

Operator's Manual



MeterMax^{Plus} Test Stand

With

AutoPilot Data Center

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$$\text{MPH} = \frac{\text{RPM X SEEDS/REV X 5940}}{\text{SEEDS/ACRE X ROW SPACING(Inches)}}$$

$$\text{RPM}_{\text{meter}} = \frac{\text{MPH X SEEDS/ACRE X ROW SPACING(Inches)}}{\text{SEEDS/REV X 5940}}$$

MPH= Miles per Hour planter speed
 RPM_{meter}= Revolutions per Minute of the Meter
 RPM_{tach}= Revolutions per Minute of the Red Tachometer
 SEEDS/REV= Number of seeds dropped per meter revolution
 SEEDS/ACRE= Planter Population Setting
 ROW SPACING= Inches per row

RPM _{tach} =RPM _{meter} X 2.54	John Deere/CNH Vacuum Meter
RPM _{tach} =RPM _{meter} X 1.5	John Deere ProSeries Meter
RPM _{tach} =RPM _{meter} X 2.32	White Air Meter

Safety Precautions



Keep hands, loose clothing, and hair away from all moving parts. This includes chains, sprockets, and rotating shafts. Do not operate without safety shields in place. Unplug Test Stand when making adjustments or servicing.

Caution When Working With Treated Seed Corn

Treated Seed Corn is harmful if swallowed, inhaled, or absorbed through the skin. Avoid inhalation and contact with eyes, skin, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse. If contact occurs with eyes, flush eyes with water for at least 15 minutes. Seek medical attention if eye, skin, or respiratory irritation persists. Seek prompt medical attention if swallowed. Treat symptomatically.

Introduction

The Precision Planting **MeterMax^{Plus}** is the most universal and accurate test stand on the market today for evaluating the performance of seed meters. This test stand is equipped with the **AutoPilot Data Center**, a microprocessor based electronic computer, which monitors and displays data related to the accuracy of the seed meter being tested. This feature saves time and increases the accuracy of meter testing.

There are seven different operation modes within **AutoPilot**: the **FINGER Mode**, **6-FINGER Mode**, **VACUUM Mode** (John Deere and CNH Vacuum meters), **PRO VAC Mode** (John Deere ProSeries Vacuum meter), **WHITE Mode** (Air meter), **HI-RATE Mode** (Soybeans), and **SENSOR TEST Mode**. In **FINGER mode** and **6-Finger mode**, a Finger Pickup seed meter is rotated by the test stand, causing seeds to fall from the unit onto a conveyer belt that is divided into cells. Photoelectric sensors, mounted at the end of the conveyer belt, monitor the cells in the conveyer belt to determine the number of seeds in each cell. This information is sent to the AutoPilot Monitor where the necessary information is calculated and displayed. The number of skips and the number of multiples are displayed for each finger during a test run. In the next four modes, **VACUUM**, **PRO VAC**, **WHITE**, and **HI-RATE**, seeds free fall from a vacuum/air meter through a vertical sensor prior to landing on the belt. The amount of time between each seed is measured to determine how accurate the meter is singulating. The photoelectric sensors at the end of the conveyer belt are used to correct the vertical sensor results if all multiples are not accurately detected. This feature is known as Multiple Correction. For all operating modes (except **HI-RATE**), total skips, multiples and % singulation is shown. **SENSOR TEST mode** is available for testing the sensors. In **HI-RATE mode** a % Population is reported. Touch switches on the front panel allow the Monitor to be set up and controlled.

AutoPilot automatically stores the completed tests in memory for recall later, and can store up to 1000 individual tests. A printer output is provided for a serial printer that will print the data on the display.

Software version 1.040 does not have **6-FINGER** or **HI-RATE** mode functionality. Version 1.110 does not have **HI-RATE** mode functionality. Version 1.120 contains all features updates discussed in this Operators Manual. The AutoPilot Data Center is updateable.

AutoPilot Data Center showing display at Startup Screen



The **AutoPilot Data Center** is conveniently mounted on the front of the **MeterMax^{Plus} Test Stand** where it is easily operated. It is designed to be operated with the Test Stand inside a building where it will not be subjected to excessive moisture or temperature extremes.

Specifications

MeterMax^{Plus} Test Stand

Input Power Required: 115 VAC 60Hz, 10 Amp

Compatible Meters:

- Finger Pickup Meter
 - Precision Planting
 - John Deere
 - Kinze
 - Great Plains
- John Deere Vacuum Meter
 - 1991 and later
 - Pre-1990
- Case-New Holland (ASM) Vacuum Meter
- John Deere ProSeries Vacuum Meter
- Great Plains Singulator-Plus
- White Air Meter 6000 Series
- White Air Meter 8000 Series

Compatible Meters, but will not work with AutoPilot:

John Deere Radial Bean Meter
Kinze Brush-Type Seed Meter

Speed Range:

Finger Meter	0-125 RPM
Vacuum Meter	0-50 RPM
White Meter	0-54 RPM
ProSeries Vac	0-83 RPM

Motor and Transmission: 115V 60 Hz 6.2 Amp 1/3 HP General Electric Motor with JK2 Zero-Max Transmission

AutoPilot Data Center

Input Power Required:	Wall mounted power supply 120VAC 60Hz input 12VAC, 750mA output
Temperature Range	Operating: 30F to 122F (0 to 50C) Storage: -40F to 140F (-40C to 60C)
Size:	8.9Inches (226mm) x 4.25In. (106mm) x 3.75In. (95mm) Thick
Weight:	1.5 Pounds (0.68Kg)
Display:	4 row x 40 character backlit dot matrix Liquid Crystal Display
Touch Switch:	Front panel mounted Touch Switch controls all functions
Touch Switch Beeper:	Tone sounds when a touch switch has been pressed and released.
Modes of operation:	Finger mode, Vacuum mode, ProSeries Vacuum mode, White Air mode, Sensor Test Mode
Memory storage of tests:	Up to 1000 test runs (Run No. 0 to 999) can be stored in nonvolatile memory for recall at any time.
Update capability:	PC Flash programming available for program updates as required. Uses PC serial port.
Sensor Inputs:	Accepts the following Sensors: • Flight Sensor photo pickup • Seed Sensor (emitter and receiver) on belt • Vacuum, Pro Vac, White, and Hi-Rate Mode Seed Boot Sensor– uses DICKEY-john <i>High Rate Seed Tube Sensor</i> • Finger Position sensor (for synchronizing & RPM) – uses <i>MeterMax tachometer sensor</i>
Outputs:	RS232 Output for: • Serial printer output • History Data Transfer to PC connection • Flash programming PC connection
Printer:	RS232 Serial Printer, Epson Model No. TM-U200D Paper: Standard 3 Inch (76.2mm) wide roll adding machine paper Ink Cartridge: Epson Part Number: ERC-38 B/R
Printer Cable:	Standard Serial Cable DB9 male – DB9 female
Printer Cable Adapter:	Cable Adapter – DB9 male – DB25 male AT modem adapter

General Operation of MeterMax^{Plus} Test Stand

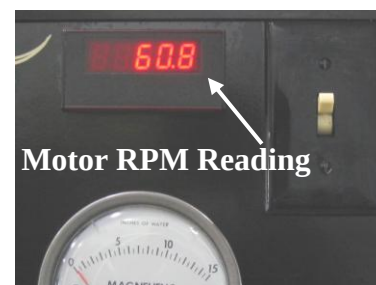
Adjusting Motor Speed: Loosen the motor speed adjustment lever by unscrewing the red knob 1/8 of a turn to the left (counterclockwise). Move the lever up to decrease motor speed and down to increase motor speed. When the desired position is located, tighten the lever by screwing the red knob back to the right (clockwise). The motor speed can be adjusted while the test stand is stopped or moving. After the motor is set to the desired speed, it is still important to monitor the speed as it may change over time due to motor temperature, seed type, or lever creep. For most consistent results, do not adjust motor speed during testing.



Test Stand Tachometer: The test stand tachometer displays only the RPM of the Finger Meter. To calculate the RPM of any of the other meters, use the following table:

Tach RPM	X	.393	=	John Deere/CNH Vacuum Meter RPM
Tach RPM	X	.667	=	John Deere ProSeries Meter RPM
Tach RPM	X	.432	=	White Air Meter RPM

Note: The AutoPilot Data Center will display actual speed in RPM of the meter being tested. Should the tachometer ever need reprogrammed, you will find the programming instructions in the INSTRUCTIONS FOR PROGRAMING TACHOMETER section of this manual



Power Receptacles: Of the 4 power receptacles, 3 are powered whenever the test stand is plugged in. The upper left receptacle is coupled with the test stand motor. The purpose of this is to control the power of the vacuum source. Therefore, the vacuum source should be plugged into this receptacle

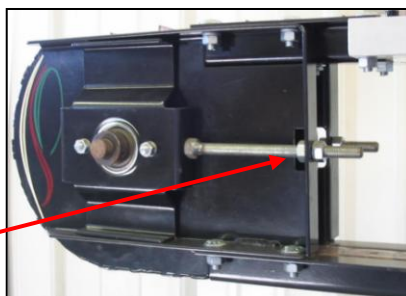
This receptacle is coupled with the test stand motor



Belt Tension Adjustment: The tension of the test stand belt has been properly adjusted at the factory. There will be no need of adjustment in the first year of operation. Proper belt tension will result in 1¾ lbs at 4 inches stretch when pulled upwards at the Seed Aligning Brush. See photo at right.

Note: If the belt is too tight, it will “rubber band” and become suspended. When this happens the seeds will vibrate around as they are carried through the belt sensors, causing faulty skips.

Belt Tension Adjustment

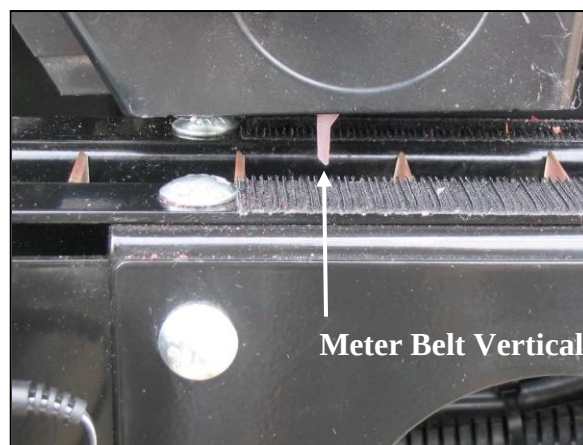
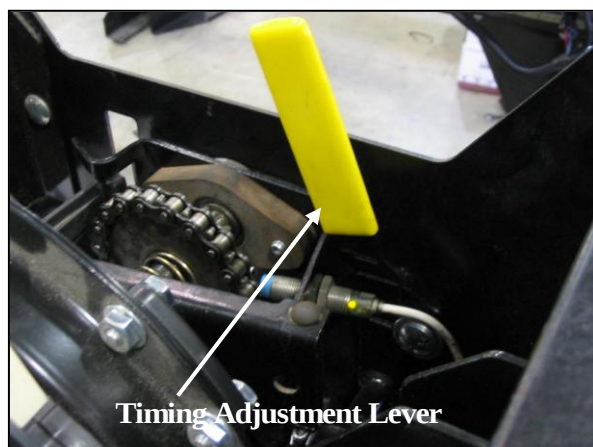


Belt Timing Adjustment

The MeterMax belt must be in proper timing with the Finger Meter belt, so there will be a smooth hand off from meter to the individual cell of the conveyor belt on the test stand. A test stand belt that is out of sync with the meter will cause seeds to either bounce out or hit the top edge of the test stand belt flights and land in an adjacent cell, skewing results.

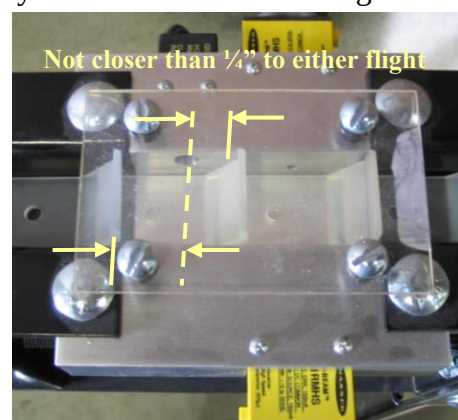
The timing of the test stand belt is adjusted by moving the Timing Adjustment Lever. To properly time the test stand, mount a new or reconditioned Finger Meter on the test stand and fill with seed. Run the test stand very slowly so that you can see where each seed lands. Loosen the knob on the back of the Timing Adjustment Lever to adjust the lever position. At slow speeds, the ideal setting is to actually have each seed hit the backside of the flight on the test stand belt. Consequently, when the test stand is operated at typical testing speeds, the seed will always land in the same cell in relation to the meter belt. The picture below shows the approximate position of the two belts in relationship to each other when the a flight of the meter belt is pointing straight downwards.

Note: The adjustment range in the Timing Adjustment Lever will advance/retard the timing up to one cell of the belt. If the correct timing position happens to be at the ends of the adjustment range, grab the belt and pull it forward until you hear the sprocket jump a tooth.



When the meter is in sync with the belt, the vertical flight of the meter belt will be approximately centered between two flights

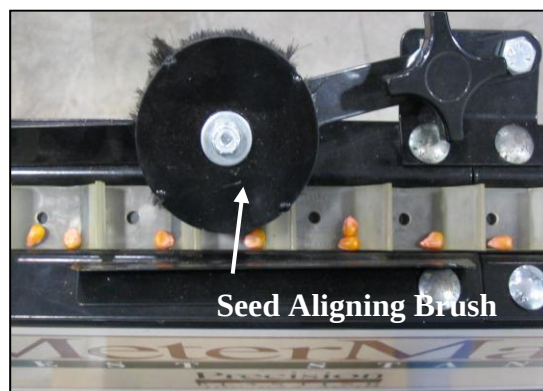
After the meter is timed to the belt, it is important to verify that the timing signal from the Finger Position Sensor does not occur while a flight is in front of the Flight Sensor. To do this, position the meter drive shaft so that the roll pin just activates the Finger Position Sensor (sensor lights up when activated). At this point, the nearest flight should be 3/16" from the flight sensor. Slightly tightening or loosening the belt will usually adequately shift the flight away from the sensor eye. If this is not done, the data from Finger No.1 may be displayed as Finger No.2



Seed Aligning Brush Setting

The purpose of the Seed Aligning Brush is to separate multiple seeds within a cell so that they each pass by the Seed Sensor one at a time. It is impossible for a seed to be counted if it is lying in the “shadow” of another seed. But, with the seeds lined up in a row, AutoPilot can very accurately count them, even if there is no spacing between them.

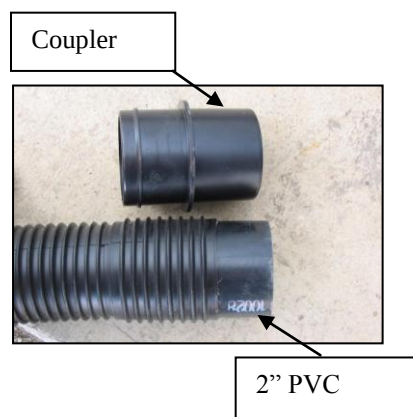
Adjust the Seed Aligning Brush so that the bristles hardly touch a single seed, but will brush the side of the second seed in a stacked pair. Although there is a considerable range of forgiveness to this setting, the brush will need to be set lower for a small seed (2000 seeds/LB) and higher for a large seed (1100 seeds/LB).



John Deere 7200, 1700 Series Finger Meter Setup: On meters with a flipper drive, an adapter is used to replace the flipper drive. The test stand belt will need to be retimed with the meter.



Vacuum Source Setup: Plug the vacuum source into the upper left receptacle with the switch of the vacuum unit left in the ON position. This ensures that the vacuum motor will only be on when the test stand motor is on. On the hose of the wet/dry vacuum, replace the coupler with a short piece of 2” PVC. Then use a 2” to 1 ½” reducer to connect to the 1 ½” PVC vacuum input tube on the side of the test stand.



Remove coupler and replace with short 2” PVC piece. Then add 2” to 1 ½” PVC reducer

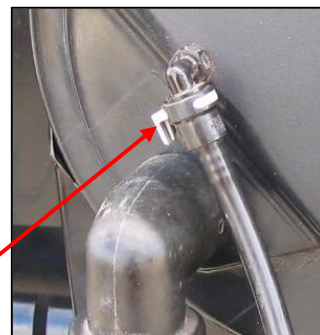


If the style of vacuum hose does not allow for the short 2" PVC piece, use a rubber 2" to 1 1/2" reducer.

