

Bushel Plus

User Manual

Last update September 2022

Find latest manual within the Bushel Plus app

**- Product utilizes Extremely Powerful Magnets -
Caution, should be taken for pacemakers
and other medical device users!**



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Foreword

Thank you for choosing the Bushel Plus multi-calibration tool — hereinafter referred to as the “Bushel Plus Set.” We appreciate your decision to purchase the Bushel Plus Set and we know it will be a vital tool in reducing your combine losses for this harvest and many more in the future.

Please read the following instructions thoroughly to use our products in a safe and correct manner. Our greatest goal is to help make your harvest a success.

Safety Instructions: Please use with care

- Product uses magnetism to attach to equipment! When the carrier is attached to the machine you should avoid and take caution driving through or over obstructions (E.g.: straw/crop windrows, swaths, weeds, standing crop, backing up into a windrow, etc.) Obstructions can leverage the magnets of the machine and cause the carrier to fall off.
- Thoroughly read and familiarize yourself with all labels, manuals and safety instructions for all devices included in the Bushel Plus Set before operating.
- Inspect the Bushel Plus Set before each use. If you notice any damage, contact the Bushel Plus Team for further instructions. Do not use the set before having it repaired.
- Do not attach or attempt to remove carrier or drop pan when combine is moving or when threshing system, any kind of seed destructor, chaff deck, chopper and/or chaff spreader are engaged and/or still spinning/moving after disengaging.
- Do not leave the carrier attached to the combine if it is not needed for measurement, especially when travelling between fields.
- Do not leave the carrier or any electronic parts outside, attached or not to equipment for long periods of time, including overnight.
- Avoid weather conditions that include moisture, cold or dew as well as extreme heat, to protect all devices.
- Do not transport or drive on public roads (especially dirt, gravel, and other side roads) with carrier and/or drop pans attached to the equipment.
- Batteries are sensitive to heat, cold, and frost. Avoid these conditions, especially when storing the devices. Charge batteries prior to long storage periods during which there is no frequent use (e.g. post season, winter storage).
- Handle the separation process with care. Wear eye protection always.
- Keep the Bushel Plus devices clean and avoid dust and dirt build ups in all devices.
- Make sure the carrier and separator are switched off after each use.
- Always watch your surroundings and ensure safe distance to all moving machinery - failure to do so can result in severe injury or death.

Safety labels – as labeled on products

Carrier:



Separator:



Operating instructions

Prior to using this product in the field, familiarize yourself with it and the different app functions. When you do this run-through before the harvest rush, you will see how easy it is in the field.

Before you start

- Charge both, the carrier and separator batteries with the Smart Charger (charge both devices only when they are turned OFF).
- Familiarize yourself with the carrier, separator, app and the way to execute the calculations, to understand the full process and capabilities of the system.

Important reference

The **ON/OFF switch** of the carrier is located beneath the permanent magnet bracket.



Only use the provided 12V Smart Charger.

1. Utilize the correct wall mount end plug for your region/country.
2. Make sure to plug into the device (carrier, separator) prior to connecting the power plug/charger to the wall socket.
3. LED on charger will indicate a red light when charger is in charging mode and switch to green when the battery is fully charged. **In rare cases** of a very low battery, the charger may stay in the green LED light mode, even throughout charging. If you experience this, please charge the device like that for 24hours, after that it should be fully functional. If not, please check the fuse inside the carrier/separator/charger male plug. If fuse is good, the battery may need to be replaced (refer to opening the device page and fuse page for how to exchange fuse details).
4. Charging is possible only from wall plug power source.

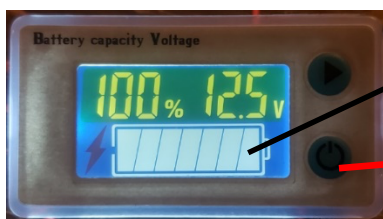


Battery indicator on separator

- Low voltage alarm will **sound** for two seconds when approx. **5 min** of usage are left.
- Recharge battery soon after low voltage alarm comes on.

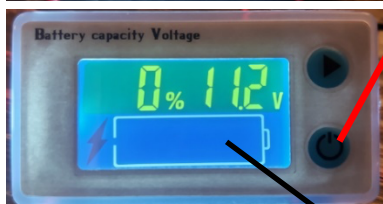


Battery indicator on carrier



Battery fully charged.

ON/OFF button for battery display only.



Power too low. Charge before usage.
Electromagnets may not release drop pan.
Battery needs to be recharged to prevent damage.

Recharge batteries before long storage periods and prior to usage.

Product Overview

Parts included

1. Carrier/Cover (attaches to the combine)
2. Wide drop pan (canola/cereal drop pan)
3. Narrow drop pan (tall stubble–canola, hemp, etc. [not included with 20"/Chaff Deck version])
4. Separator
5. Scale
6. Smart Charger (not shown)
7. Remote Control / Transmitter (with LED feedback function, 2x AAA batteries not included)
8. User Manual (not shown)
9. Downloadable Bushel Plus app (not shown)
10. Serial # label to register product for warranty in the Bushel Plus app



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Why two different red drop pans?

Good question! Stubble conditions all over the world are different from field to field, difference in seed row spacing, varieties, plant stand and etc. have a great effect on how the pans fall to collect a sample.

➔ That's why we developed two different sizes for you.

The **wide drop pan** works great in most stubble conditions, even when harvesting canola. In some cases, if stubble is very tall, it is possible that a wider pan tips over too much or cannot drop properly because the stubble is up to the axle of the combine. In that case the **narrow drop pan** works well, as it has a better chance of dropping in between the stubble because of its angled shape, (straight cut canola, hemp, stripper header, etc.).

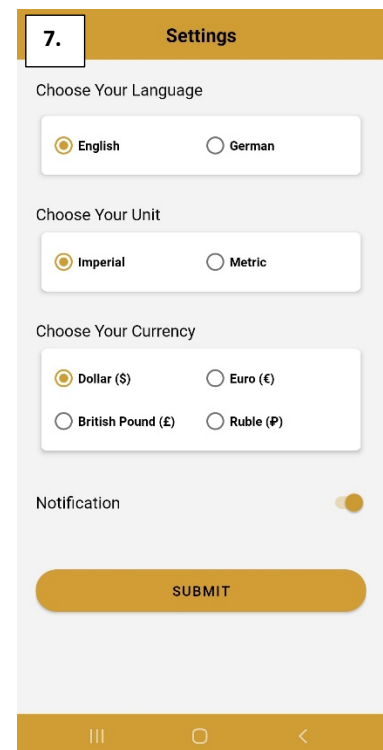
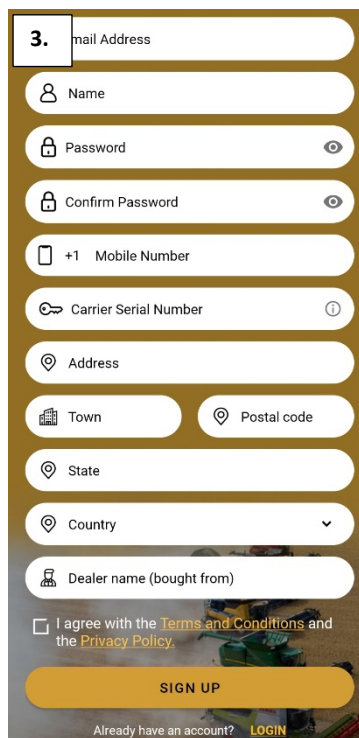
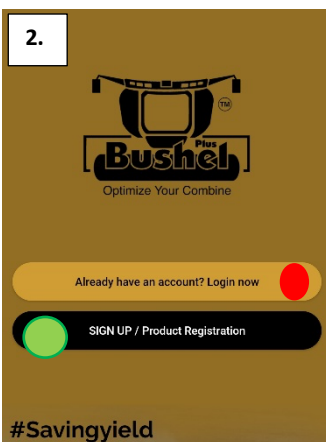
Tips: In tougher longer cereal stubble, the narrow pan can be helpful to fall more evenly into the stubble and catch a sample. It can be helpful to add more weight to either drop pan as well. Welding a flat piece of metal along the pan to help in rigid stubble like sunflower or corn (distribute the weight of the metal plates evenly across the pan or center it). -> more tips to cutting high stubble, please refer to page 22 – mounting options for BP.

