Operation Manual

Moisture/Matic Plus

(Prototype)

August, 2004

GSI, Inc.

Notes: This manual covers the moisture controller only. Please refer to the Operator's Manual provided with the dryer for dryer operation, maintenance and troubleshooting.

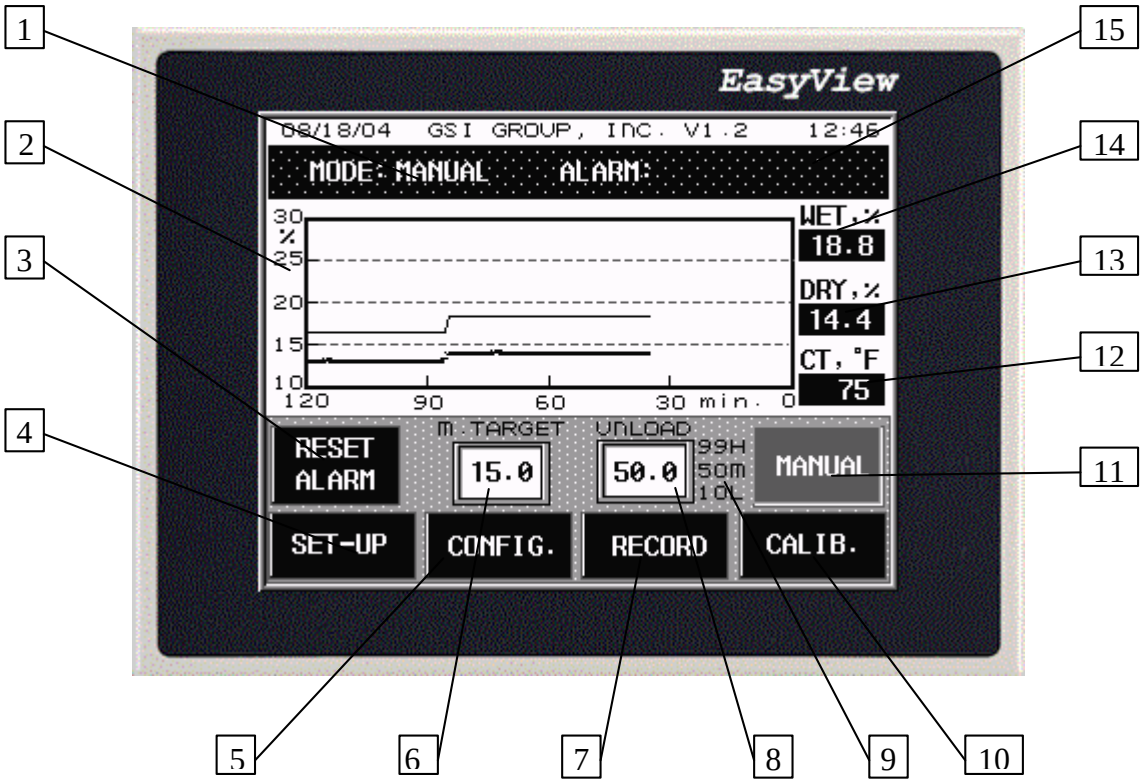
Table of Content

I. Front Panel

1. Panel LED indicators
   POWER – lit when panel gets power
   READY – lit when the dryer unload is on. It gives a signal to the moisture controller indicating dryer is running.
   REMOTE – lit if the dryer unload speed is controlled by the moisture controller; off if controlled locally from the dryer control panel.
   AUTO – lit if the moisture controller is in auto mode.
   ALARM – flash if there is an alarm.

