

User Instructions for the Protimeter Grainmaster 900 and 900E Grain Moisture and Temperature Instruments

CONTENTS

Section

1. Introduction
2. The **Protimeter Grainmaster 900 & 900E**
3. Before you take a moisture measurement
- 3.1 Installing batteries
4. Selecting the desired crop
5. Taking a measurement using the
Protimeter Grainmaster 900 or 900E
6. Crop calibrations and instrument functions
7. The instrument functions explained
- 7.1 Automatic Temperature Correction ON/OFF
- 7.2 Self test
- 7.3 Beep ON/OFF
- 7.4 Temperature °C/°F
- 7.5 Temperature probe
- 7.6 Adjusting calibrations
- 7.7 Cancelling calibration adjustment

Section

8. Additional functions of the **Protimeter Grainmaster 900E**
- 8.1 Setting date & time
- 8.2 Pre-set crop selection keys A,B,C & D
- 8.3 Averaging
- 8.4 Printing
- 8.5 Logging and Printing Results
9. Maintenance
- 9.1 The grinder/compressor
- 9.2 Battery replacement
- 9.3 Storage
- Appendix A** Error codes
- Appendix B** Accessories
- Appendix C** Adding new calibrations
- Service & Warranty

1. INTRODUCTION

Protimeter Plc manufacture an extensive range of instruments for the measurement of moisture in solid materials and gases. Of particular interest to the agricultural industry are the Protimeter range of grain moisture meters. These instruments determine the % moisture content of the crop under test.

Most grain moisture tests are taken during harvest or during drying when grain is not in moisture equilibrium, necessitating the need to grind. Grinding the sample gives a more accurate result, as it tests moisture throughout the grain and not just the skin. Additionally, the results obtained rely on the sample being compressed to a constant pressure which is achieved by Protimeter's innovative combined grinder/compressor.

Protimeter products are built to a high standard of durability and provided the instrument is regularly serviced and stored properly, it will give years of reliable service.

2. THE PROTIMETER GRAINMASTER 900 & 900E

The new generation of Protimeter Grainmaster moisture meters, the 900 series, currently consists of two models, the 900 and 900E.

Both instruments incorporate the new Protimeter grinder/compressor unit. The Protimeter 900E differs from the 900 as follows:-

- The 900E has facilities to perform averaging of readings
- The 900E can print results on an optionally available ticket printer
- The 900E has 4 keys to facilitate quick selection of frequently tested crops

Both instruments are supplied with 10 crop calibrations and with facilities for adjusting these crop calibrations, measuring temperature, two displays and a wipe down dust proof keypad.

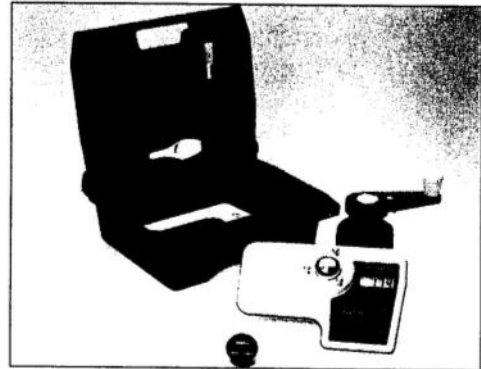
Display 1 (top) shows one of the following values:-

- (a) Moisture %
- (b) Temperature probe reading
- (c) Calibration adjustment (if selected)

Display 2 (bottom) shows sample cell temperature and the selected crop or function.

Grainmaster 900 & 900E are supplied complete with the following

Carrying Case	Brush
Instrument	10ml Scoop
Grinder/Compressor	Grain Cup
Quick Check	Instructions



3. BEFORE YOU TAKE A MOISTURE MEASUREMENT

3.1 INSTALLING BATTERIES

Both the 900 and 900E require 4 x AA batteries in order to operate. We recommend that alkaline batteries are used. The battery compartment is located on the underside of the instrument and the cover is removed by loosening the retaining screw. The orientation of each battery is clearly marked in the battery compartment.

4. SELECTING THE DESIRED CROP CALIBRATION




To activate the instrument press the ON button, display 2 will show the last selected crop and the cell temperature. The instrument will turn off automatically after 4 seconds to save battery life.

