DIGITAL MOISTURE METER
MODEL: DMM B18

INNOVATIVE INSTRUMENTS

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1. INTRODUCTION

1.1 Principle:

DMM B18 digital moisture meter works on the radio-frequency (RF) dielectric method. This method measures moisture content in sample by sensing the dielectric constant of the sample. The dielectric constant is a measure of a material's ability to store electrical charge when placed in an electric field. Because of its molecular structure, water has a very high dielectric constant (approximately 80) compared to other grain constituents (2 to 3). The RF dielectric method is influenced significantly by grain kernel structure and composition, moisture distribution within kernels and grain temperature, necessitating individual calibration equations for different grain types.

1.2 Calibration method:

DMM B18 digital moisture meter is calibrated using a standard process. This calibration process consists of determining individual calibration equation by establishing a co-relation between the measured dielectric constant of the sample and the standard reference method. The standard reference methods used are Oven Drying Method and Toluene method (Dean-Stark) as applicable for the sample. The calibration equation compensates the temperature variation of the sample too.

I. The Oven Drying Method: References for the standard methods used:

- ISO 712: 1998 : Cereal and cereal products :Determination of moisture content - Routine reference method

- IS 4333(part 2) : 2002 (Reaffirmed in 2012) : Method of analysis for food grains, Determination of moisture content
  Method: The sample is ground after pre conditioning. It is dried in a preheated oven at a temperature of 130 ^{0}C+/- 3 ^{0}C for 2-3 hrs till constant weight of the sample is achieved.

- ISO 6540 : Maize-Determination of moisture content in milled grains and whole grains
  Method: The sample is ground after pre conditioning. It is dried in a preheated oven at a temperature of 130 ^{0}C+/- 3 ^{0}C for 4 hrs till constant weight of the sample is achieved.

- ISO 665: 2002 - Determination of moisture and volatile matter for oilseeds

- IS 3579-1966 (Reaffirmed in 2000): Method of test for Oilseeds.
  Method: The sample is ground after pre conditioning. It is dried in a preheated oven at a temperature of 103 ^{0}C+/- 2 ^{0}C for 6-7 hrs till constant weight of the sample is achieved.

II. Distillation Method (The Dean and Stark) : References for the standard methods used:

- ISO 939-2021: Spices and condiments- Determination of moisture content
  Method: A known weight of sample is placed in a flask with an organic solvent toluene which is insoluble with water and has higher boiling point and less density than water. This flask is attached to a condenser and the mixture is heated. The water in the sample evaporates and moves up into the condenser where it is cooled and converted back into liquid water, which then trickles into the graduated tube. When no more water is collected in the graduated tube (this process takes around 1 hr), distillation is stopped and the volume of water is read from the tube. This water is directly proportional to the moisture content in the sample.

2. MODELS

I. **DMM B18 (SMALL)** Digital Moisture Meter is widely used by the producers, suppliers and traders for measuring moisture content of various small size food products such as Cereals, Pulses, Dals, Oilseeds, Spices, Vegetable Seeds, DOC's & Cakes, Flours And Powders, Dehydrated Products, Dry Fruits, Medicinal seeds and other miscellaneous products

II. **DMM B18 (BIG)** Digital Moisture Meter is widely used by the producers, suppliers and traders for measuring moisture content of various bigger size food products such as Papad Pipe/ Fryums, Dry Ginger, Nutmeg, Cashew Kernel, Raw Cashew , Chikori Cubes, Chikori Grains, Bagasse, Black Pepper, Groundnut Pods, Betel Nut/ Sopari, SoyaVadi, Dhupa Seed, Almond, Long Pepper etc.

3. FEATURES

- Auto start to 00.0% moisture in all commodities.
- Auto senses empty meter and displays "Pour".
- Indication for selected commodity.
- Direct easy to read display in %.
- Auto switch off after 10 minutes of no operation.
- Automatic Internal Temperature Compensation.
- Non-destructive testing.
- Easy to use: Pour and get result.
- Repeatable and accurate results.
- Compact in size, light in weight and portable to carry.
- Rugged construction for field use.
- **Optional advanced features:**
  Printing, Recording and Email Sharing of measured moisture data through Windows computer software or Bluetooth connectivity mobile application.

4. TECHNICAL SPECIFICATIONS

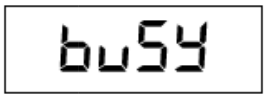
Table 4.1

Specification	DMM B18 (SMALL)	DMM B18 (BIG)
Moisture display :	XX.X % (3 digit display)	
Moisture range :	3% to 35%	
Resolution :	0.1%	
Accuracy :	+/- 0.5%	
Power source :	1.5V AA pencil cells x 4 qty	
Sampling rate :	60 samples per hour	
Power consumption:	0.04 Watts	
Construction:	Moulded from high impact resistant ABS plastic	
Switch :	Tactile switch	
Display :	Custom LCD display	
Dimensions (Approx.)	92H x 145W x 110D mm	180H x 190W x 225D mm
Weight (Approx.) :	600 grams	1 kg
Commodity Sample Size :	Full volume or 30 to 150 gram as specified for commodity	100 grams to 1 kg as specified for commodity

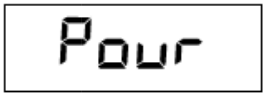
5. OPERATING PROCEDURE

i. Place meter on a wooden table. Ensure no object is near the meter and no sample is in the cavity.

