Delmhorst®
INSTRUMENT CO
WHEN ACCURACY IS THE POINT.®

Owner's Manual FX-20

Rev 1 - October 2023

Contents

1. Introduction

Thank you for purchasing the new FX-20 hay moisture meter, the latest in Delmhorst's legacy "F-series" moisture meters and part of the new Navigator™ family of meters. Delmhorst moisture meters are known to hay producers worldwide for their unmatched reliability and ease of use.

The FX-20 is the ideal tool for hay producers large and small. It offers the latest in features and functionality. The FX-20is packaged in a robust and ergonomically designed ABS case (patent pending). The meter has large, tactile buttons to provide a premium, tactile feel, and intuitive user interface with dashboard-like display.

The FX-30 carries a two-year limited warranty. REGISTER YOUR METER by using the QR code on the back of the meter to receive an additional three month's warranty.

We recommend that you read the following pages in detail to take full advantage of all the FX-20 has to offer.

Should you need assistance at any time, please contact us via email at info@delmhorst.com or by calling 877-DELMHORST (335-6467).

2. Safety

Sharp Measurement Prods: The prods are very sharp as they are intended to penetrate through dense bales. Store prods and other accessories in the carrying case when not in use to avoid unintentional injury.

Meter Calibration: Meters are factory-calibrated prior to shipment. Calibration should be checked before performing a job (using the internal Cal Check feature or external MCS calibration standard) to ensure the meter is working correctly and electrically accurate.

Proper Use: When used properly, the FX-20 can help users make informed decisions on the hay moisture levels throughout production and storage. A moisture meter is a secondary method of determining moisture content, and users should be aware of other potential influences on the accuracy of conductance meter readings.

3.Meter Features

Figure 1: Meter components

1. Display – Easy to read, backlit LCD display.

2. Read Button – When in live reading mode, press this button to hold a reading. When in any other mode, press this button to enter live reading mode.

3. Navigation Buttons – Use the up/down/left/right buttons to navigate through the meter's display. Use the center button to confirm a selection.

4. Easy Grip Handle – The handle is contoured to provide a comfortable grip for right or left-handed users. This shape also allows for increased leverage when pushing the meter into hard materials. The battery door is located on the rear of the handle.

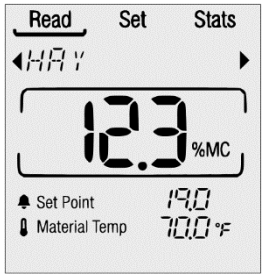
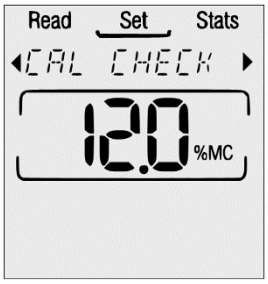
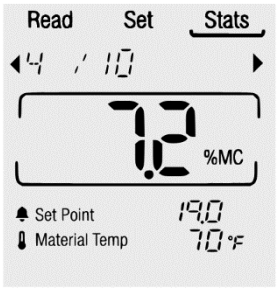
5. Ambient Light Sensor – When the backlight is set to Auto, the ambient light sensor will trigger the backlight to turn on or off (to the brightness level set by the user) according to ambient lighting conditions.

6. Electrode Connector – Connect any external special application Delmhorst electrode. Most common for hay are the 1235 bale prod and H-4 handle, required for 830-series bale prods and 831 prod for windrows.

4. Menu Features

The Delmhorst FX-20 has three operating modes: **Read, Set, and Stats**. The currently selected menu is marked with an underline. To change the menu, press the up button until the menu underline is blinking. Then use the left and right buttons to switch between menus. Use the down or center button to enter the menu. When a line on the display (Set Point, or Material Temp) is bracketed by the solid black left and right arrows, it is "active", and that selection can be changed by pressing either the left or right key.

