



GrainGages™

H2/H3 Single

HARDWARE MANUAL

H2/H3 Single GrainGage Hardware Manual

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Cautions

⚠ CAUTION: This symbol indicates that failure to follow directions could result in damage to equipment or loss of information.



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GrainGagesTM

H2/H3 Single



CHAPTER 1

Introduction

1. Introduction

The H2 and H3 Single GrainGage systems deliver highly accurate measurements of plot weight, moisture, test weight, and more during the harvest of large plot, high-volume grain samples. The key difference between the H2 and H3 GrainGage models lies in their moisture sensing technology. The H2 uses an EM moisture sensor, while the H3 uses SCiO™ near infrared (NIR) spectroscopy.

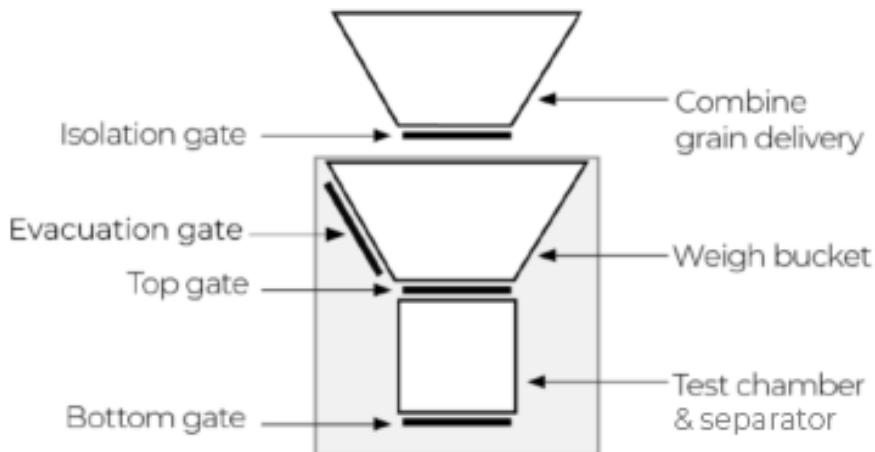


The GrainGage controls the flow of harvested material through the measurement system and compensates for slope and motion to produce results similar to those on a stationary, level platform. The heart of the GrainGage is the DSP (Digital Signal Processing) electronics module, which handles the bulk of logic, communications, and control in the GrainGage.

1.1 Illustration of the Single GrainGage System

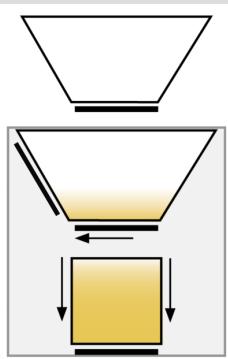
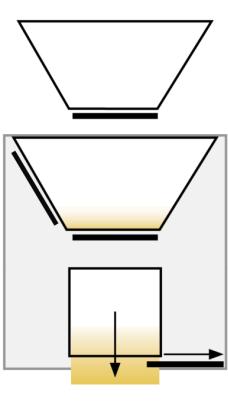
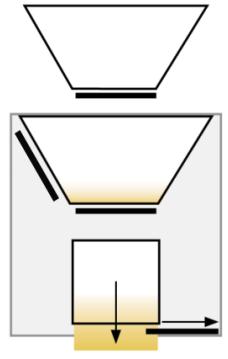
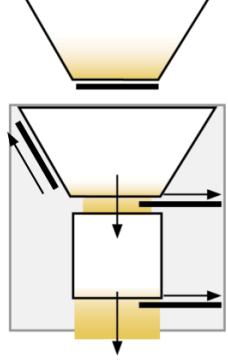
The GrainGage uses a batch-measurement system, which automatically detects when to cycle based on the weight trip point. The number of cycles per plot is determined by the amount of harvested grain.

The basic process is outlined below:



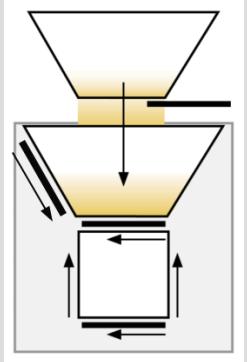
Single GrainGage System

| Step | Description | Diagram |
|------------------------|--|---------|
| 1. Incoming grain. | <p>The isolation gate opens.</p> <p>Grain falls into the weigh bucket as it is harvested until a cycle is initiated either by the operator (flush cycle) or by the GrainGage when the weight trip point is met.</p> | |
| 2. Prepare to measure. | <p>The isolation gate closes.</p> <p>If the amount of harvested grain is above the minimum weight threshold, the top gate opens. The test chamber fills with grain from the weigh bucket.</p> <p>If the amount of harvested grain is below the minimum weight threshold, the sample is weighed, but no test weight, moisture, or NIR constituent data is taken. The sample is evacuated.</p> | |

| | | |
|----------------------------------|--|---|
| 3. Measure. | <p>The top gate closes.</p> <p>Test chamber drops and separates from the weigh bucket.</p> <p>The GrainGage measures total bucket weight, test weight, moisture, and constituent NIR data.</p> |  |
| 4. Evacuate the test chamber. | <p>The bottom gate opens, emptying the test chamber.</p> <p>If the harvested material meets the following criteria, go to step 5.</p> <ul style="list-style-type: none"> ▪ The max sub-cycle is set to greater than 1. ▪ The grain in the bucket meets the minimum weight threshold. ▪ This isn't the last sub-cycle according to the setting in Mirus. <p>Otherwise, go to step 6.</p> |  |
| 5. Measure additional sub-cycle. | <p>The bottom gate closes.</p> <p>The test chamber re-docks to weigh bucket.</p> <p>The top gate opens, and the test chamber fills with grain from the weigh bucket.</p> <p>Go to step 3 until the set number of sub-cycles is complete or the grain in the bucket does not meet the minimum weight threshold. Note: The total bucket weight is not repeated for additional sub-cycles.</p> |  |
| 6. Evacuate weigh bucket. | <p>The top and evacuation gates open (while the bottom gate is still open).</p> <p>All remaining grain empties from the weigh bucket and test chamber.</p> |  |

7. Grain flows into the weigh bucket for next plot cycle.

The top, bottom, and evacuation gates close.
Tare check is performed.
The test chamber re-docks to the weigh bucket.
The isolation gate opens.
Go to step 1 if the trip was due to bucket weight trip point.



8. Finalize plot.

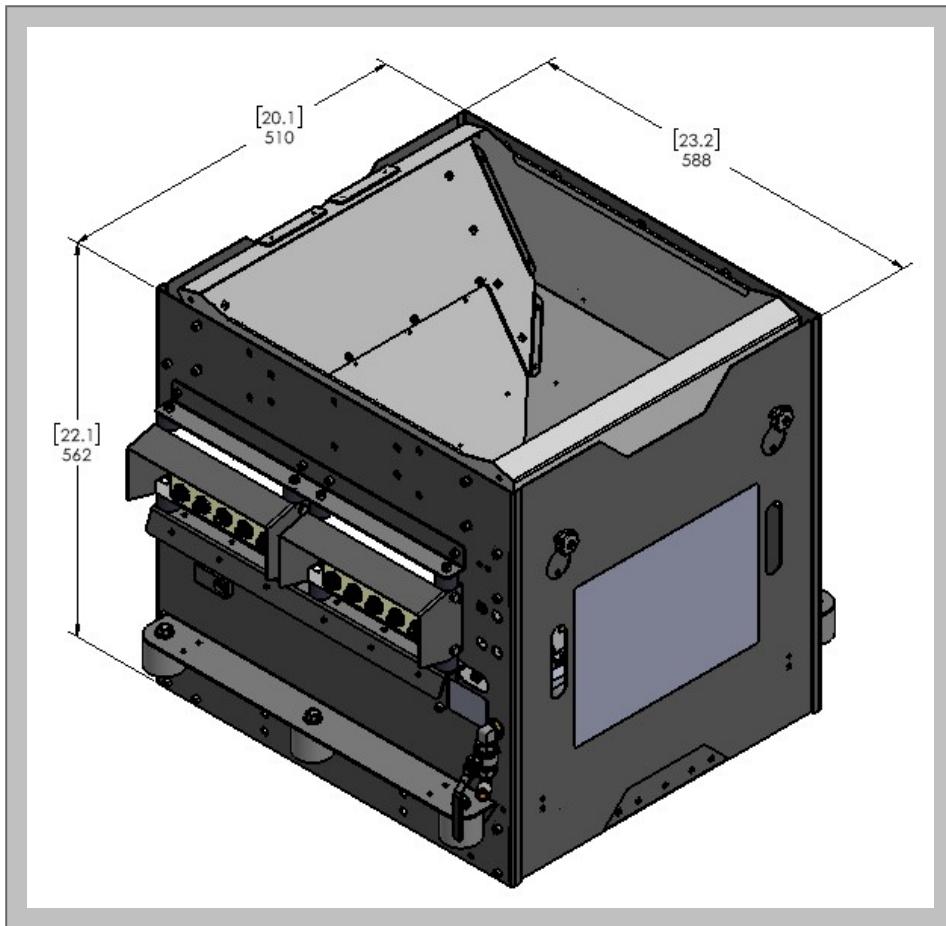
The GrainGage averages the sub-cycle values, totals the bucket weights, and records the final results for the plot.

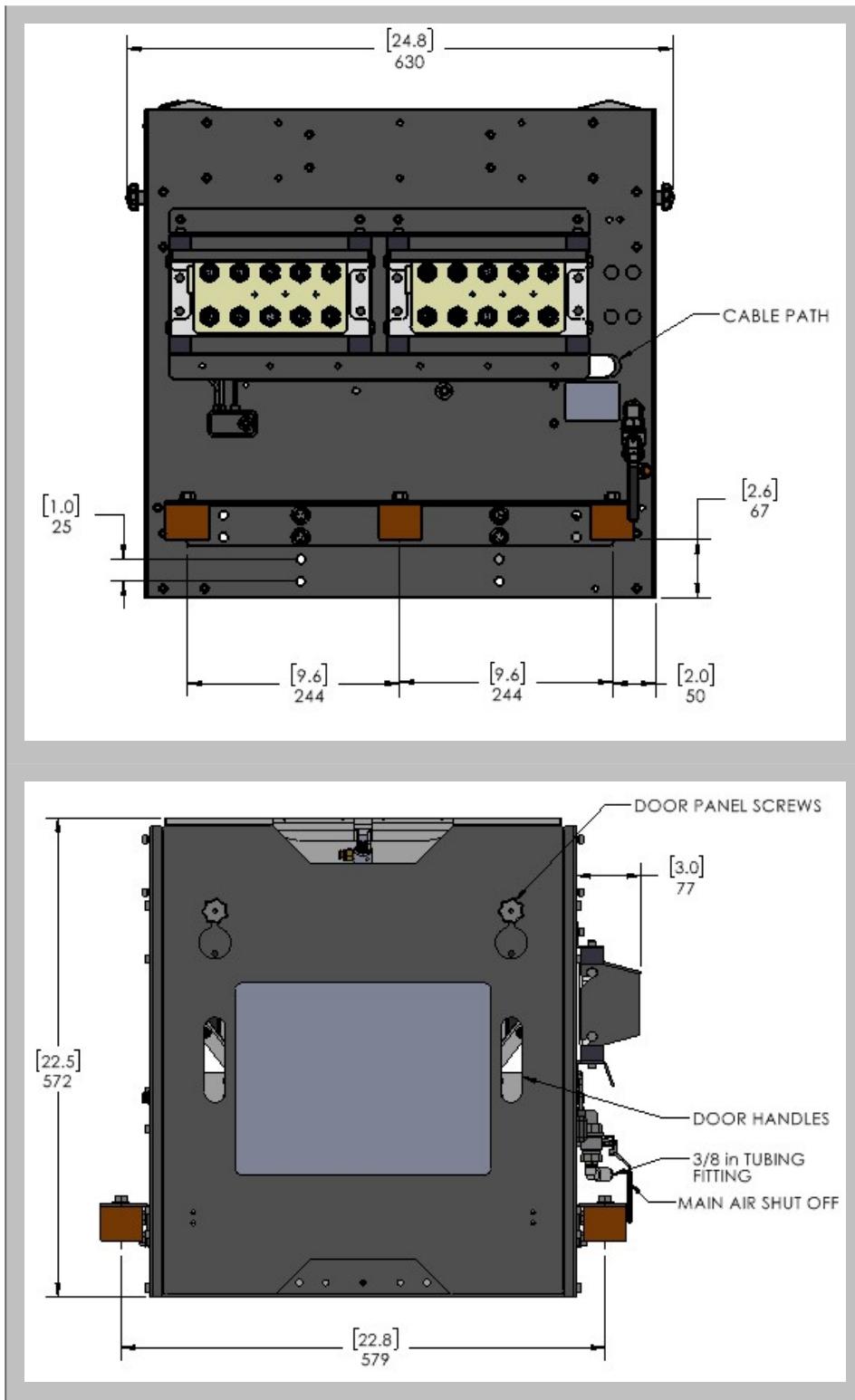
(no diagram)

Repeat from step 1 for the next plot.

1.2 Single GrainGage Specifications and Dimensions

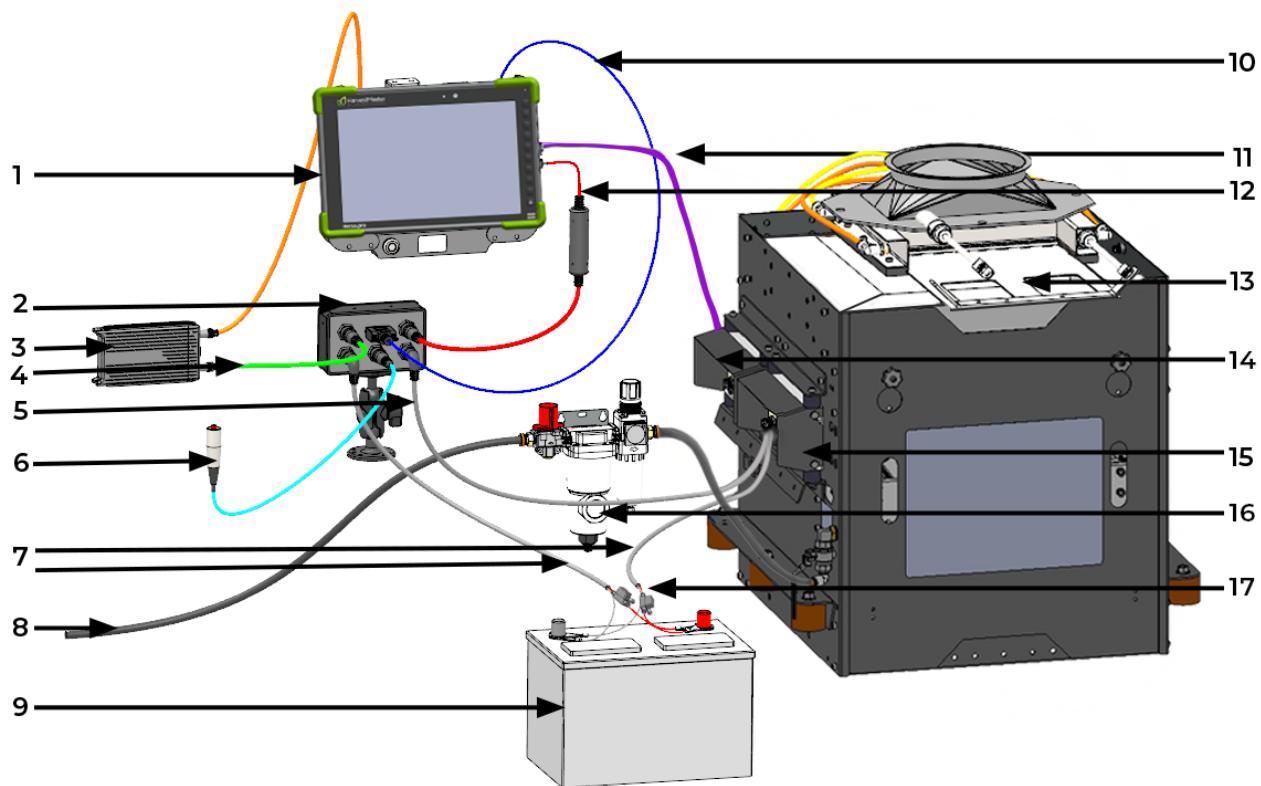
These images show the outer dimensions of the H2 and H3 Single GrainGage chassis.





1.3 Single GrainGage System Diagram

The following diagrams show the basic layout and parts of the Single GrainGage system. For detailed installation instructions and a complete list of parts, see [Install the GrainGage](#).



| | |
|-------------------------------|--|
| 1. Rugged tablet | 10. Serial cable |
| 2. System controller | 11. SCiO serial to USB cable (H3 only) |
| 3. Power supply | 12. CAN to USB cable (optional) |
| 4. Lind charge cable | 13. Isolation gate * |
| 5. CAN cable | 14. Actuator module |
| 6. Remote enter press | 15. DSP module |
| 7. 12 V DC power cables | 16. Pneumatic air prep |
| 8. Pressurized air | 17. ATC 20 A fuses |
| 9. 12 V DC automotive battery | |

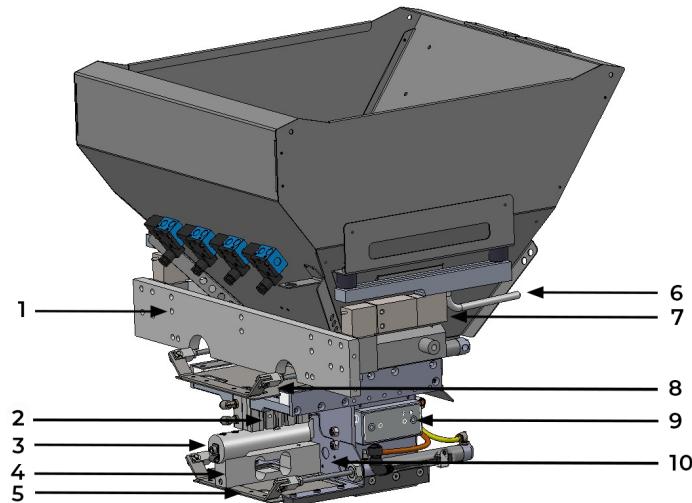
* The orientation of the isolation gate may vary based on the combine.

Note: Use either the serial cable (10) or the CAN to USB cable (11). Do not use both at the same time.

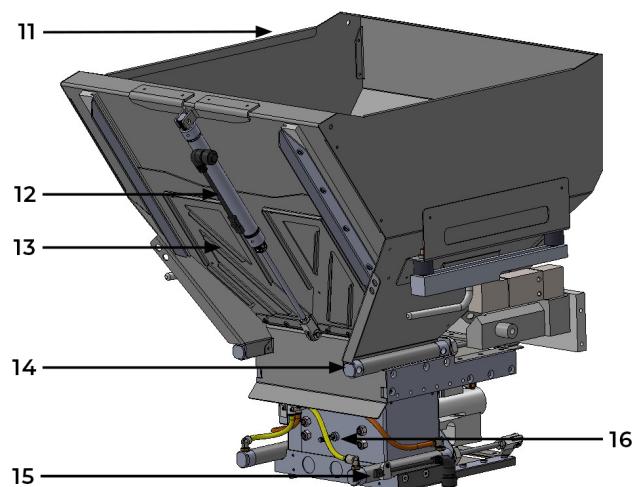
Note: HarvestMaster requires that you install ATC 20 A fuses (16) on all power cables that connect to the battery.

