GE
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Protimeter MMS
Moisture Measurement System

Instruction Manual

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Instruction Manual
INS5800A
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Introduction

The *Protimeter Moisture Measurement System* (Protimeter MMS), is a powerful and versatile instrument for measuring and diagnosing dampness in buildings and building materials. This product enables building surveyors and other practitioners to measure moisture levels of building elements such as walls, floors and building environments simply by switching between the three different modes of operation. In this way, a detailed understanding of the moisture condition of the property can be obtained.

1 Product Features

The Protimeter MMS kit comprises a carry case containing the MMS instrument and a range of standard accessories, as detailed in Table 1 below. As an example, the figure on the next page shows a BLD5800 kit.

Table 1: Protimeter MMS Kit

Description	Part Number
Standard Kit	BLD5800
Kit with Hygrostick/Data cable/software	BLD5800LH
Kit with Humistick/Data cable/software	BLD5800HS
Kit Components	
Protimeter MMS instrument	POL5800JC
Instruction manual	INS5800
Carry case	POU5800-01
Moisture probe	BLD5060
Deep Wall Probes (5.5 in. (140 mm) long)	BLD5018
Surface temperature sensor (direct contact)	BLD5804
Calibration check device (for %WME)	BLD5086
Hygrostick/Humistick extension lead	BLD5802
Hygrostick hygrometer probe	POL4750
Humistick moisture probe	POL7750-2
Data cable and software (option)	BLD5810

**BLD5800 Kit**

The Protimeter MMS instrument is a battery-powered, handheld unit that has a cluster of four buttons and a large liquid crystal display (LCD). A sensor for detecting moisture within solid materials is housed in the bulge at the top of the instrument. The following external connections are found on the instrument case (*see the figure on the next page*):

- *EC 1* - This edge connection socket is for use with a *Hygrostick* or *Humistick* probe.

- *JC* - This jack connection socket is for use with a moisture probe, deep wall probes or a hammer electrode.

- *EC 2* - This edge connection socket is for use with the *Direct Contact Surface Temperature Sensor* and for connection to a PC when using the optional MMS logging software.

EC 1

EC 2

JC

Search Mode Sensor
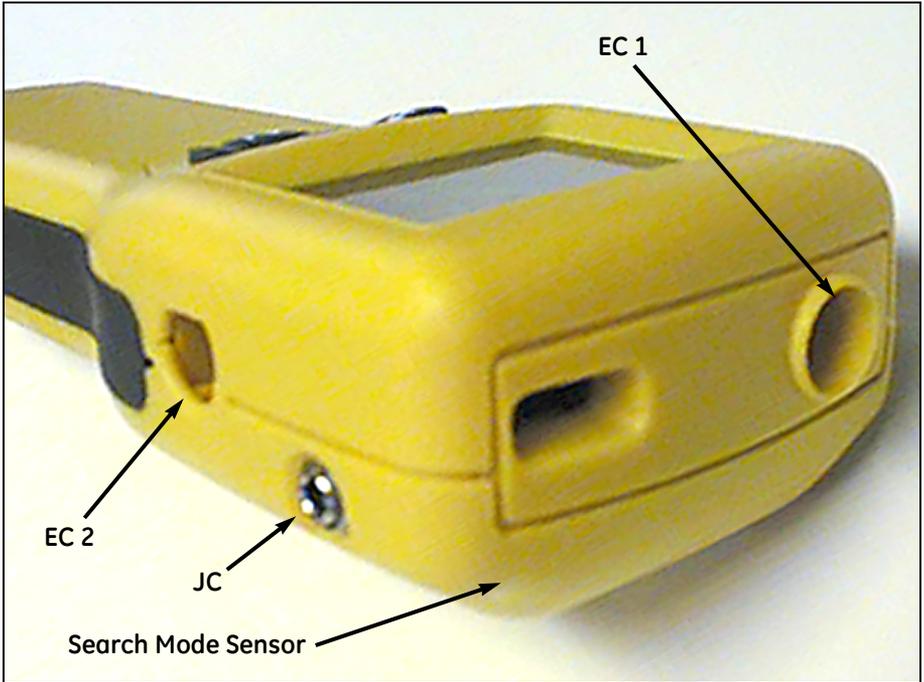
The following probes and sensors are included in the standard Protimeter MMS kits:

- The *Hygrostick*® (POL4750) and *Humistick*® (POL7750-2) probes measure relative humidity (%RH) and ambient air temperature (T_{AIR}) in rooms or materials. They can be connected to the Protimeter MMS instrument either directly or by means of the Hygrostick/Humistick extension lead.