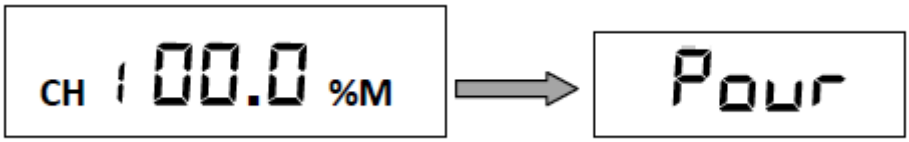
ii. Press **ON/OFF** switch. **"Busy"** will blink for few seconds. Do not touch the meter while "**busy**" is blinking.



iii. Wait till **"Pour"** is displayed.



iv. Once "**Pour**" is displayed, press **CHANNEL 1** switch to see that meter displays **"CH 1 00.0 %M"** when meter is empty. After few seconds meter will automatically display "**Pour**" if no sample is dropped in meter.

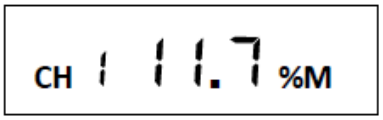


v. Take the indicated weight or volume of the sample to be tested. Fill hopper with the sample. Weigh accurately as mentioned. For **"FULL"** or **"WEIGHT NOT MENTIONED",** fill the hopper fully.

vi. Place the sample filled hopper on meter and drop down the sample in meter cavity **by pressing the lever.**

vii. **Remove the empty hopper** and keep aside.

viii. Press the appropriate channel switch to start the moisture measurement. "**Busy**" will blink for few seconds then moisture will be displayed. **DO NOT SHAKE OR TOUCH THE METER WHILE "busy" IS BLINKING ON DISPLAY**



Where "CH 1" indicates channel/switch no., "11.7" is the moisture %.

ix. Once meter is emptied, "**Pour**" will be displayed after few seconds. Machine is intelligent enough to sense that the sample is taken out and now the cavity is empty. Once meter is displaying "**Pour**", next sample can be measured. Repeat from step 3.

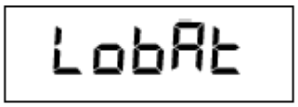
x. The meter gets automatically switched **OFF** after 10 minutes if not in use. Or press **ON/OFF** to switch off the machine.

*** Operating Procedure for moisture measurement in Cotton Seed, Rui, Kapas:**

- Follow steps i to iv as mentioned above.
- Weigh the sample as indicated on the meter and fill with hand in the meter cavity.
- Gently press the sample with hand until the sample is compressed into the meter cavity.
- Follow steps viii to x as mentioned above.

6. PROCEDURE TO REPLACE BATTERIES

- If "LobAt" appears on the display on pressing any switch, then there is a need for replacement of batteries.



- The battery compartment is located at the bottom of the meter. Pop up the flap to remove the battery. Insert 4 nos. of fresh battery **(1.5V, AA pencil cell)** with proper polarity.

7. SAMPLE PREPARATION AND HANDLING

This is most important to get the best representative results. The sample taken should be well mixed and its condition should be typical of the total batch. If a sample is to be held for a short time before being tested for moisture content, this should be placed into a tightly closed (air-tight) container such as plastic bag or jar. A sample stored in this manner will not lose or gain moisture. The temperature of air and sample, relative humidity of air and the moisture content of the sample will all work together to determine whether the sample loses or gains moisture. A high moisture sample spread out to air can gain or lose 1% to 2% moisture in only few minutes.

Cold samples when brought into warm atmosphere will condense moisture out of air and cause erroneous readings. Such samples should be sealed in air-tight container before being brought back to warm atmosphere and allowed to warm to room temperature before testing. Similar care should be taken for heated samples also.

Sample with water added externally will show higher moisture than the actual, when tested immediately after adding the water to the sample. Such sample with water added, should be shaken periodically and should be kept at low temperature in a sealed jar for at least 24 hrs. This will ensure the uniform moisture penetration in the sample and then it can be tested in the meter. In any case, free water deposition on sample grain surface should not be entertained for measurement using this meter.

8. WARRANTY

Digital Moisture Meter is guaranteed free from defect in material and workmanship for a period of **1 year** from the date of purchase. This does not cover the battery or damage caused by misuse or negligence or a Digital Moisture Meter repaired or altered by any unauthorised agents. Written authorisation from the factory is necessary before any moisture meter can be returned under the terms of this warranty.

In the event that service is required and authorisation has been obtained, pack the unit carefully and return to factory with transportation prepaid. If the Digital Moisture Meter is returned within the warranty period, this will be sent back to the customer after repair, free of charge. However, component replacement shall be charged. After the warranty period your Digital Moisture Meter will be repaired at the cost of the materials, labour and shipping.