Internal Components of Single GrainGage

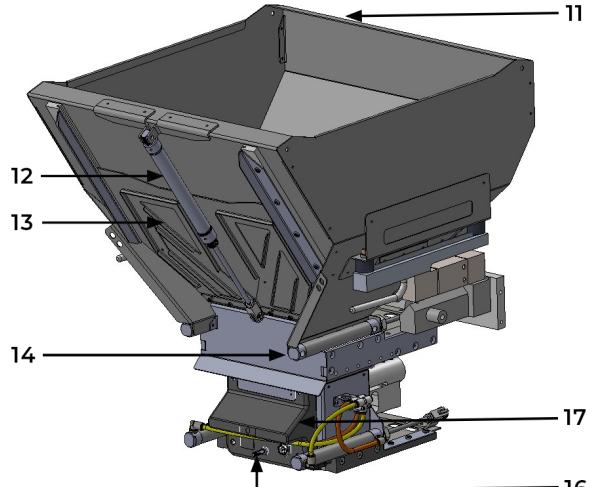
H2 & H3 Single GrainGages



H2 Single GrainGage



H3 Single GrainGage



1. Weigh frame

10. Test chamber

2. Separator limit switch

11. Plot bucket

3. Separator cylinder

12. Evacuation gate air cylinder

4. Test chamber load cell

13. Evacuation gate

5. Bottom gate

14. Air cylinder

6. Calibration hook for plot weight

15. Air cylinder limit switch

| | |
|--|--------------------------------------|
| 7. Plot bucket load cell | 16. Calibration hook for test weight |
| 8. Top gate | 17. SCiO NIR Sensor |
| 9. Grain moisture sensor (optional for H3) | |

1.4 Single GrainGage System Components

The following table describes the components in the GrainGage system.

| System Components | |
|---------------------------------|---|
| Component | Description |
| DSP module | An electronic module that controls the signal conditioning, measurement, isolation door, and some control of the GrainGage. |
| Primary actuator module (lower) | Controls the top, bottom, separator, and evacuation gates. |
| H3 SCiO NIR Sensor | Analyzes the moisture, protein, oil, and other constituents (when applicable) of the test chamber sample using near-infrared (NIR) technology. |
| EM3 moisture sensor | Measures the permittivity of the test chamber grain sample and converts that value to a grain moisture percentage, using the following formula: $\text{Percent moisture} = 100 \left(\frac{M_w}{M_d + M_w} \right)$ M_w is the mass of the water in the grain. M_d is the mass of the grain. |
| System controller | Provides communications and signal interface to the GrainGage, including a serial communications interface, a remote enter button connection, a computer power supply, CAN (Control Area Network) connectivity, a USB connection, and system power switch. |
| Tablet | Runs the Mirus software for field data collection. Mirus software runs on Windows 10 or later. |
| Plot bucket | Holds the harvested plot. |
| Test chamber | Holds the grain sample while it is measured for moisture and test weight. |

| | |
|-------------------------|---|
| Isolation gate | Prevents grain from dribbling or flowing into the plot bucket during a measurement cycle. |
| Top gate | Regulates the amount of grain entering the test chamber. |
| Bottom gate | Closes to hold grain in the test chamber and opens to allow grain to flow out of the GrainGage. Located at the bottom of the test chamber. |
| Evacuation gate | Opens between cycles or plots to help evacuate the sample quicker. |
| Separator cylinder | Moves the test chamber upwards into the filling position or downwards to the weighing position. |
| Load cell | The GrainGage has three aluminum, full-bridge strain gauge load cells. Two are used to make precise weight measurements of the entire plot bucket of the GrainGage, and the third load cell measures the weight of the test chamber contents. |
| Solenoid | The GrainGage has five solenoids, which are controlled by the DSP and actuators module and independently open and close gates and separate/dock the test chamber. |
| Actuator (air cylinder) | Moves the GrainGage gates using pneumatic cylinders. |
| Limit switch | Senses if the gates are closed. |

1.5 Terminology

| Terminology | |
|--------------------------|---|
| Term | Definition |
| CAN | The Control Area Network (CAN) is a robust electronic communication protocol common in automotive applications. |
| Minimum weight threshold | The minimum amount of weight required to include moisture, test weight, and NIR constituent data from that specific sub-cycle in the average for that plot. |

| | |
|-------------|---|
| Flush cycle | The last cycle of the plot and Mirus advances to the next plot. |
| Sub-cycle | A sub-cycle is a measurement of test weight, moisture, and NIR constituent data performed when the test chamber drops. The number of sub-cycles taken for each plot bucket of grain is adjustable in Mirus based off individual needs. Data for each sub-cycle is available in the backup file. |
| Plot weight | The plot weight is the total weight of grain for an individual plot. This would be cumulative weight for all GrainGage weight-trip cycles within a plot. |
| Test weight | The test weight is weight per unit volume of a sample of grain in the test chamber. Test weight is measured in lb/bushel or kg/hL. |

1.6 Inspect the GrainGage Shipping Crate

The GrainGage ships in a corrugated cardboard shipping crate and is secured with packing material. Upon delivery, inspect the shipping crate for any signs of damage. If you identify any damage, contact the shipping company to file a claim. The insuring agency must inspect the package before it is opened. If you do not find any issues with the shipping crate, open it and inspect the items you received.

⚠ CAUTION: Do not open the shipping crate if you identify damage. Contact the shipping carrier of the insuring agency so that they can inspect the package before it is opened. Otherwise your claim may be denied.

⚠ CAUTION: Take care when unpacking the GrainGage. Use extra care with the weigh system load cells. Dropping one may result in permanent damage, which is not covered under HarvestMaster's standard warranty.

GrainGagesTM

H2/H3 Single



CHAPTER 2

Install the GrainGage

2. Install the GrainGage

2.1 Components and Parts

The following tables list the standard components, installation parts, and optional accessories for the Single GrainGage.

2.1.1 Standard Components and Accessories

| Standard Components and Accessories | | | | |
|-------------------------------------|-----|---|---|---|
| PN | Qty | Description | Notes/Purpose | Photo |
| 24401 | 1 | H2 Single GrainGage | |  |
| 31001 | 1 | H3 Single GrainGage | |  |
| 25030 | 1 | System controller with RAM mount and two button-head cap screws | Allows the operator to turn on/off the power to the GrainGage. |  |
| 24407 | 1 | Test chamber calibration weight (approx. 3 lb (1.4 kg)) | Use the calibration weight (stamped with its precise weight) to calibrate the weight measurement of the test chamber. |  |

| | | | | |
|-------|---|---|---|---|
| 24408 | 1 | Plot bucket calibration weight (approx. 11 lb (5 kg)) | Use the calibration weight (stamped with its precise weight) to calibrate the weight measurement of the plot weight hopper. |  |
|-------|---|---|---|---|

2.1.2 Single H2/H3 Cable Kit

Parts Included in the Single **H2/H3 Cable Kit (PN 25088)**

| PN | Qty | Description | Notes/Purpose | Photo |
|-------|-----|--|---|---|
| 15332 | 2 | HM8 12 V DC power cable, 20 ft | One cable provides power to the system controller. The second cable provides power to the GrainGage power bulkhead cable. |  |
| 15336 | 1 | HM8 CAN communications cable, 25 ft | The CAN communications cable connects the system controller to GrainGage CAN bulkhead cable. |  |
| 15374 | 1 | HM8 remote enter button and cable assembly | The remote enter button allows the operator to manually trigger a measurement cycle on the GrainGage. |  |
| 15386 | 1 | Actuator cable assembly | Controls the isolation gate solenoid. |  |
| 24434 | 1 | Solenoid valve mac 45 in-line | Operates the isolation gate. |  |

| | | | |
|-------|---|------------------------------------|---|
| 23237 | 1 | HM 9-pin serial cable, 10 ft (3 m) | Connects the computer to the system controller. |
|-------|---|------------------------------------|---|



| | | |
|-------|---|----------------------------|
| 24942 | 1 | H2 actuator bulkhead cable |
|-------|---|----------------------------|



| | |
|---|-------------|
| 1 | HM fuse kit |
|---|-------------|

Includes the materials and instructions for installing fuses on the battery cables connected to the GrainGage.



| | | |
|------|-------|--|
| 9455 | 30 ft | PLS polyurethane tubing 0.375 in. OD, 0.250 in. ID |
|------|-------|--|

Provides pressurized air to the GrainGage.



| | | |
|------|------|--|
| 9592 | 5 ft | PLS polyurethane tubing 0.25 in. OD, 0.16 in. ID |
|------|------|--|

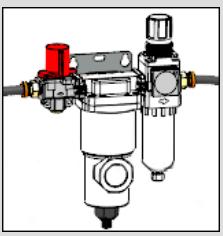
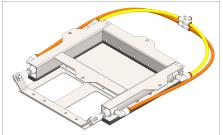
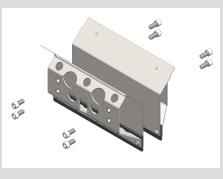
Connects the auxiliary pneumatic actuator to its pneumatic control valve.



2.1.3 Optional Parts

Use these parts as needed for your unique installation.

| Accessories | | | | |
|-------------|-----|-------------|---------------|-------|
| PN | Qty | Description | Notes/Purpose | Photo |

| | | | | |
|-------|---|-------------------------------------|---|---|
| 15450 | 1 | Pneumatic air prep (regulator) | Use between the air tank and the GrainGage to regulate or shut off air pressure and to remove oil aerosols, liquids, and fine particles. |  |
| 26530 | 1 | Isolation gate kit | Add an isolation gate if your combine doesn't already have one. |  |
| 26545 | 1 | H2 low yield insert kit | (H2 only) Use the low yield insert kit to measure test weight and moisture in low volume plot samples. |  |
| 26566 | 1 | DSP I/O actuator cable | Connects to GPIO 1 of the DSP module and breaks out the actuator 5 & 6 controls. |  |
| 27092 | 1 | HMS USB-CAN right angle connector | Use for troubleshooting. |  |
| 31045 | 1 | H3 low yield insert subassembly kit | (H3 only) Use the low yield insert kit to measure test weight and moisture in low volume plot samples. |  |
| 31517 | 1 | SCiO serial to USB cable | (H3 only) Connects the SCiO Sensor junction on the GrainGage to the rugged tablet. Use the extension cable (PN 31518) if this cable is too short. |  |

| | | | | |
|-------|---|---|---|--|
| 31740 | 1 | H3 sensor hole plug subassy kit | (H3 only) Covers the SCiO Sensor hole in the test chamber. Install if you are using an EM sensor. |  |
| 31796 | 1 | H3 moisture sensor plug plate subassy kit | (H3 only) Covers the EM sensor hole in the test chamber. Install if you are using a SCiO Sensor. |  |
| 31798 | 1 | H3 low yield insert plug plate kit | (H3 only) Covers holes in the test chamber. Install if you are not using the low yield insert. |  |
| 31518 | 1 | SCiO 15 ft serial to USB extension cable | (H3 only) An extension cable for the SCiO serial to USB cable (PN 31517). |  |

2.1.4 Tablet Computer Options

Below are the rugged tablet computer options for running Mirus and operating the GrainGage.

| Tablet Computer Options | | | |
|-------------------------|-------------|--|---|
| PN | Description | Notes/Purpose | Photo |
| ST1-112 | Mesa® Pro | 10-inch ultra-rugged tablet computer running Microsoft® Windows 11 |  |
| MS4-CFG | Mesa 4 | 7-inch ultra-rugged tablet computer running Windows 11 |  |

| | | | |
|-------|---|--|---|
| 25681 | Mesa powered vehicle dock | Powered vehicle dock for the 7-inch Mesa 3 or Mesa 4 tablet computer |  |
| 22485 | Tablet C size (1.5 in.) RAM ball | Use to mount the rugged tablet in the combine. Works in conjunction with part numbers 22484 and 23848. |  |
| 22484 | Tablet C size (1.5 in.) RAM double socket | Use to mount the rugged tablet in the combine. Works in conjunction with part numbers 22485 and 23848. |  |
| 23848 | Tablet RAM mount with versa plate | Use to mount the rugged tablet in the combine. Works in conjunction with part numbers 22485 and 22484. |  |
| 31822 | Mesa Pro 1000 W vehicle dock Lind charger | |  |
| 25414 | Mesa 3 or Mesa 4 mounting bracket (7 in.) | |  |
| 31814 | Mesa Pro powered vehicle dock | |  |

31016 Mesa Pro mounting bracket



31640 Mesa Pro Lind power supply (12–32 V)



2.2 Installation Types

Always use the base mounts to install the GrainGage. There are multiple configurations using slides (not included), swing hinges (not included), or solid mounts.



2.2.1 Remove Shipping Stops

During shipping, four shipping stops stabilize the weigh bucket and prevent damage to the GrainGage. Each shipping stop is held in place by a yellow bracket, bolt, and lock nut.



Before installing and using the GrainGage,

1. Detach the yellow shipping stops by first removing the four bolts, nuts, and spacers that hold them in place.



2.2.2 Install on a Combine

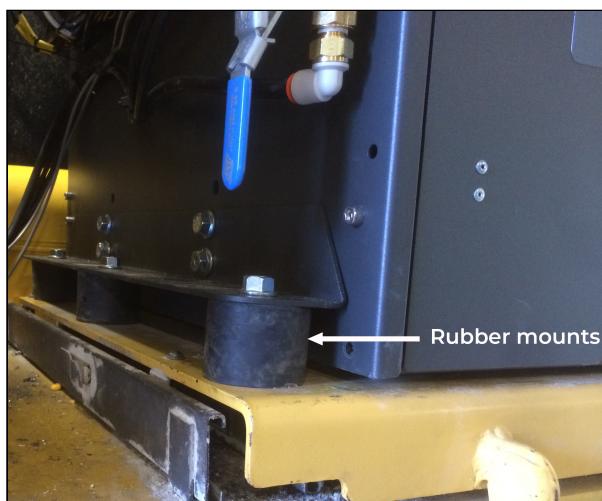
To install the GrainGage on a combine,

1. Park the combine on a level surface and check the tire pressure to make sure all tires are at normal operating pressure.
2. Identify the location on the combine where the GrainGage will be mounted. When selecting a location, ensure the cyclone, GrainGage, and sump are aligned and there is enough room for the grain to exit from the side evacuation gate. Additionally, ensure that you have clearance to perform maintenance, daily checks, and repairs.

Note: In the example below, the GrainGage will be mounted with the evacuation gate opening toward the cab of the combine. Mounting it in the opposite direction will not allow the grain to evacuate into the return hopper.



3. Mount the GrainGage on the combine. Ensure it is straight and level. The GrainGage can be mounted on slides or a robust hinging mechanism to give better access for calibration and maintenance. Options for slides are available from <http://www.generaldevices.com>.
4. Use the rubber mounts already installed on the GrainGage to cushion it from the mechanical shocks of the operating combine.



If the GrainGage is mounted in a location where you cannot see the grain flow and the gates moving, consider mounting a camera to allow observation of the gates and the grain as it flows through the system. Commercially available vehicle backup camera systems can serve this purpose.

2.3 Install the System Controller, Tablet, and Cabling

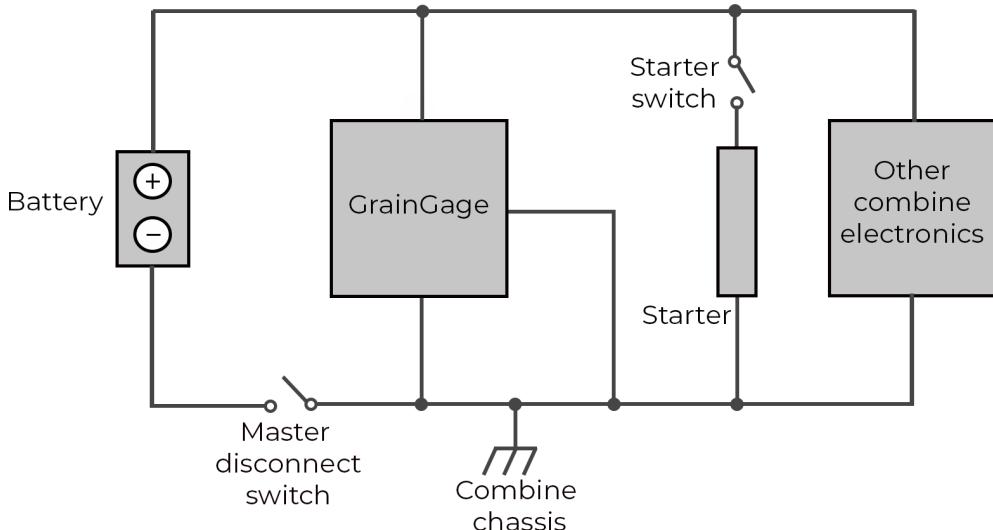
The system controller switches power to the system and indicates the status of operation. It also charges the tablet (12 V DC, maximum 12 A unregulated), provides the connection point for the remote enter switch, and serves as the CAN interface between the GrainGage and the tablet.

To install the system controller and tablet on the combine,

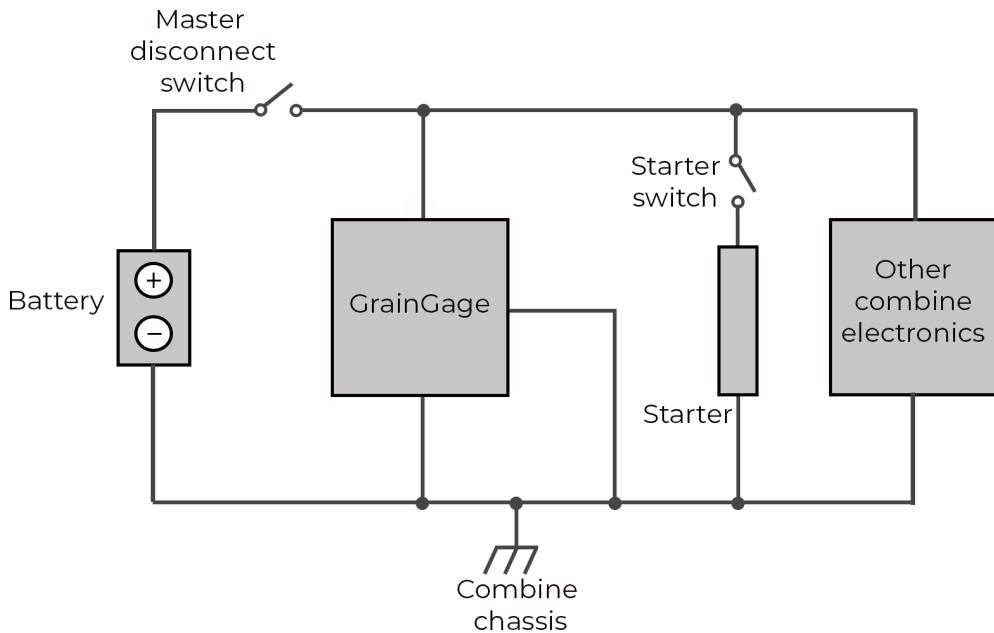
1. Identify mounting locations in the cab for the system controller and the tablet. Position the tablet and controller within easy reach and view of the operator and close enough to allow serial cable (PN 23237) or CAN to USB cable (PN 27092) to reach between them.
⚠ CAUTION: Prevent premature wear or damage to the connectors by providing **strain relief for the** connections so that the weight of the cable does not pull on the connectors.
2. Use the RAM mount in the appropriate position for your installation.
3. Mount the tablet in the desired location.
4. Determine the route of cables and hoses that keeps them out of the way of moving parts. If routing cables along existing cables or hoses, use plastic zip ties to hold them in place (at least one tie every 2 ft (.6 m)).
⚠ CAUTION: Ensure the cables are free from pinching or kinking during use and maintenance to prevent damage to the cables.
5. Before wiring, locate the combine's master disconnect switch. If the combine does not have a master disconnect switch, go to step 6.

Determine whether the disconnect switch controls the negative or positive battery terminal. The GrainGage power cable connected to that terminal must pass through the disconnect switch. This ensures power to the GrainGage is fully cut off when the switch is off.

Option 1: Master disconnect switch connected to negative battery terminal



Option 2: Master disconnect switch connected to positive battery terminal



6. Route two separate power cables (PN 15332) from the battery to the GrainGage components.
 - Cable 1—Connects the system controller and the battery.
 - Cable 2—Connects the bulk head power connector (dual ports on the side of the GrainGage) and the battery.

Route the appropriate cable (based on the wiring identified in step 5) through the master disconnect switch. If the combine does not have a master disconnect switch, connect directly to the 12 V battery source.

7. Trim the pigtail end of both cables to the appropriate length for battery connection.
8. Install an ATC 20 A fuse (included) on all power cables leading to the battery to protect the GrainGage and system controller and reduce the risk of fire if your cable is damaged. (For installation instructions, see [Install Fuse on HarvestMaster Power Cables](#).)
9. Route the CAN cable (PN 15336) from the system controller to the bulk head power cable (dual CAN ports on the side of the GrainGage).
10. For the H3 Single GrainGage, route the SCiO serial to USB cable (PN 31517) from the SCiO Sensor junction cable (PN 30712) on the outside of the GrainGage to the tablet.

⚠ CAUTION: The GrainGage requires a clean 12 V DC supply in the range of 11.5 V to 18.0 V. The power supply must be free of transient power spikes.

⚠ CAUTION: When using a battery booster for welding on the machine or to furnish a quick charge on the combine battery, disconnect the GrainGage power source to prevent damage. DC voltages over 18 V can damage GrainGage electronics. Many automotive battery boosters exceed 18 V.

2.4 Install a Pressurized Air Supply

The GrainGage requires pressurized air between 75–85 PSI. The air tank must be at least two gallons and must have a water drain petcock valve on the bottom. Use a pneumatic conditioner and air shutoff (PN 15450 or similar) between the air tank and the GrainGage to regulate the pressure and to remove oil aerosols, liquids, and fine particles. The air supply should have a filtration of 5 micron or smaller. HarvestMaster recommends using the air filter from your combine engine.

Note: Before mounting anything, make sure the air hose can reach from the air tank to the pneumatic conditioning center (with shutoff valve) and then to the GrainGage.