- The *surface temperature sensor* (T_S) is used when investigating condensation situations.

- The *moisture probe* is used to obtain percent moisture content values in wood or wood moisture equivalent (WME) values in other non-conductive materials.

- *Deep wall probes* are used to obtain WME values deep below the surface in solid structures such as walls and floors.

1.1 Switching the MMS ON and OFF

Prior to initial use, ensure that two **AA** batteries are correctly inserted in the battery compartment.

Note: *Low battery power is indicated by* ▮▮ *on the display; when this symbol appears, replace the batteries.*

Switch the MMS **ON** by pressing $\binom{|}{\ }$ momentarily.

The MMS switches **OFF** automatically after 1 minute, unless the default setup is changed (see section 2.5 for instructions). To switch the instrument **OFF** immediately, press $\binom{|}{\ }$ and hold for at least 3 seconds. Once $\binom{|}{\ }$ has been depressed for 3 seconds or more, all text blocks appear on the display; when $\binom{|}{\ }$ is released, the text blocks disappear and the unit switches **OFF**.

1.2 Optional Accessories

A range of optional accessories may be used with the Protimeter MMS. These include:

- hammer electrodes

- data download software & cable

- additional Hygrosticks and Humisticks

For more information please contact GE Sensing.

2 Moisture Meter Modes

The Protimeter MMS can be used to detect and measure moisture in non-conductive solid materials such as wood, drywall and masonry. Two modes of operation are available, the *Search Mode* for qualitative measurements and the *Measure Mode* for precise and localized moisture content measurements in wood or WME values in materials other than wood.

2.1   Search Mode - Selection and Use

Turn the MMS **ON** by pressing $(\mid)$. Select the moisture meter mode by pressing ▶▶ repeatedly until the word **MOISTURE** is visible in the top right corner of the LCD. Then press ▶ to select the **Search** mode, indicated by **REL •)))** on the LCD.

The instrument can now be used to take relative moisture readings in solid, homogenous materials (such as walls and floors) by holding the leading edge of the sensor bulge against the surface (see the figure below) at an angle ranging from 20° to 50°. Relative readings ranging from 0-1000 appear on the LCD together with a progress bar that indicates whether the material is in a **DRY**, **AT RISK** or **WET** condition.

As reliable readings are obtained only if the leading edge of the sensor bulge is in direct contact with the surface, the *Search* mode is not suitable for surveying textured finishes. The nominal depth of penetration is up to 0.6 in. (15 mm) in dense, homogeneous materials. Readings taken through low-density coverings (carpets, polystyrene tiles, etc.) will not be representative of the moisture level in the substrate itself. When using the MMS in *Search* mode, it is recommended that no attachments (i.e. Hygrostick probe, Humistick probe, Surface Temperature Sensor, or Moisture probe) are connected. This practice will minimize reading errors and the potential for electromagnetic interference with other electronic equipment.

2.1.1   Search Mode - Zeroing Function

If that instrument is used in *Search Mode* at an ambient temperature that is significantly different from the ambient temperature at the time of the original calibration, the instrument may show a small, non-zero reading when held in free air.

If this should occur, re-zero the instrument as follows:

1. Remove any attached accessories and select *Moisture Search Mode* (see section 2.1 for instructions). **MOISTURE & REL** is displayed.

2. With one hand, hold the instrument at least 12 in. (0.3 m) from all objects (see the figure to the right).

3. With your other hand, simultaneously press the ▶▶ and ▶ buttons. Hold them down until the display shows **nul**, then **Air**. Quickly release the buttons and continue to hold the instrument as shown, well clear of your body and your other hand. Keep the instrument in free air (i.e. at least 12 in. (0.3 m) from all objects) while the display is showing **Air**.