- For the 900** To select a different crop calibration or function as shown on display 2
- (a) Press **ON** button
 - (b) Press **V** repeatedly or hold the button to scroll down the menu
 - (c) Press **^** repeatedly or hold the button to scroll up the menu
 - (d) To select the displayed crop type press **ON** or allow the instrument to time out

- and for the 900E**
- (a) Press **ON** button
 - (b) Press **SET V** button
 - (c) Press **SET V** button repeatedly or hold to scroll down the menu
 - (d) Press **Σ ^** button repeatedly or hold to scroll up the menu
 - (e) To select the displayed crop type press **ON** or allow the instrument to time out

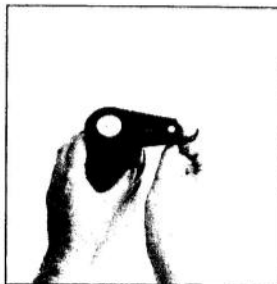
The last selected crop will always appear when the instrument is turned on. Select one of the preset crops and save your selection as previously described. Note new crops may be installed with the aid of an IBM compatible personal computer and purpose designed software. This work may be carried out by you, the user, your local dealer or the Protimeter service centre. See appendix C for further details.

5. TAKING A MEASUREMENT USING THE PROTIMETER GRAINMASTER 900 or 900E

- 5.1 Before attaching the grinder/compressor to the instrument check that the slider is in the compress  position. To do this rotate the handle until the yellow cross lines up with the pips and move the slider (B) to the compress position. (See Photo 1)
- 5.2 Rotate the handle in an anticlockwise direction until you hear the clutch click a few times.
- 5.3 Move the slider to the grind  position. (See Photo 2)
- 5.4 Place the grain cup onto the electrode.
- 5.5 Locate the grinder/compressor onto the 3 lugs surrounding the instrument cell and lock by rotating the grinder/ compressor clockwise.
- 5.6 Using the 10ml scoop provided pour the sample into the hopper. Now rotate the handle clockwise so grinding the sample. (See Photo 3) **CAUTION:** always use the correct amount of sample (10ml).
- 5.7 When the sample is fully ground through, align the yellow cross with the black pips as before and move the slider to the compress  position. (See Photo 4)
- 5.8 Rotate the handle clockwise compressing the sample until the clutch clicks a few times. (See Photo 5)
- 5.9 Press the ON button, check that the correct crop is selected (as described in 4 above). (See Photo 6) Display 1 shows the moisture content as long as the ON button is pressed.
- 5.10 After recording the moisture content rotate the handle anti-clockwise. This releases pressure on the sample and allows easier removal of the grinder/compressor unit from the instrument.
- 5.11 Remove the ground sample by lifting the grain cup off the cell. Clean the instrument and grinder/compressor with the brush provided.
- 5.12 Continue to rotate the handle anti-clockwise until the clutch starts clicking again and move the slider to the grind position ready for the next sample. Ensure all the old sample is cleared from the grinder/compressor.



1



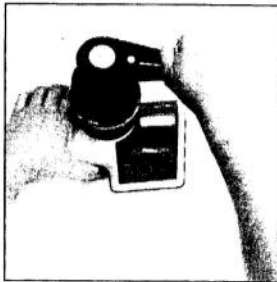
2



3



4



5



6

NOTE: If very wet grain has been used in the grinder you must clean the grinder through using dry grain samples.

WARNING: DO NOT INSERT FINGERS INTO THE GRINDER AREA.

6. CROP CALIBRATIONS AND INSTRUMENT FUNCTIONS

The table shows the sequence in which the various instrument functions (e.g. A.T.C. ON/A.T.C OFF) and crop calibrations are stored. Any one of these functions or calibrations may be selected, as described previously for selecting a crop calibration, using the (V)/(Λ) keys. For 900E press (SET V) then (SET V) or (Λ).

For example, if you wish to turn off the audible beep that sounds when a button is pressed, simply select "Beep OFF" and allow the instrument to time out.

