



Owner's Manual



Table of Contents

General

Legal & Safety.....	3
System Requirements.....	4
Quick Start Guide.....	5,6
FAQ's.....	7-9

Component installation

Mounting the CM.....	11-18
Connecting Communication.....	19-21
Row Unit Conversions*	
Air Lines & Fittings Plumbing*	
Air Lines info and P/N's.....	22
Air Fittings info and P/N's.....	23,24
Lift Switch*	

Compressor Module

Overview*	
Connecting Power*	
Schematic*	
Parts list*	
Maint. Guidelines*	
Harnesses*	

Initial Start-Up

AFM Serial #.....	25
Declaring Compressor type.....	26
Declaring Air Bag Type.....	27,28
Running Health Check.....	29,30

Walkthrough

DownForce Details.....	31,32
AirForce Control Center.....	33-35
AirForce Setup.....	36-38
AirForce Diagnostics.....	39,40
AirForce Logs.....	41

Troubleshooting

Troubleshooting Checklist.....	42
Troubleshooting Guide.....	43
Compressor not running	
AFM light blinking once per second.....	44,45
No Red light on AFM.....	46,47
Solid Red Light on AFM.....	48
Red Light present, blinking fast, >1 blink per second.....	49,50
Compressor running weak.....	51
Compressor running intermittently.....	52
Compressor running continuously.....	53
Compressor running OK.....	54-60

Reference info

Pneumatic Springs.....	61
Down Force Applied by Spring Type and Position.....	62

Insert Individual Component Installation Sheets Here

Legal & Safety Warnings

This product is warranted for one (1) year from date of purchase. If the system fails the first time the system is tested in the second season, there may be policy decisions to cover those failures covered on a case by case basis.



Precision Planting is not liable for any failures to the system or planting loss due to decisions made from the information presented on the 20/20 SeedSense.

The display unit contains some high voltage components and should be kept dry and closed. There are no serviceable components in this unit. Do not open this display unit or the Smart Connector. Opening of the covers should be done by, or with guidance from trained personnel.

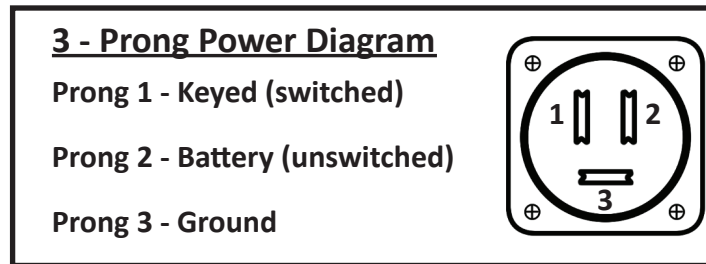
Before activating the Air Force system, ensure that no person is near the row units and that **all** components are in place and properly tightened and adjusted.

- Use extreme caution; Airbags exert large forces.
- **DO NOT** remove Air Lines when under pressure; may cause severe injury.
- **DO NOT** touch air compressor while running or shortly after, may cause severe burns.
- **DO NOT** leave compressor running unattended.
- Follow all maintenance schedules and recommendations.

System Requirements

Power Supply

The 20/20 system uses both a switched power source and a constant unswitched power source. By using the constant source, the system will maintain power to save data and safely shut down if the ignition is suddenly shut off. By using the switched or keyed source, the 20/20 will turn itself off to keep from draining the battery if the system is left on after the ignition is shut off. If you are only supplying constant power, when you turn on the 20/20 you will only see a blank grey screen. If this happens, you have two options. One, you can correct the problem by fixing the switched power leg of the 12V receptacle, or two, you can move the terminal plug on the 20/20 tractor harness from the white to the red spade. By doing this, your 20/20 will no longer shut itself down automatically when you turn the ignition off, so, if you do not turn the 20/20 off, you risk draining your battery.



Fuse Protection

To protect the 20/20 from damage, always use a minimum of a 30 Amp fuse or circuit breaker on the power supply circuit.

To protect the AirForce system from damage:

Always ensure the integrity of the integrated 60 amp fuse at the tractor cable where connected to the battery in case of short or over-circuit

There is a 7.5 amp fuse located in the control harness, located within the enclosure, to protect the AirForce Module and all other enclosure components less the compressor.

Seed Tube Sensors

In order to collect the accurate and precise data, 20/20 requires 3/4" Dickey John or John Deere three eyed sensors. The 1/2" sensors used on some older planters have only two eyes and do not provide consistent data.

Quick Start Guide

Step 1: Compressor Module Installation

Begin the installation of your 2020 AirForce upgrade with mounting the Compressor Module (CM) combination onto the planter. Placement of the CM will vary on the make and model of the planter.

Note: Be sure to check clearance of CM in all locations, especially noting tractor tires and folding/unfolding the planter for transport mode.

Step 2: 12V Power / Hydraulic Connection

Now that the CM is mounted connect the air compressor power source. For hydraulic models the power source will be the hydraulic system from the tractor. The two most common points to tap into the hydraulic system will be:

1. Using a separate dedicated remote for the CM.
2. Tapping into the 'CCS' circuit on Pro-Series planters.

Electrically powered models will require a 12V line run to a power source on the primary planting tractor. This line should be routed in a manner that protects the line from excessive wear and heat as well as any pinch points. One of two power sources may be used; the tractor battery (s) or the tractor starter. This line must be connected directly to the power source, not through another item.

Step 3: Row Unit Installation/ Conversion

With the CM mounted on the planter and the power source provided for it is time to begin installing the individual row unit conversions. Release tension on existing down force system before disassembly. Remove completely or in portion as needed your current down force system and begin installation of conversion components. Take care not to over-tighten Air Bags. Once the installation/conversion is complete check for free range of motion of all components as well as row cleaners etc...

Step 4: Plumbing Installation

Now with the Tank Module and the individual row unit airbags installed the system can be plumbed. The system will be plumbed in series (plumb directly from Air Bag to Air Bag with no return line). The Lift Bag system will be plumbed from the bottom-most (RED) port in the manifold on the Tank/Enclosure Module. The remaining three ports are available for Down force Air Bags.