4. After about 10 seconds, the display should return to normal and the instrument should read zero when held in free air.

You may now take normal *Search Mode* readings with the MMS.

2.1.1.1 Troubleshooting the Zeroing Function - The instrument changes mode when zeroing Is attempted

If the instrument changes mode when you attempt to zero it, you have most likely not pressed the two buttons at exactly the same time. Return to *Search Mode* and attempt to press and hold the two buttons simultaneously.

2.1.1.2 Troubleshooting the Zeroing Function - The instrument shows Air, but then displays Err or E30 and shuts OFF

If this situation occurs, repeat the zeroing procedure. If this does not solve the problem, it is likely that the temperature adjustment is outside the permitted range. If possible, allow the unit to return to normal room temperature (about 20°C/68°F). If the unit will not re-zero at this temperature, the unit is likely faulty and requires repair/service.

2.2   Measure Mode - Selection and Use

Turn the MMS **ON** by pressing (power icon). Select the moisture meter mode by pressing ▶▶ repeatedly until the word **MOISTURE** is visible in the top right corner of the LCD. Then press ▶ to select the **Measure** mode, indicated by **%WME**▱ on the LCD. Connect the *Moisture Probe*, *Deep Wall Probe*, or *Hammer Electrode* into socket **JC** of the MMS instrument.

The instrument can now be used to take actual %MC readings in wood and %WME readings in non-conductive solid materials other than wood by pushing the moisture probe pins into the surface (see the figure to the right).

The measured value is displayed and the progress bar indicates whether the material is in a **DRY**, **AT RISK** or **WET** condition, as listed in Table 2 below.

Table 2: Measure Mode Readings

%MC (wood only) or %WME	MMS Measure Mode Display
<8%	– – – % (denotes out of range), [inactive progress bar]
≥8% but <17%	%MC or %WME value, **DRY**, [active progress bar]
≥17% but <20%	%MC or %WME value, **AT RISK**, [active progress bar]
≥20% but <28%	%MC or %WME value, **WET**, [active progress bar]
≥28% to 100%	Relative value only, [active progress bar]

2.2.1 Using Auxiliary Moisture Probes in Measure Mode

To take sub-surface readings in masonry, the *Deep Wall Probes* should be used instead of the standard *Moisture Probe*. To use the deep wall probes, drill two 1/4" (6 mm) diameter clearance holes, spaced 2-3 in. (50-75 mm) apart, to the required depth (see figure at right). Push the two Deep Wall Probes into the holes and press and hold the tips firmly against the bottom of the holes. Ensure that the probes are connected to socket **JC** and measure the **%WME** value as described in section 2.2.

Note: *The most convenient way to take sub-surface readings in wood is by using an optional* Hammer Electrode*.*

2.2.2 Detecting Hygroscopic Salts

The Protimeter MMS instrument can be used as a basic salts detector when used with the *Moisture Probe*, filter papers and distilled water (not included). Moisten the filter paper with the water and take a reference reading across it with the Moisture Probe. Then place the moistened filter paper against the surface of interest and hold in place for 30 seconds. Remove the paper and place the pins of the Moisture Probe across the paper again and observe the reading. Compare this reading with the original reference reading. If the difference is more than 20 points, there is significant salts contamination that may warrant further investigation.

2.3 Hygrometer Mode - Selection and Use

To use the Protimeter MMS as a hygrometer, connect the *Hygrostick* or *Humistick* probe into socket **EC1** either directly or indirectly with the extension lead. Turn the MMS **ON** by pressing $(^{|})$. Then, select the *hygrometer mode* by pressing ▶▶ repeatedly until the word **HYGROMETER** is visible in the top left corner of the LCD. Then press ▶ to select *relative humidity* (%rh), *ambient temperature* (T_{AIR}), *dew point temperature* (T_{DEW}), or *specific humidity* (g.Lb or AbS) as required. Temperature values can be displayed in °C or °F (see section 2.5 for instructions).

