



DMC500 Digital Moisture Meter

ÍNDEX

B	
Block Diagram	12
C	
Caution during Moisture Measurement	11
Conventions	4
D	
Description	7
E	
Extreme Conditions	11
G	
DMC500 Error Messages	15
I	
Important	5
Introduction	3
M	
Maintenance	15
Moisture Measurement Processes	13
O	
Operation	8
S	
Setting up	10
Standard Scales	17
Surface Moisture	11
T	
Technical Specifications	18
W	
Warranty Restrictions	19

SEEDBURO is launching its Model DMC500 Portable Digital Moisture meter in the marketplace. This revolutionary moisture meter was designed to supply direct and accurate readings of Moisture Percent.

With a simple operation and without operator intervention, model DMC500 will provide moisture readings in a few seconds for a wide variety of products.

With a simple 5-key keypad, the instrument can be easily operated and set up, without intensive user training.

Calibration curves for each cereal have been obtained using samples collected from several areas of the plantation. Using as a reference the standard oven method, measurement scales for each product were developed. These curves were transferred to the DMC500 memory and they are easily identified by product name. DMC500 incorporates two instruments into one, managed by a state-of-the-art internal microprocessor and its program performs all the required calculations, thus providing extremely reliable and repeatable readings. These two instruments are:

- One built-in digital thermometer to measure the sample temperature in the chamber, in order to compensate the cereal temperature effect.

- One capacity meter that indicates the moisture percent to be later corrected by other parameters. It also performs: automatic setting and checking the proper operation of all electronic circuitry.

The instrument design allows the performance of quick measurements, namely, in less than one minute.

Just weigh and pour the sample in the DMC500 hopper, the instrument will perform the measurements and, after a few seconds, you will be given the Sample Moisture and Temperature shown on an easy to read 16-character / 2-line alphanumeric LCD display, without the need of tables or factors.

DMC500 is operated by a wall power source, may be connected to a 100 - 240VAC mains and, if it is disconnected from the power source, it will operate with a built-in 9-V battery, thus ensuring its portability. Its battery will keep it continuously running for 20 hours.

Conventions



STOP!

This icon represents an important topic in the DMC500 operation, stop and read carefully.

HINT

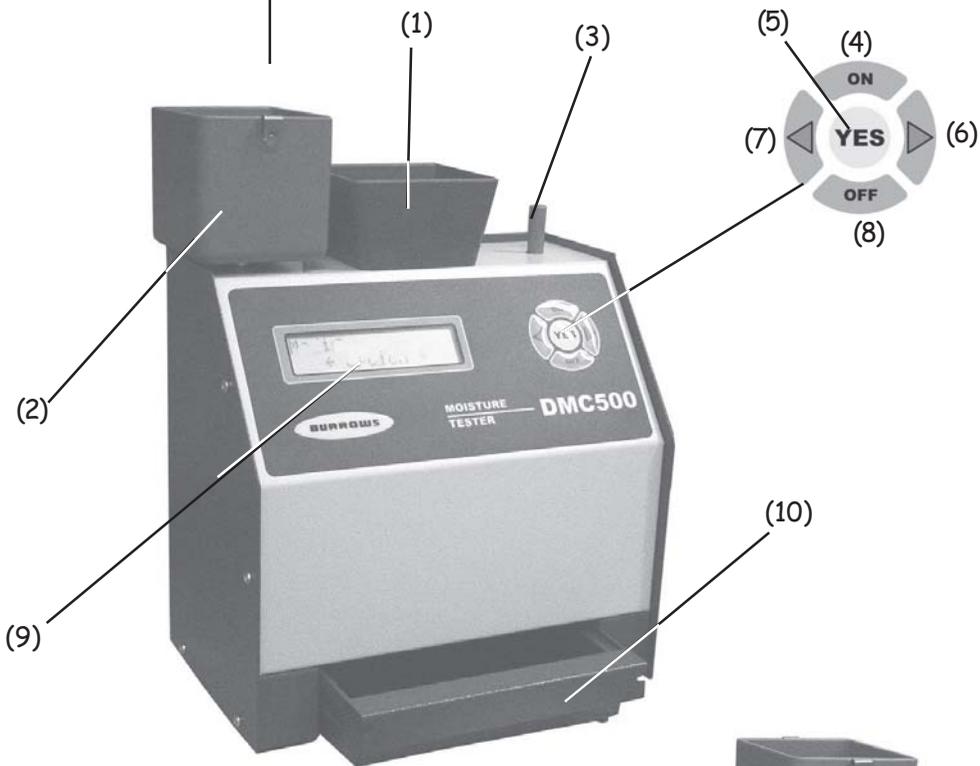
This icon means that the paragraph contains an operation hint, read and remember it, you will save time

