Delmhorst Instrument Co.

Model F-2000/H (Hay and Hops)
Owners Manual – v3.6 (reissued July 2015)

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FEATURES

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- Digital readout
- Built-in calibration check
- Temperature stable circuit
- Ergonomic case design
- Includes (1) 9-volt battery
- Three year warranty
- Over fifty years of proven quality, accuracy and service

BEFORE YOU BEGIN

BUTTON FUNCTIONS

Read (#1): Reads the percent moisture content value %MC.

Calibration Check (#2) Checks the meter calibration. Displays the average of up to 100 accumulated readings; displays the highest stored reading; erases the readings

Scale Button (#3): Displays the meter scale (hay or hops) and acts as a toggle switch to change between two scales. Also acts as an arrow button when pressed after the set-point button to decrease the set point to a lower value.

Set-Point (#4): Displays the current set-point. Also acts as an arrow (scroll) button to increase the set-point value in 1% increments.

When the battery is replaced, the meter displays its software version for one second and then turns itself off. After replacing the

battery, you must reset the meter as described below in the "Resetting the Meter" section.

CHECK CALIBRATION

- **Remove the probe** from the top of the meter.

- **Press and hold** the read button (#1) and check button (#2) simultaneously. Meter is in calibration if it displays "12" (± .2) on the scale, regardless of the scale setting.

If you check the calibration and the display does not read "12," it is likely an indication of a low battery. If this occurs, change the battery immediately. Continued use with a low battery may cause the meter to go out of calibration. If you have a fresh battery and the instrument still does not indicate an acceptable calibration, return it to DELMHORST for service. See "**Service for Your Meter"** section.

SET THE SCALE

- To change the scale, press the scale button (3) to display the current scale. Scale #1 is used to test hay; scale # 2 is used to test hops.
- Hold the scale button (3) to toggle between the scales.
- Release the scale button (3) to stop at the desired scale.
- After the scale is changed, the meter will clear any stored readings and restore the set point to its default view.

CHANGE THE SET-POINT

- **To change the set-point value, press the set-point button (#4)**. The meter will display the current set-point value.

- **To scroll forward** to a higher value, hold the set-point button (#4) while the current value is displayed and scroll to the set-point value desired.

- **To scroll backward** through the set-point values, press and release the set-point button (# 4). Within one second press and hold the set point decrease button (#3).

- **Continue** to hold the set point decrease button (#3) and the set-point will decrease.

- **When scrolling in either direction,** release the button to stop at your desired set-point.

If the meter reads a %MC higher than that of the set-point, a buzzer will sound.

TO CHECK THE ACCUMULATED READINGS

This feature allows you to view the total number of all accumulated readings for the given product you have chosen, the average of those readings, and the highest stored reading.

- **To add a reading to the sum of all previously stored readings, release the read button (#1)** within 2 seconds. If you press and hold the read button #1, the meter will repeat its read cycle, but will not add a new reading to the storage until the button is released.

- **To view the readings** press and release the calibration check button (#2). First the meter displays the number of accumulated readings for one second, then the average of those readings for two seconds. Then it displays the highest stored reading for two seconds. The total "cycle" time is five seconds.

- **To erase all the accumulated readings**, hold the calibration check button (#2) for more than five seconds until the meter displays "0."
- **To keep the accumulated readings in memory,** release the calibration check button (#2) before the total cycle time is complete.

The meter will accumulate up to 100 readings. After all 100 readings are stored, it will not add new readings until the memory has been cleared. It will also continue to display the average of all 100 readings as a reminder that the memory is full.

Readings below 8% will be displayed as "0". Those above 40% will be displayed as "99.9." Neither will be added to the accumulated readings or used in calculation of average or highest reading.

TO RESET THE METER

- **Press and release** the calibration check button (#2).

- **Within one second**, press and hold the scale button (#3).

- **The meter will reset itself** and display "119." This indicates that the meter has been reset to scale #1 (hay) and default set-point 19%. It will also clear all of the readings stored in memory.

If you are testing hops, you must change the scale back to #2 after resetting the meter.

TAKING A READING

TESTING BALED HAY – set meter to scale no 1

- **Connect the probe** to the external connector on the top of the meter.

- **Insert the probe into the bale**.

- **Press the read button (#1).** The meter displays the %MC for two seconds.

NOTES

- ✓ The hay prod is electrically insulated, except at the metal points near the tip. The moisture content measured represents the hay in contact with the tip of the prod only.

- ✓ Partially cured hay may have wide variations in moisture content throughout the bale. Readings should be taken in several different parts of the bale and the highest readings used as a guideline. The arrangement and compaction of hay fibers in a bale may have an effect on meter readings.

- ✓ If you are testing high density bales, we recommend using the H-3 handle with the 830-2 10" prod, 830-3 18" prod, or the 830-4 36" prod. Using the handle/prod combination eliminates excess stress on the instrument case that may occur when trying to insert the prod into a high density or large bale.