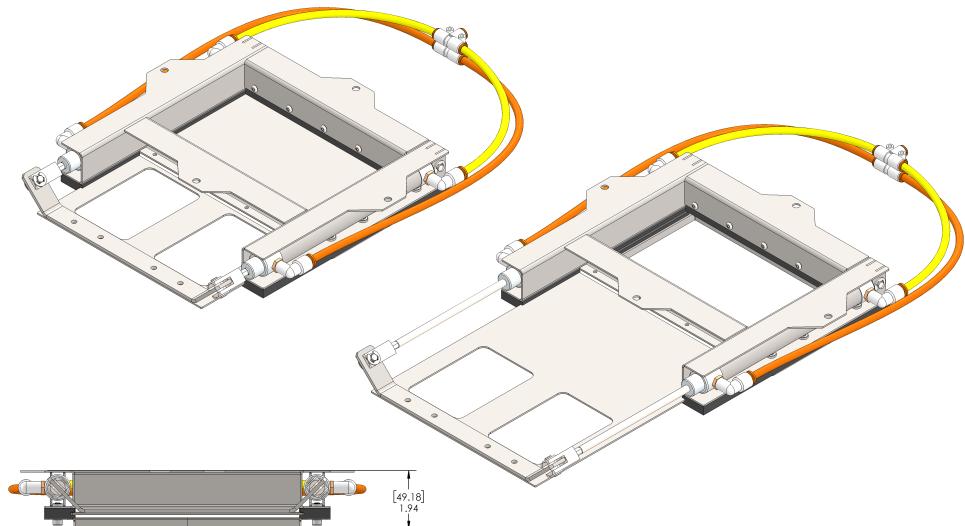
To install a pressurized air supply,

1. Mount the air tank in a location that allows the operator to drain the tank daily.
2. Mount the pneumatic conditioner and shutoff. Ensure the operator can access the shutoff valve.
3. Connect the air hose from the air tank to the pneumatic conditioner and shutoff.
4. Connect air from the pneumatic conditioner and shutoff to the GrainGage with $\frac{3}{8}$ in. poly tubing.

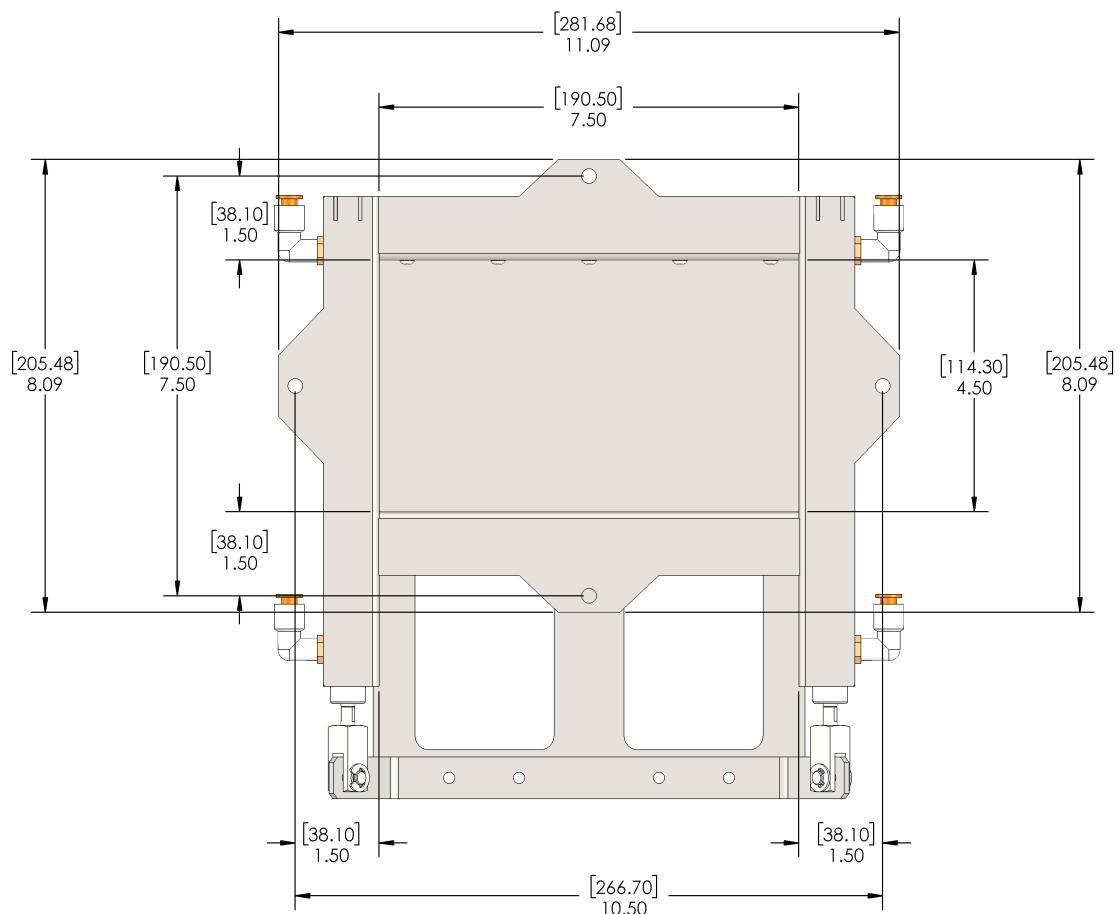
⚠ CAUTION: Lubricating the actuators and solenoid valves in the GrainGage system may lead to premature failure of these components.

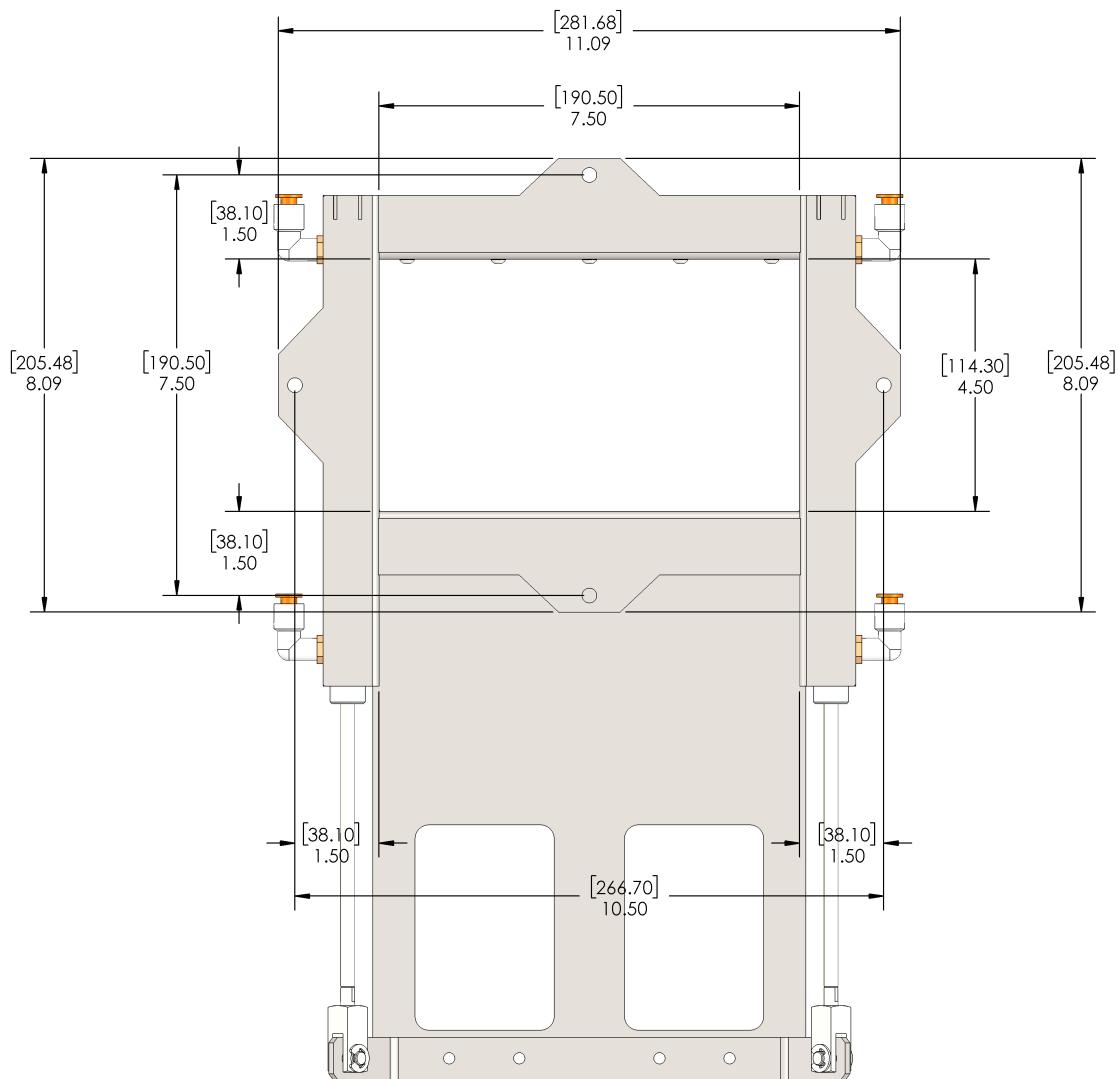
2.5 Add an Isolation Gate

The Isolation Gate Kit is optional but recommended if your combine does not already have an isolation gate. The isolation gate halts grain flow into the GrainGage during a measurement cycle. When installing, ensure the cyclone has sufficient holding capacity above the isolation gate to accommodate the grain flow for several seconds while the measurement sequence executes.



The following drawings show the dimensions of the isolation gate in the closed and open positions. The drawings appear in inches and millimeters.





2.6 Add Low Yield Inserts to the Test Chamber

Low yield inserts make it possible for the GrainGage to measure test weight and moisture for smaller plot samples. The number of inserts you can install and the process you use for installing the inserts depends on whether you are using an EM sensor or a SCiO Sensor in your GrainGage. See [Appendix A: Volume, Weight, and Industry Standard Values](#) for volume and weight requirements.

| Low Yield Inserts | | | |
|---------------------|-------------|-------------|---------------------|
| GrainGage Model | Sensor Type | Part Number | Installable Inserts |
| H2 Single GrainGage | EM Sensor | 26545 | One or Two |
| H3 Single GrainGage | SCiO Sensor | 31045 | One |
| | EM Sensor | 31045 | One or Two |

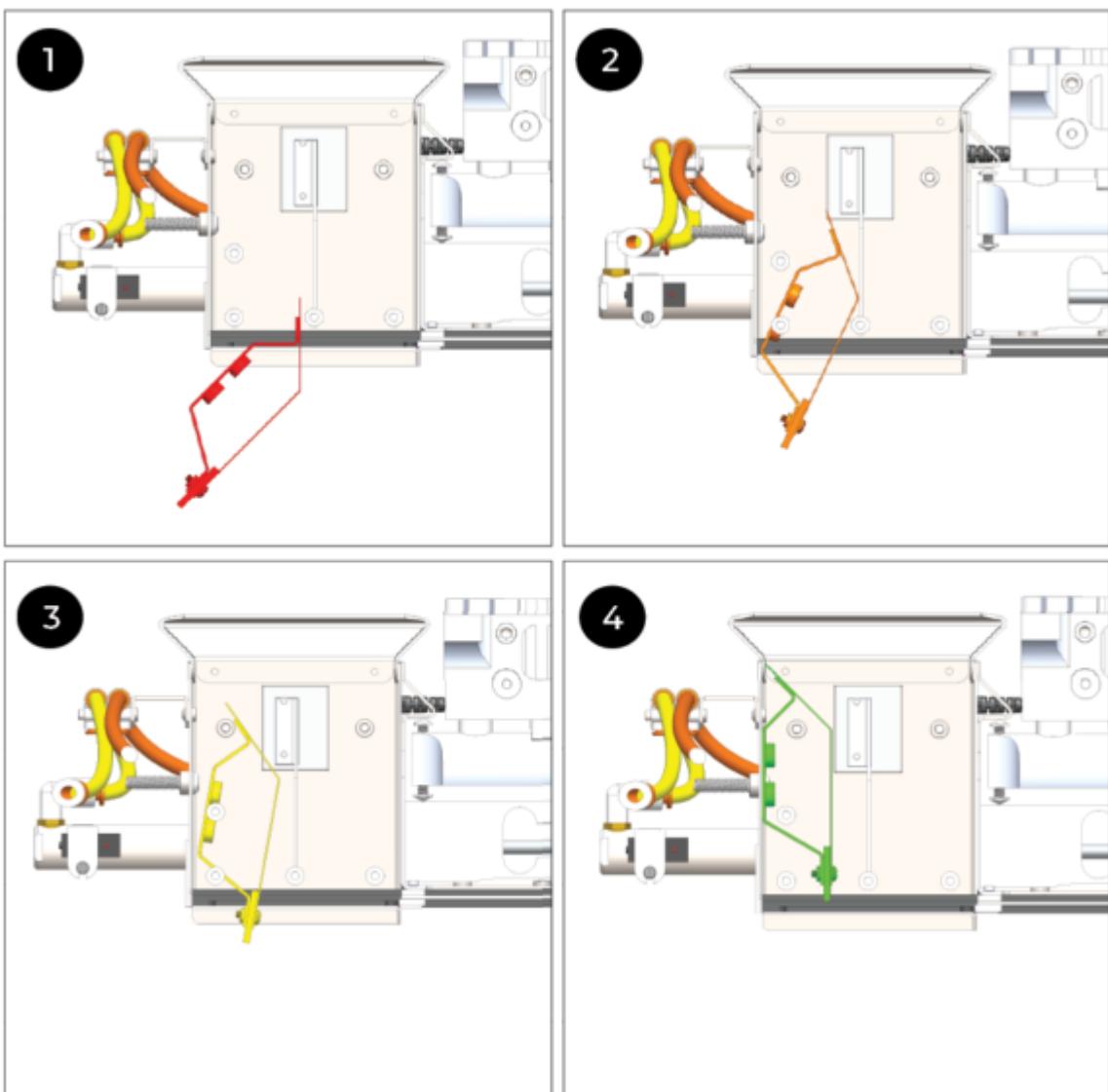
Note: The low yield inserts are designed specifically for each GrainGage model and are not interchangeable.

2.6.1 Add Low Yield Inserts with the EM Sensor

With the EM sensor, you can install one or two low yield inserts. The holes in the test chamber for the low yield inserts are plugged by two metal plates (one on each side) with four hex nuts.

To install a low yield insert,

1. Open the bottom gate.
2. Remove the low yield plug plate from the side on which you want to install the low yield insert. Save the plates and nuts to cover the holes when the inserts are removed.
Note: If you are using only one insert, install the insert on the side where the calibration weight hangs.
3. Slide the insert up and into the test chamber. Begin the insertion between the pressed in nuts on the bottom of the test chamber.
4. Angle and rotate the insert as you slide it into place against the wall of the test chamber.



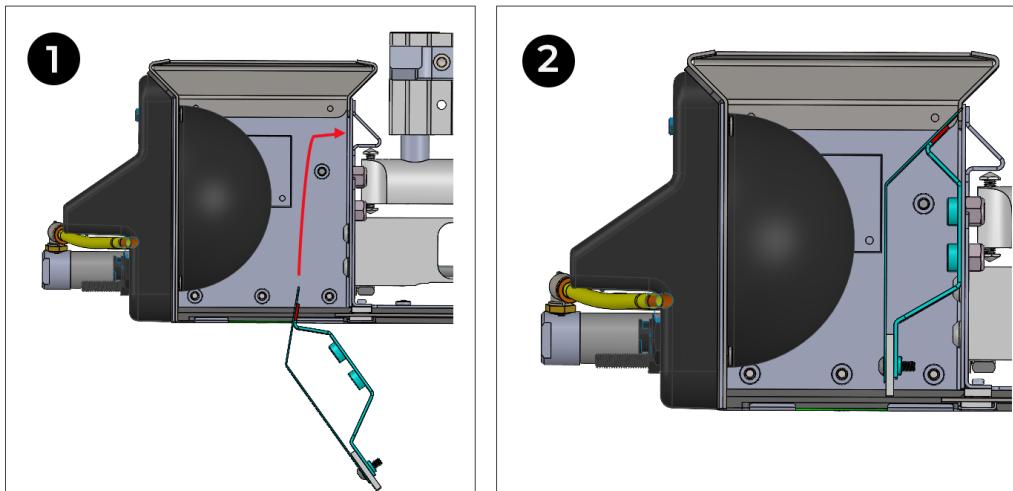
5. Secure the insert with four hex-drive, socket-cap screws (1/4-20 x 0.5 in.).
6. Repeat this procedure to install a second insert on the other side of the chamber.

2.6.2 Add a Low Yield Insert with the SCiO Sensor (H3 Only)

With the SCiO Sensor, you can install one low yield insert in the test chamber on the side opposite the SCiO Sensor. The holes in the test chamber for the low yield insert are plugged by a metal plate with four hex nuts.

To install the low yield insert,

1. Open the bottom gate.
2. Remove the low yield plug plate from the wall of the test chamber opposite the SCiO Sensor.
3. Slide the insert up and into the test chamber. Begin the insertion between the pressed in nuts on the bottom of the test chamber.
4. Angle and rotate the insert as you slide it against the wall opposite the SCiO Sensor.



5. Secure the insert with four hex-drive, socket-cap screws (1/4-20 x 0.5 in.).

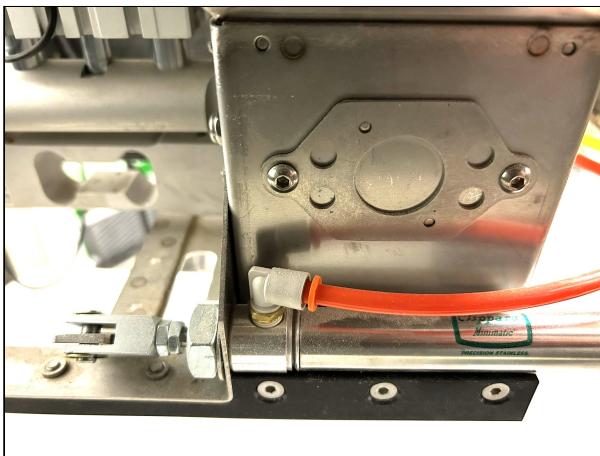
2.7 Change the Moisture Sensor (H3 only)

The H3 Single GrainGage uses either a SCiO Sensor or an EM sensor for detecting moisture. The SCiO Sensor comes with the H3 Single GrainGage, and the EM sensor can be purchased separately. Use the instructions below to change the moisture sensor installed in the H3 Single GrainGage.

2.7.1 Install EM Moisture Sensor

To install the EM sensor in the H3 GrainGage,

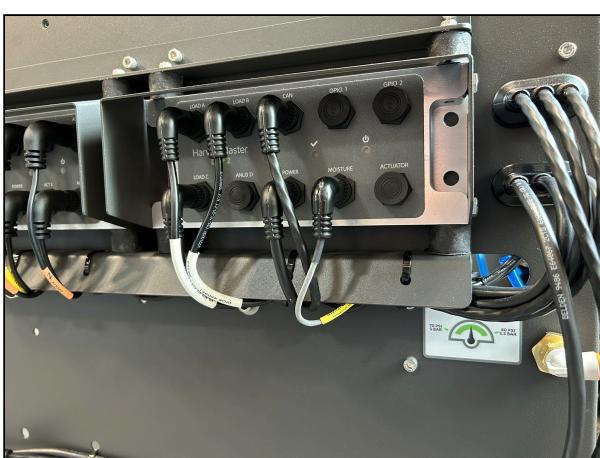
1. Remove the EM moisture sensor plug plate from the exterior of the test chamber. Save the plug plate and screws for future installation.



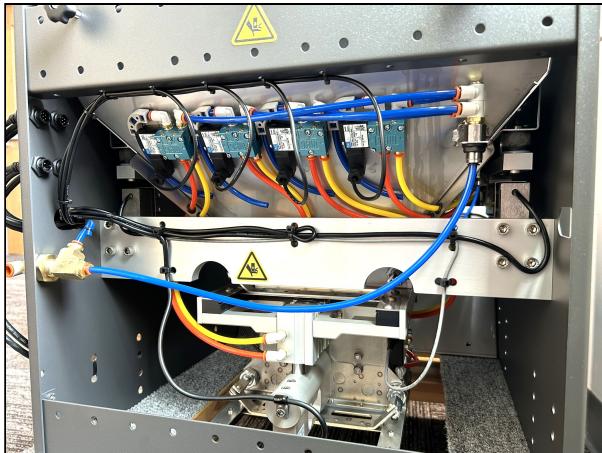
2. Insert the EM sensor into the opening on the test chamber. Ensure the label on the EM sensor is facing up.
3. Secure the EM sensor to the test chamber with two star washers and captive screws.



4. Route the EM sensor moisture cable along the GrainGage frame to the DSP module.
5. Attach the moisture cable to the DSP moisture port.



6. Use zip ties to secure the moisture cable to the GrainGage frame, as shown. For best results,
 - Leave enough slack in the moisture cable so that it does not pull on the test chamber and interfere with the weight measurement.
 - Ensure the moisture cable does not touch the bottom gate.



2.7.2 Remove the EM Sensor

To remove the EM sensor,

1. Remove the two star washers and captive screws that secure the EM sensor.
Note: Save the washers and screws if you plan to reinstall the EM sensor in the future.

