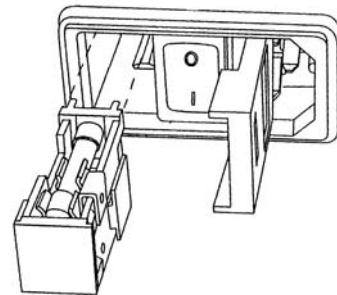


Figure X:2. Fuse holder removed and fuse coverlid open. (115V; 6.3x32 mm fuse)

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### 230V~ instruments

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#### **Check your mains supply:**

1. If your mains supply is 230V~ use a fuse marked T5AL 250 V. The fuse size is 5 x 20 mm, spare part number 90.16.50. Insert the new fuse (fuses) in the fuse holder. The fuses will remain in place by the spring loaded holder.
2. Turn the fuse holder so that the text 230 points to the left and press in the fuse holder in the power module.
3. Close the fuse cover lid firmly so it snaps in position. Check that the text 230V can be seen in the small window, see Figure X:3.
4. Reconnect the apparatus to the mains power.



Figure X:3. Check that the correct voltage can be seen in the small window.

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## 115V~ instruments

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### ***Check your mains supply:***

If your mains supply is 115V~ use a fuse marked T10AL 250V ceramic. The fuse size is 6.3 x 32 mm, spare part number 90.19.00. Insert the new fuse (fuses) in the fuse holder. The fuses must be kept in place by squeezing with your fingers.

Turn the fuse holder so that the text 115 points to the left and press in the fuse holder in the power module.

Close the fuse cover lid firmly so it snaps in position. Check that the text 115V can be seen in the small window, see Figure X:3.

Reconnect the apparatus to the mains power.

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## XI. THE PRINTER

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The FN 1900 is equipped with a thermal printer.

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### Loading paper

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Part number of thermal printer paper is 17.19.18 (5 rolls).

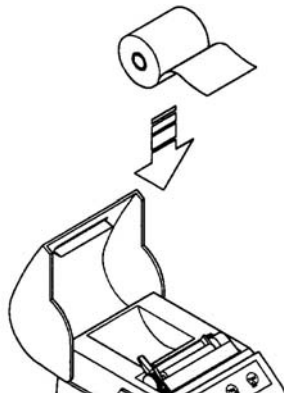


Figure XI:1. Position the paper roll.

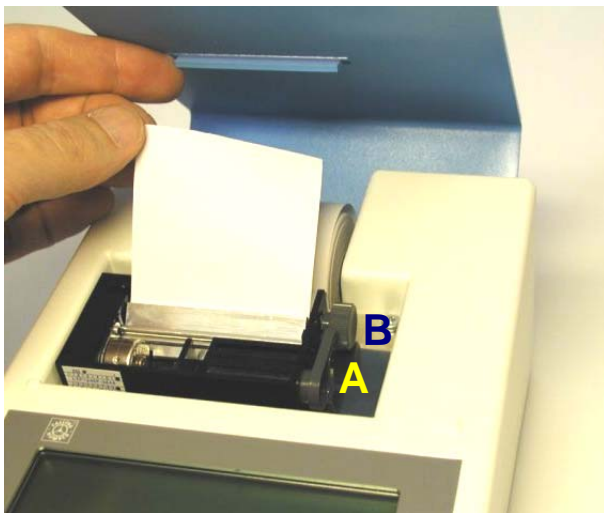


Figure XI:2. Lever (A) to lift the print head. Knob (B) to feed the paper.

1. Open the printer cover and position the paper roll so that it rotates in the direction indicated in figure XI:1.
2. Lift the lever (A) to lift the print head, see figure XI:2.
3. Insert the end of the paper roll in the slit on the print mechanism. To feed the paper turn the grey knob (B) clockwise until paper is fully through the mechanism.
4. Lower the level (A). Insert the paper through the slit in the cover when closing the cover.

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## XII. RS 232

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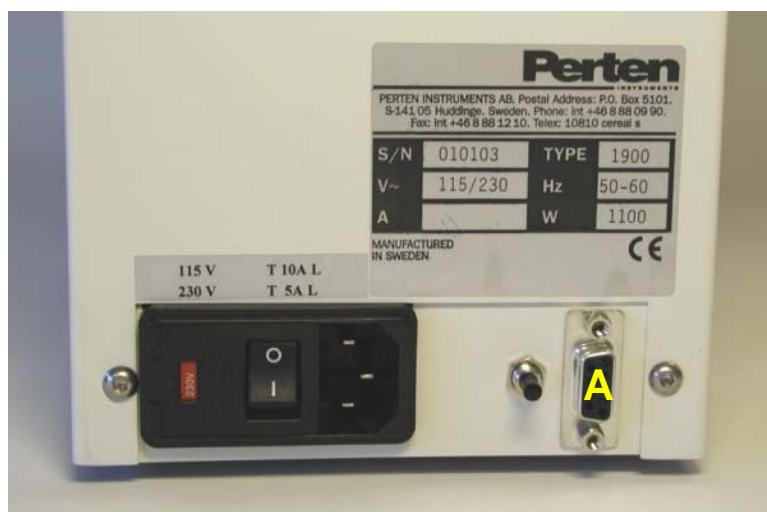


Figure XII:1. RS-232 connection (A) on FN 1900 stirrer unit.

The FN 1900 instrument can be connected to a PC for sending Falling Number results from the instrument to the computer. For detailed information about this function, please contact Perten Instruments or your local distributor.