- ✓ When using the 36" prod, be sure to guide the prod into the bale with one hand while pushing on the H-3 handle.

TESTING IN THE WINDROW

When testing in the windrow, push down on the pressure button until the palm of your hand touches the screw that holds the button in place. The pressure button depresses a calibrated spring inside the handle. When the screw touches the palm of your hand, the pressure applied on the sample is 27 – 30 lbs., which closely simulates the pressure in a standard bale of hay.

There are three ways to test moisture content in the windrow:

Test A:

- **Attach the #831** short pin prod to the H-3 handle and connect the handle to the external connector on top of the meter.

- **Prepare a representative sample** by collecting hay from various parts of the windrow.

- **Place hay in a non-conductive container** (such as a 5 to 10 gallon plastic pail) and apply the short pin prod to the hay.

- **Press down on the electrode** until the head of the screw which holds the pressure button, touches the palm of your hand.

- **Press the read button (#1)** and take a reading.

- **Mix the sample once again** and take at least two more readings. Use the highest readings.

NOTES

- ✓ Whenever pressure is being applied on the electrode, be sure that the points of the electrode are touching nothing but the hay.

- ✓ Repeat the steps above if considerable variations are found in the meter readings. To reduce these variations, chop the hay, mix it thoroughly and take several readings by following the procedures above. This will make the moisture distribution in the sample more uniform

Test B:

- **Attach the #831 short pin prod** to the H-3 handle and connect the handle to the external connector on top of the meter.

- **Apply the prod** to the hay in the windrow and press down on the electrode handle until the head of the screw touches the palm of your hand.

- **Press the read button #1** and take a reading.

- **Make several tests** on the hay exposed to the sun, then turn the windrow over and make an equal number of tests on the hay that had been closer to the ground. Use the highest readings.

NOTES

- Make sure that the points of the electrode are not touching the ground. The electrode points should make contact with the hay only.

Test C:

- **Select up to five large, slower-drying stems** from a section of the windrow.

- **Place them one at a time** across two adjacent points on the #831 short pin prod.

- **The average of these stem readings** should be about two to five points higher than the actual moisture content.

NOTES

- Repeat these steps in different parts of the field and pay special attention to the areas where the hay is heaviest.

- The amount of variation found among windrow readings as well as the average stem moisture should be taken into consideration before the decision is made to start baling.

FACTORS AFFECTING YOUR READINGS

Because of the many variables that affect the electrical meter readings, the indicated moisture content should not be used as an absolute quantitative measurement. Meter readings are very useful guidelines for safe storability of hay.

Meter readings become more significant when they are considered in the light of the density of the bales, anticipated handling and storage, and prevailing climate conditions.

RANGE OF MOISTURE CONTENT

The F-2000 is designed to test moisture in hay over a range of 8%-40%. Readings over 30% should be used only as a qualitative indication of high moisture content. Delmhorst moisture meters use the relationship existing between electrical conductivity and moisture content in hay. As moisture content increases, so does the conductivity.

Tests on hay at high moisture content, over 25%, are less accurate. This is mostly due to the variability in moisture distribution. The reduced level of accuracy in the high range does not significantly affect the usefulness of the meter, as a few high readings indicate that some action be taken to dry the hay to avoid spoilage or even self-combustion.

While it is important to note the average of several readings, it is even more important to note the high readings and the frequency at which they occur.

HAY TEMPERATURE

The F-2000 has been calibrated at 80°F on various samples of different types of hay, mostly alfalfa, and on different cuttings and mixtures. The higher the temperature of the sample, the higher the meter readings will be. Temperatures lower than 80°F cause lower meter readings. The correction is approximately 1% point for every 20° F difference. Refer to chart below:

Hay temperature	Add to reading	Subtract from reading
20°F/-7°C	3	--
40°F/ 5°C	2	--
60°F/15°C	1	--
80°F/30°C	0	0
100°F/40°C	--	1
120°F/50°C	--	2
140°F/60°C	--	3

Example:

Meter reading: 22%
Temperature: 40°F/5°C
Moisture Content: 24% (22 + 2)

CURING

Before proper curing has taken place, wide variations in moisture content should be expected in both recently baled hay and hay in the windrow. These variations will be exposed by meter readings taken on different parts of the windrow or bale. **The higher the moisture range, the wider are the variations. The more curing has been allowed to take place, the greater uniformity in moisture distribution can be expected.**

The validity of the meter readings is closely related to the care spent in sampling the hay to be tested. Whether hay in the windrow or baled hay is tested, the number of tests made should be increased whenever the initial readings show considerable variations.

DENSITY

The calibration of the moisture testers applies to bales of normal "average" density. Generally:

- Denser bales may yield readings 1-2% points higher.
- Looser bales tend to yield 1-2% point lower.
- Tests in stacks usually yield readings 2%-3% lower.
- Tests on grass hay may yield readings about 3% lower.