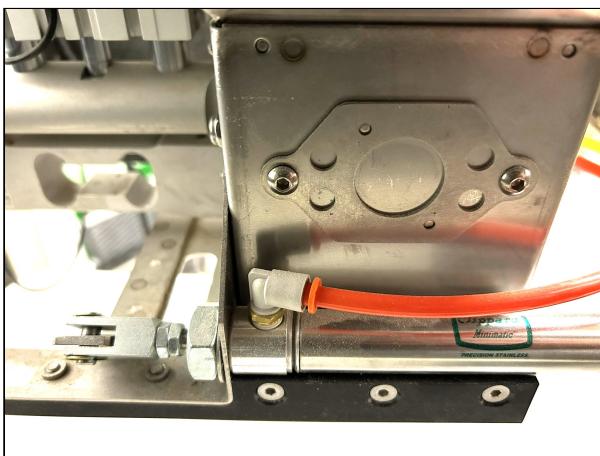


2. Remove the EM sensor.
3. Cut the zip ties securing the moisture cable to the GrainGage frame.

4. Disconnect the EM moisture cable from the DSP moisture port.



5. Cover the opening for the EM moisture sensor with the H3 moisture sensor plug plate (PN 31796). Attach it to the test chamber with two 8-32 x 3/16 SS button head socket head cap screws.



2.7.3 Install SCiO Sensor

To install the SCiO Sensor in the H3 GrainGage,

1. Disconnect the orange and yellow air hoses from the left of the cylinder to give access to the SCiO Sensor mounting area.
2. Remove the four 8-32 x 3/16 SS button socket head cap screws securing the H3 SCiO hole plug plate (PN 31740) to the test chamber. Save the plug plate and screws for future installation.
3. Position the SCiO Sensor in the test chamber. For best results,
 - Match the top of the sensor to the top of the chamber opening.

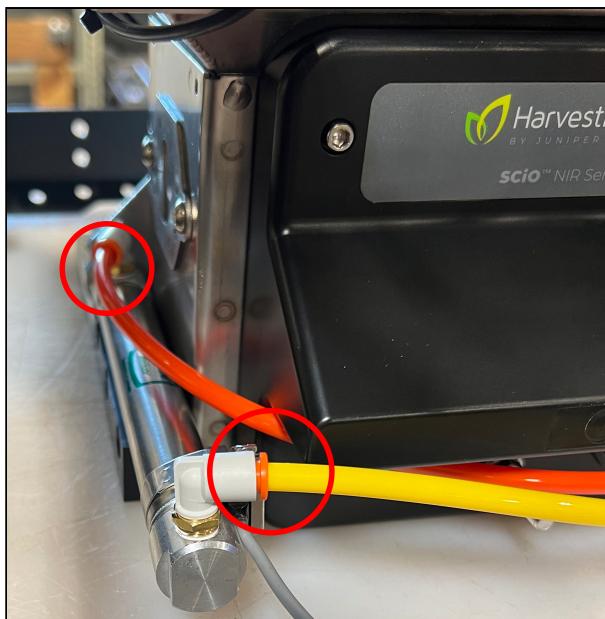
- Insert the sensor at a slight angle with the top of the sensor angled toward the opening.



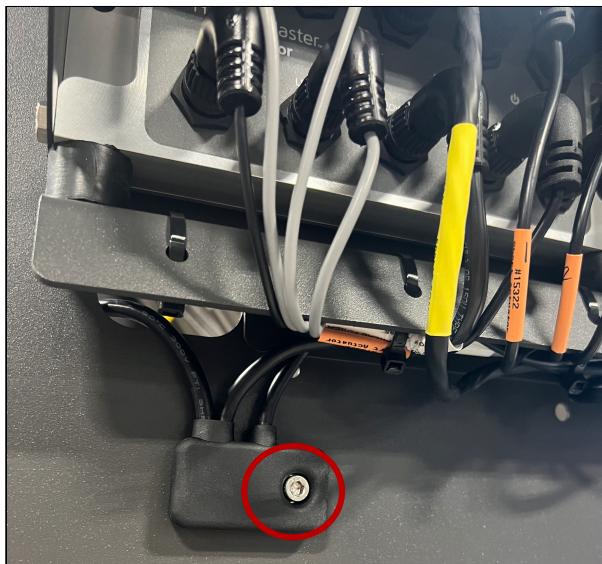
4. Tighten the four captive screws in the sensor, using a cross pattern.
⚠ CAUTION: The screws will still tighten even when misaligned, and it's not **always obvious**. If the sensor plastic is recessed or misaligned, loosen the four screws and realign.
5. Ensure the SCiO Sensor aligns properly with the test chamber from the inside. In proper alignment,
 - The square portion of the sensor inserts fully through the sheet metal.
 - The sensor plastic is flush with the inside of the sheet metal. It is not recessed. There is no gap.



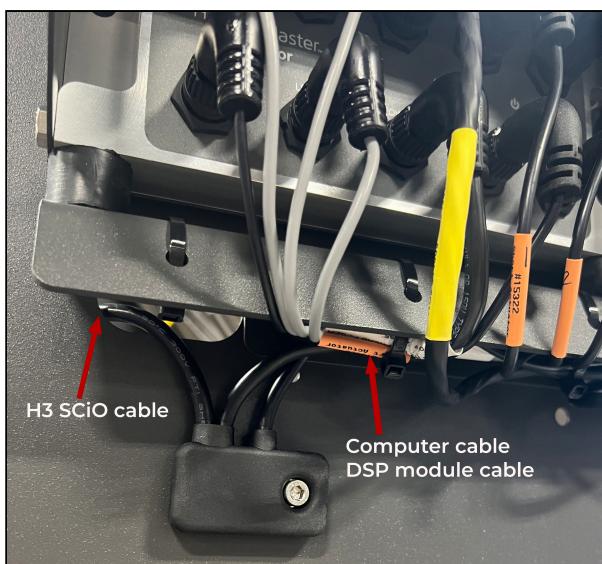
6. Connect the air lines to the left of the air cylinder.



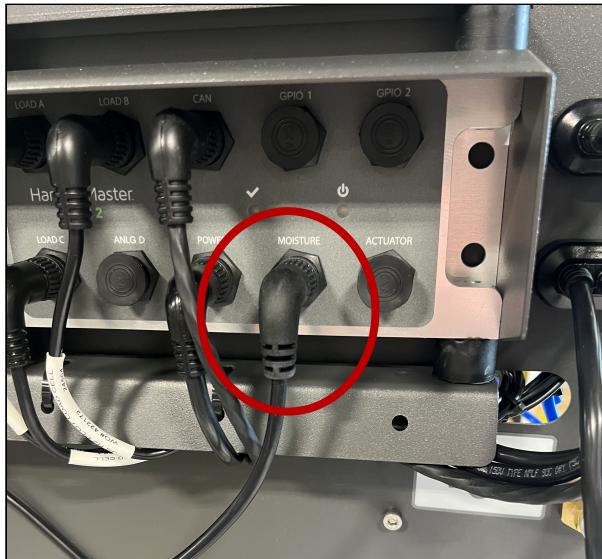
7. If not installed, attach the SCiO cable assembly (PN 30712) to the outside of the GrainGage, using the 1/4-20x1/2 in. socket head cap screw and nylock nut.



8. Route the H3 SCiO cable into the GrainGage, and route the computer and DSP module cables under the cable rail.



9. Attach the moisture cable to the DSP moisture port.



10. Position the computer cable end as needed. Shown in the image below inside the chassis.



11. Coil and secure the computer and moisture cables to the cable rail, using zip ties.

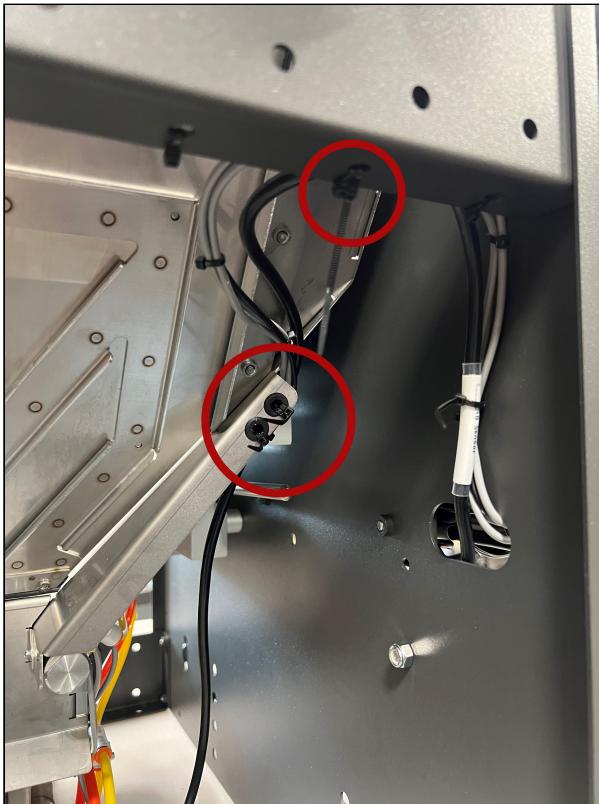


12. Attach the SCiO cable to the SCiO Sensor.

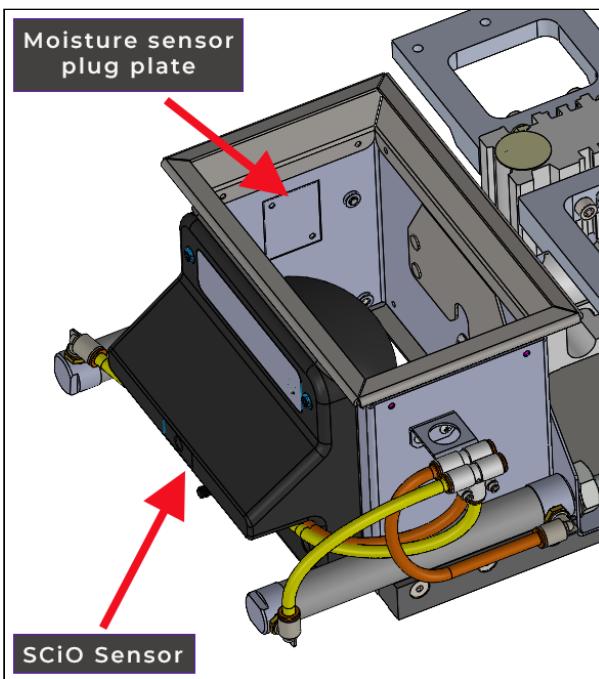


13. Secure the cable (as shown) with zip ties. Allow enough slack for the test chamber to cycle without stretching the cable. A strained cable could affect the accuracy of the test

weight.



14. If not installed, attach the H3 moisture sensor plug plate (PN 31796) to the exterior of the test chamber with two 8-32 x 3/16 SS button head socket head cap screws.



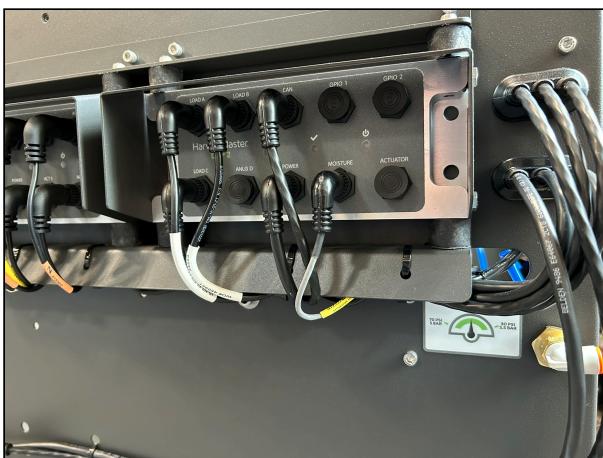
2.7.4 Remove the SCiO Sensor

To remove the SCiO Sensor,

1. Disconnect the SCiO Sensor cable from the SCiO Sensor.



2. Disconnect the moisture cable from the DSP moisture point.

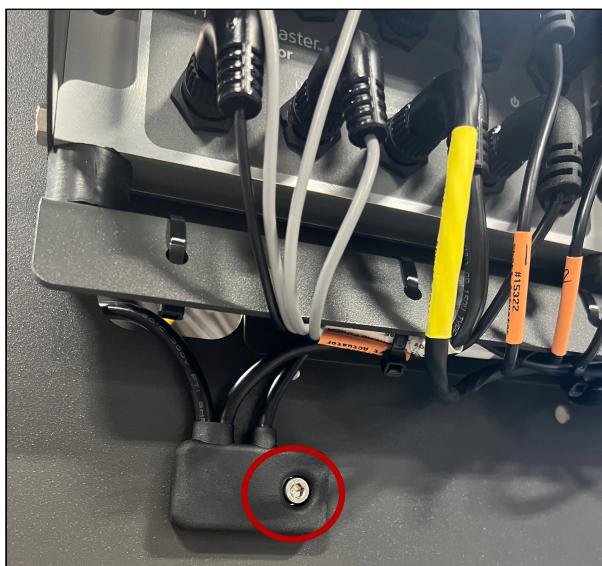


Note: If you will be reinstalling the SCiO Sensor at a later time, leave the SCiO moisture and computer cables routed along the chassis crossbar. Add zip ties as needed to hold the SCiO cables away from the weigh bucket and any moving components.

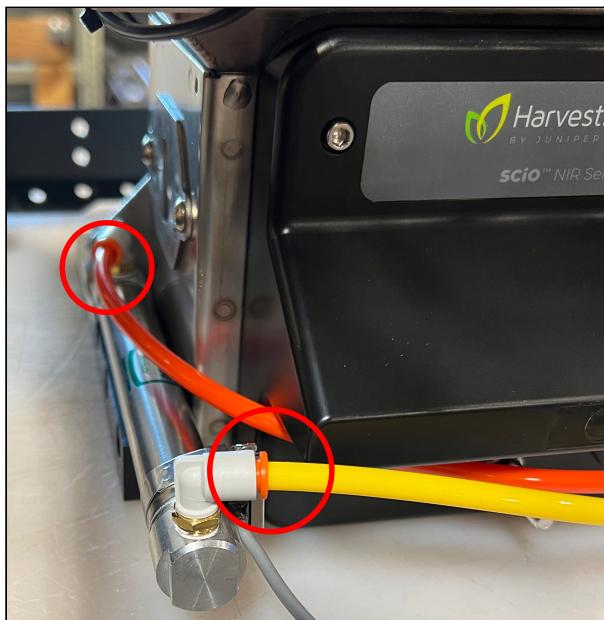
3. (Optional) Remove the SCiO moisture and computer cables by cutting all the zip ties holding it secure.



4. (Optional) Unscrew the 1/4-20x1/2 in. socket head cap screw and nylock nut that attaches the SCiO cable assembly to the outside of the GrainGage.



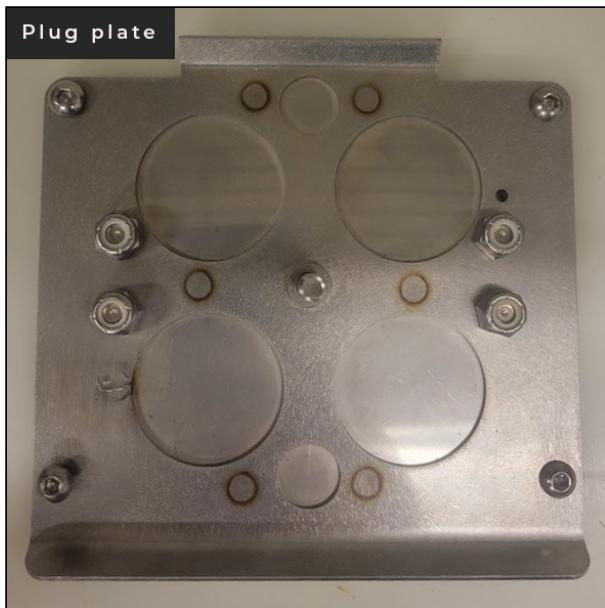
5. Disconnect the air lines to the left of the air cylinder.



6. Remove the four captive screws in the SCiO Sensor.



7. Remove the SCiO Sensor from the test chamber.
8. Cover the SCiO Sensor hole with the H3 SCiO hole plug plate (PN 31740). Attach it to the exterior of the test chamber with four 8-32 x 3/16 SS button head socket head cap screws.



9. Reconnect the air lines to the left of the air cylinder.

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CHAPTER 3

Inspect the GrainGage

3. Inspect the GrainGage

After you install the GrainGage system (and at the beginning of each harvest season thereafter), perform a mechanical inspection and check the system diagnostics in Mirus.

3.1 Perform a Mechanical Inspection

The inspection includes a mechanical validation of the GrainGage and an operational validation in Mirus.

Mechanical Validation

- Before using the system for the first time, ensure the shipping stops have been removed. (See [Remove the Shipping Stops](#).)
- Check the plot bucket for proper alignment. Verify that it is resting on the load cells and weighing properly. (See [Perform Daily System Checks](#).)
- Check all cables and electrical connections. Verify that they are secure and have not come loose.
- Inspect all cables for mice damage.
- Ensure the cables and hoses are securely tied on each side to minimize movement. Cables and hoses should not have any tight bends or kinks.
- Turn off the air and verify that all gates fully open and close at the end of the stroke. HarvestMaster recommends keeping some spare gate cylinders on hand for needed replacements.
- If you are using the EM sensor, clean the EM moisture blade.
- If you are using the SCiO Sensor, clean the glass dome on the SCiO sensor with glass cleaner and a non-abrasive microfiber cloth.
- Turn on the air and set the regulator to 80 psi. (The system supports air pressure between 75–85 PSI.) Check for air leaks throughout the system while opening and closing the gates.
- Ensure all actuators operate normally and cycle smoothly.
- Make sure the separator cup moves up and down freely.
- Clean the actuator slide rods with a damp cloth. Do not lubricate or clean the actuator slide rods with WD-40 or other penetrating lubricants. This can degrade the internal seals.

Operational Validation

Check the following weight and moisture calibrations in Mirus.

- Slope and motion
- Weigh bucket
- Test weight load cell
- (Option) SCiO NIR Sensor self test
- Moisture chamber

For detailed instructions, refer to the [Mirus for H2 Single GrainGage User Guide](#).

3.2 Check the Diagnostics in Mirus

As part of the initial GrainGage setup (and periodically thereafter), use Mirus Diagnostics to manually check the weight, moisture, test weight, and actuator diagnostics. For information on diagnostics in Mirus, refer to "GrainGage Diagnostics & Alerts" in the [Mirus for H2 Single GrainGage User Guide](#).

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CHAPTER 4

Maintain the GrainGage

4. Maintain the GrainGage

Regular maintenance ensures your GrainGage continues to operate efficiently. The following sections outline essential maintenance tasks.

4.1 Clean and Maintain the System

Periodic cleaning and regular maintenance of your GrainGage will assure excellent performance. HarvestMaster field technicians and engineers can come to you and perform a full system calibration and inspection before the harvest season begins.

To clean and maintain the GrainGage,

- Perform daily system checks before you begin harvesting.
- Perform system cleaning and protective measures at the end of season.
- About a month before the harvest season, perform (or have a HarvestMaster Field Engineer perform) a thorough system inspection, which includes checking all cables for mice damage, replacing worn parts, calibrating the system, and checking the measurement diagnostics in Mirus. (See [Inspect the GrainGage](#).)
- If using a SCiO Sensor, perform a SCiO NIR Sensor Self Test in at the beginning and middle of each harvest season. (Refer to "SCiO NIR Sensor Self Test" in the [Mirus for H2 Single GrainGage User Guide](#).)

For optimum system service and longevity, HarvestMaster offers [service plans](#).

4.2 Perform Daily System Checks

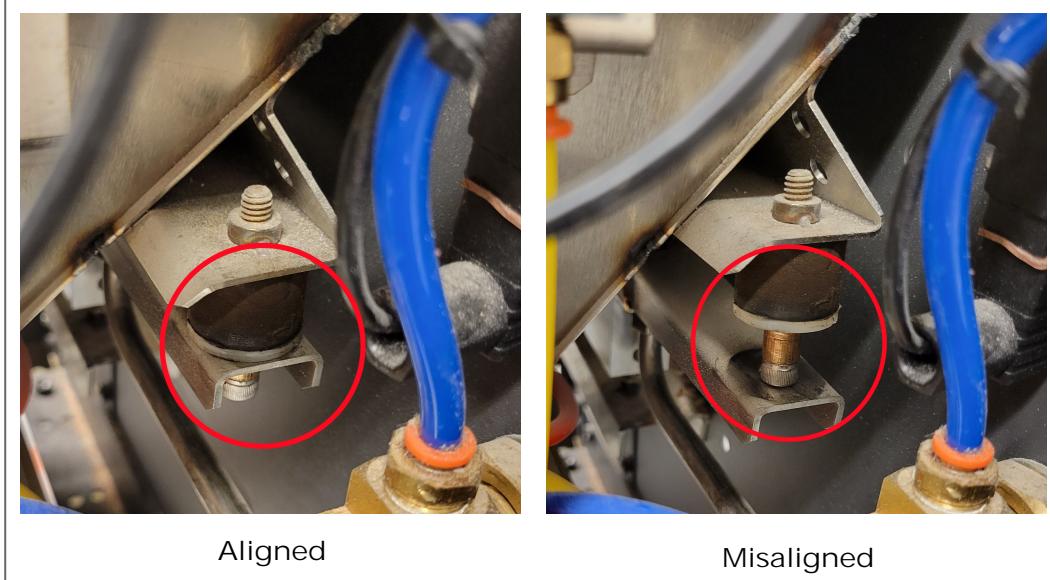
Perform the following system checks before each use of the GrainGage.