Note: *The Mixing Ratio (AbS) or Specific Humidity (g.Lb) displays are preceded by a momentary beep to draw attention to the unit of measure prior to displaying the value.*

%rh and **T**ᴀɪʀ measurements are made with the *Hygrostick* or *Humistick* sensor, and the MMS instrument uses these values to calculate **T**ᴅᴇᴡ. When using the MMS to measure the conditions in air, the humidity probe is normally connected directly to the instrument. However, when it is impractical or awkward to use the instrument in this way, the extension lead may be used to connect the Hygrostick or Humistick to the instrument. Typically, the extension lead will be used when taking readings from probes that have been embedded in structures such as walls and floors.

2.4 Condensator Mode - Selection and Use

The *Condensator Mode* enables the user to assess the risk of condensation occurring on surfaces or to confirm whether or not condensation is present on a surface.

To use the MMS as a Condensator, connect a Hygrostick probe directly into socket **EC1** and connect the surface temperature sensor into socket **EC2**. Turn the MMS **ON** by pressing ⏻. Select the condensator mode by pressing ►► repeatedly until the word **CONDENSATOR** is visible at the top of the LCD. Then press ► to select *relative humidity* (%rh), *ambient temperature* (Tᴀɪʀ), *dew point temperature* (Tᴅᴇᴡ), *surface temperature* (Tꜱ) or *temperature difference* (Tᴅɪꜰꜰ) as required. Tꜱ and Tᴅɪꜰꜰ measurements can only be obtained if a

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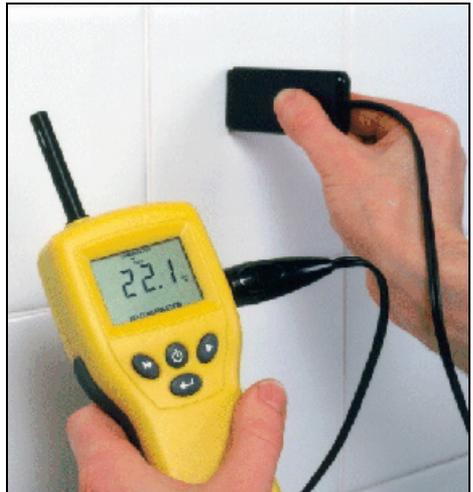
Surface Temperature Sensor is connected to the instrument and held against the surface of interest. Temperature values can be displayed in °C or °F (see section 2.5 for instructions).

T$_{\text{DIFF}}$ is a useful function when investigating condensation, as it tells the user how many degrees a surface is above or below the prevailing dew point temperature. When a surface exceeds the dew point by more than 3°C, T$_{\text{DIFF}}$ is displayed with the message **NO CONDENSATION**. When a surface exceeds the dew point by 3°C or less, T$_{\text{DIFF}}$ is displayed with the message **AT RISK, NO CONDENSATION**. When the surface temperature is equal to or lower than the dew point, a negative T$_{\text{DIFF}}$ is displayed with the message **CONDENSATION**. The *progress bar* is activated when T$_{\text{DIFF}}$ is less than 14°C above the dew point. The indicator moves from left to right to signify the increasing risk and degree of condensation. Table 3 below summarizes this functionality.

Table 3: Condensator Mode Readings

Temperature of Surface	MMS Condensator Mode Display
>14°C above dew point	T$_{\text{DIFF}}$, NO CONDENSTATION, [inactive progress bar]
≤14°C but >3°C above dew point	T$_{\text{DIFF}}$, NO CONDENSTATION, [active progress bar]
≤3°C above dew point	T$_{\text{DIFF}}$, AT RISK, NO CONDENSTATION, [active progress bar]
≤ dew point	T$_{\text{DIFF}}$, CONDENSTATION, [active progress bar]

2.4.1 Sensor Installation

All humidity probes must be plugged into socket **EC1** in the top ("nose") of the instrument. This includes:

- **POL4750**   Hygrostick (30-100% RH)

- **POL7750-2** Humistick (1-100% RH)

The only accessories that should be plugged into socket EC2 on the side of the instrument are:

- **BLD5804**   Surface Temperature Probe

- •   MMS-to-PC Data Logging Cable

Note: *With older instruments, the* Low RH Sensor (0-40% RH) **BLD5812** *was plugged into socket* **EC2** *on the side of the instrument.*

2.5   Setup Mode - Selection and Use

The Protimeter MMS instrument has a range of features that can be selected by the user (see Table 4 on the next page).