2. REMOTE/LOCAL Switch
   Turn to "REMOTE" position if the dryer unload speed is to be controlled from the mositure controller in either MANUAL or AUTO mode. Turn to "LOCAL" position if the unload speed is to be controlled locally, and the moisture controller will be in "MONITOR" mode, i.e. checking moisture in and out without controlling the dryer.
3. Power Switch
4. Display (see section II)
5. Printer (see section VIII)
6. Feed Paper Momentary Switch

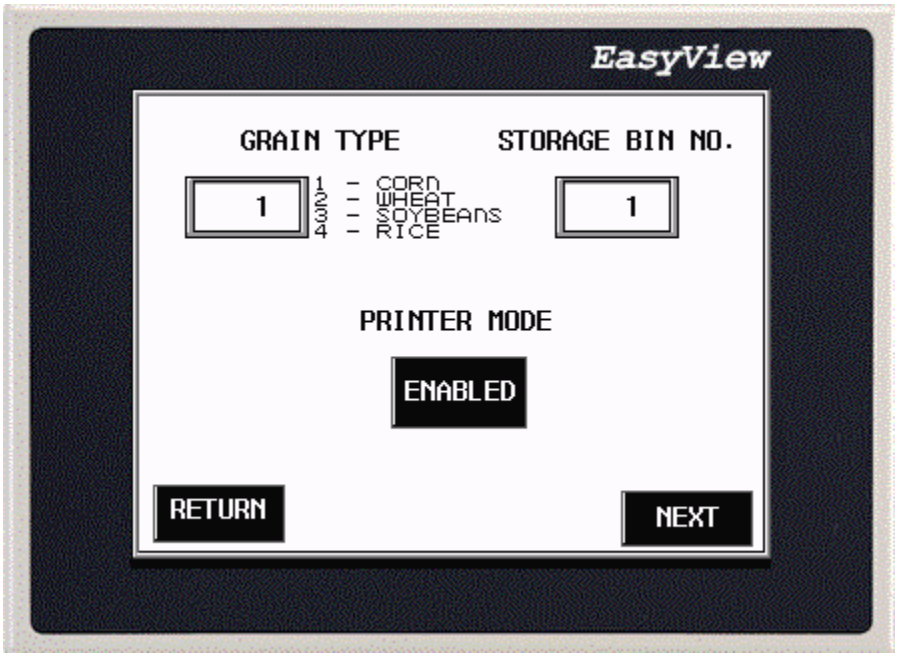
II. Display



1. Control Mode – MONITOR, MANUAL or AUTO
2. Two-hour moisture history chart. Lighter line for coming-in moisture and darker line for moisture out.
3. Alarm reset button – to reset the alarms
4. Setup button - to access set-up screens
5. Configuration button – to access configuration screens. For factory use only.
6. Moisture target. To change the moisture target, press within the rectangular area and key in the new target from the pop-up keypad.
7. Record button - access drying history screens
8. Unload speed. It displays current unload speed if the dryer is under remote control, otherwise it displays as 0.0. The manual unload setting is displayed at the background with a lighter color. To change the manual unload speed setting, press within the rectangular area and key in the new speed from the pop-up keypad.
9. Unload speed settings:
   H - high limit of the speed
   M – manual speed
   L – lower limit of the speed
10. Calibration button - to access sensor calibration screen (see section IV, step 5)
11. Control Mode button - toggle the control mode between MANUAL and AUTO by pressing the button.
12. Current column grain temperature measured from the RTD sensor at the end of the drying section.
13. Grain moisture measured by the dry sensor.
14. Grain moisture measured by the wet sensor.
15. Alarm message