Step 5: Lift Switch Installation

Once the system is installed the final hardware component to install is the Lift switch. Return to one of the rows that has been outfitted with a Row Unit Module (RUM); mount the lift switch and bracket on the parallel arm, and connect the lift switch to the RUM.

Quick Start Guide

Step 6: Update the AirForce Software

When installing your AirForce system, you should update your 20/20 display unit software to the most recent version. Go to www.precisionplanting.com, click on **"20/20 SeedSense"**, and then click on **"Technical Support"**. Scroll down to the section labeled **"20/20 Display Software"**. There are two links. Select the appropriate software link based on your current software version. Click on the link, click on save, and then save the file to your USB drive. Once the download is complete, take the USB drive to your 20/20 Display Unit. If you have 2008 software on your display unit (version 2.x.x), insert the USB drive and turn the display unit on. The software will update as part of the boot process. If you have an earlier version of 2009 nine software (version 3.x.x), then power up your display unit, insert your USB drive, press **SETUP**, then **DATA**, then **SOFTWARE UPDATE**. Select the software version you just downloaded and press enter. Follow any on-screen prompts. You should check the website regularly for new software upgrades.

Step 7: Setup the AirForce System

Once your software is updated and the 20/20 AirForce is connected to the 20/20 SeedSense system, you will need to set up your display unit for AirForce operations. You will be prompted to enter the serial number of your AirForce System. This seven digit number is printed on a sticker located inside the compressor enclosure. From the dashboard screen, press **SETUP**, then select the **SYSTEMS** tab at the top of the screen, and then press the **AIRFORCE** button. You are now on the AirForce Setup screen. In the second row of buttons, press **AIR BAG TYPE**, select your down force system, and then select your lift system. Next, press **COMPRESSOR TYPE** and select **ELECTRIC** or **HYDRAULIC**. Now press the **PLANT** tab at the top of the screen and press **PLANTER**. Make sure that your planter is properly configured on this screen, particularly number of rows. This information will be used in the next step.

Step 8: Perform a Health Check

Now that the AirForce system is set up, perform a Health Check of the system. Before performing a health check, make sure to fully unfold your planter. If you have a 12 volt electric compressor, you may perform the health check while your planter is lifted or while it is lowered. However, if you have a hydraulic compressor, you must perform the health check with the planter lowered. To begin the health check, press the **DIAGNOSE** tab at the top of the screen and then press the light green button labeled **"AirForce"**. This brings up the AirForce Diagnostics page. On the right side of the screen, press the **HEALTH CHECK** button. Select the **ALL** button to begin a Compressor Check, Wiring and Plumbing Check, and a Leak Check on your AirForce system.

Step 9: Enabling Control

When you are ready to use the AirForce system in the field, press the **AIRFORCE** button on the dashboard screen to enter the AirForce Control Center. Select your control mode. Press the **ENABLE CONTROL** button on the left side of the screen.

Frequently Asked Questions

“How much Down/Lift Pressure should I be running?”

That depends. The amount of Down/Lift Pressure will vary greatly across soil types, tillage practices, soil moisture, row unit weight... and many other variables. In the Standard Mode, AirForce will manage the pressures in the Down and/or Lift circuits in order to maintain 95%+ Ground Contact while keeping the Margin between 10-60lbs. See the Normal Operating Ranges below for safe operating pressures.

“Why does my Lift Circuit Pressure jump up or spike?”

This situation is most likely to happen as the planter is raised at the end of a pass or while crossing waterways. This is due to the transfer of weight – downward force – including the weight of the row unit, seed, insecticide, row cleaners, coulters, as well as the amount of down or spring force being applied. As the planter is raised and the row unit lowers to a ‘hanging’ position, all of this force is applied to the Lift Circuit, squeezing the bags, and causing a spike in pressure. This is the reason for the installation of the 80ci Lift Air Receiver Assemblies on the planter, to help distribute the increased pressure across a greater volume.

“Why is my AirForce constantly disabled?”

The AirForce Module components will be disabled upon startup and will automatically disable itself anytime power or communication to the system is reset or fluctuated. This is because the system will be controlling moving parts on the planter. It is a safety aspect of the system and cannot be bypassed.

“What Control Mode should I run the AirForce in?”

The most common control mode utilized, and also the best setting to start with, will be the Standard Mode. In this setting, the 20/20 will control AirForce to maintain 95%+ Ground Contact and keep the Margin in the range between 10 – 60lbs. Starting in the Standard setting, make a pass or two through the field to allow the system to acclimate itself to your individual planter. Once you are comfortable with the responsiveness of the system, feel free to experiment with the Light, Heavy, and Custom control modes. After any change, allow the system to move to the new settings, then verify and inspect the results. Repeat as necessary.

“How can I be running Margin and less than 100% Ground Contact at the same time?”

This situation can exist if one or more of the SmartPins are reading a loss of Ground Contact while others are reading levels of Margin. AirForce makes many calculations based on the data it receives from the SmartPins, including entire planter averages. Because of this, it is possible for the planter averages to display both a Margin reading and a loss of 100% Ground Contact

Frequently Asked Questions

“Why do the ‘Down’ and ‘Lift’ numbers on the monitor not match the gauges on the enclosure?”

In its Default configuration, AirForce will display on the Home screen the Tank pressure in psi, and the Down and Lift circuits in pounds of applied force. The gauges on the enclosure are readings in psi of the respective circuits. The home screen uses the pounds of applied force because it is more intuitive and that it equates more fluently to the margin readings. To read the Down and Lift circuit pressures simply touch the AirForce icon on the Home screen to enter the AirForce Control Center. At the bottom of the AirForce Control Center page the target (black line) and actual (green bar) pressures are displayed in psi for each circuit.