To enter the *Setup Mode*, switch the instrument **ON** and disconnect any attachments that may be connected. When the display shows three horizontal dashes (**- - -**), press (ᶦ) momentarily; the word **SETUP** then appears in the bottom left corner of the LCD together with the code **S 1** in the middle of the display. Within three seconds, press ►► repeatedly to scroll through the setup codes as detailed in Table 4 on the next page. Press ► to set the desired setup option.

Table 4: Setup Options

Setup Code	Setup Selection
S 1	Displays temperature values in °C
S 2	Displays temperature values in °F
S 3	Activates LCD backlight
S 4	Deactivates LCD backlight
S 5	Activates beeper
S 6	Deactivates beeper
DEF	Default settings (°C, activated backlight, activated beeper, 1 min. auto switch off)
0.00	Real-time clock (adjustable only through IrdA comm port with Protimeter software)
T 1	Auto switch off adjustment, from 1-6 minutes

Example 1: To deactivate the backlight and change the temperature readings from °C to °F:

- Enter *Setup Mode* by pressing ( ) momentarily.

- When the display shows **- - -** , scroll to **S 4** by pressing ▶▶.

- Press ▶ to select the *deactivated backlight* option.

- Scroll to **S 2** by pressing ▶▶.

- Press ▶ to select the *°F* display option.

- Press ( ) momentarily (or wait for three seconds) to return to *Operating Mode*.

The instrument now displays temperatures in °F with no backlighting.

Example 2: To change the auto switch off time from the default 1 minute to 5 minutes:

- Enter *Setup Mode* by pressing ( ) momentarily.

- When the display shows **- - -** , scroll to **T 1** by pressing ▶▶.

- Press ▶ four times to display **T 5**.

- Press ( ) momentarily (or wait for three seconds) to return to *Operating Mode*.

The instrument now switches **OFF** automatically after 5 minutes.

2.6 Holding and Measurement Storage Mode - Selection and Use

Moisture, temperature and RH readings can be held by pressing and holding
$(^{|})$. If the button is held down for less than three seconds, the instrument
reverts to the previously selected mode of measurement. If the button is held
down for more than three seconds, the instrument switches off when the
button is released (see section 1.1).

Readings can be stored in the MMS memory (minimum of 300 line entries)
by pressing ↵. Table 5 below details the information that is stored when using
this function in the various modes. Contents of the memory can be
downloaded to a PC running Microsoft$^{®}$ Windows 95 or later, and can be
uploaded to the MMS with the Protimeter MMS Logging Software.

Note: *For further information see the MMS Logging Help document*
(INS5800L) *supplied with the Protimeter Logging Software CD.*

Table 5: Logging Information

Mode	Display	Information Logged
MOISTURE Meter	**REL •)))**	yr/mm/dd, hr:min, relative value (e.g. 00/01/07, 09:30, 530)
	%WME	yr/mm/dd, hr:min, %WME value (e.g. 00/01/07, 09:30, 12.5)
HYGROMETER	%rh	yr/mm/dd, hr:min, %rh, T_{AIR}, Hygrostick SN (e.g. 00/01/07, 09:30, 52.5, 21.2, 123456)
	T_{AIR}	yr/mm/dd, hr:min, T_{AIR}, Hygrostick SN (e.g. 00/01/07, 09:30, 21.2, 123456)
	T_{DEW}	yr/mm/dd, hr:min, T_{AIR}, T_{DEW}, Hygrostick SN (e.g. 00/01/07, 09:30, 21.2, 10.5, 123456)
CONDENSATOR	%rh	yr/mm/dd, hr:min, %rh, T_{AIR}, Hygrostick SN (e.g. 00/01/07, 09:30, 52.5, 21.2, 123456)
	T_{AIR}	yr/mm/dd, hr:min, T_{AIR}, Hygrostick SN (e.g. 00/01/07, 09:30, 21.2, 123456)
	T_{DEW}	yr/mm/dd, hr:min, T_{AIR}, T_{DEW}, Hygrostick SN (e.g. 00/01/07, 09:30, 21.2, 10.5, 123456)
	T_S	yr/mm/dd, hr:min, T_S (e.g. 00/01/07, 09:30, 18.6)
	T_{DIFF}	yr/mm/dd, hr:min, T_{DIFF}, T_{AIR}, T_{DEW}, Hygrostick SN (e.g. 00/01/07, 09:30, 8.1, 21.2, 10.5, 123456)