4.2.1 Inspect Cables and Air Supply Tubing

Remove the rear chassis door to view the pneumatic air valves and cylinders. Ensure the cables and air tubing do not interfere with the slide gates or test chamber. Ensure the air supply tubing and instrumentation wiring between the chassis and the test chamber do not rub on anything when the door is in place.

4.2.2 Check Plot Bucket Alignment

Ensure the four plot bucket anchor pins are aligned through the load cell support frame (two resting points above each load cell). Any bumps in the road during transport on a truck can move the hopper up and out of these supports. For accurate weight measurements, the plot bucket must be in its proper operating position.



4.2.3 Clean the GrainGage

Use a pressurized air to blow off excess dust, chaff, or trash that has accumulated on all surfaces.

For debris/buildup that cannot be removed by pressurized air, use a grease removing dish soap, such as Dawn, and warm water. If you need something stronger, HarvestMaster recommends Extreme Simple Green Aircraft & Precision Cleaner, which is advertised as safe on metals, plastics, and rubber.

⚠ CAUTION: Clean the air cylinder rods with a dry lube only. Do not use dish soap or cleaner.

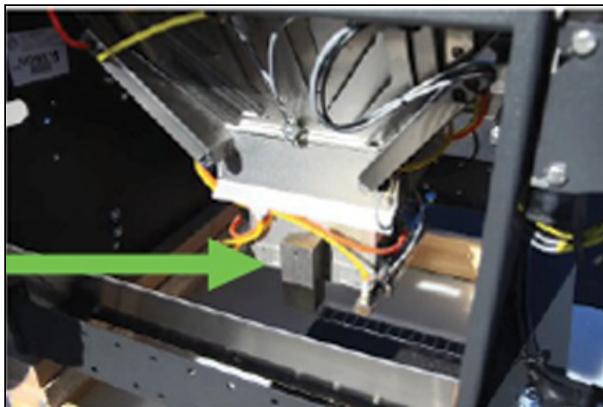
4.2.4 Check the Weigh Bucket

Use the calibration weight (included with your GrainGage system) to check the weigh bucket reading. The calibration weight is stamped with its value.

To check the weigh bucket reading and test the weight readings,

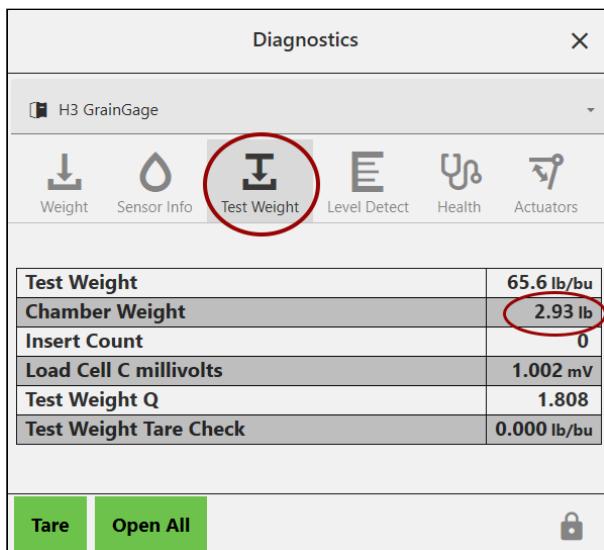
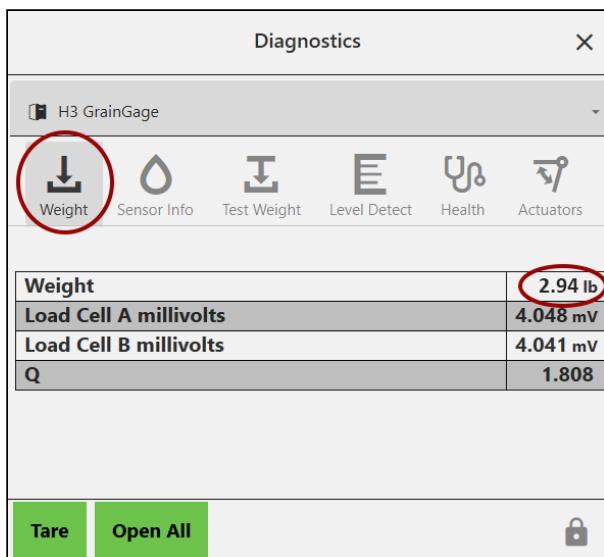
1. Turn off the combine engine.
2. If possible, slide the GrainGage out to access the bottom. If the bottom of the GrainGage is not accessible, remove the GrainGage access panel on the air supply side.
3. Close the top and bottom slide gates.
4. Place the larger calibration weight inside the weigh bucket.

If the top of the weigh bucket cannot be easily accessed, hang the smaller calibration weight from the weight hanger on the test chamber.



5. Open the Diagnostics screen in Mirus.
6. Compare the weight on the Weight tab to the chamber weight on the Test Weight tab.

The two values should be within 0.02 lb (.01 kg) of the weight stamped on the calibration weight, indicating that the system is operating within the specified range. With the combine engine and thresher running, the weight and chamber weight should be within 0.05 lbs (.023 kg) of the calibration weight.



- If the reading is outside of this range, do the following:
 - Press down on the plot bucket and then release. The weights should return to within 0.05 lbs (.023 kg). Lift up the test chamber and then release. The weights should return to within 0.05 lbs (.023 kg).
 - Look for objects interfering with the movement of the plot bucket. Check for cables or air lines that may need to be re-tied. Ensure the bucket is in the tracks and not rubbing.

Note: If the weight readings are drifting, the load cell may be bad.

- If needed, re-calibrate the slope and motion, weight, and test weight. See "Calibrate Test Weight" in the [Mirus for GrainGage user manual](#).

For additional assistance, call [HarvestMaster customer support](#).

4.2.5 Clean the Glass Dome for the SCiO Sensor

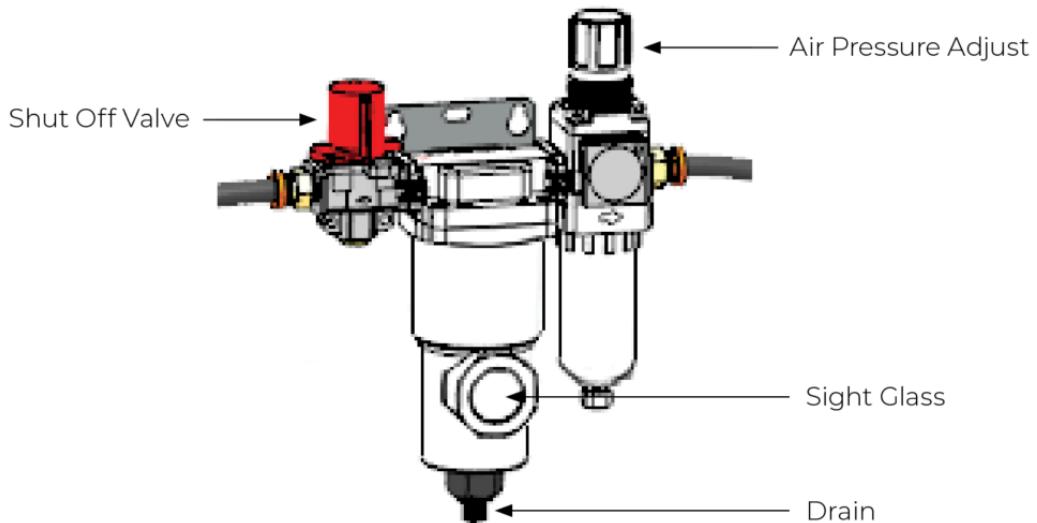
If applicable for your model, clean the glass dome on the SCiO Sensor with glass cleaner and a non-abrasive microfiber cloth.

4.2.6 Drain the Pneumatic Air Prep (Regulator)

At the end of each harvest day, drain the pneumatic air prep (regulator).

To drain the pneumatic air prep,

1. Twist open the drain located on the bottom of the pneumatic air prep.
2. Let the collected fluid drain out.
3. Twist the drain closed.



Note: To adjust the air pressure, pull up and turn. To adjust the shut off valve, press down and turn.

4.3 Perform End-of-Season Maintenance

After the end of the harvest season, complete the following tasks to prepare your system for storage.

- Clean the entire GrainGage, including the gates and slides, with high pressure air.
- Check the battery and system power cables. Clean and replace if necessary.
- If using the EM sensor, clean the EM moisture blade.
- If using the SCiO Sensor, clean the glass dome on the SCiO Sensor with glass cleaner and a non-abrasive microfiber cloth.
- Inspect rubber ISO mounts for cracks or damage. Replace if necessary.
- Check and clean the intake filters for the compressor. HarvestMaster recommends changing the intake filters annually.
- Lubricate the gates with a dry film lubricant that is safe for Nitrile seals.
- Use products, such as paste, dryer sheets, or mothballs, to repel rodents from the equipment. Place odor repellents near the wiring harnesses inside the GrainGage and in the cab. Fresh Cab Rodent Repellent repels rodents and is safe for pets. Ensure these products are not placed in locations that could interfere with the GrainGage's operation.

4.4 Unplug Power Cable Before Welding or Jumping the Battery

To avoid damage, unplug the power cable for each GrainGage module and the system controller in the cab before welding on the combine or jumping/boosting the combine battery.

⚠ CAUTION: Although HarvestMaster electronics are protected against power overload, damage may occur if the modules and system controller are plugged in while welding on the machine or jumping the combine battery.

GrainGagesTM

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CHAPTER 5

Replace Basic Parts

5. Replace Basic Parts

The following sections outline how to replace basic parts on the GrainGage.

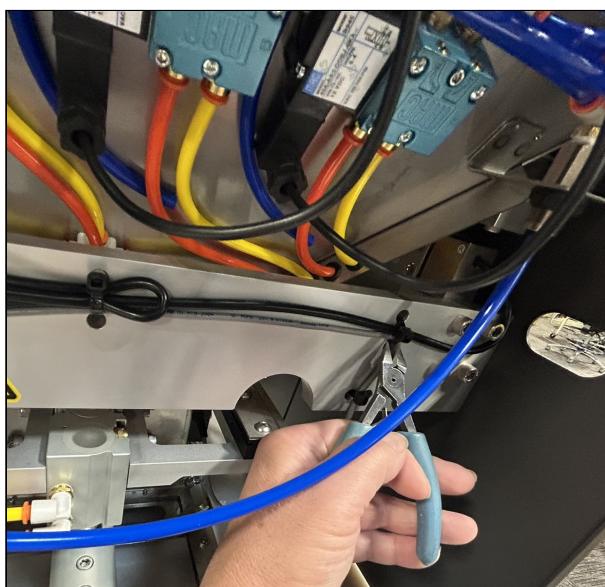
5.1 Replace the Plot Bucket Load Cell

To replace the plot bucket load cell,

1. Check the voltage to locate the bad load cell.
For information on checking voltages, see [Diagnostics in Mirus](#).
2. Disconnect the load cell connector from the DSP module.



3. Cut the zip ties holding the load cell cords.



4. Lift the bucket out of the track using a ratchet strap to hold the bucket at least 1-2 inches off the load cell.

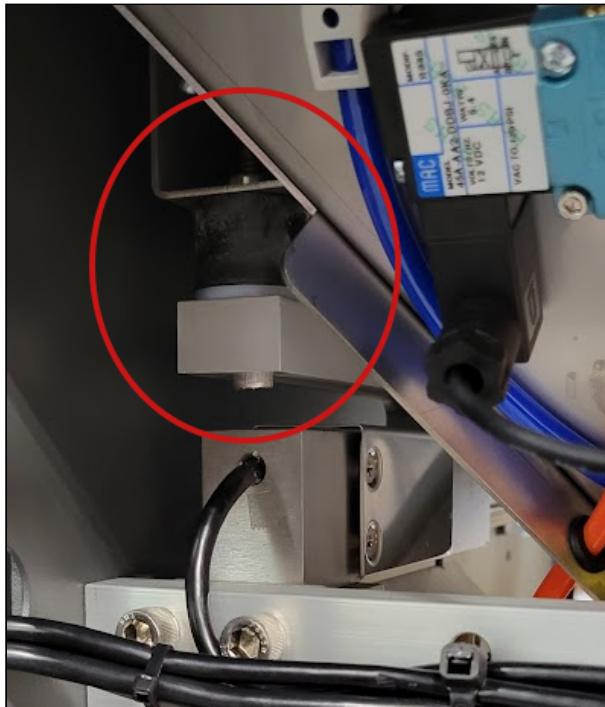
5. Use a 3/16 Allen wrench to remove the two cap screws from the bottom of the load cell. Remove the entire load cell assembly from the GrainGage (load cell and plot bucket track).



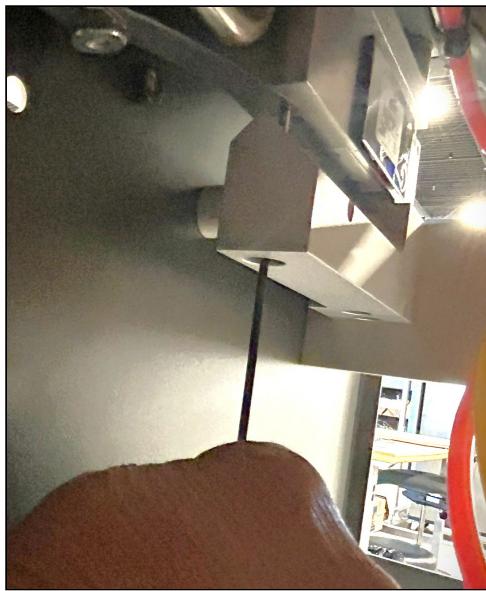
6. Remove the two cap screws from the top side of the bucket track with the 3/16 Allen wrench.



7. Remove the load cell.
8. Insert the new load cell. Apply Loctite 243 to the threads of the two button head screws and tighten the cap screws from the top of the bucket track. Ensure the track and load cell are aligned.
9. Apply Loctite 243 to the threads of the two button head screws and tighten the cap screws into the bottom of the load cell. Ensure everything is aligned, and the bucket is in the track.



10. Remove the ratchet strap and let the bucket rest on the load cells.
11. Use a 7/64 Allen wrench to set your overload protection screw, so it is snug on the .010 feeler gauge.



12. Plug the load cell cord into the port on the DSP module.



13. Route the load cell cables as they were originally installed before removing the load cell. Use zip ties to secure the load cell cables. Clip the end of the zip ties.



Note: Only secure the black load cell cables with zip ties. Leave the air line cables untied to allow unrestricted movement.

14. Re-calibrate the weigh bucket. (Refer to the [Mirus for H2 Single GrainGage User Guide](#))

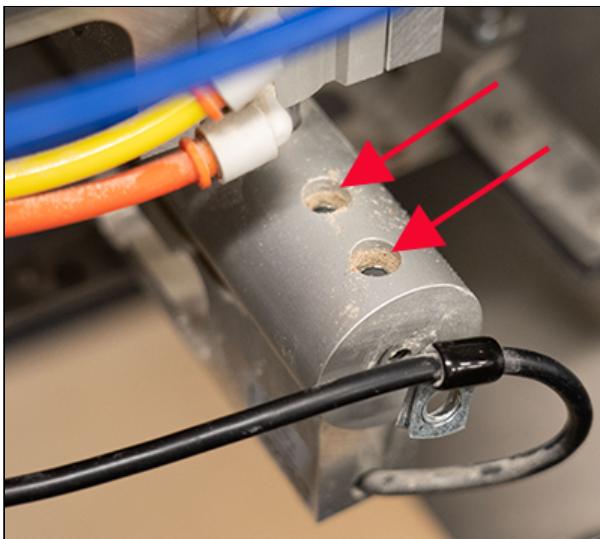
For additional assistance, contact a [HarvestMaster Field Service Engineer](#).

5.2 Replace the Test Weight Load Cell

To replace the test weight load cell,

1. Use a 3/16 Allen wrench to remove the socket cap screw holding the load cell cable to the separator cylinder.

2. Use the same wrench to remove the two socket cap screws holding the separator cylinder and load cell together.



3. Turn off the GrainGage air and manually slide open the bottom gate.
4. For the H3 GrainGage, remove the SCiO Sensor. (For instructions, see [Remove the SCiO Sensor](#).)
5. While supporting the test weight chamber, use a 5/32 Allen wrench to remove the two button head screws from inside the test weight chamber.



⚠ CAUTION: Be careful not to round the screws. Clean the dirt from the head of the screws. If they are locked too tight, heat the screws with a small blow torch to loosen the Loctite®.

Note: The test weight chamber is now loose and must be supported with your hand or a zip tie.

6. Cut the zip ties that route the load cell cable to the DSP module.
7. Remove the load cell from the system.
8. Install the new load cell.
 - a. Reinstall the two screws securing the separator cylinder to the load cell.
 - b. Reinstall the screw securing the load cell cable to the separator cylinder.

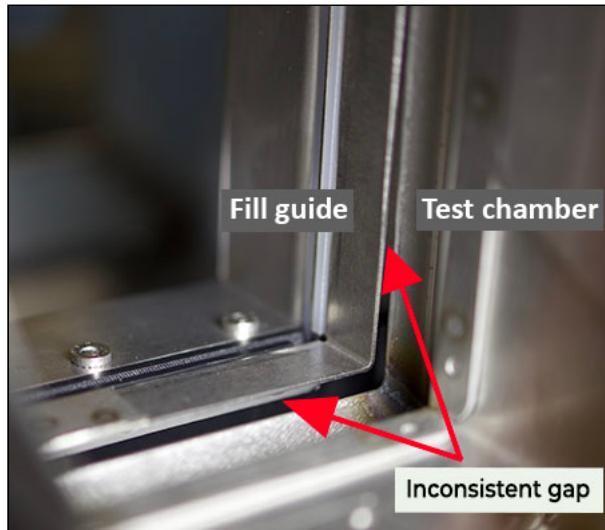
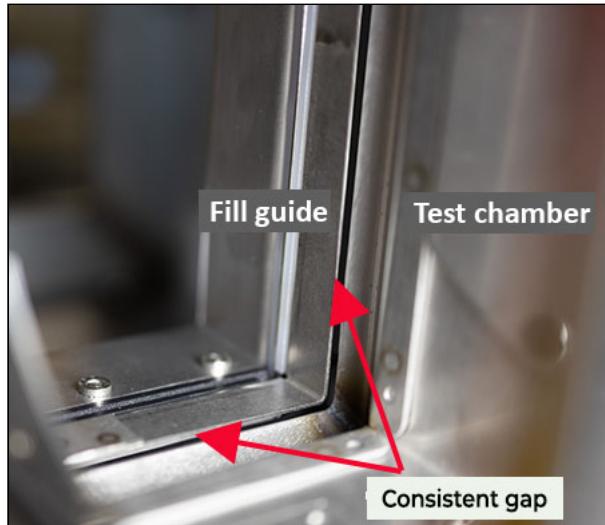
9. Apply Loctite 243 to the threads of the two button head screws. Hand tighten the screws.



10. Check that new chamber is properly aligned.

- The gap between the fill guide and the chamber is even and consistent. Check the gap when the chamber is in the down position.

- The chamber slides freely. It does not rub or bump.



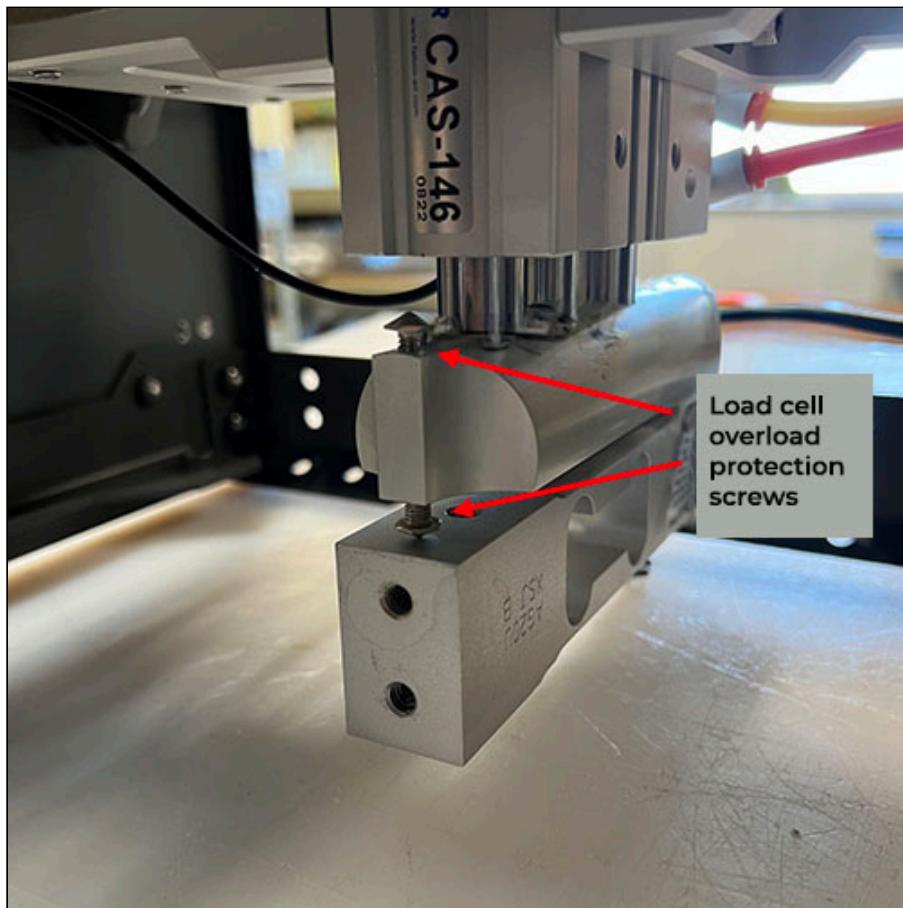
11. Tighten the button head screws securely.

