Field Research Software™

High Capacity GrainGage™ for Laptop

Reference Guide

Contents

Software License Agreement

Manufacturer Agreement

This Software License Agreement is between the end-user and Juniper Systems, Inc. (manufacturer). Please read the following terms and conditions before using Field Research Software with a laptop device. This agreement supersedes any prior agreement, written or oral.

Granting of License

The manufacturer grants, under the following terms and conditions, a non-exclusive license to use Field Research Software.

Ownership

Juniper Systems, Inc. retains the title to and ownership of the software plus any copies made of the software.

Software Use

The FRS license and registration are only valid on one laptop device per licensed copy. To purchase additional license copies, contact the manufacturer. You may make one copy of the software to be stored as a backup.

Copyright

Field Research Software is copyrighted by Juniper Systems, Inc. You may not rent, lease, lend, sub-license, modify, or disassemble this program. The associated documentation may not be reproduced without written permission.

Term

This License is in effect until terminated. It will be terminated under one of the following conditions:

- You destroy all copies of the software and documentation.

- You return all copies of the software and documentation to us.

- You fail to comply with any provisions of the License Agreement.

Acceptance or Disagreement

Use of the software in any manner indicates your acceptance and acknowledgment of the terms and conditions of this agreement. If you do not agree with any of the terms and conditions, do not use the software. Return the disk and documentation to the manufacturer. If the software was installed on the mobile device at the factory, you must delete it.

C H A P T E R   1

INTRODUCTION TO FRS *HARVEST ON LAPTOP*

Gatting Started:How to install FRS *Harvest*

Registering FRS Laptop

Introduction to FRS *Harvest*™ on a Laptop

Designed by seed researchers, the Field Research Software™ (FRS) helps seed researchers and agriculture scientists perform data collection tasks on research plots.

The High Capacity GrainGage™ is employed on combines to record weight, moisture, and test weight on grains. It aids research scientists by automating data collection. This Field Reference Guide helps you through the setup, calibration, and harvest with the Twin or Single High Capacity GrainGage.

This guide also outlines the operation of the Field Research Software Harvest module. The FRS Harvest module is a component of the FRS Note Taking™ application. This Field Reference Guide assumes the user is familiar with the operation of FRS Note Taking. For more information, see the FRS Note Taking Field Reference Guide.

FRS software for a laptop is designed so you can either use a mouse or the keyboard. Function keys, arrow keys, the Enter key, and the Tab key are designed to help you move the cursor through the software and make selections.

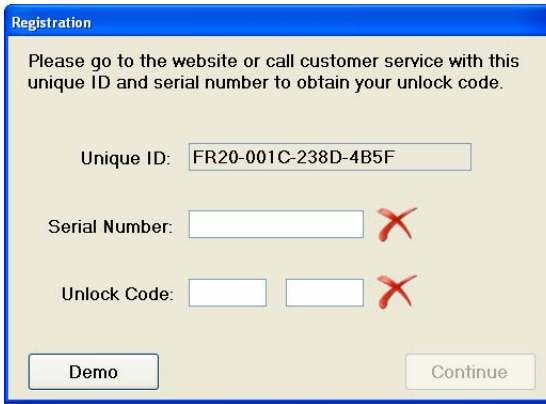*Figure 1-1: Left: Single HCGG—Right: Twin HCGG*

Getting Started: How to install FRS Harvest

For instructions on installing the latest FRS Harvest software onto your laptop, follow these steps:

1. Visit our website at ***www.harvestmaster.com.***

2. Select ***Support,*** then select ***Downloads***.

3. Choose the version of software from the appropriate menu.

Registering FRS Laptop

When registering FRS Laptop, the following FRS Registration Form will appear.

Figure 1-2: Registration screen

Before filling out this form, go to our Web site at www.harvestmaster.com/register and complete the Online Software Registration form. When asked for the software serial number, enter the serial number from your software license card. Next enter The Unique ID from the FRS Registration Form that appeared when FRS was first launched. See Figure 1-2. When the form is filled out, push the Register Software button. An Unlock Code will then be emailed to you.

Enter the Software Serial Number and the Unlock Code on the FRS Registration Form. The code is case sensitive so enter capital and lower case letters as shown. Write down the Unlock Code and keep it for future reference. The Xs on the screen will change to check marks when the screen is properly filled out. Select Continue and you'll get a message that indicates that FRS is now registered.

DEMO mode can be used before registering to try out the software. It is fully functional with the exception that no data can be exported until it is registered.

SETTING UP FRS
HARVEST™

Setting Up FRS *Harvest*™

Follow these steps to enable your Twin or Single High Capacity GrainGage to work with FRS **Harvest.** This includes models with BDS module.

1. Make sure the cables between the control device and the laptop are set up properly so the software and hardware can communicate. For details about cable placement, see ***Appendix B: Cable Wiring for the HM-800.***

2. From the Main FRS Screen, select Setup (F3).
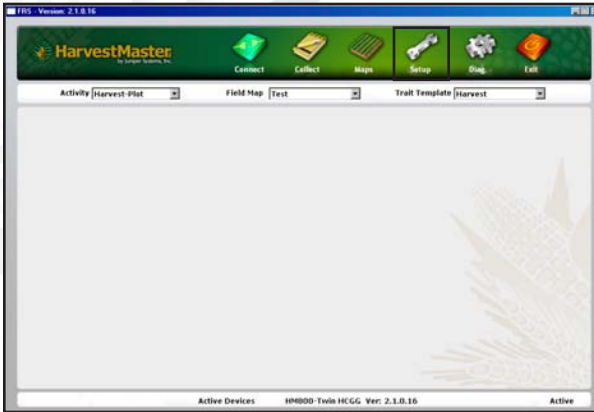
Figure 2-1: Choose* Setup *on the Main FRS Screen

3. Select **Manage Devices** either with the mouse or using the up or down arrow keys and pressing the Enter key.

Figure 2-2: Setup menu with Manage Devices selected

4. In the Devices screen shown below, enable the Twin or Single High Capacity GrainGage.

Note: Only one device can be enabled at a time.
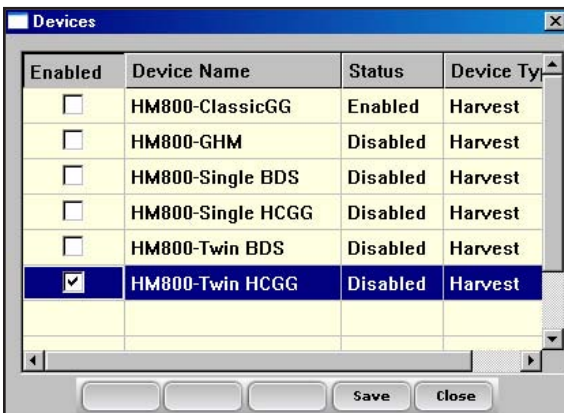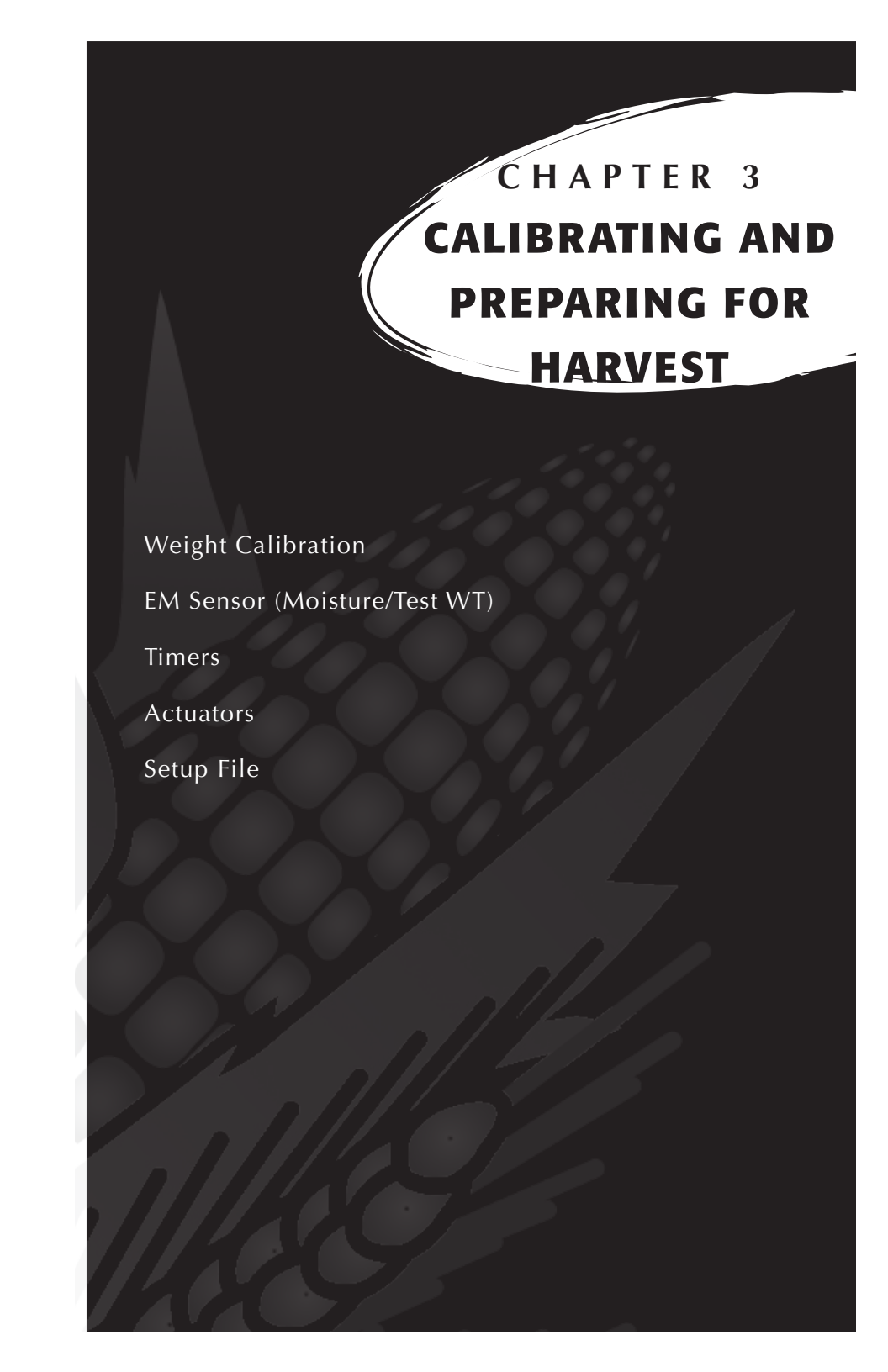
Figure 2-3: Devices screen showing the HM800-Twin HCGG as enabled

5. Select **Save** (F4) and **Exit** (F5). The software begins
    to load and checks to see if hardware devices are
    connected. Wait until the software has finished loading
    before proceeding to the next chapter.

    FRS software has an emulation mode to allow software
    familiarization without being connected to a hardware
    device.

    Select units of measurement, either English or Metric.
    The default is English.

CALIBRATING AND PREPARING FOR HARVEST

Calibrating and Preparing the High Capacity GrainGage for Harvest

This chapter explains how to calibrate and set up your High Capacity GrainGage to work with FRS Harvest. The sections below describe the first- and second-level menu options in the Setup menu under **HCGG Setup.**
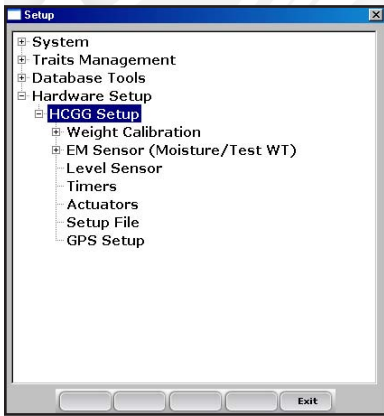
Figure 3-1: This chapter explains the options under HCGG Setup in the Setup menu

Weight Calibration

Before you can collect data using your High Capacity GrainGage, you need to first calibrate the weight, edit the weight calibration for your data, enter the weight calibration for the Slope and Motion Sensor, and set the Retare Warning.

The following sections explain how to perform each task, each of which is listed as an option in the Setup menu under **Weight Calibration.**

Load Cells—Calibration Wizard

Follow these steps to calibrate the weight for the load cells.

1. From the main FRS screen, select **Setup** (F3).

2. Arrow down to the Hardware Setup option and expand it by clicking the [+] or using the right arrow on the keyboard.

3. Expand **HCGG Setup.**

4. Expand **Weight Calibration.**

5. Select **Load Cells** as shown in Figure 3-2. Follow the instructions on the screen.
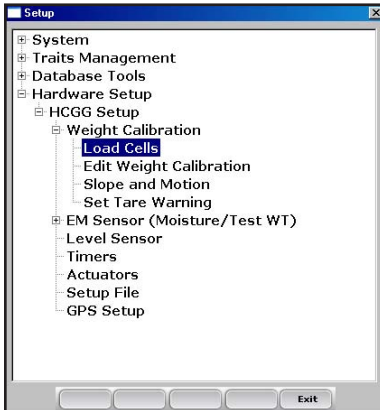
Figure 3-2: Setup menu with Load Cells selected

6. Enter the known value of your calibration weight in pounds or kilograms to the nearest hundredth. *Example: 11.56 lbs.*
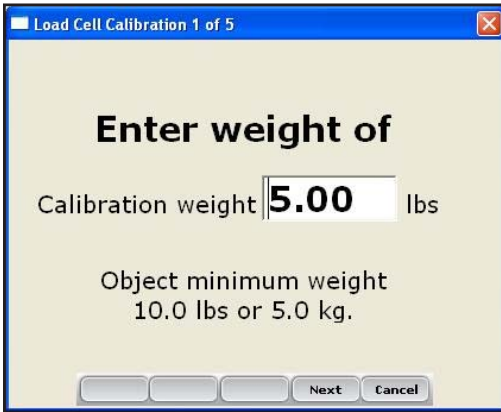
Figure 3-3: Enter the weight calibration value

7. Select *Next* (F4) to move to the next screen.
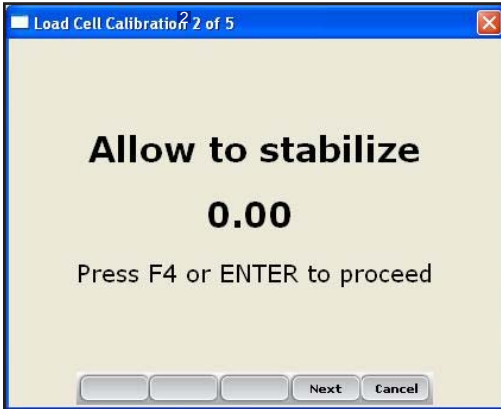
Figure 3-4: Load Cell Calibration screen 2 of 5

8. Allow the reading to stabilize, then click **Next** (F4). A new screen appears, telling you to place a weight on one side of the bucket.

9. Place the known weight on one side of the bottom weigh bucket as far to one side as possible (see Figure 3-5).

    Note: If a small grain insert is being used in the HCGG, place the weight under the insert by opening the bucket door then placing the weight on one side.
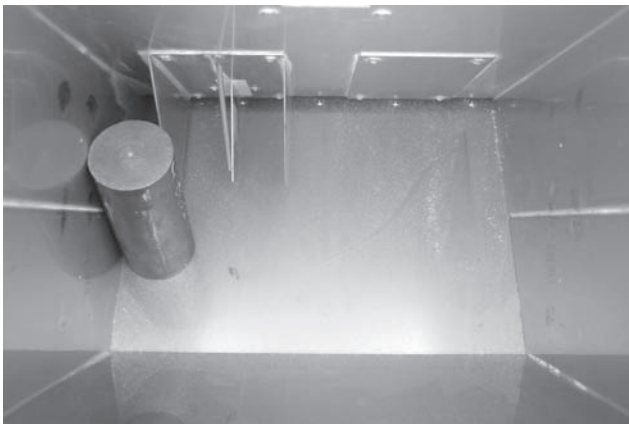
Figure 3-5: Place the weight on the far side of the weigh bucket

The Load Cell Calibration screen shows the weight reading (see Figure 3-6). The weight displayed may not equal the value of your weight. This is okay.
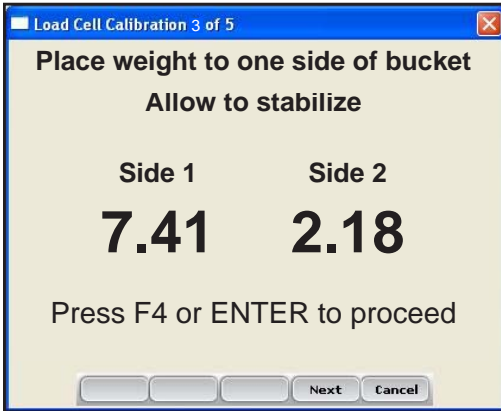
Figure 3-6: Load Cell Calibration screen after a weight is added

10. Click **Next** (F4) to move to the next screen.
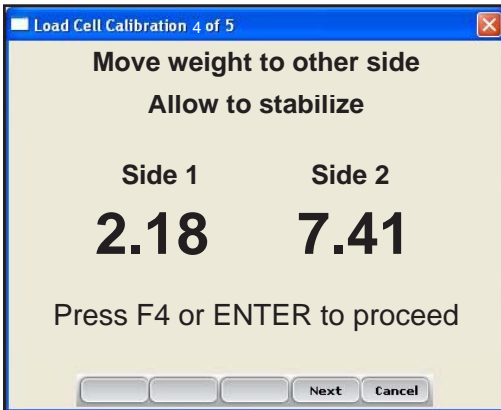
Figure 3-7: Load Cell Calibration screen 4 of 5

11. Move the weight to the other side of the weigh bucket for calibration.
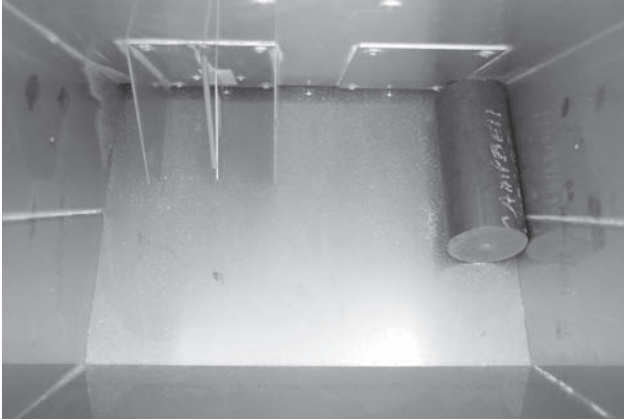
Figure 3-8: Weight on the other side of the weigh bucket

12. Click **Next** (F4) or press **Enter** to get a new weight reading. If the calibration was successful, new load cell calibration coefficients will be displayed under **Current calibration coefficients** along with the previous calibration coefficients.
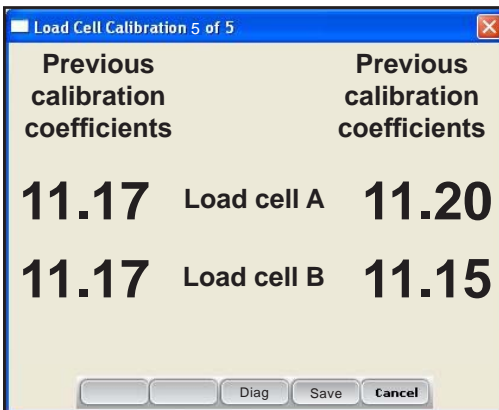
Figure 3-9: New and current calibration coefficients are displayed

Note: You can check your load cell calibration from this screen by selecting *Diag.* (F3). The Diagnostics screen appears. Click *Close* (F5) to close the Diagnostics screen and return to the last step in the calibration menu.

13. Click *Save* (F4) to accept the calibration changes and return to the Setup menu.

Edit Weight Calibration

You can manually adjust load cell calibration coefficients by selecting *Edit Weight Calibration* under *Weight Calibration* on the Setup menu.
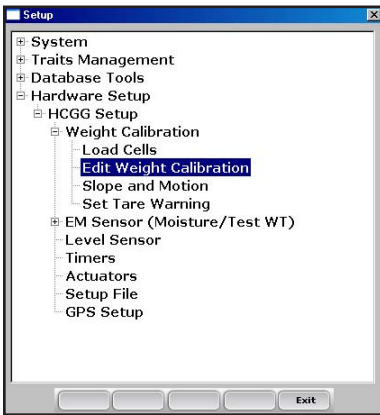
Figure 3-10: Select **Edit Weight Calibration** *on the Setup menu*

The **Edit Weight Calibration** screen appears, shown in
Figure 3-11. If you know the load cell coefficients for each
load cell, you can enter them here. If you do not know the
coefficients, calibrate the load cell using the calibration
wizard described earlier in this chapter.
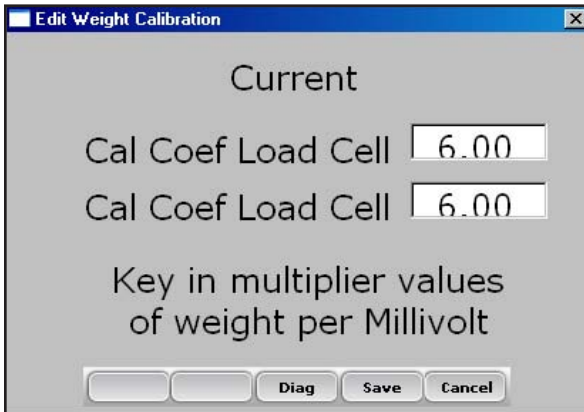
Figure 3-11: Edit Weight Calibration screen

Slope and Motion

The Slope and Motion Sensor refers to patented technology
used to eliminate errors created by combine vibrations. The
sensor lets you collect weight readings while the combine is
in motion. To set the sensor, follow these steps:

1. From the Setup menu, select **Hardware Setup** > **HCGG Setup** > **Weight Calibration,** then arrow down or select **Slope and Motion.**
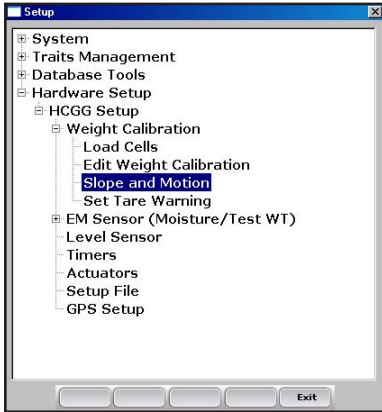
Figure 3-12: Setup menu with Slope and Motion selected

Figure 3-13: Slope and Motion Setup screen with the Slope and Motion Sensor turned off

With HM800 electronics, an internal Slope and Motion is used. Select the internal Slope and Motion. No weight value

is required with internal Slope and Motion and the combine should still be level and the motor turned off.

4. To disable the Slope and Motion Sensor, select **OFF.**
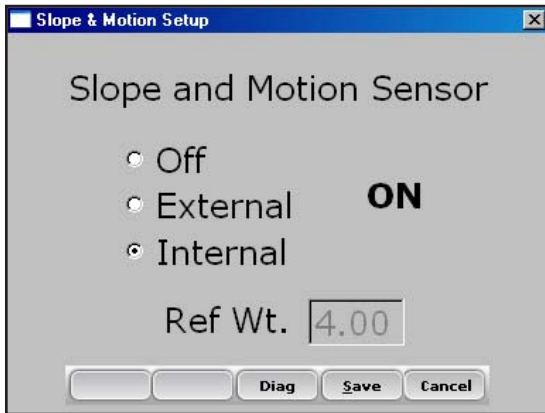
Figure 3-14: Slope & Motion Setup screen with the Slope and Motion Sensor turned on

Set Tare Warning

During harvest, the HCGG software checks that the bucket has returned to its tare or zero weight after the weigh bucket has been emptied. If the weight or moisture value does not return to the tare value (indicating that perhaps grain or trash has lodged in the plot bucket), an error message appears, indicating the system did not tare. If you see this error message, stop and check the bucket because the system does not stop cycling when this message appears.

To adjust the tare threshold (the point at which the error message appears) so that it checks the system more or less frequently, follow these steps:

1. From the Setup menu, select **Hardware Setup** > **Weight Calibration** > **Set Tare Warning.**
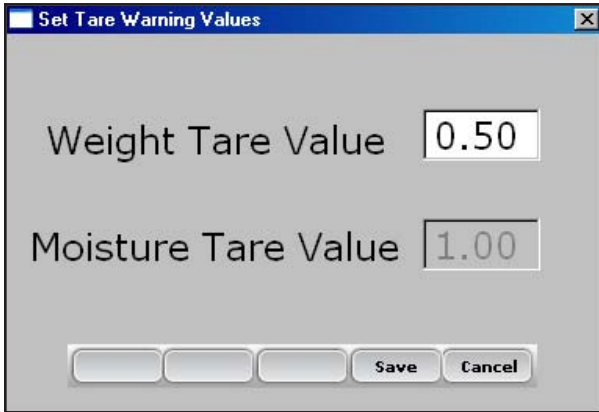
Figure 3-15: Set Tare Warning Values screen

2. Set the weight Tare to the desired value.

Note: The default Tare setting for the HCGG is 0.5 lbs. The moisture default is 1% and is not adjustable.

EM Sensor (Moisture/Test WT)

The HCGG system can use the EM Grain Moisture sensor for both moisture and test weight measurement. Two

options are available under **EM Sensor (Moisture/Test WT):**
Moisture Curve and **Test Weight Coefficients.** Each option is
described below.
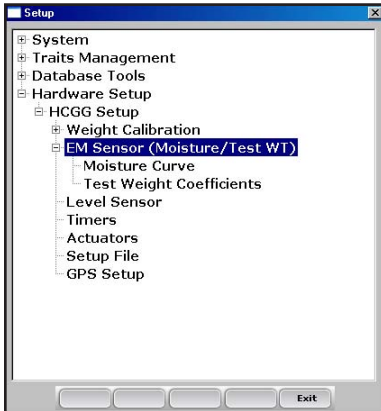
Figure 3-16: Setup screen with EM Sensor option selected

Moisture Curve

Editing a moisture curve

To edit a moisture curve, follow these steps.