10. Find serial # label here

Register product – start the app

Start:

1. Download the Bushel Plus – Smart Drop app from Google Play or Apple app store.
 2. **First time user** hit: **“SIGN UP/ Product Registration to use app”** (marked green below)
 3. Create your account with your email address and unique password. You will not need to re-enter the password every time you open the app, only if you log out of your account or switch phones.
 4. **Register the serial# of your carrier and contact details as part of your warranty - Hit “Sign up”.** (You can register up to three accounts with the same serial#).
- **[Serial #]** located at topline of carrier, beside the battery voltage display, see prior page. Enter numbers and dashes as shown on the serial# label.]
5. A confirmation email will be sent to you to. Confirm your email by clicking on the link in the email sent to you. [Check your spam folder for incoming emails as well].
 6. **After that you can log in with your email address and password, by clicking on “Login now”** (marked red below)
 7. Choose your language, currency, and unit of measure after your first log in (can be changed later).



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NOTE: Currently your saved results are saved on your device. If you lose/change your phone or the app crashes, you may lose your saved data. Please backup your data by sending it to your email address to avoid loss of valuable information.



Pairing/adding carrier to your phone app

The **3.W (serial numbers with "WX")** is the newest version of the **Bushel Plus System**. The carrier creates its own and unique WiFi network which will be picked up by your cell phone. The drop pan can be released with your cell phone through our app or with the remote control unit included in the set.

Pair/Add

→ You only have to do the pairing process for your phone once in the beginning, after that the carrier is saved to the device list in the **WiFi pan control page (6a)** in the Bushel Plus app. Do this prior to harvest, so your phone has the carrier already added to the Bushel Plus app and only needs to connect to it through the WiFi. → In some cases, you need to turn your mobile data off or set your phone to airplane mode to connect to the carrier's wifi network. Some phones like to switch back automatically to use mobile data but going into airplane mode will prevent this and makes the connection to the carrier possible. → The remote controls do not need to be paired; they are programmed from factory to your Bushel Plus carrier.

1. Turn carrier ON. ON/OFF switch located beneath the permanent magnet bracket.



2. Go to **WiFi settings** in your phone and turn on Wi-Fi mode.
3. Find the Wi-Fi network of the carrier, named by default as: **"SMARTCU_XXXXXX"**.
4. Connect to this Wi-Fi network with the default password: **"12345678"**.
5. A window may open to advice you, that this WiFi network does not actually supply internet, hit: **"Accept"**.

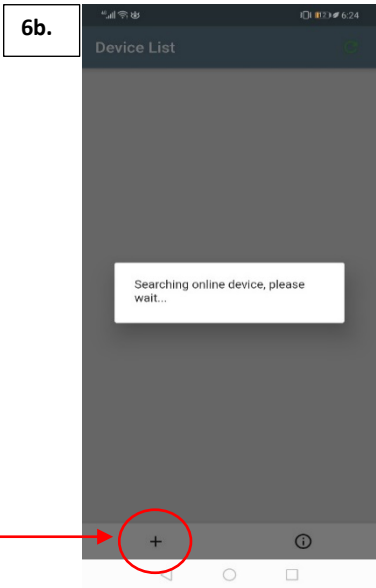
6. Now open the **Bushel Plus app home screen**:

6a.

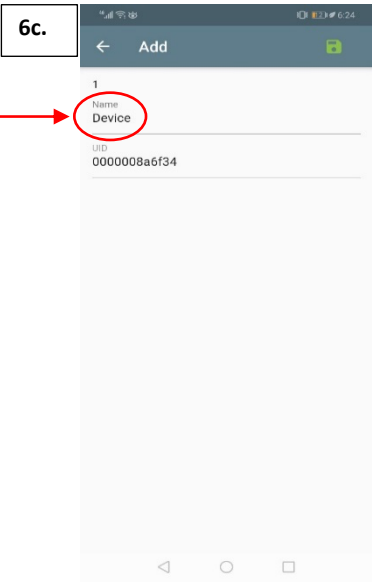
- a. Go to the **Wi-Fi pan control page**.



- b. Click **"+"** at the bottom, app will auto search for the new carrier.



6b.



6c.

- c. Change the name of the WiFi carrier network and hit save.
 - i. (we suggest naming it with the last 4 digits of your serial#, so it is easy to cross reference)
- d. **NOTE:** A carrier network that has already been added to this phone will not appear in the search list again.

IMPORTANT: While your phone is connected to the WiFi carrier network, your phone **cannot** use data/internet [G or LTE] and therefore will not send or receive messages/calls which require data/internet.

When you are done testing - one of the following may be required, to ensure your phone data can be used again:

1. Turn carrier OFF.
2. Disconnect your phone from the WiFi carrier network (“SmartCU_xxxx”).
3. Turn your phone WiFi OFF.

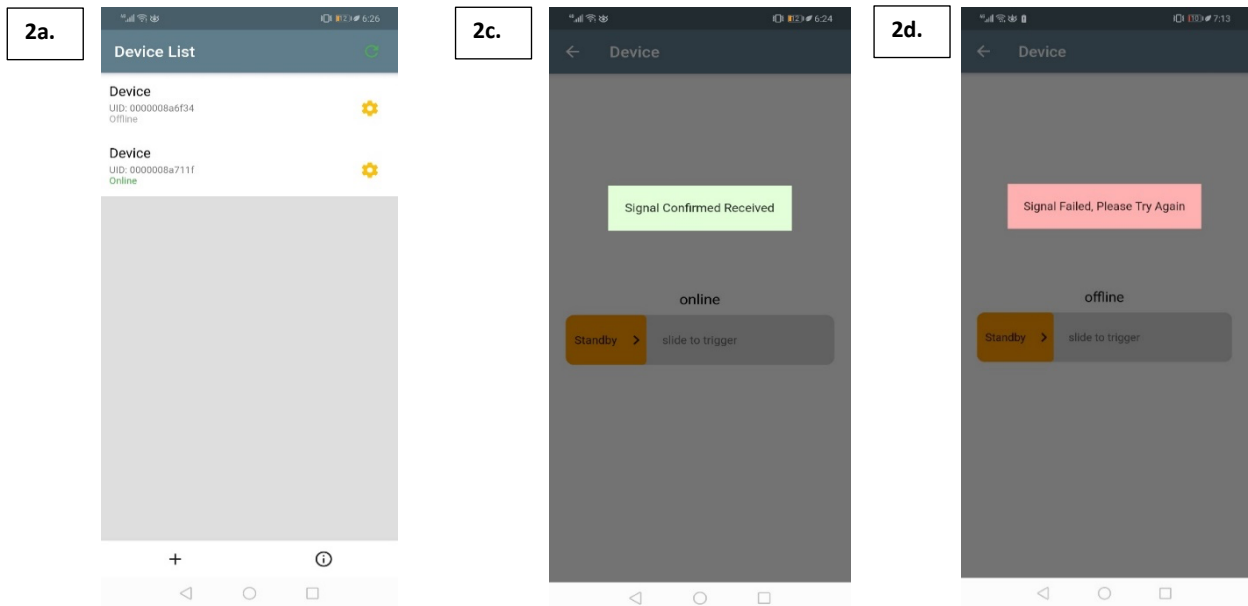
Usage in the field – Dropping pan with app

1. Connect to the carrier:
 - a. Turn carrier ON.
 - b. When the carrier network is in range, go to the phone WiFi settings and select the carrier network “SmartCU_xxxx” you want to connect to.
 - i. If you are in range of multiple active carrier networks, your phone may auto connect to the last carrier you had used. (This depends on phone and network settings)

2. Release drop pan:



- a. Go to the WiFi pan control page in the Bushel Plus app and choose the carrier you want to control (usually only one unit will show unless you have purchased multiple sets).
- b. When you click on the carrier, the next page will open with an activation bar, swipe the bar across to the right to drop the pan out of the carrier.
- c. If the signal reached the carrier successfully, the pan will drop and **“Signal Confirmed Received”** will show on the phone screen for three seconds with a green background.
- d. If the signal did not reach the carrier for some reason, the pan will not drop and **“Signal Failed, Please Try Again”** will show for three seconds on screen with red background.