Normal operating ranges:

- Down Pressure Bags: _____ 8psi to 120psi
- Lift Pressure Bags: _____ 8psi to 120psi
Note: The Lift Circuit may spike in pressure at the end of passes as the planter is lifted.
- Tank Pressure: _____ 0psi to 150psi
The tank has a relief valve that will automatically lower the pressure any time it reaches above 165psi.
- Compressor Temperature: _____ Ambient to 350°F
User will receive a warning message when the compressor head temperature reaches 350°F; the system will disable itself when the temperature reaches 400°F.
- AirForce Control Module (AFM) Voltage: _____ 11.5 to 14.0volts
- 12V Compressor Voltage: _____ 11.5 to 14.0 Volts
- Compressor Duty Cycle: _____ 0-80%

“I can’t get any air to the bags without running a Health Check.”

This is most likely a confusion surrounding the Control modes and planter status. AirForce has two basic control situations: Manual and Automatic (any one of Standard, Light, Heavy, or Custom).

Manual Mode:

Compressor: 12V - will run with the planter Raised or Lowered.

HYD - will run only with the planter Lowered (assuming standard plumbing of hydraulic lines).

Solenoids (to Down & Lift Circuits): Will activate only when the planter is Lowered.

Automatic Modes:

Compressor & Solenoids will activate only when **actually planting** this requires the system to recognize that the system is:

- 1) In the Lowered position.
- 2) Moving forward – speed/GPS information.
- 3) Seeing seed tube data.

Note: once the system recognizes it is in a planting situation, you may notice the compressor running while lifted, or not moving (at the end of a pass or while filling the planter)

Compressor: 12V - will run with the planter Raised or Lowered.

HYD - will run only with the planter Lowered (assuming standard plumbing of hydraulic lines).

Frequently Asked Questions

“Do I really need a new lift switch or can I use my existing one?”

You need to install a new lift switch. Our switch is wired directly into the RUM auxiliary port. Combining an existing lift switch into both the JD planter system and our RUM might be able to be made to work, but installing a separate one keeps the system simple and robust.

“How much power is required for the 12V compressor?”

The compressor will draw between 40 and 50 amps at 12 volts. The 12V compressor is sized to run 50% of the time or less, so in order to have adequate power generation on the alternator, you should have 25 amps of spare alternator capacity. If testing this with an amp meter, be sure to have all lights and accessories powered.

“Will my tractor be able to handle the Hydraulic compressor?”

Basic Hydraulic Requirements: Flow: 3.5 gpm
 System Pressure: 2000 psi
 System Type: Closed Center
 No case drain is required for this hydraulic motor

“What is the flow rate of the two different compressors?”

The following table shows nominal flow rates in Cubic Feet per Minute (CFM) for each option

Compressor Model	0 psi	100 psi	125 psi	150 psi
12V	6	1.7	1.5	1
HYD	9.2	7.8	7.5	7

Notes

Compressor Module Mounting



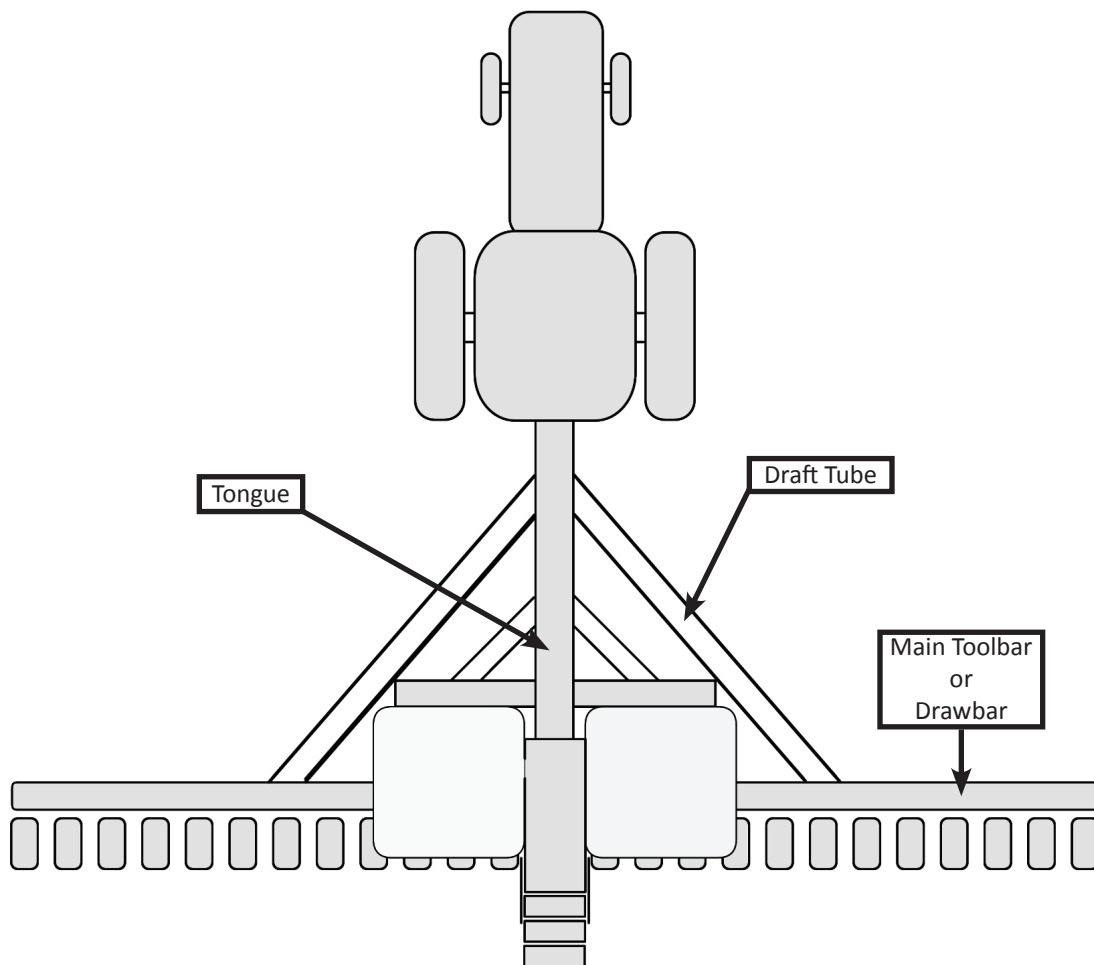
- Every planter will contain its own unique situations in regard to mounting the Compressor Module for clearance and accessibility. ***YOU SHOULD EXERCISE YOUR OWN BEST JUDGMENT TO FIT YOUR SITUATION.***
- 12V Compressors require mounting within 26' of the power source (tractor battery or starter post).
- Hydraulic Compressors require mounting with access to a Closed Center system with 2000 psi and 4.0gpm.