⚠ CAUTION: Make sure the test chamber can slide up and down freely without contacting the fill guide.

Note: It is possible to install the test chamber crooked enough that it will hit the fill guide when it raises. Lightly tighten the test chamber screws, ensure proper alignment, and then tighten the test chamber screws completely.

12. Route the load cell cable to the module as it was routed on the previous load cell.

13. Locate the two overload protection screws.



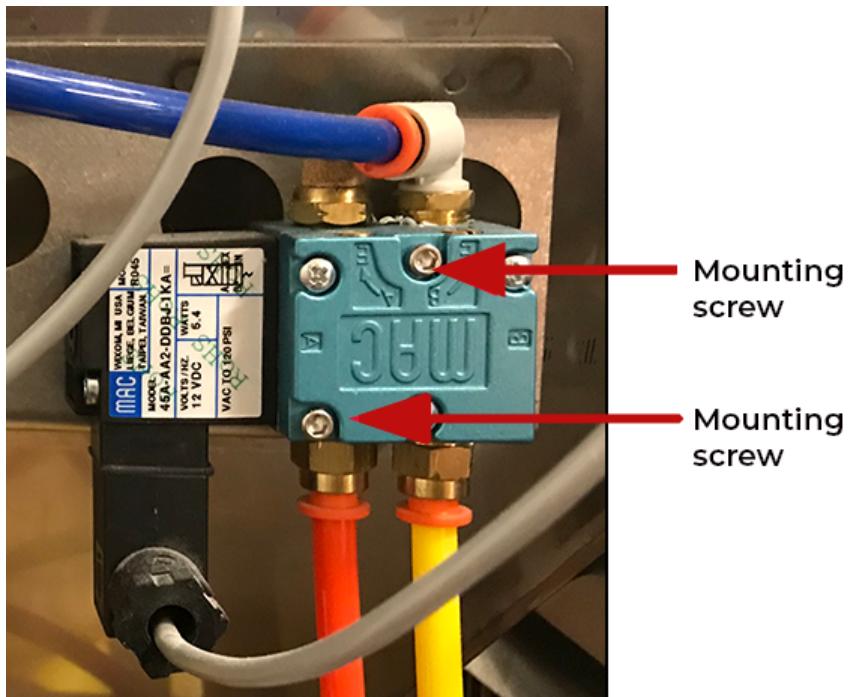
14. Adjust the overload stops to the following specifications:
 - Top screw: 0.009 in. gap
 - Bottom screw: 0.014 in. gap
15. Recalibrate the test weight load cell as outlined in the [*Mirus for H2 Single GrainGage User Guide*](#).

5.3 Replace the Solenoid

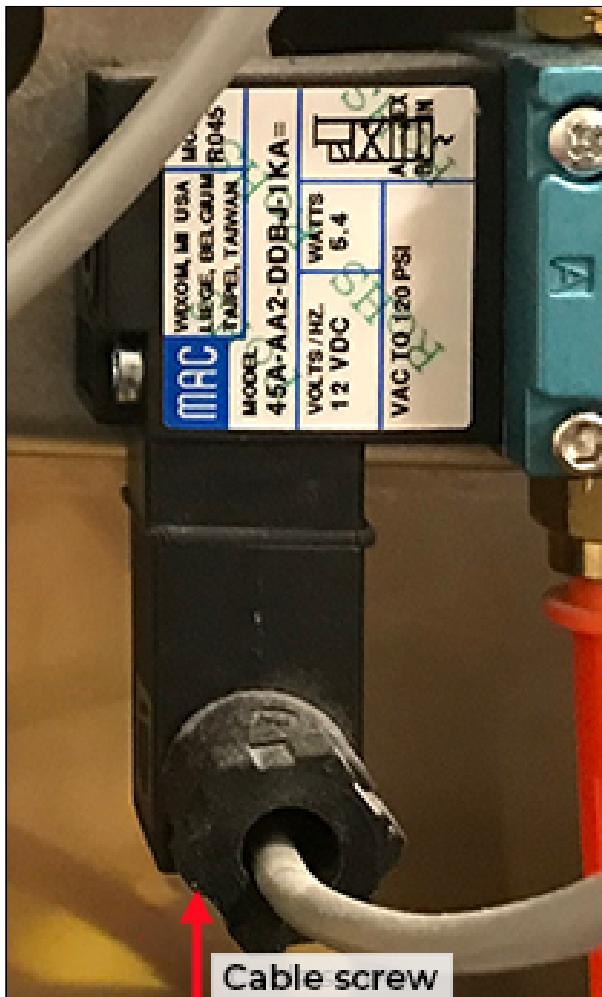
To replace the solenoid,

1. Turn off the air and power to the GrainGage.
2. Disconnect the airlines from the solenoid. Note the location of each color.

3. Remove the mounting screws with a 7/64 Allen wrench.



4. Disconnect the cable by removing the cable screw underneath the black cable box and unplugging the cable.



5. Plug the cable connector into the new solenoid and tighten the cable screw.
6. Secure the new solenoid in place with the mounting screws.
7. Reconnect the airlines.
8. Turn on the air and power to the GrainGage.

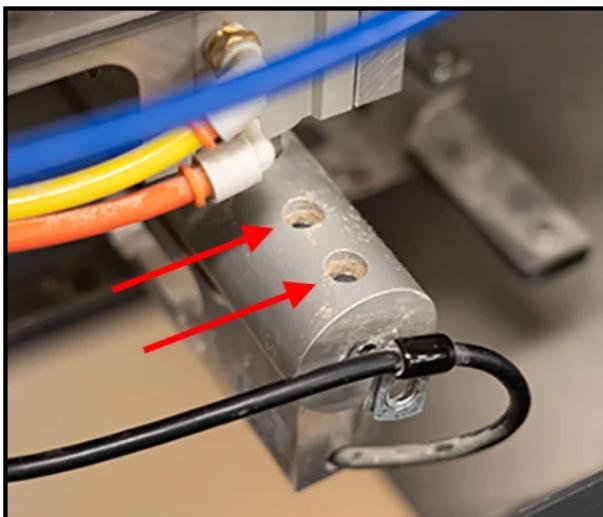
5.4 Replace the Test Weight Separator Cylinder

Remove the Faulty Cylinder

1. Remove the load cell wire support socket cap screw with the 3/16 Allen wrench.

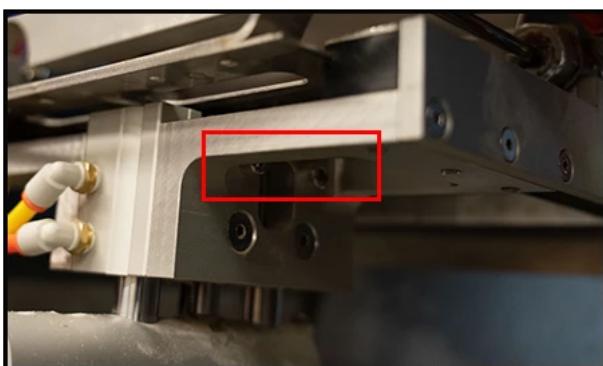


2. Remove the socket cap screws that attach the load cell to the support arm.

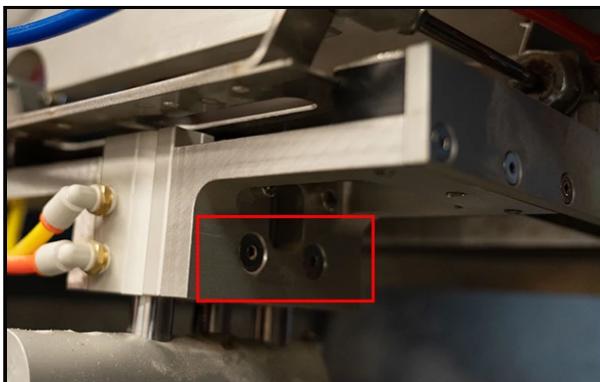


Note: The test weight chamber will drop down when the load cell socket cap screw is removed. Support the test weight chamber so that it does not hang on the load cell and limit switch wires.

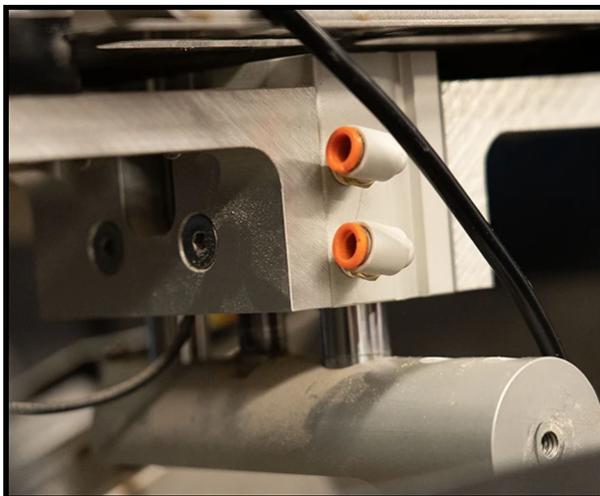
3. Remove the two socket cap screws on either side of the separator cylinder supports with the 3/16 Allen wrench.



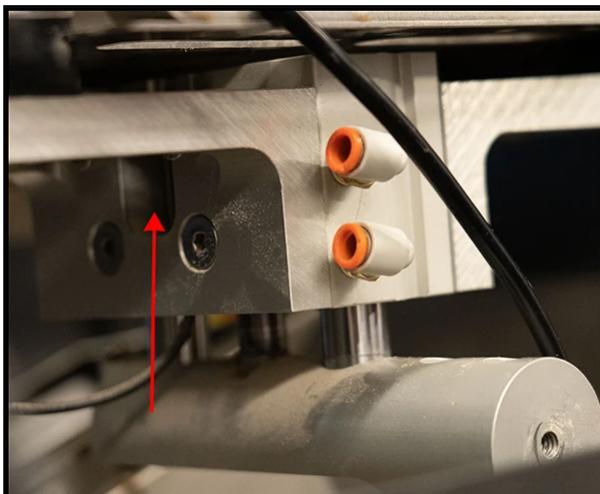
4. If the bracket has two countersunk Allen screw on each side of the separator, remove the screws with the 5/32 Allen wrench.



5. Detach the air hoses by compressing the orange collar and pulling out the hose. Note the location of each color.



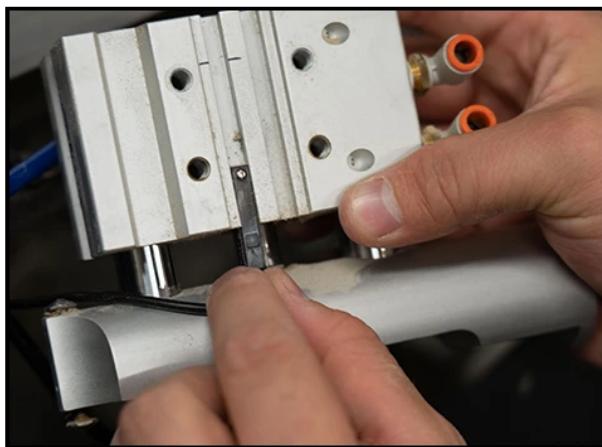
6. Lower the separator cylinder from the supports and loosen the limit switch sensor with the small 1.8 mm flathead screwdriver. Extend the separator cylinder to fully release the sensor from the cylinder.



Note: Pay attention to the orientation of the limit switch sensor, including which side the sensor is on and which channel the sensor is in.

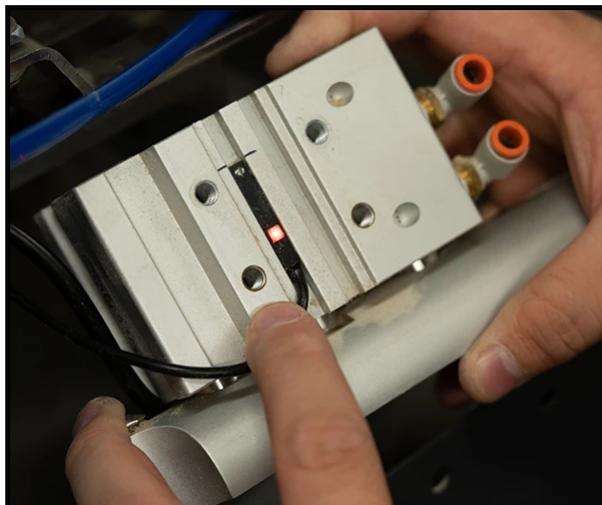
Install the New Cylinder

1. Turn on the GrainGage console.
2. Extend the new separator cylinder and slide the limit switch into the channel.
3. Retract the separator cylinder.



With the GrainGage power on, the red LED will light up when sliding the sensor up and down in the channel.

4. Put the sensor in the middle of the lit-up range and tighten securely with the small flathead screwdriver.
5. Apply medium strength Loctite to all four threaded holes on both sides of the separator cylinder.



6. Raise the separator cylinder carefully between the support brackets from the bottom of the brackets up.

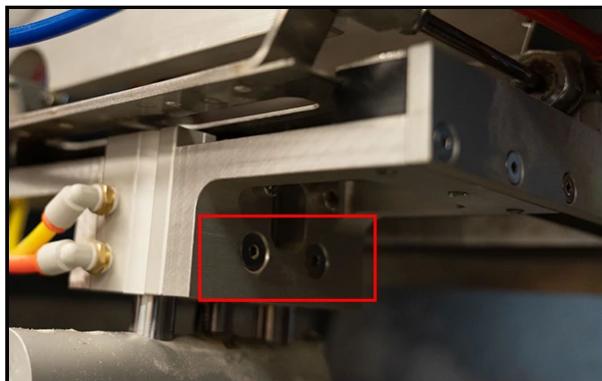
7. Reinstall the two socket cap screws on each side of the separator cylinder.



8. Reinstall the two countersunk Allen screws on each side of the separator cylinder.

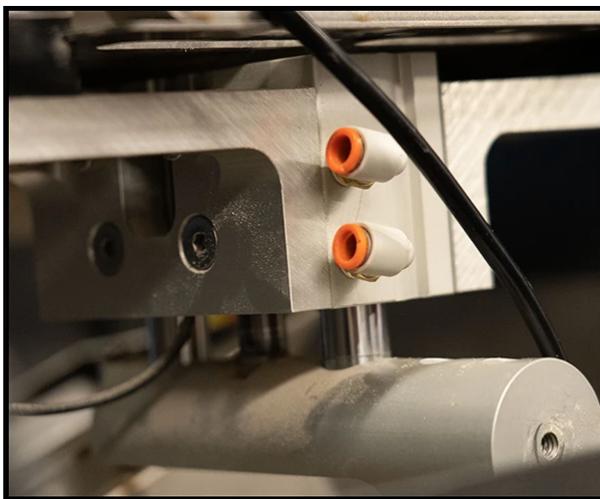
Note: Tighten the countersunk Allen screws before tightening the socket cap screws to align the separator into place.

9. Apply non-permanent Loctite to the two threaded holes in the top of the load cell and raise the test weight chamber back into place. It may take a little work to get the weight chamber into place on top of the overload protection screws in the load cell support arm.

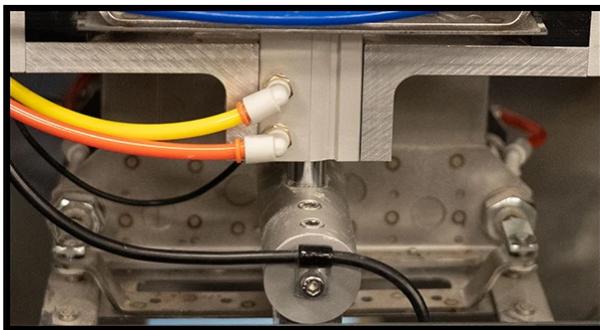


10. Reinstall the two socket cap screws through the support arm into the load cell and tighten.

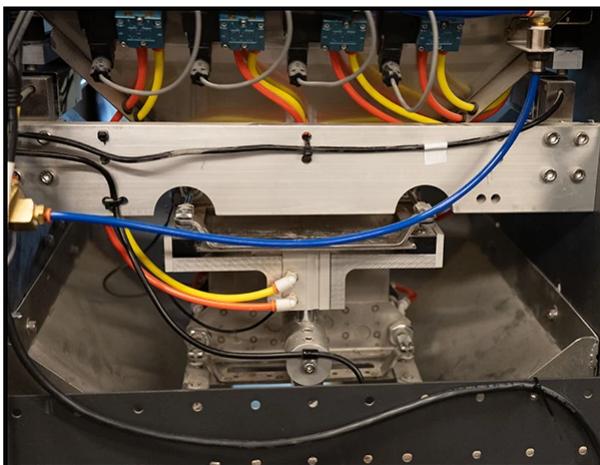
11. Apply medium strength Loctite to the threaded hole at the end of the load cell support arm.



12. Reattach the load cell wire support hanger with the socket cap screw.
13. Reattach the air hoses.



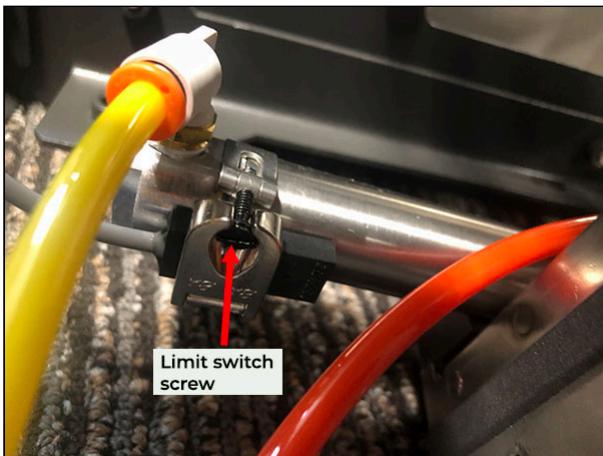
14. Adjust the overload protection screws, using the 5/16 wrench with the feeler gauge to a .009 gap on the top of the overload screw followed by a .014 gap on the bottom overload screw by the load cell.
15. Verify that the new separator cylinder operates smoothly.



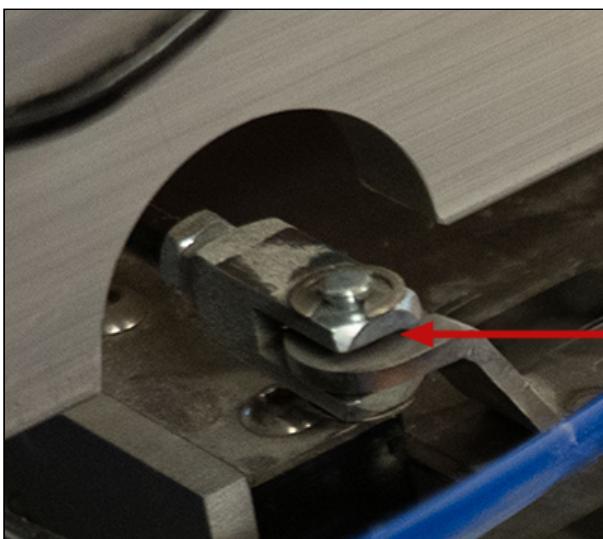
5.5 Replace the Gate Air Cylinders

To replace the gate air cylinders,

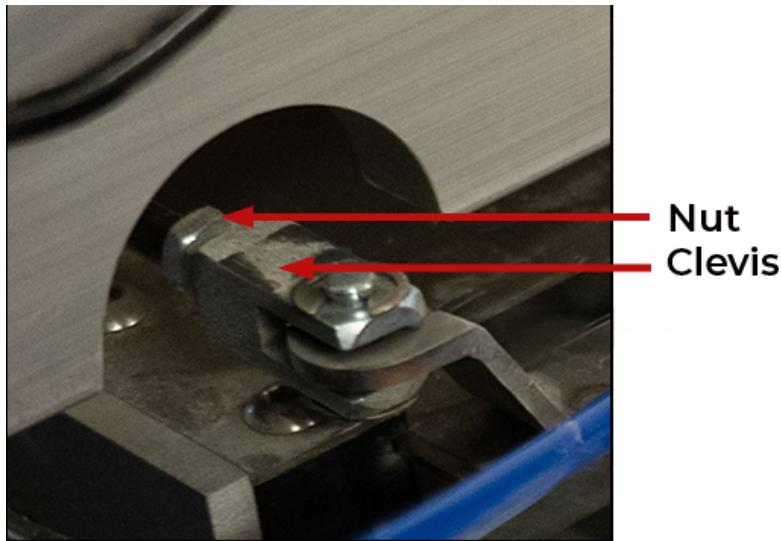
1. Turn off the air and power.
2. Disconnect the airlines to the desired cylinder. Note the location of each color.
3. Remove the screw on the limit switch and mounting bracket. Set the screw aside.



