



S-SERIES COMBINE CALIBRATION GUIDE

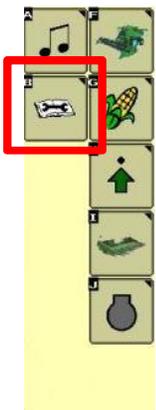
CLICK THE ARROW TO GET STARTED



1. TEMPERATURE CALIBRATION

Temperature calibration should be performed when the sensor has not been in direct sunlight or filled with grain, such as first thing in the morning. The reading should be an accurate reading of the surrounding air temperature. To be performed each season.

1



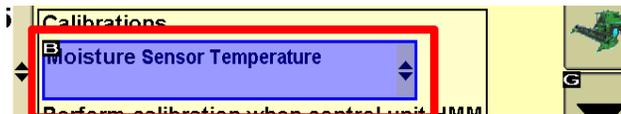
Select Button "B" from the combine main run page.

2



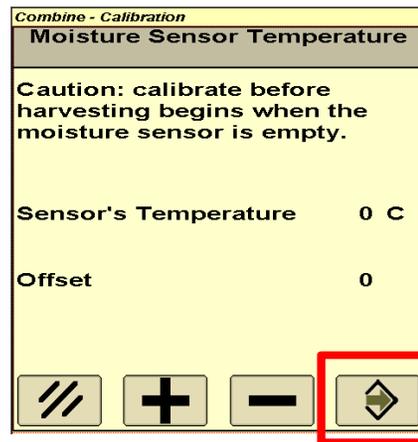
Select Button "G" for user calibrations.

3



Select "Moisture Sensor Temperature" from the list of calibrations and select the "accept" button.

4



Use the "+" and "-" buttons to accurately identify the offset between the air temperature and the moisture sensor temperature. Change until Sensor's Temperature matches the surrounding temperature.

Select the "accept" button when complete.

2. MASS FLOW VIBRATION CALIBRATION

Be certain to select the correct crop in the combine setup prior to completing this calibration. This calibration will be saved under the crop identified in the combine setup. This calibration must be performed with the correct head on the combine and with the head in the operational position for harvest. To be completed with each crop.

1



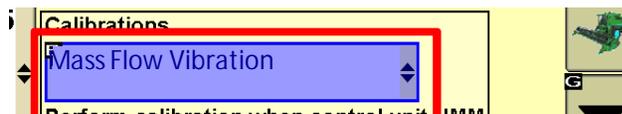
Select Button "B" from the combine main run page.

2



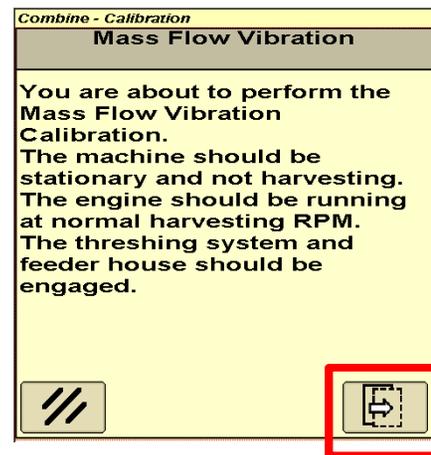
Select Button "G" for user calibrations.

3



Select "Mass Flow Vibration" from the list of calibrations and select the "accept" button.

4



With the combine running and empty of grain, engage the separator and header. While sitting still at full engine RPM and the correct header in the operating position (but not resting on the ground), select the accept button.

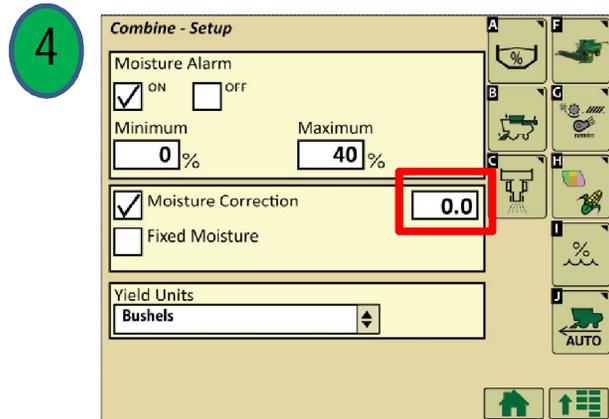
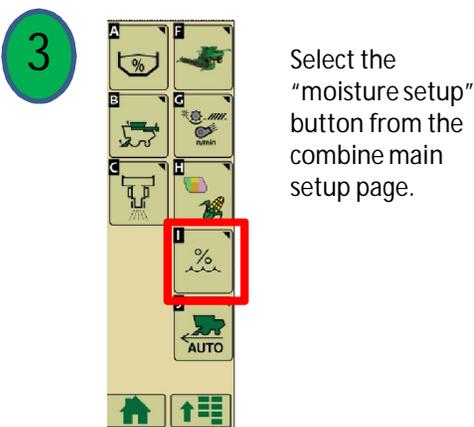
The calibration will take up to 60 seconds and a confirmation screen will appear when complete. Press the "accept" button again to accept the final calibration.