First, locate a possible mounting location. The image below shows the three most common mounting locations and the terms by which we refer to them. Use the diagram on the following page for dimensions and clearance requirements.

Second, visually inspect the proposed mounting location for structural stability and to find signs of wear in that location. Possible obstructions to be aware of include marker arms, liquid fertilizer tanks, rear tires (duals especially) during tight turns, etc...

Mark out the position of the Compressor then complete a thorough cycle of folding/unfolding to transport mode and raising/lowering of the planter; as well as, driving in a tight circle in one or both directions, in planting position, to verify or identify obstructions.

Once the CM is mounted, repeat the previous process very cautiously to once again verify that the CM is clear of obstructions.



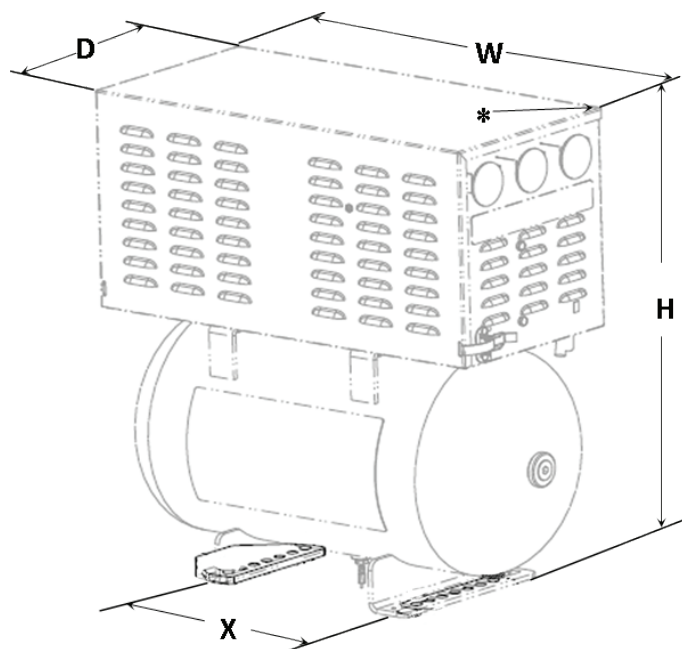
Compressor Mounting Bracket Guide

Part Number	Image	Description	Width (X) in.	Height (Y) in.
726050	A	U-Bolt	3	5
726051			3	6
726052			3	8
726053			4	6
726054			4	7
726055			5	7
726057			8	10
726397			4	4
726490			8	12
726059			N/A	Bolts Only
726450	B	Universal (up to 9X10 Bars): Threaded Stud with Brackets		
726056	C	U-Bolt w/ Spacer Bracket	7	7
726058			8	8
726455			10	10
726500			7	4
726435	D	Angle Bracket	Kinze 3700	Kinze 3700
726060	E		Kinze 3800	Kinze 3800
726470	F	High Above Tube	N/A	N/A
726515	G	Stand - Above Crossbar	N/A	N/A
726612	H	Low, Side Mount	7	7
726613	H		8	8
726614	H		10	10
726398	I	J - Bolt	See Image	See Image

Use the diagram to the right to identify possible mounting locations on your specific planter.

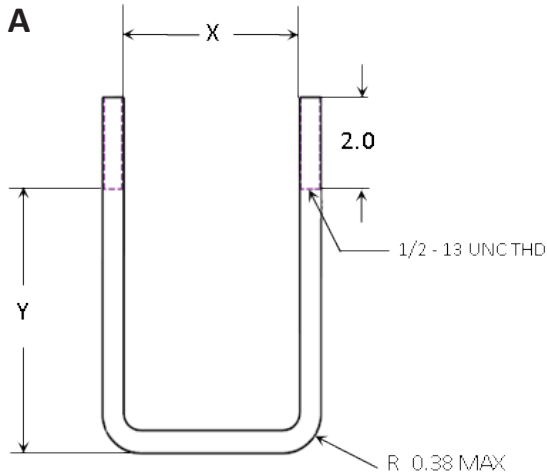
*Remember to allow room for the lid to open properly. Measure 15" vertically and 8" to the right of this point. *

The 'X' dimension is the spacing between the tank rail bolt holes, on center. The bolt holes are spaced 1" on center, with 1" slots at each end.



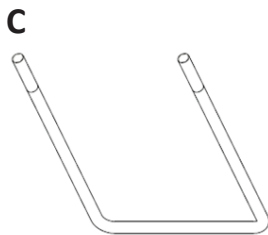
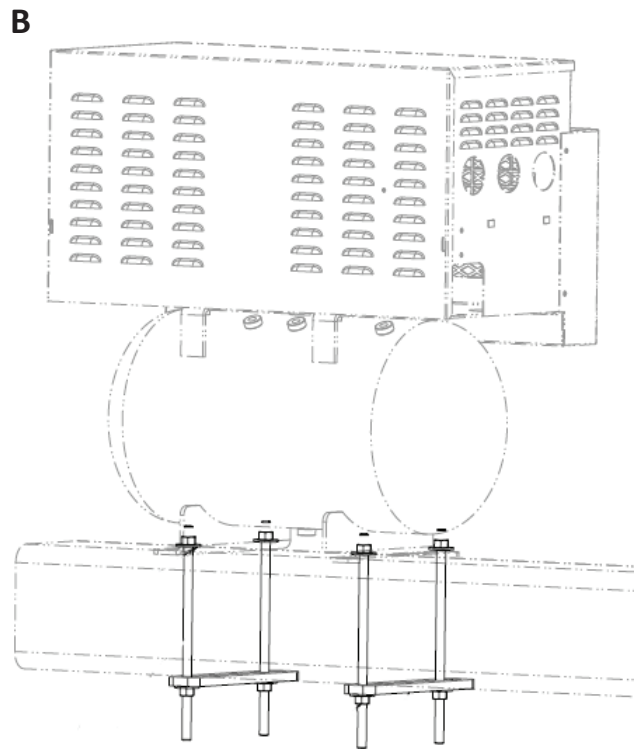
	Dimensions (inches)			
	H	W	D	X
Hydraulic	28.5	28.0	15.5	12.0
12V Electric	26.0	24.0	12.0	12.0