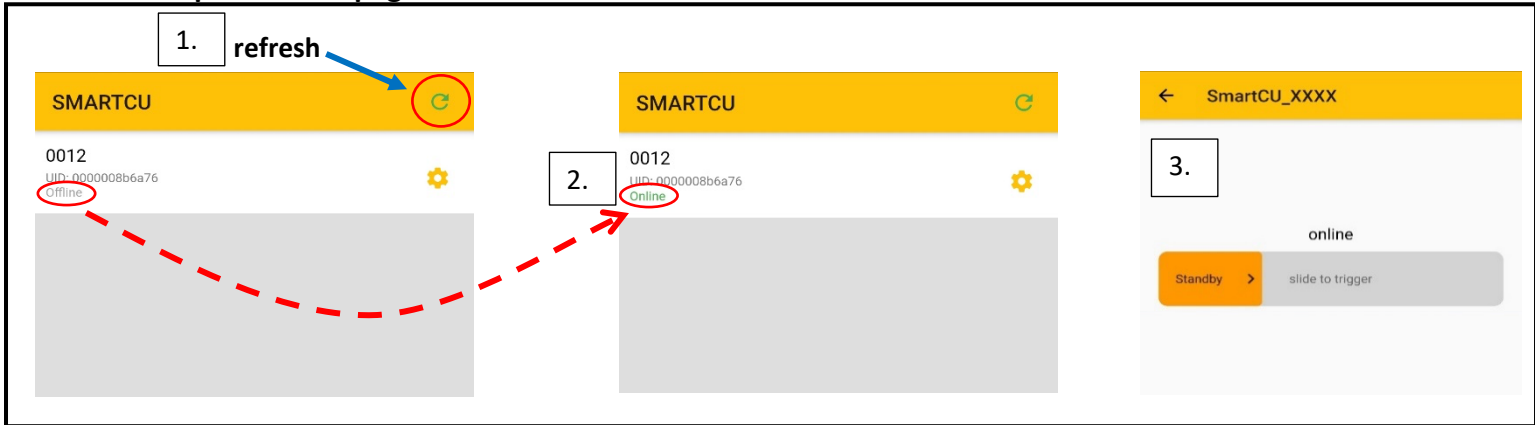
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IMPORTANT – auto connect vs. no auto connect on your phone

1. When phone wifi is set to: “auto connect” to carrier WiFi network:

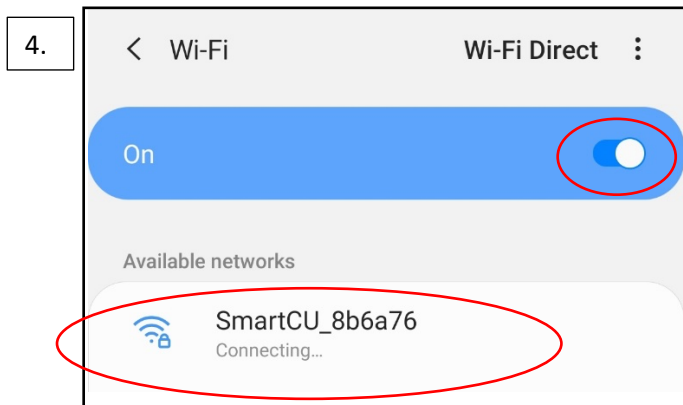
Make sure carrier and phone wifi are turned ON. When you are in the operating area of the carrier, up to 150' (45m) away, open the BP app and go in the WiFi pan control page – you may have to hit “refresh” (1) and if carrier is ON and within range the unit will show as “online” (2). Click on the unit and it will take you to the screen where you can swipe the bar across to release the pan (3)

WiFi pan control page:



2. When phone wifi is **not** set to “auto connect”:

Make sure carrier is turned ON. When you are in the operating area of the carrier, up to 150' (45m) away. Go to your phone wifi settings, turn on wifi and select the carrier WiFi network (“SmartCU_XXXX”) to connect to (4). Now open the BP app and you may have to hit “refresh” (1). If the carrier is ON and within range the unit will show “online” (2). Click on the unit and it will take you to the screen where you can swipe the bar across to release the pan (3).



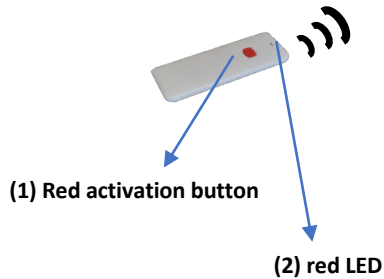
Design may be subject to change without notice.

Usage in the field – Dropping the pan with the remote control /transmitter

The 2022 versions (Serial #WX) of the Bushel Plus System include one remote control:

- The operating distance is around 150ft (45m), depending on conditions and equipment.

→ The remotes are paired to the individual carrier from factory. A maximum of two remotes can be paired to one carrier. But one remote can be paired to three carriers, to drop three pans at once.

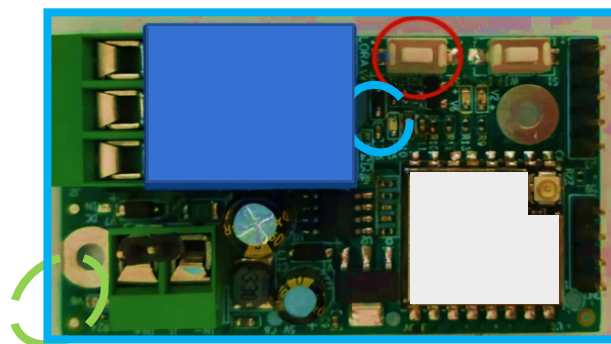


1. When pressing the red activation button (1), a red LED (2) above the button will light up for 2 seconds.
2. If the signal was successfully received by the carrier and therefore the drop pan dropped out of the carrier – the red LED will blink again approx. 3 to 5 seconds after the red activation button got pressed.
3. If the signal did not get received from the carrier and therefore the pan did not drop out of the carrier to the ground, then the red LED will not light up a second time after pressing the activation button. In this case, please find a different position and try again, it can also help to hold up your arm and hand (if it is safe to do so) to increase the range of the remote. (Tires, Metal or other obstacles can block the signal from traveling to the carrier). Optionally flip the carrier around so that the remote control antenna (black color) is on the opposite side of the carrier now.

How to pair a remote to the dual WX-receiver

If you want to add an additional remote control, want to drop multiple pans with one remote or if you lost one and need to pair a new remote to the dual receiver. Please follow the steps below:

1. Refer to chapter, “Opening devices -> Carrier:” in this manual to open the battery latch on the carrier.
2. In the opened channel, beside the red foam pad which secures the battery, you will see the grey/black square receiver. -> Open the lid of the receiver with a small Philips screwdriver (4 screws) and take the lid off.
3. The pair button, marked with **red circle** below manages the pairing for the remote control:
 - a. Each receiver can be paired with 2 remotes maximum at once.
 - b. If you press **and hold** this button (red circle) for three seconds, all remote controls will be unpaired from the receiver – the green LED (**green circle**) will flash fast for a few seconds.
 - c. To pair a remote to this receiver, press the pair button **once (red circle)** for one second. The green LED (**green circle**) will start to flash slowly. Now press the red activation button on the remote control **(1)** once for one second. Wait for a couple of seconds, then press the remote control button again to test – if it worked, you will see the blue LED (**blue circle**) lighting up and hearing a clicking noise for acknowledgement.



Receiver box opened, top view.

App overview

For convenience we have developed the **Bushel Plus – Smart Drop App**. Available in the google play and apple app store.

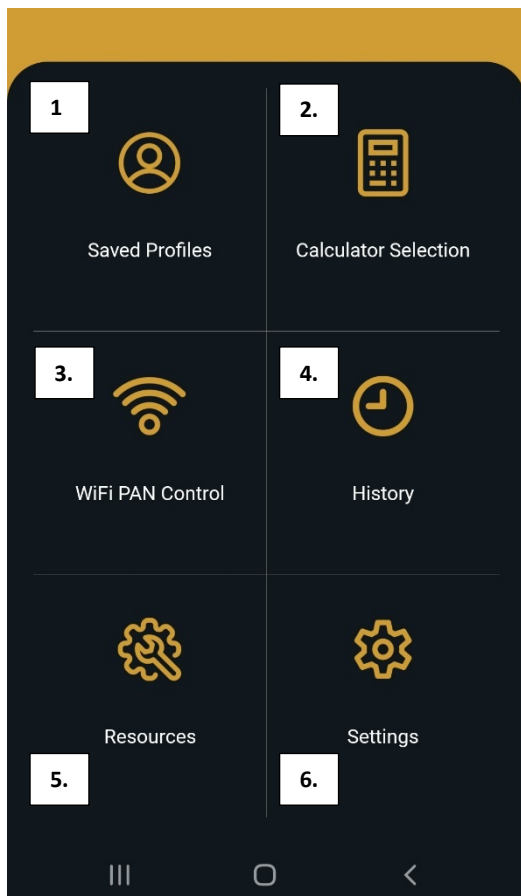
After downloading the app for the first time, you must register the product with your name and serial# of the carrier as part of your warranty (described on page 7).

NOTE: Currently your saved results are saved on your device. If you lose/change your phone or the app crashes, you may lose your saved data. Please backup your data by sending it to your email address to avoid loss of valuable information.

→ Some tabs or layouts may differ from the ones described in the following pages but, the most recent manual can always be found as a reference in our app under the “menu” tab.