3. MOISTURE SENSOR CORRECTION

- Temperature calibration should be completed before this correction.
- Calibrate for each crop type, at the beginning of the season.
- Possibly avoid confusion by following steps 3 and 4 to set the moisture correction value to 0.0, and ensure the moisture correction box is checked before beginning this process.
- Take time to thoroughly clean the moisture sensor metal plates at the beginning of each season with glass cleaner or water.
- If moisture readings become erratic while harvesting high moisture grain, clean the moisture sensor with glass cleaner or water to remove buildup on metal capacitance plates.

1 Harvest one Grain tank of grain with "Moisture Correction" checked (see Step 4), and note the average moisture displayed on the Harvest Monitor/Doc display.

2 Randomly sample the grain from several location in the grain tank to collect an average moisture sample, then measure the moisture of this sample using an accurate/trusted moisture tester.



Ensure there is a check mark in the moisture correction box. Then select the correction value, and enter the correct offset between the actual measured value and the displayed value, and accept. This can be a positive or negative number, and needs to be added to any existing offset.

Example: elevator moisture (13%) minus combine measured moisture (12%) = moisture offset (+1%).

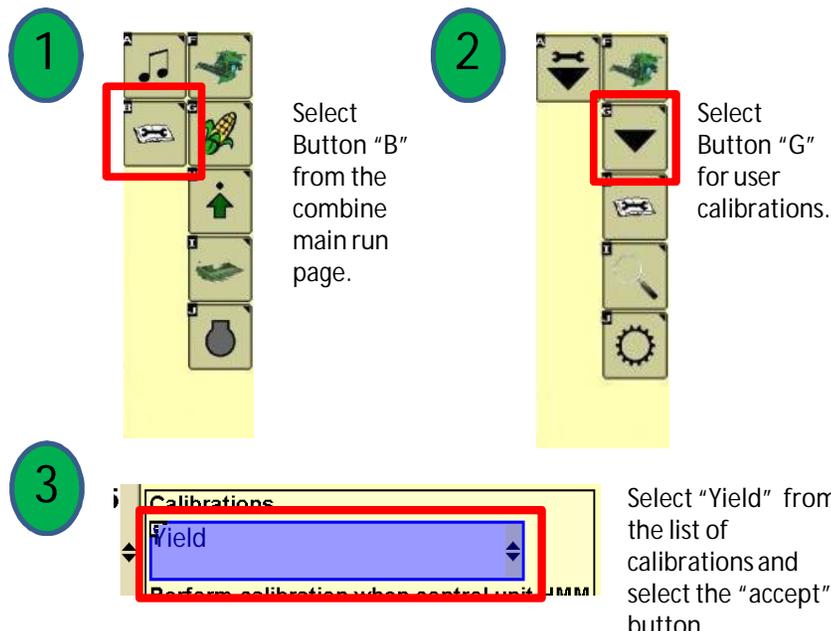
4. WEIGHT CALIBRATION

Note: Mass Flow Vibration and Moisture Sensor Temperature calibrations need to be completed before weight.

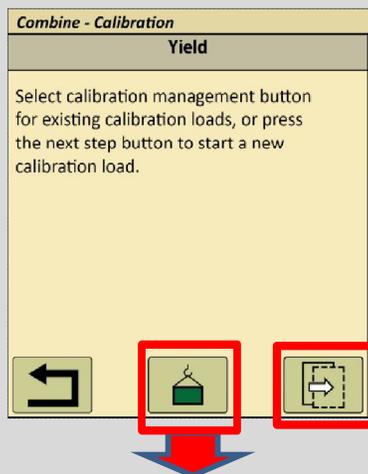
- Calibration loads must be uniform in size and over 3,000 lbs.
- Weight calibration can be completed at any time during the season, it will not impact already harvested data. It is recommended to calibrate early in the season.
- Harvest each calibration load at a different flow rate. Grain Flow can be altered by changing ground speed.
- Harvest at a constant flow rate during each calibration load target speed, the performance monitor flow rate (Bu/Hr) can be used to monitor this. Avoid headland turns if possible.

Calibration load	1	2	3	4	5	6	7
Harvest Speed	+½ MPH	Normal Harvest Speed	- ½ MPH	- 1 MPH	-1½ MPH	-2 MPH	-2½ MPH

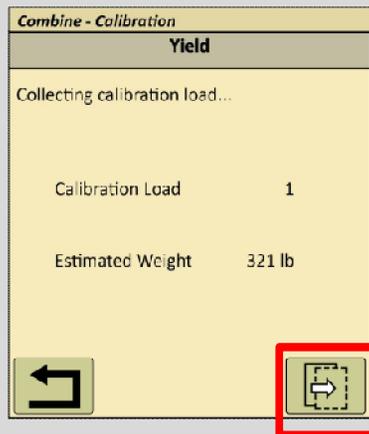
- A maximum of 13 cal loads can be used for each crop, but for most accurate results, use 5-7 calibration loads for each crop. If high accuracy isn't desired, 1-3 loads can be performed near the normal flow rates.
- Make note of the speed, moisture and flow rate (bu/hr) of each calibration load for future reference. These loads do not need to be in any specific order.
- In corn it is possible to use up to 6 calibration loads for dry or wet corn, and one replacement calibration load.