1	Clear Memory		
2	Send memory		
3	Date & Time (900E only)	(Λ)	(V)
4	Self Check		
5	Calibration adjustment OFF		
6	Calibration adjustment ON		
7	Degrees F		
8	Degrees C		
9	Beep OFF		
10	Beep ON		
11	A.T.C. OFF	(Λ)	(V)
12	A.T.C. ON	(Λ)	(V)
13	Temp Probe	(V) or (Λ)	
14	Wheat		
15	Barley		
16	Rape		
17	Oats		
18	Linseed		
19	Beans	(V) or (Λ)	
20	Peas		
21	Rye	(Λ)	(V)
22	Sunflower	(Λ)	(V)
23	Maize		
24	0-100	(V)	

7. THE INSTRUMENT FUNCTIONS EXPLAINED

In the earlier sections of these instructions, guidance was given regarding the key press sequences required to change crop calibrations for the **Protimeter Grainmaster 900** and **900E**. These same key press sequences apply when any of the following instrument functions are to be selected. ie.

- For the 900
- Press (ON) key
 - Press the (V) or (Λ) key to scroll through the menu until the selected function/crop calibration is displayed on the lower display
 - To select the displayed function/crop, press the (ON) key or allow the instrument to time out

- For the 900E
- Press the (ON) key
 - Press the (SET V) key
 - Press the (SET V) key or (Σ Λ) key to scroll through the menu until the selected function/crop calibration is displayed on the lower display
 - To select the displayed function/crop, press the (ON) key or allow the instrument to time out.

7.1 A.T.C. ON and A.T.C. OFF (Automatic Temperature Correction)

Automatic Temperature Correction is a facility that adjusts the instrument calibration to compensate for differences in grain and ambient temperature. Temperature can affect readings greatly. The instrument will give a true reading with A.T.C. OFF at 20°C but the reading will vary as the temperature varies. With A.T.C ON the instrument automatically adjusts the measured reading to compensate for sample temperatures between 0° and 40°C. In almost all circumstances A.T.C. should remain ON, but should the temperature of the instrument and sample vary greatly it is necessary to let the crop temperature settle on the electrodes (do

not keep the ON button pressed, just press occasionally). If the sample temperature takes a long time to stabilise, turn off the A.T.C. and use an independent thermometer (fast response) and correct the reading manually. To correct the reading manually use the following formula, when A.T.C. is OFF.

For every 1°C above 20°C deduct 0.01x the reading shown.

For every 1°C below 20°C add 0.01x the reading shown.

7.2 SELF TEST

The user may use the SELFTEST facility as a means of verifying that the instrument is functioning correctly.

The SELF TEST performs an internal check on the electronics of the instrument. In particular, the memory devices that store the crop calibrations are thoroughly tested to ensure they have not been corrupted or damaged in any way.

Once this memory test is complete, the MEMORY TEST PASS or MEMORY TEST FAIL message is shown on the lower display. In addition to the memory test, the SELF TEST will test the instrument's measurement performance. This is carried out with the use of the QUICK CHECK device as detailed below:-

1. Press the check device onto the cell and turn to ensure a good contact.
2. Select Self Test on the main menu.
3. Press the **(ON)** button and record reading.

The reading should display 36.5 (± 1.0) on the upper display. If the reading is not within these limits please refer to the Protimeter Service Centre.

On the lower display, the cell temperature and the instrument temperature will be displayed alternately. The cell temperature is measured by a temperature sensor embedded within the cell and the instrument temperature is measured by a separate temperature sensor mounted on the main electronic board within the instrument.

To exit the SELF TEST function, press the **(ON)** button or allow the instrument to time out.

7.3 BEEP ON/BEEP OFF

An audible beep will sound when the keyboard buttons are pressed. The beep sound confirms the command is entered. To turn the beep on or off, select the appropriate function (i.e. BEEP ON or BEEP OFF) using the **(V)** / **(A)** keys followed by pressing the **(ON)** button or allowing the instrument to time out.

NOTE: The beep will always sound when a crop calibration that has been adjusted by the user is selected. (See adjusting calibrations).

7.4 DEGREES CELSIUS OR FAHRENHEIT

This function allows the temperatures to be shown in °C or °F. The selected units will apply to both the cell temperature reading shown in the lower display (display 2) and the external temperature probe reading, if connected, shown in the upper display (display 1).

The **(V)** / **(A)** keys are used to select either °C or °F, followed by pressing the **(ON)** button or allowing the instrument to time out.