1. Select **Setup** (F3), then choose **Hardware Setup** > **HCGG**
   Setup > **EM Sensor** > **Moisture curve.**
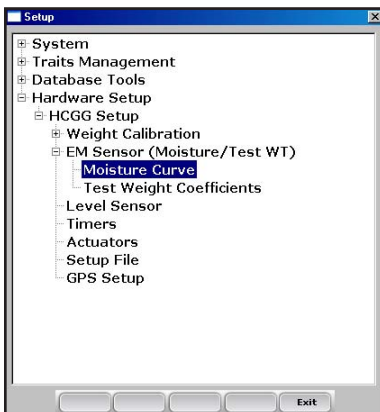
Figure 3-17: Moisture Curve screen selected

The **Moisture Curve** screen appears, listing any existing moisture curves and giving you the option to edit, delete, or copy moisture curves. Each of these actions is described in more detail below.

Note: The check mark next to one of the curves indicates the curve most recently used.
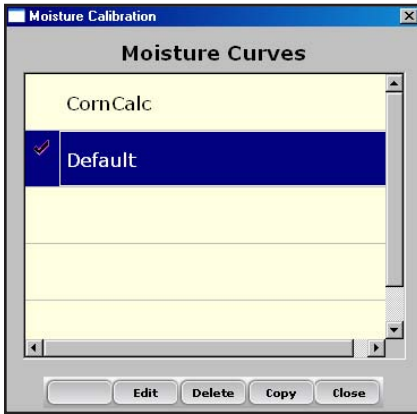
Figure 3-18: Moisture Calibration main screen

The **Moisture Calibration** screen lists all moisture curves that have been created. One of the curves is a **Default** grain moisture sensor curve that comes with FRS. It can be copied but not modified. The default curve consists of a set of known data points, which the system uses when making the moisture measurement on a sample of grain.

When plotted in a spreadsheet, the default curve appears like the graph (see Figure 3-19).

Default Moisture Curve

Moist %	MV
0.00%	0.00
10.00%	1.22
13.00%	1.61
16.00%	1.93
19.00%	2.19
22.00%	2.41
25.00%	2.60
28.00%	2.77
31.00%	2.93
34.00%	3.07
37.00%	3.19
40.00%	3.30
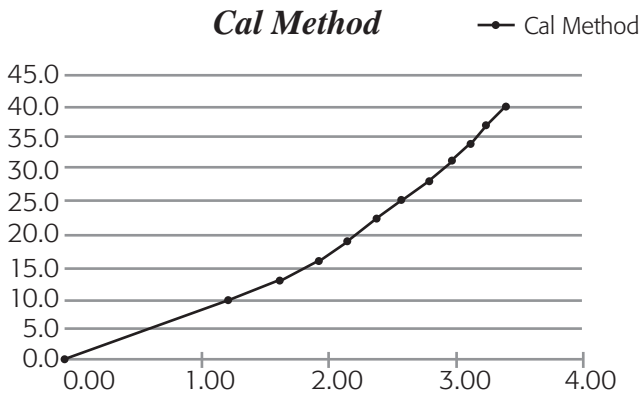
Figure 3-19: Default moisture curve as it appears in a spreadsheet (top) and as it appears in a graph (bottom)

To check moisture, choose **Diags** (F4) on the main FRS screen then select **Moisture.** Record the Rel Vlts and the Moisture (%) from each sample that has been cycled through the grain gage. Compare the Moisture (%) reading with a known percent moisture from a standard.
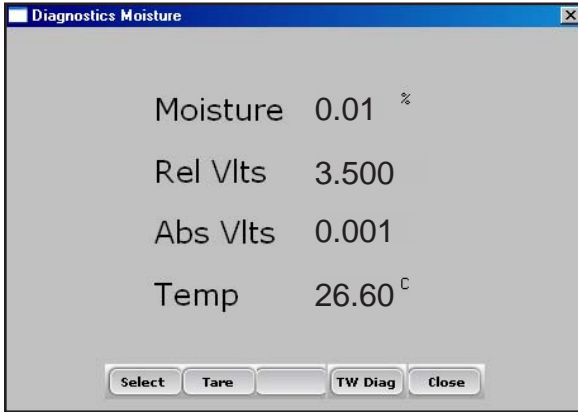
Figure 3-20: Diagnostics Moisture screen

2. Adjust the moisture curve by adjusting individual points in the curve or by adjusting the value of the Calibration Temperature. The following sections explain how to make adjustments to individual points, how to adjust the moisture grain temperature, how to delete a curve, and how to copy a curve.

Note: We recommend creating a different moisture curve for each different grain type. A custom spreadsheet to aid in adjusting your moisture calibration can be found on the HarvestMaster web site. This spreadsheet helps you adjust the points on the moisture curve to match your system.

Go to ***www.harvestmaster.com*** to access the spreadsheet and choose ***Support*** > ***Downloads.*** Choose the link called ***EM Moisture Sensor Curve Calculator*** to view the spreadsheet.

Adjusting Individual Points

To adjust individual points, follow these steps:

1. Select the moisture curve you want to edit and click ***Edit*** (F2).
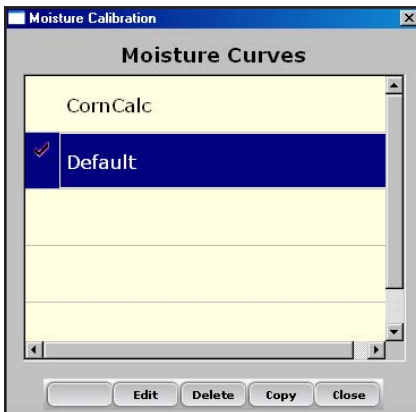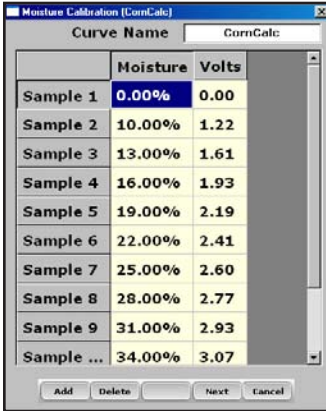
Figure 3-21: Moisture Calibration main screen
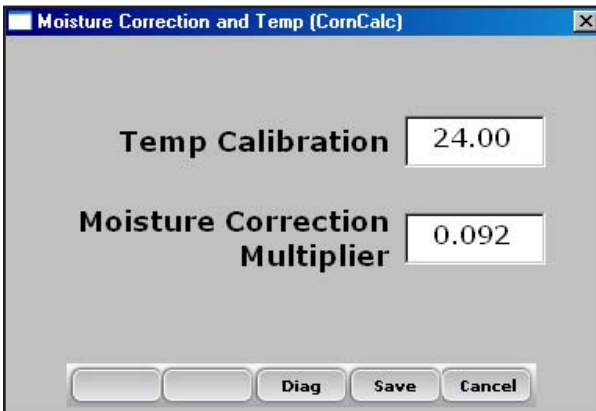
2. Select the percent or volts you want to adjust, and enter the new values.

Figure 3-22: You can edit Moisture or Volts for a sample

3. Select *Next* (F4) to save your changes to the moisture curve and advance to the Moisture Correction and Temperature screen.

Figure 3-23: Moisture Calibration Correction and Temperature screen

We recommend setting Temp Calibration to the current temp reading found in the diagnostics menu.

Note: When grain moisture readings are harvested at a different temperature than the temperature during the original calibration, the grain moisture measurement needs to be corrected to adjust for this difference. The HCGG System automatically makes this moisture correction based on the Temp Calibration and Moisture Correction Multiplier found in the screen above.

4. When you are finished editing your moisture curve, click **Save** (F4) to exit and save your changes.

Adjusting the Grain Moisture Temperature

You can also use the temperature calibration to make small adjustments to moisture readings taken by the system. To change the temperature calibration to match your grain samples, follow these steps:

1. From the Main FRS screen, Select **Setup** (F3), then **Hardware Setup** > **HCGG Setup** > **EM Sensor (Moisture/ Test WT)** > **Moisture Curve.**

2. Select a moisture curve then select **Edit** (F2) or **Copy** (F4).

3. Click **Next** (F4). The Moisture Correction and Temperature screen appears.
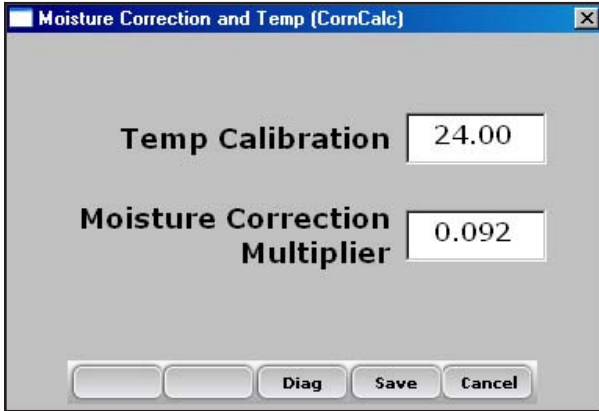
Figure 3-24: Moisture Correction and Temperature screen for the "corncalc" curve

Even though the moisture correction is automatic, changing the Temp Calibration shifts all moisture readings up or down, depending on if the temperature was increased or decreased. If you find that your new moisture reading is consistently high over the whole range, you can lower the calibration temperature to decrease all moisture readings. You can also raise the calibration temperature if your moisture is consistently too low. This is an easy way to fine-tune the moisture curve after calibration.

Follow these steps to calculate the proper temperature adjustment:

1. If the HCGG provides a different moisture value than your actual moisture value (e.g., 19.5% instead of

18.5%) and you'd like to adjust it, use this formula to figure out the calibration value:

$$\text{(Actual Moisture} - \text{HCGG Moisture)/}$$
$$\text{Moisture Correction Multiplier} =$$
$$\text{Mstr. Temperature Calibration}$$

$$18.5\% - 19.5\% / 0.092 = -10.87 \text{ C}$$

2. Next, add this value to your existing temperature.

   Note: If the calibration value you calculated in Step 1 is negative as in the example above, keep the negative sign.

   In this example, assume the existing temperature calibration is 27 C:

$$\text{Temp Calibration} + \text{Mstr Temp Cal} =$$
$$\text{New Temp Calibration}$$

$$27.0 + (-10.87) = 16.13$$

3. Save any changes you made to the settings on the Moisture Correction and Temperature screen by clicking *Save* (F4). You can check the moisture calibration by selecting *Diag* (F3) before saving your changes.

Deleting a Curve

The *Delete* option in the Moisture Curve menu allows you to remove unwanted moisture curves. To delete an unwanted moisture curve, follow these steps:

1. Select the curve you want to delete and click **Delete** (F3).
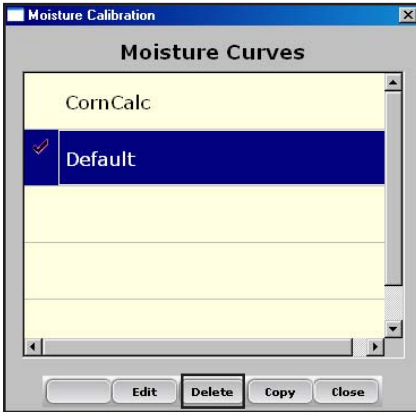
Figure 3-25: Delete a moisture curve by selecting it and clicking* Delete *(F3)

2. Confirm the delete by selecting **Yes** or **No.**
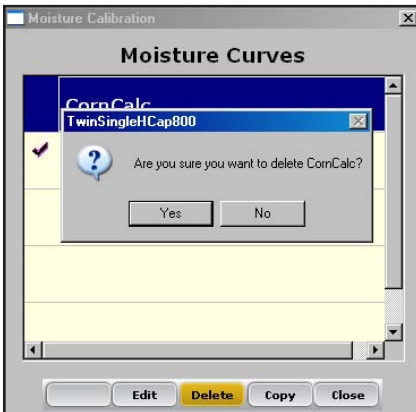
***Figure 3-26: Warning screen requires you to choose* Yes *or* No**

Copying a Curve

The Default Moisture cannot be modified. To make changes to this curve you must first make a copy of it. Follow these steps to copy a curve:

1. Select the moisture curve you want to copy or rename and then click **Copy** (F4).

2. Type in the new name of the moisture curve, make any desired changes, then click **Next** (F4).

3. Select **Save** (F4) to save the file and exit the screen.
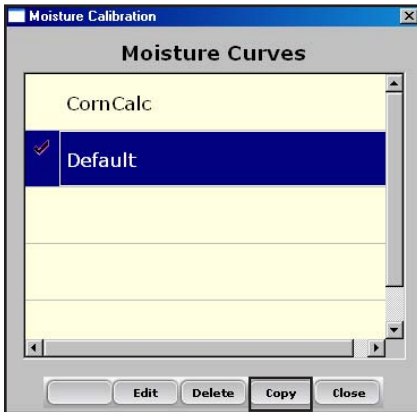
Figure 3-27: Copy a moisture curve by selecting it and clicking Copy (F4)

Test Weight Coefficients (test weight calibration check)

Note: If your systems is equipped with a Bulk Density Sensor refer to Chapter 4 for setup and calibration.

After you have adjusted the moisture curve but before you do any weight measurements, prepare to gather the needed test weights by following these steps:

1. From the Main FRS screen, Select **Setup** (F3), then **Hardware Setup** > **HCGG Setup** > **EM Sensor** > **Test Weight Coefficients.** The Test Weight Coefficient screen appears.

Figure 3-28: Test Weight Coefficient screen

Test Weight is determined by changes in the voltage and frequency of the EM Grain Sensor rather than by volume methods. Coefficient V (CoefV) and Coefficient F (CoefF) values have been optimized; **DO NOT ADJUST THEM.**

To adjust test weight measured by the EM Grain Sensor adjusting Coefficient Z, as explained below.

Coefficient Z is an offset adjustment used to adjust the measured test weight positively or negatively to match the actual test weight. In the event that the measured test weight is higher than the actual test weight, decrease the Coefficient Z. The example below aids in this adjustment.

2. Before adjusting the Test Weight Coefficient Z, get to know the following terms.

   - **Actual test weight** is the true test weight of the grain as measured by a USDA or other standard method.

   - **Measured test weight** is the test weight measured by the EM Grain Sensor and the GrainGage.

3. To adjust your test weight reading, determine the actual test weight of the grain sample by using a USDA quart cup or some other standardized method. Enter the diagnostics screen by selecting ***Diag (F3)*** to see the measured test weight and then pour the grain sample into the weigh bucket

Use the formula below to figure out how much to adjust Coefficient Z to create the New Coefficient Z value.

<div align="center">

Actual Test Weight – Measured test weight = Coefficient Z adjustment value

</div>

For example, if the system produces a measured test weight of 55.62 lbs/bu (pounds per bushel) but the

actual test weight was 54.62 lbs/bu, then you would need to decrease the Coefficient Z value by 1.

Figure 3-29: Example shows Test Weight

54.62 lbs/bu − 55.62 lbs/bu = −1.00 lbs/bu

In the Figure 3-30, the Coefficient Z value is 67.00, so changing the Coefficient Z value by −1.00 changes the new Coefficient Z to 66.00.

Figure 3-30: The new Coefficient Z value in this screen differs from the old value by −1.00

Level Sensor

The level sensor is used to automatically cycle the system when harvesting strip tests or plots longer than 20 ft. (6 m).

To view or change the settings of the level detect sensor, follow these steps:

1. Choose **Setup** (F3) on the main FRS screen, then select *Hardware Setup* > *HCGG Setup* > *Level Sensor.*
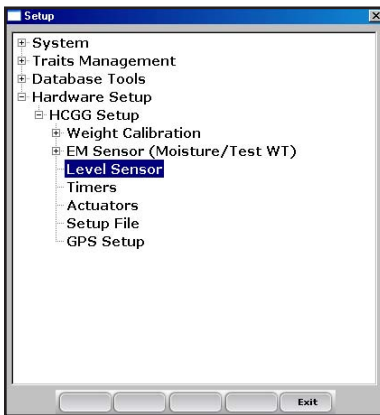
Figure 3-31: Choose Level Sensor from the Setup menu

The Level Detect Sensor Settings screen appears (see Figure 3-32).
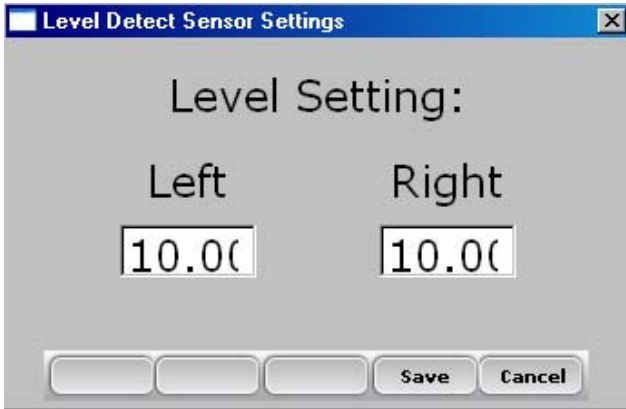
Figure 3-32: Level Detect Sensor Settings main screen

2. For most grains, set the level sensor to 10.0. The level's setting indicates the trigger point of the level sensor while harvesting in strip mode. A higher value corresponds to a less sensitive operation, which allows more grain to fill the bucket before beginning a measurement sequence.

3. Select **Save** to save the settings or **Cancel** to exit.

Timers

The Timer screen is used to adjust various timers used with the system. Each of these timers can be adjusted using the Timer Setup screen, which is available by choosing **Setup (F3)** from the main FRS screen then selecting **Hardware System** > **HCGG Setup** > **Timers.**
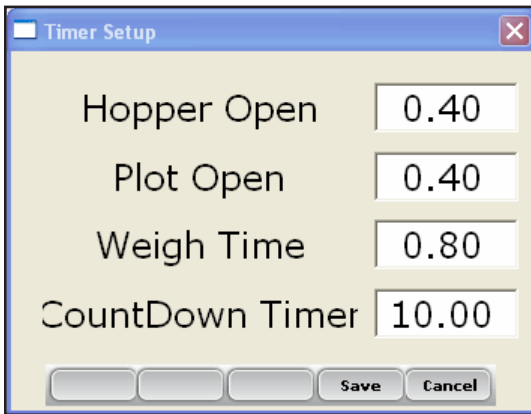
Figure 3-33: Timer Setup screen

- **Hopper Open.** The amount of time the hopper door remains open before beginning the close process. Note: 1.00=one second.

- **Plot Open.** The amount of time the plot door stays open before starting the close process.

- **Weigh time.** The amount of time data is collected and averaged to determine the actual weight reading

Chapter 3

• **CountDown timer.** The amount of time from when the enter key is pressed until the system starts to cycle. Usually equal to the time it takes for the combine to clean out or the time it takes for the last grain kernels to travel from the head of the combine to the hoppers. Note: 1.00=one second.

Actuators

The Actuator Setup screen is used to select the appropriate type of actuator and transition times for your system. To access the screen, choose **Setup** (F3) on the main FRS screen then select **Hardware Setup** > **HCGG Setup** > **Actuators.**
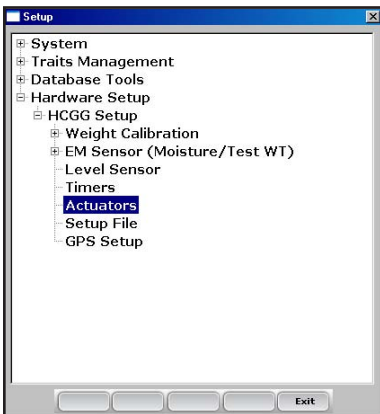
Figure 3-34: Select Actuators from the Setup menu to access the Actuator Setup screen

Once you see the Actuator Setup screen, select the appropriate actuator type from the drop-down menu for each actuator.
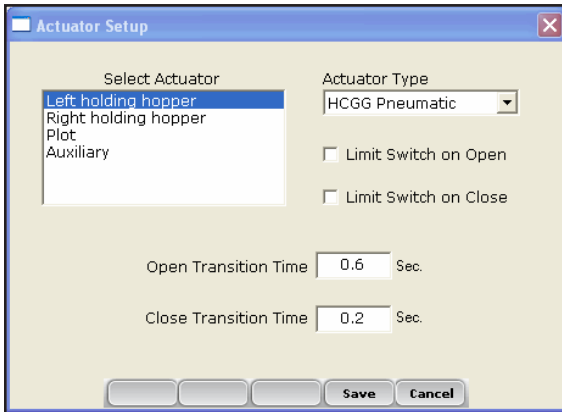
Figure 3-35: Actuator Setup screen

Setup File

The **Setup File** option on the Setup menu is a way to establish specific settings for a specific machine. This is helpful if you want to use your laptop with more than one combine. The steps below explain how to establish setup files for two combines.

1. Set up and calibrate one combine.

2. Enter the Setup File screen by selecting *Setup File* in the Setup menu. A list of existing setup files appears.
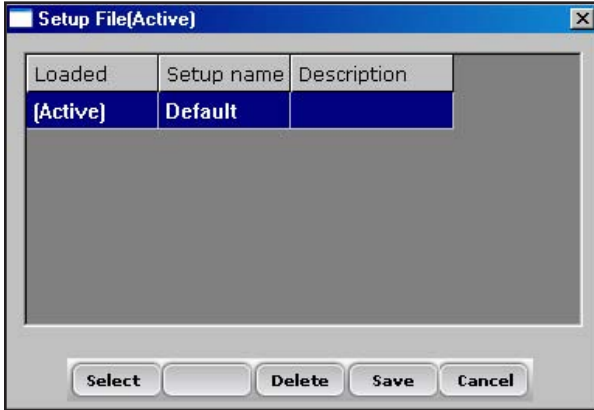
Figure 3-36: Setup files that appear by default

By default, the settings you created when you set up and calibrated the laptop were saved to the Default setup file.

3. To create a setup file for a second combine, selecting *Save* (F4).
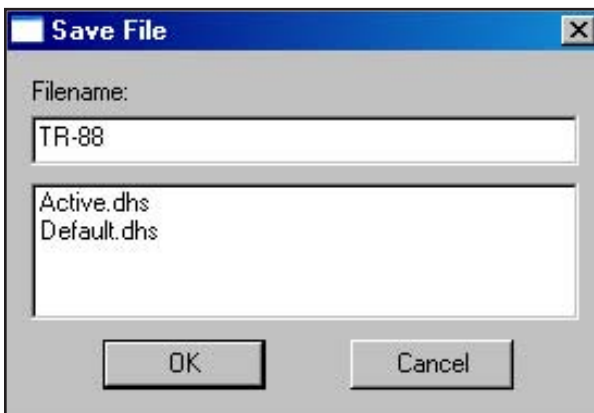
Figure 3-37: Naming a new setup file

4. Create a name for the second setup file.

5. Repeat steps 1-2. The new setup file appears.
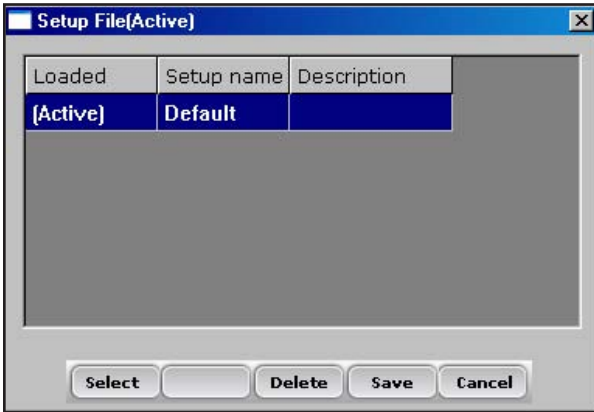
Figure 3-38: The new setup file appears

6. As you can see in the first column, this second setup file is now the active file, which means that any setting and calibrations changes you make are automatically saved to that file. To make another setup file active, select it then click **Select.**

   To create setup files for additional machines, repeat the process.

BULK DENSITY SENSOR

Bulk Density Sensor

Bulk Density Sensor

Bulk Density Sensor

The Bulk Density Sensor (BDS) is an innovative design to measure grain test weight in the HarvestMaster High Capacity CrainGage. The BDS measures test weight using the traditional volumetric method. The BDS is compatible with HM800 Twin and Single High Capacity GrainGages.

Figure 4-1: BDS cup inside bucket and outside of bucket

The central parts of the BDS include a precision load cell and a cylindrical volume cup with dumping door and leveling arm. These items are mounted inside the weight bucket of the High Capacity GrainGage.
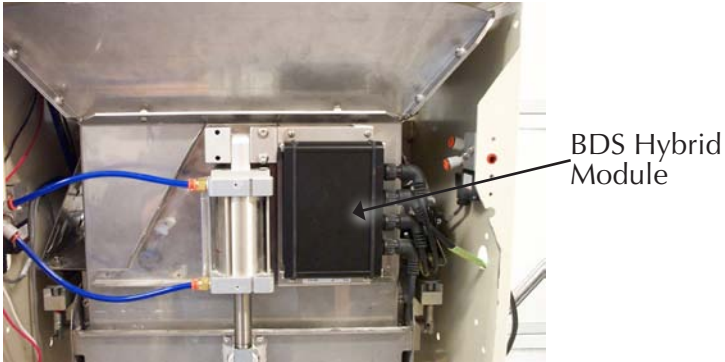
Figure 4-2: Picture of BDS Hybrid on bucket.

Electronic control and measurement for the BDS is performed by the HM800 Hybrid Module. This module controls the cycling of the door that empties the BDS cup and the sequence of the leveling arm used to clear excess grain off the BDS cup. The BDS Hybrid also provides an analog input for the precision load cell.

A unique feature of the BDS Hybrid is its internal motion compensation. This feature internally compensates the final BDS test weight data to account for vibrations and movement that typically occur when measurements are made on the combine. These vibrations can cause errors in the resulting test weight data. With the internal compensation, BDS test weight data accuracy and repeatability is superior over other standard methods of test weight measurement.

Inputs to the BDS Hybrid module are as follows:

- LC (Load Cell Input)
- PWR (+12v Power)
- CAN (communications from BDS Hybrid to the HarvestMaster system)
- ACT (actuator input for the BDS Cup Door and Level Arm)

The BDS Hybrid also includes LED diagnostics for troubleshooting and communications. LED function is outlined below.