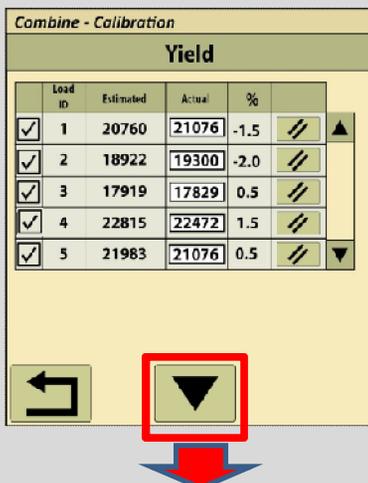
WEIGHT CALIBRATION SCREEN OVERVIEW



Selecting the "next" button will start the next available calibration load



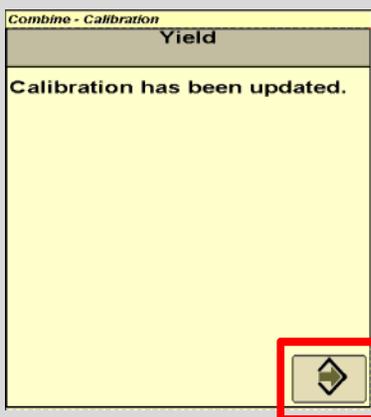
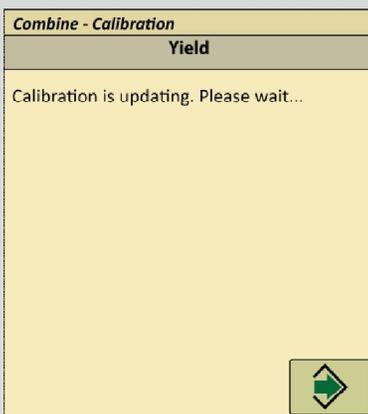
Selecting the "next" button again will complete the calibration load, scale weights will be entered in the calibration management screen



Calibration Management Screen

This is the main screen for interacting with calibration loads. Calibration occurs when a cal load with actual pounds is 'checked', and the calibration button at the bottom center of the screen is pressed. The "Actual" column is where the scale weight for the given calibration load is entered, then a % error will be displayed in the "%" column.

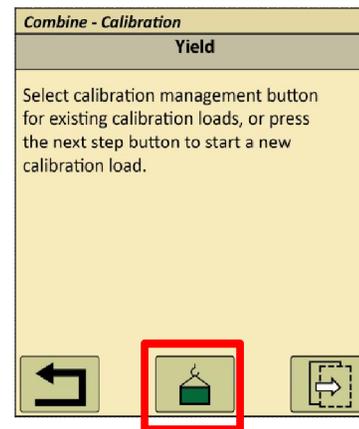
For best accuracy, make sure 5 - 7 loads are 'checked', then press the "calibration" button. If % error is too high (greater than 2 or 3%), 'uncheck' that load and do another cal load at the same flow rate (from step #4 above). 'Check' the new load, and press the calibration button again. Press the  (delete button) to permanently delete a cal load.



Selecting the "accept" button will complete the weight calibration process.

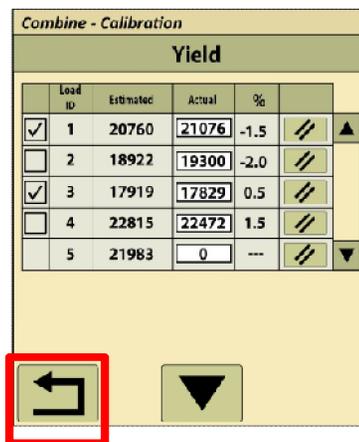
4. WEIGHT CALIBRATION CONT

4



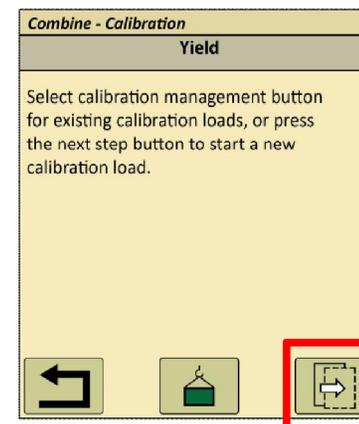
Selecting the "calibration load management" button and be sure to have enough clear calibration loads for the desired number of calibrations you intent to perform at different grain flow rates. Make room by deleting old or unwanted calibration loads.

5



Return to the main calibration page by selecting the "back" button.

6



Select the "next" button to begin the first calibration. Ensure that the combine grain tank is empty.

4. WEIGHT CALIBRATION CONT

7

The display will select the first open calibration load number in the “calibration load management” list each time a calibration is initiated. As the grain is harvested the combine estimated weight will increase. Be certain to keep speed (grain flow rate) constant during the calibration load, harvest at least 3,000 pounds. Select the “next” button to complete the calibration load.

8

Repeat steps 6 and 7 for a minimum of four calibration loads at different flow rates (speeds).

9

Load ID	Estimated	Actual	%
1	20760	21076	-1.5
2	18922	19300	-2.0
3	17919	17829	0.5
4	22815	22472	1.5
5	21983	0	---

Enter the actual scale weight of each calibration load. This is done by selecting the open box in the “Actual” column next to the corresponding calibration load. A number entry pad will appear enter the weight and select “accept” button. This can be done after each load or later when all of the loads have been collected.