Compressor Mounting Guide (Continued)

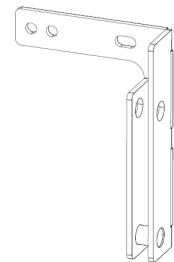
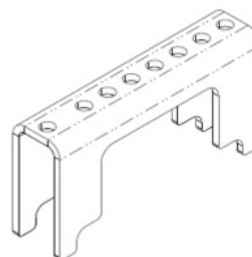
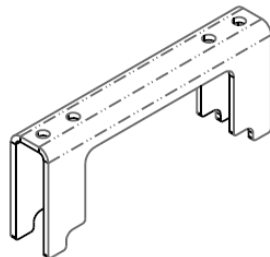
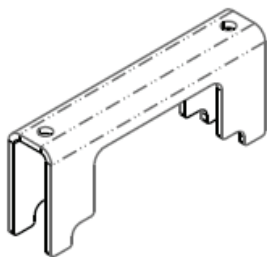


This will be the most common and simple means of mounting the compressor to your planter. Two U-bolts and hardware will be supplied. These will be wrapped around the chosen draft bar, toolbar or tongue location and fix the compressor in place through the base feet on the tank.

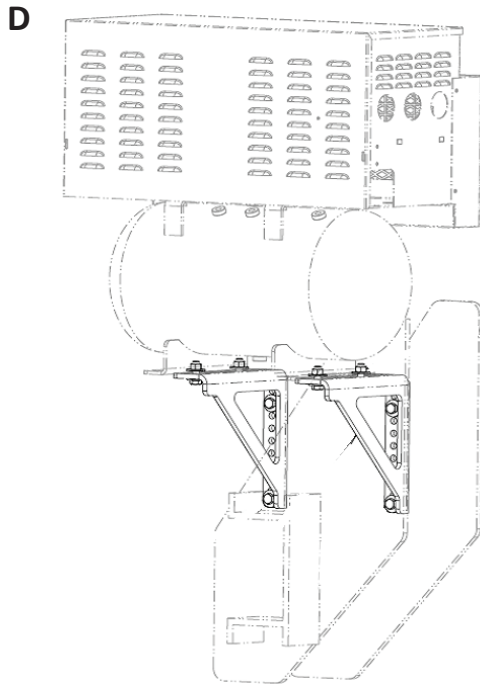
The Universal mounting bracket will work the same as U-bolts. Four lengths of threaded studs, two brackets, and hardware will be supplied to take the place of the U-bolt. This will be commonplace for non-standard mounting locations and bar sizes, up to 9"X10".



This group of mounting brackets will be most common on Kinze and stack-fold planters and may require the removal of the jack stand mounting bracket. Three U-bolts, three brackets, and the necessary hardware will be provided. Two of the brackets, similar to those shown below, will be used to space the tank above hoses and communication lines on the tongue or toolbar. The remaining U-bolt and bracket will be used to relocate the jack stand on Kinze planters to the vertical riser.

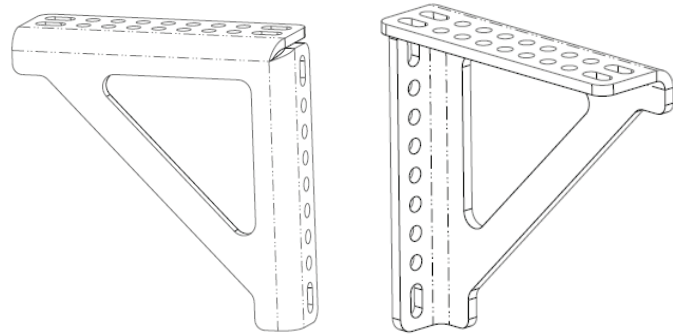


Compressor Mounting Guide (Continued)

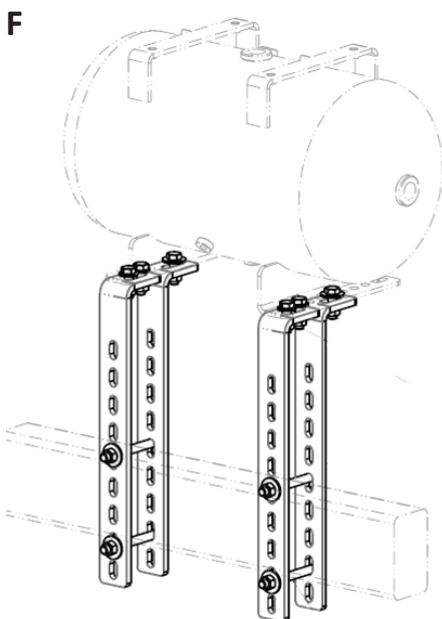
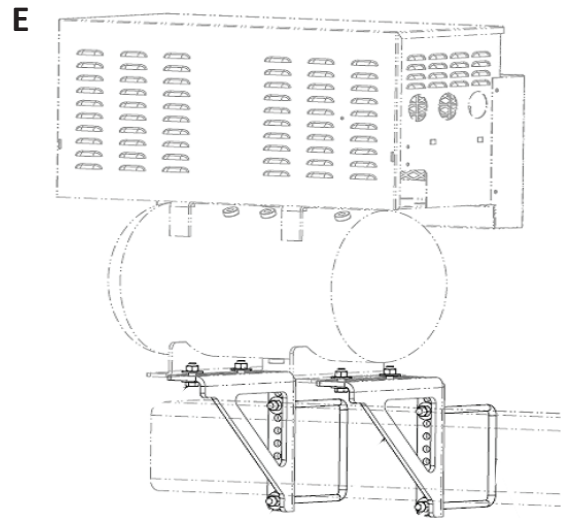


This mounting kit will offer a side mounted position for the Compressor Module. Shown at left mounted on the forward portion of the tongue on a Kinze 3700. Two brackets and hardware will be supplied and some drilling may be necessary.