- PWR—solid Green LED when 12v power is applied

- RX—Flashing Red LED indicating data is being received by the BDS Hybrid. When no data is being sent to the hybrid, this LED remains unlit.

- TX—Flashing Red LED indicating data is being transmitted from the BDS Hybrid. When no data is being sent from the hybrid, this LED remains unlit.

- IND—Flashing yellow light every second indicates the BDS Hybrid is functioning correctly.

Refer to Figure 4-3 for location of connectors and LEDs.

Figure 4-3: Side view of BDS Hybrid showing connectors and labels.

The BDS Hybrid communicates from the CAN communications connector to the CAN Breakout box located inside the High Capacity. The short CAN Terminator

normally installed on the CAN Breakout box should be
moved to the CAN Diagnostics port found on the HM800
Analog module. Refer to the HM800 Wire Diagram for
further information.
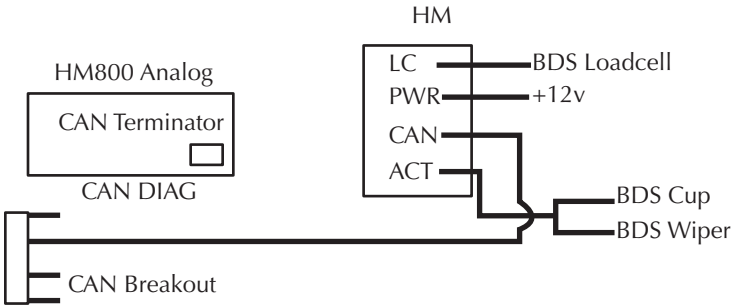
Figure 4-4: HM800 Wire Diagram

Figure 4-5: Analog module

FRS with BDS

To start using the BDS system, the BDS High Capacity
software should first be installed onto the laptop. The
BDS module can then be enabled. Refer to the section on
installing FRS software found in the FRS User's Guide.

Enable Twin/Single Bulk Density Sensor

To enable the Bulk Density Sensor (BDS), select **Setup** (F3) from the main FRS Screen. Expand the System tree then go to **Manage Devices.**
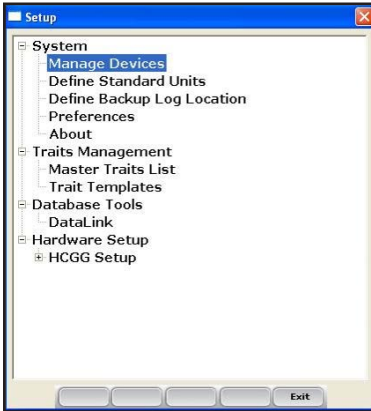
Figure 4-6: Manage Device Setup screen
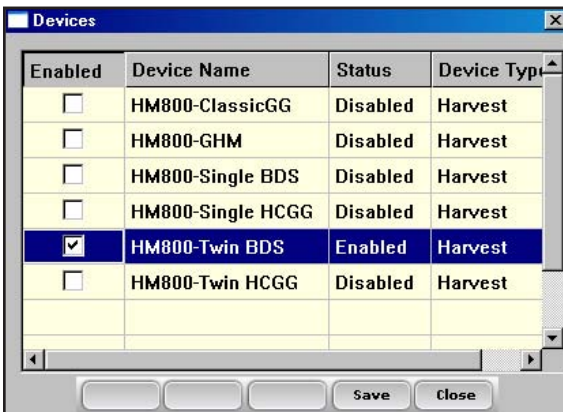
Figure 4-7: Enable BDS screen

The BDS module can be enabled by highlighting the selection and clicking the screen to select or by pressing the space bar. Click **Save** (F4) to save and exit.

BDS Calibration and Setup

To calibrate the BDS, select **Setup (F3)** from the main FRS screen.
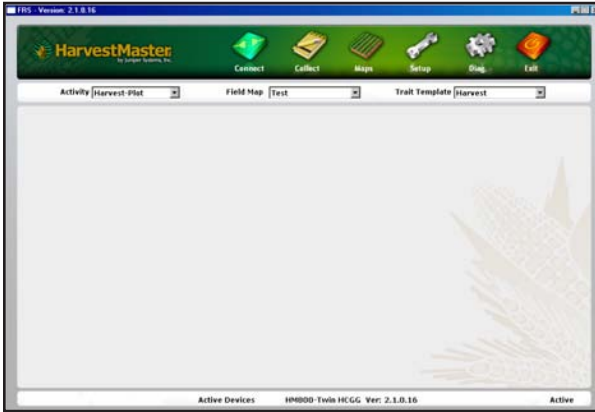
Figure 4-8: Main FRS screen

From the Setup menu, arrow down to **HCGG Setup**. Expand this menu tree and arrow down to the **Test Weight** menu item, then select **Enter.**
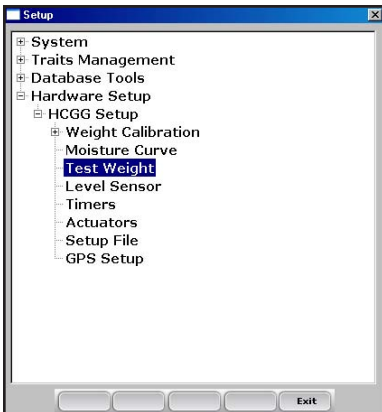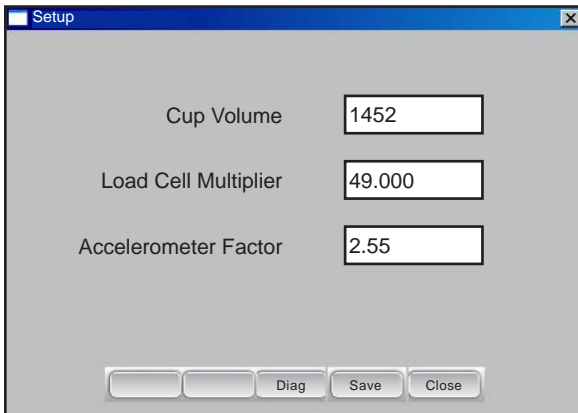
Figure 4-9: BDS Setup Screen

Description of BDS Setup screen

Figure 4-10: Test Weight Setup Screen

Cup Volume

The Cup Volume is used to adjust the actual volume of the BDS cup to account for difference in grain compaction and grain types. It is recommended to check Test Weight accuracy and adjust cup volume for each type of crop harvested. Typical value is between 1450 and 1550. Units for the cup volume do not change between English and Metric units.

Load Cell Multiplier

The load cell multiplier is used to adjust the calibration of the BDS based on variation in the load cells. For greatest accuracy the load cell multiplier for each BDS system should be calculated.

Typical value for the Load Cell Multiplier is 450 to 500.

Accelerometer Factor

The Accelerometer Factor (AF) setting for the BDS is generally set to a value between 2.00 and 2.70. Its purpose is to "amplify" the correction factor for vertical motion sensed by the Bulk Density Sensor (BDS) signal conditioning unit during a measurement. To disable the slope and motion compensation for BDS readings, set the Accelerometer Factor to 0.00.

BDS Calibration and Verification

Weight Calibration

The first step to calibrating the BDS system is to set the load cell multiplier and verify accuracy against a known standard weight. A precision weight for calibrating the BDS is included with each BDS system.

Figure 4-11: BDS Calibration weight.
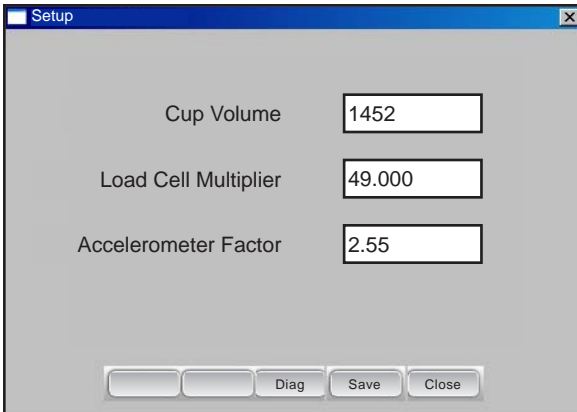
Figure 4-12: Test Weight Setup Screen

To adjust the Load Cell Multiplier, enter Diagnostics by selecting F3. Tare the LC and Accelerometer by selecting F1 then F2 in the Diagnostics screen.

Note: It is important that the combine be turned off and as level as possible before setting the Tare on the Accelerometer.
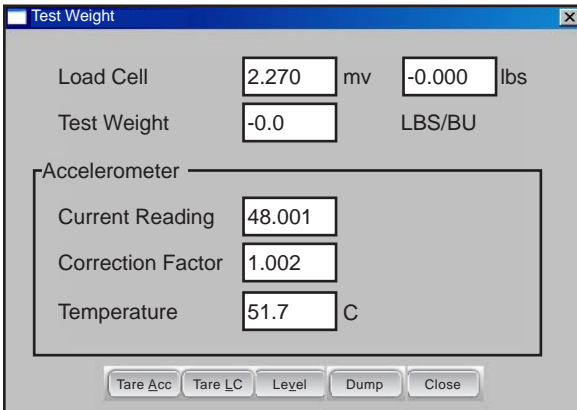
Figure 4-13: Diag TW screen

Place the BDS Calibration weight inside the BDS cup and observe the weight reading in the diagnostics screen.

Figure 4-14: Weight being placed in BDS cup
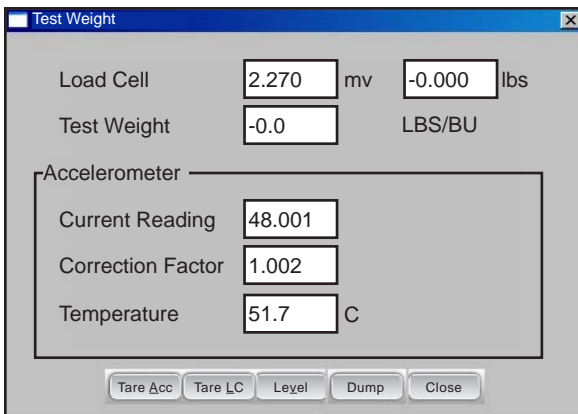
Figure 4-15: Diag TW Screen

If the weight reading observed in diagnostics does not match the actual value of the calibration weight, use the following formula to adjust the Load Cell Multiplier.

Select **Close** (F5) to return to the **Setup** screen.

New Load Cell Multiplier=
Actual Weight/BDS Measured Weight * Load Cell Multiplier
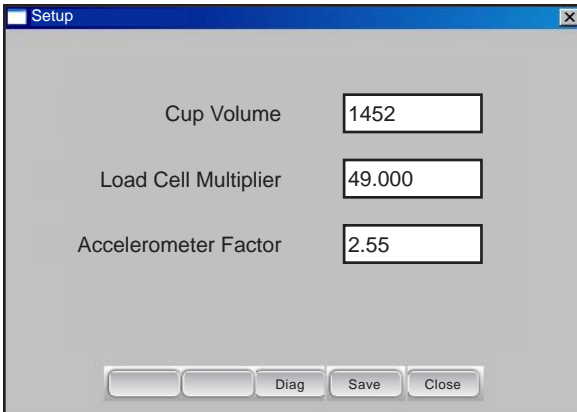
Figure 4-16: Test Weight Setup Screen

Key the new Load Cell Multiplier into the text box and select
Save (F4). Check load cell calibration in Diagnostics and
repeat tare and calibration if necessary.

Test Weight Calibration
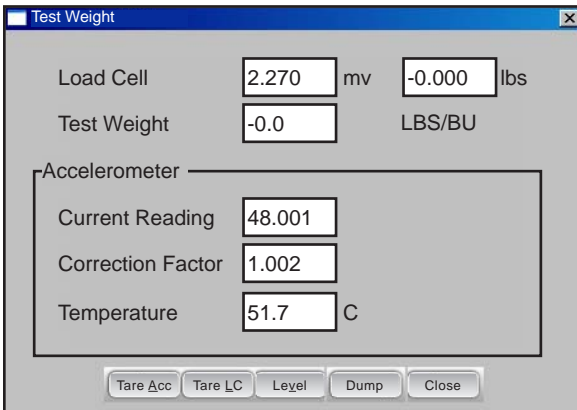
Figure 4-17: Diag TW with empty cup

Pour a known test weight sample into the BDS while in the
Test Weight Diagnostics screen. Select **Level** (F3) to level the

grain to the top of the cup. Observe the Test Weight reading in the diagnostics.

Note: Check that the grain sample in the High Capacity Weigh Bucket is not touching the bottom or sides of the BDS cup. It is recommended that the Weigh Bucket be opened when pouring and verifying a grain sample.

Test Weight	✕
Load Cell	4.598 mv	2.512 lbs
Test Weight	61.0	LBS/BU

Accelerometer

Current Reading	48.013
Correction Factor	1.001
Temperature	51.7 C

Tare Acc | Tare LC | Level | Dump | Close
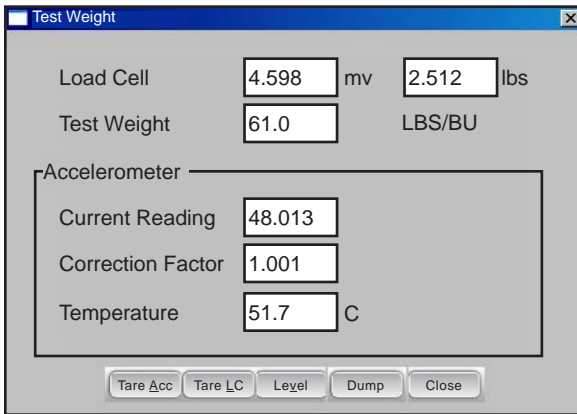
Figure 4-18: Diag TW with grain

If the test weight reading of the BDS does not match the known test weight of the grain sample, adjust cup volume using the formula below.

**New Cup Volume = BDS Measured TW /
Actual TW from Standard * Cup Volume**

Click **Close (F5)** to return to the **Setup** screen.
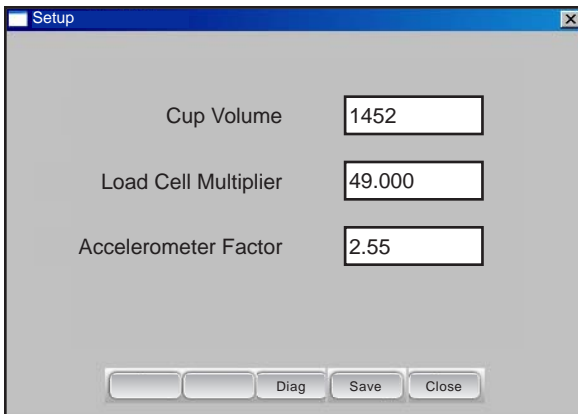
Figure 4-19: Diag Setup Screen

Key in the new cup volume into the setup menu then verify BDS test weight measurement again by dumping the grain sample into the BDS cup.

Setting the Accelerometer Factor (AF)

With the BDS installed and operational, use the following method to find the setting best suited for the harvester on which the system is installed. Have a fairly level area (e.g. empty parking area or a field) where the harvester can move forward and stop to simulate harvesting plots.

1. Set the BDS calibration weight in the top of the BDS sample cup.

2. Make observations in the test weight diagnostics screen to see which AF settings give the best results with harvester vibration and harvester motion. The harvester motion should include the up/down jolting of the machine which occurs with up/down positioning of the head.

3. With the BDS calibration weight on the cup and the combine still, Test Weight Diagnostics will display a constant weight typically around 2.50 lbs (61.016/bu) or the value of the BDS calibration weight. Determining the best AF value is an exercise in successive approximation, observing the diagnostics weight value for minimum variance while subjecting the machine to separator vibration as well as harvester forward/back motion and head up/down motion.

| Test Weight | ☒ |

| Load Cell | 4.598 | mv | 2.512 | lbs |
| Test Weight | 61.0 | | LBS/BU | |

Accelerometer
Current Reading	48.013
Correction Factor	1.001
Temperature	51.7	C

[Tare Acc] [Tare LC] [Level] [Dump] [Close]
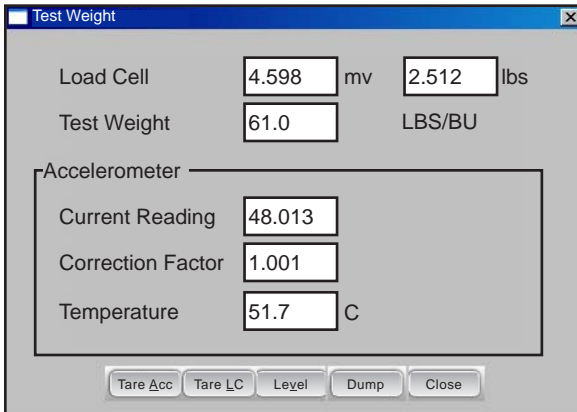
Figure 4-20: Test Weight Diag screen

4. Begin with AF = 2.55 (default value). Note the diagnostic weight value range with each of the harvester motions (separator and head running, forward/reverse harvester motion, and head up/down motion).

5. Perform subsequent repeats of step 4 with AF equal to values of 1.5, 2.0, 2.5, and perhaps even 3.0. There should be a range of AF values in which the variable of the diagnostic test weight reading is minimized. Typically, the Test Weight reading should not vary more than ±0.5 lb/bu while moving the combine head.

These calibration factors (Load Cell Multiplier and Accelerometer Factor) should be very stable for a given installation, and one would not expect to see them change from year to year.

BDS Diagnostics

The Diagnostics Test Weight menu allows you to view readings associated with the Bulk Density Sensor (BDS), which is used to measure test weight volumetrically. The following information appears on the screen.
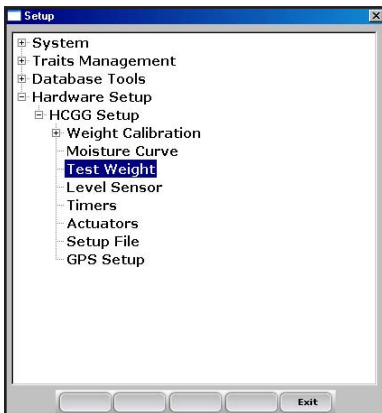
Figure 4-21: Diag Setup Screen
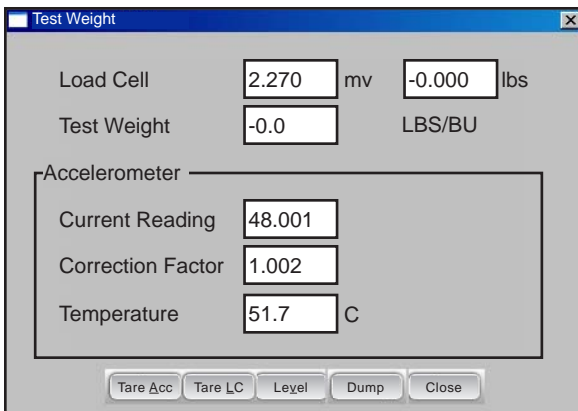
Figure 4-22: BDS Diag Screen

Load Cell

The millivolt reading for the load cell used with the BDS sensor is displayed along with the corresponding weight reading in lbs or Kg. By placing a know weight in the BDS cup, the weight accuracy can be verified.

Test Weight

Shows the converted test weight in lbs/bu or Kg/hL as measured by the BDS cup.

Accelerometer

Current Reading

Shows the current voltage reading from the internal accelerometer used to compensate BDS data readings to eliminate vibration errors.

Correction Factor

The amount of correction or compensation applied by the BDS to the test weight reading. A correction factor of 1.000 signals no compensation.

Temperature

Temperature of the BDS circuitry used for troubleshooting and monitoring of the BDS compensation.

Function Keys

- **Tare Acc (F1)** Sets the tare or reference value for the accelerometer. This should only be selected when the combine is turned off and level.

- **Tare LC (F2)** Sets the tare or zero point for the BDS load Cell.

- **Level (F3)** Extends the BDS cup level arm to provide uniformity in the amount of grain in the cup.

  To test BDS test weight accuracy, dump a grain sample into the holding hoppers then open hoppers to fill BDS cup. Select *Level* (F3) to level the grain in the cup. Record the value displayed in the Test Weight reading and compare this reading from the BDS to a known sample test weight. To adjust refer to BDS Setup section of manual.

- **Dump (F4)** Opens the BDS cup to empty contents in the BDS cup.

- **Close (F5)** Exits the Test Weight Diagnostics screen.

BDS Harvest Sequence

To begin harvesting with the BDS, first ensure the Twin or Single High Capacity GrainGage has been enabled.
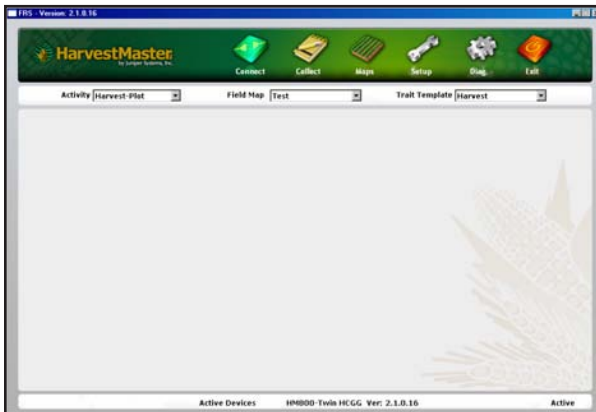
Figure 4-23: Main BDS FRS screen

A system with the BDS enabled operates in a similar manner to a regular High Capacity GrainGage except test weight is measured volumetrically with the BDS.

Once a BDS device has been enabled, follow the same harvest sequence by selecting **Collect** (F1) from the main FRS screen. Follow the initialization sequence found in Harvest Data Collection chapter of this manual.

The High Capacity with BDS, cycles in the same manner as a non BDS High Cap except when measuring test weight. Grain is dumped into the weigh bucket and the BDS is filled. Plot weight and moisture are recorded then the Plot door is opened. As soon as the Plot door opens, the BDS level arm extends to level the grain in the BDS cup. The test weight is then measured in the BDS cup and stored. The cup door opens emptying the grain then the plot door closes. The Plot bucket is now ready to accept grain from the next hopper.

Note: For best accuracy it is also recommended to install the wind guard when harvesting with the BDS. Contact HarvestMaster if a wind guard is not available.

C H A P T E R 5
DIAGNOSTICS MENU

Load Cell

Moisture

Test Weight

Level Detect Sensor

Actuators

Print Calibrations

Diagnostics Menu

The Diagnostics menu is designed to help you troubleshoot and test your hardware. To access this option, select **Diag.** (F4) from the main FRS screen. Six submenu options appear on the Diagnostics Menu page, shown in the following image. Each option is described below.
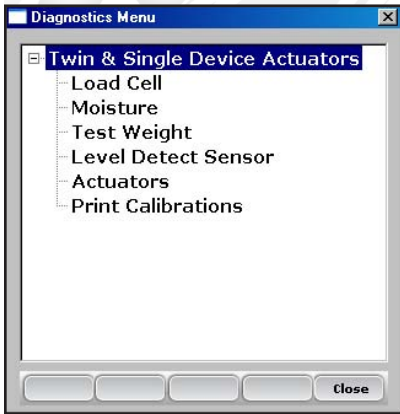
Figure 5-1: Diagnostics Menu screen

Load Cell

Checking the calibration

You can check the calibration of the load cell using the options on the Diagnostics Menu screen. Before you do that, however, first check the accuracy of your calibrations by ensuring that

• the combine is on level ground and out of the wind

• the weigh bucket is empty

• the calibration weight is close to the weight of a typical plot you plan to harvest

Follow these steps to check your load cell calibration:

1. From the Diagnostics Menu, select **Load Cell.** The Diagnostics Load Cell screen appears, shown here.
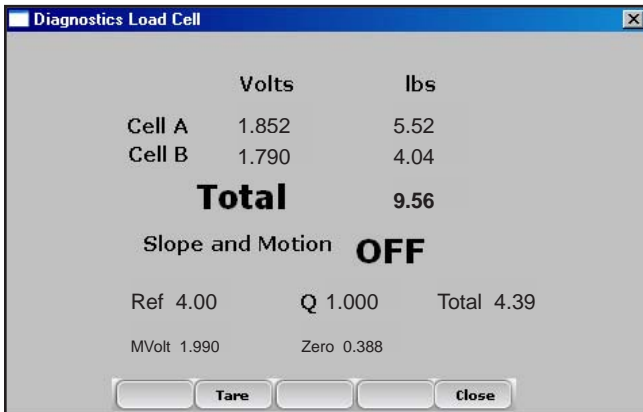
Figure 5-2: Diagnostics Load Cell screen

2. Make sure the weight values for Cell A, Cell B, and the total weight all equal close to zero. If not, tare the system by selecting **Tare** (F2).
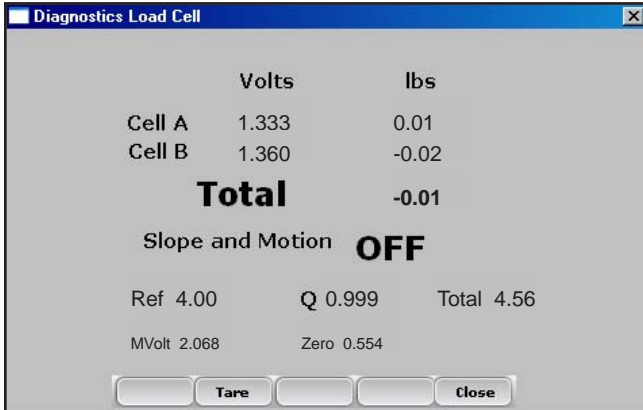
Figure 5-3: Weight values for Cell A, Cell B, and Total change after a tare

3. Place your known weight into the bucket.

4. The weight shown in the **Total** line should match your known weight. If the weight is incorrect, recalibrate the load cells by returning to the main FRS page and selecting **Setup** > **Hardware Setup** > **HCGG Setup** > **Weight Calibration.**

In addition to showing information related to the load cells, the **Diagnostics Load Cell** screen shows the values

associated with the Slope and Motion Sensor. Information for this screen is described below.
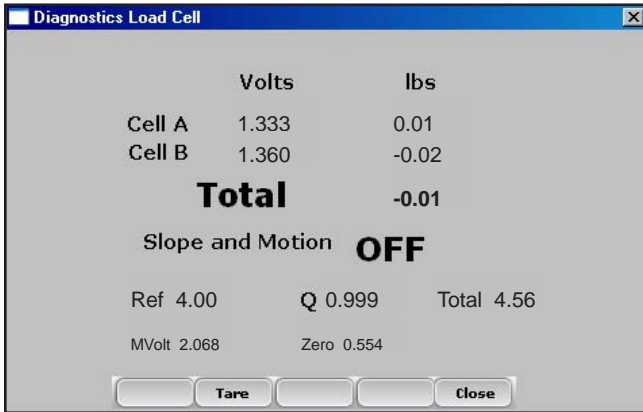
Figure 5-4: Elements of the Diagnostics Load Cell screen

Volts (voltage)

The Volts reading displays the raw voltage reading from load cells A and B.