Table 1: Menu Features

Read	Set	Stats
		
• Take readings • Change set point • Change material temperature	• Cal check • Temperature unit • Off Timer • Backlight ON/OFF/AUTO • Backlight brightness • Screen contrast	• Total Readings • Average value • Highest value • Lowest value • Standard deviation • View readings • Erase all reading data

5. Read Menu

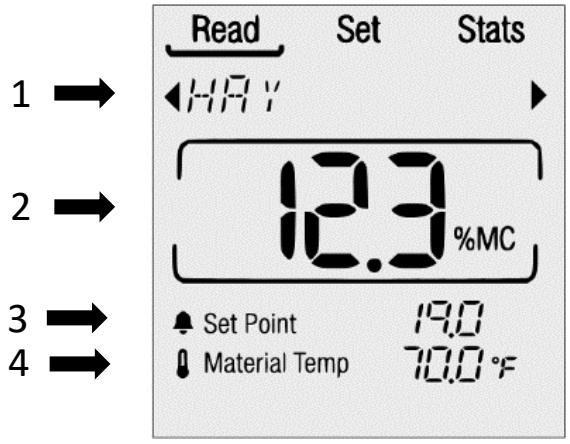


Figure 2: Read screen components

1. Live Reading Area

Info: The live reading area displays the moisture value of the hay. The reading is corrected using the Material Temperature (3 if the user has input hay temperature (see Figure 2 above).

Indicated readings with a less than (<) or greater than (>) sign are considered out of range. Out of range readings can be saved to memory but will not be used in stats calculations.

Use: Use the navigation buttons to move to the live reading area (entry will be confirmed when a live reading appears on screen). **Tip: If a live reading is not currently being displayed, pressing the Read button will navigate to the live reading area.**

Take a Reading: Insert the bale prod or the pin prod the hay. (See Appendix). The moisture content of the hay will appear in the live reading area.

Hold a Reading: Press the Read button to hold the reading on screen. HOLD will appear in the material selection line and the

meter will beep. A held reading can be saved, if desired (see below). Saving a reading or pressing the Read button a second time will return the meter to live reading mode.

Save a Reading: Press the Center button to save a live or held reading. This will store the reading, material temperature, and pin correction type to meter memory. A 'Saved' message will appear followed by the memory slot which the reading occupies (ex. HAY 2/100). This message can be bypassed by pressing the Read button.

Memory: There are 100 memory slots available in the meter. As readings are saved, the memory slots will fill in order from lowest (1) to highest (100). After 100 readings are stored, newly saved readings will replace the oldest stored readings.

2. Set Point

Info: The Set Point is the user-selectable moisture level at which the alarm will sound. This feature allows users to take readings without having to review each one individually, helping to quickly identify high moisture areas.

Use: When active, press the left and right buttons to adjust the Set Point down or up. Holding the left or right buttons will cause the Set Point to change more rapidly.

The Set Point alarm can be turned off by adjusting the set point value to zero (--.-).

3. Material (Hay) Temperature

Info: The FX-20 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° difference. For best accuracy, use the temperature correction in the meter, especially when working in extreme environments (outside 50-90°F or 10-32°C) and environments subject to temperature variation such as baled hay in storage.

Use: When active, press the left and right buttons to adjust the Material Temperature down or up. Holding the left or right buttons will cause the temperature to change more rapidly.

6. Set Menu

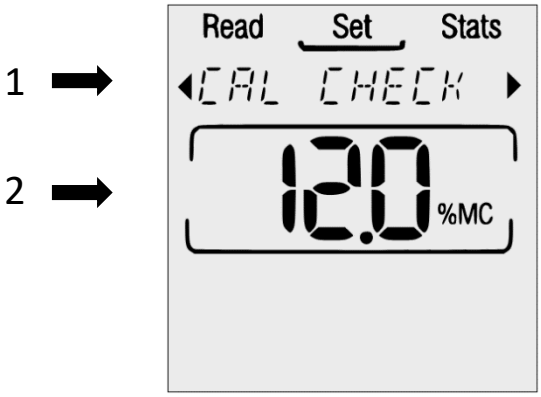


Figure 3: Set screen components

1. Setting Selection

The setting selection area will display all settings in a scrollable list. Each setting is listed and explained in Table 2 below. Press the left and right buttons to view settings. After locating the desired setting, press the down or center button to enter the setting state. Then press the Read button to enter the live reading screen.