Handling the app:

Overview of the home page (screenshot below):



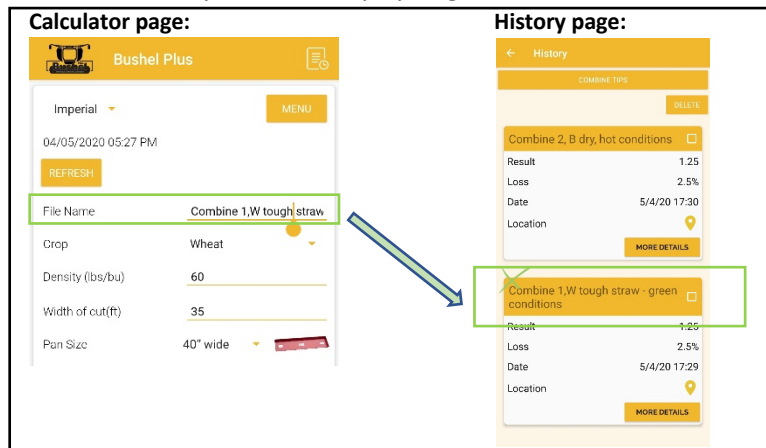
- 1. Saved Profiles:** You can save favorite app settings and calculator selections as a profile, that way you don't need to navigate through the calculator selection pages (#2 beside) each time you do a calculation. To save a profile, you will see a button called “saved profile” on the bottom of the calculator page (where your bu/ac results are shown). The saved profiles will be stored here. Some profiles may already be in the app by default.
- 2. Calculator Selection:** Click here to start the calculation for your loss sample. You will be guided to choose the pattern of your chaff spread (blue lines behind the icons), as well as the spread pattern of the straw (yellow lines behind the icons) on your combine. When clicking on the question mark buttons in the app, a help window will open with more details to the specific icon selection.
- 3. WiFi Pan Control:** Choose this option to drop the pan from your smart phone. Please find all details for this process described on page 8 of this manual.
- 4. History:** Takes you to previous saved results to review, add more info or deletion of files.
- 5. Resources:** Brings you to a menu where you can find tips and resources around the Bushel Plus System and optimizing your combine. For ex. Weblink to the combine optimization tool from the Canola Council of Canada, user manual, troubleshoot tips, etc.
- 6. Settings:** Change setting in the app for language, unit of measure, currency, etc. Android users can turn off the notification function. We recommend to leave this featured turned on to stay up to date for any product updates or new features from Bushel Plus.



Question mark icons: Throughout the app, you will see numerous question mark icons in different areas. By clicking on the icon, a help window pops up with more details to the specific area where the icon was located (ex. calculator icons, explanations of certain words or pictures, etc.).

Terminology on the calculator page explained:

- **File name:** Give your individual test a file name if you plan on saving it, this name will be the heading of the file once it is saved in the history list. It is best to use a reference in the name that allows you to find this file back easily once it is in the history list.
 - o For example: One method of labeling might be driver initials (MF), crop type wheat (WH), humidity outside (RH90), or crop moisture (CM12). Find a format that makes sense for your operation, but keep in mind to keep it consistent in the format and have the most important information first (example below: combine 1 or 2), as this is your go to in locating it in the history list. This helps you get back to those low losses in similar conditions.



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- **Crop:** select the crop from the drop-down menu.
- **Density:** This number shows you the bushel weight in lbs/bushel when in the imperial mode. You can change the bushel weight (lbs/bu) to adjust to your crop conditions and variety specifics. In metric all measures are done by weight and do not need to be adjusted to a bushel volume measurement.
- **Width of cut:** This is the width of the combine header or swathing header that was used. Please note, use the actual working width you are cutting instead of the total physical width of the header.
- **Width of spread pattern:**
 - This will be the width of your straw/ chaff spread that is coming out of the back of the combine.
 - a. When spreading, try to be accurate to the width the material is distributed.
 - b. When doing normal windrowing/dropping the straw in a windrow, it is recommended to use the actual width of the windrow (straw/chaff pattern on the ground), this will calculate the concentration factor automatically in the background of the app and account for the amount of loss occurring in the concentrated (smaller) windrowed area. (see details in chapter: About calculations)
 - c. When doing **narrow chaff lining**, please enter the actual width of the chaff line on the ground. This will calculate the concentration factor automatically in the background of the app and account for the different pan sizes and the amount of loss occurring in the concentrated (smaller) windrowed area.

- **Pan size:** Please select the pan size which you are using for your test.

- **Weight in grams:** This is the number on the scale with the results of the drop pan, enter to the tenth of the gram, IE 3.4 gm. **Note:** If you are spreading the crop through the chopper and you feel the chopper is breaking the kernels that you found as loss, you can double the weight of these broken kernels to account for the full weight if you feel the other half is not in the pan and you think this is necessary in your circumstance.

- **Calculate:** Hit this button to run the calculations with your above input measures.

- **Results:** Here you will see the loss results in bu/ac or kg/ha.

- **Performance monitor:**

This opens the tab for more detailed information to:

- Harvest loss in % to the yield (yield can be a closed guess)
- Lost product per area (\$/acres or \$/hectare)
- Lost product per hour (\$/hour)
- Total \$ loss per farm/crop area

The above results can be seen after entering the following information (the currency can be changed in the setting tab and doesn't influence the results, it just changes the symbol of the currency being used):

- Yield (bu/ac or t/ha)
- Commodity price (\$/bu or \$/t)
- Combine capacity in area per hour OR in volume (bu/t) per hour
- Total area to harvest (either entire farm or crop specific area)

- **Save Data:** hit this button to save your details on your phone. You can find the saved details under the history tab. On the history page you have the following options:

- **Add picture:** It is possible to add one picture, either from the phone gallery or to take one directly with your camera.
- **Relative notes:** Room for your notes and things you want to keep track of. Height or angle of the header, did you find unthreshed grain with these settings, what details made the difference, etc. Feel free to add more notes to learn more about your machine as you go.
- **Share:** Hit this button to share your results and send these results to your email or teammates via email, text messages or other communication apps.
-

- **Save profile:** This function allows you to save the current calculator selections as a profile, that way you don't need to navigate through the calculator selection pages each time you do a calculation. You will be prompted to name the the profile and can find it back on the home page under "Saved Profiles".

Slide bar:

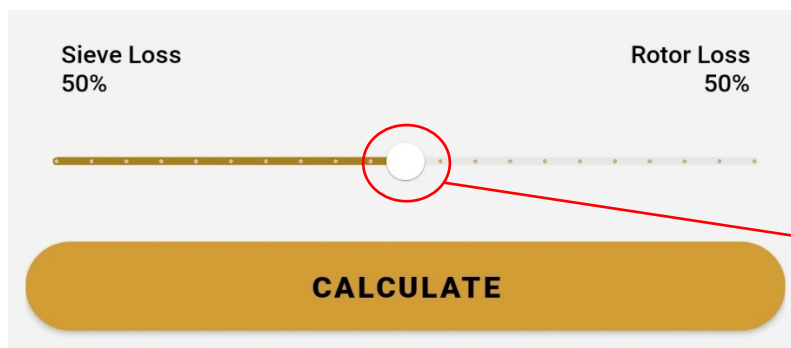
In instances where the rotor and sieve losses are spread in different patterns, there is an option to estimate total loss with a single sample (Named: **One-Drop Estimate of Total Loss** in the app selection).

The ratio of loss originating from the rotor vs. the sieve will affect the result of this calculation.

A slide bar (shown below) will appear when this option is selected. By default, the loss ratio is 50% from the sieves and 50% from the rotor. By using your experience in the field and the loss monitor data, the slide bar can be adjusted from the default.

For example, if the loss monitor shows that most of the loss is coming from the rotor, the slide bar can be adjusted to show 20% Sieve Loss and 80% Rotor Loss.

After moving the slider across, the new ratio needs to be confirmed by pushing the calculation button once again, this will then update the calculations.



Move this slider further left or right and hit the **calculate** button **again** once it's moved to adjust for a different ratio of results sieve vs. rotor loss in this specific spot of the drop pan.

In the field – Ways of testing for loss:

PLEASE NOTE: Overall and regardless to the loss result shown in the reference guides/phone app or formulas, you want to make sure to have a smaller amount of grain loss in the same area, on your second measurement (third one and so on) compared to your first test – this means you are going the right direction with the combine calibration after changing settings. Multiple measurements should be taken throughout the day, in multiple spots around the machine (as described below), that way you are able to find the spot with the highest amount of loss (trouble area) and can monitor from there in the future. It is all about learning more about your machine for the conditions you are in.

Suggested Start:

Prior to using the system and to figure out if the Bushel Plus is saving you any grain/money going out the back of the combine - Adjust the combine the way you usually do and follow the steps listed below to check your overall loss. Use the app and track those numbers, this will be your starting point to compare future efficiencies.