3 Diagnostic Procedure Guidelines

When diagnosing dampness in buildings, there are three key criteria that must be considered. These are outlined in Table 6 below.

Table 6: Diagnostic Criteria

Item	Criteria	Notes
1	Is a wall or other building element in a safe air-dry condition?	Air-dry is the moisture content that is normal and safe (from moisture-related deterioration or decay) in buildings. When the Protimeter MMS moisture meter modes are selected, measured values are identified as **DRY**, **AT RISK** or **WET**.
2	Is the surface temperature of a wall or other building element above or below the dew point?	Dew point is the temperature at which a given quantity of air becomes saturated (100% RH) and forms dew, or condensation. If a surface is colder than the dew point, condensation occurs. When the Protimeter MMS Condensator Mode is selected to measure T_{DIFF} (the proximity of a surface to the dew point) the instrument identifies either a **NO CONDENSATION** condition, an **AT RISK** condition, or a **CONDENSATION** occurring condition.
3	Is a wall surface or other building element contaminated with hygroscopic salts or other conductive material?	Artificially high moisture meter readings may be obtained either in material that has been heavily contaminated by hygroscopic salts or in materials that are conductive by nature. The presence or absence of nitrates and chlorides should be established when investigating suspected rising dampness situations in particular.

Item 1: The *Search* and *Measure* modes should be used in combination to map out the extent of a moisture problem and to distinguish between surface and sub-surface moisture. The profile of readings obtained will give insight into the potential cause (e.g. condensation, lateral ingress or rising dampness) of a moisture-related problem.

Far greater insight will be obtained from moisture readings taken in a methodical manner than from those taken in a random manner. When testing walls, the user should start by taking readings at the lower levels and move up the wall in regular steps of 4-6 in. (10-15 cm).

When high sub-surface relative readings are obtained in the *Search* mode, the user is strongly recommended to quantify these values in **%WME** terms by using the *Deep Wall Probes* in the *Measure* mode. If the depth of clearance holes is increased incrementally by a nominal 0.4 in. (10 mm) at a time, the moisture profile through the wall can be established.

Item 2: Condensation related moisture problems are common. When assessing the risk of condensation, or confirming its existence, the proximity of the actual temperature of the surface under investigation to the dew point must be established. The T_{DIFF} measurement in **CONDENSATOR** mode tells the user how many degrees the temperature of a surface is above or below the dew point.

As many condensation situations are transient, T_{DIFF} readings should be taken in a methodical and regular manner, similar to moisture meter readings in materials. Ambient RH and temperature values should also be taken to assess the moisture condition of the room as a whole. Dwellings and working environments generally have an RH from 40% to 60%, so there may be cause to investigate environments that register RH values outside this range.

Item 3: Two hygroscopic salts, chlorides and nitrates, may build up on the surface of walls where rising dampness or wicking occurs. As groundwater moves through the wall and migrates to the surface, salts tend to accumulate where the rate of evaporation of this water is greatest. The salts themselves are non-conductive, but when mixed with a small amount of moisture a highly conductive solution is formed. The presence (or absence) of such salts should therefore be established when rising dampness is suspected by using the Protimeter MMS in *Measure* mode as described. When required, the Protimeter *Salts Analysis Kit* (part number **BLD4900**) can be used to identify the relative concentrations of nitrates and chlorides.