Indication conventions for DMC500 LCD display are as follows:

->	right-hand arrow
<-	left-hand arrow
SIM (yes)	option acknowledgment.
LIGA (on)	ON key
DESLIGA (off)	OFF key

The information in this manual is regarded correct until the date of its publication, as stated in the sales Invoice of the product or good. SEEDBURO will not assume any liability resulting from the improper use of this manual; and it reserves the right to modify it without previous notice. SEEDBURO refuses any direct or indirect liability for accidents, damages, loss and profits, good or bad results on analysis, processing, purchase or sale of goods based on this instrument. The equipment sold is guaranteed against failures of material and craftsmanship, for a period of one year from the date of manufacture or sale. The responsibility of Manufacturer/Seller under this guarantee is limited to the repair or replacement, or optional credit granted, of any products returned by the user/buyer during the guarantee period. This warranty does extend to the coverage of damages or malfunction caused by fire, accident, modification, carelessness, improper use, repair or recalibration without authorization of the manufacturer, or even by negligence, lack of expertise in the use. The seller does not expressly or implicitly guarantees, except hereby notified, and the seller does not guarantee the continuity of merchantability of these goods and products, or its suitability for a given purpose. The responsibility of the seller under this contract is limited to the unit sales price, as stated in the invoice or price schedule, of any defective good, and it will not include the repair of losses, other damages, loss profit or any consequential damages arising from the use of the equipment, other than those previously provided.

Important



- 1- Loading Hopper:
Place where the cereal to have the moisture measured will be poured.
- 2- Weighing Cup:
Used for sample weighing.
- 3- Discharge Pushbutton:
When depressed the sample is poured in the drawer.
- 4- LIGA (on) key:
Turns DMC500 on.
- 5- SIM (yes) key:
Acknowledges the performance of one operation.
When the display is indicating moisture, if depressed performs a new measurement of the same product.
- 6- LEFT-HAND ARROW key:
Brings in the next function or reading by shifting to the right.
- 7- LEFT-HAND ARROW key:
Brings in the next function or reading by shifting to the left.
- 8- DESLIGA (off) key:
Switches the DMC500 off.
- 9- LCD display:
Indicates every step of the measuring process, with alphanumerical characters..
- 10- Drawer:
Receives the cereal sample from the chamber, after depressing the discharge pushbutton.
- 11- DC power supply connector:
Point where the power supply cord will be connected.
- 12- Scale Arm
Shall be in the horizontal position when the sample weight is achieved, say 142g.

Description



Operation



(13) Conversor AC/DC



(1)



(4)



(5)



(5)

13- AC/DC converter:

Supplies power to DMC500. This is a FULL RANGE converter and it operates with mains voltages of 90 - 240VAC, without the need of selection.

Moisture Metering Function

- 1- Turn the converter ON in the moisture meter rear panel; do not worry about voltage selection since this converter is of the FULL RANGE type and it operates with mains voltages between 90 a 240VAC.



At that point a series of self tests is started that will check the operation of all components. If you prefer you can operate with the built-in battery, you don't need to switch the converter on. Caution: When the converter plug is connected to DMC500 it will be supplying power for its operation, this way saving battery energy.

- 2- Depress the LIGA (on) button on the instrument front panel. DMC500 will at his point start a series of self-checking operations to ensure the quality of the Moisture measurement. If by any chance the instrument detects the malfunction of one of its components, it will show an error message in the display stating that a failure has occurred. This failure has to be reported to SEEDBURO Service Department. This step takes around 7 seconds.

- 3- The DMC500 shall be operated in a place free of excessive dust with room temperature between 5° to 40°C. If the room temperature is out of this range the equipment will give an error message "TEMPERATURA FORA DE FAIXA" (temperature out of range).

- 4- Mount the scale assembly as shown in the figure, the scale arm is fastened on the rear side of DMC500.

- 5- Get a sample of the product to have the moisture measured, slowly pour the sample into the Weighing Cup until the scale arm reaches the horizontal level.

- 6- Select the type of cereal you want to measure the moisture. Therefore, when the display reads "MEDIR"

(measure) depress the SIM (yes) key.