1. Windrowing mode (drop mode):

We suggest doing the first few loss checks/calibration while dropping the straw and chaff in a windrow (chopper disengaged), this will show if the machine is threshing the kernels properly out of the head/spindel of the crops. (If an unthreshed head/spindel goes through the engaged chopper it may be chopped up going through the blades and it is hard to evaluate if the heads got threshed properly in the front of the machine or not). If you find unthreshed heads/spindels you have to readjust one or more of the following: your concave, rotor/drum settings or other settings which could be causing this issue.

NOTE: (We do realize it is not possible to drop the straw in the windrow with every machine, for example with use of a Chaff Deck or certain chopper set ups, please see the details below to a guideline of measuring loss in spreading mode). You will find the detailed manual for checking loss with the EMAR chaff deck or when Chaff Lining in our app. Refer to the user manual of your combine, chopper, or other devices like the EMAR chaff deck or seed destroyers for their manufacturer suggestions.

2. Spread mode:

Once you are happy with those dropping results and you are ready to start spreading your straw and chaff, we suggest measuring your loss in multiple locations around the machine when spreading.

→ Going from dropping to spreading your straw may change back end dynamics on certain machines and it may influence the amount of loss coming out of the back of the machine, therefore it is important to check again after you have checked in dropping mode and switched to spreading. You want to check the way you combine instead of “setting and forgetting”. When in spreading mode, the user should measure the loss in the middle (behind the machine) and then on both sides of the machine and count the average of the measurements as the total loss result, this allows you to get a better sense of the total losses coming out.

Tip: If you are spreading your chaff of the sieves (chaff spreader) but windrow the straw of the rotor, please take separate loss test beside the machine and in the windrow. If the chaff spreader doesn't spread/drop kernels in the windrow: then add each loss result together for total machine loss. If chaff spreader drops kernels in the windrow as well, then you captured the sieve loss and rotor loss in that windrow combined, to figure out your rotor loss by itself you can then subtract the loss caught from only the chaff spreader (side of combine) off the windrow loss. **Similar method applies if you are dropping your chaff but spreading your straw (chaff lining in AUS for example).** → This method will be incorporated as an automated feature in the NEW 2021 APP update release for June/July 2021. Our app does automate all these functions for you and shows them visually in logical orders.

IMPORTANT NOTE: The reason for this method is, that you want to take/catch a good average of the loss getting spread across the entire width of the spread and not just in the middle, because some machines tend to “overload” on one side and therefore show a higher loss on one side of the machine compared to the middle or the other side.

Also, some machines have chaff spreaders which spread the chaff and kernels mostly to the outside and hardly anything right behind the machine.

- For that you can attach the carrier in different places on the combine and header and take multiple measurements. (as shown in following chapter “Process of taken one drop pan sample”).
- Or you can purchase a second carrier unit to attach to the header and drop two drop pans.

You may find a certain area that always shows a higher amount of loss (“hotspot”), once you are comfortable that this is the best spot to do your checks, you can utilize this spot as your “go to” location to reduce the overall machine loss within this point of reference. If you are only checking in this hotspot, keep in mind that the loss number becomes more of a reference (high / low) instead of the exact loss average. This goes back to above starting point: Wanting to catch less loss the second time around in the same spot.

NOTE: If your combine manufacturer recommends power stops as part of your loss analyses to see where issues are coming from or where material is building up inside the machine, then we welcome this as part of the process, if the user/operator follows the operator/user manual and safety instructions of the specific machine. (Check your operator/user manual of your combine).

Spreading mode:



Windrow/Drop mode:



Also refer to: Mounting options for Bushel Plus set on page 20.

How Losses are calculated

This section explains which factors you need to input in the app and **how the math in the background of the app works. The app does the calculation for you automatically, this chapter just explains the process.**

PLEASE NOTE: Overall and regardless to the loss result shown in the reference guides/ app and formulas, you want to make sure to have a smaller amount of grain loss in the same area, on your second measurement (third one and so on) compared to your first test – this means you are going in the right direction with the combine calibration after changing settings. Multiple measurements should be taken throughout the day as the conditions change or as you notice higher or lower yields coming in.

Factors to know – for entering into the app:

The outcome of your calculation depends on:

1. The width of your header (actual cutting width),
2. Whether you are dropping the straw and chaff in a windrow or spreading it through the chopper/chaff spreader.
 - Therefore, the width of your discharge is a key factor.

→ If you are spreading the chaff and dropping the straw at the same time or dropping the chaff and spread the straw at the same time (chaff lining in AUS), please refer to explanation on the previous two pages.

3. You also need to know which size of the drop pan you are using and the kernel weight, that was found in the drop pan to enter in the app (details below).

NOTE: With above values, the loss/ac (loss/hectare) is estimated through third party approved formulas in the app and reference guides and is based on an even distribution of the kernels.

The amount and type of loss depends on various different factors (combine set up, crop, variety, field conditions, moisture, sample spots etc.) and needs to be judged on a case-by-case bases.

→ Please refer to the previous section for a detailed description of the app functions.

Calculation process explained:

NOTE: The app does the following steps for you. This section is only to show the concept and difference of the spreading and dropping math calculations as well as the importance of accurate input of values.

Enter the below information in the app section of the harvest calculator page:

- **Pan size:** Please select the size out of the drop-down menu which you are using for your test.
 - 20" (0.5m/Chaff Deck) - wide only
 - 40" (1m) - wide or narrow
 - 60" (1.5m) - wide or narrow

Width of cut: Means, this is the width of the combine header or swathing header that was used. Please, use the actual working width you are cutting instead of the total physical header width.

Width of spread pattern:

This will be the width of your straw/ chaff spread that is coming out of the back of the combine.

1. **When spreading**, try to be accurate to the width the material is distributed.
2. **When doing normal windrowing/dropping the straw** in a windrow, it is recommended to use the actual width of the windrow (straw/chaff pattern on the ground), this will calculate the concentration factor automatically in the background of the app and account for the amount of loss occurring in the concentrated (smaller) windrowed area.
3. **When doing narrow chaff lining**, please enter the actual width of the chaff line on the ground. This will calculate the concentration factor automatically in the background of the app and account for the chosen pan size, as well as the amount of loss occurring in the concentrated (smaller) windrowed area.

Spreading mode and windrowing/drop mode:

Spreading:

The drop pans have a certain size - can be referenced either as **square ft** or **sq-m2** in this text - which catches a certain number of kernels.

Therefore, we know how many grams/square foot (grams/square meter) of loss occurred in that area.

Through the equation of the formulas, it will estimate how many bushel/acre (kg/hectare) this would be.

Equation:

IMPERIAL: (grams/ square foot -> grams/ acre -> **bu/acre**)

METRIC: (grams/ square m -> grams/ hectare -> **MT/hectare**)

Note: The math equation will assume that the same amount of loss is happening on every square foot / square meter across the entire acre / hectare.

- ➔ That is the reason why it is so crucial to take multiple measurements across your entire width of the spread and use an average of these measurements. And, to identify your highest loss area (for future testing) behind the machine, to start reducing the loss sample in that area.
- ➔ As stated previously, do not get hung up on the exact bu/ac or kg/ha digits. The main thing is you have less loss in the current test than previously, and now you know you are going in the right direction and decreasing your overall losses.

Windrow/ drop mode

If your **discharge width is significantly smaller than your header width**, a so called "Concentration Factor (CF)" comes into place. The calculations always start with the above spreading formulas which assume an even spread, the CF comes into play at the end.

NOTE: The app does the CF step automatically for you in the background, all you must do is enter the **header width** and the **discharge width** in the app.

Here is how the formula works in the background:

As mentioned, when windrowing, enter the width of the sieves as the discharge width, unless the windrow is smaller than the drop pan. (see *discharge width description* on previous page).

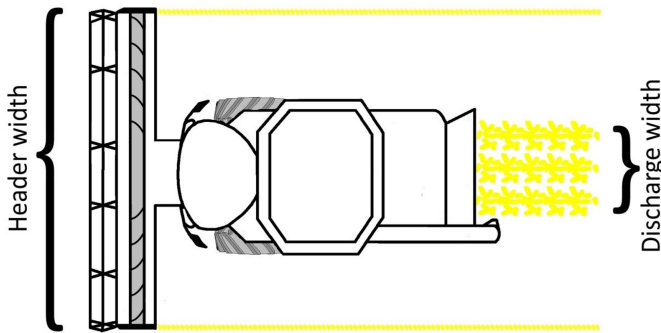
Example 1:

Combine with a 40ft (12m) header and a 5ft (1.5m) discharge width out the chopper and chaff spreader.

Step 1:

The Concentration Factor (CF) results from the ratio of header to discharge width.