10

Load ID	Estimated	Actual	%
✓ 1	20760	21076	-1.5
✓ 2	18922	19300	-2.0
✓ 3	17919	17829	0.5
✓ 4	22815	22472	1.5
✓ 5	21983	21076	0.5

Place a check mark next to each of the calibrations that are recently completed at the different grain flow rates, have an error of less than 3.0%, and are to be used to generate the multi-point calibration. Select the “calibration” button and accept the final calibration when successful, this calibration will be saved under the crop identified in the combine setup.

WEIGHT CALIBRATION HELPFUL HINTS

•Keep a log of your calibrations, this will be helpful in identifying them later. If using combine yield maps as part of your crop insurance practices, be certain to fill out the calibration log from your crop insurance agent.

LOAD I.D.	MOISTURE	SPEED	FLOW RATE
1.	DRY 18%	3.0 MPH	1320 bu/hr
2.	DRY 22%	3.5 MPH	1540 bu/hr
3.	DRY 20%	4.0 MPH	1760 bu/hr
4.	DRY 19%	4.5 MPH	1980 bu/hr
5.	WET 28%	3.0 MPH	1310 bu/hr
6.	WET 25%	3.5 MPH	1550 bu/hr
7.	WET 27%	4.0 MPH	1750 bu/hr
8.	WET 28%	4.5 MPH	1990 bu/hr

NOTE: USE LOADS 5 THROUGH 8 FOR CORN OVER 25%

•Calibrate all loads at the same time, once per season per crop – Treat wet corn and dry corn as separate crops.

•Calibrate in as uniform of crop as possible, avoid calibrating when opening a field.

•Check/confirm calibrations from time to time during the season.

•Re-Calibrate/confirm calibration with dramatic changes in grain (i.e. test weight changes more than 6 - 8 pounds, or moisture changes more than 8-10 points on average).

•Calibrate to an accurate reference scale.

•Do not dump on the go while calibrating.

•Clean moisture and mass flow sensors before calibration.

•If after final calibration the error is over 3%, uncheck the load the the maximum error and re-perform the final calibration, You must still have over 4 loads checked to perform a full calibration.

•The greater the variability in the crop the more calibrations loads at varying grain flow rate (speeds) are recommended, up to 13 are possible, 5 to 7 are recommended

•Less than 4 calibration loads will result in a linear calibration, it is recommend to always utilize more than four calibration loads for the greatest accuracy.

• Complete as much of the documentation setup in the display as possible before season.

•When preparing the combine, setting up the monitor, and make a test run in the barn yard for a few feet and check data, 0 bu./ac. yield data is still data. Unload date frequently.

•After harvesting part of the first field, or at least after harvesting the first field, Download data into Apex to verify that the data will transfer correctly.

•Update software prior to each season.

5. YIELD CALIBRATION

INTRODUCTION:

There are two primary methods for calibrating yield monitoring/mapping on combines; single point and multi-point. These methods focus on the calibration of the mass flow sensor, specifically the generation of the calibration curve. Often times combine operators calibrate yield monitoring/mapping systems without a complete understanding of this process. Usually this is not an issue until that operator changes systems and thus unknowingly calibration methods. For example, if the operator had a single point system (70 series combine and older) and moves to a multi-point system (S-Series combine) without changing the yield monitor/mapping system calibration procedure, usually the resulting outcome can be less than desirable. This is often a challenge for customers changing between an AgLeader system and a John Deere system. When this challenge comes up, it is best to start with the theory of calibration curve generation, and then apply those concepts to the actual calibration procedure. *This is not a recommendation by John Deere, rather designed to help change calibration procedure methodology when calibrating an S-Series Combine.*

THEORY OF CALIBRATION:

Calibration is simply the comparison of an unknown reading/result to a known data set. A common application of this concept is utilized in determining soil fertility levels using soil samples. What happens when a soil sample is taken from a field and sent to a laboratory to determine how much of a nutrient, say phosphorus, is in the soil to make recommendations on how much phosphorus fertilizer to apply? The sample of soil is dried and ground into a fine powder. A predetermined amount of soil is collected, and then a measured amount of liquid chemical is used to extract the plant available phosphorus out of the soil. This results in a liquid sample, but what is the phosphorus concentration of the liquid sample? It should be the same as the soil, which is where the phosphorus came from. The liquid sample is run through a machine that measures the physical properties of the sample, but is unable to give a direct phosphorus concentration, and displays a relative number reading. To identify the actual phosphorus concentration in the sample, this relative soil test result is compared to the machines results when samples of known phosphorus concentrations are ran. So, if the machines results for the known samples are graphed, a chart known as a calibration curve is created. This may look like the graph (Figure 1) at the beginning of the next page. If the soil sample reading was 0.3, then the phosphorus concentration in the soil sample is 20 ppm or 40 lbs./ac.