7.5 TEMPERATURE PROBE

Selecting this function with the **(V)** / **(A)** keys will cause the reading from the external temperature probe to be shown on the display. Should the external temperature probe not be 'connected', the display will show P/N/C to denote Probe Not Connected.

7.6 ADJUSTING CALIBRATIONS USING THE CALIBRATION ON/OFF FUNCTIONS

The calibrations stored within the **Protimeter Grainmaster 900** and **900E** are all based on oven dried references, dried in accordance with different International and British standards. Occasionally, it may be desirable to adjust the crop calibrations, perhaps to align the values measured with the Protimeter Grainmaster 900/900E with those obtained with another instrument. The 900/900E has a calibration adjustment feature that will allow the user to add or subtract an adjustment factor to the measured value. For example, you may wish to add 0.5% to all wheat readings.

A calibration adjustment can range from -1.5 to +1.5%, in steps of 0.1%. Further, each crop type can have different calibration adjustments (e.g. Wheat: +0.5%, Barley: -0.7% etc). To apply a calibration adjustment:-

1. Select the crop to be adjusted, using the **(V)** / **(A)** keys
2. Press **(ON)** key
3. Select calibration **(ON)**, using the **(V)** / **(A)** keys
4. Press the **(ON)** key. (The upper display will now show 0.0, denoting no calibration adjustment)
5. Using the **(V)** / **(A)** keys, the calibration adjustment may be increased/decreased, in 0.1% increments, to a maximum of $\pm 1.5\%$
Should the **(V)** / **(A)** keys be pressed after the range limit has been reached, the calibration adjustment will revert to the 0.0 position.
6. Once the desired adjustment has been selected, press the **(ON)** button to store this value.

When an adjustment has been made to a crop, with subsequent use of the instrument, display 1 will show the value of the adjustment factor for 2 seconds when the **(ON)** key is pressed. An asterisk will also appear alongside the crop name in the lower display and the "BEEP" will sound to warn that the calibration has been adjusted.

NOTE: The "BEEP" will always sound when the **(ON)** key is pressed in association with an adjusted calibration irrespective of whether "BEEP ON" / "BEEP OFF" has been selected previously.

7.7 CANCELLING ADJUSTED CALIBRATIONS - CALIBRATION ADJUST OFF

The "Calibration adjustment off" function is a quick way of cancelling previously stored adjustment factors as follows:-

1. Select the adjusted crop calibration using the **(V) / (Λ)** keys.
2. Press the **(ON)** key.
3. Select the "Calibration adjustment off" function using the **(V) / (Λ)** keys.
4. Press the **(ON)** key.
5. Repeat for different crops.

8.0 ADDITIONAL FUNCTIONS OF THE PROTIMETER GRAINMASTER 400E

8.1 SETTING THE DATE & TIME

Within the 400E is an electronic clock. This clock is used to record date and time information when a sample is taken and shown on a ticket printed via the optional ticket printer. To adjust the date & time:-

1. Select the date and time function using the SET **(V) / (Λ)** keys.
2. Press the **(E / >)** key. (Print) The lower display, display 2, will show the current date and time in the following format:-

DD/MM/YY HH:MM:SS

A flashing cursor (**_**) will appear below the first date figure.

Subsequent pressing of the **(E / >)** key will move the cursor to the right. Pressing the **(E / >)** key when the cursor

is below the last time character (seconds) will cause the cursor to reposition at the start; immediately below the first date figure.

3. Once the cursor is positioned at the appropriate point, the value of the number displayed is increased/decreased using the **(V) / (Λ)** keys.
4. Press the **(E / >)** key to start the corrected value and position the cursor to the next figure.
5. Press **(ON)** to store the new date and exit this function.

8.2 PRESET CROP SELECTION KEYS A,B,C AND D

For added ease of use, the "A", "B", "C" and "D" buttons may be used to quickly change from one crop calibration to another without having to scroll through the main menu of crop calibrations and instrument functions.

At the factory the buttons are set to the following crop calibration:-

A Wheat B Barley C Oilseed Rape D Temperature Probe

Should the above factory set calibrations not be ideally suited to the crops you wish to measure, the settings may be adjusted as follows:-

1. Select the crop type you wish to allocate to one of the buttons (A, B, C, and D) using the **(V) / (Λ)** keys.
2. Press the desired PRESET KEY, "A" or "B", or "C" or "D".
3. Press the **(ON)** key or allow the instrument to time out.
4. Repeat the above steps 1 to 3 for the remaining PRESET keys as required.

