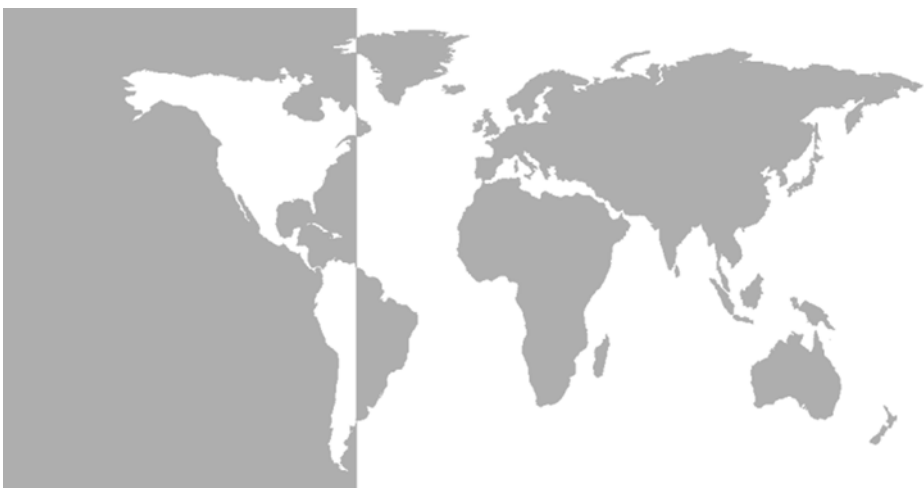
GE
Sensing

Grainmaster i®

Protimeter Grain Moisture Meter



Instruction Manual

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Introduction

The ***GE Protimeter Grainmaster i*** (integrated) is a versatile moisture meter for measuring moisture and temperature levels in crops. It is used with a grinder compressor unit to measure small samples of grain during harvesting and drying. Also, it can be used with optional probes for monitoring the temperature and moisture levels of stored grain and the moisture levels of baled hay and straw.

1 Product Features

The ***Grainmaster i*** is a hand-held instrument powered by one 6F22R 9V battery located in a compartment on its underside. It incorporates a grain cell with retaining lugs for the grinder-compressor unit, a liquid crystal display (**LCD**) and four buttons for selecting the operational modes and taking measurements. There is a socket on the left-hand side of the instrument for optional probes (see section 3 for details). The instrument is supplied with the following auxiliary items (see photo):

- Grinder-Compressor Unit
- Grain Cup
- Sample Spoon (10 ml)
- Cleaning Brush
- Quick Check
- Pouch
- Instructions

1.1 Display and Buttons

The ⏻ button is pressed to switch the instrument **ON** and to take moisture measurement readings. The instrument has two primary modes of operation, selected by pressing the ▶ button. In internal measurement mode, the instrument is used in combination with the grinder compressor unit to measure a small sample of grain in the grain cell. The ∧ and ∨ buttons are then used to select the required crop calibration and to switch from moisture to temperature displays. The instrument is used in external measurement mode when using optional moisture/temperature probes.

1.2 Crop Calibrations and Functions

Sixteen calibrations are pre-programmed into the ***Grainmaster i*** (see in Table 1 below):

Table 1: Pre-Programmed Calibrations of Grains

Wheat	Canola	Coffee	Rice
Oats	Linseed	Soya (soybean)	Sorghum
OSR (oilseed rape)	Sunflower	Beans	Paddy
Barley	Corn (maize)	Peas	0-100 relative

Note: *Not all calibrations are for Ground samples. Also, some of the pre-programmed calibrations are not available with the optional external Moisture and Temperature Probe (see Section 3.1.)*

Before measuring moisture and temperature of ground and compressed samples, as detailed in Section 2 below, do the following:

1. Enter the Setup Mode from the switched **OFF** state by pressing ▶ while switching **ON** using ⏻.
2. Switch temperature display from **°C** to **°F**.
3. Switch automatic temperature correction (**ATC**) **ON** or **OFF**. However, GE Protimeter recommend that **ATC** is always activated when measure moisture levels in crops. When **ATC** is **OFF**, the **°C** to **°F** icon, as applicable, is flashed as a warning while moisture measurements are displayed.