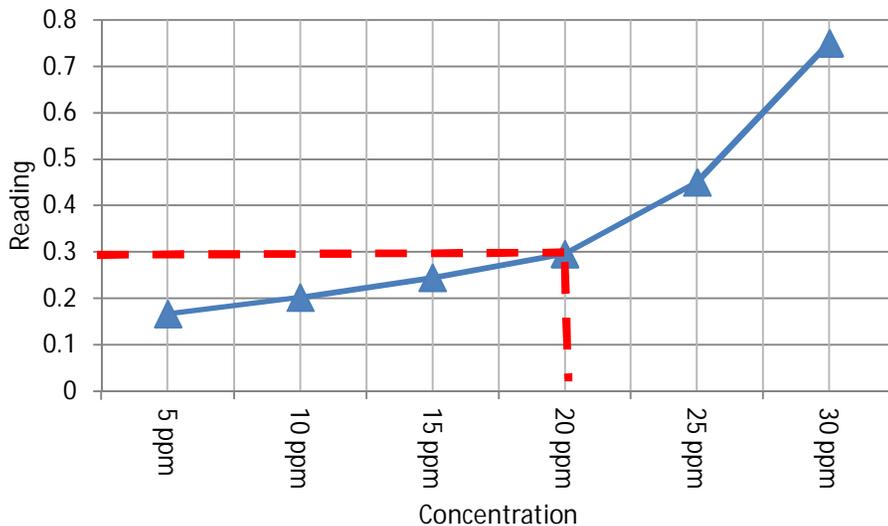
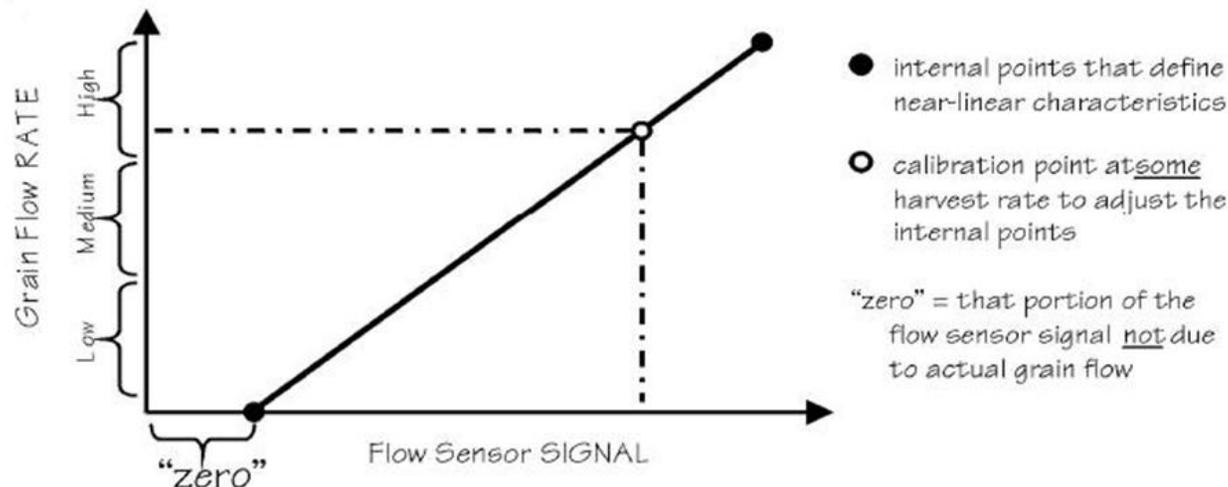


Figure 1 – Phosphorus Calibration Curve

Calibrating a combine is creating a calibration curve comparing mass flow sensor signal (readings) to actual scale weights. Once this curve is generated, any mass flow sensor signal can be related to a grain weight. A poorly generated calibration curve will lead to poor yield estimation accuracy within the yield monitoring/mapping system.

SINGLE POINT CALIBRATION

Single point calibration is having a pre defined curve shape (or could be linear/ straight) and the calibration only determines one point on the curve. See Figure 2. Figure 2 – Single Point Calibration Curve – L. Haag, Kansas State University



The single point yield calibration of the John Deere 70 Series combines and older requires the operator to only identify the value of a single calibration point. The “zero” or “vibration” value on the chart is pre determined by the software. This value is the reading from the mass flow sensor while the combine is running empty. The vibration of the combine can add additional erroneous flow rate to the reading. A yield monitoring/mapping system without this point can add 50 to 100 lbs. of grain per second to the data while sitting still with the separator engaged.

The key challenge with single point calibration is to get an accurate calibration point. With this form of calibration it is very important to follow the flow rate indicator on the calibration screen to get the grain flow rate in specific range of the chart (see Figure 3). Equally as important is to complete at least three calibration loads to generate an average to be entered into the screen. Flow rate is simply the amount of grain moving through the machine at any given point in time, measured in pounds per second. The lower the flow rate, the lower the yield at a constant speed. So by adjusting ground speed a desired grain flow rate can be achieved. The flow rate is only force experienced by the mass flow sensor per second, this is not yield until compared to distance traveled during that one second of time. When calibrating a combine, the combine is not calibrated for bushels per acre, rather weight per second. Then, with accurate speed, bushels per acre can be calculated.

Three or more loads at a constant grain flow rate, will allow the operator to identify if there was consistency in the calibration process and results. If the individual calibration load results in inconsistent calibration numbers and varies by more than 5%, there is either a mistake in the calibration process or a hardware issue on the machine. The single point calibration method allows for the entry of a single number to identify the entire calibration curve. In John Deere combines, the low flow procedure allows for the modification of the lower flow portion of the curve, and needs to be performed again each time the calibration number is changed.