Lbs or kg (weight)

The Weight reading displays the calibrated weights of the load cells.

Total

This value reflects the total weight on both load cells plus any adjustment if the Slope and Motion sensor was turned on.

Ref, Q, and Total

These values are used for calculations. Note that the Q value should typically read 1.000. If it does not, we recommend

that you disable then re-enable the Slope and Motion sensor from the Setup menu.

Slope and Motion status
The slope and motion status shows whether the Slope and Motion Sensor is turned **On** or **Off.**

Tare (F2)
Tares the load cells if the Total weight is not zero.

Moisture

The Moisture option allows you to view readings associated with the EM Grain Moisture sensor, which is also used to measure test weight.

To view the **Diagnostics Moisture** screen, select **Moisture** from the Diagnostics menu. The following information is displayed:
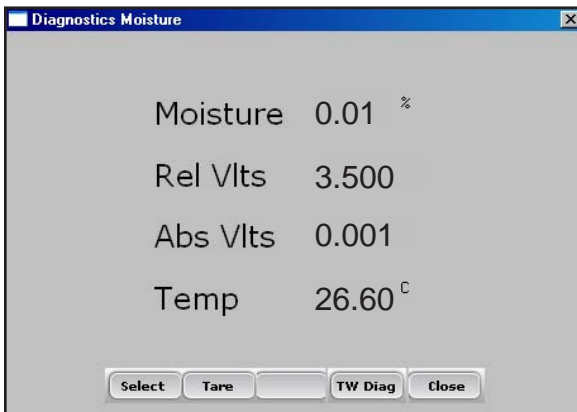
Figure 5-5: Diagnostics Moisture screen

Moisture

The percentage of moisture read by the moisture sensor.

Rel Vlts (Relative Volts)

The tared-out voltage reading of the moisture sensor.

Abs Vlts (Absolute Volts)

The raw voltage reading from the moisture sensor.

Temp (Temperature)

The temperature read from the moisture sensor.

Select (F1)

Clicking this soft key opens the moisture curve menu screen, allowing you to select a moisture curve to be used for checking calibration. Select the curve and then click **Select** (F1) again to return to the previous screen.

Tare (F2)

To tare the moisture reading, select **Tare** (F2).

TW Diag. (F4)

Takes you to the Diagnostics Test Weight screen. See the next section for more details.

EM Sensor Test Weight

Note: If a Bulk Density Sensor is installed, refer to Chapter 4 for Diagnostics.

The Diagnostics Test Weight menu allows you to view readings associated with the EM Grain Moisture sensor, which is used to measure test weight and moisture. The following information appears on the screen:
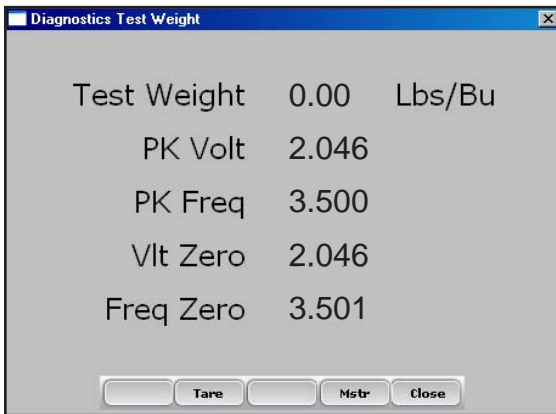
Figure 5-6: Diagnostics Test Weight screen

Test Weight
Appears in either pounds per bushel or kilograms per hectoliter, depending on which units you selected in the Setup menu. This example shows pounds per bushel. For details about selecting units, see the **Field Reference Guide (Note Taking)**.

PK Volt
Current voltage reading from the EM Grain Sensor

PK Freq
Current Frequency readings from the EM Grain Sensor

Vlt Zero
Tare Voltage Value

Freq Zero
Tare Frequency Value

Tare (F2)
Performs a tare of the test weight system.

Mstr (F4)
Takes you to the Moisture diagnostic screen. Since the EM sensor measures both moisture and test weight, navigation is provided from one to the other.

LED Codes on the EM Grain Moisture Sensor

Green, yellow, and red LED's (light-emitting diode) are designed into the sensor for service and diagnostics purposes. These LED's can be viewed by looking at the right side of the white plastic housing of the sensor. The function of the LED's are described as follows.

Green: On solid when +12 VDC is applied to the sensor

Yellow: Blinks whenever a message is transmitted from the sensor such as when the application software is in the moisture diagnostics menu.

Red: Indicates sensor error conditions. With no error codes, the red alternates one second on, then one second off.

Any error codes are represented by pairs of 'rapid blinking', the number of blinks corresponding to the first and second digit of an error code from the list below:

11. Watchdog reset has occurred

12. Timed Task Buffer overflow detected

13. Low memory alert (M < 50 bytes)

21. Input buffer overrun

22. Checksum error detected

23. Unrecognized command received by sensor

24. RS-485 busy encountered

25. Sensor response message aborted

32. Frequency measurement zero error (no oscillation counts)

33. Frequency measurement range error (over 3 Mhz)

41. Blade voltage range error

42. Temperature sensor zero error (reading at or below −15° C (5° F)

43. Temperature sensor range error (reading above +60° C)

44. System supply voltage below +10.0 Volts

45. System voltage above +18.0 Volts

55. Invalid error code reported

When the sensor is operating normally, no error codes should show. There should just be a steady one second on, one second off blink of the red. Otherwise, general interpretation would be:

11, 12, 13, 55:   Software system problems. Report to customer service and design engineering with description of circumstances.

21, 22, 23, 24, 25:   Faulty sensor wires, or faulty SCCU. These could be caused by some fault within the EM Moisture Sensor, but it is not likely.

32, 33, 41:   Likely cause would be a bad connection from the sensor to the ground plane around the blade, or from the sensor board to the blade.

42, 43:   Assuming the temperature is in a normal ambient range from -10 C to +40 C, these codes would indicate a failed temperature sensor, or board solder connection.

44,45:   These are more likely caused by a problem in the power supplied to the EMGS.

Level Detect Sensor

The Diagnostics Level Detect Sensor screen shows readings from the level detect sensor, which is used to detect the level of grain in a bucket. To access this screen, select **Diag** (F4) from the main FRS screen, then select **Level Detect Sensor.** The following information is displayed.

Diagnostics Level Sensor		
	Left	Right
Current	901.00	905.00
Tare Value	901.00	905.00
Trip Point	10.00	10.00

Tare · Close
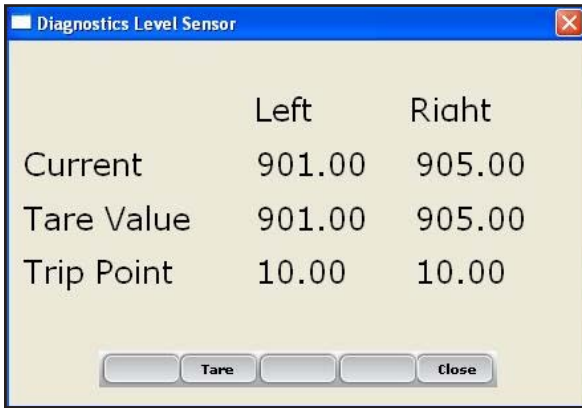
Figure 5-7: Level Detect Sensor screen

Current
The current readings from the level detect sensor.

Tare Value
The zero reference frequency

Trip Point
The minimum reading that the level detect must reach before cycling the system.

Tare (F2)
Retares the level detect reference frequency.

Actuators

This Actuator Controls screen allows you to open, close, or cycle any or all of the actuators. To access this screen, select *Diag. (F4)* from the main FRS screen, then select **Actuator.** The Actuator Controls screen appears.
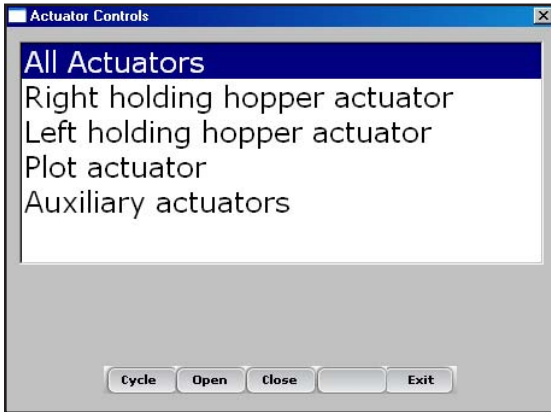
Figure 5-8: Actuator Controls screen

Select the actuator you want to control, and then choose from one of the menu options: **Cycle** (F1), **Open** (F2), or **Close** (F3).

Print Calibrations

The Print Calibrations menu allows you to print your calibration settings. To print, simply select one of the calibration options and select **Print** (F1).
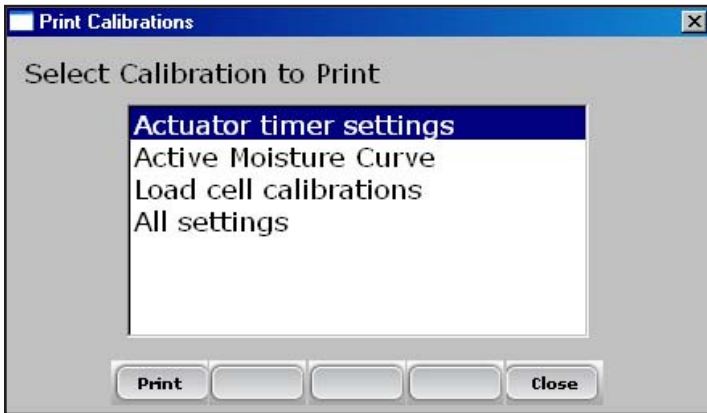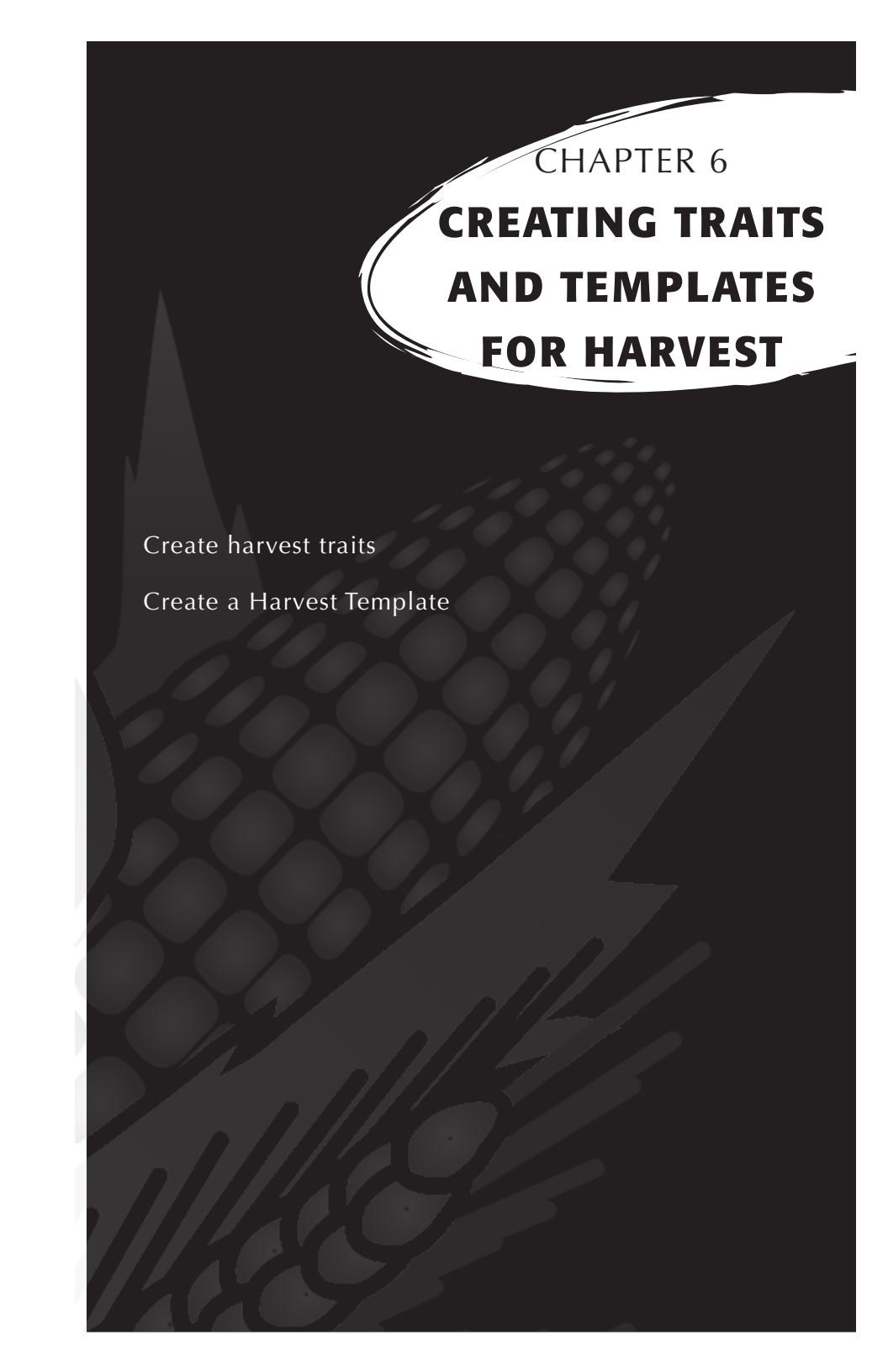
Figure 5-9: Print Calibrations screen

CREATING TRAITS AND TEMPLATES FOR HARVEST

Create harvest traits

Create a Harvest Template

Creating Traits and Templates for Harvest

Create harvest traits

Before you can collect harvest data, you first need to add or select harvest traits from the Master Traits List and create a harvest trait template for these new traits. FRS includes sample harvest traits and templates. You can create your own traits or modify the traits, that are included with FRS.
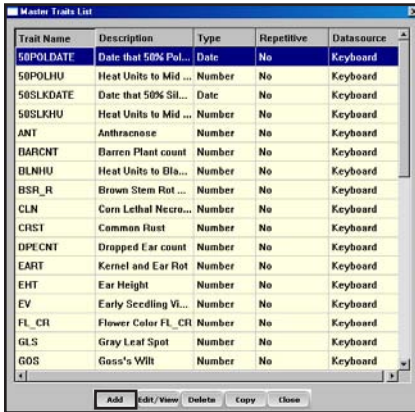
Note: It is especially important that traits that reflect data from the GrainGage such as moisture and weight are set up correctly in order for the software to register data from the hardware. If these traits are not set up correctly, data will not be recorded from these devices.

Adding a trait to the Master Traits List

Follow these steps to add a trait to the Master Trait List:

1. Open the Master Traits List screen by choosing **Setup** (F3) and clicking **Traits Management.**

2. Select *Add* (F1) from the Master Traits List screen.

Figure 6-1: Create a new trait list by selecting Add on the Master Traits List screen

3. Type in a name you would like to use for harvest traits. Common names used are *Moisture* for grain moisture, *Weight* for plot weight, and *Test* for the grain test weight.

    Important: If you are collecting harvest data, you need to create a trait for weight. Creating traits for moisture and test weight is optional.

Figure 6-2: Entering a Trait Name for a new trait

4. Skip down to Data Source on the screen and select **HM-Moisture, HM-Weight or HM-Test Weight** from the drop-down box, depending on which trait you are creating. In order for the trait data to be recorded from the GrainGage, the correct data source must be selected. The Type and Length information is automatic.
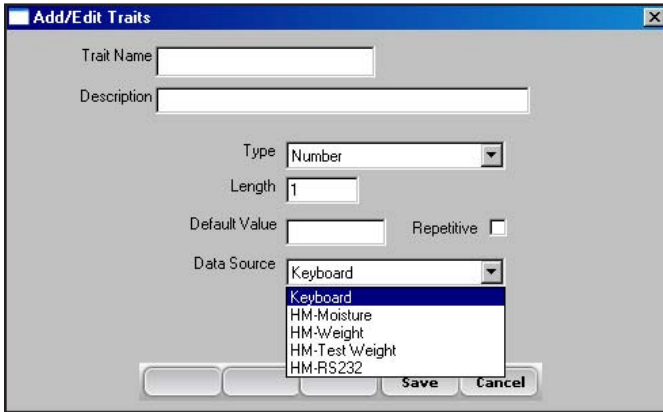
Figure 6-3: Selecting a Data Source

5. *(Optional)* Add a trait description to clarify the type of trait that has been created. Example: **Moisture of grain at harvest.**

6. Save the new trait by selecting Save (F4).
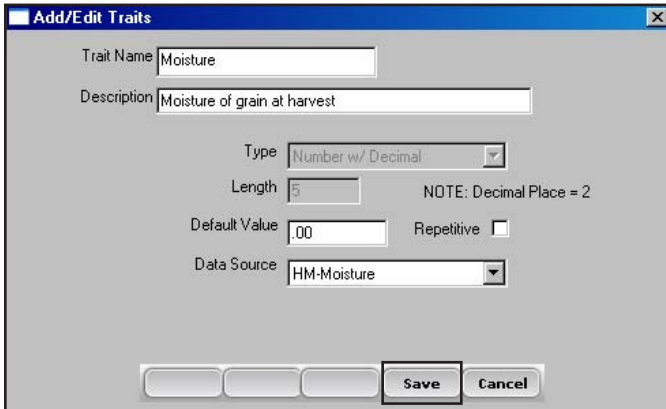
Figure 6-4: Saving a new harvest trait

Create a Harvest Template

After you have added harvest traits to the Master Trait List, create a trait template that contains these new traits.

To create a trait template, follow these steps:

1. From the Setup Menu, expand the Traits Management option and select *Trait Templates.*
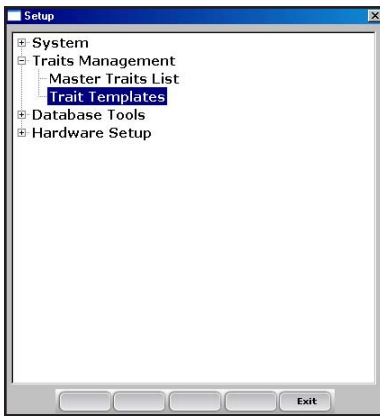
Figure 6-5: Select **Trait Templates** *to open the Trait Templates screen*
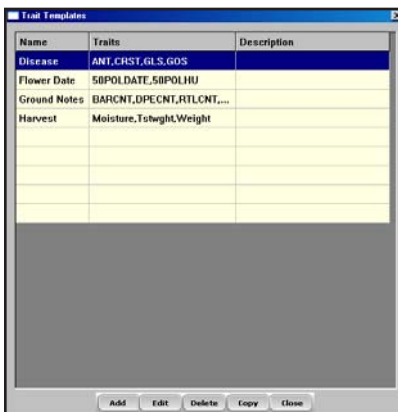
Figure 6-6: Trait Templates screen

2. Select **Add** (F1) to create a blank template. The **Add/Edit Trait Templates** screen appears.
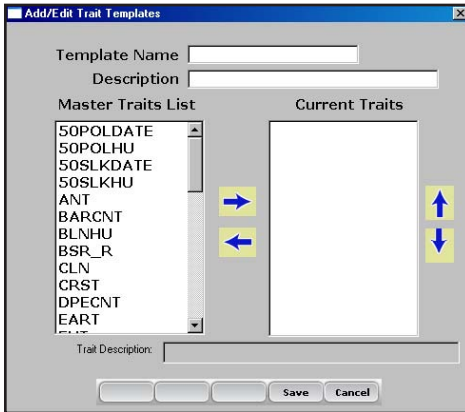
Figure 6-7: Add/Edit Trait Templates screen

3. Type a Template Name and Description to help identify the template. **(Harvest or Harvest Data are suggested template names.)**

4. Scroll down through the Master Traits List to find the Weight, Moisture and Test Weight traits you created. Highlight one of the traits, then click the right arrow in the middle of the screen to move it to the Current Traits window. In the example below, Weight, Moisture, and Test traits have been added as Current Traits.

Note: You can change the trait order by clicking the up or down arrows on the screen.
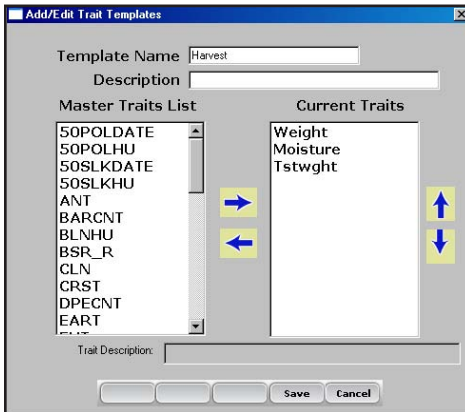
Figure 6-8: New template called Harvest

5. Select **Save** (F4) to save the new template.

Chapter 6

CHAPTER 7

HARVEST DATA COLLECTION

Collection screen

Preparing to collect harvest data

Harvesting and collecting data

Viewing your harvest data using the List Screen

Harvest Data Collection

After you have calibrated the High Capacity GrainGage, created harvest traits, and created a new harvest trait template, you are now ready to collect data. This chapter explains how to prepare for, collect, and view harvest data using FRS. For addition information, refer to the **FRS Field Reference Guide (Note Taking).**

Collection Screen

FRS Laptop has a distinct advantage in that the collect screen allows users a view of several different screens at the same time. It is divided into four areas: Control Panel, Form Screen, Spatial View and List View.
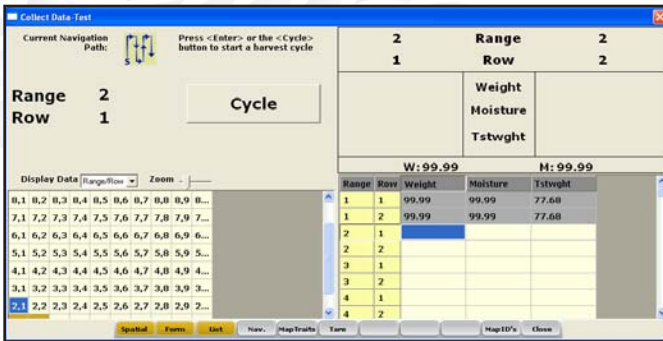
Figure 7-1: Collection Screen

Control Panel

This portion of the screen shows the navigation path, the current plot and the Cycle button.

Form Screen

This shows the data as it is collected as well as live readings of the weight and moisture.

Spatial View

Several options are available from the Spatial View. The pull-down menu offers a look at the RangeRow layout of the map or weight, moisture, or test weight of any plots that have been collected. This view is helpful to assure desired navigation of the field/map or to re-position to any plot on the map.

NOTE: When re-positioning, select the desired plot location, then go to the navigation screen to save that new setting before continuing the collection activity.

List View

The List View allows you to see your harvest data after it is collected.

Preparing to collect harvest data

Follow these steps to prepare FRS to collect harvest data:

1. On the FRS Main Screen, make sure the Active Devices at the bottom of the screen shows Twin HCGG or Single HCGG, depending on which device you enabled in the Setup menu under **System** > **Manage Devices.**
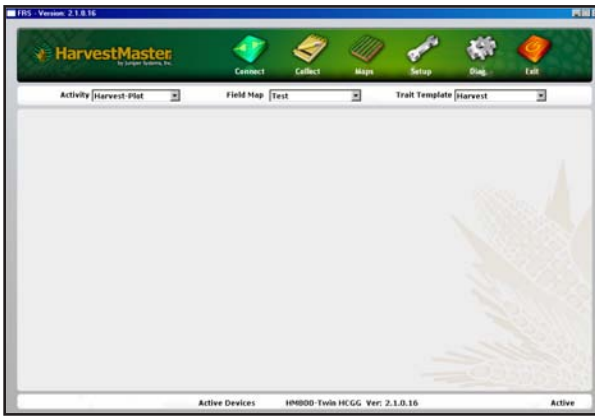
Figure 7-2: The HM800-Twin HCGG appears as the Active Devices at the bottom of the screen

2. Select the appropriate activity from the Activity drop-down menu on the FRS Main Screen. For example, if you plan to use FRS for harvesting, select the **Harvest-Plot** or **Harvest-Strip** Activity. For standard plot lengths, set the activity to Harvest-Plot.

3. On this same screen, select the correct field map name from the pull down menu.

   Note: If you need a new field map for harvest, create one before proceeding to the next step. Refer to the FRS

Note Taking Field Reference Guide (Note Taking) manual for instructions on creating a new field map.

4. Select the trait template you want to use from the Trait Template drop-down box. Options include the harvest traits you created such as Weight, Moisture or Test Weight.

5. Select **Collect** (F1) to enter data collection mode. The Moisture Calibration screen appears.
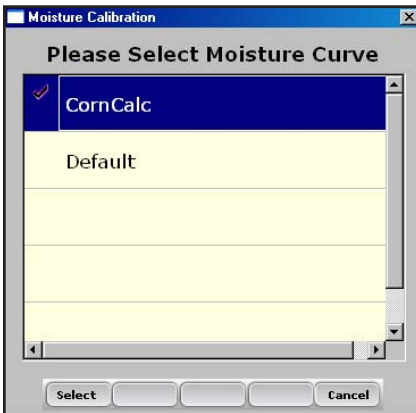
Figure 7-3: Moisture Calibration screen

6. Select a moisture curve from the list, then click **Select** (F1). Wait while harvest set-ups are loaded.

   Note: The High Capacity GrainGage automatically performs a tare function to zero out readings when entering data collection.