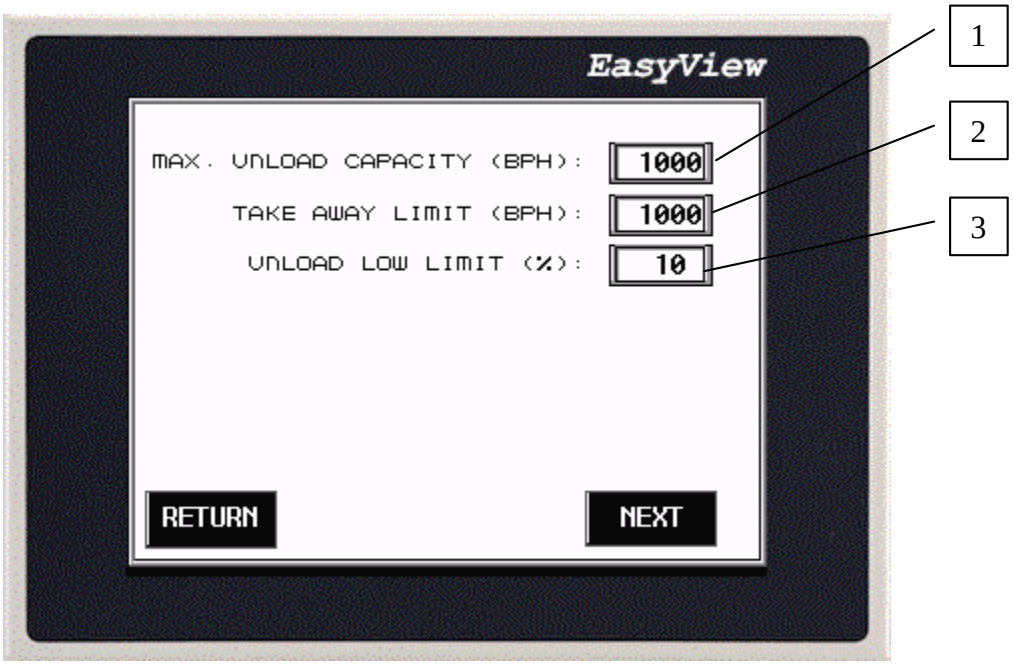
III. Set-up of the Controller

1. Press the “SET-UP” button and then “NEXT” button to open the following screen:



Choose the GRAIN TYPE and BIN NO. , or enable/disable the printer.

2. Press “NEXT” button to open the following screen:



1) MAX. UNLOAD CAPACITY - the capacity of the dryer unloading device itself (e.g. metering roll) running at 100% of the speed. It is not the rated dryer capacity and call the dryer manufacturer for a specific unload device.
2) TAKE AWAY LIMIT - the maximum capacity of the overall take away equipment. The take away equipment refers to any augers/conveyors/legs after the

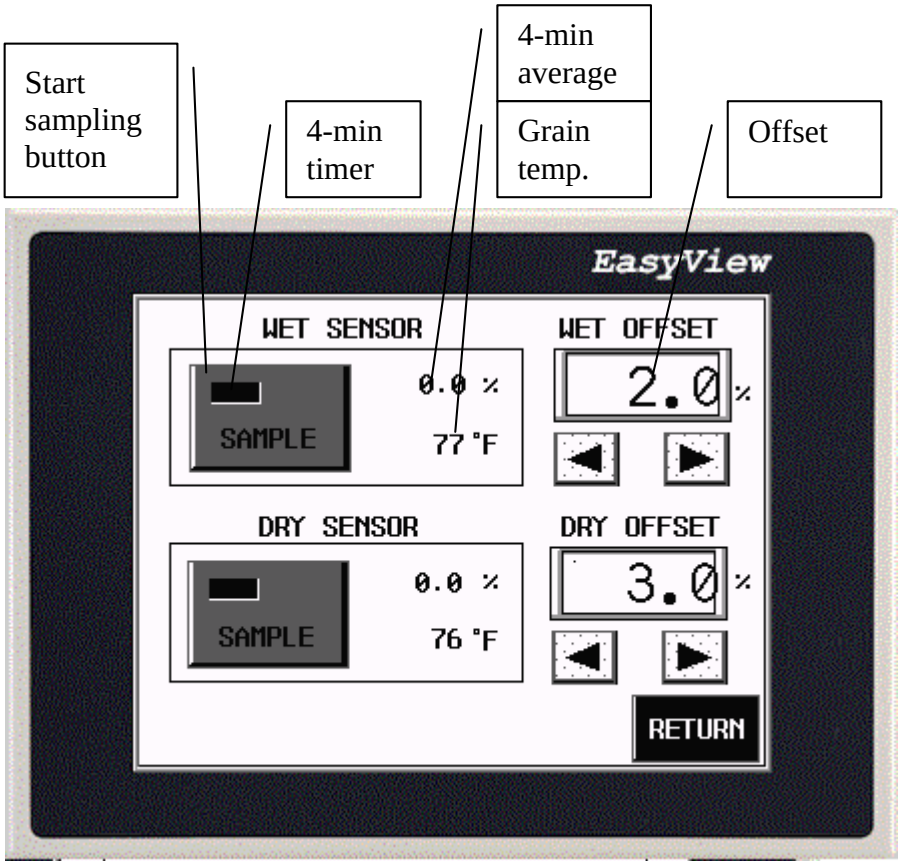
unloading device. The take away limit is the maximum capacity in which dryer can run without plugging any unload equipment.