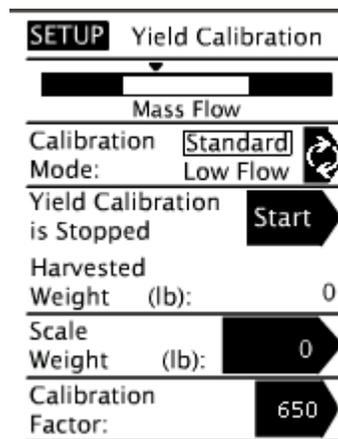


Figure 3 - Note the Mass Flow bar at the top of the calibration screen, the goal is to operate a constant speed in consistent crop so that the small triangle remains in the center unshaded portion of the Mass Flow bar. This is near max operating speeds where operators usually run. This not visible in the 70 series combine, so operate the combine at a consistent speed in uniform crop during all calibration runs, the speed should be near normal harvesting speeds for the given crop.

MULTIPLE POINT CALIBRATION

Multipoint calibration has been credited with higher accuracy, keep in mind the key to yield monitoring/mapping accuracy is accurate calibration, regardless of calibration method. The multipoint calibration method uses multiple points to create a non-linear calibration curve. See Figure 4. The S-Series combines have adopted the multipoint calibration method, and therefore the calibration process has changed. Calibrating a S-Series combine with the same process as older John Deere combines can and most likely will result in lower than desired yield monitoring/mapping accuracy.

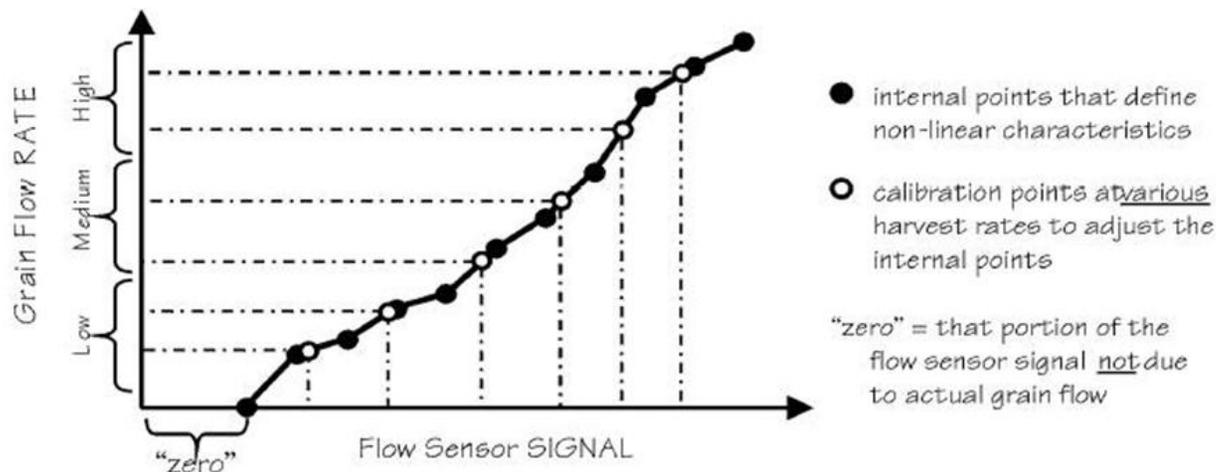


Figure 4 –Multipoint Calibration Curve – L. Haag, Kansas State University

To generate a quality calibration curve in a multipoint calibration method will require multiple calibration loads at various crop flow rates. Various flow rates can be obtained by performing the calibrations at different harvesting speeds. Opinions will vary on the number of needed calibration loads, however, most will agree that the more calibration loads you perform, the higher the accuracy of the system. Also, a vibration calibration must be performed for each crop each year. This is also referred to the C0 or “zero” calibration in some systems.

A simple rule of thumb is to perform two calibration loads at normal operating speed and then perform a calibration load at four additional speeds: ½ and 1 MPH faster and slower. This should result in 6 total calibration loads. See Table 1. One of these calibration load speeds could be performed three times to verify repeatability as noted with the single point calibration systems. Additional calibration loads can be performed by selecting additional target speeds.

Calibration	1	2	3	4	5	6
Speed	+ 1 MPH	+ ½ MPH	Normal Harvest Speed	Normal Harvest Speed	- ½ MPH	- 1 MPH

Table 1 - Calibration load target speeds

A common mistake is trying to calibrate a multipoint system in the same manner as a single point, usually this results in the operator trying to vary crop flow between the calibration loads by increasing or decreasing harvest speed. Remember, the key to a single point calibration is to have a constant and pre defined crop flow rate. Trying to calibrate a multipoint system the same as a single point causes all of the calibration loads to be a very close flow rates and generates only a straight line, thus eliminating the detailed nature of a multipoint calibration curve.

MOISTURE SENSOR TEMPERATURE CALIBRATION PROCEDURE



The moisture sensor temperature calibration is new on the S-Series combines. The calibration is in reference to temperature rather than moisture. A traditional table top grain moisture sensor results depend on the temperature of the grain sample. Combine moisture sensors also utilize grain temperature to accurately determine a final grain moisture. This calibration adjusts the temperature reading of the combine moisture sensor with the goal of increasing moisture reading accuracy. To do this, ensure the moisture sensor is empty of grain. Navigate to the calibration list on the arm rest display and select "Moisture Sensor Temperature" from the drop down menu. Then adjust the temperature to match the ambient (reference) temperature using "+/-" buttons, selecting enter to confirm. See Figure 5.