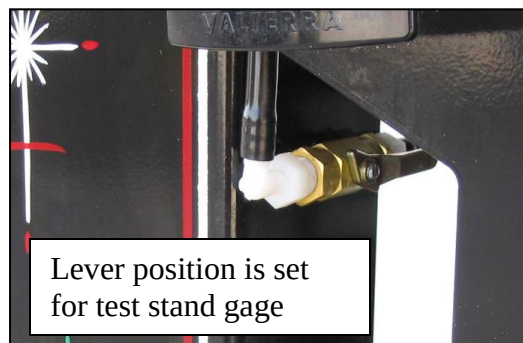
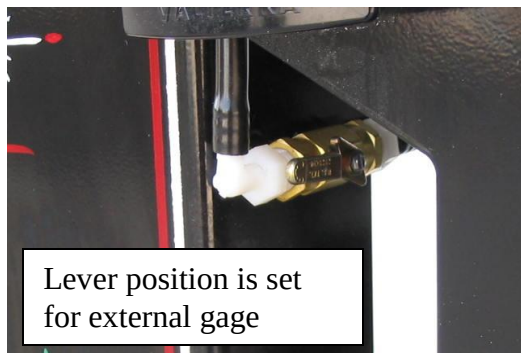
Vacuum Monitoring Port: Connect the quick-connect fitting (tie strapped to the vacuum hose) to the meter to monitor the vacuum level at the meter. Since this port will not be on every meter, it is recommended to change out the vacuum meter dome cover with one which has the port.

Note: If the vacuum gage is not responding, make sure the vent hole on the side of the gage is open.

Vacuum Monitoring Port

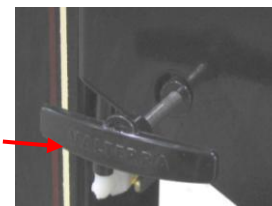


Setting Customer's Vacuum Gauge: Located just to the left and below the vacuum regulator gate, is a brass valve which allows a customer's gauge to be plumbed into the test stand for the purpose of setting the two gauges to read the same. When operating a customer's gauge, the lever of the valve should be pointing towards the front. To monitor the vacuum level on the test stand gauge, the lever should be pointing towards the back.



Adjusting Vacuum Level: Use the vacuum regulator gate to control the amount of vacuum at the meter. Pushing the gate in will increase the vacuum while pulling it out will decrease the vacuum.

Use lever to adjust vacuum supplied to meter



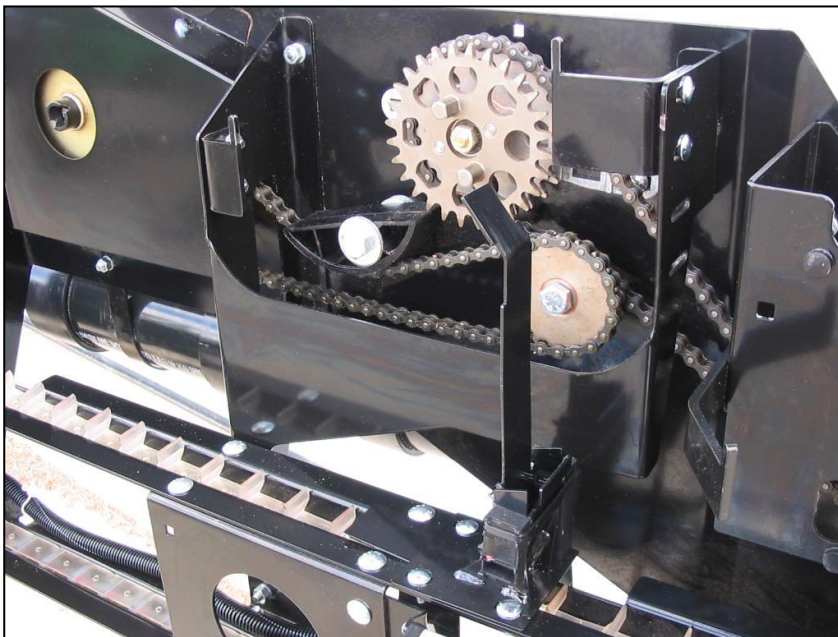
Vacuum/Air Meter Setup

John Deere Vacuum Meter (1991 and later): Perform tests in AutoPilot **VACUUM MODE**. Use the photos on this page for proper setup. For accurate test results verify that:

- The seed boot is positioned such that seeds can free fall through the seed boot sensor without directly hitting the boot. See photo in lower right corner.
- Position the meter by moving the mounting brackets such that the inside back wall of the meter housing is against the riser of the seed boot with less than .060" gap.



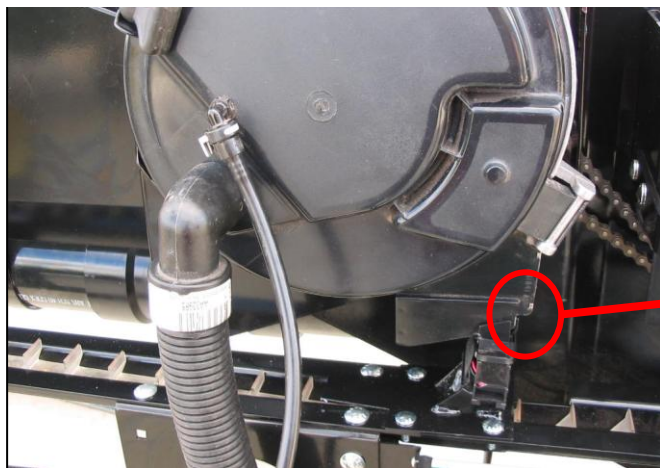
John Deere Vacuum Meter (1991-) Brackets



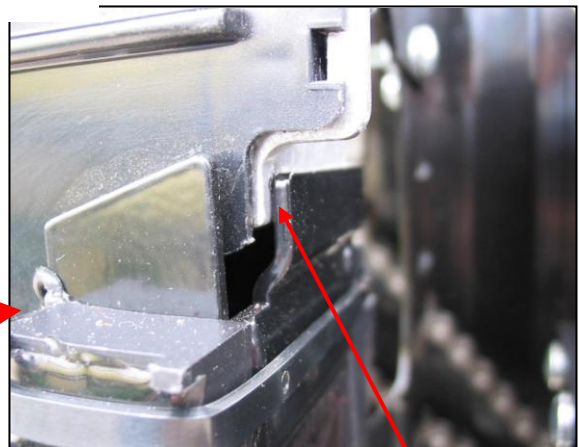
Overall view of John Deere Vacuum Meter (1991-) Setup



Less Than .060" Gap Between Riser of Seed Boot and Meter Housing



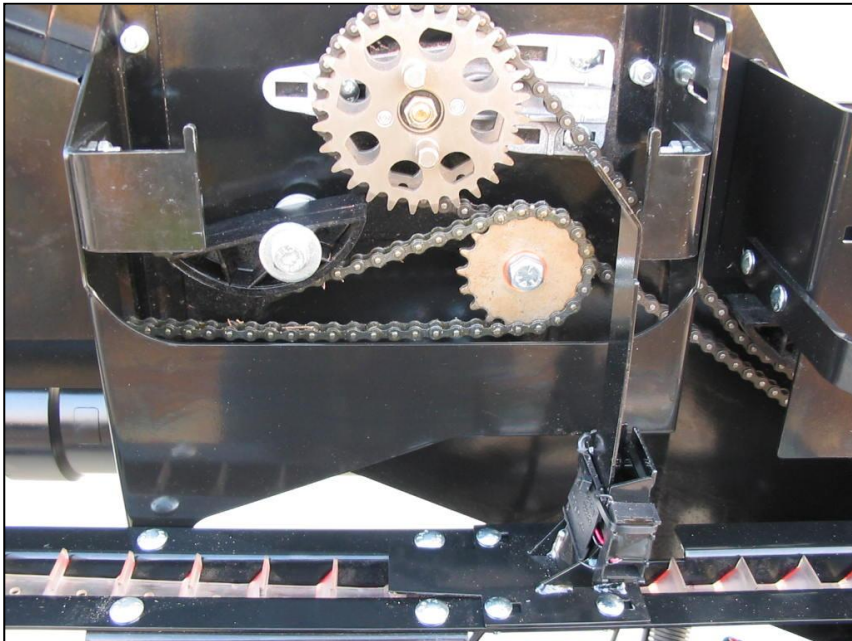
Vacuum Supply Hose and Vacuum Monitoring Hose Correctly Attached



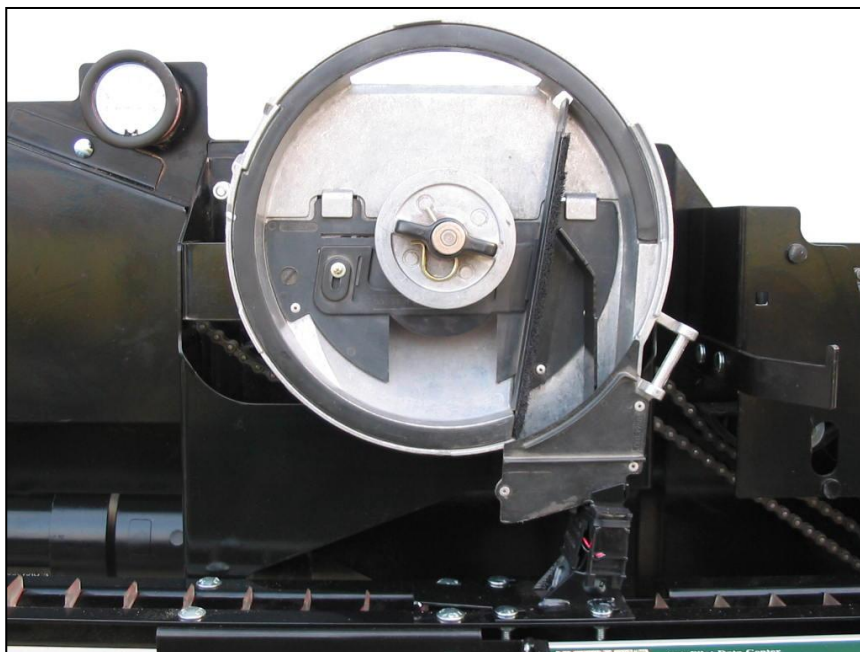
IMPORTANT! Adjust Seed Boot to Achieve contact between Meter Housing and Seed Boot

John Deere Vacuum Meter (Pre-1990): Perform tests in AutoPilot **VACUUM MODE**. Use the photos on this page for proper setup. For accurate test results verify that:

- The seed boot is positioned such that seeds can free fall through the seed boot sensor without directly hitting the boot.
- Position the meter by moving the mounting brackets such that the inside back wall of the meter housing is against the riser of the seed boot with no gap



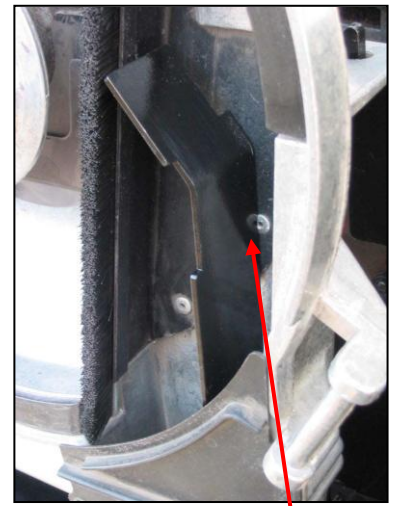
Overall View of John Deere Vacuum Meter (pre-1990) Setup



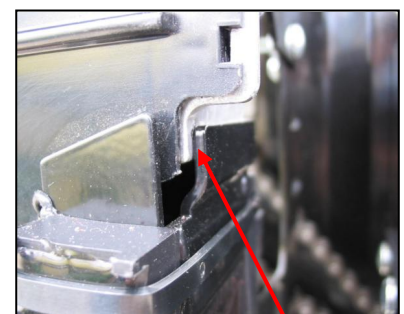
John Deere Vacuum Meter (pre-1990) Mounted on Test Stand with Dome Vacuum Meter Cover Removed



John Deere Vacuum Meter (pre-1990) Brackets



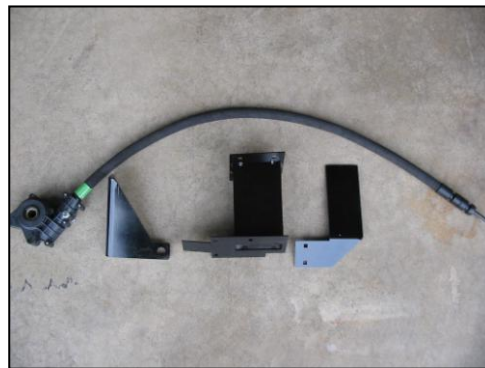
Seed Boot Riser Should be Touching Meter Housing



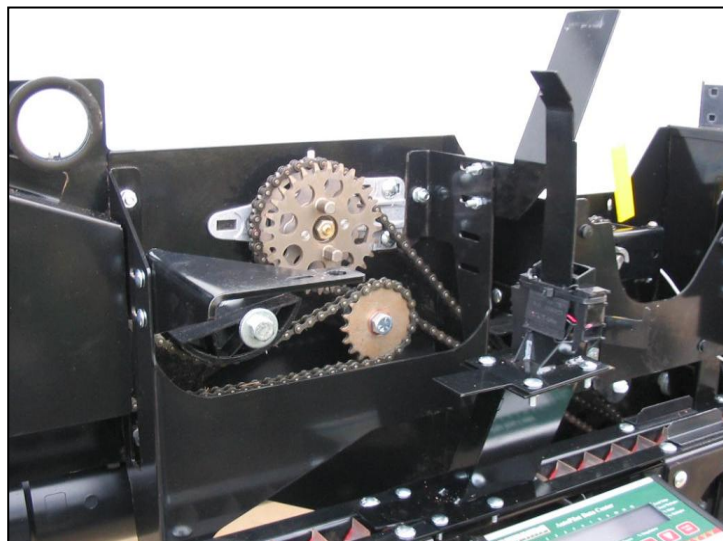
IMPORTANT! Adjust Seed Boot to Achieve contact between Meter Housing and Seed Boot

John Deere ProSeries Vacuum Meter: An optional kit must be purchased to test the John Deere ProSeries Vacuum Meter. Perform tests in AutoPilot **PRO VAC MODE**. Assemble the front and rear meter support brackets at the end of the slots. Use the same John Deere vacuum meter seed boot with the seed boot extension between the boot and the test stand.

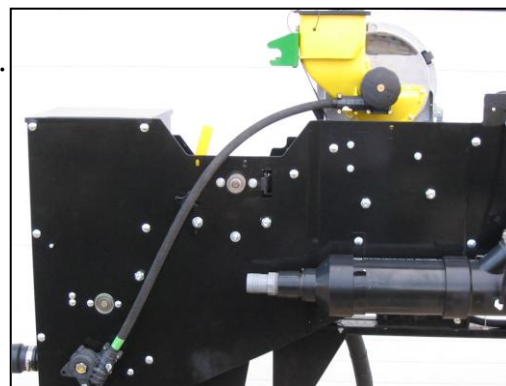
- The seed boot is positioned such that seeds can free fall through the seed boot sensor without directly hitting the boot.
- Position the meter by moving the mounting brackets such that the inside back wall of the meter housing is against the riser of the seed boot with less than .060" gap.