3) UNLOAD LOW LIMIT - the minimum speed the unloading device can run. It should not trigger the unload alarm at this speed for the dryer having an unload monitoring device.

3. Go to next screen to adjust date/time if necessary.

IV. Operation Procedure

1. Power up the Moisture/Matic, leaving the REMOTE/LOCAL switch to the "LOCAL" position.
2. Start the dryer; set the dryer unload at a desired speed from the dryer control panel.
3. Set the same manual unload speed on the main screen of the moisture controller and switch the REMOTE/LOCAL switch to "REMOTE" position. The dryer unload is then controlled manually from the Moisture/Matic.
4. Leave the dryer running at the remote manual mode for warming up until the column grain temperature (CT on the main screen) has stabilized and the moisture coming out of the dryer is within ± 2% of the target moisture.
5. During the warm-up period, calibrate both the wet and dry sensors against a bench meter as following:
   a) Press "CALIB." button from the main screen to open the sensor calibration screen.



   b) Press "SAMPLE" button of the dry or wet sensor, depending on which sensor is intended for calibration. Then a 4-min timer will start counting down. Take grain samples during the 4 min period, measure the moisture with a bench

meter and then compare to the 4-min-average reading of the sensor displayed by the "SAMPLE" button after timing out (displayed as 0.0% before timing out). Change the sensor offset if the 4-min-average does not match the bench measurement. For example, if the offset was 1.0%, and the 4-min-average during the sampling period is 0.5% lower than bench meter, then change the offset to 1.5% to match the sensor to the bench meter.

Note: the sensor should be calibrated 2-3 times a day. At the same time check and clean the sensor and sensor sampling box to make sure there are no cobs or straws blocking the grain flow around the sensor.

6. Enter the target moisture from the front panel.
7. Press "SET-UP" button once and check the current unloading settings, i.e. the upper limit of the unload rate (HIGH), manual unload rate (MAIN) and lower limit of the unload rate(LOW). Change the upper or lower limit if needed. However, the upper and lower limits will go back to defaults every time the manual unload speed is changed.
8. Press the control mode button from the main screen and set the mode to AUTO. The Moisture/Matic will start adjusting the unload rate between the upper and lower limits of the unload speed to maintain the moisture coming out the dryer close to the target.

V. How the Controller Works

The controller continuously monitors the moisture coming in and out of the dryer, and the column grain temperature at the end of the drying section. However, the control action is mainly based on the dry sensor at the outlet of the dryer. If the moisture coming out of the dryer is not right at the target, the controller will speed up or slow down the unload accordingly. The wet sensor and the column grain temperature sensor are intended to detect moisture spikes coming into the dryer so that the moisture controller can react ahead of time. For example, if the wet sensor detect a jump of moisture coming into the dryer, the controller will start to slow down the unload speed right away. However, the controller does not act to the full scale immediately. Instead, it slows down the dryer gradually so that the grain currently in the dryer would not get too much overdried.