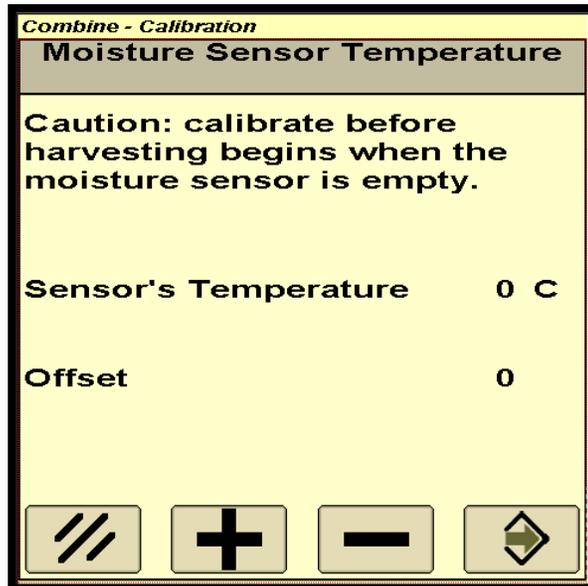


Figure 5 – S-Series Moisture Sensor Temperature Calibration Screen

Calibrate the moisture sensor temperature before each crop. Common sense will help in this process, so do not pull the combine out of the heated shop on a cool fall day and then immediately adjust the calibration to the Weather Channel. Allow the sensor to come to a steady temperature and compare to an accurate handheld thermometer next to the sensor.

MASS FLOW VIBRATION CALIBRATION PROCEDURE

Mass Flow Vibration Calibration is a base line reading from the mass flow sensor generated by the vibration of the combine in operation. This calibration will help the system remove any data created simply due to the vibrations of the combine. This should be done for each crop and header. Significant changes in combine settings such as rotor speeds changes or changing heads can impact the vibration characteristics of the machine and thus a new Mass Flow Vibration Calibration should be performed. This calibration is performed by running the machine stationary at full harvesting engine RPM with the separator and header equipment engaged and no crop in the machine. This calibration will take up to 60 seconds once initiated.

To initiate this calibration, navigate to the calibration list on the arm rest display and select "Mass Flow Vibration" from the drop down menu. The screen will instruct the operator to run the machine in a stationary position at full harvesting engine RPM with the separator and header equipment engaged and no crop in the machine. See Figure 6. The operator will select the next page icon in the lower right corner of the screen to initiate the calibration. Upon completion of the calibration, a screen will either confirm the calibration or give more instructions.

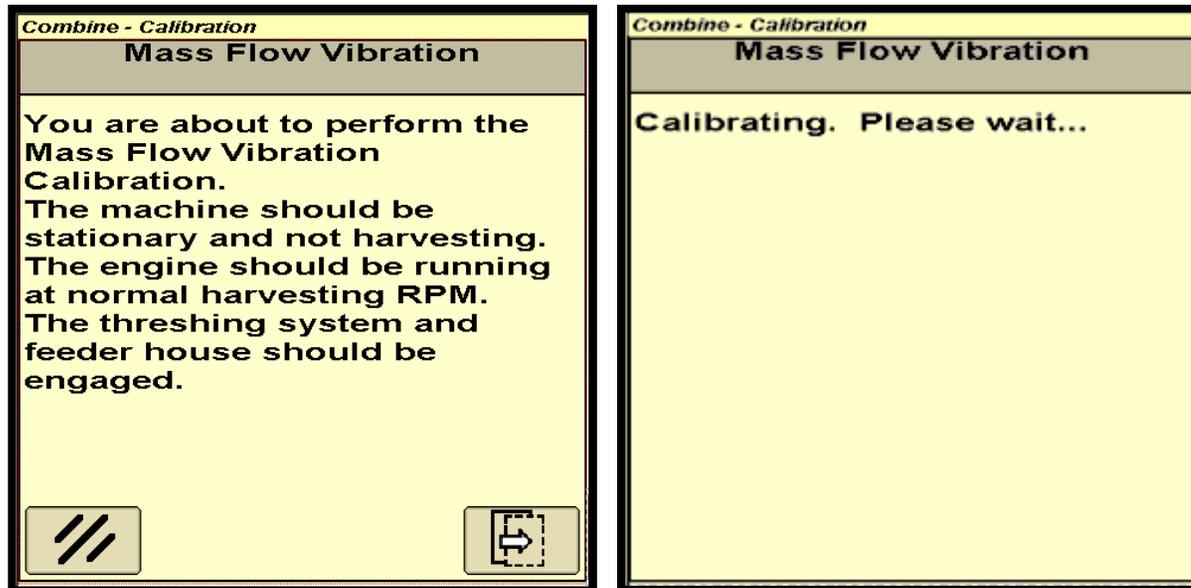


Figure 6 – S-Series Mass Flow Vibration Calibration Screen

YIELD CALIBRATION PROCEDURE

Before calibrating the yield of the S-Series combine, be certain to go into the combine settings and choose the appropriate crop. This calibration will then follow the crop. For example, if the operator is starting to harvest wet corn, select your general combine setting crop as corn (wet) and then proceed to calibrate. The resulting calibration will be the one used every time corn (wet) is selected in the combine.