2 Measuring Moisture and Temperature of Ground and Compressed Samples

To take moisture and temperature measurements of 10 ml samples of crops, complete the following steps:

1. Ensure that no external probe is connected. Switch **ON** in internal measurement mode by pressing and releasing ⏻. If it is in the correct mode, the display will show H_2O in the top left-hand corner, three horizontal lines and the previously selected crop. If the display shows **BALEPROBE or PROBE** (instrument is in external measurement mode) or if a number is displayed, press ▶ to switch to internal measurement mode and to cancel the reading.
2. Scroll to the required crop calibration (or 0-100 relative scale) by pressing ∧ or ∨.
3. Be sure the grain cell of the instrument is clean. If it is dirty, clean it with the brush.
4. Place the grain cup (the matt aluminium ring) over the grain cell.

5. Ensure that the grinder-compressor unit is clean and is operating smoothly. If not, disassemble and clean as detailed in section 5.1.

6. Prior to placing the grinder-compressor unit on the instrument, ensure that the plunger is fully retracted within its housing. The plunger is retracted fully by sliding the switch on the underside of the rotating handle forward into the compress position (picture) and rotating handle anti-clockwise until the clutch clicks a few times. The sliding switch can only be pushed or pulled into position when the black pips on the top of the rotating handle are aligned with the yellow X.

7. Pull the switch on the underside of the rotating handle to the grind position and place the grinder-compressor unit over the grain cup. Lock the unit in place by twisting it clockwise against the three lugs.

8. Always use the correct sample size of 10 ml. Using the 10 ml spoon provided, pour a sample into the hopper on the side of the grinder-compressor unit.

9. Hold the ***Grainmaster i*** against a flat and horizontal surface and rotate the handle clockwise to grind the sample and push it through into the grain cup. If necessary, check to see the entire sample has passed through the grinder blade by turning the handle anti-clockwise a quarter turn and looking into the hopper.

10. Align the pips and the yellow X of the rotating handle and push the sliding switch forward into the compress position. Turn the handle clockwise to screw the plunger onto the ground sample that is now in the grain cup. Correct compression is reached when the clutch clicks a few times.

11. Press and hold ⏻ to display the moisture content of the sample. When the reading has stabilized, release ⏻ to freeze the **%H_2O** value for approximately 7 seconds. Note and record this value as required.

12. If necessary, display the temperature of the sample by pressing the ∧ or ∨ *only* after releasing ⏻. Note and record this value as required.

13. Having noted the moisture (and/or temperature) reading, turn the handle anti-clockwise until the clutch clicks (to fully retract the plunger!). Remove the grain cup and the tested sample and clean the grain cell with the brush prior to commencing another test.

2.1 Adjusting the Pre-Programmed Calibrations

If required, each of the 15 pre-programmed crop calibrations (i.e. all except the 0-100 scale) can be adjusted individually by ±1.5% to allow for subtle changes that can be caused by crop variety, growing conditions or geographical region. Pragmatic users may choose to adjust their meter to match the results obtained from a local instrument used commercially.

Note: *Whenever a user adjustment is active, the* **!** *symbol flashes in the bottom right corner of the display.*

To adjust calibrations, complete the following steps:

1. Select required crop and measure the moisture content of a sample as outlined in section 2.0.

2. While holding the ⏻ button to display the **%H_2O** value, press ∧ to increase the calibration or ∨ to decrease the calibration in increments of 0.1. An **!** flashes in the bottom right corner of the display to indicate that a calibration has been adjusted by the user.

3. Remove a calibration adjustment by pressing ▶ while pressing ⏻. The **!** will disappear from the bottom right corner of the display.

Note: *The adjustments are separate for each crop and are stored in the instrument's non – volatile memory until cleared in step 3 above or in* Section 4 (Setup Mode)*. No adjustment is provided for temperature readings.*

3 Optional External Moisture and Temperature Probes

A range of external moisture and temperature probes are available for use with the ***Grainmaster i***. The external probes connect to the instrument via the edge connector socket on the left-hand side of the instrument, this is protected by a blanking grommet when not in use.

3.1 Using the Optional Moisture and Temperature Probe No. GRN3005

Nine calibrations for the external Moisture and Temperature probe are pre-programmed into the ***Grainmaster i*** as shown Table 2 below:

Table 2: Optional Moisture and Temperature Probe Calibrations

Wheat	Canola	Oats
OSR (oilseed rape)	Beans	Barley
Linseed	Peas	0-100 relative

Note: *The optional probe can be used with the* ***Grainmaster i*** *for checking the moisture and temperature levels of stored grain. This probe is used to monitor the condition of stored grain quickly; it is not a substitute for moisture measurements taken from ground samples as detailed in section 2.0. Ground sample measurements are more reliable than moisture probe measurements.*