In summary, effective dampness diagnosis is a process that draws on the knowledge and expertise of the surveyor. The Protimeter MMS kit enables the user to investigate moisture levels in materials and environments from various perspectives that, in turn, permits a more thorough and reliable judgement as to the cause of dampness related problems.

4   Calibration Checking

Check the Moisture meter *Measure Mode* by holding the pins of the *Moisture Probe* across the exposed wires of the calibration check device (**Calcheck**). The **WME** value of correctly calibrated instruments is **17-19**. Instruments that register values outside this range should be returned to GE Sensing (or an official GE Sensing distributor) for servicing.

Note: Search *mode can be checked against a stable area of wall. For comparative purposes, humidity and ambient temperature conditions should be stable and consistent.*

Working *Hygrostick* and *Humistick* probes can be checked against reference probes and/or over standard salt solutions.

5   Care and Maintenance

The Protimeter MMS is a precision-built electronic instrument that will provide many years of reliable service if the following points are observed:

- When not in use, keep the MMS instrument and its accessories in the factory *Carry Case*. Store the case in a stable, dust-free environment and keep it out of direct sunlight.

- If the instrument is to be stored for more than four weeks or if the *low battery power* symbol appears on the display, remove the batteries from the instrument.

- When using the MMS in *Search* mode, do not slide the bulge across surfaces, as this may lead to rapid instrument case wear. The instrument should be lifted and placed in position to prevent such wear.

- Check the condition of the MMS accessories on a regular basis, and replace them if they become worn or damaged.

- To preserve their calibration characteristics, *Hygrostick* probes should not be exposed to saturated environments. If this is unavoidable, Hygrostick probes should be replaced on a regular basis and their calibration should be checked frequently.

6 Technical Specifications

Weights and Dimensions

Protimeter MMS Kit (BLD5800): 2.5 lb (1.1 kg),
9 in. x 7.5 in. x 3.5 in. (230 mm x 190 mm x 90 mm)

Protimeter MMS Instrument (POL5800JC): 10.58 oz (300 g),
7 in. x 2.75 in. x 1.9 in. (180 mm x 70 mm x 49 mm)

Hygrostick Probe (POL4750): 2 in. long x 0.3 in. (50 mm long x 8 mm),
optimal clearance hole 12 mm dia. (when used with compression sleeve
to measure ERH in solid material)

Humistick Probe (POL7750-2): 2.5 in. long x 0.5 in. (65 mm long x 12 mm)

Power

2 x AA batteries

Measurement Ranges

Moisture Meter
Search Mode:	0-1000 relative scale, nominal depth of measurement 0.6 in. (15 mm), tolerance ±10 relative scale
Measure Mode:	8-29 %WME, 30-100 relative scale in saturated material

Hygrostick Probe
Measurement Range:	30-100 %rh, 32 to 122°F (-10 to 50°C)
Tolerance (nominal):	30-40 %rh, ±3 %rh @68°F (20°C)
	41-98 %rh, ±2 %rh @68°F (20°C)
	32 to 122°F (-10 to 50°C), ±0.6°F (±0.3°C)

Humistick Probe
Measurement Range:	0-100 %rh, 32 to 122°F (-10 to 50°C)
Tolerance (nominal):	0-10 %rh, ±3 %rh @68-86°F (20-30°C)
	10-90 %rh, ±2 %rh @68-86°F (20-30°C)
	90-100 %rh, ±3 %rh @68-86°F (20-30°C)
	32 to 122°F (-10 to 50°C), ±0.6°F (±0.3°C)

Surface Temperature Sensor: 32 to 122°F (-10 to 50°C), ±0.6°F (±0.3°C)

7 Displaying the MMS Information

By pressing ↵ while switching **ON** using (⏻), the following information is displayed in sequence on the screen:

Information	Example
Firmware Version	2.02
Instrument Part Number	BLD5800
%rh Calibration Curve	d2-5
Firmware Date	yy-mm-dd
Hygrostick Serial No. (when connected)	123456

A1 Using the Protimeter MMS to Measure Moisture in Floors

A1.1 Rapid Moisture Level Assessment of Solid Floors

Note: *See section 2.1 for basic* Search Mode *instructions.*

In *Search Mode*, the Protimeter MMS can be used to assess the moisture level of solid concrete floor slabs in relative terms and to identify areas of concern that may warrant a more detailed investigation.