$CF = \frac{\text{Header width}}{\text{Discharge width}}$	$8 \text{ CF} = 40\text{ft header} / 5\text{ft discharge}$
---	--



Step 2:

In the background the **bu/ac (kg/hectare)** result [which was calculated in the spreading formula prior, **15bu** and **300kg** used as an example in here] will then be divided by the CF. The reason for this is, that in drop mode with a 40ft (12m) header, all the loss from 40ft (12m) working width is not getting distributed over the 40ft (12m) spread but is now **concentrated** to a lot smaller area/spread, for example 5ft (1.5m). Therefore, the CF will put this loss into perspective. This works the same in imperial and metric, shown below:

Loss result through spread formula:	15bu/ac	→ then divided by CF: 15/8 = <u>1.8bu/ac actual loss.</u>
	300kg/ha	→ then divided by CF: 300/8 = <u>38kg/ha actual loss.</u>

Example 2: Combine has a 40ft (12m) header and a 25ft (7.6m) discharge width out the chopper & chaff spreader and **5bu/ac (135kg/ha)** loss results through the spread formula:

Step 1: We understand, the discharge width is not as wide as the header = CF needed.

1.6 CF = 40ft header / 25ft discharge

Step 2:

Loss result through spread formula:	5bu/ac	→ then divided by the CF: 5/1.6 = 3bu/ac actual loss.
	135kg/ha	→ then divided by the CF: 135/1.6 = 84kg/ha actual loss.

Example calculations only.

Process of taking one drop pan sample & calibrating loss monitor

- Start harvesting in a representative area of your field with the basic settings recommended by your combine manufacturer. Fine-tune these settings to achieve an acceptable loss level, as you would have done in the past.
- Set your **combine's loss monitor sensitivity** to a setting that indicates you are at an "ok loss range." For details about setting your loss monitor sensitivity, please refer to the operator's manual of your combine.
- When you are ready to check, stop the combine, disengage the threshing system and chopper/spreader (wait until all running parts have stopped moving), attach the bushel plus carrier to the combine. At the same time, attach one of the drop pans to the electromagnets in the carrier (shown in picture below), then switch the ON/OFF button of the carrier to ON.
- Resume harvesting. When you are ready to measure, release the drop pan by pushing the red activation button of the remote control/transmitter and hold for a few seconds, or by utilizing the app with the WiFi release, as described in the app section: After activating the drop function in the app, a pop up window will appear to indicate if the carrier did receive the signal and dropped the pan or not. Range of the signal depends on field conditions and where the carrier is mounted but can be anywhere from 50 to 150ft. (15 to 45m).

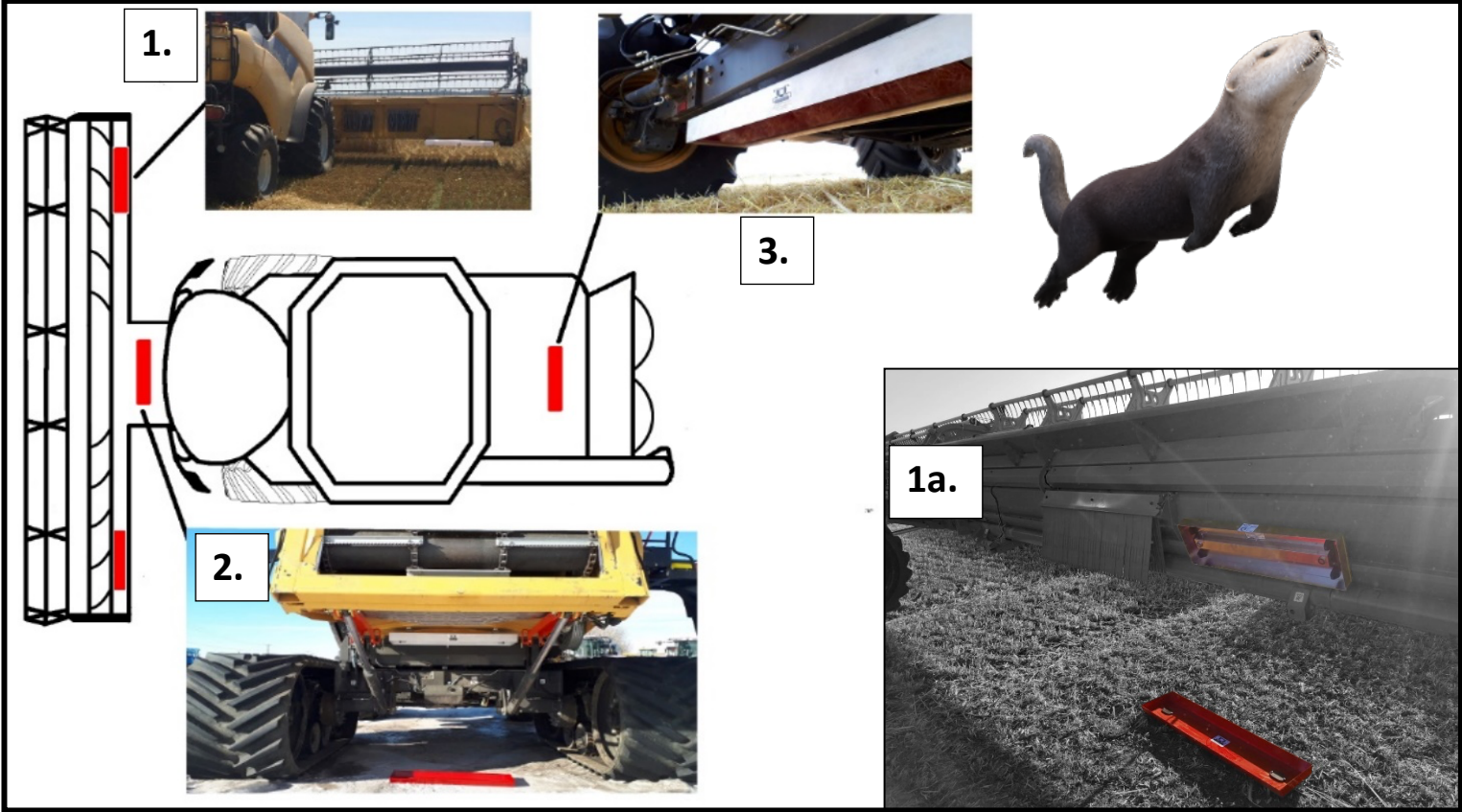


IMPORTANT: When you release the drop pan, check the level on the loss monitor. This level will serve as your benchmark. Make a note of this data.

- Once released, the drop pan falls to the ground. As the combine moves over the drop pan, it catches straw, chaff, and potential lost grain, which is spread out or dropped by the combine.
- If you are driving the combine yourself, make sure that you move far enough away from the drop pan, so that no further straw, chaff, and lost grain are caught by the pan when you stop to check your results.
- If you released the pan remotely from a distance, wait until the combine has been moved far enough away to safely collect the drop pan.
- When you release the pan look at your loss monitor so you have a reference point of where it is in relation to your losses caught in the pan.
- Now you know what the loss monitor was showing at the time of the drop, therefore you can benchmark the result in the drop pan to the level of the monitor and if it does correlate or if the sensitivity needs to be readjusted (example of success: low loss = loss monitor in the green). This should be replicated multiple times a day.

NOTE: If you are using the remote control from inside the cab of the combine, please note that the communication between the remote control and the carrier works better the closer the carrier is mounted to the cab. It can also be beneficial to point the remote towards the rear of the combine or towards the mirrors when pushing the button of the remote. The ideal location for the carrier depends on the machine and the scenario of use.

Mounting options for Bushel Plus Set



Depending on the combine, chaff spreader, chopper set up, etc.

1. Check the loss on the side of the machine from your chaff spreader/chopper by releasing the drop pan from your header. You may have to implement a flat steel bracket to the header for the magnets to attach to, if your header has round tubing.
CONTACT US for our new header brackets to make instalment to the header easier.
 - a. **NOTE:** the 20 & 40" carrier can also be mounted in a vertical & angled position on to the header, the drop pan will still release and fall out of the carrier.
2. Attach the drop pan beneath your feeder house in long stubble conditions (mostly for wide-body machines), this way it is protected and cannot be stripped off the axle from tall standing stubble (canola, sunflower, corn, etc.). [Does not work with 60" carrier -> 20" and 40" only].
3. Check your threshing system losses in the middle of the machine, by releasing the drop pan from the rear axle.

Header loss:

Header loss can be measured conveniently at the same time as machine loss. When lifting the drop pan you can find the amount of header loss beneath. This area that was covered by the drop pan when the combine went over it, will have no chaff or straw and shows the amount of header loss. You can collect these kernels, weight them separate and enter this value to your notes. Please note some of this maybe from mother nature as well, please scout prior to dropping the pan for potential pre harvest loss.