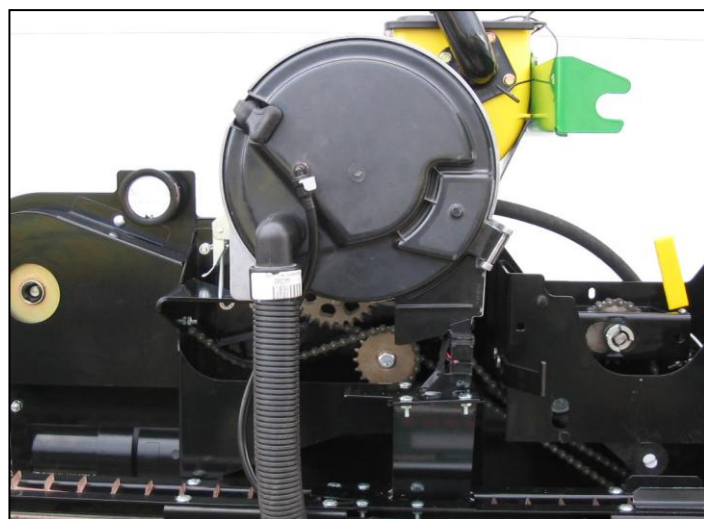
Primary Components in the Optional John Deere ProSeries Kit



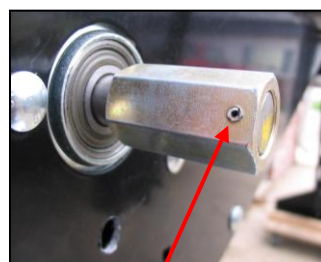
John Deere ProSeries Vacuum Meter Brackets Correctly Installed



John Deere ProSeries Cable Drive



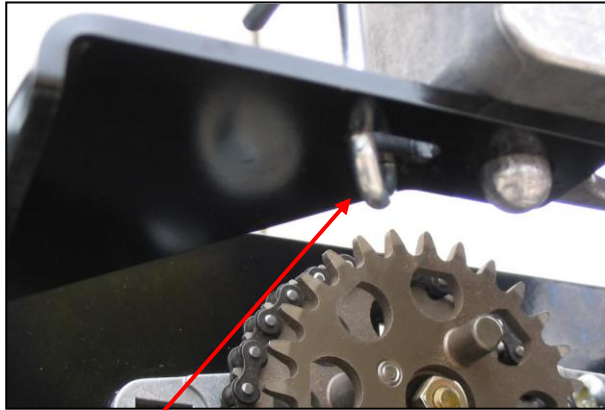
John Deere ProSeries Vacuum Meter on Test Stand



1/8" X 3/4" Roll Pin
Secures Hex Adaptor to
the Shaft



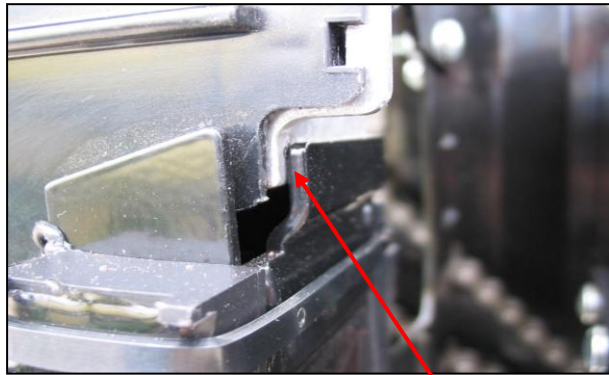
3/8" X 2" Bolt Fixes
the Driver Gear Box in
Place



Twist “J” Hook 1/8 Turn and Flip Down Latch to Secure Meter to Rear Support Bracket



Front Meter Support for John Deere ProSeries Vacuum Meter



IMPORTANT! Adjust Seed Boot to Achieve contact between Meter Housing and Seed Boot



Rest Cable on Air Accumulator When Not in Use



Less than .060” Gap Between Riser of Seed Boot and Meter housing

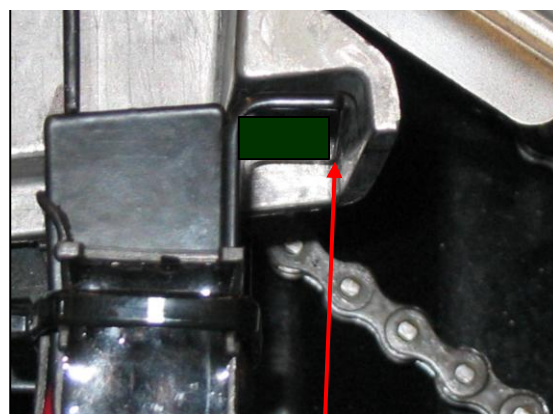
Case-IH/New Holland (ASM) Vacuum Meter: An optional kit must be purchased to test a CNH Vacuum Meter. Perform tests in AutoPilot **VACUUM MODE**. The CNH vacuum meter mounts in the same location as a John Deere (non-ProSeries) vacuum meter, except uses a unique seed boot, mounting brackets, and a drive adapter. Since this meter operates at a higher vacuum level than a John Deere, a 25" H₂O vacuum gage is included. This gage can be connected as an external gage or replace the standard 15" H₂O vacuum gage.

The CNH vacuum meter requires a high amount of air flow along with a high vacuum level to perform properly. It may be required to connect directly from the vacuum source to the meter to get sufficient vacuum.

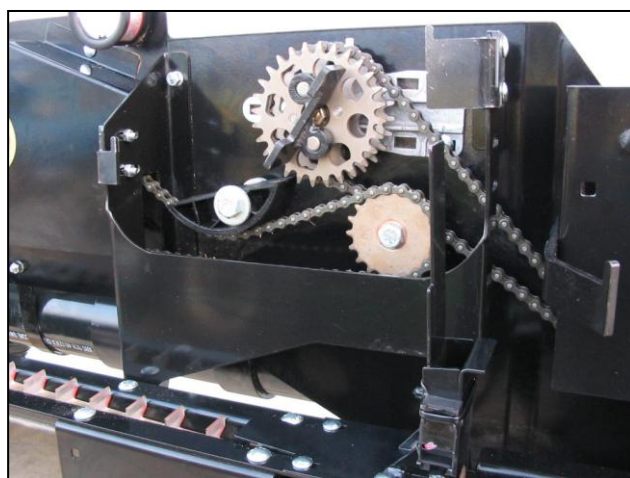
It is very important that as the seeds are released from the disk that they fall untouched until after they pass the seed boot sensor. Proper positioning of the seed boot, as shown in the photo on the right, will ensure this.



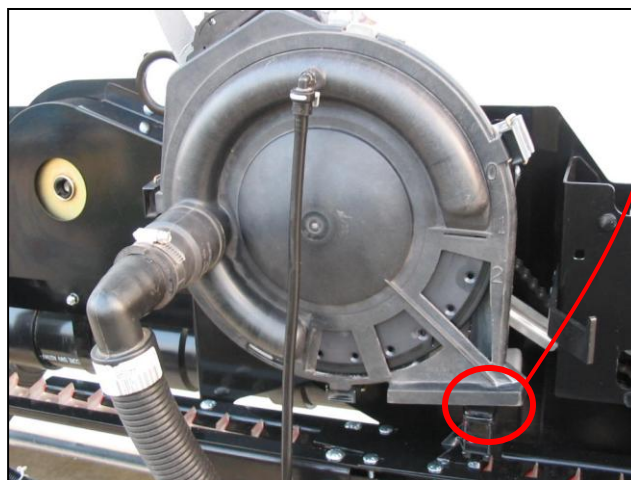
Primary Components of the Optional CNH Vacuum Meter Kit



IMPORTANT! Position Seed Boot So That the Boot and the Meter Housing Touch Here



Proper Setup of Brackets and Seed Boot for CNH Vacuum Meter



CNH Vacuum Meter Mounted on the Test Stand

White Air Meter: An optional kit must be purchased to test White air meters. Perform tests in AutoPilot **WHITE MODE**. The kit consists of the seed boot with sensor and J-bolts which fixture the meter to the test stand.

Since a White Meter operates on positive air pressure, it is required that the vacuum source hose be connected to the blower port. Then connect the flexible plastic hose (which normally supplies vacuum to the vacuum meters) the accumulator air inlet on the backside of the test stand. Finally connect the 3" flexible hose to the air inlet of the meter, securing it with a hose clamp.

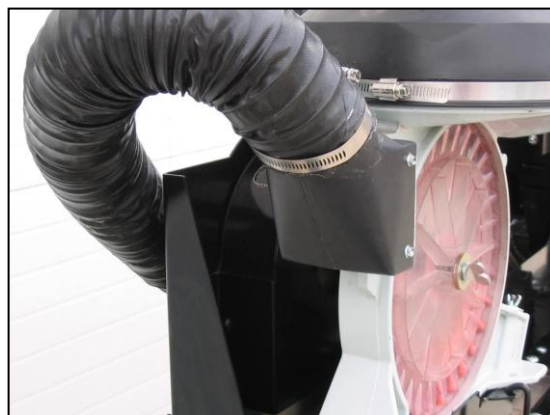
The air pressure level is monitored at a port on the accumulator and displayed on the 5" Water Column gage.



Primary Components of the Optional White Air Meter Kit



Shop Vac Setup to Supply Air to the White Meter (Hose connected to blower port)



3" Flexible Hose Connected to Meter Air Inlet.



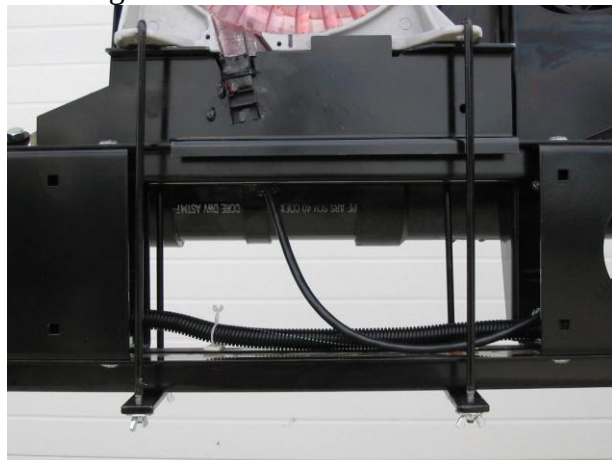
3" Flexible Hose Connected to Meter Air Inlet.



Air Pressure Gage, Which Is Connected to a Port Off of the Accumulator

6000 Series

The 6000 Series White Meters mount on top of the seed boot with the four 12" J-bolts attaching the meter to the stand



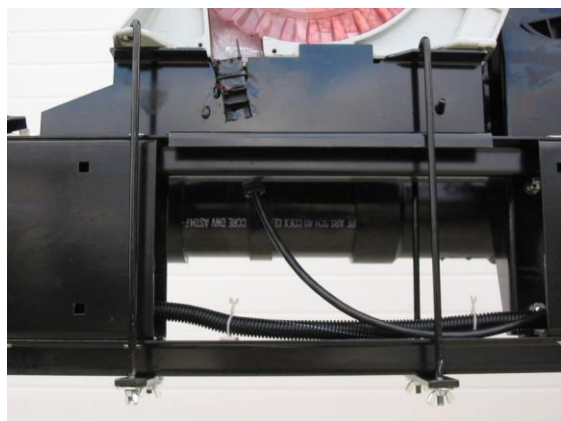
6000 Series White Meter is Held to the Test Stand by Four 12" J-Bolts



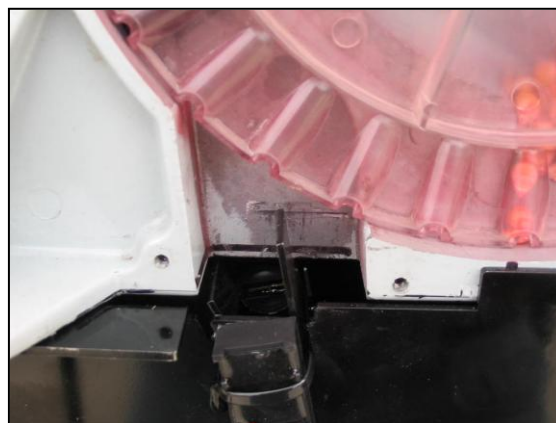
6000 Series with Galvanized Cover Removed.

8000 Series

The 8000 Series White Meters mount on top of the seed boot with two 12" J-bolts attaching the rear of the meter to the stand. The other two J-bolts hold the front of the boot to the test stand. Then a fifth 5" J-bolt is used to clamp the front of the meter to the boot.



8000 Series White Meter. The Two Front J-Bolts Holds the Boot to the Test Stand



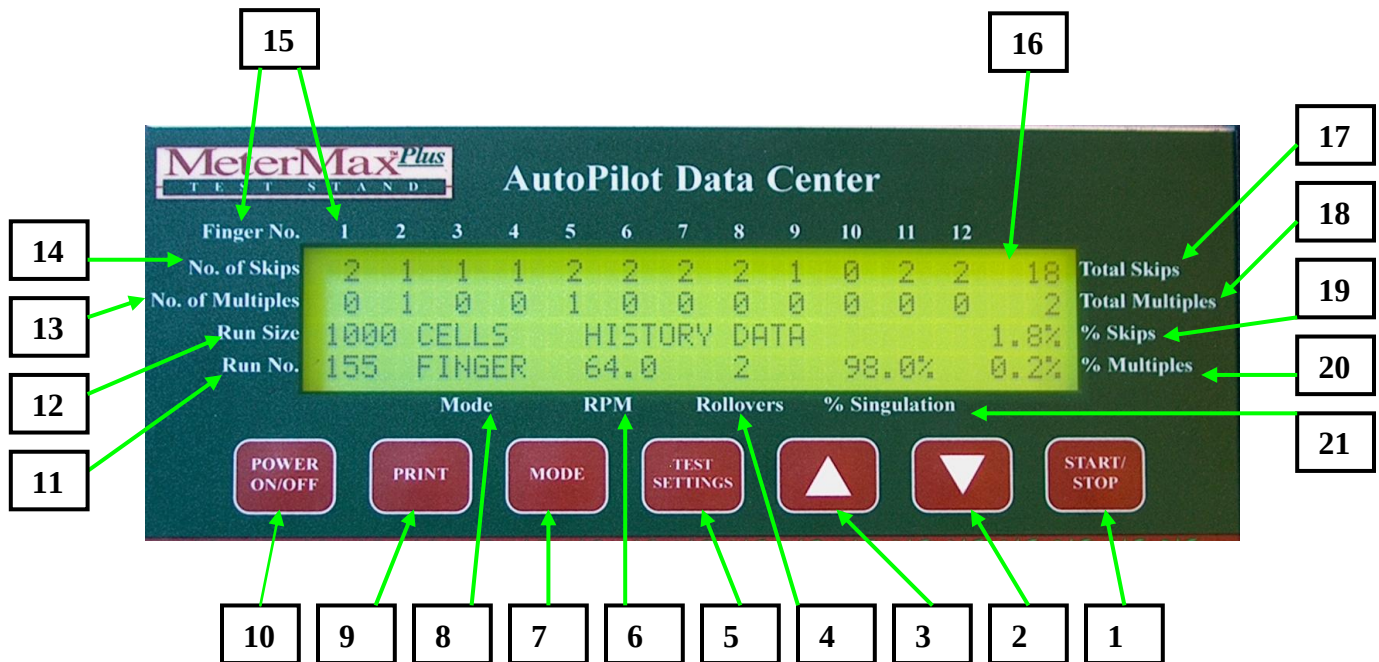
8000 Series with Galvanized Cover Removed

In either the 6000 or 8000 series set up, to get accurate results it is important to carefully set the seed boot so that seeds fall past the seed boot sensor without bouncing off the boot. This means that the fore-aft position of the seed boot may need to be shifted as the meter RPM changes.



8000 Series White Meter Uses a 5" J-Bolt to secure it to the boot

Description of Display and Controls for AutoPilot



1. **START / STOP** switch: Pressing this switch starts and stops the test. When the test is running, calculations are being made, and the numbers will be updating on the display. The test can be stopped at any time by pressing this switch again. The test will automatically stop when the **Run Size** number has been reached. When the test stops, either automatically or by pressing the **START / STOP** switch again, the monitor will calculate and display the totals and averages based on the entire Run Size, and the display will be static and stop changing. The stopped test will be saved in memory under the **Run No.** indicated on the display.
2. **Down Arrow** switch: This switch has the following uses:
 - When screen shows **HISTORY DATA**, pressing this switch selects the previous **Run No.** data for display.
 - Press to change **Run Size** to lower number of **CELLS** when the **Run Size** number is flashing.
 - Press to change the **CELL DISK** number to a lower value when it is flashing in the **VACUUM**, **PRO VAC**, **WHITE**, and **HI-RATE** modes.
 - Decreases the contrast of the display by pressing while the **MODE** switch is pressed and held down.

Note: Pressing and releasing will change one digit per press; pressing and holding will allow scrolling through the available selections.
3. **Up Arrow** switch: This switch has the following uses:
 - When screen shows **HISTORY DATA**, pressing this switch selects the next **Run No.** data for display.
 - Press to change **Run Size** to increase number of **CELLS** when the **Run Size** number is flashing.

- Press to change the **CELL DISK** number to a higher value when it is flashing in the **VACUUM, PRO VAC, WHITE,** and **HI-RATE** modes.
- Increases the contrast of the display by pressing while the **MODE** switch is pressed and held down.

Note: Pressing and releasing will change one digit per press; pressing and holding will allow scrolling through the available selections.

4. **Rollovers:** When in the **FINGER** or **6-FINGER** mode of operation, indicates the number of times a rollover occurs during a test. A **Rollover** is registered when a Skip is immediately followed by a Multiple (double) and indicates a seed on the conveyer belt has rolled over into the next cell. Rollovers are ignored for the **Total Skips, Total Multiples, %Skips** and **% Multiple** values. Rollovers are not displayed in the **VACUUM, PRO VAC, WHITE,** and **HI-RATE** modes.
5. **TEST SETTINGS** switch: This switch has the following uses:
 - In **FINGER** or **6-FINGER Mode** and test is not running, press to change the **Run Size** number (number of **CELLS** to be counted during the test). The **Run Size** number will flash, indicating it can be changed using the **Arrow Switches**. Press **TEST SETTINGS** again to save the selected value.
 - In **VACUUM, PRO VAC, WHITE,** and **HI-RATE** modes and test is not running, press to change the **Run Size** number (number of **CELLS** to be counted during the test). The **Run Size** number will flash, indicating it can be changed using the **Arrow Switches**. Press **TEST SETTINGS** again to save the selected value, or press **MODE** to change the **CELL DISK** number. Press **TEST SETTINGS** again to save the **CELL DISK** number.
 - To turn the switch beeper on or off, press **TEST SETTINGS** at the same time as the **MODE** switch.
6. **RPM:** Indicates the speed of the meter in Revolutions Per Minute. The RPM is calculated from the meter speed at the beginning of the test and will not be changed during the test. If the RPM is not stable, the test will be stopped and **BELT SPEED IS NOT STABLE** warning will appear on the display. If no speed signal is available, the display will read **TURN ON THE TACHOMETER AND/ OR BELT**. The Tachometer must be turned on since it powers the finger position sensor.
7. **MODE** switch:
 - Changes the operating **Mode** from **FINGER** to **6-FINGER** to **VACUUM** to **PRO VAC** to **White** to **HI-RATE** to **SENSOR TEST** as indicated on the display, to correspond to the type of seed meter being tested or sensor diagnostic test display.
 - When in **VACUUM, PRO VAC, WHITE,** or **HI-RATE** modes, and **TEST SETTINGS** has been pressed, pressing **MODE** will select either the **Run Size** or **CELL DISK** parameters. The flashing number indicates which is selected and can be changed with the **Arrow Switches**. Press **MODE** again to select the other parameter.
 - To turn the switch beeper on or off, press **TEST SETTINGS** at the same time as the **MODE** switch.