Baling should be done according to the lower meter reading.

When testing baled hay, drive the prod across the slices of the bale, not between them. This will ensure firmer and more uniform contact.

When using the short pin prod, uniformity of pressure from one sample to the other is achieved by applying pressure to the "pressure button" at the end of the H-3 handle as described on page 5.

USE OF PRESERVATIVES

Hay preservative or stabilizers may also have an affect on meter readings. Normally a bale of hay treated with preservative will read higher than a bale of the same hay that had not been treated. The readings typically increase by 2-4% points, and 24-48 hours after treatment, the readings between the bales tends to equalize.

Occasional higher readings may occur if, in addition to the effect of the increased conductivity due to the stabilizer, the bales tested also show an increase in temperature and "sweating." As the stabilizer becomes more thoroughly absorbed and the sweating subsides, the meter readings recede to the initial level and will continue to decrease, assuming that the bale becomes progressively dryer.

SAMPLE SIZE

When testing baled hay, it is essential to take readings at several different points in the bale. Hay moisture may vary a great deal in the same bale. For example, at one point bale moisture may be 20% and at another over 35%.

More tests must be made whenever the variations among readings are greater. If there is a possibility of high moisture areas, samples from these locations should be taken. Areas of high moisture content will spoil, resulting in loss.

It is extremely important to note the high readings and the frequency at which they occur.

Testing Hops – set meter to scale no 2

The F-2000 enables you to easily check moisture levels in baled hops to assure quality and safe storage.

When measuring moisture content, keep in mind the average moisture content is not necessarily a true indication of the safety for storage, as a few wet spots in the hops can cause considerable damage.

The meter indicates the moisture level in the hops that is in contact with the uninsulated tip of the prod. Therefore, it is very important to make a number of tests in all parts of a bale for proper testing. Since moisture distribution usually varies in baled hops, an average of several tests will give greater validity to the data collected.

Also, temperature of hops affects the reading of the moisture meter. As the temperature of the hops increases, the moisture meter reading will also increase. If possible, test bales with a temperature as close to a nominal 80°F as possible.

CARE OF YOUR METER

To keep you new moisture meter in good working order:

- Store your meter in a clean, dry place. The optional protective carrying case is an ideal storage place when the meter is not in use.

- Change battery as needed. Continued use with a low battery may cause the meter to go out of calibration.

- Clean the meter and probe with any biodegradable cleaner. Use the cleaner sparingly and on external parts only. DO NOT IMMERSE THE METER OR ANY PROD IN WATER.

- Remove the battery if the meter will not be used for one month or longer.

SERVICE FOR YOUR METER

If your meter is not working properly, replace the battery with a new one and check the calibration. If this does not resolve the problem please send your meter back to Delmhorst for repair. Go to www.delmhorst.com and click on Support and then download the Return Form. If you require further assistance please call 877-DELMHORST (335-6467) or 973-334-2557. E-mail info@delmhorst.com

WARRANTY

Delmhorst Instrument Co., referred to hereafter as Delmhorst, guarantees its F-2000 meter for three years from date of purchase and any optional electrodes against defects in material or workmanship for 90 days. If, within the warranty period of the F-2000, you find any defect in material or workmanship return the meter following the instructions in the "**Service for Your Meter"** section. This limited warranty does not cover abuse, alteration, misuse, damage during shipment, improper service, unauthorized or unreasonable use of the meter or electrodes. This warranty does not cover batteries, pin assemblies, or pins. If the meter or any optional electrodes have been tampered with, the warranty shall be void. At our option we may replace or repair the meter.

Delmhorst shall not be liable for incidental or consequential damages for the breach of any express or implied warranty with respect to this product or its calibration. With proper care and maintenance the meter should stay in calibration; follow the instructions in the "**Care of Your Meter"** section.

UNDER NO CIRCUMSTANCES SHALL DELMHORST BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES OF ANY TYPE WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, LOST PROFITS OR DOWNTIME ARISING OUT OF OR RELATED IN ANY RESPECT TO ITS METERS OR ELECTRODES AND NO OTHER WARRANTY, WRITTEN, ORAL OR IMPLIED APPLIES. DELMHORST SHALL IN NO EVENT BE LIABLE FOR ANY BREACH OF WARRANTY OR DEFECT IN THIS PRODUCT THAT EXCEEDS THE AMOUNT OF PURCHASE OF THIS PRODUCT.

The express warranty set forth above constitutes the entire warranty with respect to Delmhorst meters and electrodes and no other warranty, written, oral, or implied applies. This warranty is personal to the customer purchasing the product and is not transferable.

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For more than 65 years Delmhorst Instrument has been the leading manufacturer of high quality, US-made moisture meters and thermo-hygrometers. Today we offer a wide range of meters for applications including water damage restoration, construction, flooring, lumber/woodworking, paper, and agriculture.

07-2015