7- Go moving the RIGHT HAND or LEFT HAND keys until finding the desired product, depress the SIM (yes) key to acknowledge your choice.

8- At this point, the DMC500 display will show the message: "DERRAME A AMOSTRA E TECLE SIM...", (pour the sample and depress yes) pour the sample in the Sample Loading Hopper. The DMC500 will start performing a series of measurements.

- 9- After a few seconds, the DMC500 display will show:
- " Product
 - " Sample % Moisture
 - " Product temperature in the chamber

Note: If there is a large temperature difference between the product and the DMC500 chamber it will wait until a thermal balance is settled between them, this could introduce a delay in the measurement performance.

10- If the DESLIGA (off) key is depressed the DMC500 will be switched off.

11- If when DMC500 is showing the Moisture Percent on the Display, the sample is unloaded the display will show again the message "PESE E DERRAME A AMOSTRA", (weigh and pour sample) and it will be ready for another measurement.

12- After depressing the unloading pushbutton, DMC500 unloads the sample on the Drawer, and it has to be removed from inside the drawer by the operator.

13- If you want to select another product when the display is showing the message "PESE E DERRAME A AMOSTRA" (weigh and pour sample), operate the RIGHT/ LEFT HAND arrows and the display will show the function "Medir" (measure) acknowledge with "SIM" (yes) and select again the desired cereal.

Note: Due to the trend of some products of not settling evenly in the chamber, it is recommended to perform at least 3 readings and make an average value out of them, such as for example for corn, which has a variation in size and settles very unevenly within the chamber.



Setting Up



Different varieties of the same product may cause changes in the electrical properties, which will contribute to an irregular reading.

SETTING FUNCTION

Through this option the curve may be displaced in the positive or negative sense in order to add or subtract a constant value in the curve of a given product.

For example, DMC500 has read a value of 13%, and it is already known that the right value for this sample is 13.5%. In order to correct the reading proceed as follows:

- 1- Switch the DMC500 on with the "LIGA" (on) key.
- 2- Depress once the RIGHT-HAND ARROW to activate de setting function, "AJUSTE" (setting) option will be displayed.
- 3- Depress the key "SIM" (yes).
- 4- The list of products will be displayed, select the desired product and depress SIM (yes) key to confirm.
- 5- Using the RIGHT/LEFT HAND arrows, set the error value, which in our example is +0,5%.
- 6- After performing the adjustment depress "SIM" (yes) key to confirm.
- 7- Measure again with the same sample in order to confirm.

This adjustment will be active even if the equipment is switched off, the adjusted value will not be lost. To adjust it again the routine shall be repeated. It is not possible to modify the angular coefficient (slope) of the curve, in this case it is necessary to build up a new scale using the UNIVERSAL scale and then sending this data to SEEDBURO, which will soon correct the equation in the DMC500 regarding this product.

AUTO SWITCH-OFF FUNCTION

A battery-saving function. The "AUTO DESLIGA" (auto switch-off) function switches the DMC500 off after 3 minutes without operation, which means without performing measurements or activating the keypad. In order to enable this function proceed as follows:

- 1- Switch the DMC500 on with the "LIGA" (on) key.
- 2- Depress two times the RIGHT-HAND ARROW and the "AUTO DESLIGA" (auto switch-off) function will show up.



3- Depress the key "SIM" (yes).

4- The options "Desligado" (off) and "LIGADO" (on) will show up; using the RIGHT/LEFT HAND arrows select the desired option.

5- After the selection depress "SIM" (yes) key.

LANGUAGE FUNCTION

1- Switch the DMC500 on with the "LIGA" (on) key.

2- Depress the LEFT-HAND ARROW two times and the option "Idioma" (language) will show up.

3- Depress the "SIM" (yes) key .

4- Using the RIGHT/LEFT HAND arrows.

5- After the selection depress "SIM" (yes) key .

TEMPERATURE UNIT FUNCTION

1- Switch the DMC500 on with the "LIGA" (on) key.

2- Depress the LEFT-HAND ARROW once and the option "Unidade Temp." (Temperature Unit) will show up.

3- Depress the "SIM" (yes) key.

4- The options "Celsius" e "Fahrenheit" will show up; using the RIGHT/LEFT HAND arrows select the desired option.

5- After the selection depress "SIM" (yes) key .

Extreme Conditions

Samples containing ice or snow will not be satisfactorily measured.

Frozen samples may be analyzed provided they are left to heat up in a hermetically closed container to get closer to room temperature. Use the average value of 3 or more readings.