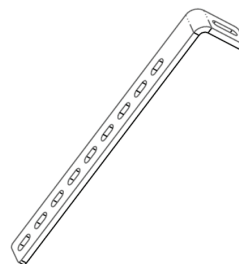
The brackets are shown in greater detail below.



This mounting kit will be very similar to the previous mounting kit. The same brackets will be provided, however there will also be two U-bolts, removing the need for a drilling operation.

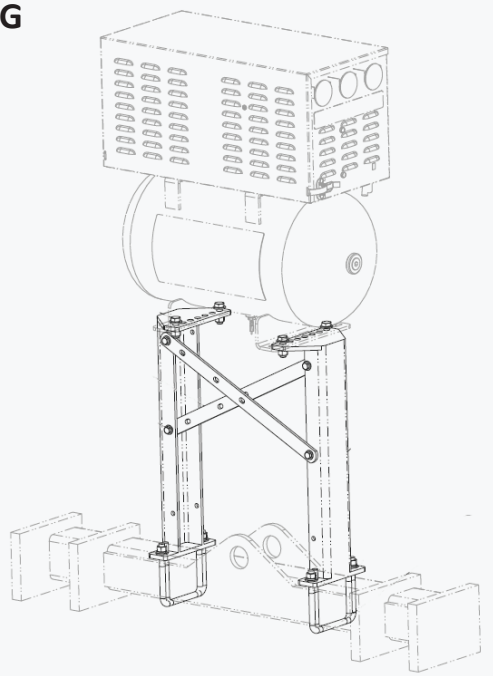


The most common mounting location for larger planters will be on the draft bar. Use this mounting kit for situations that do not provide enough clearance for the compressor to rest directly on the draft bar. Four of the straps shown below as well as hardware will be provided. This will allow the compressor to be elevated and set back (or forward) to avoid clearance issue.

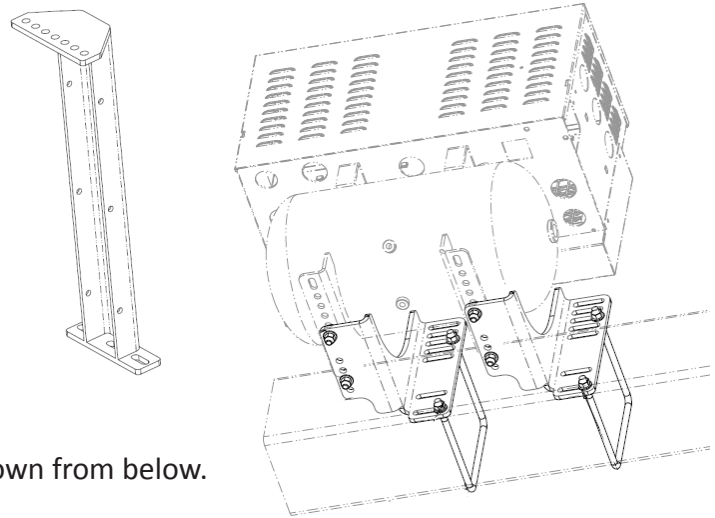


Compressor Mounting Guide (Continued)

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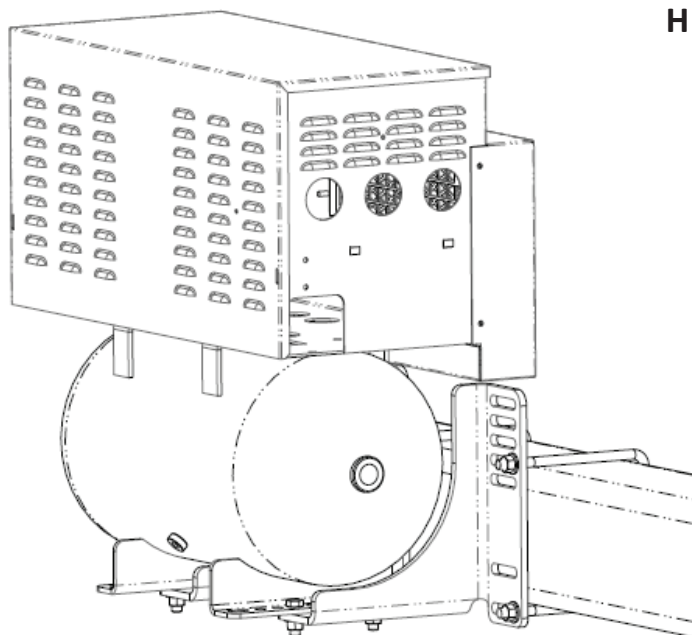


This mounting kit is designed for situations that do not allow mounting on the planter, or require greater elevation of the compressor for clearance reasons. Two of the brackets (shown below right), two straps, two U-Bolts, and hardware will be supplied. The image at left shows the compressor mounted above the 2 point cross-hitch.

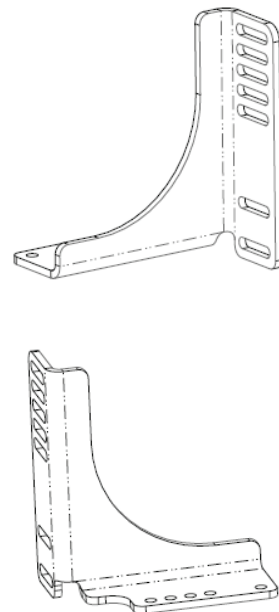


Shown from below.

This mounting kit will locate the Compressor low and to the side of the main tongue. Used primarily for Kinze planters to provide clearance under the Lift and Twist transport. Two brackets, two U-bolts, and hardware will be supplied with this kit.