8. **Mode:** The current operating **Mode** will be indicated on the display above the word **Mode**. There are seven operating **Modes**: **FINGER**, **6-FINGER**, **VACUUM**, **PRO VAC**, **WHITE**, **HI-RATE** and **SENSOR TEST**. The first six are used for testing meters. The seventh diagnostic mode called **SENSOR TEST** allows monitoring the sensors used with **AutoPilot**. These modes of operation are selected with the **MODE** switch.
9. **PRINT** switch: When a serial printer is attached to the RS232 port, and this switch is pressed, the printer will print the display information report for the data currently shown on the display. Prior runs can be printed once displayed.
10. **POWER ON / OFF** switch: Turns the AutoPilot Data Center power on and off. On is indicated by the display being illuminated.
11. **Run No.:** Indicates the current test run number for the data shown on the display. Every new run is given a new **Run No.** after the test starts, simply one digit higher than the highest test in memory. Tests are automatically saved in memory. All previous test data is available by using the Arrow Switches to select the desired **Run No.**, and the data for that test will appear on the display. The AutoPilot Data Center automatically assigns the next highest unused **Run No.** from **0** to **999**. When all **999 Run No.**'s have been used, the previous tests will be erased one at a time starting at **Run No. 0** and reused for the new test data.
12. **Run Size:** In **FINGER** and **6-FINGER Mode**, shows the number of **CELLS** on the MeterMax belt that will be monitored during the test, or for memory data of a previous test, it shows the number of **CELLS** that were monitored during that test. In **VACUUM**, **PRO VAC**, **WHITE**, and **HI-RATE Mode**, **CELLS** is the number of cells on the disk monitored during the test. The **Run Size** number can be changed with the **Arrow Keys** before starting a new test after pressing the **TEST SETTINGS** switch when the display is static.
13. **No. of Multiples:** In the **FINGER** and **6-FINGER Mode**, indicates how many times the finger on the test meter corresponding to the **Finger No.** identified on the front panel label delivered multiple seeds. In the **VACUUM**, **PRO VAC**, and **WHITE Mode** of operation, this display location is used to show the size of the **CELL DISK** selected. Refer to **TEST SETTINGS** switch description to change the **CELL DISK** number.
14. **No. of Skips:** In the **FINGER** and **6-FINGER Mode**, indicates how many times the finger on the test meter corresponding to the **Finger No.** identified on the front panel label failed to deliver a seed. **No. of Skips** is shown only in the **FINGER Mode** of operation.
15. **Finger No.:** Indicates which planter meter finger number the display information relates to. Only Finger 1 to 6 is displayed in **6-FINGER Mode**. Each finger number on the front panel above the display has under it a number indicating the Number of Skips and also the Number of Multiples. Finger data is shown only when in the **FINGER** or **6-FINGER Mode** of operation. Refer to the section in the manual titled **Determining Finger Number** for more information on how to correlate the data by finger to as specific finger in the meter.

- 16. Display:** The display is a 4 line x 40 character LCD display used to show the test results and highlight error and informational messages during the test. It has a backlight so it can easily be viewed in low light conditions. The contrast of the display is adjustable. During normal operation it should not require adjustment, but may be necessary if the Data Center is operated in temperature extremes. The contrast of the display can be changed by pressing and holding the **MODE** switch and pressing and holding an **Arrow Switch** at the same time.
- 17. Total Skips:** The number shown on the display is the total number of times that the fingers or cells of the disk failed to deliver seeds during the test run.
- 18. Total Multiples:** The number shown on the display indicates the total number of times that the fingers or cells of the disk delivered more than one seed during the test run.
- 19. % Skips:** The number shown on the documents the percentage of skips occurring during the test run as a percentage of the total **Run Size**.
- 20. % Multiples:** The number shown on the display indicates the percentage of **Multiples** dropped by the planter meter during the test as a percentage of the total **Run Size CELLS**.
- 21. SINGULATION:** The number shown on the display indicates the percentage of singulation, which is the percent of fingers/cells of the disk which delivered only one seed compared to the total **Run Size** number.
- 22. (not shown) Switch Beeper ON/OFF:** To turn the switch beeper on or off, press and hold down the **MODE** switch then press the **TEST SETTINGS** switch.

Display Messages

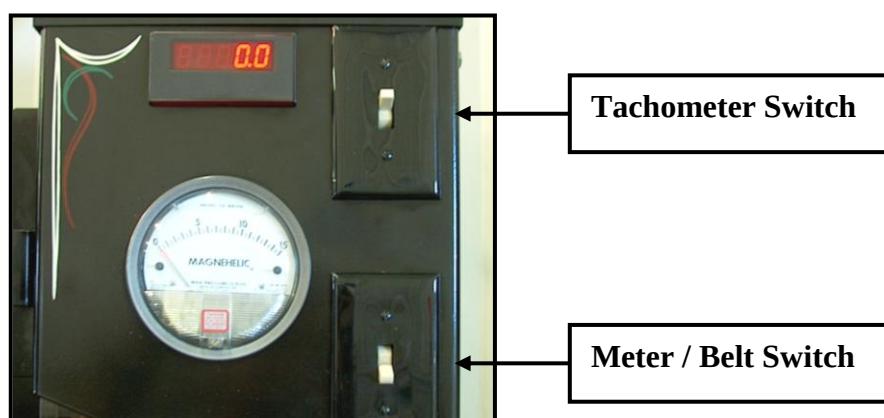
During operation of the AutoPilot Data Center, messages may appear on the display. Shown below is an example of one of these messages. Refer to the list below to determine the full meaning of the message and what response to take.



Error Messages:

Following is a complete list of the error messages that will cause the test to be stopped and a message appear with no other data on the display. A description and solution to correct the error is listed with each.

- **TURN ON TACHOMETER / BELT** – AutoPilot is not receiving a RPM signal from the Finger Position Sensor. Common causes of this would be: the test stand Tachometer switch in the upper right corner of the test stand Control Panel (see below) is not turned on (which powers the sensor), the belt is not moving because the test stand Meter / Belt Switch is not turned on, the sensor wiring harness is not plugged in, or the Finger Position Sensor is faulty.



MeterMax Test Stand Switch Locations

- **BELT HAS BEEN TURNED OFF** – AutoPilot has not received a signal from the Flight Sensor in the last three seconds. This warning indicates the test was underway and the belt stopped moving. The Meter / Belt Switch should be turned on and the test started again after the belt is moving and seed is being dropped. If the problem persists, test the **FLIGHT SENSOR ON BELT** as described in the **Sensor Test Mode** section of this manual.

- **BELT SPEED IS NOT STABLE** – The RPM of the belt has changed. The RPM is measured and displayed at the beginning of the test. If the RPM changes by more than 20% during the test, the test is stopped and this message is displayed. Correct the reason for the RPM change and restart the test. If the problem persists, test the **FLIGHT SENSOR ON BELT** as described in the **Sensor Test Mode** section of this manual.
- **ERROR – FINGER TIMING** – In **6-FINGER** mode, this error is displayed when the finger set in not installed with fingers aligned with the drive roll pin or if belt timing is drastically off. When this error is detected, it will flash on the screen while the test continues to run.
- **NO SEED DETECTED: CHECK METER** – This error occurs when seeds are not being detected by either the Seed Sensor on Belt or the Seed Boot Sensor. Verify that the meter is dropping seed. In Vacuum Mode, this error will occur if the Seed Boot Sensor is unplugged from the harness.
- **ERROR – FLIGHT SENSOR** – This error does not stop the test. This message will appear flashing on the display when AutoPilot misses a pulse from the Flight Sensor. When this happens, AutoPilot will include the seed count from the cell missing the flight signal with the seed count for the next cell. If this message appears, verify that the Flight Sensor is being triggered by every flight by running the Flight Sensor test in the **Sensor Test Mode** section of this manual. The same section also contains corrective actions.
- **PRINTER IS BUSY** – Wait until the printer stops printing before pressing **PRINT** again.
- **PRINTER IS NOT RESPONDING** – AutoPilot cannot communicate with the printer. It is either turned off or not connected properly. Turn it on and press **PRINT** again. If it still does not print, check the connection and make sure the printer has power.

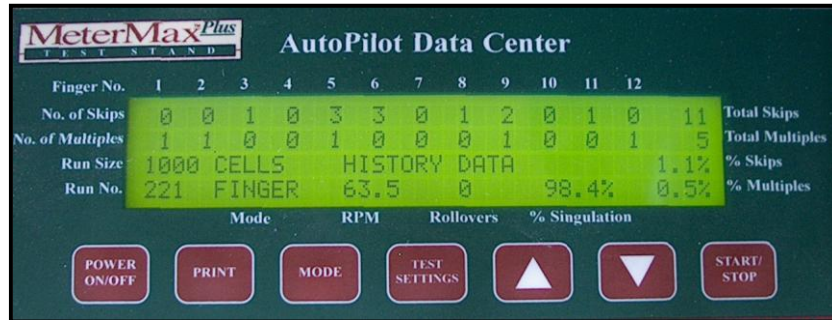
Information Messages:

Following is a list of Information Messages that will be shown on the display along with data while the test is being set up or run. A description of each follows.

- **HISTORY DATA** – This indicates that the data shown on the display is from a previous test that has been saved in memory. The test can be identified by the **Run No.** shown. It is not possible to make any changes to **HISTORY DATA**, but it can be printed.
- **PRESS START TO BEGIN TEST** – This indicates the AutoPilot Data Center has enough information to start a test. The test will start whenever **START / STOP** is pressed.
- **TEST RUNNING** – Indicates the test has started and data is being calculated.
- **DETERMINING SEED SIZE AND BELT SPEED** – This message appears when the test is first started and remains until the first 100 CELLS have been counted. Seed Data will not be displayed until after that. This allows AutoPilot to calculate more accurate data. However, **Run No.**, **Run Size**, and **RPM** will be displayed as soon as the test starts.
- **TEST COMPLETED** – Indicates the test is over. This test will become **HISTORY DATA** the next time you start a test or power AutoPilot Data Center down and back up again.
- **PRESS TEST SETTINGS TO SAVE** – This indicates the **TEST SETTINGS** switch has been pressed and either **Run Size** or **CELL DISK** number is flashing. During this time the Arrow Switches can be used to change these values. Press **TEST SETTINGS** to save the value for use in the next test.
- **PRESS MODE TO SELECT ANOTHER PARAMETER** – This appears only in the **VACUUM**, **PRO VAC**, **WHITE**, and **HI-RATE Mode**, and allows the **CELL DISK** number (parameter) to be changed to match the disk in the meter.

FINGER and 6-FINGER Mode Operating Instructions

1. Install a Finger Pickup meter on the test stand and fill it with seed.
2. Turn on the test stand tachometer switch (in the upper right corner of the panel).
3. Press the **POWER ON/OFF** switch to turn the AutoPilot Data Center **ON**. When the AutoPilot Data Center turns on, the display will show the **HISTORY DATA** from the last test run as shown below.



4. If **FINGER** or **6-FINGER** shows above the **Mode** label, a new finger test can be started directly from this screen by pressing the **START/STOP** switch, however, it will use the **Run Size** number shown on the display. If the **Mode** is not **FINGER**, press the **MODE** switch until **FINGER** appears above the **Mode** label on the display (Note, there are seven choices: **FINGER**, **VACUUM**, **PRO VAC**, **WHITE**, **Hi-RATE** and **SENSOR TEST**).
5. The **Run Size** number can be changed by pressing the **TEST SETTINGS** switch. The current **Run Size** number will be flashing, as shown below, indicating it can be changed to one of the following selections: **100**, **250**, **500**, **1000**, **2000**, **4000**, **8000**, or **9999 CELLS**.



6. To change the **Run Size**, press the **arrow keys** to select the desired **Run Size**. When the desired **Run Size** is shown, press **TEST SETTINGS** again to save the value you have selected. The following screen will appear and you are now ready to start the test.



7. To start the test, turn the Test Stand main switch on to rotate the meter. Adjust the **RPM** to the desired setting. After fresh seeds are being dropped and have passed the sensors on the end of the belt, press the **START/STOP** touch switch. The AutoPilot Data Center will immediately start counting and will display **TEST RUNNING** and a new **Run No.** will be shown, which will be one digit higher than the previous test run. As it is counting, it will also be computing the screen data. While data is being computed, the message **DETERMINING SEED SIZE AND BELT SPEED** will appear. Note: The test can be started directly from the Test Settings.



Periodically Visually Verify Meter Performance on Belt.

8. No data will be displayed on the screen until 100 cells have been counted. Then **Skips** and **Multiples** data will be shown. The individual **No. of Skips** and **No. of Multiples** data for each **Finger No.** and the Totals will be updated instantaneously while the test is running. The **RPM** value is determined at the start of the test and will not change. If the **RPM** varies, a warning message will appear. (Refer to the Error Message Section for more information.) The values for **% Skips**, **% Multiples**, and **% Singulation** will be a running average value for 50 cells. When the number of **CELLS** indicated for the **Run Size** has been analyzed, the test is complete, and will automatically stop and **TEST COMPLETE** will be indicated as shown below. At this point **% Skips**, **% Multiples**, and **% Singulation** will be calculated for the entire test. The test can be ended at anytime by pressing the **START/STOP** touch switch and the data up to that point will be displayed. If the test stand is shut off during the run, the entire test will be aborted.



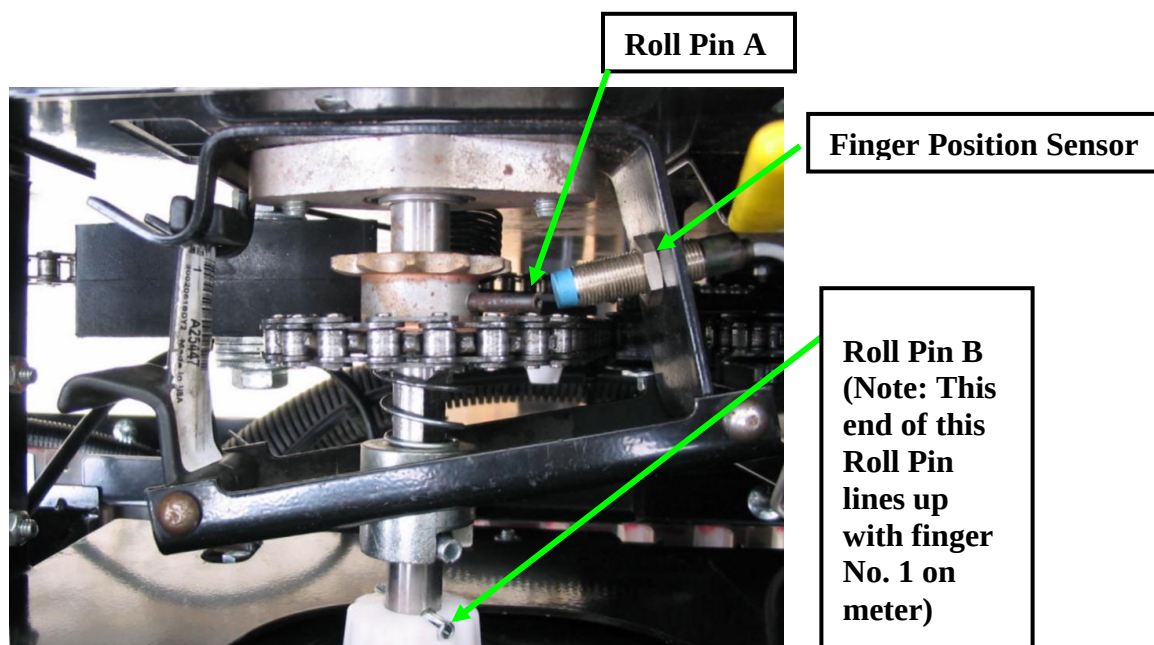
9. The test stand can now be stopped. The data on the screen is now saved in memory and can be printed or viewed at a later date. If another test is run, or the AutoPilot Data Center is turned off, the information from this test will be available as **HISTORY DATA** by selecting its **Run No.**
10. The results may be printed off, if desired. Make sure the printer is properly connected, turned on, and the desired Run No. is displayed. Then press **PRINT**.

Note on 6-FINGER MODE: The finger set of a 6-finger meter should be installed so that two fingers are aligned with the drive roll pin on the back of the meter (Roll Pin B in lower picture). If the finger set is not installed in this manner, the meter can be tested but ERROR-FINGER TIMING will be displayed on the screen.

Determining Finger Number

Since AutoPilot analyzes each finger, it may be necessary to locate a finger in the meter that corresponds to the AutoPilot. This is possible by identifying the No. 1 finger on the meter and then counting the fingers counterclockwise (viewed from the front of the meter) from finger 1 to locate any specific finger. Finger No. 1 delivers it's seed first, then Finger No. 2, etc.