Speed is the simplest way to control the grain flow rate experienced by the combine in a uniform field. You will find that more advanced, multipoint system users will watch the actual grain flow of the combine and aim for specific bushel per hour flow rates. Those rates will vary by machine and again we will want to target a flow rate pattern similar to the speed pattern illustrated in Table 1.

To initiate this calibration, navigate to the calibration list on the arm rest display and select "Yield" from the drop down menu. See Figure 7. If a calibration has been performed for this crop in the past select the Calibration Management button in the lower center of the first screen to enter the Calibration Management screen on the right of Figure 7. Selecting the next button on the lower right corner of the first screen will take you directly to the calibration load screen to collect the next calibration load. It is not required, but is advisable when performing an initial calibration for the season, or crop, to enter the Calibration Management and delete all existing calibration loads to reduce the chance of old calibrations being confused with new calibration loads.

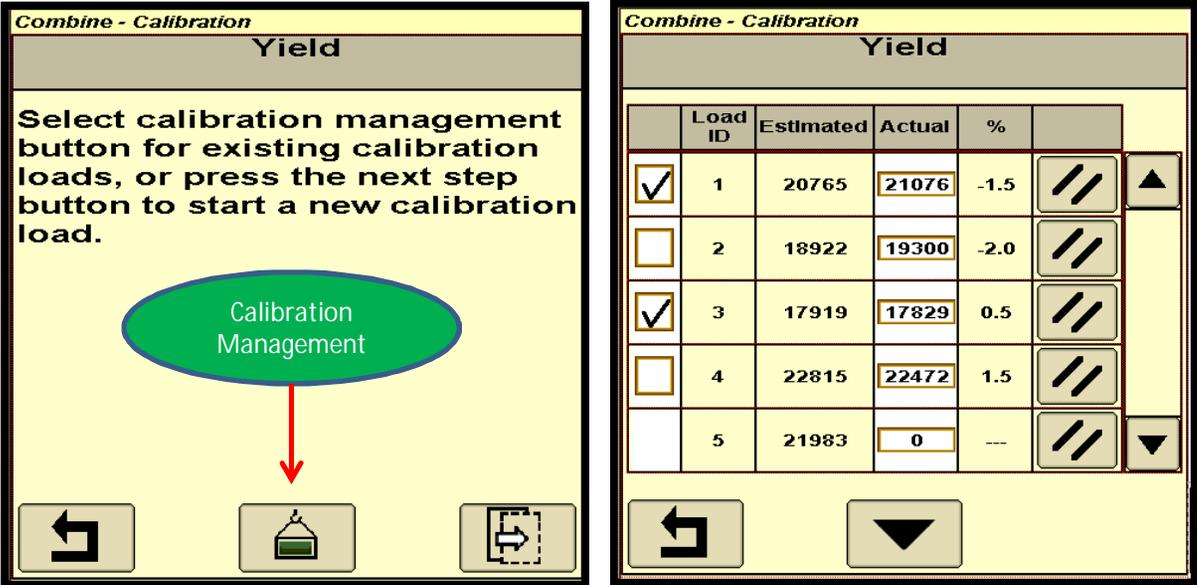


Figure 7 – Yield Calibration

New calibration loads then can be initiated from the initial yield calibration screen, the left screen of Figure 7, following the speed pattern in Table 1. Keep note of the speed at which each calibration load is completed for later reference. Each calibration load must be started with an empty grain tank on the combine and an empty wagon/truck/weigh wagon or other means of obtaining an accurate weight of each individual calibration load. Each calibration load will consist of at least 3,000 pounds and no more than one grain tank full. The estimated weight of each calibration load will be displayed during the harvesting of the load. Upon completion of a calibration load, the estimated weight (combine measured) will appear on the Calibration Management Screen. The actual weight then can be entered at any time in the entry box directly to the right of the estimated weight for each calibration load.

Once the actual weight is entered, a calculated percentage of error will appear to the right of the actual weight. This is the percentage of error between estimated and actual weight. If the error is more than acceptable, usually 3% is a good reference, delete the calibration load and do another calibration load at the same speed/flow rate. This is why it is important to keep note of the speed/flow rate at which each calibration load was performed.

Once you have a set of calibration loads at various speed/flow rates with acceptable errors, select each of these calibration loads by placing a check mark in the box to the left of the calibration load in the Calibration Management Screen. Again the right screen in Figure 7. Then press the downward triangle button in the bottom center of the Calibration Management screen, this will initiate the generation of a final calibration of the system using the selected data points.

Follow this by monitoring a truck or semi load of grain to verify the error between the combine estimated weight and the actual weight. If this check is performed directly after calibration, repeat those calibration loads with the highest calculated error in the Calibration Management Screen. If it has been some time since calibration, the physical characteristics of the grain have changed significantly (i.e. as moisture and test weight) a complete calibration will be required. It is recommended to calibrate the yield for each crop, including wet and dry corn.



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