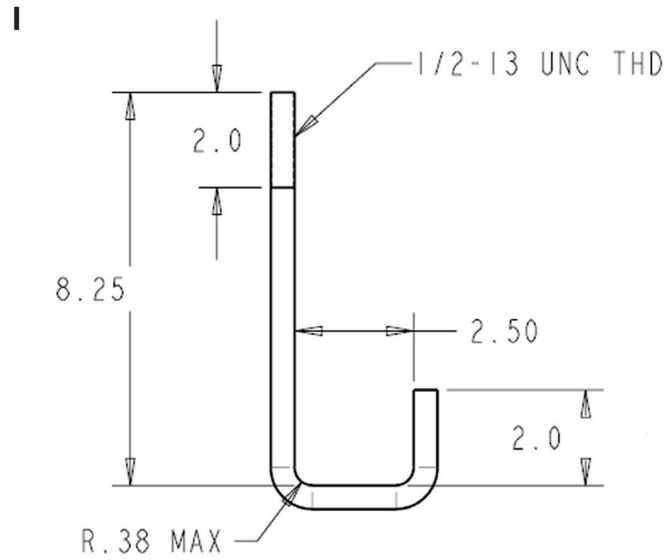


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Compressor Mounting Guide (Continued)

This mounting kit has the same concept as the basic U-bolt, that is adapted for non-standard tubes or channels that comprise the tongue of some planters.



Compressor Mounting Guide (Continued)

John Deere

Planter Model	Description	Comments	Part Number
JD7000	Drawn Rigid Tongue - <20'		726055
	Drawn Folding Tongue		726059
	30' front fold	Preference - 1 - Above Draft Tube	726052
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	40 or 60' wide front fold	Preference - 1 - Above Draft Tube	726050
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	JD7100	3pt Mounted	
JD7200	Drawn, folding tongue < 20'		726055
	Drawn Folding Tongue		726059
	30' front fold	Preference - 1 - Above Draft Tube	726052
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	40 or 60' wide front fold	Preference - 1 - Above Draft Tube	726050
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	JD7240	Drawn, folding tongue < 20'	
JD7300	3pt Vertical fold or rigid frame		726056
	3pt Stacker	Preference - 1 - Above the 7x7 Bar	726056
		Preference - 2 - In front of 7x7 bar	726060
		Preference - 3 - Non-standard/Custom	726450
JD1700/1710	3pt Rigid & Vertical Fold	Preference - 1 - Above the 7x7 Bar	726056
		Preference - 2 - In front of 7x7 bar	726060
JD1720	3pt Stack Fold	Preference - 1 - Above 7x4 bar	726500
		Preference - 2 - Above 7x7 bar	726056
		Preference - 3 - Non-standard/Custom	726450
JD1730	Rigid Narrow Row		None
JD1750	Drawn, folding tongue < 20'		726059
JD1760	Wing Fold		726057
JD1770	30' front fold	Preference - 1 - Above Draft Tube	726052
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	40 or 60' wide front fold	Preference - 1 - Above Draft Tube	726050
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
JD1770NT	Front Fold	Preference - 1 - High Mount	726470
		Preference - 1 - Rear Center Mount	726490
		Preference - 2 - Above 3x5 bar	726050
		Preference - 3 - Above cross bar	726515

Compressor Mounting Guide (Continued)