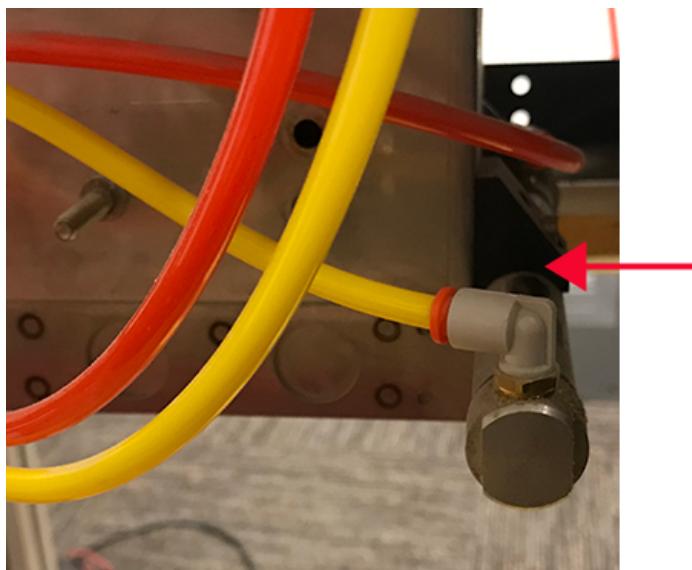
4. Remove the snap ring and retaining pin that holds the air cylinder clevis to the slide gate.



5. From the open access panel, hold the nut with a 7/16 wrench and use another 1/2 wrench to remove the clevis from the cylinder rod.



6. Remove the remaining nuts with the 7/16 wrench.
7. Remove and discard any black retainer blocks from the cylinder. Plug the hole with a shorter bolt.

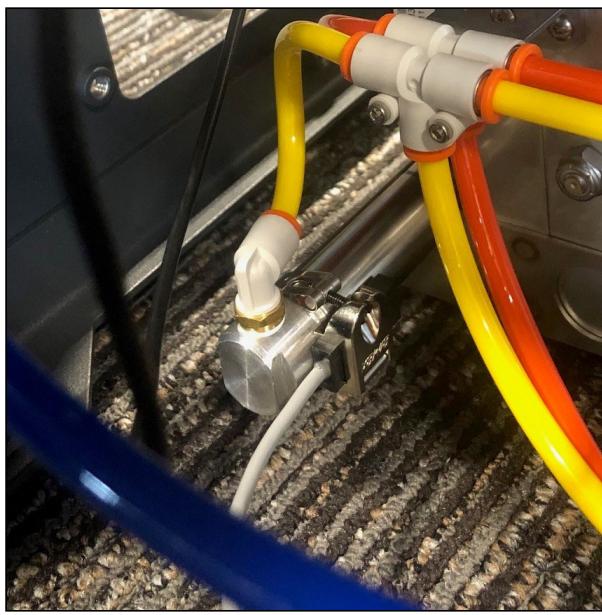


8. Use a 5/8 wrench to hold the back of the cylinder while using a 5/16 deep socket and extension to remove the large nut securing the cylinder.

9. Remove the cylinder.

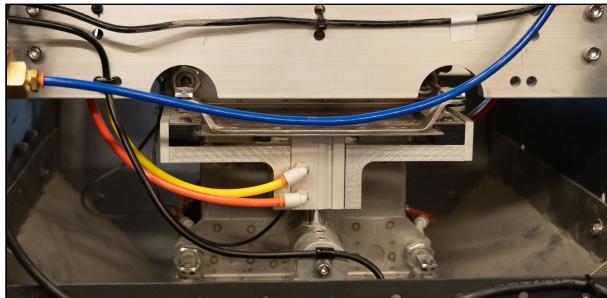


10. Remove the NPT fittings (air fittings) from the old cylinder and install the fittings on the new cylinder. Use Teflon tape to seal the threads.
11. Install the two 1/4 inch nuts and clevis on the new cylinder rod. Tighten the nuts to the end of the threads on the rod.
12. Slide in the new cylinder and position it so that the air inlet/outlet matches the position of the old cylinder.
13. Tighten the larger nut on the new cylinder with a 15/16 socket and extension while holding the back of the cylinder with 5/8 wrench.
14. Reattach the slide gate to the air cylinder clevis using the snap ring and retaining pin.
15. Reinstall the limit switch.



16. Adjust the gate cylinder limit switches. (See [Adjust the Bottom Gate Limit Switch](#) or [Adjust the Top Gate Limit Switch](#).)

17. Reconnect the airlines and turn on the power and air to the GrainGage.



5.6 Upgrade to SCiO NIR Sensor (H2 Only)

With the H2 NIR Upgrade Kit, you can replace the EM moisture sensor with an NIR sensor and convert an H2 GrainGage to an H3 with a few simple modifications. For instructions on upgrading to the NIR sensor, see [H2 NIR Upgrade Installation Guide](#).

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CHAPTER 6

Obtain HarvestMaster Service Help

6. Obtain HarvestMaster Service Help

For technical questions or repairs, contact a HarvestMaster Field Service Engineer. In many situations, a HarvestMaster Field Service Engineer can resolve problems over the phone and even guide you in replacing parts.

| USA | Europe |
|--|---|
| Web: www.HarvestMaster.com Email: support@HarvestMaster.com Phone: +1 (435) 753-1881 | Web: www.HarvestMaster.eu Email: support@HarvestMaster.eu Phone: +43 724 221 9333 |

6.1 Add HarvestMaster Service Plans

The [warranty](#) covering the GrainGage protects against manufacturer's defects. In addition to the warranty, HarvestMaster offers [service plans](#) to help reduce downtime during the busy harvest season.

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CHAPTER 7

Standard Weight, Volume, and Moisture

7. Appendix A: Volume, Weight, and Industry Standard Values

7.1 Test Chamber Volume and Weight on H2

This table includes the chamber volume and minimum required test chamber weight including 20% head room for the H2 Single GrainGage.

| H2 Test Chamber Volume and Weight | | | |
|------------------------------------|-------------------|---|-------------------|
| Crop | Number of Inserts | Volume | Minimum Weight |
| Canola 47 lb/bu (60 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 3.72 lb (1.46 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 2.96 lb (1.16 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.20 lb (0.85 kg) |
| Soybeans 55 lb/bu (71 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 4.35 lb (1.76 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.46 lb (1.40 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.58 lb (0.98 kg) |
| Wheat 60 lb/bu (77 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 4.75 lb (1.84 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.78 lb (1.46 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.81 lb (1.05 kg) |
| Barley 48 lb/bu (61 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 3.80 lb (1.72 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.02 lb (1.37 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.25 lb (1.02 kg) |
| Corn 56 lb/bu (72 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 4.43 lb (2.01 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.53 lb (1.60 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.62 lb (1.89 kg) |
| Rye 56 lb/bu (72 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 4.43 lb (2.01 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.53 lb (1.60 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.62 lb (1.19 kg) |

| | | | |
|-------------------------------------|---|---|-------------------|
| Sorghum 56 lb/bu (72 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 4.43 lb (2.01 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 3.53 lb (1.60 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 2.62 lb (1.19 kg) |
| Oats 32 lb/bu (41 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 2.53 lb (1.15 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 2.02 lb (0.92 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 1.50 lb (0.68 kg) |
| Sunflower 25 lb/bu (32 kg/hL) | 0 | 142 in ³ (2325 cm ³) | 1.98 lb (0.90 kg) |
| | 1 | 113 in ³ (1850 cm ³) | 1.57 lb (0.71 kg) |
| | 2 | 84 in ³ (1375 cm ³) | 1.17 lb (0.53 kg) |

7.2 Test Chamber Weight for SCiO Sensor on H3

This table includes the minimum required test chamber weight including 20% head room for the H3 Single GrainGage with SCiO Sensor.

| H3 Test Chamber Weight with SCiO Sensor | | |
|---|-------------------|-------------------|
| Crop | Number of Inserts | Minimum Weight |
| Canola 47 lb/bu (60 kg/hL) | 0 | 3.52 lb (1.60 kg) |
| | 1 | 2.64 lb (1.20 kg) |
| Soybean 55 lb/bu (71 kg/hL) | 0 | 4.12 lb (1.87 kg) |
| | 1 | 3.09 lb (1.40 kg) |
| Wheat 60 lb/bu (77 kg/hL) | 0 | 4.50 lb (2.04 kg) |
| | 1 | 3.37 lb (1.53 kg) |
| Barley 48 lb/bu (61 kg/hL) | 0 | 3.60 lb (1.63 kg) |
| | 1 | 2.70 lb (1.22 kg) |
| Corn 56 lb/bu (72 kg/hL) | 0 | 4.20 lb (1.91 kg) |
| | 1 | 3.15 lb (1.43 kg) |
| Rye 56 lb/bu (72 kg/hL) | 0 | 4.20 lb (1.91 kg) |
| | 1 | 3.15 lb (1.43 kg) |

| | | |
|-------------------------------------|---|-------------------|
| Sorghum 56 lb/bu (72 kg/hL) | 0 | 4.20 lb (1.91 kg) |
| | 1 | 3.15 lb (1.43 kg) |
| Oats 32 lb/bu (41 kg/hL) | 0 | 2.40 lb (1.09 kg) |
| | 1 | 1.80 lb (0.82 kg) |
| Sunflower 25 lb/bu (32 kg/hL) | 0 | 1.87 lb (0.89 kg) |
| | 1 | 1.40 lb (0.64 kg) |

7.3 Test Chamber Weight for EM Sensor on H3

This table includes the minimum required test chamber weight including 20% head room for the H3 Single GrainGage with EM sensor.

| H3 Test Chamber Weight with EM Sensor | | |
|---------------------------------------|-------------------|-------------------|
| Crop | Number of Inserts | Minimum Weight |
| Canola 47 lb/bu (60 kg/hL) | 0 | 4.04 lb (1.83 kg) |
| | 1 | 3.12 lb (1.42 kg) |
| | 2 | 2.20 lb (1.00 kg) |
| Soybean 55 lb/bu (71 kg/hL) | 0 | 4.73 lb (2.15 kg) |
| | 1 | 3.65 lb (1.66 kg) |
| | 2 | 2.58 lb (1.17 kg) |
| Wheat 60 lb/bu (77 kg/hL) | 0 | 5.16 lb (2.34 kg) |
| | 1 | 3.98 lb (1.81 kg) |
| | 2 | 2.81 lb (1.27 kg) |
| Barley 48 lb/bu (61 kg/hL) | 0 | 4.13 lb (1.87 kg) |
| | 1 | 3.19 lb (1.45 kg) |
| | 2 | 2.25 lb (1.02 kg) |
| Corn 56 lb/bu (72 kg/hL) | 0 | 4.82 lb (2.19 kg) |
| | 1 | 3.72 lb (1.69 kg) |
| | 2 | 2.62 lb (1.19 kg) |

| | | |
|-------------------------------------|---|-------------------|
| Rye 56 lb/bu (72 kg/hL) | 0 | 4.82 lb (2.19 kg) |
| | 1 | 3.72 lb (1.69 kg) |
| | 2 | 2.62 lb (1.19 kg) |
| Sorghum 56 lb/bu (72 kg/hL) | 0 | 4.82 lb (2.19 kg) |
| | 1 | 3.72 lb (1.69 kg) |
| | 2 | 2.62 lb (1.19 kg) |
| Oats 32 lb/bu (41 kg/hL) | 0 | 2.75 lb (1.25 kg) |
| | 1 | 2.12 lb (0.96 kg) |
| | 2 | 1.50 lb (0.68 kg) |
| Sunflower 25 lb/bu (32 kg/hL) | 0 | 2.15 lb (0.98 kg) |
| | 1 | 1.66 lb (0.75 kg) |
| | 2 | 1.17 lb (0.53 kg) |

7.4 Test Chamber Volume for SCiO and EM Sensors on H3

This table includes the test chamber volume for the H3 Single GrainGage with SCiO Sensor or EM sensor.

| H3 Test Chamber Volume for SCiO and EM Sensors | | |
|--|---|---|
| Number of Inserts | SCiO Sensor | EM Sensor |
| 0 | 134 in ³ (2200 cm ³) | 154 in ³ (2525cm ³) |
| 1 | 101 in ³ (1650 cm ³) | 119 in ³ (1950 cm ³) |
| 2 | n/a | 84 in ³ (1375 cm ³) |

7.5 Standard Moisture and Test Weight

Test weight should always be calibrated using a sample with a moisture content as close to the industry standard as possible. The table shows the industry moisture standards for some common grains.

| Standard Moisture and Test Weight | | |
|-----------------------------------|----------|---------------------|
| Grain | Moisture | Test Weight |
| Canola | 8.5% | 47 lb/bu (60 kg/hL) |

| | | |
|-----------|--------|---------------------|
| Soybean | 13% | 55 lb/bu (71 kg/hL) |
| Wheat | 13.5% | 60 lb/bu (77 kg/hL) |
| Barley | 14.5 % | 48 lb/bu (62 kg/hL) |
| Corn | 15.5% | 56 lb/bu (72 kg/hL) |
| Rye | 14% | 56 lb/bu (72 kg/hL) |
| Sorghum | 13% | 56 lb/bu (72 kg/hL) |
| Oats | 13.5% | 32 lb/bu (41 kg/hL) |
| Sunflower | 10% | 25 lb/bu (32 kg/hL) |

*These measurements are based on the United States (Winchester) bushel.

References for Standard Moisture and Test Weight

Devkota P., & Mulvaney M. J. (2020, May). Adjusting crop yield to a standard moisture content. IFAS Extension, University of Florida. <https://edis.ifas.ufl.edu/pdf%5CAG%5CAG44200.pdf>.

Isleib, J. (2012, August 6). Test weight in small grains. Michigan State University Extension. https://www.canr.msu.edu/news/test_weight_in_small_grains.

GrainGagesTM

H2/H3 Single



CHAPTER 8

Troubleshooting

8. Appendix B: Troubleshooting

This chapter contains basic troubleshooting information and additional help can be found in the [HarvestMaster knowledge base](#). Refer to [Maintain the GrainGage](#) for additional information on maintaining your system.

8.1 Troubleshooting SCiO Sensor (H3 only)

To troubleshoot the SCiO Sensor,

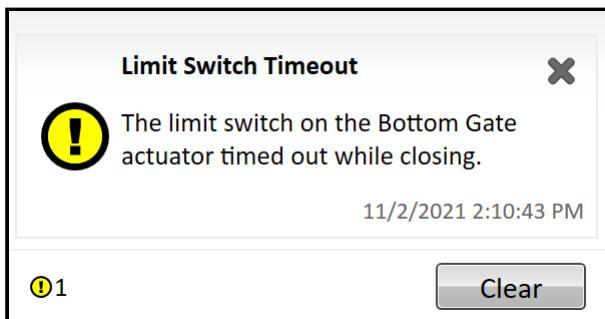
- Check the SCiO glass dome for damage.
- Clean the SCiO glass dome with glass cleaner and a microfiber cloth.
- Ensure the SCiO serial to USB cable (PN 31517) and the SCiO Sensor junction cable (PN 30712) are undamaged and properly connected between the GrainGage and rugged tablet.
- Ensure the SCiO Sensor junction cable (PN 30712) is properly routed to the SCiO Sensor and does not impede the movement of the test chamber.
- Check the alignment of the SCiO Sensor in the test chamber. When properly aligned, the square portion of the sensor inserts fully through the sheet metal and the sensor plastic is flush with the inside of the sheet metal and is not recessed.



For more information on troubleshooting the SCiO Sensor from Mirus, refer to the [Mirus for Single GrainGage User Guide](#).

8.2 Correct Limit Switch Error Message

If you receive a limit switch error message in Mirus for the top or bottom gate, check the air pressure and the functionality of the gate. For more information about checking the air pressure, see [Install a Pressurized Air Supply](#).

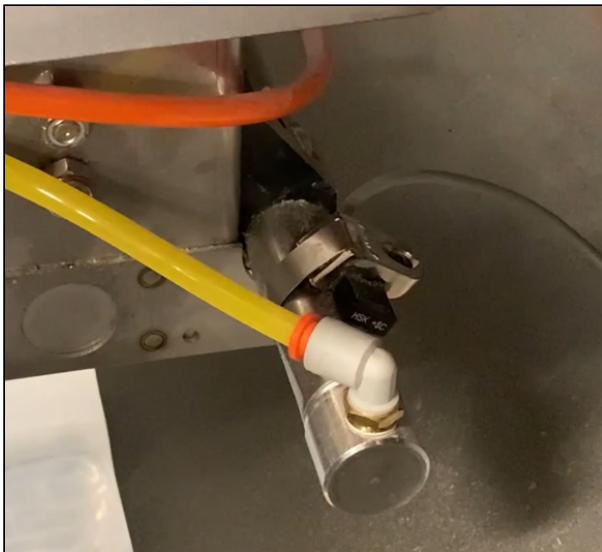


If the gate is uninhibited and the air pressure is correct, adjust the limit switches.

8.3 Adjust Bottom Gate Limit Switch

To adjust the bottom gate limit switch,

1. Ensure the bottom gate is closed.
2. Use a small flat head screwdriver to loosen the screw of the limit switch.



3. Move the limit switch toward the test chamber. After the light turns on, move the limit switch an additional quarter inch until the light turns off.
4. Tighten the limit switch screw.
5. Use Mirus to open and close the bottom gate. Then, verify the limit switch notification is gone. (For more information, see [Check Actuator Diagnostics](#).)

If you are still receiving the notification, contact a [HarvestMaster Field Service Engineer](#).

8.4 Adjust Top Gate Limit Switch

To adjust the top gate limit switch,

1. Ensure the top gate is closed.
2. Use a small flathead screwdriver to loosen the screw of the limit switch.



3. Slide the band behind the rivet to ensure the limit switch is as far down as it will go.
4. Tighten the limit switch screw.
5. Use Mirus to open and close the top gate. Verify the limit switch notification is gone. (See [Check Actuator Diagnostics](#).)

If you are still receiving the notification, contact a [HarvestMaster Field Service Engineer](#).

8.5 Diagnose Air Leaking from Solenoid or Cylinders

If you can hear air coming from the solenoid, you may need to replace the solenoid or cylinders. To determine whether a solenoid or cylinder needs to be replaced,

1. Turn on the air and identify which solenoid is leaking air.
2. Follow the air hoses from the leaking solenoid to its cylinder(s).
3. Remove the non-pressure hose from the cylinder(s).
4. Listen to see whether the air has stopped leaking from the solenoid and is now leaking from the cylinder(s).
 - If air is leaking from the non-pressurized side of the cylinder, the air leak is in the cylinder.
 - If air continues to leak from the solenoid after the hose is removed, the air leak is in the solenoid.
5. Replace the leaking part(s).

For more information, see [Replace the Solenoid](#) and [Replace the Gate Air Cylinders](#).

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CHAPTER 9

Sensor and Module Error Codes

9. Appendix C: Sensor and Module Error Codes

9.1 Moisture Sensor LED Error Codes

The EM3 Moisture Sensor contains an orange LED and a red LED. A red LED blinking at the rate of once per second indicates normal status. The orange LED is off unless communicating with Mirus. The red LED displays error codes by groupings of short pulses, beginning after a long (one second) “on” pulse. For instance, an error code of 21 would be displayed as two short red light pulses, pause, then one short red light pulse followed by a pause. If more than one error code is present, the next error code begins showing right after the first, until all error codes have been displayed. This is followed again by a long (one second) red “on.” Then, the sequence restarts.

| Moisture Sensor LED Error Codes | |
|---------------------------------|--|
| Error Code | Description |
| 11 | Stack overflow—sentinel byte overwritten |
| 12 | Watchdog reset has occurred |
| 13 | Timed task buffer overflow |
| 21 | Input buffer overrun (>25 character pack received) |
| 22 | Checksum error detected |
| 23 | Unrecognized command |
| 24 | RS485 busy (for 5 ms) encountered |
| 25 | Transmit message aborted due to the 50 ms RS485 busy |
| 31 | Frequency interrupt overrun (missed frequency count) |
| 32 | Frequency measurement zero error (no oscillation counts) |
| 33 | Frequency measurement range error (>4.2 MHz) |
| 44 | System supply voltage below +10.5 V |
| 45 | System voltage above +16.0 V |
| 55 | Invalid error code |

9.2 DSP Module Run-Time Error Codes

The DSP module contains a green LED, orange LED, and red LED. A solid green LED appears when the module is powered on. An orange LED blinking at a rate of once per second indicates normal status. The red LED flashes to show run-time error codes for the DSP module.