9. MOISTURE GUIDELINES IN DIFFERENT COMMODITIES

Table 9.1 DMM B18 SMALL:

Commodity	Average natural moisture (%)	Commodity	Average natural moisture (%)	Commodity	Average natural moisture (%)
CEREALS					
Wheat	10.0	Paddy	11.0	Maize	11.0
Bajra/ Millet	10.0	Jowar/ Sorghum	10.0	Boiled Broken rice	13.0
Barley	10.0	Boiled rice	12.0	Ragi	10.0
Hulled Barley	9.0	Basmati rice	12.0	Maize Grit	11.0
Broken Rice	12.0	Raw Rice	12.0	Big paddy	11.0
Small paddy	11.0				
PULSES					
Moong	9.0	Tur	10.0	Cowpeas	10.0
Chana	9.0	Masoor	10.0	Tivda/ Khesari	10.0
Kabuli chana	10.5	Moth	9.0	Vaal	10.0
Batri	10.0	Rajama	13.0	Peas	9.5
Urad	10.0				
DALS					
Tur dal	9.0	Moong dal	9.0	Urad dal Chilka	11.0
Chana dal	9.0	Moth dal	9.5	Kabuli chana dal	10.0
Masoor dal	9.5	Moong dal chilka	10.0	Tivda dal	9.0
Urad dal	9.5	Peas dal	9.5	Cowpeas dal	10.0
OILSEEDS					
Groundnut	5.0	Mustard	6.5	Rui	7.0
Groundnut HPS	5.0	Kardi/ Saflower)	7.0	Cottonseed	7.0
Til	3.5	Neemseed	6.0	Kapas	7.0
Sunflower	6.0	Toria	6.5	Karanja	6.0
Nijjar	6.5	Hulled Til	3.5	Jetropha	5.5
Lin seed	6.0	Soyabean	7.0	Castor	4.5
Mahuva	7.0				
SPICES					
Cumin/ Jeera	7.0	Blackpepper	9.5	Fennel /Variyali	6.0
Dhania/Coriander	8.0	Cloves	7.0	Cardamom/Elaichi	9.5
Fenugreek/ Methi	8.0	Celery/ Ajwain	7.5	Long pepper	10.0
Cardamom seed	9.0				
VEGETABLE SEEDS					
Bhindi/ Okara	9.0	Chilli Seed	9.0	Carrot	9.0
Ash Gourd/ Galka	8.0	Bitter Gourd/ Karela	9.0	Cucumber	8.0
Ridge Gourd/ Turia	8.0	Sponge Gourd	8.0	Bottle Gourd/ Lauki	8.0
Tomato	9.0	Radish	9.0	Snake Gourd	8.0
Muskmelon	8.0	Pumpkin	8.0	Cabbage	10.0
Spinach	10.0	Onion Seed	10.0	Watermelon	8.0
Potato	8.0	Brinjal	9.0		

DOC'S & CAKES					
Soya Doc	10.0	Sunflower Doc	9.5	Mustard Doc	8.5
Poultry Feed	11.5	DORB	9.0	Mustard Cake	8.5
Castor Doc	7.0	Groundnut Doc	9.5	Til Doc	6.0
Cottonseed Cake	9.0	Cattle Feed	10.0	Lin Seed Doc	8.0
Rice Bran/ Rice Polish	9.0				
FLOURS & POWDERS					
Atta	10.0	Soji/ Rava	12.0	Maida	13.5
Besan (Peas)	9.0	Besan (Chana)	9.0	Besan (Chickpeas)	9.0
Bhusi Small	10.0	Bhusi Big	12.0		
DEHYDRATED PRODUCTS					
Garlic Buds	8.5	Garlic Powder	8.0	Coconut Powder	2.0
Onion Flakes	6.5	Onion Powder	5.0		
DRY FRUITS					
Cashew Kernel	3.5	Almond	5.0	Raisin	11.0
Pista	3.5	Walnut	6.5		
MEDICINAL					
Gloriasa Superba/ Herbal Seed	10.0	Isabgol	8.0	Isabgol Husk	10.0
Paracetamol Powder	8.0				
MISCELLANEOUS					
Puvad/ Cassia seed	7.5	Guvar Gum	11.0	Guvar	10.0
Fava Seed	10.0	Puvad Dal	8.7	Guvar Churi	10.5
Chia seed	6.0	DDGS	11.0	Quinoa Seed	12.0
Coffee Beans	9.0	Cocoa Beans	9.0	Jute Seed	9.0
Noni Seed	10.0	Lotus Seed	10.0	Rajgaro	9.5
Neem Fruit	8.0	Neem Cake	9.5		

Table 9.2 DMM B18 BIG:

PapadPipe/Fryums	6.5	Dry Ginger	8.0	Dhupa Seed	10.0
Cashew Kernel	3.5	Raw Cashew	5.0	Nutmeg	10.0
Chikori Grains	8.0	Bagasse	5.0	Chikori Cubes	8.0
Groundnut Pods	5.0	Betel Nut/ Sopari	10.0	Black Pepper	9.5
Long Pepper	10.0	Almond	5.0	Soya vadi	8.5
Dry Ginger Pieces	10.0				