Table 2: Settings options

Setting	Description
Cal Check	• Allows users to check the electrical calibration of the meter • A value between 11.8 and 12.2 means the meter is in calibration • A value of <11.8 or >12.2 means the meter is out of calibration – change the batteries (2 x AA)
Temperature Unit	• Changes the temperature unit between Fahrenheit and Celsius • *Factory default is Fahrenheit*
Off Timer	• Choose 1, 4, or 10-minute screen off timer

	• *Factory default is 1 minute* • Manually turn the meter off by depressing the center button until screen goes blank – approx. 3s
Backlight	• Turn backlight ON enable, and OFF to disable • Turn the backlight ON when in low ambient light, and OFF when in bright ambient light • When set to AUTO, meter will automatically enable and disable backlight according to ambient light • *Factory default is off*
Brightness	• Adjust backlight brightness from 1 (low) to 10 (high) • The selected brightness level will be used whenever backlight is enabled (ON or AUTO) • *Factory default is brightness level 2*
Contrast	• Adjust the contrast level of the screen from 1 (low) to 10 (high) • *Factory default is contrast level 5*

6. Stats Menu

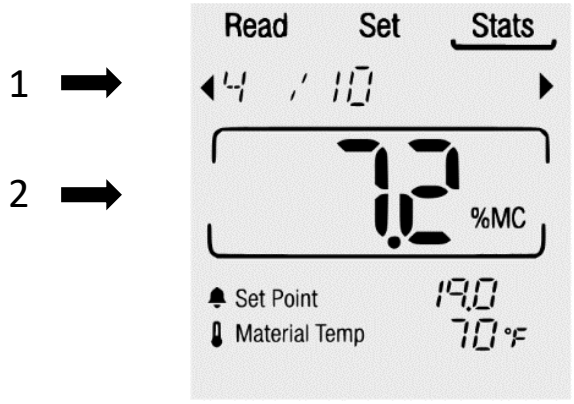


Figure 4: Stats screen components

1. Stats Selection

The stats selection area will display all statistics in a scrollable list (see Table 3 below). Press the left and right buttons to view statistics.

2. Stats Details

Statistics are calculated from the list of saved readings in meter memory, and only readings taken within the valid measurement range of the selected material are used for the calculations. Out of range readings will not be included in statistical calculations for average and standard deviation.

The meter provides statistics (average, high, low, standard deviation) for the readings that are currently stored in the meter. Note: The statistics in the meter are calculated without any out of range readings.

The stats details section can only be selected for the 'View Data' and 'Erase Data' options. For these two cases, press the down or center buttons to enter stats details box from stats selection. Use the left and right buttons to scroll the list of latest readings or select the desired

option for clearing readings. For all other statistics, stats details will simply reflect the details of the above statistic and cannot be selected.

Table 3: Available Stats

Statistic	Description
Readings	• Displays the total number of readings stored in the meter
Average	• Displays the average value of the saved readings.
High	• Displays the highest value of the saved readings.
Low	• Displays the lowest value of the saved readings.
Standard Deviation	• Displays the standard deviation of the saved readings.
View Data	• Displays a list of all saved readings. The %MC, temperature, and pin type of each reading are displayed.
Erase Data	• Clears all saved readings and statistics from the meter.

8. Specifications and Operating Conditions

Temperature Compensation Range: (not operating temperature)

0-255 °F / -18-124 °C

Operating Range:

0 – 40 °C

Reading Range:

Hay: 6% - 40%MC – calibration is primarily alfalfa

Power:

2x AA Alkaline Batteries

Battery life while using the meter in reading mode and active LED's is estimated at 125-150 hours. A combination of alarm, backlight and Bluetooth will reduce expected life to a minimum of 35 hours. A "LOW BATT" warning will appear on screen when the meter is woken up if battery voltage is below 1.75V. At this level the meter has 1-2 hours of life depending on the functions being used. The same alert is sounded and displayed every 5 minutes. Continued use with a low battery may cause your meter to go out of calibration. TIP: Extend battery life by setting the backlight brightness low and using shorter timeout settings.