Cleaning your sample

- Remove the straw, chaff and kernel mix from the drop pan and fill into the separator.
- Multiple fills may be needed if you are testing in windrow mode or using the 60" drop pan.
- Take the larger straw pieces out of the drop pan by hand and make sure the kernels stay inside the pan while doing so.

IMPORTANT: Place the separator on a clean surface (e.g. the tailgate, the drop pan) while operating. This will avoid getting dirt and chaff into the unit.

If needed: Separator has a plastic plug on the bottom which can be removed in order to clean out any material.

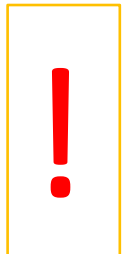
IMPORTANT: WEAR PROTECTIVE EYE GEAR as material may be thrown from the separator.

- Pour the sample into the separator before you turn it on.
 - The separator can be filled right to the top with material.
 - Place one hand on top of the material and press slightly down while you turn the separator ON.
 - With the variable speed function, **start the unit slow and increase speed as require**, especially for smaller seeds (ex. Alfalfa, Flax).
 - While the air starts moving through the sample, the one hand can slightly move around the inside of the tube and stir up the contents of the sample. This gives the kernels a chance to fall through and separate from the chaff and straw.
 - The airflow of the separator will force the chaff and straw out of the sample and out of the separator.
 - If a lot of material is in the drop pan, you may have to repeat this task a few times.
 - Different weight, size, crop and straw moisture may require it to take a few seconds longer to clean the sample. Heavier stalks may remain inside the separator as well - remove that by hand.
 - Once the sample is clean, pour the contents onto the scale to weigh them.
-
- Using the scale: make sure to tare the scale with the container/tray/scale lid that you are going to use. **NOTE:** scales come pre calibrated from factory. Have the scale sitting on a flat surface and protected from wind as much as possible. Put the kernels onto the scale tray and weigh your sample. (Tip: Turning the scale on with the empty tray on the scale will tare the tray weight automatically).

- **At beginning of cleaning ALWAYS turn speed dial up slowly to start and increase fan speed.**

- **Low voltage alarm will sound when approx. 5 min of usage are left.**

- **Recharge battery soon after low voltage alarm comes on.**



- **The newest air separator versions will have an ON/OFF switch additionally to the speed dial, in this case the ON/OFF switch will need to be activated before the speed dial can change the speed of the air separator fan. Please switch back to OFF when done cleaning. The variable speed dial can stay in a certain position while switching the ON/OFF switch if you wish.**



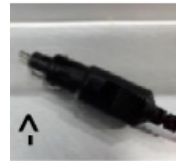
Battery and fuse – opening the device:

Inserting new battery and fuse into your separator, charger plug or carrier can easily be done by opening the devices as shown below.

NOTE: Make sure devices are **turned OFF** before you open them – especially the separator!

Fuse:

- Carrier and separator operate with a 5 Amp mini fuse, the 2021 units have an additional fuse tied to the fuse holder for your convenience.
- Charger operates on a GMA 5 Amp glass fuse, located inside the male plug that plugs into the devices.



Battery:

Separator:

- Built before year 2020: **12 Volt**/5 Amp, SLA/AGM Sealed Gel Lead Acid Battery (Approx.: 4"x3.5"2¾").
- Built in 2020 and onwards: **12Volt**/1.6Amp, LiFePrO4 battery.

Carrier:

- Built before year 2020: **12 Volt**/1.3 Amp SLA/AGM Sealed Gel Lead Acid Battery type 1213 (Approx.: 3.75"X 2"X1.5/8")
- Built in 2020 and onwards: **12 Volt**/1.6Amp, LiFePrO4 battery.

NOTE: New LifePro4 batteries can be used with earlier product versions through an update kit.

WARNING: Don't short batteries out! Assure that you are re attaching the correct Positive and Negative cables, keep and secure the wire harness away from moving parts (example: fan), use zip ties if needed. Batteries are held in place with double sided tape, in foam padding or by a metal battery clamp and need to be re attached in proper position when replaced.

Opening devices:

Separator:

WARNING: Keep fingers away from fan while device is open and connected to battery power! Make sure ON/OFF button/switch stays OFF!

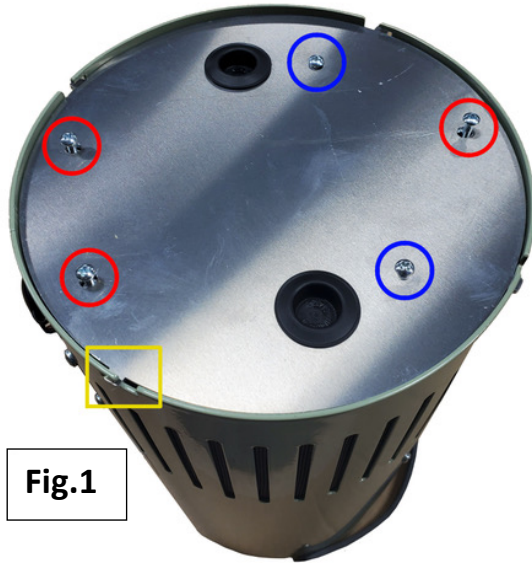


Fig.1

Fig. 1: To change the battery or fuse in your separator, shut separator OFF, unscrew 3 screws on the bottom plate (marked red and closest to the edge). Bottom plate can now be twisted and taken out of the fastening notch (marked yellow), this will open the bottom and give access to components. Turn the separator onto side to open the bottom easier. Undo the cable off the battery.

The battery is secured by a clamp which is fastened with two screws to the bottom plate (marked blue).

Make sure to place the bottom plate in the same spot to close the separator up again and to allow the screws to line up to the holes to fasten to.

NOTE: When closing up bottom plate, make sure the wire harness is not able to touch the fan, use zip ties to shorten/secure the harness if needed.

Carrier:

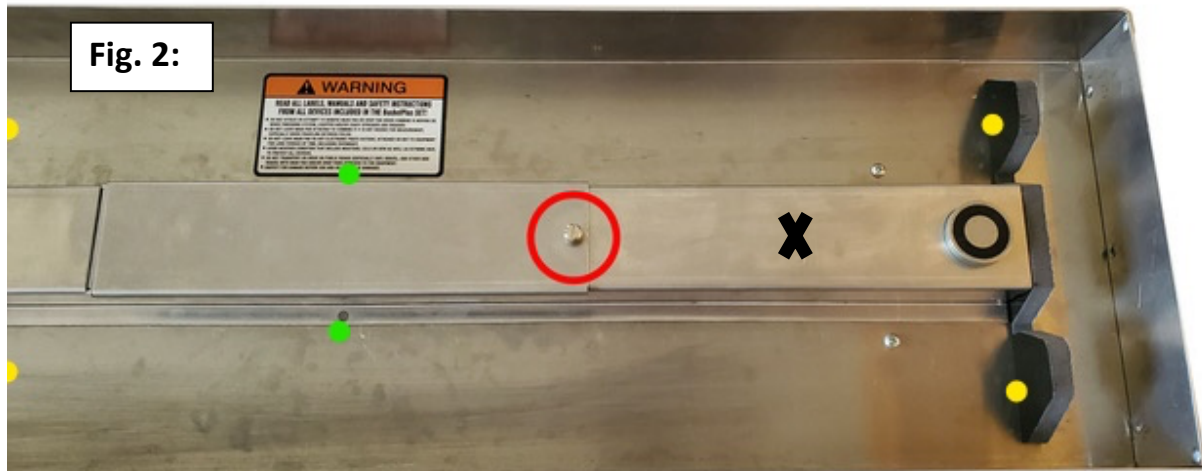



Fig. 2: Carrier view from the bottom. Red drop pan removed.

If red drop pan can not be released/taken out with the remote control/app, it can be removed by hand. Watch your hands carefully when pulling the drop pan slowly of the electromagnets, slide/push the pan in one direction to the opposite long edge first. This allows more room for the fingers to pry with.