Note: *Be sure that the instrument's internal grain cell should be empty while using the external moisture probe. Avoid contact with the centre pad of the cell while using the grainprobe.*

Use the optional external moisture and temperature probe as follows:

1. Remove the protective cap from the tip of the *Moisture and Temperature Probe*.
2. Push the probe into the grain and, initially, allow a few minutes for temperature to stabilize. Connect the probe to the instrument as described above.
3. Press and release ⏻ to switch **ON**, confirm that the instrument senses external moisture probe flagged by display showing '**PROBE**' – if not, press ▶ once to do so.
4. As with the internal grain cell, if the crop shown is not the required one, then press ∧ or ∨ to select it; note that some crops are not available with the external moisture probe.
5. Press and hold ⏻ to display either the temperature or moisture level. Release ⏻ and press ∧ or ∨ to switch from moisture to temperature displays as required. ▶ will toggle back to the internal grain cell.

Note: *The user adjustments may be made in the same manner as for the internal grain cell, these are stored separately from the later.*

The spiral wound electrodes (that make the moisture measurement) should be wiped clean with a cloth at regular intervals to prevent the accumulation of dust that may attract moisture and give an erroneous reading. A temperature sensor is mounted in the tip of the probe. This is easily damaged if the probe tip is rammed against hard surfaces. Always replace the protective cap when the *Moisture and Temperature Probe* is not in use.

3.2 Using the Optional Temperature Probe (Part No. GRN6046)

Note: *An Optional Temperature Probe No. GRN6046 can be used with the* ***Grainmaster i*** *for checking the temperature of stored grain.*

Use the optional temperature probe as follows:

1. Push the probe into the grain and, initially, allow a few minutes for temperature to stabilize. Connect the probe to the instrument as described above.

2. Press and release ⏻ to switch **ON**, confirm that the instrument senses external moisture probe flagged by display showing '**PROBE**' – if not, press ▶ once to do so.

3. Press and hold ⏻ to display the temperature of the grain. Note that ∧ and ∨ have no effect in this mode; ▶ will toggle back to the internal grain cell.

Note: *There is no user adjustment to the temperature reading.*

3.3 Using the Optional Bale Probes (Part Nos. GRN6138 and GRN6138-S)

Note: *An optional* Bale Probe *can be used with the* ***Grainmaster i*** *for checking the moisture level of bales of hay and straw.*

The *Bale Probe* is available in two lengths:

- 1400 mm (part no GRN6138)
- 700 mm (part no GRN6138-S)

Use the optional bale probe as follows:

1. Push the *Bale Probe* into the bale. Connect the probe to the instrument as described above.

Note: *Be sure that the instrument's internal grain cell should be empty while using the bale probe. Avoid contact with the centre pad of the cell.*

2. Press and release ⏻ to switch **ON**, then confirm that instrument senses the bale probe as flagged by the display showing '**BALEPROBE**' – if not, press ▶ once to do so.

Note: *No crop selection is possible in Baleprobe mode.*

4 Setup Mode

The setup mode is entered from the switched – **OFF** state by pressing ▶ while switching **ON** using ⏻. This action displays the firmware version of the instrument (example 1.00) until all buttons are released. The product part number (example Grn3000) then scrolls across the display from right to left followed by the firmware date in **yy-mm-dd** format (example **00-06-16**) and then the first set up code, **0=0**.

The user then has the option of restoring the factory settings (**°C, ATC ON**, all user crop adjustments cleared) or simply changing the default setting for the temperature display (**°C or °F**) or of enabling/ disabling the automatic temperature correction.

The buttons have the following effects:

- ⏻ Exit setup mode without any further changes.
- ▶ Save any changes and advance to next option
- ∧ or ∨ Modify the value for the selected option.

Table 3: Setup Mode Options

Display	Description
0=0	No action
0=1	Resets all user settings to the default settings (**°C, ATC ON**). Also resets all user crop adjustments to zero.
1=0	Selects **°C** for temperature display (accompanied by °**C** on display)
1=1	Selects **°F** for temperature display (accompanied by **°F** on display)
2=0	Activates automatic temperature correction (**!** in corner cleared)
2=1	Deactivates temperature correction (**!** displays)

Example: To change temperature the display from **°C** to **°F** and switch **OFF ATC**:

1. Press and hold ▶, briefly press ⏻, release both buttons.
2. Wait until **0=0** is displayed, press ▶ to display **1=0**, **°C**
3. Press ∧ to change display to **1=1**, **°F** (Temperatures now in **°F**)
4. Press ▶ to save this change and display **2=0**

5. Press ∧ to change display to **2=1**, **!** (**ATC** is now deactivated.)
6. Press ▶to save this change and display **0=0**
7. Press ⏻ to exit.