The controller does not have enough information of the grain in the dryer in the first pass after the dryer is started. It controls the dryer by using the manual speed setting as the starting point. In other words, the manual speed setting is most responsible for the first pass of drying. Therefore, set the manual unloading speed as close as it should be for the grain currently in the dryer before switching to AUTO control mode. The manual speed setting does not have to be adjusted after the controller is switched into AUTO mode.

VI. Alarms

The controller checks the sensors and control status regularly. If abnormal conditions are detected, a corresponding alarm will go off, an alarm message will come up on the main screen **and the controller will switch to or stay in the MANUAL control mode.** The alarm message will stay on until the operator reset it by pressing "RESET ALARM" button on the main screen.

Again, it is important to keep the manual speed setting as close as it should be. The controller will switch back to the manual speed whenever alarms come up and the dryer will run at that manual speed until the alarm is acknowledged and reset by the operator.

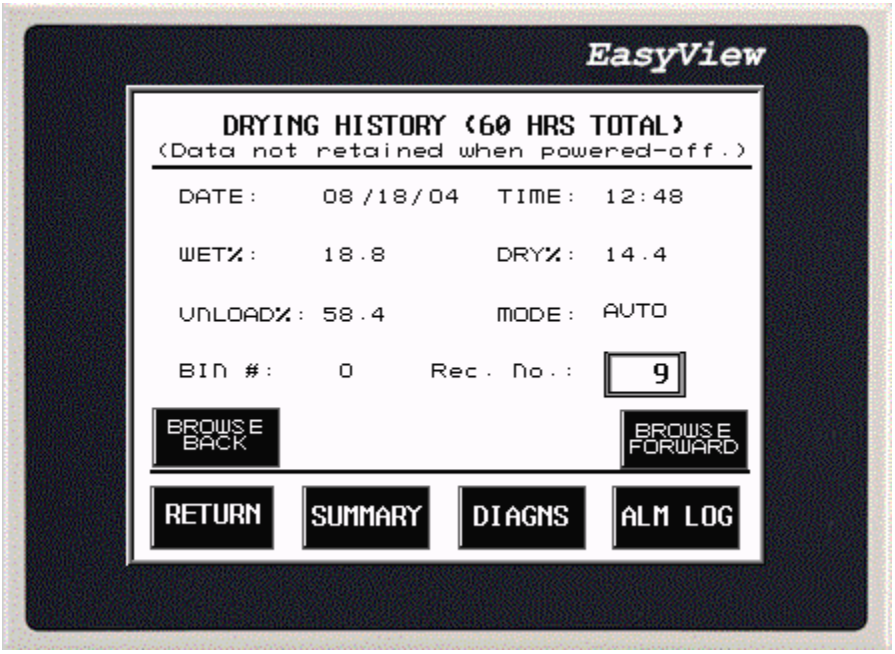
The moisture control alarms do not affect the dryer control other than the unload speed.