8.3 AVERAGING RESULTS

By pressing the **(Σ)** key the instrument will calculate the average of up to 9 previous measurements in that selected crop.


As measurements are taken, the number of measurements are counted and the corresponding values stored in the memory. This "average count" is displayed in the lower display in front of the cell temperature value. Pressing the **(Σ)** key will cause the average of the preceding measurements, (a maximum of 9 results) to be displayed on the upper display. The count will then be reset to 0 in readiness for carrying out the averaging of subsequent samples.

NOTE 1: Measured values that are over/under range will be ignored for averaging purposes.

NOTE 2: Should more than 9 readings have been taken before the Σ key is pressed, the average value will be that of the last 9 measurements.

NOTE 3: Changing the crop calibration selection will cause the "average count" to 0 and previously stored measurements deleted.

8.4 THE PRINT FUNCTION

With the optionally available printer connected, a record of measured values may be printed simply by pressing the  key.



The print out will show the following information:-

PROTIMETER PLC.	
CAL. 6 JUNE 94	
09/06/94	10:41
MAIZE	
SAMPLE NO.	000185
TEMPERATURE	23.7 C
MOISTURE	10.8 %

PROTIMETER PLC.		
CAL. 6 JUNE 94		
10/06/94	09:33	
WHEAT		
SAMPLE NO.	000009	
AVERAGE OF	9 SAMPLES	
TEMPERATURE	23.7 C	
ATC OFF		
MOISTURE	10.8 %	
CAL. ADJUSTMENT	-0.3	

8.5 LOGGING AND PRINTING RESULTS

As well as printing out individual sample records the instrument will also store up to 50 records that can be down loaded for example at the end of the day. Once the instruments memory has 50 results it automatically removes the first record from the memory so that the printer down load contains the last 50 sample records. It is possible to clear the memory. The instrument will then store and print out only the records entered after the memory was cleared.

1. Select the SEND MEMORY function using the SET ∇ / \wedge keys.
2. The lower display will show SEND MEMORY 45 (the number 45 shown corresponds with number of sample records stored at that time).
3. Press the  (Print) to send the data to the printer.
4. The display now shows CLEAR MEMORY.
5. Press the  (Print) key to clear memory press, ON or time out instrument to continue adding records.

9. MAINTENANCE

9.1 THE GRINDER/COMPRESSOR

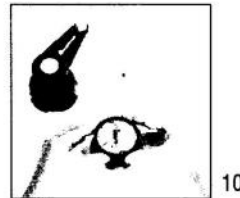
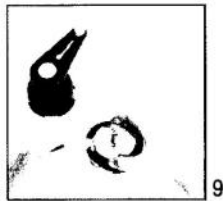
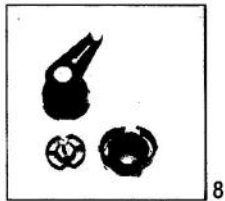
It may be necessary to clean out the grinder/compressor or change the blade. Before starting, select compress and turn handle anti-clockwise until the clutch clicks. The sequence of operation is shown below:-

1. Turn the yellow locking ring and pull the unit apart as shown in figures 1 to 4 below.
2. Open the two blade retaining wings so that they just clear the blade and lift out the blade. See figure 5 & 6.
3. Clean the area around the blade and cutters thoroughly. See fig. 7.



4. Insert the blade, matching up the locating pip and groove. See fig. 9.
5. Close the blade retaining wings (fig. 10) and replace the top half of the grinder/compressor making sure that you line up the square head with the insert. (fig. 11) Rotate the body until the locating lugs line up and press together. (fig. 12 & 13)
Replace locking ring. (See fig. 14 & 15)

IMPORTANT: For correct operation it is very important to keep compressor shaft thread clean and lubricated regularly (every 60 samples) with gear oil.



9.2 BATTERY REPLACEMENT

Should the battery power become low the display will show LOW BATTERY. To replace the AA batteries remove the screw and cover from the rear of the instrument and insert replacements.

NOTE: Use alkaline batteries for better performance. Rechargeable batteries should not be used in this instrument.