7. The **Collect Data Spatial** screen appears, shown below.

Display Data	Range/Row ▼				Zoom				
7,1	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,9	7...
6,1	6,2	6,3	6,4	6,5	6,6	6,7	6,8	6,9	6...
5,1	5,2	5,3	5,4	5,5	5,6	5,7	5,8	5,9	5...
4,1	4,2	4,3	4,4	4,5	4,6	4,7	4,8	4,9	4...
3,1	3,2	3,3	3,4	3,5	3,6	3,7	3,8	3,9	3...
2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9	2...
1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	1...

Spatial   Form   List
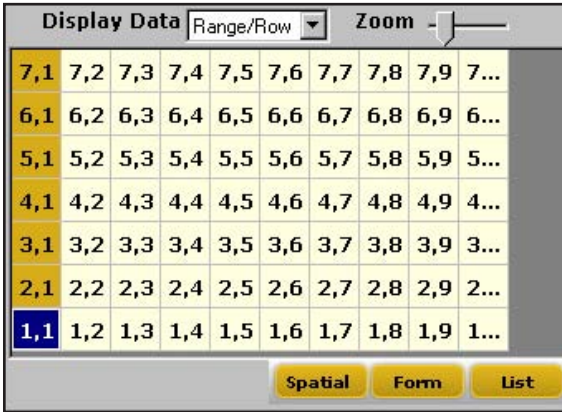
Figure 7-4: Row 1, Range 1 is selected in the Collect Data Spatial portion of the screen

8. Choose the starting plot location by clicking on the cell. In Figure 7-4, the selected cell is Row 1, Range 1. After you click on the starting plot cell, the screen shows the combine's current location in the field and which plots have already been harvested.

    Note: For a twin plot combine, the selected cell always represents the left side for the combine, as shown in Figure 7-5. For single plot combines, it represents the starting plot.

```
5,1   5,2   5,3   5,4   |5,5|

4,1   4,2   4,3   4,4   4,5

3,1   3,2   3,3   3,4   3,5

2,1   2,2   2,3   2,4   2,5

|1,1|  1,2   1,3   1,4   1,5
```
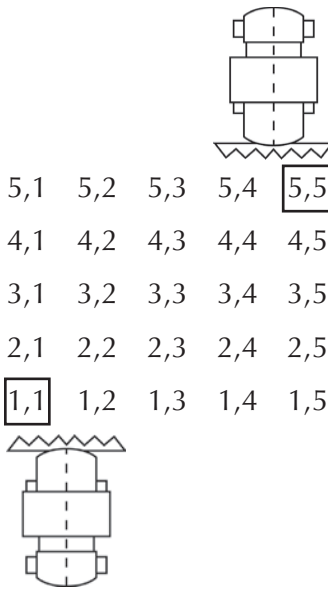
Figure 7-5: Make sure the left side of your twin plot combine is lined up with the first plot you have scheduled to harvest. For Single Plot combines, the starting range and row correspond to the plot being harvested.

9. Establish your navigation type by selecting ***Nav.*** (F4). The ***Select Navigation*** screen appears.
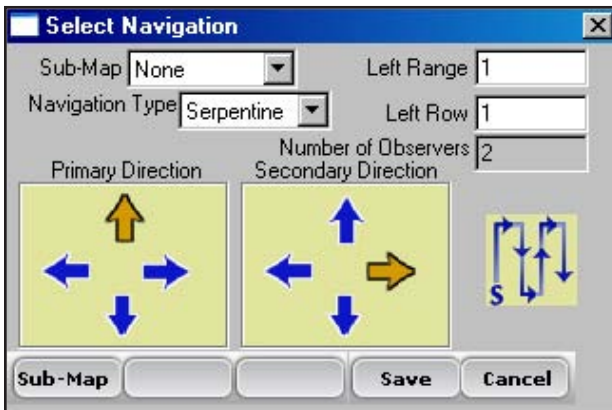
Figure 7-6: Select Navigation screen for a single plot combine

97

Navigation Type
The navigation type is the harvest route through a field.
Select a navigation type from the pull down menu. Examples
of Navigation patterns for harvest are shown below.
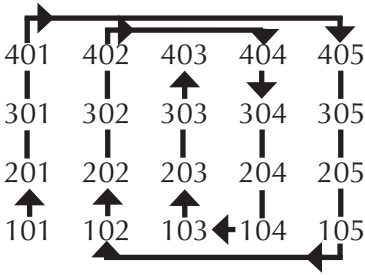
Figure 7-7: Circular navigation type
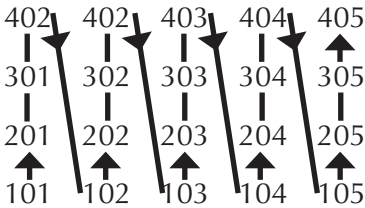
Figure 7-8: Sequential navigation type
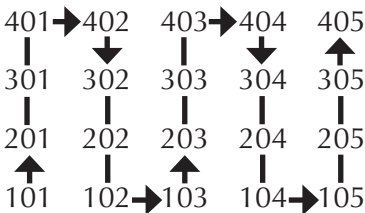
Figure 7-9: Serpentine navigation type

Left Range, Left Row (starting location)
The Left Range and Left Row options on the screen show
the starting plot you selected in the previous screen. If you
are using a twin plot combine, the selected cell always
represents the left side of the combine.

Number of Observers

The number of observers is set automatically based on the equipment used. For twin plot combines, the number is set to 2; for all single plot combines, the number is set to 1.

Click **Save** (F4) to save your settings.

Harvesting and collecting data

Just as there are two basic methods for harvesting, there are two harvest methods with FRS: Plot Harvest and Strip Harvest. The steps for performing each method using FRS are described below.

Plot Harvest Sequence (also called Harvest-Plot on the FRS Main screen)

1. To begin harvesting, select the **Form** (F2) button from any of the Data Collection screens. The Form screen appears, which allows you to cycle the system and record your harvest data.

1	Range	1
1	Row	2
	Weight	
	Moisture	
	Tstwght	
W:0		M:0

Figure 7-10: Form portion of the screen before data has been collected

99

Note: Clicking F6 retares the system.

2. Harvest the first plot, as soon as all the grain has left the combine header, press the Enter key on the laptop to begin the countdown timer. The timer corresponds to the amount of time it takes for the combine to thresh the grain and for all of the grain to reach the hoppers.

3. At the end of the plot, stop the combine and wait until the timer reaches zero.

1	Range	1
1	Row	2
	8	

Figure 7-11: Countdown timer as it appears with the High Capacity GrainGage

As soon as the countdown timer reaches zero, the High Capacity GrainGage starts its sequence. The auxiliary actuator door (isolation gate) closes to prevent any mixing of plots and the left hopper door opens, emptying its contents into the weigh bucket where weight, moisture, and test weight are recorded.

Note: You can start harvesting the next plot as soon as the countdown timer reaches zero. The Aux actuator or Isolation gate prevents grain in the combine from mixing with grain being processed by the High Capacity GrainGage.

Note: If necessary, you can adjust the countdown timer in the Setup Timer menu. To access that menu, go to **Setup** (F3) > **Hardware Setup** > **HCGG Setup** > **Level Sensors.** We recommend setting the Countdown Timer to reflect the time it takes so that there is less than .5 lb (.23 kg) of grain carryover from plot to plot.

The High Capacity GrainGage then follows this sequence: After the system has measured the grain from the left hopper and emptied it from the weigh bucket, the right hopper door opens, emptying its grain into the plot bucket.

Figure 7-12: Form screen showing data for left side of the combine

The right hopper door closes and the Aux actuator opens, allowing grain to flow into the hopper again. Data from both hoppers is stored to the FRS database and sent to the printer for data backup.

Typically, the user can press Enter again after the data from the left hopper has been shown on the screen.

The current plot identifiers are then advanced to the next in sequence after the data is stored. The process continues for each new plot.

1	Range	1
1	Row	2
10.07	Weight	12.06
15.18	Moisture	15.08
63.20	Tstwght	63.29
W:0.02		M:0.01

Figure 7-13: Form screen showing data for both sides of the combine

Single Plot Harvest

When harvesting with a single plot combine, the harvest sequence is the same as for a twin plot. The Form Screen changes for single plot mode.

Weight	11.95
Moisture	13.38
Tstwght	63.41
W: 0	M: 0.02

Figure 7-14: Form screen showing data for a single plot combine

Strip Harvest Sequence

Strip test harvest involves harvesting plots that are longer than the standard 20 ft. plot. On strip plots, the amount of grain to be harvested exceeds the 45 lb. capacity of the weigh bucket. To prevent the weigh bucket from overfilling, grain level sensors installed into the holding hoppers trigger the system to cycle when the grain reaches a certain level on the level detect sensors. To set this level, go to **Setup** (F3) > *Hardware Setup* > *HCGG Setup* > *Level Sensors.*
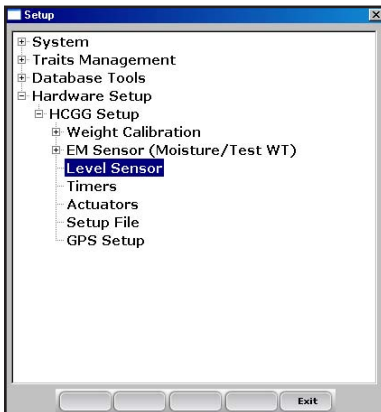
*Figure 7-15: Select **Level Sensor** from the Setup menu to access the Level Detect screen*

The level indicates the amount of grain required to trigger the strip harvest sequence. The higher the level detect setting the more grain required to trigger strip harvest.

In the case of a Single Plot combine, the Left level sensor value corresponds to the level sensor installed into the weigh bucket.

To begin the sequence of strip harvest, select the Harvest-Strip from the Activity drop down menu located on the main FRS screen.
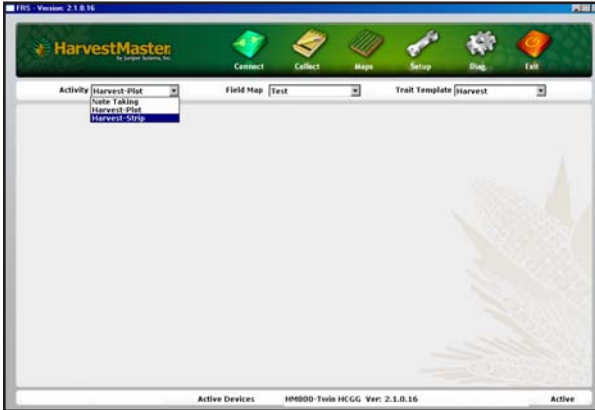
Figure 7-16: Harvest-strip in drop down menu

After selecting the strip harvest activity, select **Collect**. Follow the same sequence as Harvest-Plot to select a moisture curve, starting range and row and the Navigation pattern.

As soon as the these settings have been saved and selected, select **Form (**F2).

The sequence for harvesting in strip mode is as follows:

- The user drives the combine through the strip plot. Grain is shelled in the combine and routed into the holding hoppers.

- When the grain becomes full enough in either hopper to trip the threshold of the level detect, the left bucket cycles in the same sequence as Harvest Plot.

- During this part of Strip harvest, the Countdown Timer is not enabled and the Aux gates remain open.

- The left hopper is cycled first, followed by the right hopper.

- The weight, moisture and test weight for the left side is displayed on the screen of the computer.

- After the weigh bucket has emptied the left side, the right hopper opens allowing grain to dump into the weigh bucket so it can be processed. Data from the right side is displayed on the screen of the computer.

10.07	Range	1
	Row	2
15.18	Weight	
	Moisture	
63.20	Tstwght	
W:10.07		M:15.18

Figure 7-17: Screen showing data while cycling

- The sequence continues to repeat as long as the level detects are triggered by grain filling up the hoppers.

- Each time data from a hopper is recorded; plot weight is added to the existing plot weight data, while the Moisture and Test weight are averaged with the previous

cycles. The number of cycles that the system has gone through is displayed on the screen.

7.01	Totaling		2
	Right		9
16.91	Weight	7.01	
	Moisture	16.91	
62.03	Tstwght	62.03	
C: 3			

Figure 7-18: Screen showing data and number of cycles

- When the entire strip has been harvested, the user presses the Enter key.

- One last bucket sequence is initiated. No moisture or test weight is recorded on this step. Plot weight is recorded and added to the total.

- A complete summary of the plot with total weight, Moisture average and Test Weight average are stored and sent to the printer

1	Ending	1
10	Strip	9
33.24	Weight	28.67
11.86	Moisture	11.68
64.04	Tstwght	64.17
	C: 2	

Figure 7-19: Summary of strip harvest

- After the last hopper closes, the plot locator or ID is advanced for both sides of the combine.

In some cases the amount of grain in a strip is too low to cycle the level detect. In this case the user can press the Enter key without the level detect triggering; the system cycles just like in normal plot mode.

CHAPTER 8
DATALINK FOR FRS

Import files to database from desktop

Export files from database to desktop

DataLink Utilities

DataLink for FRS
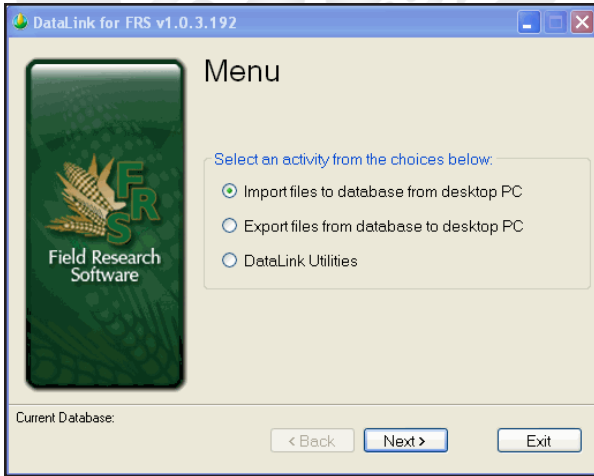
Figure 7-1: DataLink main menu

DataLink for FRS is a utility program for your PC that facilitates the management of the FRS database.

DataLink Functions

Three functions are available from the opening screen for *DataLink for FRS*.

The three functions are:

• Import file to database from desktop PC

• Export files from database to desktop PC

• DataLink Utilities

DataLink is found under *Setup* and *Databse Tools.*

Importing a File to the Database
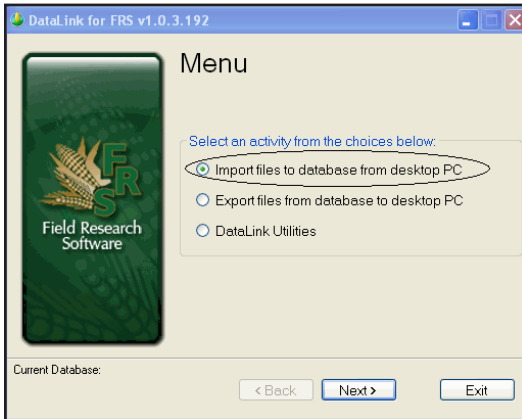
Figure 7-2: Importing file to database

Select the *Import* option and click *Next.*

Several types of files can be imported to the database.
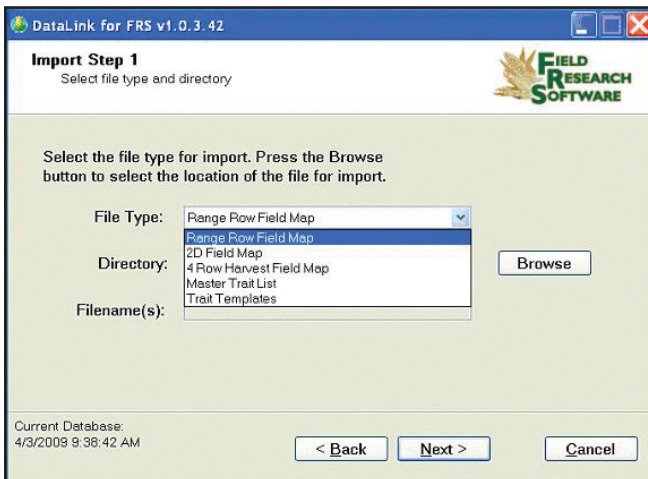
Figure 7-3: Select file type

111

- Range Row maps are the most common field maps in FRS.

- 2D and 4 Row maps are specialty maps for specific applications.

- The Master Trait List is a list of all traits that can be observed.

- A trait template is for organizing a smaller list of traits that are of interest for daily or seasonal observations.

These files can be created or edited on a PC and then imported to the FRS database using *DataLink*.

As is common in many Windows applications, the browse feature lets you select the file to import.
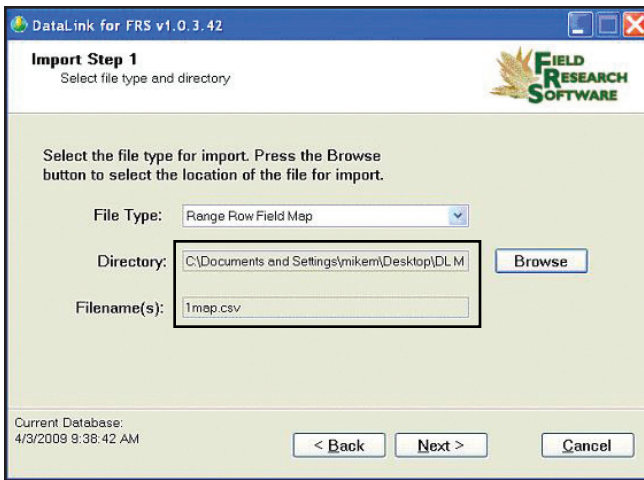
Figure 7-4: Select file

When a field map is selected, the *Next* button allows you to choose map settings. FRS organizes all maps by range row, and then handles any other map identifiers simply as additional identifiers. Therefore range row must be defined

as to its location in the spreadsheet that is being imported.

DataLink reads the column headings from the map to be imported, and populates them in the drop down menu. Select the appropriate column heading from the map that corresponds to the Range and Row from the choices in the drop down menu.
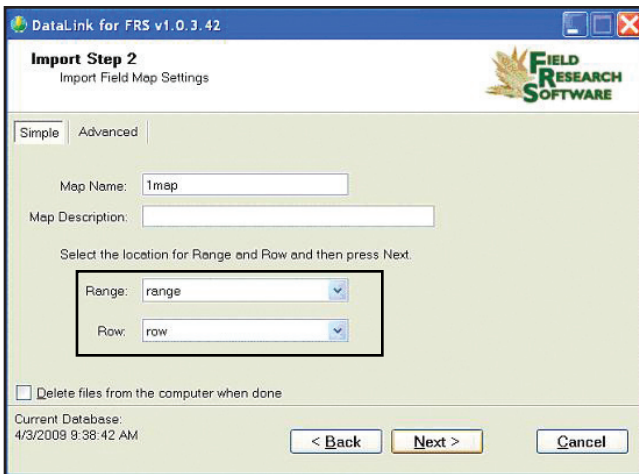
Figure 7-5: Range and Row headings

The following discussion involves specialty maps that may or may not apply to your situation. If you do not need to use 2D maps or 4 Row Harvest maps, skip this section.

The 2D Map feature refers to maps that are created two-dimensionally to represent the same layout as the field.

ID's in 2D maps allows any plot name in any order to be used on a map. Plot names can be repeated on the same map as many times as needed. This type map must be created with a spreadsheet or text editor and saved as a tab delimited file or .txt file. Do not use any headings or spaces when creating a 2D map.

101	Trial	Border	102
201	202	North	South
101	102	103	104
201	202	203	204
Beans	Rice	Wheat	Corn
Sally	George	Sue	Charles

Figure 7-6: Example of 2D map layout

DataLink will assign range row to each plot and associate the plot IDs as additional plot identifiers.

The 4 Row Harvest Field Map is a unique layout where every other plot or set of 2 rows is border throughout the field. 4 Row Harvest Field Maps allow a map that only contains the research rows to be imported into FRS. Upon import, the border rows are created by FRS and carry the same row number as the previous research row with the addition of an "X."

Example is the first row or plot is Range 1 Row 1, then next row or plot is designated Range 1 Row 1X. This sequence is repeated throughout the field.

The field is harvested the same as any other field map with data being stored for research plots and buffer plots. Upon Export, the buffered rows are not exported, only the research rows are included in the export file.

Importing Master Trait Lists and Templates

Master trait lists and trait templates are files that can be imported. When you import either, the existing list or

templates will be deleted. A warning appears so the user can confirm the action.
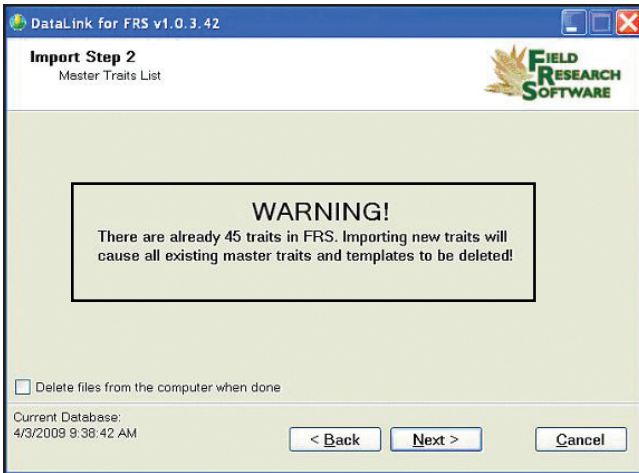
Figure 7-7: Warning on importing traits

Exporting a File from the Database
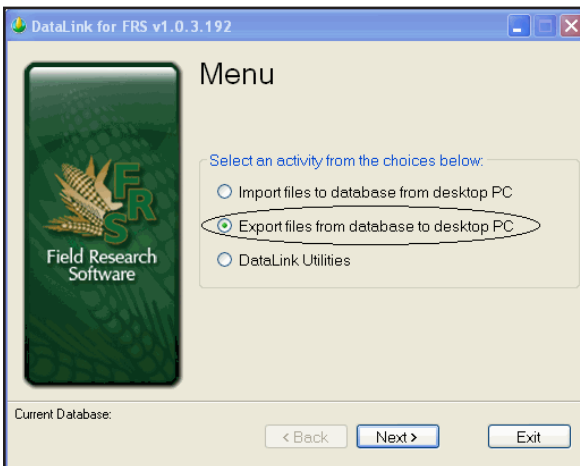
Figure 7-8: Export files from database

Select the **Export** option and click **Next.**
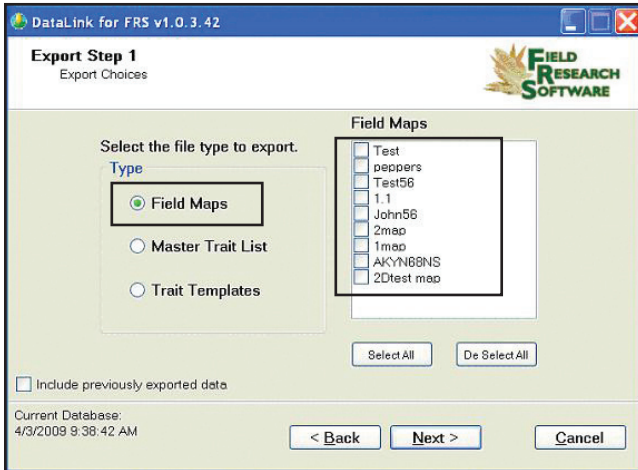
Figure 7-9: File types and files

This screen allows the selection of what file type and which files to export. The ***include previously exported data*** checkbox allows data collected and exported in separate activities or days to all be exported together on one spreadsheet at the conclusion of a map.

For example, at the end of the season, a spreadsheet could contain several observations accomplished with different templates and traits and the harvested data together on one map.

Imagine that in the spring, an emergence observation could occur and the data down-loaded for safe keeping. Mid summer might be a good time to take notes on any disease evidence and that data could be downloaded. In the fall a lodging study might be appropriate and downloaded after completion. Then the crop is harvested and the plot weight, moisture and test weight are recorded. When this last data is exported the "Include previously exported data" checkbox could be checked. The spreadsheet would now contain all

the collected data from the season in one place.

After making the desired selection and selecting next, the choice is where to put the exported files. The browse button facilitates the choice.
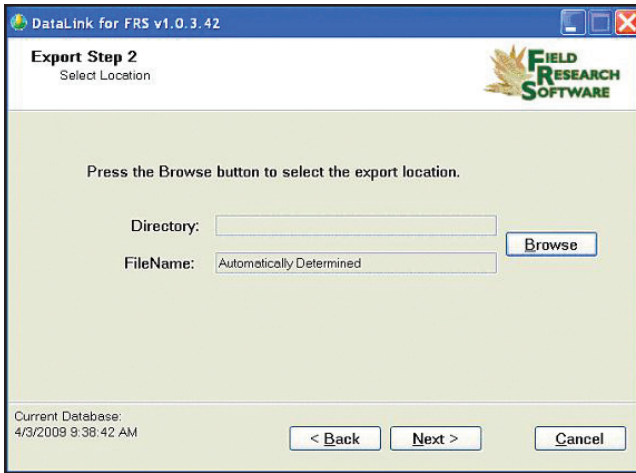
Figure 7-10: Exported file location

Step 3 allows the user to choose the map IDs and in what order, they will appear in the exported file.