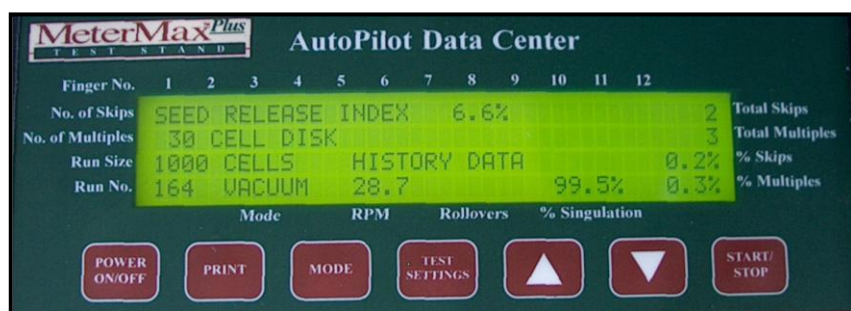
When a Finger Pickup meter is installed on the Test Stand, Finger No. 1 on the meter will always be in line with the correct end of **Roll Pin B** (as shown below) on the meter drive. The correct end of Roll Pin B always corresponds to the end of Roll Pin A that extends closest to the Finger Position Sensor. Roll pin A is located on the sprocket directly behind the meter. You can see both Roll Pins by looking down on the top of the Test Stand. Once the correct end of Roll Pin B has been identified, Finger No. 1 can be identified. Note: Finger No. 1 is the finger that closest matches the location and direction of the correct end of Roll Pin B. It may not be exactly in line. Identifying individual fingers is generally the easiest when utilizing a “flip lid” which allows visibility to the fingers without removing the meter from the stand. If the meter is removed and it is desired to maintain finger data correlation, mark the Finger No. 1 direction of Roll Pin B on the meter.



The MeterMax Finger Position Sensor monitors Roll Pin A. This sensor provides the RPM signal to the MeterMax Tachometer and the AutoPilot for RPM & Finger No. 1 timing.

VACUUM, PRO VAC, WHITE, and Hi-RATE Mode Operating Instructions

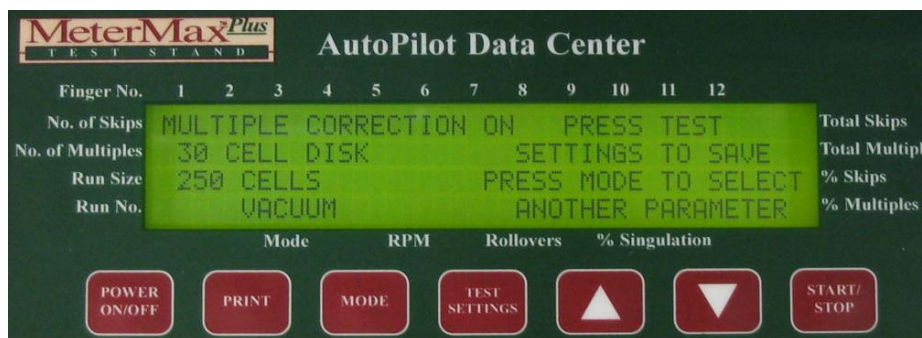
1. Install a vacuum/air meter on the MeterMax test stand and fill it with seed. Install the vacuum/air source. See Meter Setup and General Operation section of this manual.
2. Turn on the MeterMax tachometer switch (in the upper right corner of the panel).
3. Press the **POWER ON/OFF** switch to turn the AutoPilot Data Center **ON**. When the AutoPilot Data Center turns on, the display will be illuminated, and show the **HISTORY DATA** from the last test run as shown below.



4. If the appropriate Mode, **VACUUM**, **PRO VAC**, **WHITE**, or **HI-RATE** shows above the **Mode** label, a new test can be started directly from this screen by pressing the **START/STOP** switch, however it will use the **Run Size** number, **CELL DISK** number and **MULTIPLE CORRECTION** setting shown on the display. If the last test is not a **VACUUM** test, press the **MODE** switch until **VACUUM** appears above the **Mode** label on the display.

Note: **VACUUM**, **PRO VAC**, and **WHITE** modes all operate identical to each other except they have different sprocket ratios programmed into each mode. **HI-RATE** mode reports **Population** from either a John Deere or Case-IH/New Holland Vacuum meter or Great Plains Singulator-Plus meter.

5. In the **VACUUM**, **PRO VAC** or **WHITE** modes, three parameters need to be established before running a test, **Run Size** (No. of **CELLS** to be counted), meter **CELL DISK** size (number of holes in the disk inside the meter) and **MULTIPLE CORRECTION ON/OFF**. These can be changed by pressing the **TEST SETTINGS** switch. The **Run Size** number can be changed first. After the **TEST SETTINGS** switch has been pressed, the current **Run Size** number will start flashing, indicating it can be changed to one of the following selections: **100**, **250**, **500**, **1000**, **2000**, **4000**, **8000**, or **9999 CELLS**. Press the **arrow switches** to select the desired **Run Size**. Next, note the **CELL DISK** number and **MULTIPLE CORRECTION** mode shown on the display. If these settings are acceptable for your meter, you do not need to change them and you can save these test settings by pressing **TEST SETTINGS** and skip steps 6 and 7 below. (In **HI-RATE** mode **MULTIPLE CORRECTION** is not an option.)
6. If the **CELL DISK** number needs to be changed, press **MODE** when the **Run Size** number is flashing and the **CELL DISK** number will start flashing. This indicates you can change it using the **arrow switches**. The **CELL DISK** number can be changed to any number from **5** to **135** and should be the same as the number of holes in the meter disc. When the desired number is on the screen, and if the **MULTIPLE CORRECTION** setting is acceptable, you can save these test settings by pressing **TEST SETTINGS** and skip step 7 below.



7. Press **MODE** to increment to the **MULTIPLE CORRECTION** setting, which will cause the setting to start flashing. Use the arrow keys to select **ON** or **OFF**. Press **TEST SETTINGS** after you have made this choice.

MULTIPLE CORRECTION ON indicates that AutoPilot will utilize both the belt and seed boot sensors in tandem to correct any doubles the boot sensor may fail to detect. After the Seed Boot Sensor detects the last seed, there is a delay before the test is completed. Next AutoPilot analyzes all seeds that went past both the belt sensors and the boot sensor. If more seeds were detected with the belt sensors, then the boot sensor failed to detect all the multiples. The additional number of seeds detected by the belt sensors will be added to the total multiples count at the end of the test. Note that in order for the Multiple Correction feature to provide the most benefit, the Seed Aligning Brush setting should be checked so that all seeds pass the seed sensor one at a time. Multiple Correction is not available in **HI-RATE** mode.

MULTIPLE CORRECTION OFF indicates that only data from the Boot Sensor will be analyzed.

8. The screen will change, as shown below, and will now say **PRESS START TO BEGIN TEST**. This indicates the test settings have been saved and will be used in the next test.

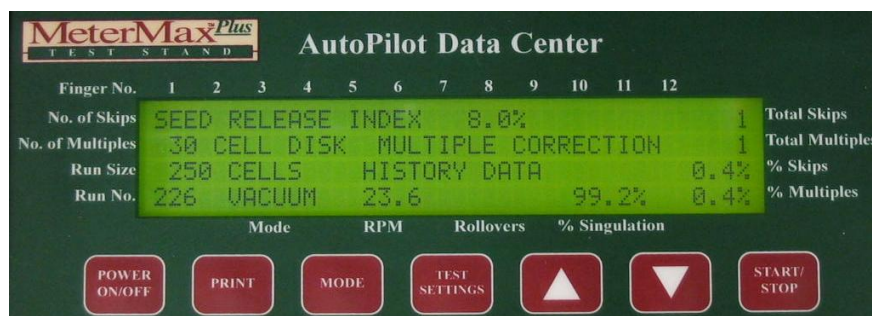


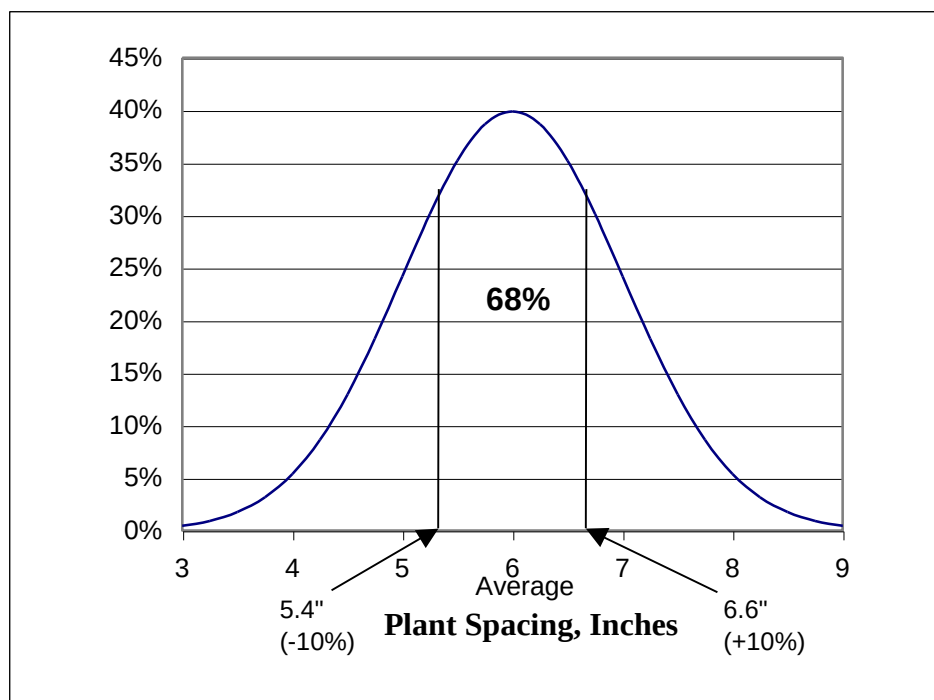
9. To start the test, first turn on the Test Stand main switch to rotate the meter. This should also turn on the vacuum/air source. After seeds begin dropping, press the **START/STOP** touch switch. The AutoPilot Data Center immediately starts counting. This will be indicated by the **Run Size** number of **CELLS** increasing and a new **Run No.** will be displayed which will be one digit higher than the last test run. As it is counting, it will also be computing the initial screen data. While data is being computed, the message **DETERMINING SEED SIZE AND BELT SPEED** will appear on the display as shown below indicating data is being computed.



Periodically Visually Verify Meter Performance on Belt.

10. When the initial data has been calculated, the **Total Skips** and **Total Multiples** data will be shown. The Totals will be updated instantaneously while the test is running. The **RPM** value is determined at the start of the test and will not change. If the **RPM** varies, a warning message will appear. Refer to the warning message section for more information. The values for **% Skips**, **% Multiples**, and **% Singulation** will be a running average value for 50 cells. During the test, the **SEED RELEASE INDEX** percentage will be shown on the screen. This is a number indicating the consistency of the spacing between the seeds. The lower the number, the more consistent the seeds were released. A normal range for this number is from 5% to 12%. This is explained in detail in the next section
11. When the number of CELLS indicated for the RUN SIZE has been counted, the test is over, and will automatically stop and TEST COMPLETE will be indicated as shown below. If the Start/Stop button is pushed during the test, the run will end at that point and the test results will appear. If the test stand is shut off during the test, the run will be aborted and no data will be computed or saved. The test stand can now be turned off. The data on the screen is now saved in memory and can be printed or viewed at a later date.





Example of a 10% Seed Release Index with 6" average spacing results in 68% of the seed's spacing will lie within 5.4" – 6.6"

Seed Release Index Explained: The Seed Release Index is the standard deviation of the seed spacing divided by the average seed spacing (Note: The term *Seed Spacing* refers to the spacing of seeds falling through the boot or seed tube and may not correlate to spacing in the ground.) This number is the percentage of deviation from perfect seed spacing in which the meter released each seed. Remember that actual deviation of plant spacing is also effected by other factors such as the seed tube and seed bounce/roll in the furrow.

The lower the number, the better the spacing will be. Typical Seed Release Index can range from 5% on the low end to 12% on the upper end, depending on the seed, meter, speed, vacuum level, and meter. Rounds typically will have a higher SRI than flats. Usually SRI increases with meter speed. Poor SRI can be caused by warped disks, worn seals, excessive vacuum pressure, or static electricity. If a meter has a SRI higher than 12%, first make sure that seeds are falling past the Seed Boot Sensor without bouncing against the seed boot.

Example: If a grower has his planter set for an average seed spacing of 6" and the Seed Release Index (SLI) is 10%. Assuming that the seed tube and seed bounce are negligible, the grower can expect that 68% (one standard deviation) of all plants will be within 10% (or .6") of the average spacing of 6" which results in a range of 5.4" to 6.6". 95% (two standard deviations) of all plants will be within 20% (SLI x 2) of the average spacing of 6" which results in a range of 4.8" to 7.2".

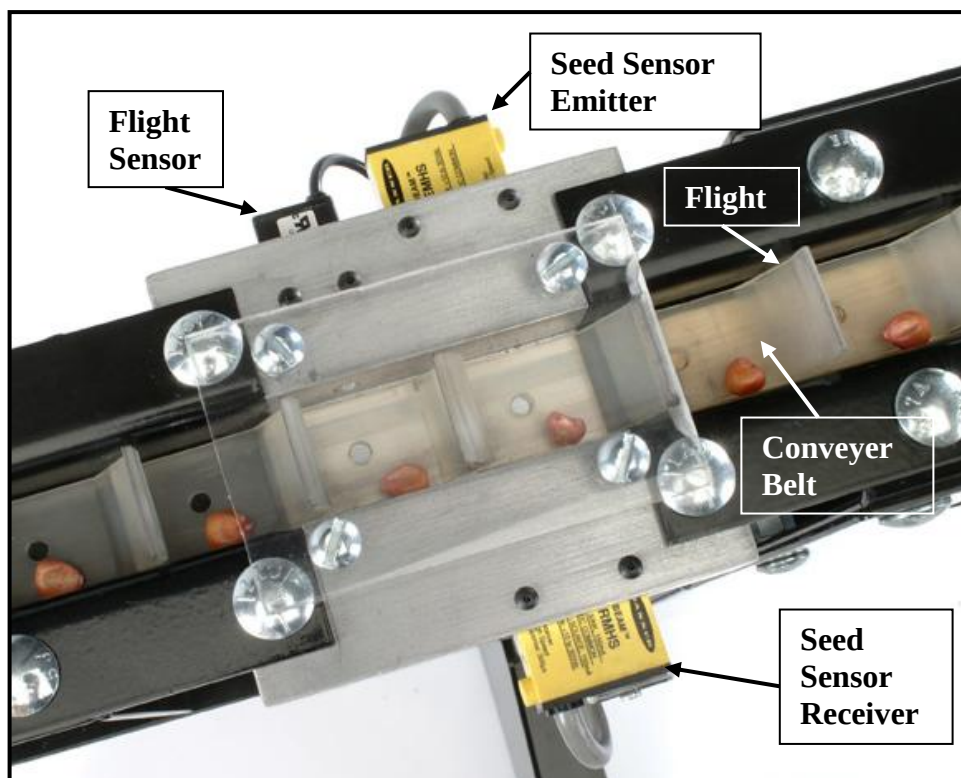
Sensor Test Mode

The Sensor Test Mode is useful to check the operation of the AutoPilot sensors to determine if they are working correctly. A visual output display is shown for each sensor.

1. To enter this mode, press the **MODE** switch until **SENSOR TEST** appears above **Mode** on the display as shown below.



2. The display lists the four sensors used with AutoPilot and shows an output number to the right of each label. When a sensor is working and sensing properly, its number will increase in value as the sensor is triggered. Following is information on each sensor and how to determine if it is working properly. Refer to the photo below for the location of the sensors on the belt. This photo shows the belt sensors as viewed from the top of the belt.



Sensors Located on Conveyor Belt

Note: Purpose of Plexiglas cover over Sensor Block is to prevent belt from rising off of bottom of trough, potentially causing seeds to be missed.

Note: Use the AutoPilot SENSOR TEST Mode display to observe the changes to the sensor outputs described in this section.

SEED SENSOR ON BELT – This sensor detects the seeds on the conveyer belt. It consists of two separate units, The Seed Sensor Receiver on one side of the belt, and the Seed Sensor Emitter on the other side. When the test stand belt is running and seed is in the cells, each time a seed passes between these two sensors, the number on the display for SEED SENSOR ON BELT should increase by 1. If you adjust the belt RPM slow enough, you will be able to see each seed being counted. Also note that a small light located on the backside of the Seed Sensor Receiver turns off when a seed is detected. Across from the Seed Sensor is the Seed Sensor Emitter. It provides a light beam across the conveyer belt which the seed interrupts. The Seed Sensor Emitter has a light on the backside of it which should be on steady when the AutoPilot is ON. For troubleshooting, the belt can be turned off and moved by hand to slowly move a seed through the Seed Sensor infrared light beam, watching for the light to turn off on the Seed Sensor Receiver.