Note: *It is recommended that the* **ATC** *is only be deactivated when using the '***Quickcheck'** *to verify the calibration of the instrument (see section 6.0). Whenever* **ATC** *is* **OFF** *the* **°C** *or* **°F** *icon (as appropriate) is flashed as a warning while moisture measurements are displayed.*

5 Care and Maintenance

When not in use, store the ***Grainmaster i*** in a stable, dust-free environment and out of direct sunlight. Remove the battery from the instrument if it is to be stored for periods of more than four weeks, or when the low battery power symbol appears on the display. Check the condition of accessories used with the instrument on a regular basis and replace them if they become worn or damaged.

5.1 Grinder-Compressor

The Grinder-Compressor unit should be cleaned and lubricated at regular intervals, especially when testing wet or oily crops that tend to clog the thread of the plunger spindle. Follow the maintenance procedure as detailed in the following steps:

1. Disengage the two halves of the Grinder-Compressor unit by twisting the yellow locking ring counterclockwise and pulling apart.
2. Open the blade retaining wings and lift out the plunger and blade assembly.
3. Separate the blade from the plunger assembly and remove the yellow feeder ring from inside the top half of the Grinder-Compressor unit.
4. Clean the blade, feeder ring and both halves of the Grinder-Compressor unit with the brush.
5. Clean the thread of the plunger unit and ensure it spins freely. Lubricate with a light oil.
6. Replace the feeder ring in the top half of the Grinder-Compressor unit.
7. Put the blade on the plunger assembly and reposition this unit in the bottom half of the Grinder-Compressor unit. Clamp in place by closing the retaining wings.
8. Slide the two halves of the Grinder-Compressor together, ensuring the location lugs and plunger spindle are correctly aligned.
9. Replace the yellow locking ring.

6 Calibration Check

The ***Grainmaster i*** is supplied with a '**Quickcheck**' device for verifying the instrument calibrations are correct with respect to factory settings. The procedure is detailed in the following steps:

1. Ensure that no external probe is connected and that internal grain cell is clean and dry.
2. Deactivate **ATC** as detailed in section 4.0.
3. Select the 0 – 100 relative scale as detailed in section 2.0.
4. Place the Quickcheck over the grain cell and hold in position to ensure contact with the concentric electrodes.
5. Press and hold ⏻. The instrument should display 36.5 ±1.0. If the reading is not within these limits, the instrument should be returned to Protimeter for servicing.
6. **Reactivate ATC** as detailed in section 4.0 before continuing to use the instrument.

7 Information Codes

The instrument displays a range of codes that represent various conditions as detailed in Table 4 below:

Table 4: Codes Interpretation

Code	Interpretation
- - -	Standby mode. When showing, use ∧ or ∨ to select required crop or leave 7 seconds to switch **OFF** automatically.
u - r	Under measurement range. The crop sample is too dry to register a value or temperature is too low / faulty.
o - r	Over measurement range. The crop sample is too wet to register a value.
°C or **°F**	(flashing) automatic crop calibration is deactivated.
!	(flashing) Crop calibration has been adjusted. See section 2.1 for details.
[!]	Low battery power. Change the battery.

Note: *If other error codes appear on the display, the instrument should be returned to the* ***GE Sensing*** *service department.*

8 Specifications

Weight of instrument c/w Grinder-Compressor unit: 1kg

Dimensions of instrument c/w Grinder-Compressor unit:

195 mm length x 185 mm height x 100 mm width

Power: x1 6F22R 9V battery

LCD resolution: **0.1**

Operating temperature range: **0 °C** to **40 °C**

%H_2O *measurement range:* See Table 5 below.

Table 5: %H_2O Measurement Range

Wheat: 11.3 to 29.3	Canola: 7.0 to 26.0	Coffee: 9.8 to 23.9	Rice: 13.2 to 26.5
Oats: 10.9 to 29.3	Linseed: 7.0 to 16.5	Soya: 7.4 to 22.2	Sorghum: 10.2 to 26.9
OSR: 7.0 to 26.0	Sunflower: 6.2 to 23.0	Beans: 12.4 to 25.0	Paddy: 10.4 to 26.2
Barley: 10.9 to 29.3	Corn: 10.4 to 26.2	Peas: 12.0 to 30.9	0-100 relative

Note: *Not all calibrations are for Ground samples.*

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