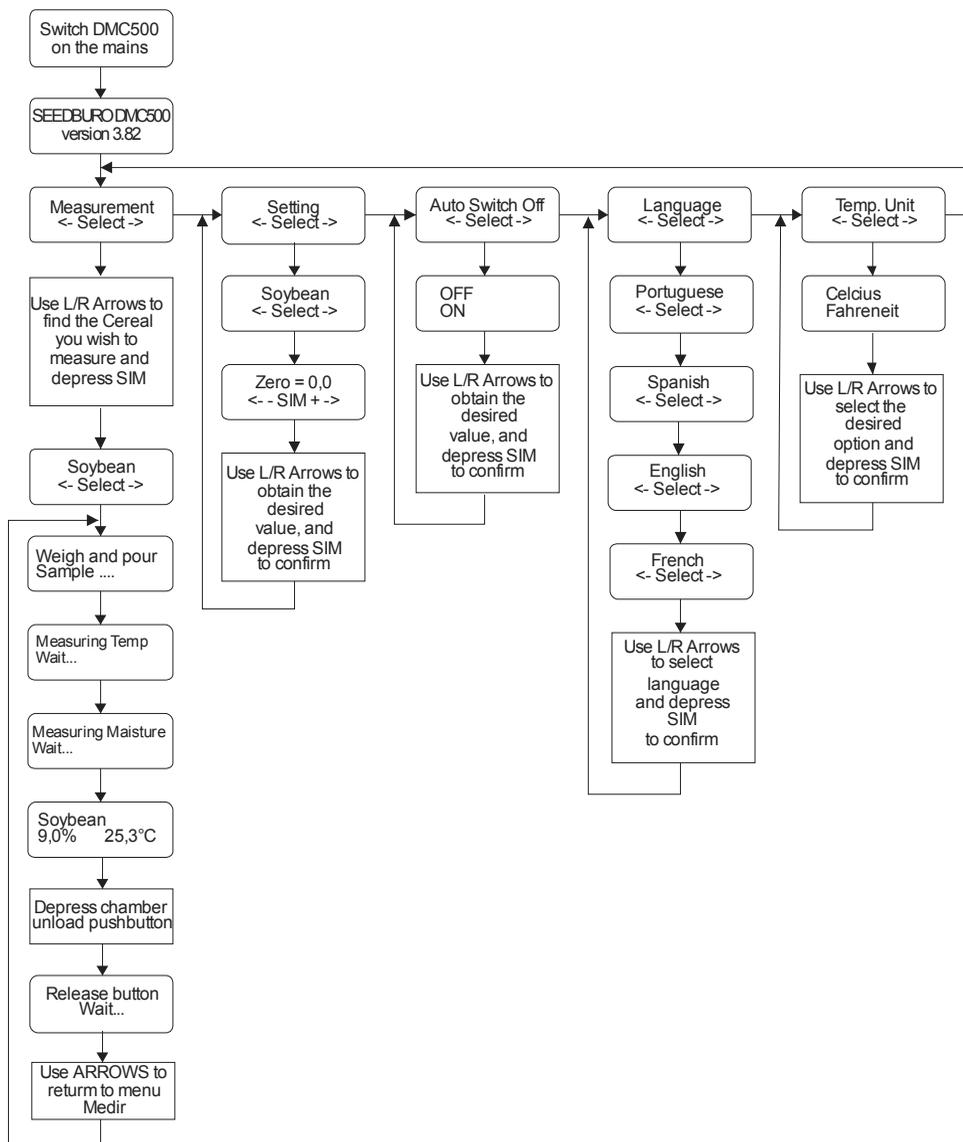
Below the temperature range of 10°C, perform three readings and use the average value.

Surface Moisture

Grains from a warmed warehouse when getting in touch with humid air develop surface moisture. The same occurs with some cereals uncovered during a rain, they will keep surface moisture for some days unless an artificial heat is applied for drying purposes. Surface moisture presents very low impedance to the high-frequency current flow and incorrect readings will consequently be obtained.

**Caution during
Moisture
measurement**

Block Diagram



Moisture Measurement Processes

There are two methods for measuring moisture in cereals. the primary one and the secondary one. The primary method consist on a procedure using an oven. This procedures is time-consuming and would not obviously be convenient. For this reason, the secondary method was developed to have the cereal electrical properties quickly measured and converted into moisture readings.