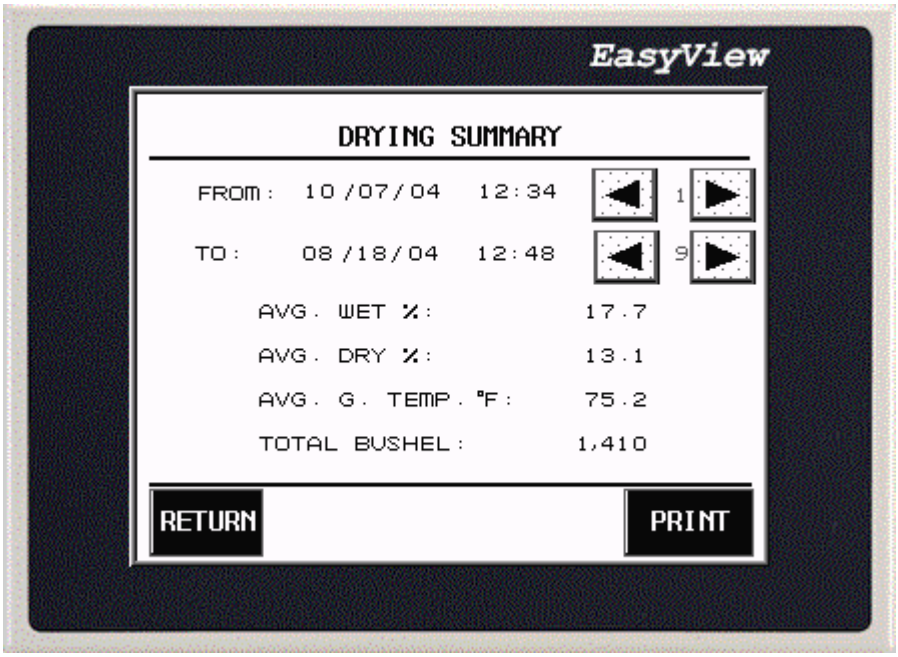
Alarm	Causes	Solution
Moisture out of range - the moisture coming out of the dryer was 2.5% above or below the set-point for more than one hour under AUTO control mode	• Sensor box plugged and sensor was not covered by grain • Dry sensor out of calibration • Too big swing of moisture coming into the dryer	• Clear the sampler and sensor box • Calibrate the sensor • Run the dryer manually for one pass
Dryer stopped more than 30 min.	• Dryer was stopped for more than 30 min while the controller was in AUTO mode	• Restart the dryer and the moisture controller
Dry grain moisture out of range – sensor reading is less than 8% or higher than 40%	• Sensor box plugged and/or sensor was not covered by grain • Out of calibration	• Clear the sampler and sensor box • Calibrate the sensor
Dry grain temperature out of range (0-200F)	• Bad wiring • Bad sensor • Bad circuit board	• Check connection • Change the sensor • Change the circuit board
Wet grain moisture out of range – sensor reading is less than 8% or higher than 40%	• Condensation on the sensor • Out of calibration • Sensor is dirty	• Calibrate the sensor • Clear the sensor
Wet grain temp. out of range (0-200°F)	• Bad wiring • Bad sensor • Bad circuit board	• Check connection • Change the sensor • Change the circuit board
RTD1 out of range (0-200°F)	• Bad wiring • Bad sensor • Bad circuit board	• Check connection • Change the sensor • Change the circuit board
RTD2 out of range (0-200°F)	• Bad wiring • Bad sensor • Bad circuit board	• Check connection • Change the sensor • Change the circuit board
Thermistor out of range (0-200°F)	• Bad wiring • Bad sensor • Bad circuit board	• Check connection • Change the sensor • Change the circuit board

VII. Access Drying History

Press the "RECORD" button from the main screen to open the drying history screen. The controller loges quarterly data up to 240 records (i.e. 60 hours) into the

archive. Press the browse buttons to browse the records. If you need a report, press the "SUMMARY" button to get to the "DRYING SUMMARY" screen, where it displays the average grain moisture, grain temperature, and the total bushels in the defined period. You can change the start time and the end time for the report by pressing the arrow buttons. Press the "PRINT" button to get a printed copy.





VIII. The Printer

To change the paper roll

1. Slide the printer cover down.
2. Lift the cover off the base.
3. Lift the LEFT end of the paper spindle first then remove the spindle.
4. Insert the end of the new roll of paper into the paper slot of the printer mechanism with the paper coming off the roll from the top.

5. Use the paper feed switch to advance paper.
6. Place the spindle in the new paper roll with the two round shafts on the left end.
7. Insert the right end of the spindle in its end first.
8. Snap the left end of the spindle into position.
9. Feed the loose end of the paper through the paper slot.
10. Replace the cover.

To change the ribbon cartridge:

1. Remove the cover.
2. Press down on the left end of the ribbon (ribbon is marked PUSH).
3. Lift both ends to remove the old ribbon.
4. Turn the knob on the right end of the ribbon as needed to keep the ribbon tight while placing the new ribbon over the extended paper and snapping it down firmly into place.
5. Replace the cover.