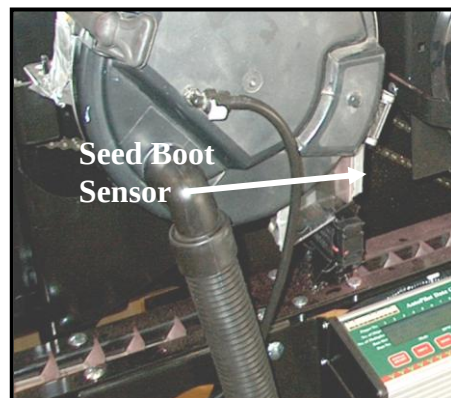
Note that the flight of the belt may or may not block enough light to turn off the seed sensor as the flight passes the seed sensor. Since the belt flight is always ignored in the AutoPilot seed counting algorithm, this does not matter.

If the sensors are powered but seeds are being missed, make sure the .040" (1 mm) orifice located in front of the Seed Sensor Receiver is not partially plugged by blowing air through it.

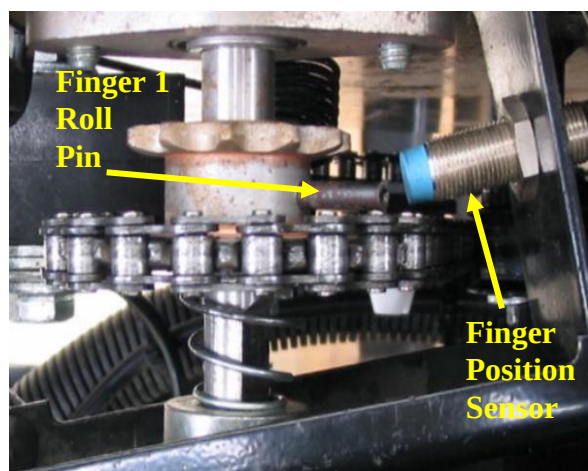
FLIGHT SENSOR ON BELT – Refer to the photo on the previous page to locate this sensor. It is mounted next to the Seed Sensor Emitter on the belt. This sensor detects the Flights on the belt, which are the vertical dividers. It contains both a light emitter and a detector, and detects the flights by bouncing light off of them when they pass by. On the backside of the sensor a green light will be lit when no flight is detected and turn yellow when a flight is detected. To check this sensor, run the belt and watch the number to the right of FLIGHT SENSOR ON BELT on the display. It should increase at a steady rate when the belt is turning slow and count all the flights on the belt at a steady rate. Another way to check it is to mark a line on the belt (with chalk, paint pen, or marker). Use the mark to indicate a starting point and run the belt one or more revolution(s). The display should indicate 140 flights have been counted for one revolution of the belt, 280 flights for two revolutions, 420 flights for three revolutions, etc. It is good to run at least two revolutions of the belt at a normal operating speed while performing this test. If the result of this test is that the flight sensor is not seeing every flight, clean the sensor lens with a soft cloth and make sure no debris is in the hole of the sensor block. Also make sure that the flight sensor is set at maximum gain by holding down the push button on the back of the sensor until the green LED flashes rapidly 5 times.

If the test stand has a new, clear belt, it may be that too much light is going into the belt and not enough light is bouncing back off of the flight. Coloring the sides of the flights black with a permanent black marker in the region that the flight sensor light reflects off the belt (.350" to .600" from the bottom side of the belt) will help prevent this.

SEED BOOT SENSOR – The Seed Boot Sensor is the sensor used to detect the seeds that fall from a Vacuum/Air seed meter. The Photo at the right shows where it is located. When the meter is being rotated and seeds are falling onto the conveyer belt, the number should be steadily increasing on the display to the right of SEED BOOT SENSOR. To check this sensor, remove the meter but leave the Seed Boot sensor on the stand. Drop seeds into the sensor one at a time and watch the display. It should increase by one for each seed dropped.



FINGER POSITION SENSOR – The signal from this sensor is used by AutoPilot Data Center to determine the belt RPM and determine Finger No. 1 position. The output signal of this pickup is one pulse per revolution of the finger meter drive, so the FINGER POSITION SENSOR number should increase one digit every time the Finger 1 Roll Pin passes the Finger Position Sensor. The photo at right shows the sensor and the Roll Pin. It is located on the sprocket directly behind the meter. You can see it by looking down on the top of the Test Stand. The Finger Position Sensor is also used by the MeterMax tachometer sensor.



Printing

The information that is on the display can be printed to a small Epson serial printer that uses adding machine type roll paper. It is shown below. To print, make sure the printer is connected as described below and press the **PRINT** switch. To print more than one copy, you must wait until one printout is completely finished before pressing the **PRINT** switch again or a warning message will appear. See the **Display Messages** section for more information.

All of the information that is on the display will be printed. There are lines on the printout to add CUSTOMER name, ROW NO., and SEED TYPE. Typical Printouts of Finger and Vacuum meter data is shown below. However they are not shown to scale. The actual size of the printout will be larger: 2.8 In. (71mm) wide, x 9 In. (230mm) long max.

AutoPilot Data Center Serial Printer



The printer for AutoPilot Data Center is an Epson Model TM-U200D.

It uses standard 3 Inch roll adding machine type paper.

The print cartridge is replaceable with an Epson Model ERC-38 B-R.

Finger Printout

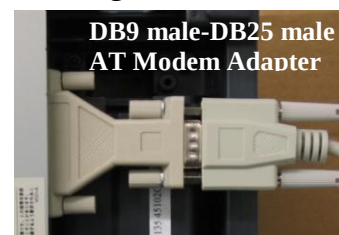
MeterMax ^{Plus} TEST STAND		
CUSTOMER:	_____	
ROW NO:	_____	
SEED TYPE:	_____	
RUN NO:	221	
RPM:	63.5	
RUN SIZE:	1000 CELLS	
FINGER	SKIPS	MULT.
1	0	1
2	0	1
3	1	0
4	0	0
5	3	1
6	3	0
7	0	0
8	1	0
9	2	1
10	0	0
11	1	0
12	0	1
TOTAL	11	5
SKIPS:	1.1%	
MULTIPLES:	0.5%	
SINGULATION:	98.4%	
V V V V V V V V V V		
www.precisionplanting.com		

Vacuum Printout

MeterMax ^{Plus} TEST STAND		
CUSTOMER:	_____	
ROW NO:	_____	
SEED TYPE:	_____	
VAC SET:	_____	
CELLS:	30	
RUN NO:	164	
RPM:	28.7	
RUN SIZE:	1000 CELLS	
	SKIPS	MULT.
TOTAL	2	3
SKIPS:	0.2%	
MULTIPLES:	0.3%	
SINGULATION:	99.5%	
RELEASE INDEX:	6.6%	
V V V V V V V V V V		
www.precisionplanting.com		

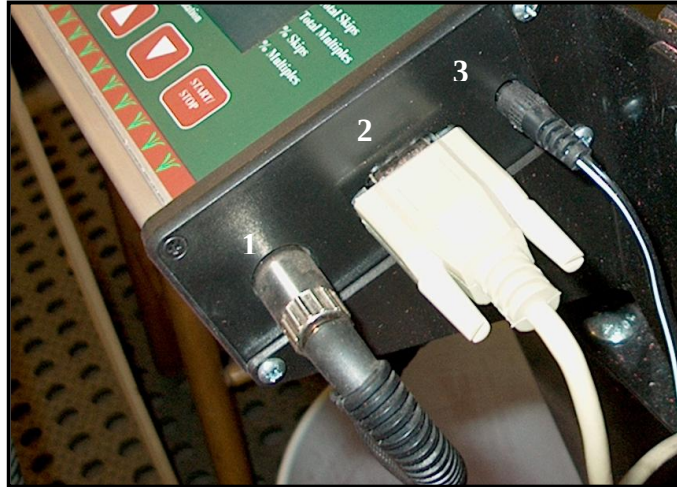
The printer is supplied with a module type power supply. It can be powered from the 110VAC outlet on the side on the Test Stand. When the printer is powered, the POWER light located on the front of the printer will be on.

The printer is connected to the AutoPilot Data Center with a standard DB9 male – DB9 Female serial cable, however a DB9 male – DB25 male AT modem adapter is required to convert to the connector on the printer. This adapter plugs into the printer. Refer to the next section **Connections to AutoPilot** for the location of the printer connector.



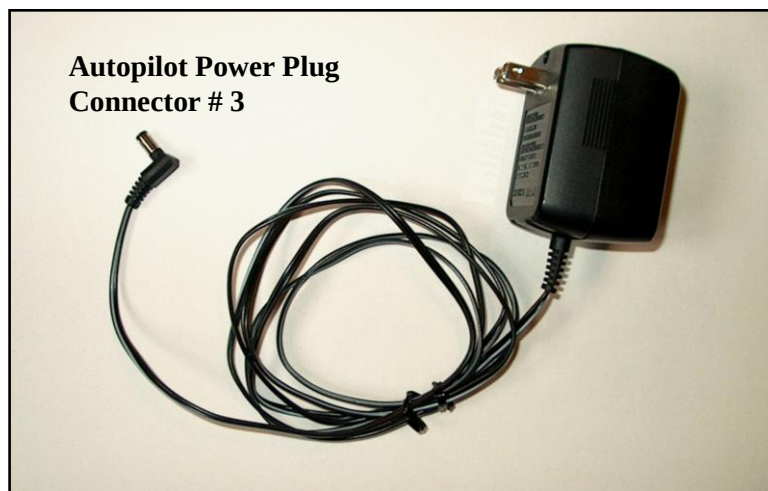
Connections to AutoPilot

All of the connections required to power and control the AutoPilot Data Center are located on the right end panel as shown below. There are three connectors that are identified below. The description of each follows:



Connector Panel Connections

1. **Sensor Connector** – 8 pin DIN cable connects to the sensors on the MeterMax Test Stand.
2. **Printer Connector** – Connects to the serial printer – DB9male – DB9female serial cable connected to DB9male – DB25male AT modem adapter on printer.
3. **Power Connector** – Connects to the small barrel type plug on the wall mounted 110VAC 60Hz 12VAC, 750mA power supply shown below. This power supply should be powered from the 110V outlet mounted on the side of the test stand.



AutoPilot Data Center Power Supply

Trouble Shooting

Periodically Visually Verify Meter Performance on Belt.

Use this section if AutoPilot results does not match what is being seen on the belt in conjunction with **no error messages** on the display. If there are error messages, refer to the Display Messages-Error Messages section of this manual. If the below information does not resolve the problem, perform a test on all sensors, following the Sensor Test Mode section. Also try rebooting AutoPilot by unplugging the power cord briefly.

Finger Mode

Excessive Multiples

- This is most often caused by the small .040" hole (1 mm) on the belt sensor mount being partially blocked. Blowing air through at the hole will usually correct this. If this does not correct the problem, make sure the seed sensor emitter and receiver lens are clean.
- If the Plexiglas Belt Sensor Cover is missing and the belt comes too far off the bottom of the sensor block, false multiples may occur. Install the Belt Sensor Cover. (Page 31)
- A jerky belt may cause multiples. Correct the cause of the uneven load.
- Check the number of rollovers occurring. More than 3 per 1000 seeds indicates the stand may be out of timing. This can affect results. (Page 8)

Excessive Skips

- Verify that the seeds, as they are carried by the belt past the sensors, are not dancing around, but riding smooth. This can be caused if the Belt Sensor Cover is installed backwards. The beveled edge should be pointing towards the meter face down. The test stand belt tension set too tight or too loose can also cause excessive skips.
- Check for seed fragments under the belt in front of the sensor block causing the belt to ride high.
- The belt not running smooth (or shaky) may cause skips. Correct the cause of the uneven load.
- If the Sensor Block Cover is missing and the belt comes too far off the bottom of the sensor block, false skips may occur. Install the Sensor Block Cover. (Page 31)
- Check the number of rollovers occurring. More than 3 per 1000 seeds indicates the stand may be out of timing. This can affect results. (Page 8)
- If the Seed Aligning Brush is set too low, seeds could possibly be thrown out and missed.

Vacuum, Pro Vac, White, and HI-RATE Modes

Excessive Multiples or Excessive Skips

- Verify that the mode is correct to the meter being tested and the correct number celled disk is set in AutoPilot.
- Verify that the seed boot is installed correctly and seeds are falling past the seed boot sensor before they hit anything. When this is happening, a skip and a multiple will occur nearly at the same time. On a John Deere vacuum meter, this

can be seen by removing the small black cover where the seeds come out. On a White air meter, remove the small galvanized shield for visibility. On a Case-IH/New Holland vacuum meter, the only way to see how the seeds are falling through the seed boot sensor is to cut a triangle out of the cover (this can be seen in the meter used for the photos in the setup sections). Unfortunately, this is not an option on a customer's meter.

- A bright light shining onto the seed boot sensor receiver can cause false skips.

Parts List

Attachment Options

Part Number	Description
300WH02	White Air Meter Kit
300C02	Case-IH/New Holland ASM Vacuum Meter Kit
300V01	John Deere ProSeries Vacuum Meter Kit
W01FP010C	John Deere Radial Bean Meter Mount

Replacement Parts

Part Number	Description
W01MTY22420	¼ ID black tubing for vacuum, sold per foot
W01FP050C	7200 Drive Adapter
W01M41CH	#41 Roller Chain, sold per foot
W01FP054C	Deere Vac Meter Mount Hook-Right
W01FP053C	Deere Vac Meter Mount Hook -Left
W01M9540K28	Rubber Bumper, Legs
W01MRA010	Bearing – Spherical Self Aligning, 5/8” ID(RA010RRB)
W01PBELT	Belt, 140 Cell
W01SDT4RL2	Digital Tachometer
W01M5372K311	Elbow- 1/8 NPT X 1/4 Hose barb (white plastic)
W01MJK2M3	Zero Max Motor and Drive 1/3 HP - New
W01MJK2M3R	Zero Max Motor and Drive 1/3 HP - REBUILT
W01SB12S12	Finger Position Sensor (Proximity Switch)
W01F204619	Seed Scoop
W01IWBLK	Chain idler Block
W01FP022C	Top Cover (above tachometer)
W01M9208T15	Mirror
300020	AutoPilot Data Center
300030	Brush
300021	Belt Sensors with Harness
300006	Belt Sensor Cover, Plexiglas

Updating the AutoPilot Software Version (Flashing AutoPilot)

The AutoPilot Data Center contains an internal software program that controls how AutoPilot functions. Periodically this program may need to be updated to provide more features or to correct operating problems encountered with its use. With the appropriate software, AutoPilot can easily be updated with the use of any PC with a Windows operating system that has a RS232 serial port. AutoPilot is “Flash Programmed” by connecting the RS232 Printer Connector to the PC RS232 port with a cable and running a program on the PC. Following are instructions on how to do this.

Checking the Software Version Number

The version number of the software currently in your AutoPilot Data Center is shown every time it is turned on. The first screen that appears shows the **SOFTWARE VERSION** number. A photo of this screen can be seen in the **Introduction** section of this manual. An example of a version number would be 1.040. Check with Precision Planting for the latest version number.

Equipment required for Flashing

In order to Flash Program AutoPilot with the latest software version, you will need the following equipment:

1. A Windows 95, 98, 2000, or XP PC with at least one available RS232 serial port.
2. Hyper Access or HyperTerminal software installed on the Windows PC – This is normally provided standard with all Windows operating systems – more information on this is shown below.
3. A standard RS232 Serial Cable with DB9male – DB9female connectors (note – this cable is the same cable provided with the AutoPilot printer).
4. The current AutoPilot software version flash file.

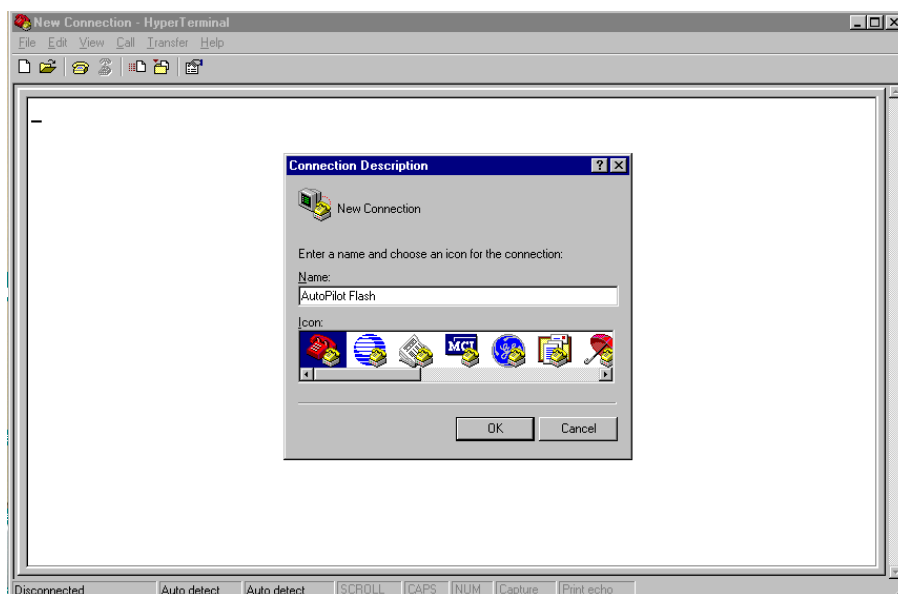
Locating HyperAccess software program

Check if your PC has a preloaded copy of **HyperAccess** or **HyperTerminal** on it. Click on the **Start** button on the lower left corner of the screen. Next, place the mouse pointer on **Programs**, then on **Accessories**, then on **Communications**. If your PC has a **Hyper** program installed it will be listed here. You can start the program by double clicking on **HyperAccess** or **HyperTerminal**.