Having selected the *Search Mode*, hold the bulge of the instrument against the floor slab and note the value on the LCD. Slabs that register a value of 200 or less are generally considered to be in a safe air-dry condition. If values of more than 200 are recorded, we recommend that the actual moisture level of the slab be quantified by alternative test procedures prior to laying decorative floor coverings.

A1.2   Equilibrium Relative Humidity Measurements in Solid Floors

Note: *See section 2.3 for basic* Hygrometer Mode *instructions.*

In *Hygrometer Mode*, the Protimeter MMS can be used to measure the equilibrium relative humidity (ERH) value of solid floor slabs. In essence, this procedure measures the relative humidity (%rh) of a pocket of air that is deemed to be in moisture equilibrium with the material under investigation. Slabs that have an ERH value of 75% or lower are considered to be in a safe air-dry condition. Slabs that have an ERH value of 80% or greater are generally considered to be in a damp condition. Please refer to local standards such as ASTM F2170 (USA) and BS8203:1996 (UK).

Note: *These tests must be performed with the* Hygrostick *sensor only.*

IMPORTANT: *Moisture sensitive coverings that are laid onto damp floors may fail in service.*

A1.2.1   Sub-Surface ERH Test Procedure (without using Protimeter Humidity Sleeves)

To perform the sub-surface ERH test, complete the following steps:

1. Drill 1/2" (12 mm) diameter clearance holes to a nominal depth of 2" (50 mm) at the required points of measurement (**POM**s) and remove all debris from the hole. Plug or cover the holes with suitable impervious material. Ideally, the holes should be drilled 24 hours before measurements are to be taken.

2. Push the Hygrostick assembly into the pre-drilled hole and twist firmly to seal (see figure at right). Ideally, leave the Hygrostick in the hole for 60 minutes before taking a reading.

3. Use the extension lead (supplied in the MMS kit) to connect the Hygrostick to the MMS instrument (having previously removed the protective yellow Hygrostick cap, if fitted).

4. Select the *Hygrometer Mode* of operation (as detailed in section 2.3).

5. Measure the **%rh** in the hole. This is the **ERH** value of the floor slab.
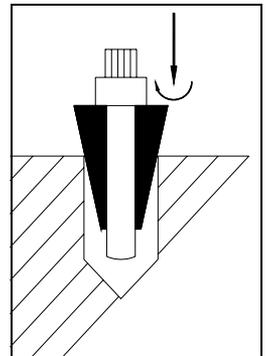
A1.2.2   Sub-Surface ERH Test Procedure (using Protimeter Humidity Sleeves)

Protimeter *Humidity Sleeves* are convenient optional accessories for use with Protimeter *Hygrosticks*. Clearance holes are drilled at the required POMs and the Humidity Sleeves are inserted. As each Humidity Sleeve has its own sealing cap, it is not necessary to plug or cover the drilled holes. Having placed the Humidity Sleeves in the floor slab (ideally, 24 hours before ERH measurements are to be taken), remove the cap and follow the procedure starting with step 2 in the previous section. Please refer to local standards such as ASTM F2170 (USA) for specific requirements.

A1.2.3   Sub-Surface ERH Test Procedure (using Protimeter Surface Humidity Box)

If it is impractical or undesirable to take sub-surface ERH readings (the best technique for determining the actual moisture condition of the slab) the *Hygrostick* can be used in combination with a *Humidity Box* placed on the surface. Typically, *Humidity Boxes* are used on floors with embedded heating pipes or when a contractor is working to standards, such as BS 8203:1996 (UK), that specify surface ERH techniques.

A Protimeter *Humidity Box* (Part No. **BLD4711**) is available as an optional accessory. It should be used in accordance with applicable standard recommendations, or it should be placed at the POM for at least 24-hours prior to taking ERH readings.

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