Size:

8.6 in x 2.9 in x 1.6 in (22 cm x 7.4 cm x 4.1 cm)

Weight:

6.9 oz (0.20 kg) without batteries
8.6 oz (0.24 kg) with batteries

Regulations/Compliance:

WEE, RoHS, CE

Dispose of your Meter

Figure 5: WEEE symbol – crossed out wheeled bin

For private households: Information on Disposal for Users of WEEE

This symbol (figure 5) on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For proper treatment, recovery, and recycling, please take this product(s) to designated collection points where it will be accepted free of charge. Alternatively, in some countries, you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

For professional users in the European Union

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

For disposal in countries outside of the European Union

This symbol is only valid in the European Union (EU). If you wish to discard this product, please contact your local authorities or dealer, and ask for the correct method of disposal. OBJ

10. Meter Care, Service and Warranty

Care for your Meter

To keep your 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 the AA batteries as needed. Continued use with a low battery may cause the meter to go out of calibration. Remove the batteries if the meter will not be used for one month or longer.

- Clean the meter and prods with any biodegradable cleaner. Use the cleaner sparingly and on external parts only. Keep cleaner out of the external connector.

Service Your Meter

If your meter is not working properly, replace the batteries and check the calibration. If this does not resolve the problem, go to www.delmhorst.com and follow the instructions under the Support tab. If you require further assistance, please call 877-DELMHORST (335-6467) or 973-334-2557.

Limited Warranty

Delmhorst Instrument Co. 51 Indian Lane East, Towaco, NJ 07082, referred to hereafter as Delmhorst, guarantees its FX-20 moisture meter against defects in material or workmanship for two years from date of purchase. Optional electrodes are guaranteed for 90 days. See the owner's manual or Delmhorst website (www.delmhorst.com) for warranty period on your specific product. If, within the warranty period of the product, you find any defect in material or workmanship, return the meter to Delmhorst or an authorized reseller, using the return form https://www.delmhorst.com/returns-service-warranty. Include proof of purchase. Shipping charges to return the product are the customer's responsibility.

This warranty does not cover abuse, misuse, damage during shipment, improper service, unauthorized or unreasonable use of the meter or electrodes. This warranty does not cover normal wear and tear, batteries, or pins. If the meter or electrode have been altered or tampered with, the warranty shall be void. DELMHORST RESERVES THE RIGHT TO REPAIR OR REPLACE THE PRODUCT AT ITS SOLE DISCRETION.

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. The meter should stay in calibration indefinitely with proper care and maintenance. Follow the manufacture's guidelines in the owner's manual.

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 either from Delmhorst directly or through an authorized reseller. Purchases through unauthorized resellers, including but not limited to unauthorized e-commerce resellers, are not covered by this warranty, to the extent permitted by law.

This warranty extends to the original owner only and is not transferable.

Contact info:

Delmhorst Instrument Co

51 Indian Lane East

Towaco, NJ 07082

USA

www.delmhorst.com

Info@delmhorst.com

973-334-2557

11. Appendix

Testing Baled Hay

- Connect the 1235 bale prod (or H-4 handle and 830-series prod) to the connector on the top of the meter.
- Insert the prod into the bale.
- Press the read key. The meter displays the %MC for two seconds.

Notes

- The bale 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.
- Take readings both across and in between slices in square bales.
- 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 influence meter readings.
- When testing high density bales, use the H-4 handle with the 830-2 10″ prod, 830-3 18″ prod, or the 830-4 36″ prod. Using the handle/prod combination eliminates 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 on round bales, be sure to guide the prod into the bale with one hand while pushing on the H-4 handle

Testing Hay in the Windrow

Test 1

- Attach the #831 short pin prod to the H-4 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- or 10-gallon plastic pail) and apply the short pin prod to the hay.
- Press the read button and take a reading.
- Mix the sample once again and take at least two more readings. Use the highest readings.

Notes

- 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 2

- Attach the #831 short pin prod to the H-4 handle and connect the handle to the connector on top of the meter.
- Apply the prod to the hay in the windrow.
- Press the read button 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 contact the hay only.

Test 3

- 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 the 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 FX-20 is designed to test moisture in hay over a range of 6%-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.

Moisture readings at all stages of production should be considered in ranges, rather than as absolute indications due to the inherent variability of material, and the moisture distribution.

Use the guidelines below and always consider prevailing environmental conditions, regional practices and the influence of preservatives:

Small square bales – 18%-25%

Large square bales – 15%-18%

Round bales – 12%-16%

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 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 testing hay in the windrow or bales, 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% higher.
- Looser bales tend to yield 1-2% 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.

Use of Preservatives

Hay preservative or stabilizers may also influence 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%, and 24-48 hours after treatment, the readings between the bales tend 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, if 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.