If your PC does not have a Hyper communications program, you can download it from the internet. It is available at www.hilgraeve.com. At the main screen, select **HyperAccess**, and it will take you to a screen where you can download a free copy. Download the program to your PC and install it. The program you download may be named **Hyper Terminal Private Edition** even though you selected **HyperAccess**. Either program will work. **Hyper Terminal** is a lower powered free version of **HyperAccess**.

Flashing AutoPilot

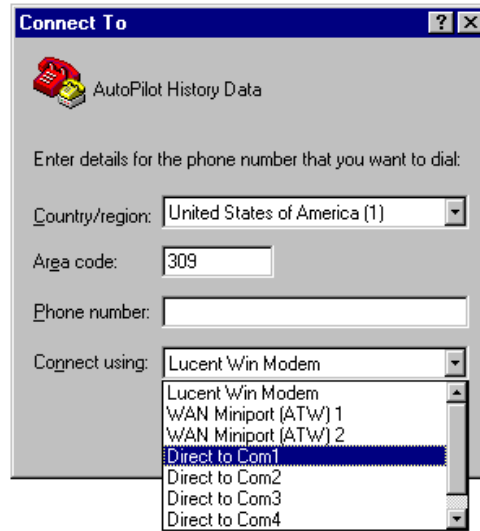
1. Connect the RS232 Serial Port on the PC to the Printer Port on AutoPilot using the printer cable provided with AutoPilot printer. If there is more than one serial port on your PC use the one with the lowest letter or number identifying it such as COM1 or A.
2. Connect AutoPilot power supply to 110Volts AC and plug in the power connector to AutoPilot. Make sure AutoPilot turns ON, then turn AutoPilot OFF. It must be **OFF** during the flashing procedure. There is a small red LED light on the end panel near the printer connector. When AutoPilot is OFF, the red light will be on. That indicates AutoPilot is ready to be flashed.
3. Determine what **RS232 Communications Port (COM 1, COM 2, COM 3, or COM 4)** you are connected to. If you do not know this, it can be determined by starting the PC and right clicking the mouse on the **My Computer** icon on the desktop. Select **Properties** at the bottom of the list, then select **Device Manager**. Look down the list and locate **Ports (COM & LPT)**. To the left of **Ports**, click on the + sign and all the ports that are enabled will be shown. It should read **Communications Port (COM 1)** or **2,3, or 4**. The first port listed will be the name of the lowest numbered serial port you have connected your cable to. Remember this **COM** number for use later. You can now close this box by selecting **OK**.
4. Start the **Hyper Access** or **Hyper Terminal** program. The startup screen should look like the screen shown below. If the Connection Description box does not appear. From the **File** dropdown menu select **New Connection**.



Hyper program startup screen

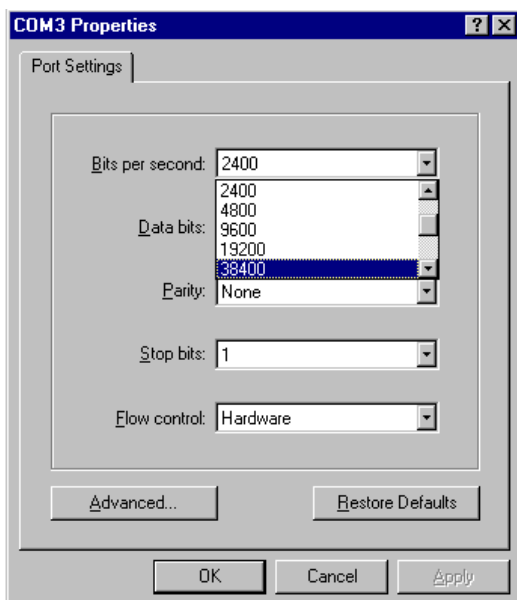
5. In the **Connection Description** box, enter a name in the space provided, such as **AutoPilot Flash** then select **OK**. The **Connect To** box will appear.

- Select the arrow at the right of the **Connect using:** window and the drop down menu of Communication Ports options will be shown. Select **Direct to Com 1**, or 2,3,or 4 for the port you will be using as discussed in a previous step. Then select **OK** and the **COM Properties** box will appear.

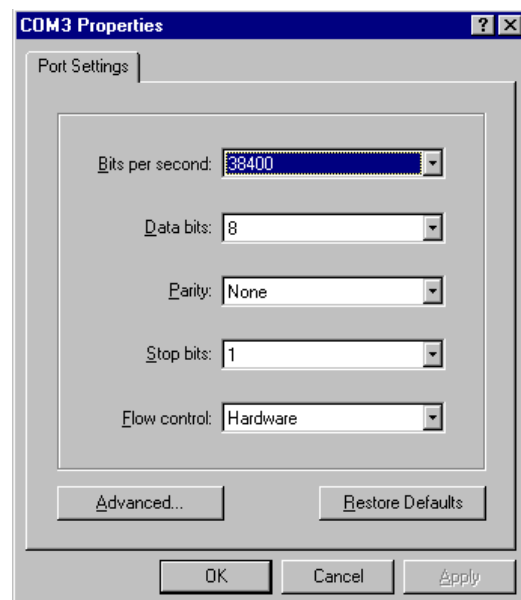


Connect To Box

- Select the arrow at the right of Bits per second, and select 38,400. This is the only speed that will work for flashing AutoPilot. The rest of the boxes should read: **Data bits: 8, Parity: None, Stop bits:1, Flow control: Hardware**. If these are correct, press **OK** and the box should disappear, leaving a clear screen and establishing a connection with AutoPilot.



COM Properties box



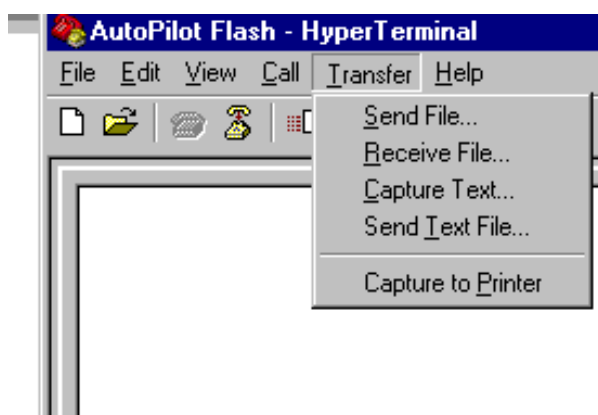
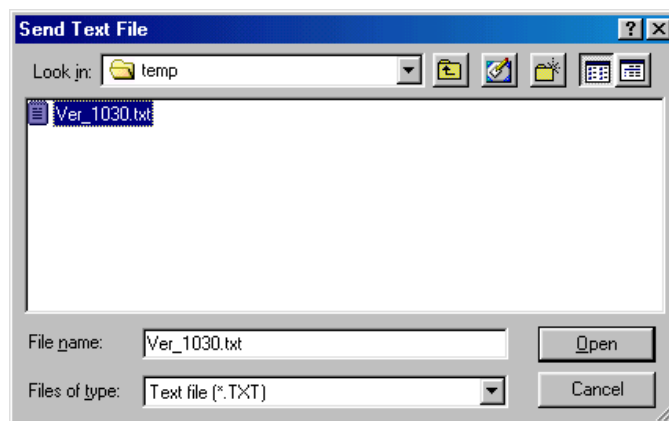
38400 Bits per second selected

8. You can tell if you have successfully connected by looking in the lower left corner of the screen. As shown below, it will read **Connected**, and show how long it has been connected. If it does not connect properly an error box will appear describing the problem.



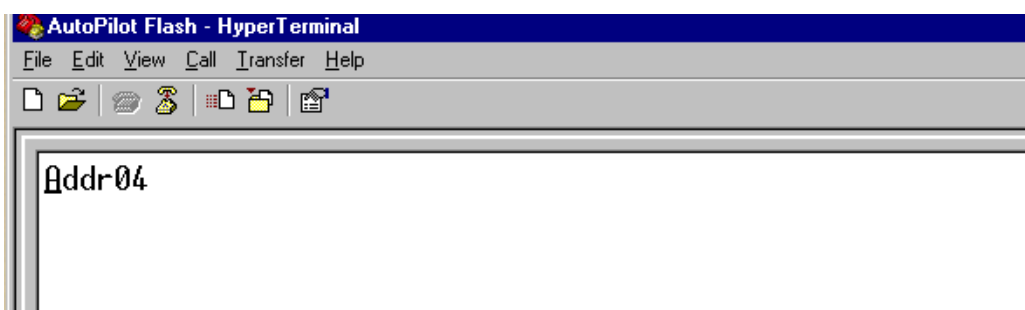
Connection established indicator

- 9.
10. You are now ready to select the flash file. On the menu bar, select **Transfer**, and on the drop down menu select **Send Text File...**. The Send Text File box will appear.

Select **Transfer**, **Send Text File...**

Send Text File box

11. Use the Send Text File box to enter the file name and location of the most current AutoPilot Flash file. If you do not know the exact location, you can use the **Look in:** drop down menu to browse and locate the file. Once you locate the file, select it with a single click and its name will appear in the File name box.
12. Next, select **Open**, and the program will automatically start downloading into AutoPilot. This will be indicated by **Addr 01** appearing, then **Addr 02**, and it will slowly count up to **Addr 72**, then **SUCCESS** will appear on the screen, indicating the download is finished.



Flash downloading screen indication

If nothing happens, make sure that AutoPilot has power but is not powered on. Verify that the correct COM port is set and connected. Unplug AutoPilot temporarily to reboot it. Close down HyperTerminal and open it back up to try again.

13. After **SUCCESS** shows on the screen, disconnect the cable from the AutoPilot printer output connector and turn AutoPilot **ON**. The new version number that you downloaded should show on the **SOFTWARE VERSION** screen. This completes the updating of AutoPilot and all the new features will now be included in the operation.

INSTRUCTIONS FOR PROGRAMING TACHOMETER

The tachometer on the MeterMax test stand comes preset from the factory. These instructions should only be needed if the tachometer is ever replaced.

You will need to snap off the front cover to get to the programming buttons. Follow the Operation flow chart to program the following settings:

dP: set to **8888.8**

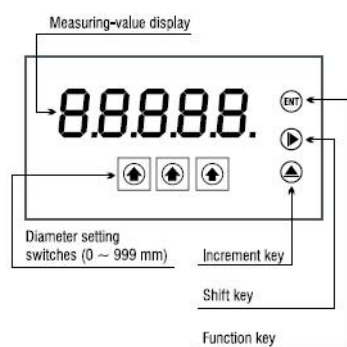
DiS-t: set to **"r-t"**

Unit: set to **"nn"**

PPR: set to **"1"**

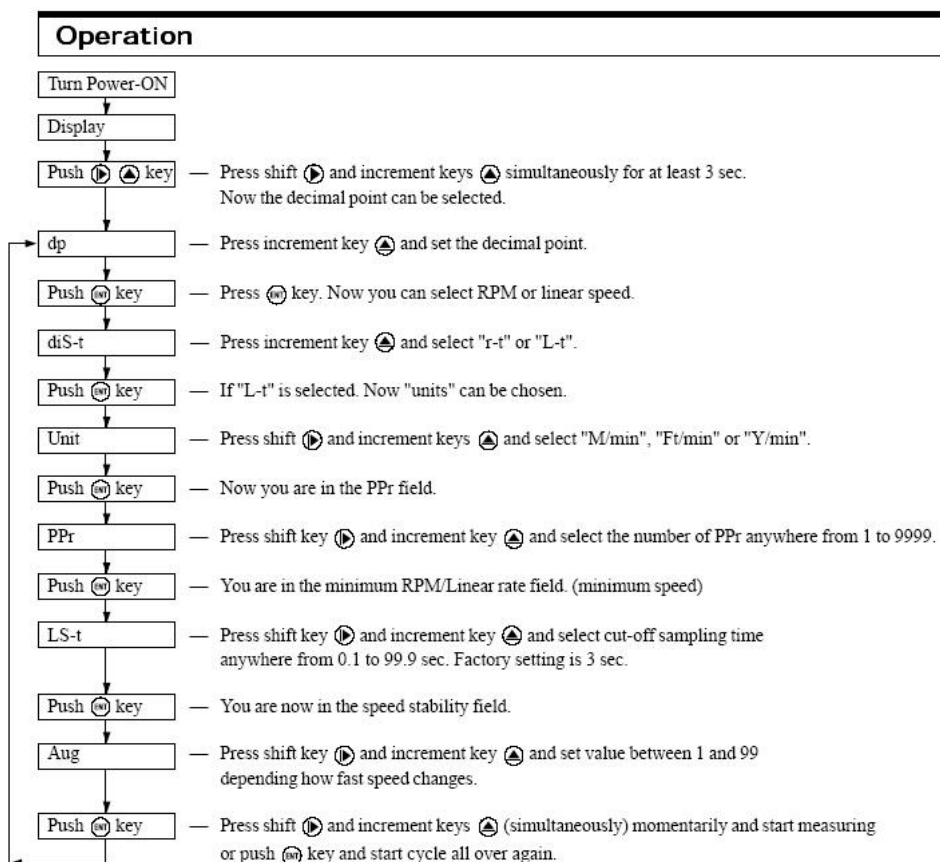
LS-t: set to **"1.0"**

Aug: set to **"02"**



Symbol Detail

- ⊙ "dP" (decimal point selection)
- ⊙ "diS-t" (display "function" selection)
 - "r-t" (RPM)
 - ★ • "L-t" (linear-speed)
- ★ ⊙ "unit" (display unit)
 - "nn" (M/min)
 - "Ft" (Ft/min)
 - "Y" (Y/min)
- ⊙ "PPr" number of pulses per revolution
- ⊙ "LS-t" sampling time (0.1 ~ 99.9 seconds)
- ⊙ "Aug" select according to how fast the observed speed changes. Set anywhere between 1 and 99.
- ★ Set diameter of feeding roller through the three rotary switches.



Finger Pickup Meter

Row Width							Miles per Hour					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	14	19	23	28	33	37
25,397	19,047	17,316	12,698	10,582	10,025	9,524	16	21	27	32	37	43
28,571	21,428	19,480	14,286	11,905	11,278	10,714	18	24	30	36	42	48
31,746	23,809	21,645	15,873	13,227	12,531	11,905	20	27	33	40	47	53
34,920	26,190	23,809	17,460	14,550	13,784	13,095	22	29	37	44	51	59
38,095	28,571	25,974	19,047	15,873	15,037	14,286	24	32	40	48	56	64
41,269	30,952	28,138	20,635	17,196	16,290	15,476	26	35	43	52	61	69
44,444	33,333	30,303	22,222	18,518	17,544	16,666	28	37	47	56	65	75
47,618	35,714	32,467	23,809	19,841	18,797	17,857	30	40	50	60	70	80
50,793	38,094	34,631	25,396	21,164	20,050	19,047	32	43	53	64	75	86
53,967	40,475	36,796	26,984	22,486	21,303	20,238	34	45	57	68	79	91
57,142	42,856	38,960	28,571	23,809	22,556	21,428	36	48	60	72	84	96
60,316	45,237	41,125	30,158	25,132	23,809	22,619	38	51	63	76	89	102
63,491	47,618	43,289	31,746	26,455	25,062	23,809	40	53	67	80	94	107
66,665	49,999	45,454	33,333	27,777	26,315	25,000	42	56	70	84	98	112
69,840	52,380	47,618	34,920	29,100	27,568	26,190	44	59	73	88	103	118
73,014	54,761	49,783	36,507	30,423	28,822	27,380	46	61	77	92	108	123
76,189	57,142	51,947	38,095	31,745	30,075	28,571	48	64	80	96	112	128
79,363	59,522	54,112	39,682	33,068	31,328	29,761	50	67	84	100	117	134
82,538	61,903	56,276	41,269	34,391	32,581	30,952	52	69	87	104	122	139
85,712	64,284	58,441	42,856	35,714	33,834	32,142	54	72	90	108	126	144
88,887	66,665	60,605	44,444	37,036	35,087	33,333	56	75	94	112	131	150
92,061	69,046	62,769	46,031	38,359	36,340	34,523	58	77	97	116	136	155
95,236	71,427	64,934	47,618	39,682	37,593	35,714	60	80	100	120	140	160
98,410	73,808	67,098	49,205	41,005	38,846	36,904	62	83	104	124	145	166
101,585	76,189	69,263	50,793	42,327	40,100	38,095	64	86	107	128	150	171
104,759	78,570	71,427	52,380	43,650	41,353	39,285	66	88	110	132	154	176
107,934	80,950	73,592	53,967	44,973	42,606	40,475	68	91	114	136	159	182
111,108	83,331	75,756	55,555	46,295	43,859	41,666	70	94	117	140	164	187
114,283	85,712	77,921	57,142	47,618	45,112	42,856	72	96	120	144	168	192
117,457	88,093	80,085	58,729	48,941	46,365	44,047	74	99	124	148	173	198
120,632	90,474	82,250	60,316	50,264	47,618	45,237	76	102	127	152	178	203
Population							RPM* Test Stand Tachometer (Red Display)					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