Notice the checkbox near the bottom of the screen. If a map was imported as a 4 Row Harvest Field Map and buffer rows

were added, checking this box will remove those added rows when the file is exported.
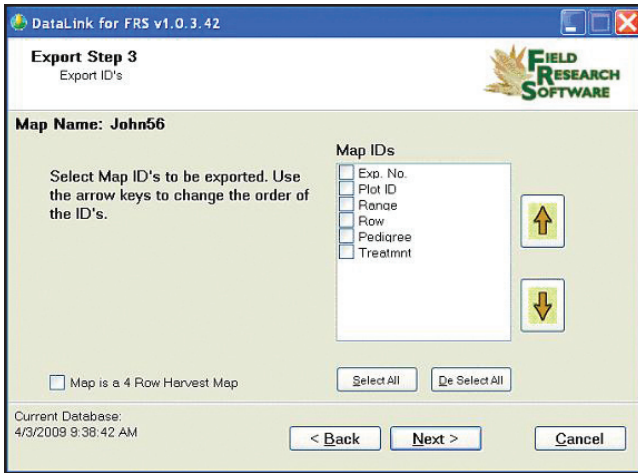
Figure 7-11: Choose which row to export

DataLink Utilities

Select **DataLink Utilities** and click **Next**.
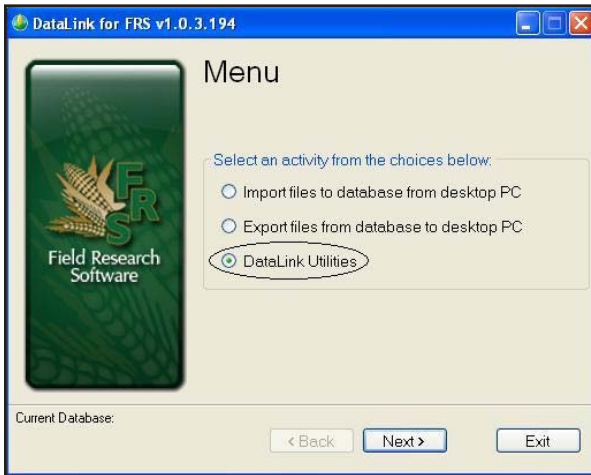
Figure 7-12: Datalink Utilities

The utility choice available is Clean Current Database.

Figure 7-13: Utility choice

This produces a compressed database that only contains active records, removing records that are marked as deleted and rebuilds all indices creating new optimized indices in the database. Selecting this periodically will help resolve any database issues and increase performance.

Select the **Clean Current Database** option and click **Next**.
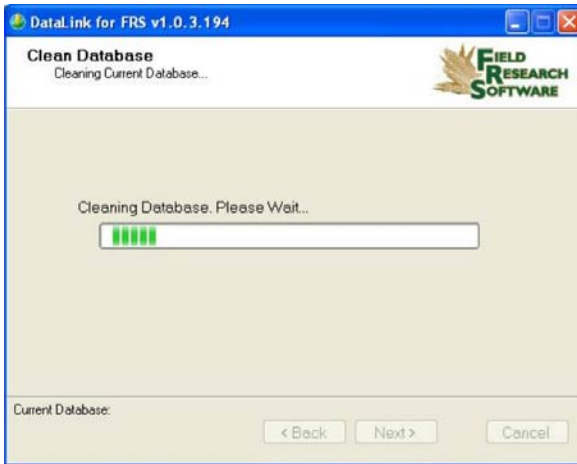
Figure 7-14: Cleaning Database screen

Notice that time was spent cleaning up the database. The time this requires is proportional to the size and length of time the database has been used.

Backup Log for Harvest Modules

FRS software creates a backup log of data that has been collected from the harvester. This log file contains the date, time, range, row, plot weight, moisture, and test weight for each plot harvested. It also contains values used for moisture and test weight calibration, and Slope and Motion compensation, or Q value.

The backup files can be found in the FRS folder in the backup folder.
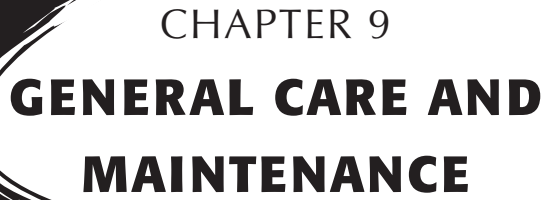
Each backup log references the same name as the field map

used for harvest. For example, if the name of the field being harvested is Smith Farm, the name of the backup log would be Smith Farm_Classic.csv.
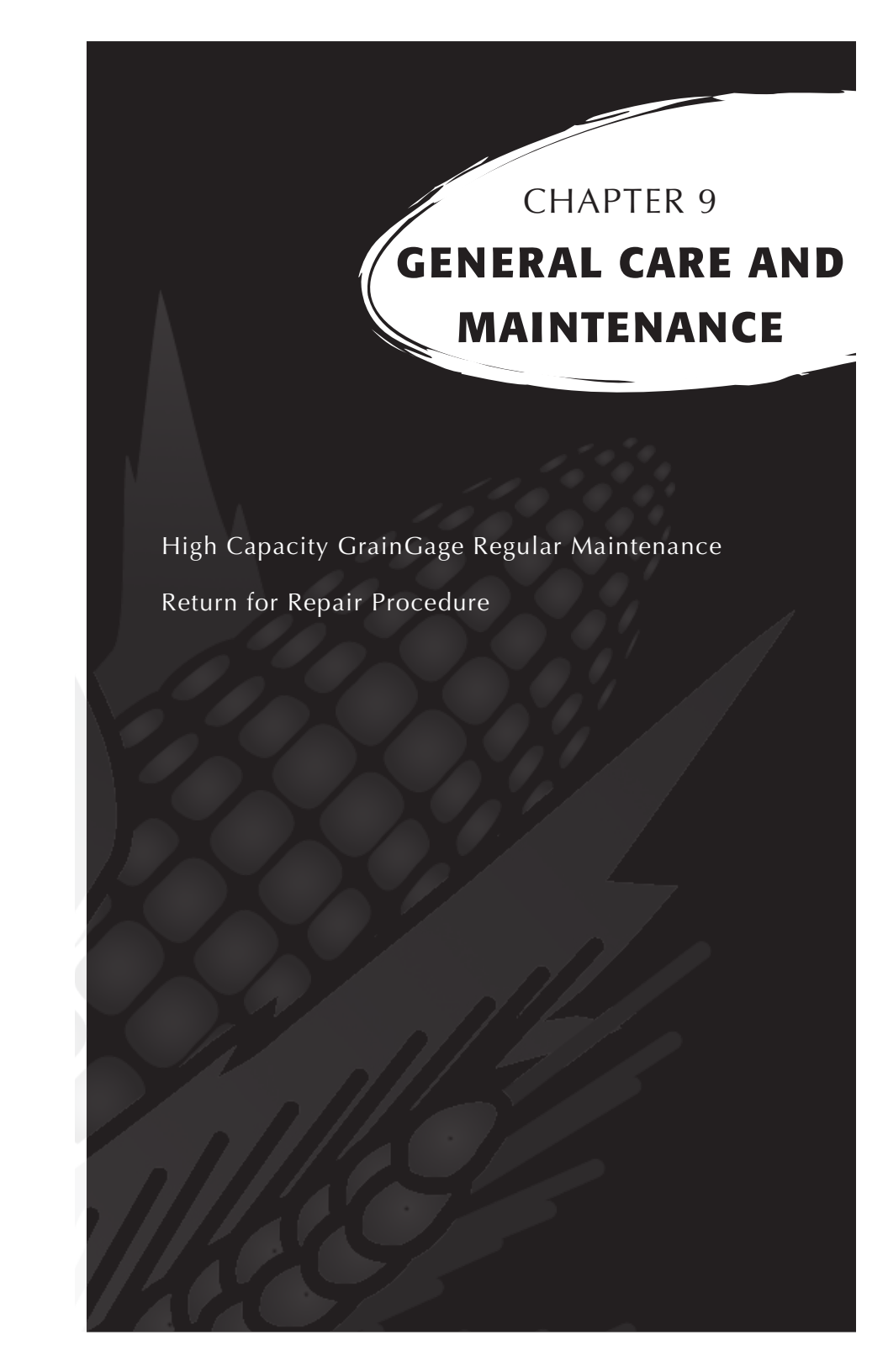
	A	B	C	D	E	F	G	H	I	J	K
1	Date	Time	Range (ID1)	Row (ID2)	ID3	Cycle#	Weight	Moisture	Test Weight	Slope Motion Q	Uncomp Weight
2	18/02/2008	14:50:54	1	1		0	0	0	0	0.000	2.441
3	18/02/2008	14:51:34	1	1		1	2.312	9.275	58.499	1.000	0
4	18/02/2008	14:51:40	1	1		2	2.289	9.111	57.907	1.000	2.312
5	18/02/2008	14:51:45	1	1		3	0.936	5.749	23.686	1.000	2.289
6	18/02/2008	14:52:08	1	1		4	-0.003	0	-0.063	1.000	0.936
7	18/02/2008	14:52:14	1	1		5	-0.003	1.003	-0.086	1.000	-0.003
8	18/02/2008	14:52:16	1	1	T		5.532	8.045	46.697		
9	18/02/2008	14:53:29	2	1		1	2.307	9.148	58.358	1.000	0
10	18/02/2008	14:53:35	2	1		2	2.303	9.271	58.262	1.000	2.307
11	18/02/2008	14:53:40	2	1		3	0.939	5.829	23.768	1.000	2.303
12	18/02/2008	14:54:06	2	1		4	2.303	9.312	58.264	1.000	0.939
13	18/02/2008	14:54:12	2	1		5	0.803	5.165	20.318	1.000	2.303
14	18/02/2008	14:54:31	2	1		6	0.002	0	0.04	1.000	0.803
15	18/02/2008	14:54:36	2	1		7	0.002	0	0.058	1.000	0.002
16	18/02/2008	14:54:39	2	1	T		8.659	7.745	43.794		
17	18/02/2008	14:55:26	3	1		1	2.334	9.344	59.036	1.001	0.002
18	18/02/2008	14:55:31	3	1		2	2.286	9.287	57.839	1.000	2.334
19	18/02/2008	14:55:37	3	1		3	0.926	5.834	23.427	1.000	2.286
20	18/02/2008	14:57:54	3	1		4	2.303	9.26	58.249	1.001	0.926

Figure 7-15: Example of backup log file.

GENERAL CARE AND MAINTENANCE

High Capacity GrainGage Regular Maintenance

Return for Repair Procedure

General Care and Maintenance

Daily System Check

1. Make sure that there are no loose cables hoses or equipment and all wires free of moving parts? Do all of the moving parts such as doors and actuators move freely without anything interfering?

2. If the combine has been transported, check to make sure the plot bucket has not shifted out of the rails or slots on either side of the bucket.

3. Connect the laptop computer to the controller and start Field Research Software. It should load the Setups for the installed hardware and boot to the main FRS screen.

4. From the main screen click **Diag** (F4) or **Connect** (F1). Select **Load Cells** from the diagnostics menu. Record or observe the voltages values for Cell A and Cell B and the Total weight with the bucket empty. Voltage values should be aprox 1.3 to 1.7 volts and the weight should be 0.00 +/– 0.04. Place a known weight—we recommend at least 10 lb.—in the plot bucket; the voltages for A and B should increase to a certain point and stabilize. The Total weight reading should correspond to the amount of the know weight placed in the bucket. Remove the weight. The voltage should return to the original voltage level and the weight should return to zero.

5. Select **Moisture** from the diagnostics menu. Check to see

the Temp reading is in the range of the current outside ambient temperature. The temperature sensor will typically be higher than current outside temperature by about 5 C. Check the Absolute voltage reading is 3.500 +/– 0.2. Check that when you dump grain into the plot bucket or grab the EM sensor blade by hand the Relative voltage increases and the Absolute voltage decreases.

6. Select **Test Weight** from the diagnostics menu. Check that the PK Volts is 2.00 +/– 0.5 and the PK Freq is 3.500 +/– 0.2. Verify that when you dump grain into the plot bucket or grab the EM sensor the PK Volts and PK Freq both decrease.

7. Cycle each gate from the console in manual mode with the laptop connected and booted into the FRS software, to make certain that all gates open and stay open while the open light is on. Close them and make sure that the gate actually closes. Also verify that all auxiliary actuators being used such as air diverters are sending the correct signal to the proper place and for the proper amount of time.

8. Make certain all diverters and special scripts are operating correctly.

9. If an oil bath compressor is used make sure that an oil separator is installed and working. Make sure that if the combine will be used in high humidity area that a water separator is installed in the air system.

10. We recommend that the next step be done with the

combine running as if you were actually going to harvest. Enter the Collect mode and **Select** (F1) the **Default** moisture curve. Select **Form** (F2) then **Save** (F4) the current Navigation screen. Cycle the system in the same manner you would during harvest letting the countdown timer and the buckets cycle. Watch the data displayed on the screen to verify that the values are zero. Grain samples can be poured into the bucket to produce harvest conditions. Verify that all gates and actuators are operating as they should. Cycle the system several times to make certain everything is operating as intended.

High Capacity GrainGage Regular Maintenance

HarvestMaster products are built to be robust and will withstand most weather conditions. All of our products are environmentally sealed and built for outdoor use. However, there are some steps you can take that will increase the operational life of the system. The following tips will help you to have fewer problems and will ensure the maximum life out of your system.

Recommended Pre-Harvest Maintenance

We recommend starting your pre-harvest checklist at least two weeks before you plan to be in the field. In addition, we also recommend that when you are checking calibrations that you run several samples of grain with known weights and moistures through the system to ensure accurate

moisture and weight calibrations.

All Systems

- Clean the combine battery terminals to ensure a good power and good connection.

- Inspect all cables for rodent damage.

- Make sure all cables are secure (locked into place) and are not touching or interfering with the weigh bucket assembly.

- If equipped with a pneumatic air system, check the filters and lubricator for contamination. Replace as necessary. Close the petcock valve on the air tank and charge the system up to 120 PSI. Check for air leaks. Operating pressure should be regulated to 50 PSI.

- Check the actuator operation for each door assembly for normal operation. Slow moving actuators are usually an indication of a plugged metal porous vent on exhaust port of solenoid. Replace or clean as needed.

- Ensure the weigh bucket or pan moves freely. Also ensure the bucket is resting in aluminum tracks and not binding.

- Check the actuators and slides for proper function and adjustment. If needed, lubricate the slides with DRY graphite to minimize gum or chaff buildup. *CAUTION: Do not use wet lubricants on the gate assemblies.*

- Run *DIAGNOSTIC* menu checks on the load cells, moisture sensor, and level detect sensor as outlined in the Diagnostics section of this reference guide.

- Check weight and moisture calibrations.

Recommended Maintenance during Harvest (each morning)

- If your GrainGage is equipped with pneumatics, drain the water from the air tank using the petcock relief valve.

- Drain water from the lubricator/water separator bowl by pulling down on the drain plug.

- Blow chaff and broken kernels out of and from around the weight bucket or pan.

- Check the load cell accuracy using a known weight.

- Check the compressor air filters.

Recommended Post-Harvest Maintenance

- Print setups and moisture curves. Save and file this information in an area where it can be found in future years if needed.

- With about 120 PSI forced air, blow all chaff and broken kernels out of and from around the weigh bucket or pan. Blow upward (from the bottom of the GrainGage) on each overload protection pin to ensure all the debris is out of the channels and away from the protection pins.

- Avoid using water to clean in and around the weigh systems. If you use a sprayer washer to clean the combine, be sure to keep the water away from all sensors and cabling.

- Disconnect the air hose from the GrainGage and let the air run (free-flow) for at least 5 minutes.

- Drain the air tank.

- Drain the pneumatic filter bowls and blow them dry with forced air.

- Retract all the cylinder rams into the housing.

- If mice have been a problem in the past, place mouse poison or traps in areas where mice might appear. Moth balls tend to help as well.

- If your Harvest Data System console is exposed to the elements (e.g. mounted outside of the cab), we recommend removing or covering the control box. It is best to store your system in a warm and dry environment.

- If the combine is not protected from the weather, cover any exposed cable ends (connectors) with plastic bags and secure tightly with twist-ties or rubber bands.

Installation and Maintenance Tips

We suggest the following tips when installing and/or maintaining the Harvest Data System:

When using pneumatics:

- Install a three to five gallon reservoir air-tank. This tank must have a petcock type drain valve or an electronically controlled drain valve to allow any water that accumulates inside the tank to be drained.

- Install the Bosch Combo filter/regulator as close to the High Capacity System as possible

- If areas of high humidity or when using a lubricated compressor, it is recommended to install a Keaser Model KOR-20.

- Replace the Keaser filter every 100,000 plots or when the indicator is mostly RED. Us the "USOR-20" replacement filter element (sourced by Juniper Systems).

- Clean filter bowls using kerosene or cleaning solvent. Replace the oil in the lubricator if contaminants collect in the bottom of the lubricator bowl or yearly. Contaminates from dirty oil may collect at the siphon tube filter, requiring the filter to be washed in kerosene and blown off with an air blow gun.

    CAUTION: Certain compressor oils, chemicals, household cleaners, solvents, paints, and fumes may damage the plastic bowl. Be sure that you use cleaning chemicals that are safe for polycarbonate material.

- Adjust the oil delivery rate to one drop for every 15 to 20 cycles of a gate. The operation of the oil delivery rate may drop after an extended period of use. If this happens, clean the lubricator and all its air and oil distribution tubes with kerosene. We recommend replacing the oil every five to six years or if the color becomes white or cloudy.

- Use #10 (90 SSU) or lighter oil in your lubricator. We recommend using non-detergent, semi-synthetic or non-synthetic air-tool oil (replace yearly). Do not over fill the lubricator bowl.

- Use special anti-freeze lubricant if you are using the system in temperatures below freezing. This oil is a special blend that can be purchased from Juniper Systems or most retail stores. The anti-freeze oil is not an additive and must not be mixed with other oils.

Operating Specifications

The following operation specifications show the maximum pressure and temperature ratings for the filter bowl:

Bowl Type	PSIG	Temperature
Transparent Plastic	150 (10.3 bar)	125° F (52° C)
Metal	200 (14 bar)	175° F (79° C)

Air Regulator

The regulator should be adjusted between 50 and 85 PSI. Colder temperatures may require higher pressures.

To adjust the pressure, complete the following steps:

1. Unlock the regulator by pulling down on the adjusting valve.

2. Turn the regulator clockwise to increase the pressure and counter clockwise to decrease the pressure.

Lubricator

Changing the Oil

Note: Cylinder manufactures no longer recommend using lubrication oil. In order to stop using oil new cylinders and solinoids must be installed.

To change the oil, complete the following steps:

1. Release the air pressure from the air lines (through the HM-1020 Pneumatic Conditioning Center).

2. Remove the four mounting screws that hold the plastic bowl securely to the metal housing.

3. Gently pull down on the bowl while gradually tipping the bowl back and forth until it is removed.

   Note: Be careful not to drop the plastic bowl from the metal bowl guard when emptying the oil.

4. Inspect the plastic bowl for deterioration or cracks. Replace as necessary.

5. Clean with a dry or water dampened cloth.

6. Refill the bowl to the level as indicated on the metal bowl guard. Do not overfill the lubricator. This causes it to malfunction and results in not providing the proper lubrication to the cylinders.

   CAUTION: Install the metal bowl guard be installed to minimize the danger of flying fragments. Be sure the lubricator has a metal bowl guard before pressurizing the system.

Adjusting the Lubricator

Your Bosch combination filter/ lubricator assembly is adjusted at the factory. If you are getting too much oil, you can adjust the assembly. To adjust the lubricator, follow these steps:

Adjustment set screw and oil viewing dome

Figure 9-1: Filter/lubricator assembly and set screw

For a simple adjustment, turn the oil flow adjustment screw clockwise until it stops. Turn the screw counterclockwise ½ turn to finish adjustment. If you wish to adjust the oil using a more thorough method, follow these steps:

1. The air system must be pressurized to operating pressure (approximately 50- 80 PSI).

133

2. Turn on the electronics of the Harvest Data system. On the laptop, go to the main FRS screen.

3. On the system, switch the Auto/Manual switch to Manual mode so you can cycle the system manually.

4. While watching the dropper in the oil viewing dome on top of the lubricator, cycle one of the gates 15 times using the Open and Close switches. Complete one cycle every 1-2 seconds.

   Note: The gates can be cycled while standing by the GrainGage by pressing the red button on the top of the control solenoid (mounted to the right inside wall of the GrainGage). If the lubricator is not mounted close enough to the GrainGage to cycle the door and watch the site dome, find an assistant to set the oil delivery drop rate.

5. Using a short-handled flat-head screwdriver, adjust the set screw in the lubricator so that a drop of oil falls inside the oil viewing dome every 15-20 cycles (cycle one door at a rate of one complete cycle every one to two seconds).

Replacing the Keaser Filter USOR-20

1. Release the air pressure from the air lines by either opening the relief valve on the GrainGage or opening the drain valve on the air tank.

2. Turn the filter bowl housing ¼ turn counter clock-wise and gently pull down on the bowl while gradually tipping the bowl back and forth until it is removed.

3. Remove the RED filter by turning it counter clock-wise (as if removing a right-handed screw).

4. Install new filter and tighten finger tight.

5. Reinstall filter bowl's housing in reverse order as removed.

Cylinder Removal and Installation

The cylinders on the High Capacity Grain Gage (HCGG) can become worn from constant use and eventually wear out. As the cylinder wears out it leaks air, or responds slowly to the open and close command of the console. When this starts happening, its time to remove your old cylinders and install new ones.

Tools Needed

Tools needed for cylinder removal:

• Small Flathead Screwdriver

• 5/32″ Allen wrench

• 3/8″ Socket wrench

• 7/16″ Socket wrench

• Crescent wrench

• Vise-grip

• Thick cotton cloth

Figure 9-2 shows the cylinder and identifies the components you need to remove or replace throughout this process.

Clevis Pin
(Inside the
Clevis Block)

Clevis Block

Limit Switch
Slide Rod

Limit Switch

1/4" Air Fitting

Cylinder Shaft

Bucket Door
Mount

Rod Pivot Block

Rod Pivot Pin
with e-ring
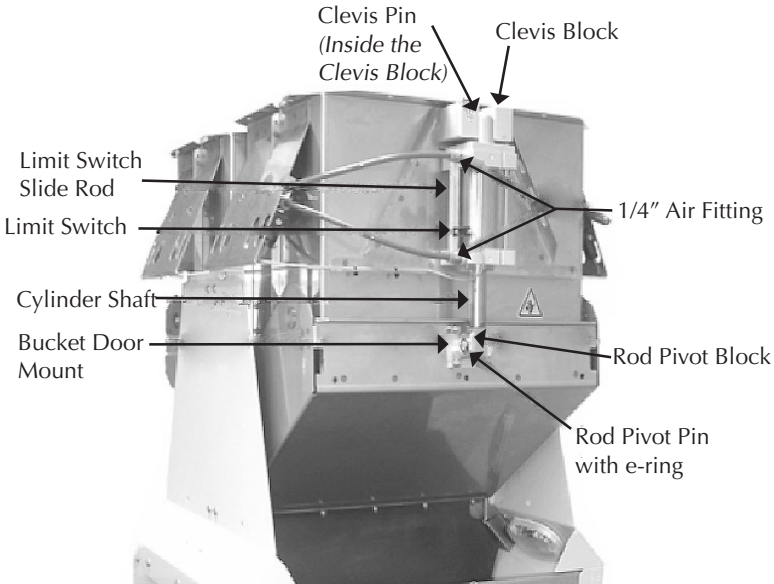
Figure 9-2: Elements of the HCGG

Removing the Cylinder

To remove the cylinder from the HCGG, complete the following steps:

1. Locate the air source shut off valve on the back of the HCGG.

2. Release the air pressure by sliding air valve to the center position.

3. Using a permanent marker, mark which air hose is attached to the top 1/4" air fitting and which air hose is attached to the bottom 1/4" air fitting. This ensures that the air hoses are connected properly when the new cylinder is installed.

4. Remove the air hoses from the cylinder by pushing the plastic ring (red/orange) into the body of the cylinder while pulling the 1/4" air fitting (commonly red or orange) while pulling the air hose out of the fitting.
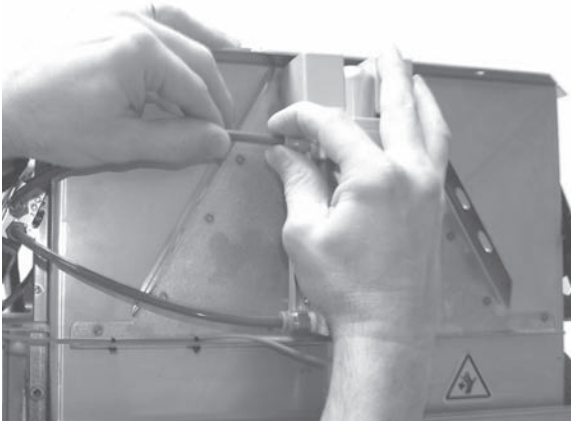
Figure 9-3: Removing the air hose

5. Using a small flathead screwdriver, loosen the limit switch screw enough so that it slides up and down freely. Do not remove the limit switch screw.
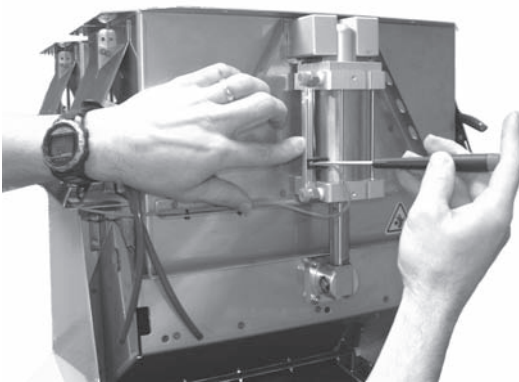
Figure 9-4: Loosening the limit switch

6. Slide the limit switch toward the top of the cylinder and pull the limit switch out of the small notch opening in the top of the limit switch mounting slide.
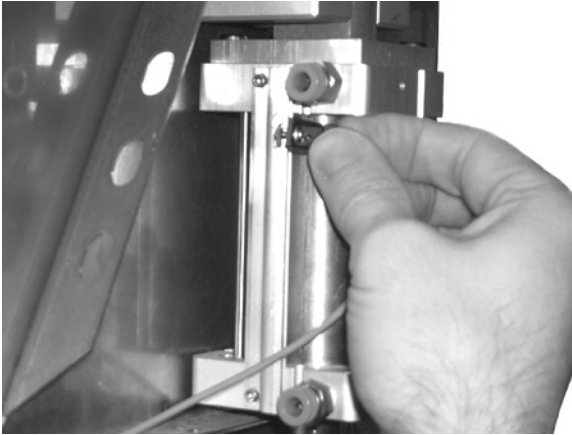
Figure 9-5: Removing the limit switch

7. Using a small flat head screwdriver, pry one locking e-ring from the end of the Rod Pivot Pin. The Rod Pivot Pin is used to secure the cylinder to the bucket door.
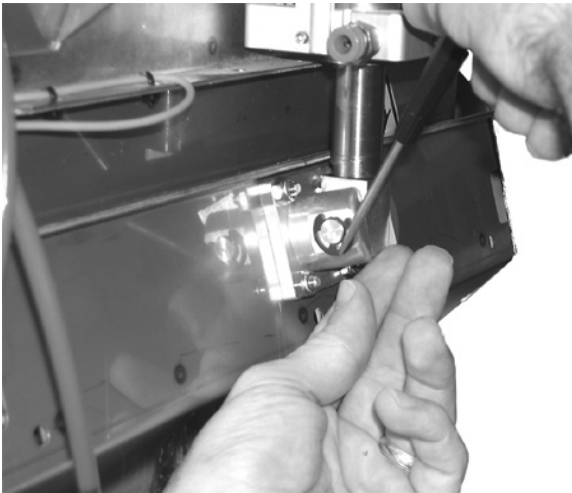
Figure 9-6: Removing the e-ring from the pin

8. Slide the Rod Pivot Pin out of the Rod Pivot Block.
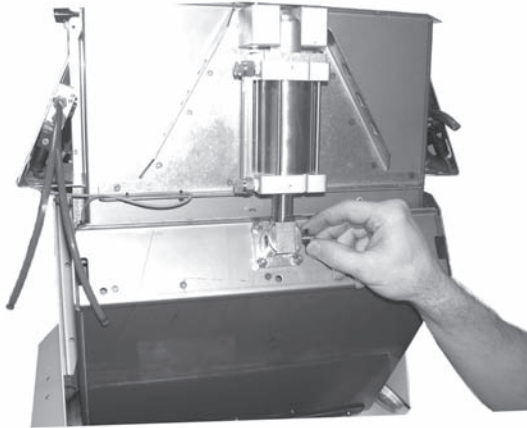
Figure 9-7: Remove the rod pivot pin

CAUTION: The door will open when the cylinder is removed from the Clevis.