Although many research works have been carried out in the field of electronics and on the properties of cereals, it is not possible to analyze a cereal without some variations. Some of the involved factors are discussed below:

We recommend that the product to be measured by the DMC500 shall be clean and free from impurities that could impair moisture measurement. We should bear in mind that in the instrument calibration process with the oven it was always used the clean product.

The standard reference method for corn, used for the calibration of moisture meters is the vented oven method, for 72 hours at 103°C. Obviously, the first issue involved in the cereal method is the standard itself.

We do not only have different cereals, such as wheat, barley, corn, soybean, rice and others, but we also have a number of variations of each cereal.

Each cereal creates its own problem for moisture measurement. h new efforts varied and hybrid cereals are developed, so the electrical properties of them may slightly vary, thus requiring periodic adjustments in the calibration of moisture meters. Unfortunately, a cereal cannot be measured until the harvest is completed and the calibration cannot be modified until the measurement of a sufficient number of samples, in order to determine the change in the cereal electrical properties.

The size of the seed does also affect the test quality. Corn is an example of a difficult cereal to be measured, due to the irregular size and shape of the seeds; in fact, there are over 400 different varieties, maturing in 90 to 125 days. It can then be seen , that the issue of precision in moisture measurement is the on-going increase in the variation of electrical properties.

Cereal moisture measurement accuracy is significantly affected by moisture and temperature range. Major problems are created by cereals such as sorghum and corn; which during winter moths undergo situations involving ice, snow and freezing that affect measuring results.

Weight of cereal, low temperatures, mold or swelling often create measurement problems. Moisture meters are calibrated with quality seeds and certain attempts of measuring electrical properties on crushed or broken grains or grains with a high content of impurities will certainly impair the results. Different regions of a country, different methods of cultivation under development and the soils, have to be taken into consideration when trying to obtain average values for calibrating a moisture meter to be used throughout the country.

In the operation of every moisture meter the duly specified mechanical operations shall be performed. A representative sample of the batch shall be collected, the moisture and temperature range shall be collected, the moisture and temperature range shall be observed. Sample weighing shall be accurate. The scale shall be periodically checked. The moisture meter shall be checked. All these precautions may vary due to human errors, thus affecting moisture measurement.

We are willing to discuss some of the problems involved in industrial moisture measurement with manufacturers of other types of moisture meters operating in the marketplace. We expect that, with this information and with your DMC500, you will be able to perform moisture measurements; this will never be as accurate as for example, volume or weight measurements. We encourage your involvement in the development of calibrations, and we kindly ask you to contribute to our work by supplying samples or items with the calibration under development.

Moisture out of Range

DMC500 was calibrated with the standard oven method, and we guarantee its accuracy within the range where the tests were performed, when the measurement is out of range the DMC500 will show this message.

Blocked Chamber

If a certain quantity of product is retained in the chamber for any reason and this impairs the measurement quality, the DMC500 will show this error message. Try to clean the chamber by performing 3 open/close cycles, if even the chamber continues blocked, turn the DMC500 upside down, open the chamber and try to clean the dirt.

This message also appears when there is a failure in the electronic circuitry; thus preventing the performance of erroneous measurements. In this case return the instrument to SEEDBURO Service Department.

Cleaning

Routine maintenance will basically consist on cleaning the moisture meter keeping it free from dirt and dust, specially the chamber and the printed circuit boards. When measuring products such as rice, barley, sunflower seed, bran, etc., the chamber may accumulate residues, specially when such cereals are very dry with a low relative humidity.

To remove residues and dust from the chamber use clean and dry compressed air. Do not try to use brushes or cloths inside the chamber, since the temperature sensor might be damaged.

Electronic components

Electronic failures are minimized in the moisture meter through the use of solid-state electronic components. The electronic circuitry is contained in a printed circuit board located on the top of the instrument. The operation is not affected by dust and the microprocessor is able to detect any failure showing an error message on the display.

DMC500 Error Messages

Maintenance

In case of failure we recommend to return the DMC500 to SEEDBURO for the required repair and recalibration work.

Remember that any time the DMC500 is switched on, the microprocessor starts a series of self-checking steps to ensure its good operation.

Batteries

DMC500 moisture meter can be battery operated. The battery is installed within the instrument. To replace it, just remove the drawer, the weighing cup and turn the DMC500 upside down. There is a clip fastening the battery. Remove the battery from the clip, remove the connector and install a new battery. We always recommend the use of an alkaline 9-V battery, because even discharged there is no risk of leaking acids that could damage the DMC500.