9.3 STORAGE

Clean the instrument thoroughly and remove the batteries before storing over winter in a dry environment at room temperature.

APPENDIX A ERROR CODES

Should the instrument read an over or under range reading an error code will appear on Display 2.

Display	Meaning
M/C ^	Moisture content over range.
M/C v	Moisture content under range.
C/T ^	Cell temperature over range.
C/T v	Cell temperature under range.

Display	Meaning
P/T ^	Probe temperature over range.
P/T v	Probe temperature under range.
P/N/C	Probe not connected.
Memory Test Fail	

APPENDIX B

ACCESSORIES

TEMPERATURE PROBE 900 & 900E

A temperature probe can be connected via the 3.5mm jack socket. The probe is extendible up to 4 metres and is ideal for monitoring temperature in grain bins and on floor stores.

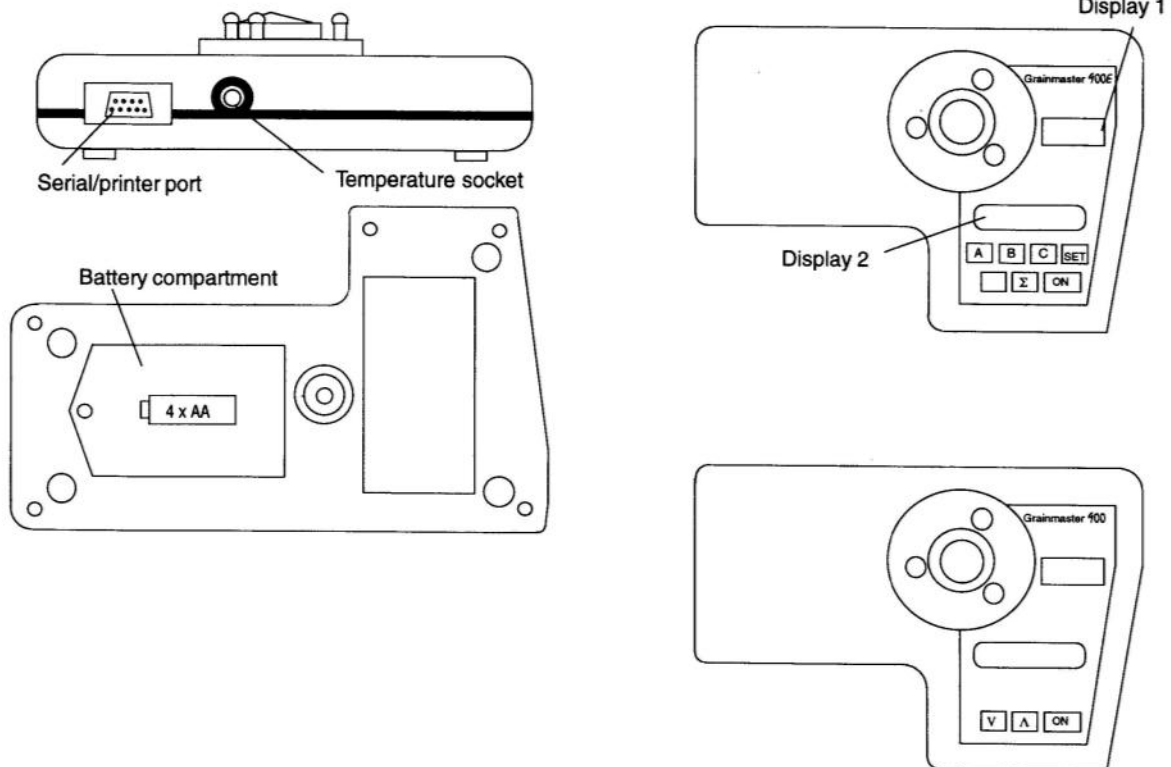
Printer (900E only)

A serial printer or IBM compatible PC, can be connected via the 9-pin (RS 232) connector. The settings for the printer are as follows:

1200 Baud rate
8 Data bit
1 Stop bit
No parity
DSR/DTR hand shake

APPENDIX C ADDING NEW CALIBRATIONS TO THE PROTIMETER 900/900E

Protimeter Plc will be able to supply software enabling customers to update existing calibrations. This software is entirely self explanatory and will run off most IBM compatible personal computers.



Disclaimer:

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