9. Using a 5/32″ Allen wrench, unscrew and remove the four 1/4″ button head screws located inside the bucket. These screws hold the left and right Clevis Blocks to the bucket.
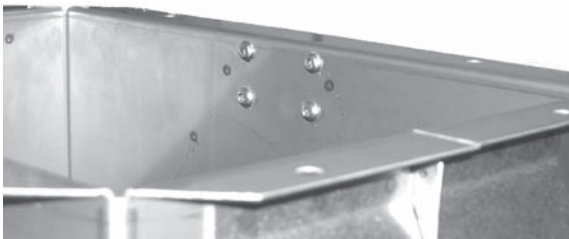
Figure 9-8: Button head screws (far side)

10. Pull one Clevis Block off the top side of the cylinder, and then slide the cylinder off the Clevis Block Pin.
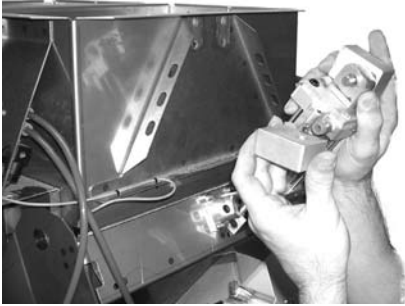
Figure 9-9: Slide the cylinder off the clevis rod

11. Use a 1/2" socket to unscrew and remove the two 1/4" air fittings from the cylinder.

12. Pull the Cylinder Shaft out of the cylinder enough to wrap some thick cotton cloth around it and clamp it with a pair of vise-grips. The cloth helps protect the Cylinder Shaft from the jaws of the vise-grip.

13. Using a crescent wrench, grab hold of the Rod Pivot Block. Turn the block counter clockwise while using the vise-grips to hold to the Cylinder Shaft.

Now that the defective cylinder is removed from your HCGG bucket, you are ready to install the new one.

Installing the Cylinder

To install the new cylinder, complete the following steps:

1. Using your fingers, remove the locking nut from the end of the new cylinder shaft and discard it.

2. Pull the Cylinder Shaft out of the cylinder enough to wrap some thick cotton cloth around it and clamp it with a pair of vise-grips. The cloth helps protect the Cylinder Shaft from the jaws of the vise-grip.

3. Using a crescent wrench, grab hold of the Rod Pivot Block. Turn the block clockwise to attach it to the cylinder while using the vise-grips to hold to the Cylinder Shaft.

4. Using a 1/2″ socket, tighten the two 1/4″ air fittings onto the new cylinder.

   Note: As an addition air tight precaution, we recommend putting Teflon tape on the threads that the air fittings screw on to, ensuring an air tight seal.

5. Slide the top of the new cylinder on to Clevis Block Pin and place the other side of the Clevis block onto the pin, clamping the cylinder in the middle.

6. Place the Clevis Blocks to their mounting locations at the top of the bucket and tighten the four 1/4″ button head screws into place using a 5/32″ Allen wrench.

   Note: Do not tighten the 1/4″ button head screws all the way; the cylinder needs to be adjusted first.

7. Extend the cylinder rod until the Rod Pivot block is inside the bucket door mounts.

8. Slide the Rod Pivot Pin through the bucket door mounts and Rod Pivot Block pin hole. This connects the cylinder shaft to the bucket door.

9. Attach the e-ring to its proper location by pushing it until it snaps into place. An attached e-ring on each end of the pin secures the Rod Pivot Pin place.

10. Adjust the Clevis Blocks so there is a 1/4" clearance between the top of the Clevis blocks and the bottom of the bucket lip. You can place a 5/32" Allen wrench between the mounting block and bucket lip to set the clearance.

Figure 9-10: Adjust the space between the clevis block and the bucket lip

11. Using a 5/32" Allen wrench, securely tighten the 1/4" button head screws into place.

12. Reconnect each air hose to its correct location (top to top, bottom to bottom) on the cylinder by pushing the air hose into the fitting then pulling on it to ensure it is securely attached.

13. Slide the limit switch back through the small notch opening in the top of the slide rod but do not tighten it.

14. Turn on the air source to the HCGG.

15. Turn on the power supply to the HCGG.

The new cylinder is installed, but the limit switch still needs to be adjusted. Refer to the Limit Switch Adjustment section of this chapter to complete the installation process.

Limit Switch Adjustment

On the High Capacity GrainGage (HCGG), each cylinder has a small black limit switch to detect the position of the bucket door. If the limit switch is not set correctly for each bucket door, it can result in the doors not opening or closing completely. Each limit switch is located by the cylinder for each bucket door.

Tools Needed

Tools needed for adjusting a limit switch:

- Flathead screwdriver

- Permanent marker

Adjusting the Limit Switch

To adjust a limit switch, complete the follow steps:

1. Check that the air source and power to the HCGG are turned on.

2. Check that the bucket door is completely closed.

3. Locate the first limit switch needing adjustment.

Limit Switch

Figure 9-11: Location of limit switch

4. If not already loosened (for those who have just installed a new cylinder), use a flathead screwdriver to loosen the small screw holding the limit switch in place.

5. Slide the loosened magnetic limit switch up or down on the channel until the LED located on the limit switch lights up.

6. Use a flathead screwdriver to tighten limit switch screw.

7. Mark the top edge of the limit switch, on the side of the actuator, with a permanent marker.

Figure 9-12: Use a marker to make the top edge of the limit switch

Follow the previous steps for each bucket door limit switch.

Testing the Limit Switch Adjustment

After the limit switch has been adjusted, we recommend testing the adjustment. To do this, complete the following steps:

1. Set the Auto/Manual switch on the console to Manual.

2. Set switch to Open, making sure the specified door opens all the way, in the correct direction at the actuation of the manual switch.

3. Set switch to Close, making sure the specified door closes all the way, in the correct direction at the actuation of the manual switch.

4. Check the console for the light to stop blinking for the bucket door you just closed. ***Note:*** If the light on the console continues to blink, the limit switch needs to be readjusted. If the console light stops blinking and stays on, the limit switch is correctly set.

5. Complete the previous steps for each limit switch on your HCGG.

The limit switches on your HCGG are now adjusted and tested.

Weigh Bucket Removal

There are rare situations that require the removal of the weigh bucket. If you find yourself in a situation that requires the weigh bucket's removal, complete the following steps to correctly remove the weigh bucket.

1. Unscrew and remove the front brace of the bottom half of the HCGG, allowing you access to the inside of the HCGG.

2. Push down the arms on the retractable locks and turn them forward so the locks are held in the "unlocked" position.

Locked   Unlocked
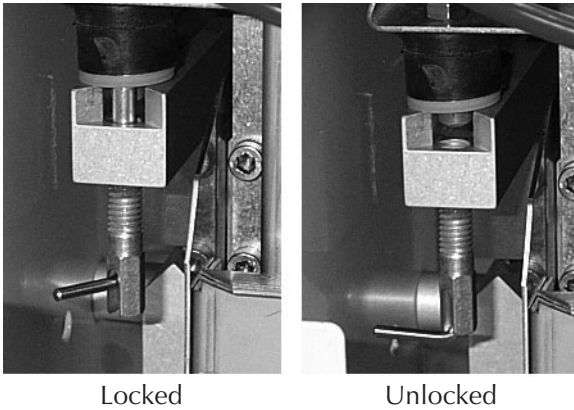
Figure 9-13: Unlocking retractable locks

3. Remove the air hoses from the cylinder by pushing the plastic ring (red/orange) into the body of the cylinder while pulling the 1/4" air fitting (commonly red or orange) while pulling the air hose out of the fitting.
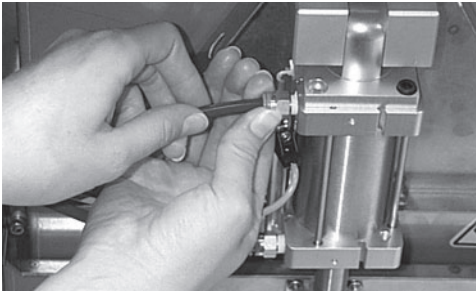
Figure 9-14: Removing the air hose

Note: Tag each airline before removal with **top** or **bottom** to
ensure correct reinstallation.

4. Remove the limit switch by loosening the mounting
    screw and sliding the limit switch up and out of the
    mounting bracket.
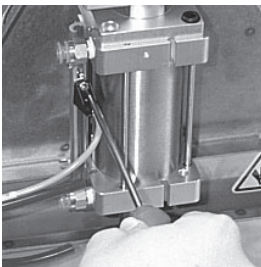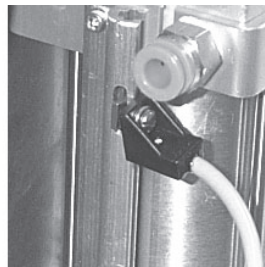
Loosen Screw   Slide Out Limit Switch

Figure 9-15: Removing the Limit Switch

147

5. Disconnect the "Moisture Sensor" connector from the breakout box.

   Note: A plastic lock allows the Moisture Sensor connector to be released. This lock must be pushed before pulling on the connector.
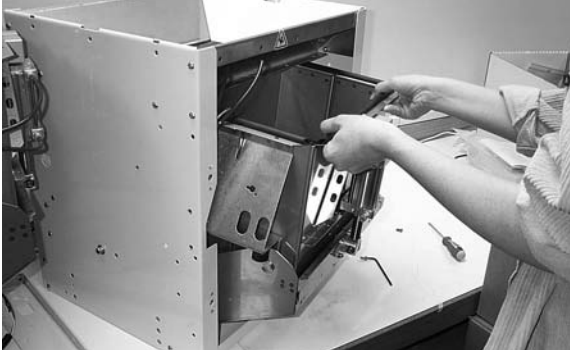
Figure 9-16: Removing the weigh bucket

Replacing the Load Cell

The load cell can be replaced once the weigh bucket has been removed. To replace the load cell, complete the following steps:

1. Locate the load cell on the inside of the HCGG.

Load cell

Figure 9-17: Load cell

2. Remove the two screws that attach to the bottom of the load cell using a 3/16″ Allen wrench.
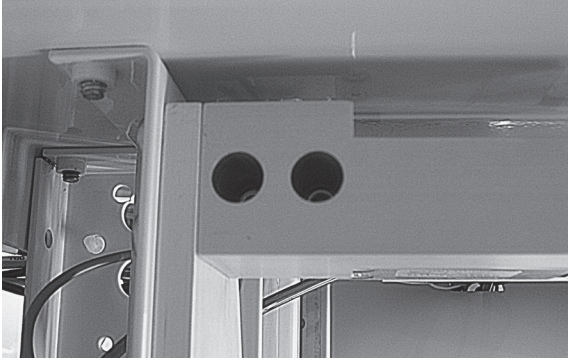
Figure 9-18: Bottom two screws of load cell

3. Use a 3/16″ Allen wrench to carefully remove the two screws on the top of the support that lead into the load cell.
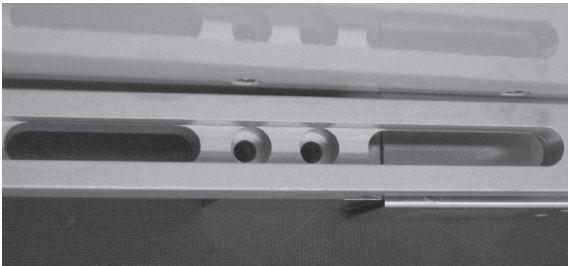
Figure 9-19: Two top screws of load cell

4. Remove broken load cell and replace with new load cell.

5. Reattach screws. We recommend using Loctite to keep screws snug.

Reinstalling the Weigh Bucket

Complete the following steps:

1. Replace the bucket by carefully pushing it into the bottom half of the HCGG and watching the hoses and limit switch so they are not caught as you push it in.

2. Connect the Moisture Sensor connector to the breakout box.

3. Return the limit switch by sliding the loosened mount screw into the mounting bracket and slide it down. Use a flathead screwdriver and tighten the screw.

4. Return the two air hoses by pushing on the plastic locks and at the same time, pushing on the hoses into the air hose holes until they cannot go in any farther.

5. Push down the arms on the retractable locks and turn them so the locks slide back up into the "locked" position.

6. Return the front brace of the bottom half of the HCGG, and screw it back into place.

Your weigh bucket is now reinstalled into your HCGG.

If you have any maintenance questions, please contact a Juniper Systems Technical Service Representative at (435) 753-1881 or email us at support@harvestmaster.com.

Return for Repair Procedure

In the event that your Harvest Data System needs repairs, go to www.harvestmaster.com and choose *Support > Repair Services > Submit Repair Order* for a Returned Materials Authorization (RMA) number. Please enter the following information:

- Serial number

- Model number

- Name and company/university/agency

- Phone and fax numbers

- Clear description of problem

- Purchase order number and billing address

Under the Premium Support Agreement, HarvestMaster will ship you a replacement loaner Next Day Federal Express or UPS Red. To avoid any problems in the return procedure, complete the following steps:

1. Once you receive the loaner unit, package your equipment (if the existing box is still good) in the same box and ship it Federal Express, Next Day Air Mail, or UPS Red.

2. Fill out the shipping and RMA forms that were included with your loaner equipment and include a description of the failure. The more information you can supply concerning the malfunction and the circumstances under which it occurred, the quicker our technicians can complete the repair.

3. Package the unit properly to avoid shipping damage.

4. Write the RMA# on the package you ship.

Your equipment will be repaired and returned to you. After
receiving your repaired equipment, you will be authorized
a period in which to return the loaner unit before you will
be billed for it. There is an annual service and support fee
that allows you to have this service. Please call for detailed
information and pricing.

APPENDICIES

A p p e n d i x   A
W a r r a n t y

Limited Warranty

Hardware

All products manufactured by Juniper Systems, Inc. (Juniper Systems) when properly installed, calibrated, and operated in accordance with instruction manuals accompanying the hardware and used for the purpose for which the hardware was designed shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment.

In the event a defect in materials or workmanship is discovered and reported to Juniper Systems within the one-year period, Juniper Systems will, at its option, repair the defect or replace the defective product. Juniper Systems' obligation hereunder will be limited to such repair or replacement.

The customer shall have the responsibility to ship the defective equipment to Juniper Systems with all cost of shipment prepaid. After repair or replacement Juniper Systems will, at their own expense, ship the replacement or repaired item back to the customer using the same type of carrier.

Software

Software products that are designed by Juniper Systems for use with a hardware product and that are properly installed on that hardware product are warranted to the end user not to fail to execute their programming instructions due to defects in materials or workmanship for a period of one year from date of delivery.

If Juniper Systems receives notice of such defects during the one-year warranty period, Juniper Systems shall, at its option, repair or replace the defective software media. Warranty is limited to repair or replacement of software media.

The warranties provided herein do not apply in the case of improper or inadequate maintenance or in the case of repair by any person not previously authorized in writing by Juniper Systems to do such maintenance or make such repairs.

These warranties likewise do not apply where the products have been operated outside the environmental specification of the product, where software products other than those specified by Juniper Systems have been used, or where attempts at software interface have been made by any person not previously authorized by HarvestMaster to perform such interfacing operations.

Disclaimer of Warranties

The warranties set forth herein are in lieu of all other warranties of Juniper Systems, whether written, oral or implied. Juniper Systems makes no warranties regarding its products (hardware or software), including without limitation warranties as to merchantability, fitness for a particular purpose, any warranty arising from course of performance, course of dealing, or usage of trade whether any of the foregoing warranties are either expressed or implied.

Juniper Systems specifically makes no warranties as to the suitability of its products for any particular application. Juniper Systems shall in no event be liable for special, incidental, or consequential damages in connection with or arising out of the furnishing, performance or use of any product covered by this agreement whether such claim is based upon warranty (express or implied), contract, strict liability, negligence, or otherwise.

Updates or Modifications

Juniper Systems shall be under no obligation to update or modify its products except as herein noted to correct program errors. Furthermore, the customer agrees that all representations and warranties contained herein shall be immediately null and void in the event of any modification, alteration, or change in or to any product affected by or on behalf of the customer except for a change made by Juniper Systems.

Removal of Serial Number

Removal of the Juniper Systems serial number label from an instrument will void any warranty on the said instrument. Juniper Systems will not repair or update an instrument and return it to an individual if the instrument is without the said serial number label.

Extended Warranties

Juniper Systems offers a variety of warranty options to extend coverage beyond the standard warranty. You can contact Juniper Systems Customer Service Department for details at (435) 753-1881 (6 am - 5 pm MST, Mon-Fri).

A p p e n d i x   B
M o u n t i n g   D i a g r a m s

Below is pictured the system console mounting diagram.
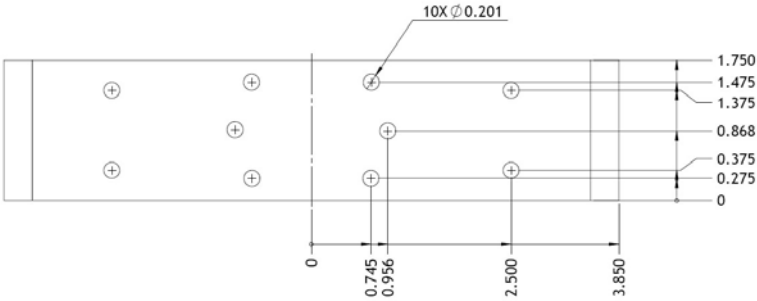
The next two diagrams are for mounting the printer.
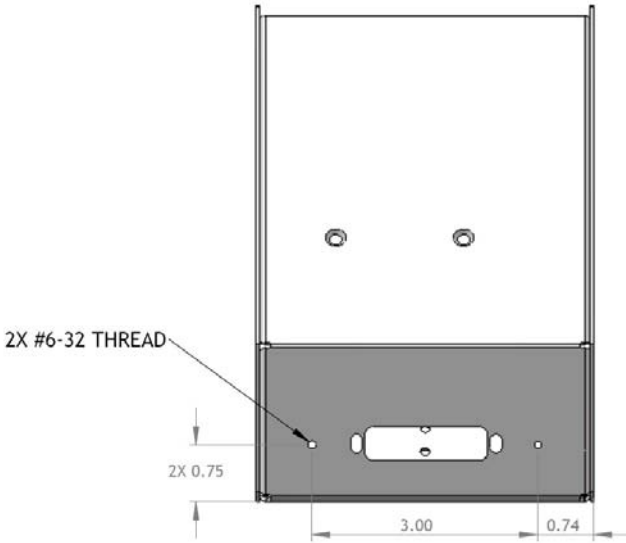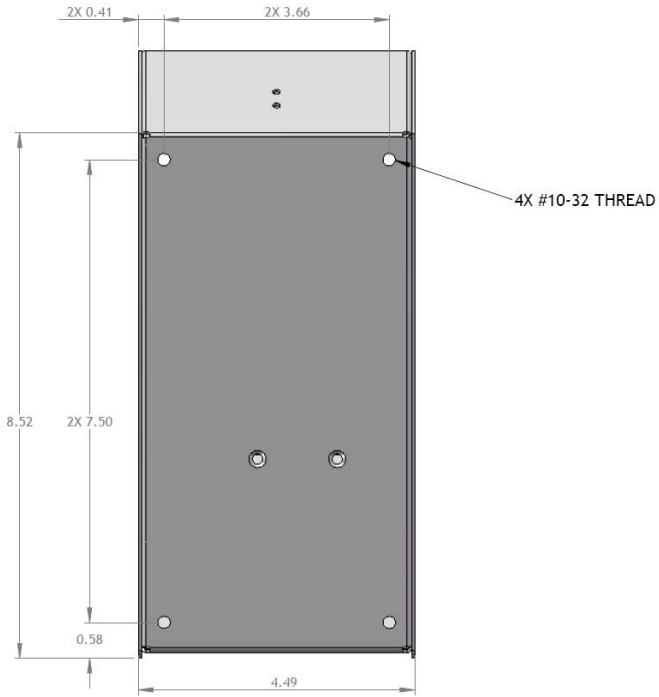
The following diagrams are for mounting the HCGG.

Side View

17.150   1.795

22.291

1.000   2.000   6X ⌀0.406

1.000
0.750   9.000   4.075

Bottom View

20.062

4X ⌀0.406

9.000
17.150

0.700

4.075

18.662
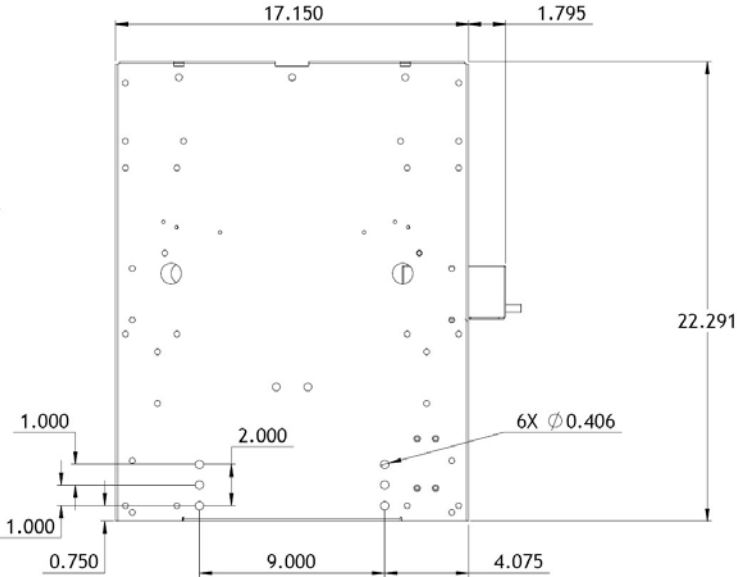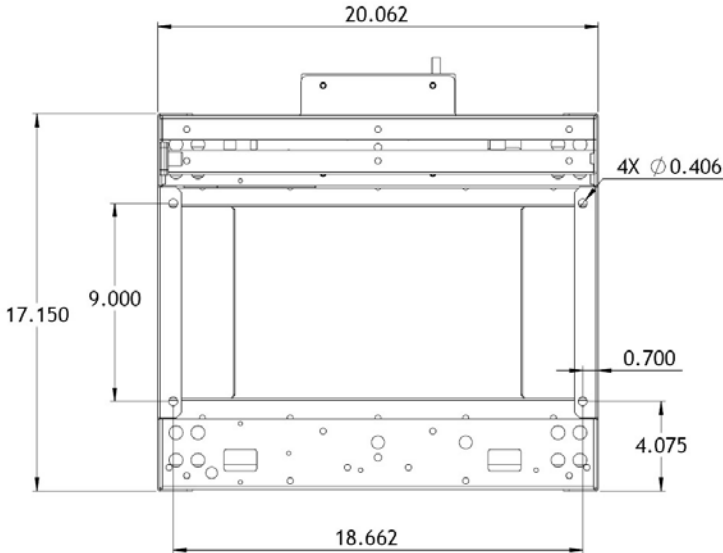
A p p e n d i x   C
C a b l e   W i r i n g   D i a g r a m s
f o r   t h e   H M - 8 0 0

Cable Connections for HM-800

Within the HM-800 there are several components.
Figure C-1 shows the components wired on the stand.