The red LED displays error codes by groups of short pulses, beginning after a one-second "on" pulse. For example, an error code of 5 would be displayed as five short red LED pulses in sequence. If there is more than one error code, the next error code begins after the first code until all the codes have been displayed. A red LED displays a one-second pulse at the end of the error codes.

| DSP Module Run-Time Error Codes | |
|---------------------------------|-------------------------|
| Code | Description |
| 1 | Hardware error |
| 2 | OS software error |
| 4 | Hardware stack overflow |
| 5 | Software stack overflow |
| 7 | BSS overflow |
| 8 | OS RAM overflow |
| 9 | TCB overflow |
| 10 | FIFO overflow |
| 11 | CAN overflow |

9.3 DSP Module Bootloader Error Codes

If you have a bootloader error on the DSP module, the red and yellow lights flash every 1.5 seconds.

| DSP Module Bootloader Error Codes | |
|-----------------------------------|------------------------|
| Blinking Pattern/ 1.5 Seconds | Description |
| Single blink | Waiting for update |
| Double blink | Flash memory empty |
| Triple blink | Flash memory corrupted |
| Quadruple blink | Firmware incompatible |

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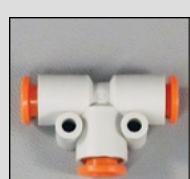


CHAPTER 10

Replacement Part Numbers

10. Appendix D: Replacement Part Numbers

Refer to the table for a list of common replacement parts for the H2 and H3 Single GrainGage systems.

| H2 and H3 Single GrainGage Parts | | |
|----------------------------------|--|---|
| PN | Description | Photo |
| 7395 | Small straight air - FIT straight 1/40 D-1/8 |  |
| 7397 | Elbow, small |  |
| 7398 | T-fitting 1/4 in. hose |  |
| 9455 | Black poly air hose per ft, .375 OD |  |
| 9555 | Piston rod clevis kit |  |
| 9592 | Blue air hose, 1/4 in. OD |  |

| | | |
|-------|------------------------------------|--|
| 13119 | Rubber mount for bucket and module |  |
| 15332 | Power cable |  |
| 15335 | CAN patch cable, short |  |
| 15336 | CAN patch cable, long |  |
| 15337 | CAN breakout box |  |
| 15374 | Remote enter cable |  |
| 15450 | Pneumatic conditioning center |  |

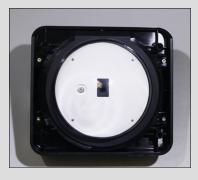
| | | |
|-------|-------------------------------------|---|
| 23237 | HM2 9-pin communications cable |  |
| 23385 | Exhaust vents VMI 22700, large size |  |
| 23695 | Yellow air line, 1/4 in. OD |  |
| 23696 | Orange air line, 1/4 in. OD |  |
| 24407 | Calibration weight, 3 lb |  |
| 24408 | Calibration weight, 10 lb |  |
| 24412 | Overload stop |  |

| | | |
|-------|---|---|
| 24422 | Service top/bottom gate cylinder (replaces PN 26267), 7.5 in. length x 4 in. stroke |  |
| 24423 | Slide gate |  |
| 24430 | Pinch strip |  |
| 24433 | Bypass gate cylinder, 9.5 in. length x 5 in. stroke |  |
| 24434 | Mac solenoid valve with connector |  |
| 24442 | Separator limit switch for H2 Twin/Single |  |
| 24443 | Gate limit switch for Twin/Single (with band) |  |
| 31683 | DSP 3 module |  |

| | | |
|-------|--|---|
| 24524 | EM sensor blade |  |
| 24563 | Test weight load cell |  |
| 24564 | H2 Twin/Single 30 kg plot load cell |  |
| 24940 | Bulkhead power cable, 3 cables |  |
| 24942 | H2 bulkhead actuator cable (for isolation gate on H2 Single DSP actuator port) |  |
| 25030 | System controller |  |
| 25071 | Actuator module |  |
| 25089 | Lind tablet charge cable for Panasonic |  |

| | | |
|-------|---|---|
| 25118 | H2 Twin/Single rubber mounting foot |  |
| 25797 | CAN extension cable (male-female), 25 ft |  |
| 26114 | Completed separator cylinder kit |  |
| 26530 | Isolation gate kit |  |
| 26545 | H2 low yield insert kit |  |
| 26566 | DSP 8 pin I/O 1 cable (GPIO 1 to DSP 5 Act & 6) |  |
| 26829 | DSP2 GPIO 1 breakout cable for overflow and Act 5 & 6 (requires actuator cable to access DSP 5 & 6) |  |

| | | |
|-------|--|---|
| 26830 | Straight actuator cable subassy |  |
| 26831 | H2 insert plug plate, 1 each |  |
| 27092 | Right angle USB/CAN converter cable |  |
| 28315 | CAN cable with right angle (female-female), 15 ft |  |
| 28540 | Internal CAN extension cable kit (male-female), 3 ft |  |
| 28941 | CAN cable right angle (female-female), 100 in. |  |
| 29111 | EM3 Grain Moisture Sensor |  |

| | | |
|-------|--|---|
| 30711 | H3 low yield insert plug, 1 each |  |
| 30712 | H3 SCiO cable assembly |  JSPN 30712 |
| 30715 | H3 SCiO sensor |  |
| 31045 | H3 low yield insert subassy kit |  JSPN 31045 |
| 31517 | SCiO serial to USB cable |  JSPN 31517 |
| 31518 | SCiO 15 ft serial to USB extension cable |  |
| 31740 | H3 SCiO sensor hole plug kit |  |
| 31796 | H3 moisture sensor plug kit |  |

31798

H3 low yield insert plug kit



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CHAPTER 11

Exploded & Mounting Drawing

11. Appendix E: GrainGage Exploded Views

The following table contains links to exploded drawings for the H2 and H3 GrainGage models.

| Drawings | |
|-----------|--|
| Model | Type of Drawings |
| H2 Single | Top Level Assembly (Exploded) Test Weight Chamber SubAsy (Exploded) |
| H3 Single | Top Level Assembly (Exploded and mounting) |

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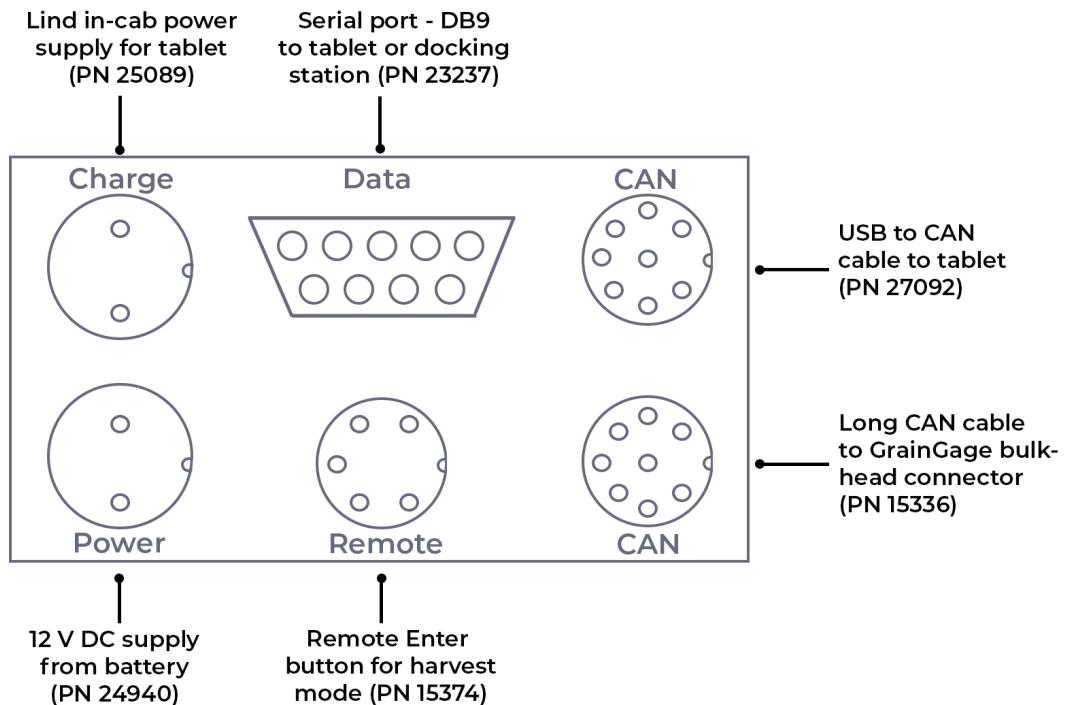


CHAPTER 12

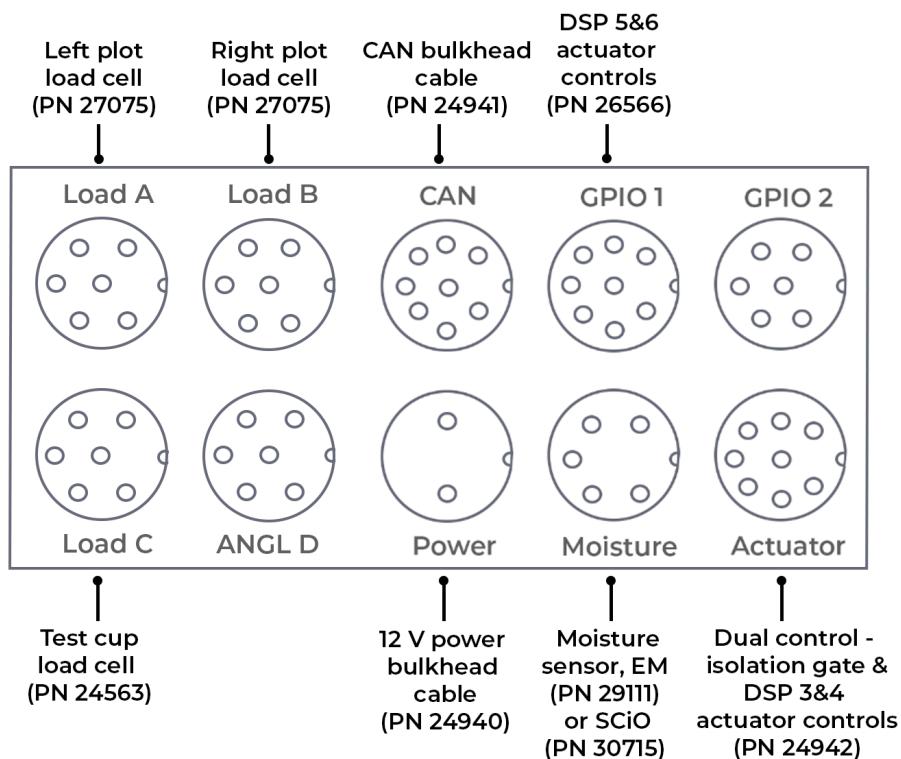
Connections and Wiring Diagrams

12. Appendix F: Connections and Wiring Diagrams

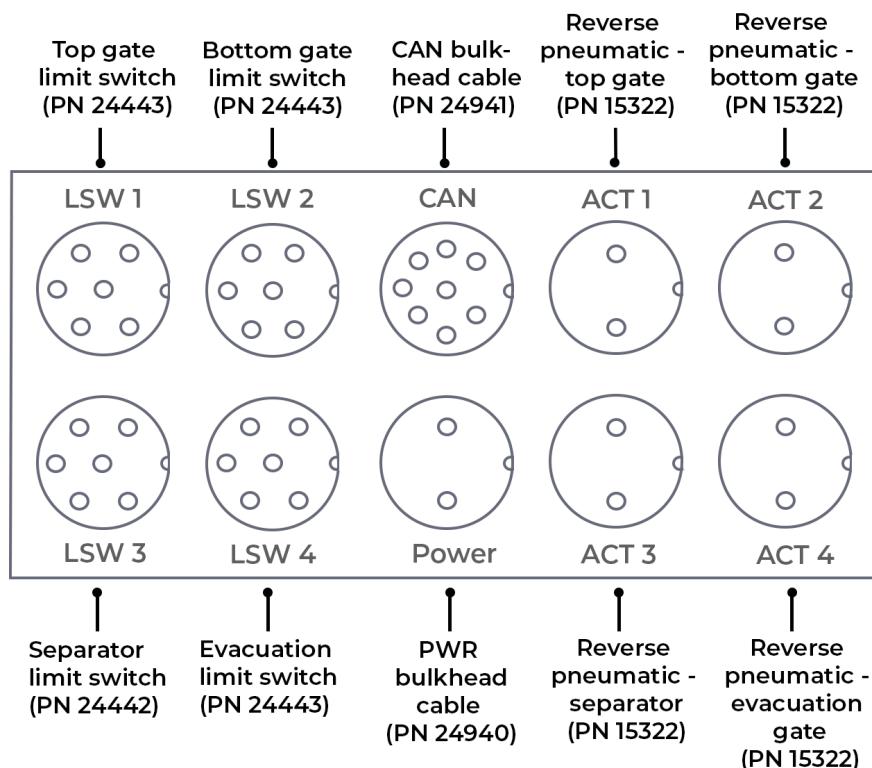
12.1 Wiring for the System Controller



12.2 Wiring for the DSP Module Ports



12.3 Wiring for Actuator 1 Ports

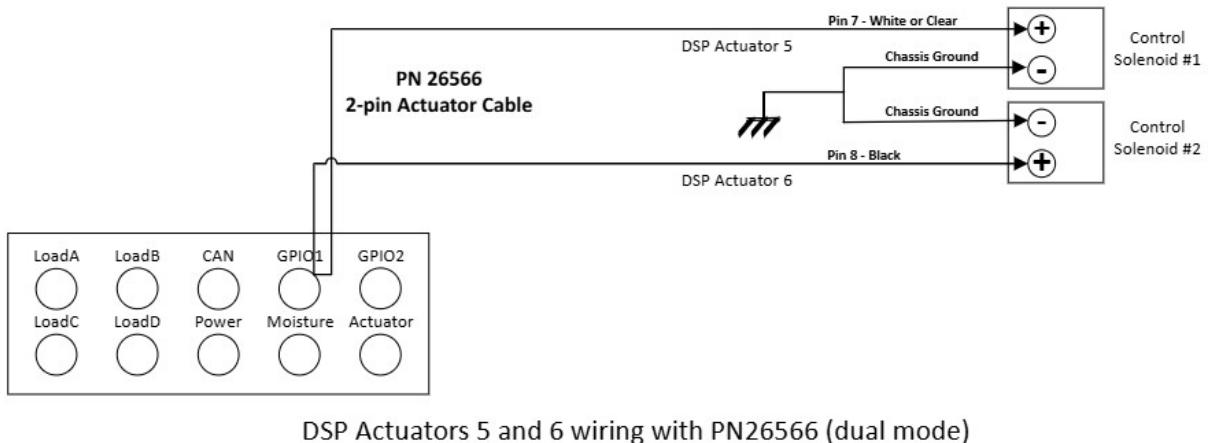


12.4 Cable Wiring Diagrams

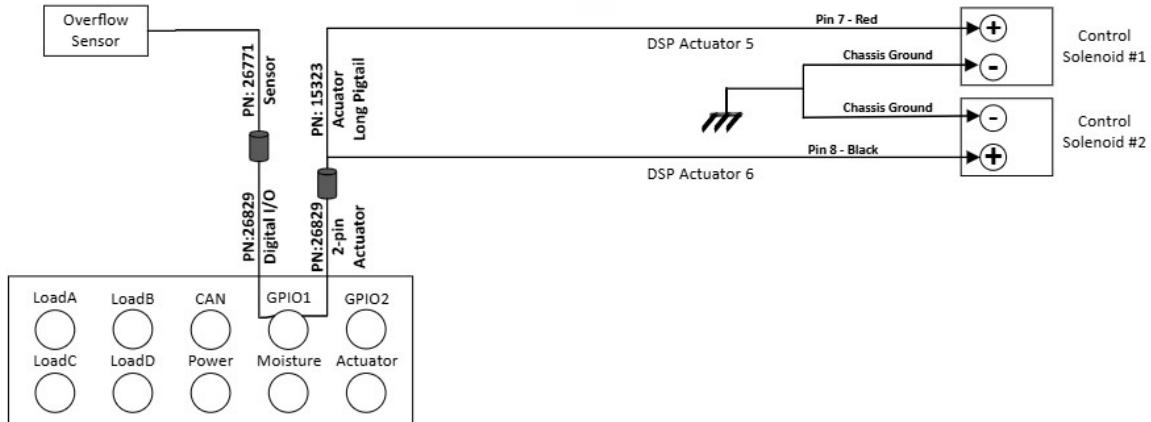
12.4.1 Control Two Separate Actuators (Dual Mode)

When using dual mode, wire the white (or clear) wire to the positive terminal on the solenoid for actuator 5, and wire the black wire to the positive terminal on the solenoid for actuator 6. Use additional wiring (not included with the part or kit) to connect the negative terminals to chassis ground. Dual mode only supports pneumatic actuators.

If DSP 5&6 are not available, another actuator control can be used in a similar way.



DSP Actuators 5 and 6 wiring with PN26566 (dual mode)

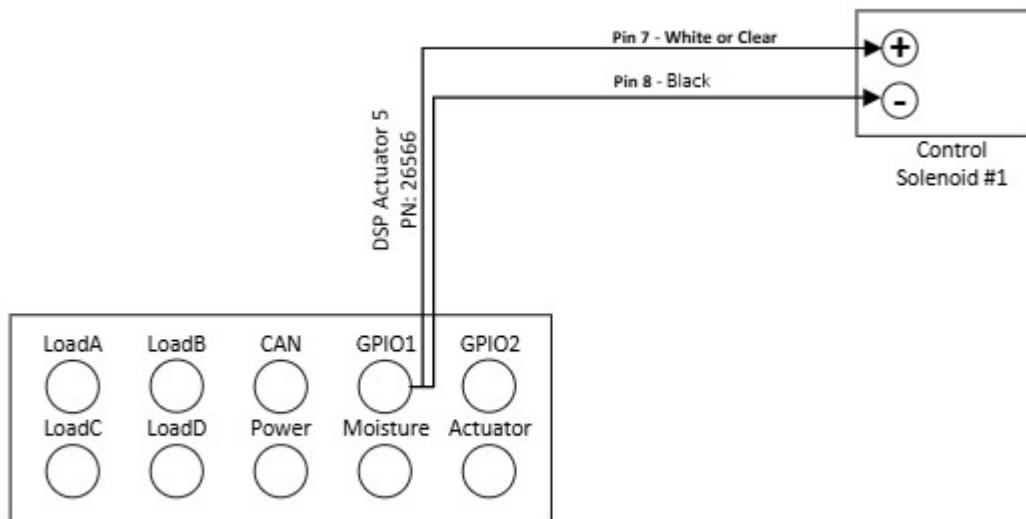


DSP Actuators 5 and 6 wiring with Overflow sensor (dual mode)

12.4.2 Control One Actuator (Non-Dual Mode)

When not using dual mode, wire the white (or clear) wire to the positive terminal and the black wire to the negative terminal. This configuration supports multiple types of actuators, such as pneumatic, hydraulic, or electric.

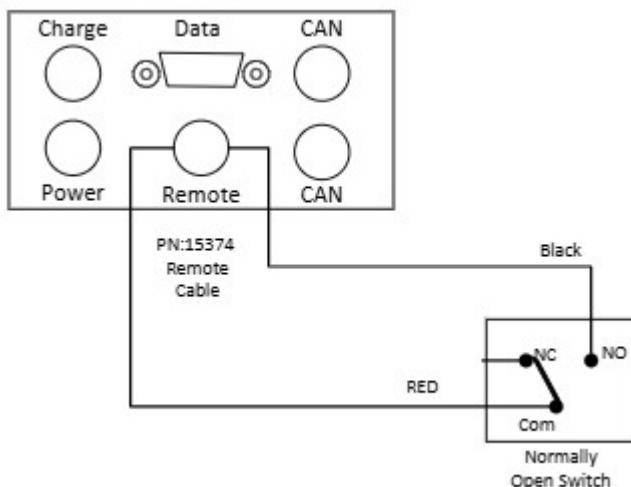
If DSP 5&6 are not available, another actuator control can be used in a similar way.



Actuator 5 wiring with PN26566 (dual mode not used)

12.4.3 Wire a Remote Switch

Use this diagram to wire a remote switch (PN 15374) to remotely cycle Mirus.



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CHAPTER 13

Warranty

13. Appendix F: Warranty

13.1 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 here-under 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.

13.2 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 material or workmanship for a period of one year from the 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 Juniper Systems to perform such interfacing operations.

13.3 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.

13.4 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.

13.5 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.

13.6 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 MT, Mon-Fri).