When we switch off the mains adapter connector, the DMC500 will continuously operate on the batteries for a period of 20 hours.

In order to save batteries, enable the "AUTO DESLIGA" (AUTO SWITCH OFF) function, then after 3 minutes without operation the DMC500 will automatically switch off.

If the battery voltage drops below the safety limit that ensures the proper operation of instrument, the Display will show the message "Troque a Bateria" (Replace battery) and will stop performing measurements, thus emphasizing the need of battery replacement.

Standard Scales

Product	Moisture	
	Min [%]	Max [%]
Runer Peanuts	4	30
Rice - Polished	5	22
Rice - Rough	8	28
Oats	9	22
* Oats Rough	5	60
Cocoa Beans	7	20
Coffee Brazil	9	25
Coffee Oro	7	30
Coffee Pergamino	6	44
Canola	5	20
Rye	6	40
Barley	6	25
Rapeseed	7	17
Ervilha	6	20
Beans - Bolinha	6	35
Beans - White	7	35
Beans - Carioca	5	25
Beans - Coruja	5	30
Beans - Fradinho	6	35
Beans - Jalo	5	25
Beans - Gold	7	30
Beans - Black	8	35
Beans - Colorado	6	35
Beans - Rosinha	6	30
Beans - Red	6	30
* Sunflower	8	25
Flax	6	17
Lentilha	7	30

Product	Moisture	
	Min [%]	Max [%]
Corn	4	20
Corn	7	40
Milhato	7	30
Popcorn	5	35
Corn Canjica	5	50
Blackpeper	6	30
Soybeans	6	30
Sorghums	7	40
Wheat	5	33
Wheat - White	5	33
Wheat - Red	5	33
Wheat - Durum	5	33
Triticale	5	22
Urucum	7	30
Uiversal	5	60

* For Oat Husk and Sunflower Seed use the Weighing Cup with a counterweight or use a precision electronic scale to weigh 85g from the sample to be measured.

TECHNICAL SPECIFICATIONS

Number of Scales	42
Moisture Resolution	$\pm 0.1\%$
Moisture Limits	Depends on scale, see table.
Moisture Accuracy	$\pm 0.5\%$ Better correlation with the standard when the samples are within the moisture limits of each scale.
Sample Weight	142 g, except Oat Husk and Sunflower Seed (85g)
Thermometer	0° - 100°C
Precision	$\pm 0.5^\circ\text{C}$
Temperature correction	Sample temperature automatic correction, within 1 - 16 seconds depending on the temperature difference between sample and DMC500. Correction range of 5°/50°C
Weight	3,7 Kg
Dimensions	298 x 247 x 158 mm
Power supply	FULL Range 100V - 240VAC power supply or 9-V Alkaline Battery.

The information in this manual are regarded correct until the date of its publication, as stated in the sales Invoice of the product or good.

SEEDBURO will not assume any liability resulting from the improper use of this manual; and it reserves the right to modify it without previous notice.

SEEDBURO refuses any direct or indirect liability for accidents, damages, loss and profits, good orb ad results on analysis, processing, purchase or sale of goods based on this instrument.

The equipment sold is guaranteed against failures of material and craftsmanship, for a period of one year from the date of manufacture or sale.

The responsibility of Manufacturer/Seller under this guarantee is limited to the repair or replacement, or optional credit granted, of any products returned by the user/buyer during the guarantee period.

This warranty does extend to the coverage of damages or malfunction caused by fire, accident, modification, carelessness, improper use, repair or recalibration without authorization of the manufacturer, or even by negligence, lack of expertise in the use.

The seller does not expressly or implicitly guarantees, except hereby notified, and the seller does not guarantee the continuity of merchantability of these goods and products, or its suitability for a given purpose.

The responsibility of the seller under this contract is limited to the unit sales price, as stated in the invoice or price schedule, of any defective good, and it will not include the repair of losses, other damages, profit loss or any consequential damages arising from the use of the equipment, other than those previously provided.

The Validity of this Guarantee is one year, starting from the date of the invoice.

Warranty Restrictions

The *Guarantee* does not cover:
Paint, any defect shall be notified within thirty days of invoice date.

Vertical springs, delta and support due to improper use, or transportation out of packing, or even with the plate fitted on the scale.

Improper use, when there are evidences.

The product requiring *Service* during the guarantee period shall have the freight to SEEDBURO and return to customer paid by the Customer.

The Seller or representative is not authorized to offer any additional guarantee other to that described in this *Manual*.