Figure C-1: Front view of HM-800 components

Figure C-2 shows the cable connections from the HM-800 System Console and modules to other components.
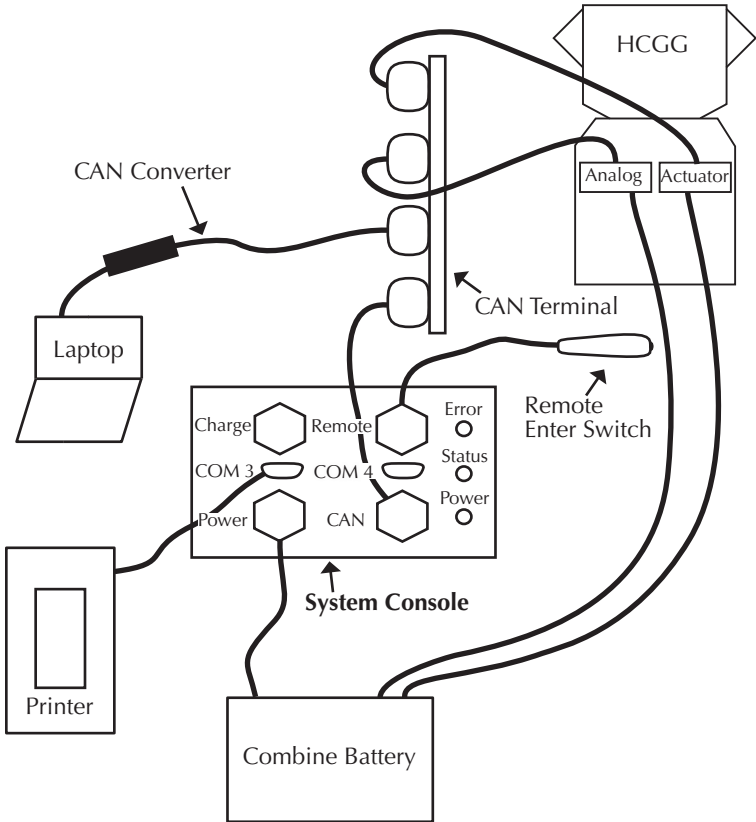
Figure C-2: Cable connections for the HM-800

ACTUATOR
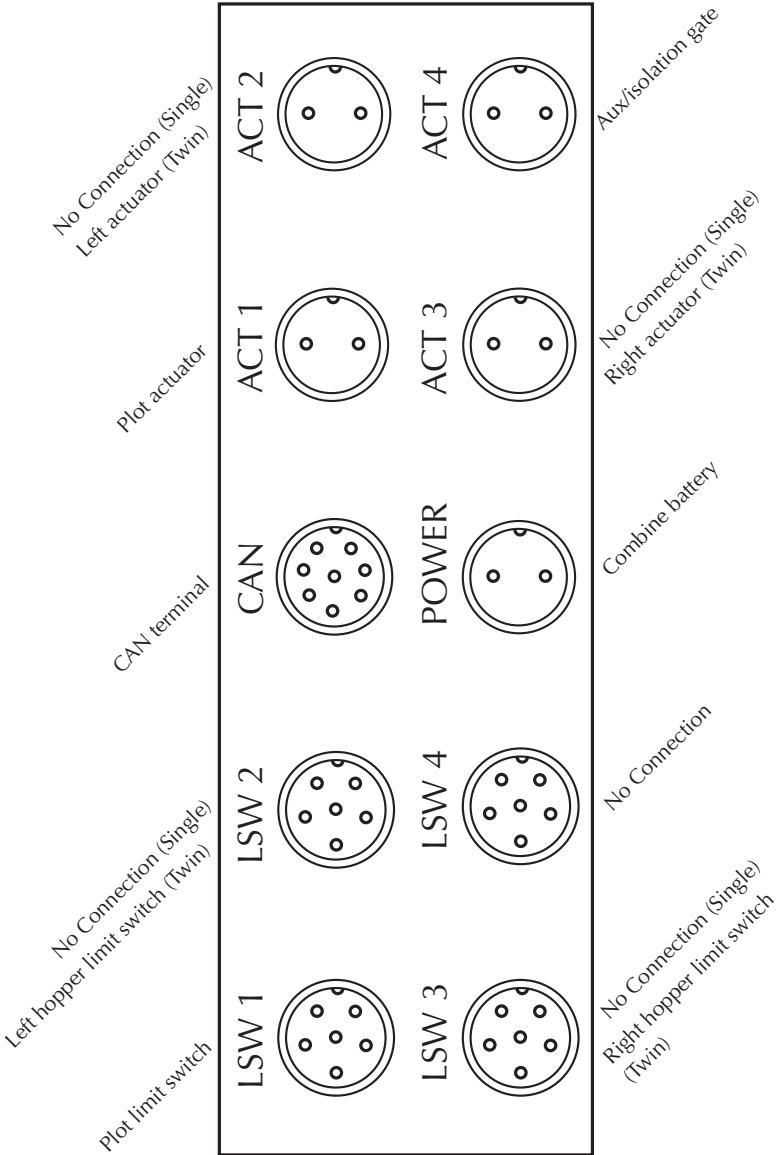
Figure C-3: Cable connections for the actuator module

ANALOG
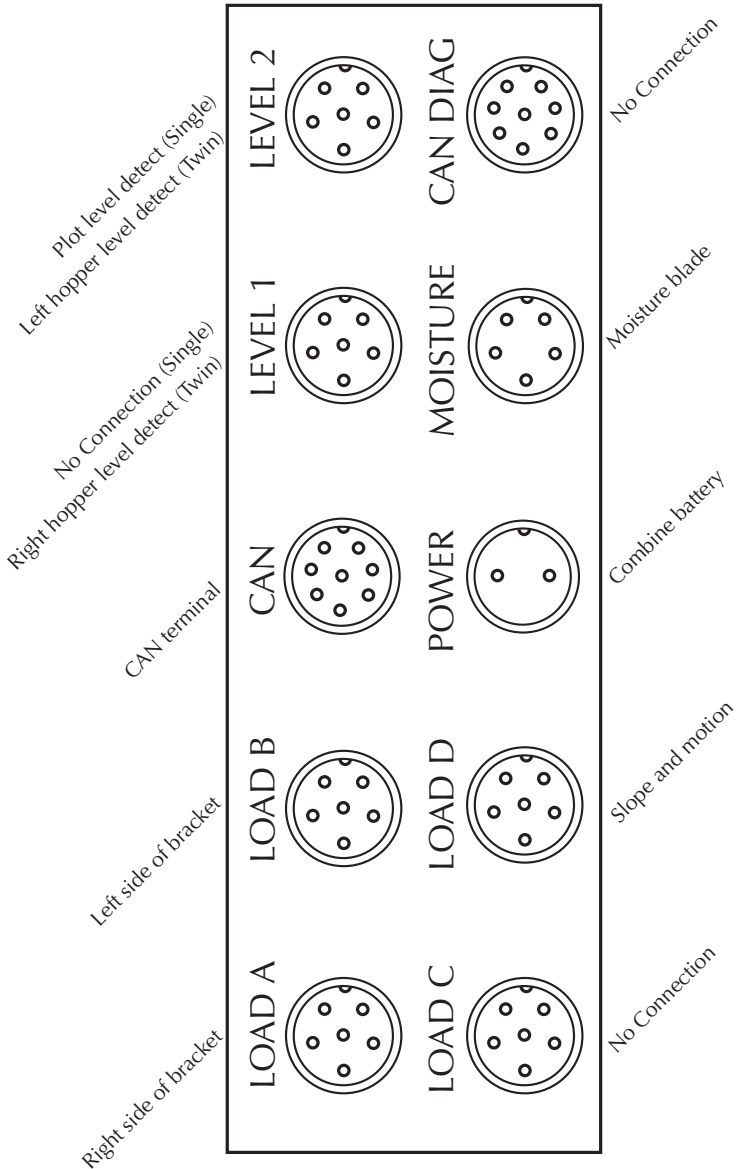
Figure C-4: Cable connections for the analog module

Supporting Hardware

The High Capacity GrainGage is composed of the following hardware:
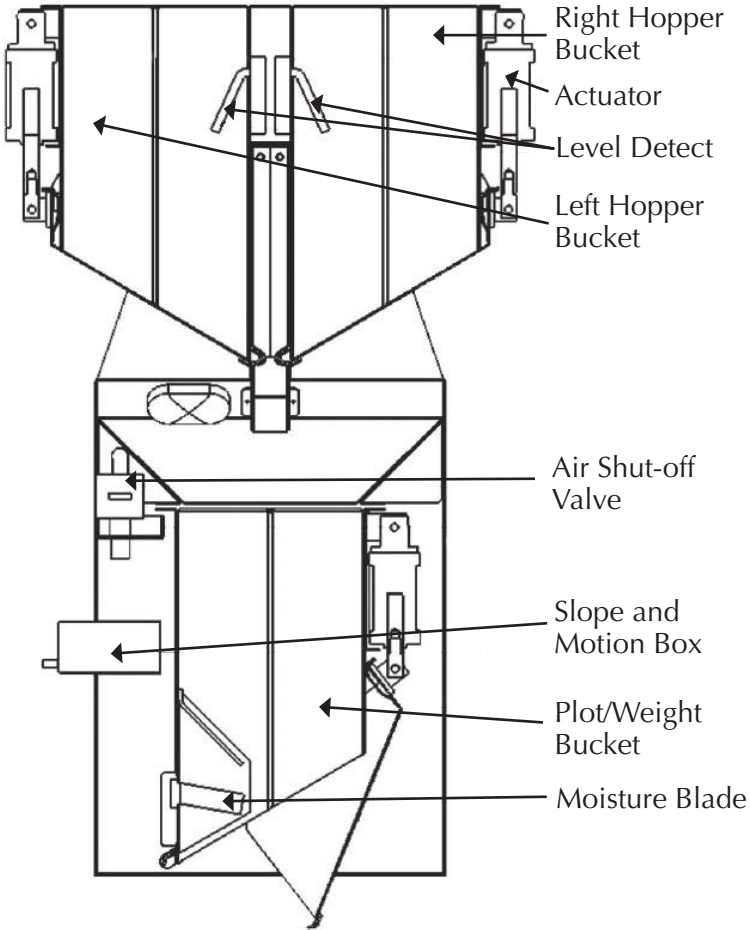
Figure C-4: A Basic HCGG System

Left and Right Hopper Buckets

Left and Right Hopper Buckets collect the initial harvest loads for reading.

Actuator

Actuator runs the mechanical functions of the hopper buckets.

Level Detect

Level Detect is used to measure grain level within each of the holding hoppers of the High Capacity GrainGage. The Level Detect sets the point that the hoppers cycle at during harvest of longer strip tests. The Level Detect is not used with normal Plot Harvest.

Air Shut-off Valve

Air Shut-off Valve shuts off the airflow in the HCGG.

Slope and Motion Box

Slope and Motion Box is a patented sensor used to decrease errors caused by combine vibrations or when harvesting on slopes. This results in increased accuracy of the weight readings. The Slope and Motion box is enabled via software and has a hardware-shipping stop.

Plot/Weight Bucket

Plot/Weight Bucket contains a moisture blade for collecting weight and moisture readings from the hopper buckets, which are filled during harvesting.

Moisture Blade

Moisture Blade is a sensor used to measure moisture and density (test weight) on the High Capacity GrainGage.

HM-800 in HCGG

Figure C-5 shows the HM-800 installed in the HCGG.
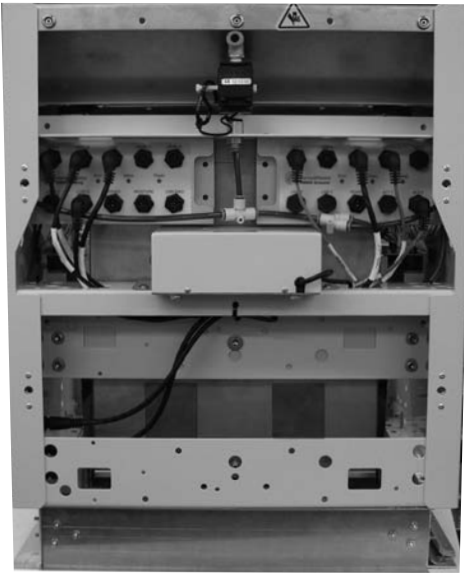
Figure C-5: HM-800 installed in the HCGG

2 pin   5 pin   6 pin   8 pin   9 pin

Analog Module	Twin	Single	Pin	Connection	Description
Level 1 *6-pin*	Level 1 Right Hopper	N/A	1	Red	Excite
			2	Shield	Ground
			3	Black	Digital In
			4	N/C	N/C
			5	N/C	N/C
			6	N/C	N/C

Analog Module	Twin	Single	Pin	Connection	Description
Level 2 *6-pin*	Level 2 Left Hopper	Plot Level Detect	1	Red	Excite
			2	Shield	Ground
			3	Black	Digital In
			4	N/C	N/C
			5	N/C	N/C
			6	N/C	N/C
Load A *6-pin*	Load A Right Load Cell	Load A Right Load Cell	1	Green	Excite
			2	N/C	N/C
			3	Red	Signal +
			4	White	Signal –
			5	Black	Excite Gnd
			6	Shield	Chassis Gnd
			N/C	Brown	N/C
			N/C	Blue	N/C

FIELD RESEARCH SOFTWARE

Analog Module	Twin	Single	Pin	Connection	Description
Load B *6-pin*	Load B Left Load Cell	Load B Left Load Cell	1 2 3 4 5 6 N/C N/C	Green N/C Red White Black Shield Brown Blue	Excite N/C Signal + Signal − Excite Gnd Chassis Gnd N/C N/C
Load C *6-pin*			1 2 3 4 5 6 N/C N/C	Green N/C Red White Black Shield Brown Blue	Excite N/C Signal + Signal − Excite Gnd Chassis Gnd N/C N/C

Analog Module	Twin	Single	Pin	Connection	Description
Load D *6-pin*	Load D SMS	Load D SMS	1	Green	Excite
			2	N/C	N/C
			3	Red	Signal +
			4	White	Signal –
			5	Black	Excite Gnd
			6	Shield	Chassis Gnd
			N/C	Brown	N/C
			N/C	Blue	N/C
CAN *8-pin*			1	Red	CAN Power
			2	Yellow	CAN +
			3	Black	CAN Gnd
			4	Green	CAN –
			5	N/C	N/C
			6	N/C	N/C
			7	N/C	N/C
			8	N/C	N/C

FIELD RESEARCH SOFTWARE
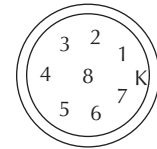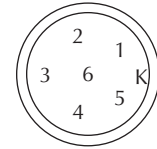
Analog Module	Twin	Single	Pin	Connection	Description
CAN-DIAG *8-pin*	CAN	CAN	1 2 3 4 5 6 7 8	Red Yellow Black Green N/C N/C N/C N/C	CAN Power CAN + CAN Gnd CAN − N/C TX RX GND
Moisture *5-pin*	Moisture EM Sens	Moisture EM Sens	1 2 3 4 5	Red Black Green White Shield	Excite Ground Signal + Signal − Ground
Power *2-pin*	Power	Power	1 2	Black Red	Ground +12 V
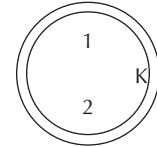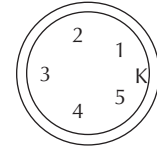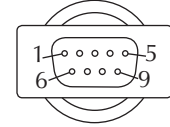
Actuator Module		Twin	Single	Pin	Connection	Description
Act 1 *2-pin*		Act 1 Plot Act	Act 1 Plot Act	1 2	Red Black	Power Ground
Act 2 *2-pin*		Act 2 Left Act		1 2	Red Black	Power Ground
ACT 3 *2-pin*		Act 3 Right Act		1 2	Red Black	Power Ground
Act 4 *2-pin*		Act 4 Aux Act	Act 4 Aux Act	1 2	Red Black	Power Ground
LSW 1 *6-pin*	Open Close	LSW 1 Plot	LSW 1 Plot	1 2 3 4 5 6	N/C N/C N/C Brown Blue Black	N/C N/C N/C Excite Ground Signal

Actuator Module		Twin	Single	Pin	Connection	Description
LSW 2 *6-pin*	Open Close	LSW 2 Left LSW		1 2 3	N/C N/C N/C	N/C N/C N/C
				4 5 6	Brown Blue Black	Excite Ground Signal
LSW 3 *6-pin*	Open Close	LSW 3 Right LSW		1 2 3	N/C N/C N/C	N/C N/C N/C
				4 5 6	Brown Blue Black	Excite Ground Signal
LSW 4 *6-pin*	Open Close			1 2 3	N/C N/C N/C	N/C N/C N/C
				4 5 6	Brown Blue Black	Excite Ground Signal

Actuator Module	Twin	Single	Pin	Connection	Description
CAN *8-pin*	CAN (patch Cable)	CAN	1 2 3 4 5 6 7 8	Red Yellow Black Green N/C N/C N/C N/C	CAN Power CAN + CAN Gnd CAN – N/C N/C N/C N/C
Power *2-pin*	Power	Power	1 2	Black Red	Ground +12 V

System Console	Twin	Single	Pin	Connection	Description
Allegro Power *2-pin*			1 2	Stria Black	+12 V Ground
Remote *5-pin*			1 2 3 4 5	Black Green Red N/C N/C	Input Ground Power N/C N/C

FIELD RESEARCH SOFTWARE

System Console	Twin	Single	Pin	Connection	Description
Com 3			1	N/C	N/C
			2	RXD	Receive Data
			3	TXD	Transmit Data
			4	DTR	Data Terminal Ready
			5	GND	Ground
			6	DSR	Data Set Ready
			7	RTS	Request to Send
			8	CTS	Clear to Send
			9	N/C	N/C
Com 4			1	N/C	N/C
			2	RXD	Receive Data
			3	TXD	Transmit Data
			4	DTR	Data Terminal Ready
			5	GND	Ground
			6	N/C	N/C
			7	RTS	Request to Send
			8	CTS	Clear to Send
			9	RI	Ringing In
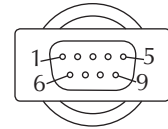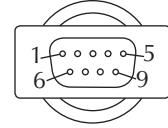
System Console	Twin	Single	Pin	Connection	Description
Power *2-pin*	Power	Power	1 2	Black Red	Ground +12 V
CAN *8-pin*	CAN	CAN	1 2 3 4 5 6 7 8	Red Yellow Black Green N/C N/C N/C N/C	CAN Power CAN + CAN Gnd CAN – N/C N/C N/C N/C

Getting the HCGG Ready

HCGG Unpacking and Inspecting

After receiving your HCGG, unpack and inspect it by
completing the following:

1. Open the boxes in which the HCGG was shipped.

2. Remove the two halves of the HCGG from the
    packaging.

3. Place the bottom half of the HCGG on the floor and the
    top half on a table in the "right side up" position.

4. Remove the installation kit from the hopper.

5. Cut the tie that is holding the cables inside the hopper
    assembly.

6. Remove the cables from the hopper bucket, and inspect
    the cables, connector ends, and appearance of the
    system for any damage that might have occurred during
    shipping.

HCGG Hopper Assembly

Now that you have unpacked and inspected your HCGG,
you are now ready to put it together. Juniper Systems, Inc.
strongly advises that you have two people to complete
the first two steps. Complete the following steps to fully
assemble the HCGG hopper.

Remove Panel Covers

There are two removable panels located on the bottom half of the HCGG. Four large screws attach each panel. These screws have a large flat surface so you can unscrew them by hand. Remove these front and back panels by completing the following:

1. Turn each of the four screws counterclockwise until the screws are loose.

2. Pull the panel off of the bottom half of the HCGG.

3. Repeat steps two and three for the other panel on the bottom half of the HCGG.

Note: We recommend removing the weigh bucket prior to assembly

HCGG Assembly of Top and Bottom Halves

Placing the top half of the HCGG on the base is the next step. Juniper Systems strongly advises that you have two people to complete this assembly process because the top half needs to be tilted back and not fully resting on the base, until the power cables are correctly installed.

Note: Do not place the top of the HCGG flat on the base or you will damage the cable assembly.

Assemble the top and base of the HCGG by completing the following:

1. Position the base of the HCGG so that the Slope and Motion box and Breakout box are facing you.

2. Place the top half of the HCGG on top of the base with the light and wiring harness on the right. Tilt it back so the top is balanced on only one edge, as shown below.

Light
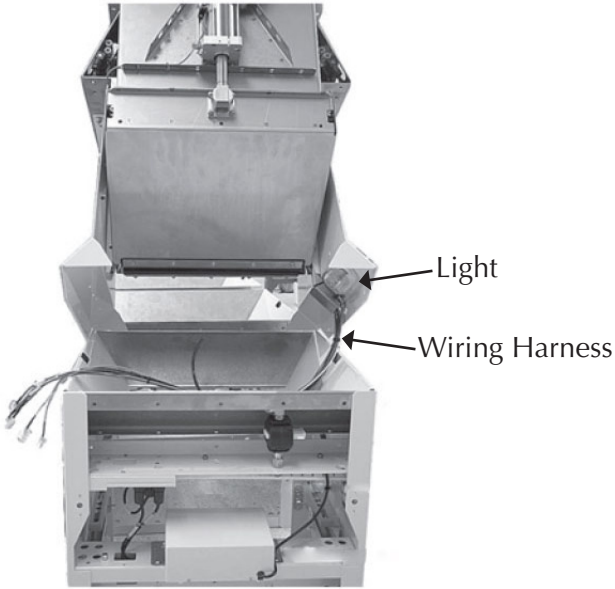
Wiring Harness

Figure C-6: Top half of High Capacity GrainGage tipped and balanced on the base

3. Feed the group of wiring cables, or wiring harness, through the access hole located directly below the wires. Feed the largest wires first and the smaller wires last.

4. Feed the wiring harness out of the HCGG by the Slope and Motion box, making sure none of the wires are wedged by the bottom half of the HCGG.

Once completed, the placement of the group of wires should resemble the picture below.

Feed wires in here
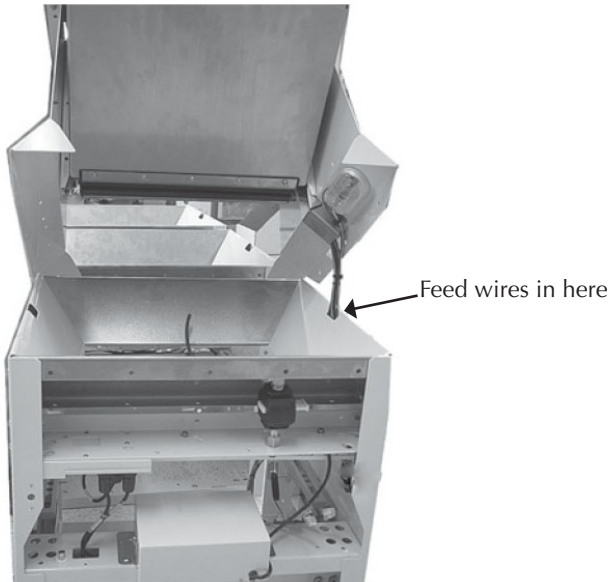
Figure C-7: Wire Harness feed-in and feed-out points

5. Lower the top half of the HCGG slowly until it rests flat on the base while watching the wiring harness, making sure it does not get between the top and bottom sections of the HCGG.

Now that the two halves of HCGG are combined into one unit, connecting and installing all of the internal wiring is the next step.

Cable Placement

When assembling the HCGG, there are specific locations for cables to feed from the top half to the modules.

1. Attach the top of the HCGG to the base. Make sure that the cables come down and feed through the hole in the top of the base.

Figure C-8: Cables coming down from top to the base of the HCGG

2. The cables run down the inside and feed through the side where the modules are located.

Figure C-9: Cables running down inside HCGG towards the modules

3. To keep the cables in place, secure them with a tie to the frame.

Figure C-10: Cables secured to frame with tie

4. Remove the blue hose plug and fit it into the "Y" to the right of the slope and motion sensor. Attach the cables to the actuator module. The cables are labeled to help with this process.
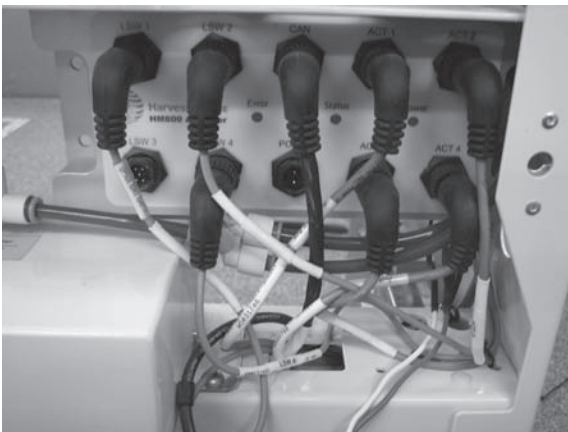
Figure C-11: Cables attached to actuator module and blue hose behind cables attached to "Y"

5. Run the analog cables below the cross beam and bring them up through hole and attach to analog module.

Figure C-12: Cables under cross beam and attached to analog module

Index

Index

calibrate 126
  accuracy 71
  equations 35, 39
  HCGG 16
  load cells 17, 22, 71
  manually adjusting load cell 22
  moisture 28
  small grain 19
  temperature 33, 34, 35
  weight 16, 22
coef F 38
coefficient Z 38
  adjustment value 39
coef V 38
cylinder 136

D

data
  backup 101
  collecting 99
  collection mode 95
  prearing to collect 94
DataLink
  exporting 115
  functions 110
  importing 111, 114
diagnostics 70, 72

E

emulation mode 14
enable
  graingage 12
  HCGG 12
error codes 78

I

installing
  cylinder 135, 140
  FRS 9
  harvest data system 130

K

Keaser filter 134

L

level detector sensor screen 80
  current 80
  tare 80
  tare value 80
  trip point 80
level sensor 41, 103, 107, 166, 167
  settings screen 41
light emitting diode. *See* moisture sensor LED codes
limit switch
  adjusting 143
  tesitng 145
load cell 17, 71, 148
  checking calibration 71
  manually adjust 22
  recalibrate 72
load cell screen 71
  ref, Q 73
  SM status 74
  tare 74
  total 73
  voltage 73
  weight 73
lubricator
  oil 132

M

N

navigation type. *See* harvesting navigation type

O

observers 99
operating pressure 127
operating specifications 131

P

pneumatics 127, 128, 130
print calibrations 82

R

range/row
  starting location 98
removing
  cylinder 136
  weigh bucket 146
repair 151
retare 25, 75, 100
  default 26
  threshold 25
Returned Materials Authorization (RMA) 151

S

SCCU
  error 79
Sensor Control and Conditiong Unit. *See* SCCU
setup
  two combines 45
setup file 45
  default 46
single plot combine 97, 102
slope and motion sensor 23, 73, 166, 167
starting plot cell 96

T

V

Views
  Form. *See* Form screen, Collect Data Form screen
  list. *See* List screen
  Spatial. *See also* Spatial screen
volts 75, 124

W

warranty
  disclaimer 156
  extended 157
  hardware 154
  serial number 157
  software 155
weigh bucket 150
wiring
  actuator 175
  analog 170
  system console 177