<i>Vacuum Meter - 30 Cell Disk</i>												
<i>Row Width</i>							<i>Miles per Hour</i>					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	14	19	24	29	33	38
25,397	19,047	17,316	12,698	10,582	10,025	9,524	16	22	27	33	38	44
28,571	21,428	19,480	14,286	11,905	11,278	10,714	18	24	31	37	43	49
31,746	23,809	21,645	15,873	13,227	12,531	11,905	20	27	34	41	48	54
34,920	26,190	23,809	17,460	14,550	13,784	13,095	22	30	37	45	52	60
38,095	28,571	25,974	19,047	15,873	15,037	14,286	24	33	41	49	57	65
41,269	30,952	28,138	20,635	17,196	16,290	15,476	27	35	44	53	62	71
44,444	33,333	30,303	22,222	18,518	17,544	16,666	29	38	48	57	67	76
47,618	35,714	32,467	23,809	19,841	18,797	17,857	31	41	51	61	71	82
50,793	38,095	34,631	25,396	21,164	20,050	19,047	33	44	54	65	76	87
53,967	40,476	36,796	26,984	22,486	21,303	20,238	35	46	58	69	81	93
57,142	42,856	38,960	28,571	23,809	22,556	21,428	37	49	61	73	86	98
60,316	45,237	41,125	30,158	25,132	23,809	22,619	39	52	65	78	90	103
63,491	47,618	43,289	31,746	26,455	25,062	23,809	41	54	68	82	95	109
66,666	49,999	45,454	33,333	27,777	26,315	25,000	43	57	71	86	100	114
69,840	52,380	47,618	34,920	29,100	27,568	26,190	45	60	75	90	105	120
73,015	54,761	49,783	36,507	30,423	28,822	27,380	47	63	78	94	110	125
76,189	57,142	51,947	38,095	31,745	30,075	28,571	49	65	82	98	114	131
79,364	59,523	54,112	39,682	33,068	31,328	29,761	51	68	85	102	119	136
82,538	61,904	56,276	41,269	34,391	32,581	30,952	53	71	88	106	124	141
85,713	64,285	58,441	42,856	35,714	33,834	32,142	55	73	92	110	129	147
88,887	66,666	60,605	44,444	37,036	35,087	33,333	57	76	95	114	133	152
92,062	69,046	62,769	46,031	38,359	36,340	34,523	59	79	99	118	138	158
95,236	71,427	64,934	47,618	39,682	37,593	35,714	61	82	102	122	143	163
98,411	73,808	67,098	49,205	41,005	38,846	36,904	63	84	105	127	148	169
101,586	76,189	69,263	50,793	42,327	40,100	38,095	65	87	109	131	152	174
104,760	78,570	71,427	52,380	43,650	41,353	39,285	67	90	112	135	157	180
107,935	80,951	73,592	53,967	44,973	42,606	40,475	69	93	116	139	162	185
111,109	83,332	75,756	55,555	46,295	43,859	41,666	71	95	119	143	167	190
114,284	85,713	77,921	57,142	47,618	45,112	42,856	73	98	122	147	171	196
117,458	88,094	80,085	58,729	48,941	46,365	44,047	76	101	126	151	176	201
120,633	90,475	82,250	60,316	50,264	47,618	45,237	78	103	129	155	181	207
<i>Population</i>							<i>RPM*</i> Test Stand Tachometer (Red Display)					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

<i>Vacuum Meter - 40 Cell Disk</i>												
<i>Row Width</i>							<i>Miles per Hour</i>					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	11	14	18	21	25	29
25,397	19,047	17,316	12,698	10,582	10,025	9,524	12	16	20	24	29	33
28,571	21,428	19,480	14,286	11,905	11,278	10,714	14	18	23	28	32	37
31,746	23,809	21,645	15,873	13,227	12,531	11,905	15	20	26	31	36	41
34,920	26,190	23,809	17,460	14,550	13,784	13,095	17	22	28	34	39	45
38,095	28,571	25,974	19,047	15,873	15,037	14,286	18	24	31	37	43	49
41,269	30,952	28,138	20,635	17,196	16,290	15,476	20	27	33	40	46	53
44,444	33,333	30,303	22,222	18,518	17,544	16,666	21	29	36	43	50	57
47,618	35,714	32,467	23,809	19,841	18,797	17,857	23	31	38	46	54	61
50,793	38,095	34,631	25,396	21,164	20,050	19,047	24	33	41	49	57	65
53,967	40,476	36,796	26,984	22,486	21,303	20,238	26	35	43	52	61	69
57,142	42,856	38,960	28,571	23,809	22,556	21,428	28	37	46	55	64	73
60,316	45,237	41,125	30,158	25,132	23,809	22,619	29	39	48	58	68	78
63,491	47,618	43,289	31,746	26,455	25,062	23,809	31	41	51	61	71	82
66,666	49,999	45,454	33,333	27,777	26,315	25,000	32	43	54	64	75	86
69,840	52,380	47,618	34,920	29,100	27,568	26,190	34	45	56	67	79	90
73,015	54,761	49,783	36,507	30,423	28,822	27,380	35	47	59	70	82	94
76,189	57,142	51,947	38,095	31,745	30,075	28,571	37	49	61	73	86	98
79,364	59,523	54,112	39,682	33,068	31,328	29,761	38	51	64	77	89	102
82,538	61,904	56,276	41,269	34,391	32,581	30,952	40	53	66	80	93	106
85,713	64,285	58,441	42,856	35,714	33,834	32,142	41	55	69	83	96	110
88,887	66,666	60,605	44,444	37,036	35,087	33,333	43	57	71	86	100	114
92,062	69,046	62,769	46,031	38,359	36,340	34,523	44	59	74	89	104	118
95,236	71,427	64,934	47,618	39,682	37,593	35,714	46	61	77	92	107	122
98,411	73,808	67,098	49,205	41,005	38,846	36,904	47	63	79	95	111	127
101,586	76,189	69,263	50,793	42,327	40,100	38,095	49	65	82	98	114	131
104,760	78,570	71,427	52,380	43,650	41,353	39,285	51	67	84	101	118	135
107,935	80,951	73,592	53,967	44,973	42,606	40,475	52	69	87	104	121	139
111,109	83,332	75,756	55,555	46,295	43,859	41,666	54	71	89	107	125	143
114,284	85,713	77,921	57,142	47,618	45,112	42,856	55	73	92	110	129	147
117,458	88,094	80,085	58,729	48,941	46,365	44,047	57	76	94	113	132	151
120,633	90,475	82,250	60,316	50,264	47,618	45,237	58	78	97	116	136	155
<i>Population</i>							<i>RPM*</i> Test Stand Tachometer (Red Display)					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

<i>White Meter - 30 Cell Disk</i>												
<i>Row Width</i>							<i>Miles per Hour</i>					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	13	17	22	26	30	35
25,397	19,047	17,316	12,698	10,582	10,025	9,524	15	20	25	30	35	40
28,571	21,428	19,480	14,286	11,905	11,278	10,714	17	22	28	33	39	45
31,746	23,809	21,645	15,873	13,227	12,531	11,905	19	25	31	37	43	50
34,920	26,190	23,809	17,460	14,550	13,784	13,095	20	27	34	41	48	54
38,095	28,571	25,974	19,047	15,873	15,037	14,286	22	30	37	45	52	59
41,269	30,952	28,138	20,635	17,196	16,290	15,476	24	32	40	48	56	64
44,444	33,333	30,303	22,222	18,518	17,544	16,666	26	35	43	52	61	69
47,618	35,714	32,467	23,809	19,841	18,797	17,857	28	37	46	56	65	74
50,793	38,095	34,631	25,396	21,164	20,050	19,047	30	40	50	59	69	79
53,967	40,476	36,796	26,984	22,486	21,303	20,238	32	42	53	63	74	84
57,142	42,856	38,960	28,571	23,809	22,556	21,428	33	45	56	67	78	89
60,316	45,237	41,125	30,158	25,132	23,809	22,619	35	47	59	71	82	94
63,491	47,618	43,289	31,746	26,455	25,062	23,809	37	50	62	74	87	99
66,666	49,999	45,454	33,333	27,777	26,315	25,000	39	52	65	78	91	104
69,840	52,380	47,618	34,920	29,100	27,568	26,190	41	54	68	82	95	109
73,015	54,761	49,783	36,507	30,423	28,822	27,380	43	57	71	85	100	114
76,189	57,142	51,947	38,095	31,745	30,075	28,571	45	59	74	89	104	119
79,364	59,523	54,112	39,682	33,068	31,328	29,761	46	62	77	93	108	124
82,538	61,904	56,276	41,269	34,391	32,581	30,952	48	64	80	97	113	129
85,713	64,285	58,441	42,856	35,714	33,834	32,142	50	67	84	100	117	134
88,887	66,666	60,605	44,444	37,036	35,087	33,333	52	69	87	104	121	139
92,062	69,046	62,769	46,031	38,359	36,340	34,523	54	72	90	108	126	144
95,236	71,427	64,934	47,618	39,682	37,593	35,714	56	74	93	111	130	149
98,411	73,808	67,098	49,205	41,005	38,846	36,904	58	77	96	115	134	153
101,586	76,189	69,263	50,793	42,327	40,100	38,095	59	79	99	119	139	158
104,760	78,570	71,427	52,380	43,650	41,353	39,285	61	82	102	123	143	163
107,935	80,951	73,592	53,967	44,973	42,606	40,475	63	84	105	126	147	168
111,109	83,332	75,756	55,555	46,295	43,859	41,666	65	87	108	130	152	173
114,284	85,713	77,921	57,142	47,618	45,112	42,856	67	89	111	134	156	178
117,458	88,094	80,085	58,729	48,941	46,365	44,047	69	92	114	137	160	183
120,633	90,475	82,250	60,316	50,264	47,618	45,237	71	94	118	141	165	188
Population							RPM* Test Stand Tachometer (Red Display)					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

ProSeries Vacuum Meter - 30 Cell Disk

Row Width							Miles per Hour					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	8	11	14	17	20	22
25,397	19,047	17,316	12,698	10,582	10,025	9,524	10	13	16	19	22	26
28,571	21,428	19,480	14,286	11,905	11,278	10,714	11	14	18	22	25	29
31,746	23,809	21,645	15,873	13,227	12,531	11,905	12	16	20	24	28	32
34,920	26,190	23,809	17,460	14,550	13,784	13,095	13	18	22	26	31	35
38,095	28,571	25,974	19,047	15,873	15,037	14,286	14	19	24	29	34	38
41,269	30,952	28,138	20,635	17,196	16,290	15,476	16	21	26	31	36	42
44,444	33,333	30,303	22,222	18,518	17,544	16,666	17	22	28	34	39	45
47,618	35,714	32,467	23,809	19,841	18,797	17,857	18	24	30	36	42	48
50,793	38,095	34,631	25,396	21,164	20,050	19,047	19	26	32	38	45	51
53,967	40,476	36,796	26,984	22,486	21,303	20,238	20	27	34	41	48	55
57,142	42,856	38,960	28,571	23,809	22,556	21,428	22	29	36	43	51	58
60,316	45,237	41,125	30,158	25,132	23,809	22,619	23	30	38	46	53	61
63,491	47,618	43,289	31,746	26,455	25,062	23,809	24	32	40	48	56	64
66,666	49,999	45,454	33,333	27,777	26,315	25,000	25	34	42	51	59	67
69,840	52,380	47,618	34,920	29,100	27,568	26,190	26	35	44	53	62	71
73,015	54,761	49,783	36,507	30,423	28,822	27,380	28	37	46	55	65	74
76,189	57,142	51,947	38,095	31,745	30,075	28,571	29	38	48	58	67	77
79,364	59,523	54,112	39,682	33,068	31,328	29,761	30	40	50	60	70	80
82,538	61,904	56,276	41,269	34,391	32,581	30,952	31	42	52	63	73	83
85,713	64,285	58,441	42,856	35,714	33,834	32,142	32	43	54	65	76	87
88,887	66,666	60,605	44,444	37,036	35,087	33,333	34	45	56	67	79	90
92,062	69,046	62,769	46,031	38,359	36,340	34,523	35	46	58	70	81	93
95,236	71,427	64,934	47,618	39,682	37,593	35,714	36	48	60	72	84	96
98,411	73,808	67,098	49,205	41,005	38,846	36,904	37	50	62	75	87	99
101,586	76,189	69,263	50,793	42,327	40,100	38,095	38	51	64	77	90	103
104,760	78,570	71,427	52,380	43,650	41,353	39,285	40	53	66	79	93	106
107,935	80,951	73,592	53,967	44,973	42,606	40,475	41	55	68	82	95	109
111,109	83,332	75,756	55,555	46,295	43,859	41,666	42	56	70	84	98	112
114,284	85,713	77,921	57,142	47,618	45,112	42,856	43	58	72	87	101	115
117,458	88,094	80,085	58,729	48,941	46,365	44,047	44	59	74	89	104	119
120,633	90,475	82,250	60,316	50,264	47,618	45,237	46	61	76	91	107	122
Population							RPM* Test Stand Tachometer (Red Display)					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.

<i>ProSeries Vacuum Meter - 40 Cell Disk</i>												
<i>Row Width</i>							<i>Miles per Hour</i>					
15	20	22	30	36	38	40	3	4	5	6	7	8
22,222	16,667	15,151	11,111	9,259	8,772	8,333	6	8	11	13	15	17
25,397	19,047	17,316	12,698	10,582	10,025	9,524	7	10	12	14	17	19
28,571	21,428	19,480	14,286	11,905	11,278	10,714	8	11	14	16	19	22
31,746	23,809	21,645	15,873	13,227	12,531	11,905	9	12	15	18	21	24
34,920	26,190	23,809	17,460	14,550	13,784	13,095	10	13	17	20	23	26
38,095	28,571	25,974	19,047	15,873	15,037	14,285	11	14	18	22	25	29
41,269	30,952	28,138	20,635	17,195	16,290	15,476	12	16	20	23	27	31
44,444	33,333	30,302	22,222	18,518	17,544	16,666	13	17	21	25	29	34
47,618	35,714	32,467	23,809	19,841	18,797	17,857	14	18	23	27	32	36
50,793	38,094	34,631	25,396	21,164	20,050	19,047	14	19	24	29	34	38
53,967	40,475	36,796	26,984	22,486	21,303	20,238	15	20	26	31	36	41
57,142	42,856	38,960	28,571	23,809	22,556	21,428	16	22	27	32	38	43
60,316	45,237	41,125	30,158	25,132	23,809	22,619	17	23	29	34	40	46
63,491	47,618	43,289	31,745	26,454	25,062	23,809	18	24	30	36	42	48
66,665	49,999	45,454	33,333	27,777	26,315	24,999	19	25	32	38	44	51
69,840	52,380	47,618	34,920	29,100	27,568	26,190	20	26	33	40	46	53
73,014	54,761	49,782	36,507	30,423	28,821	27,380	21	28	35	41	48	55
76,189	57,142	51,947	38,094	31,745	30,075	28,571	22	29	36	43	51	58
79,363	59,522	54,111	39,682	33,068	31,328	29,761	23	30	38	45	53	60
82,538	61,903	56,276	41,269	34,391	32,581	30,952	23	31	39	47	55	63
85,712	64,284	58,440	42,856	35,713	33,834	32,142	24	32	41	49	57	65
88,887	66,665	60,605	44,443	37,036	35,087	33,333	25	34	42	51	59	67
92,061	69,046	62,769	46,031	38,359	36,340	34,523	26	35	44	52	61	70
95,236	71,427	64,934	47,618	39,682	37,593	35,713	27	36	45	54	63	72
98,410	73,808	67,098	49,205	41,004	38,846	36,904	28	37	47	56	65	75
101,585	76,189	69,262	50,792	42,327	40,099	38,094	29	38	48	58	67	77
104,759	78,570	71,427	52,380	43,650	41,352	39,285	30	40	50	60	69	79
107,934	80,950	73,591	53,967	44,972	42,605	40,475	31	41	51	61	72	82
111,108	83,331	75,756	55,554	46,295	43,859	41,666	32	42	53	63	74	84
114,283	85,712	77,920	57,141	47,618	45,112	42,856	32	43	54	65	76	87
117,457	88,093	80,085	58,729	48,941	46,365	44,047	33	44	56	67	78	89
120,632	90,474	82,249	60,316	50,263	47,618	45,237	34	46	57	69	80	91
<i>Population</i>							<i>RPM* Test Stand Tachometer (Red Display)</i>					

*Note: This chart lists the appropriate RPM which the Test Stand Tachometer (red display) should be set at using the meter specified at the top of the page. Because of different gear ratios between the different meter drives, when running Vacuum, ProSeries Vacuum or White Meters, the RPM displayed on the Test Stand Tachometer is not the actual meter RPM. AutoPilot Data Center always displays actual meter RPM.