- ➔ To change the **battery** in models built **after Jan 2020** – loosen the battery latch screw (marked in red) and open the latch. The battery is nested inside the red foam tray which keeps it in place. Take the battery out and undo the cable connector carefully.
- ➔ To change the receiver: The receiver is fastened with double sided tape and in order to change the receiver, it needs to be pried off the metal carefully. A square 4 pin connector attaches the receiver to the harness and can be unplugged. The antennas can be screwed off the receiver. The white antenna is the wifi and the black antenna is the 433 Mhz remote control antenna.
- ➔ To change the **fuse** in models built **after Jan 2021** – loosen the battery latch screw (marked in red) and open the latch. The fuse holder is built into the harness and will be nested beside the black/grey wifi receiver, it is possible that it slipped beneath the U channel but can be pulled out easily while tucking carefully on the wire harness. An additional spare fuse is zip tied to the harness for your convenience.
- ➔ To replace the **fuse or receiver in units built before 2021**, the centre U channel needs to be taken off (see following instructions).
- ➔ **Fuse holder** is built into the harness, close to the ON/OFF switch inside the centre U channel.
- ➔ To remove the electrical centre U channel (marked with X), please loosen: two nuts on the 40” unit or four nuts on the 60” unit on the upper side of the carrier (marked green points) and the four screws going into the plastic guides (marked yellow points) from the upper side. You can now remove the centre U channel, and this will expose all the electrical wiring and components.
 - ➔ This process also works for the carriers built **prior to 2020** - to gain access to the battery.

Troubleshooting – Please find most updated troubleshoot details in the latest Bushel Plus app.

NOTE: Before opening the devices, make sure power is turned off!

Symptom	Problem	Solutions
The drop pan will not disengage when activated by remote control or swipe function of the app.	The battery power of the remote control (transmitter) too low. (The red light of the transmitter does not light up when the button is pushed).	Insert a new battery in the transmitter. (Transmitter opens best on the side of the lanyard hole).
	The battery power of the carrier is too low (check battery indicator).	Charge the battery with the smart charger. Only use the correct smart charger and make sure to plug into the device prior to connecting the charger to the wall/power outlet.
	App or wifi is not connected to the carrier.	Double check wifi connection to the carrier and re connect.
	Carrier is turned OFF.	Turn carrier ON.
The battery of the carrier/ separator will not charge. (Aka: Device does not function, even after 24h of charging). Check in this order:	1. Blown fuse in carrier or separator.	Replace the fuse (refer to section: opening devices)
	2. Blown fuse in the male plug of the charger: 	Open the male plug of the charger with screwdriver and change fuse (refer to chapter: Fuse above for the correct fuse).
	3. A defective battery.	Contact us for replacement battery & change the battery (refer to section: opening devices).
Transmitter (remote) lost connection to receiver (remote control 3.0 and 3.W (WX) version)	Make sure all scenarios above are exhausted.	Open the channel on the bottom side of the carrier unit (refer to section: opening devices). 2018& 19,20 units: Open the cover of the grey receiver housing with a screwdriver. Push and hold the button “P1”, inside the receiver and push the button “A” of the transmitter at the same time for a couple seconds. A blinking LED inside the receiver will indicate that the reconnection was successful. NOTE: the carrier needs to be turned on for this task, because the receiver needs power. 2021 units, see page 11
Battery indicator display does not light up.	Display is most likely turned off.	Push the ON/OFF button on the battery indicator display to turn it back on (see page 5).

Warranty and limitation of liability

This Warranty and Limitation of Liability is provided as part of 7424401 Manitoba Ltd.'s ("Bushel Plus" or "Seller") support program for buyers ("Buyer") who operate and maintain products ("Goods") and/or receive services (including the receipt of Goods and accessing Bushel Plus software, referred to herein as "Services") as described in this User Manual.

1. Limited Warranty.

- a) Seller warrants to the original Buyer that for a period of ONE (1) year from the date of shipment of the Goods ("Warranty Period"), that such Goods will materially conform to Seller's published specifications in effect as of the date of shipment and will be free from material defects in material and workmanship. **This warranty is not transferrable and does not apply to any Bushel Plus non-embedded software.**
- b) Seller warrants to Buyer that it shall perform the Services using personnel of required skill, experience, and qualifications and in a professional and workmanlike manner in accordance with generally recognized industry standards for similar services and shall devote adequate resources to meet its obligations under this Agreement.
- c) **EXCEPT FOR THE WARRANTIES SET FORTH IN SECTION 1 (a) AND SECTION 1 (b), SELLER MAKES NO CONDITION OR WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS OR SERVICES, INCLUDING ANY (a) CONDITION OR WARRANTY OF MERCHANTABILITY; (b) CONDITION OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) CONDITION OR WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.**
- d) Products manufactured by a third party ("Third Party Product") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 1(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS, CONDITIONS OR WARRANTIES WITH RESPECT TO ANY THIRD-PARTY PRODUCT, INCLUDING ANY (a) CONDITION OR WARRANTY OF MERCHANTABILITY; (b) CONDITION OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) CONDITION OR WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.**
- e) The Seller shall not be liable for a breach of the warranties set forth in Section 1(a) or Section 1(b) unless: (i) Buyer gives written notice of the defective Goods or Services, as the case may be, reasonably described, to Seller within thirty (30) days of the time when Buyer discovers or ought to have discovered the defect; (ii) if applicable, Seller is given a reasonable opportunity after receiving the notice of breach of the warranty set forth in Section 1(a) to examine such Goods and Buyer (if requested to do so by Seller) returns such Goods to Seller's place of business at Buyer's cost for the examination to take place there; and (iii) Seller reasonably verifies Buyer's claim that the Goods or Services are defective.
- f) The Seller shall not be liable for a breach of the warranty set forth in Section 1(a) or Section 1(b) if: (i) damage to the Goods is caused by handling, shipping, transit, processing or installation; (ii) Buyer makes any further use of such Goods after giving such notice; (iii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; or (iv) Buyer alters or repairs such Goods without the prior written consent of Seller.
- g) Subject to Section 1(e) and Section 1(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate provided that, if Seller so requests, Buyer shall, at Seller's expense, return such Goods to Seller.
- h) Subject to Section 1(e) and Section 1(f) above, with respect to any Services subject to a claim under the warranty set forth in Section 1(b), Seller shall, in its sole discretion, (i) repair or reperform the applicable Services or (ii) credit or refund the price of such Services at the pro rata contract rate.
- i) **THE REMEDIES SET FORTH IN SECTION 1(g) and SECTION 1(h) SHALL BE THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTIES SET FORTH IN SECTION 1(a) and SECTION 1(b), RESPECTIVELY.**

2. Limitation of Liability.

- a) **IN NO EVENT SHALL SELLER BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES, LOST PROFITS OR REVENUES OR DIMINUTION IN VALUE, ARISING OUT OF OR RELATING TO ANY BREACH OF THESE TERMS, WHETHER OR NOT THE POSSIBILITY OF SUCH DAMAGES HAS BEEN DISCLOSED IN ADVANCE BY BUYER OR COULD HAVE BEEN REASONABLY FORESEEN BY BUYER, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE.**
- b) **IN NO EVENT SHALL SELLER'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THIS AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE TOTAL OF THE AMOUNTS PAID OR PAYABLE TO SELLER FOR THE GOODS AND SERVICES SOLD HEREUNDER.**
- c) Distributor.
 - a) The selling distributor has no authority to make any representation or promise on behalf of the Seller or to modify the terms or limitations of this Warranty and Limitation of Liability in any way.

Other products from Bushel Plus

Grain Shaker Box

Easy - Informative - Quick

The Bushel Plus Grain Shaker Box helps you to check a sample of your grain for quality and cracked kernels within seconds. No matter where you are – in the cab of the combine or at the augers of the grain dryer – this tool lets you check any size seed for cracks or quality.

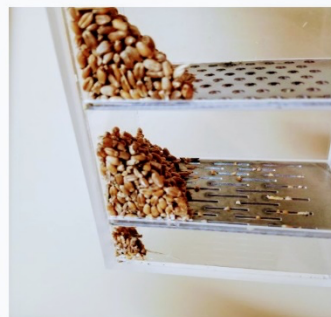
Don't lose money on bad grain or seed quality due to poor settings on the combine that can be avoided. Our Shaker box is inexpensive, easy to use and provides valuable information to grain growers as well as quality seed growers alike. Very well suited for checking your new concave set up.

The Shaker box is designed for a full view of what the kernels look like.

We supply 5 different slotted plates so it can be used in a variety of crops (kernel size) and you can mix and match them to meet your needs. **Very fast quality assessment of a grain sample (splits, cracks, fusarium, dockage, white heads, etc.) from the hopper, grain cart or before/after auger checkup, etc.**

Use it for: rice, cereals, canola, sesame, corn, soybeans, lupins, you name it.

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[#shakeshakeshake](#) [#kornqualität](#)



Contact us for more info or bulk pricing!

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More products @ www.BushelPlus.com

Contact:

Please keep this manual for future reference.

If you have any questions or concerns, please contact:

Bushel Plus LTD.

Unit B - 44 Limestone Road East, Brandon, MB R7A 7L5

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+1 833 – 3767 – 726

➔ Contact form on our website: www.BushelPlus.com

Wishing you a successful and safe harvest,

with more grain in the bin and less in the field!





Part#: DP-MANUAL-3WX



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