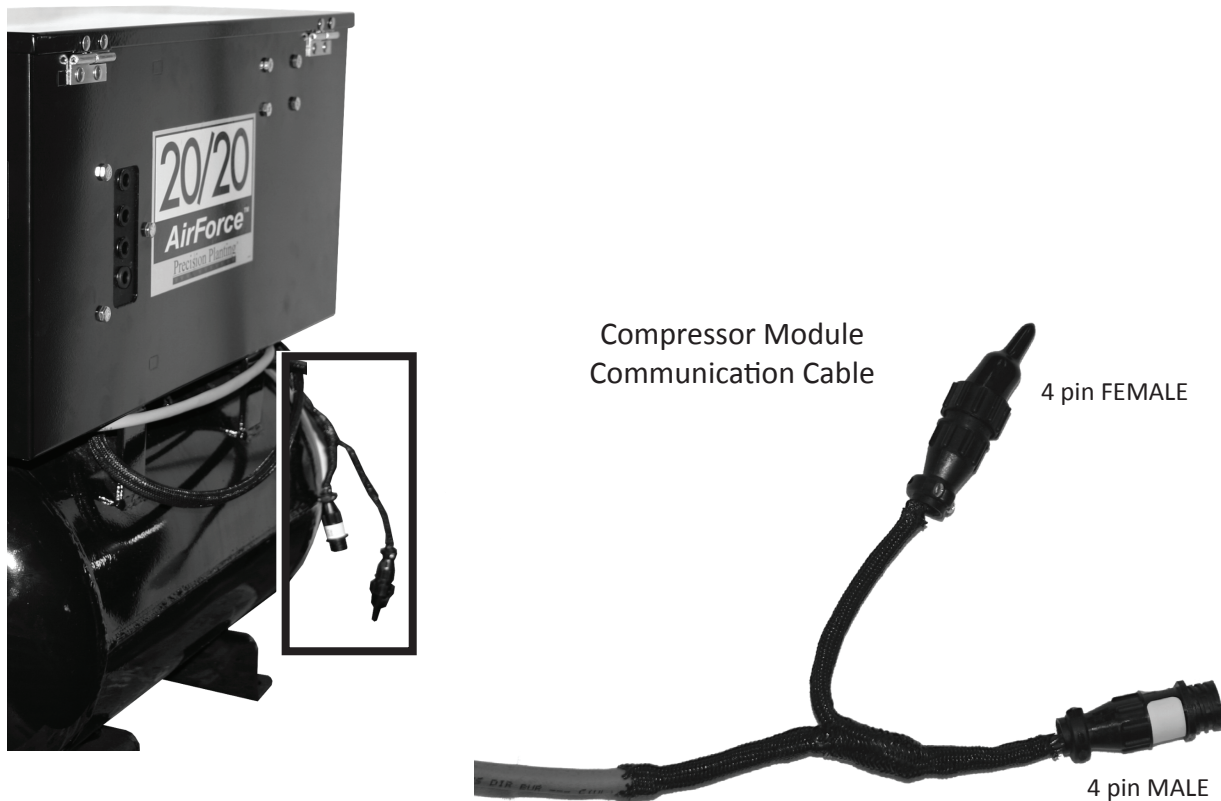
John Deere

Planter Model	Description	Comments	Part Number
JD1780	Drawn, folding tongue < 20'		726059
	30, 40, or 60' wide front fold	Preference - 1 - Above Draft Tube	726053
		Preference - 2 - High Mount	726470
JD1790	12V 30, 40, or 60' wide front fold	Preference - 1 - Above Draft Tube	726050
		Preference - 2 - Above Cross Bar	726515
		Preference - 3 - High Mount	726470
	HYD 30, 40, or 60' wide front fold	Preference - 1 - Rear Center Mount	726490
		Preference - 2 - Above Draft Tube	726050
		Preference - 3 - Above Cross Bar	726515
DB44, 58, 60, 66, & 80 Prior to 2010		Preference - 1 - Above Draft Tube	726051
		Preference - 1 - Rear Center Mount	726490
		Preference - 2 - High Mount	726470
DB88, 90, & 120 Prior to 2010 ALL 2010+ DB models		Preference - 1 - Above Draft Tube	726053
		Preference - 1 - Rear Center Mount	726490
		Preference - 2 - High Mount	726470

Kinze

Planter Model	Description	Comments	Part Number
Rear Fold	Rear Fold		726397
2000, 3000	2 tube tongue		726398
2100, 3110	Rigid		726056
2200, 3200	Wing Fold		726054
2300, 2500 3400, 3500	Twinline	Preference - 1 - Above 7x7 bar	726056
		Preference - 2 - Offset from 7x7 bar	726612
2600, 3600, 3650, 3660	Twinline 30' Bar	Preference - 1 - Above 8x8 bar	726058
		Preference - 2 - Offset from 8x8 bar	726613
	Twinline 40' Bar	Preference - 1 - Above 10x10 bar	726455
		Preference - 2 - Offset from 10x10 bar	726614
2700, 3700	Front Fold		726435
3800	Front Fold		726060
3120, 3140	3pt Vertical & Stack Fold	Preference - 1 - Above 7x7 bar	726056
		Preference - 2 - Offset from 7x7 bar	726060

Connecting Communication to the Compressor Module



The Compressor Module communication cable ends in a 'Y' with a 4 pin MALE and a 4 pin FEMALE connection. This cable is used to connect the AirForce Module that monitors and controls the Compressor Module to the 20/20 SeedSense monitor. The Compressor Module can be connected in **SERIES** between the SeedSense monitor and the Smart Connector **OR** in **PARALLEL** with the Smart Connector directly to the SeedSense monitor.

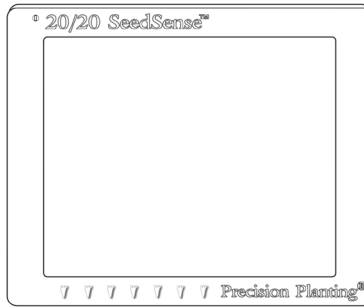
Most connections will be made in **SERIES** using the 725206 and 725499 Tractor Harnesses.

Some connections will be made in **PARALLEL** and will most often occur (but are not limited to) configurations using the 725207 Tractor Harness.

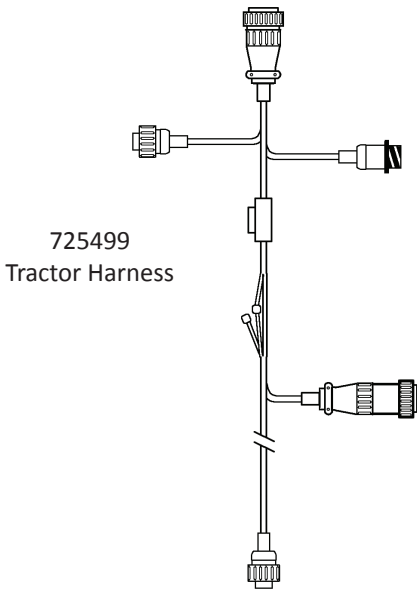
See following pages

Connecting Communication in Series

This configuration will apply to the majority of the systems sold from October 2008 on.

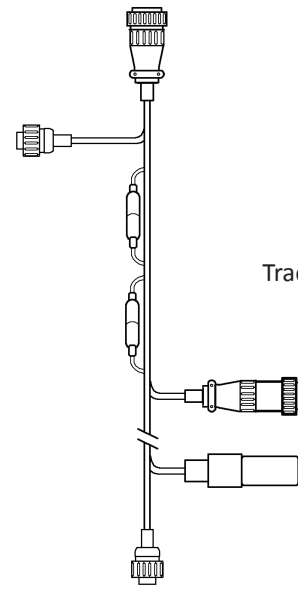


20/20 SeedSense Monitor



725499
Tractor Harness

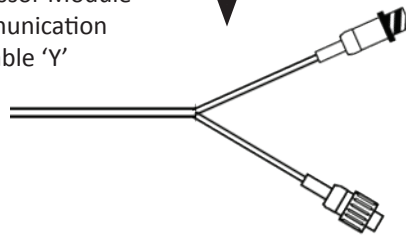
OR



725206
Tractor Harness

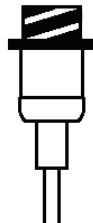
CONNECT TO

Compressor Module
Communication
Cable 'Y'

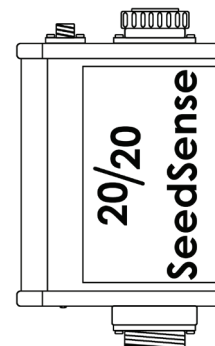


CONNECT TO

4 Pin Male
Extension to Smart
Connector



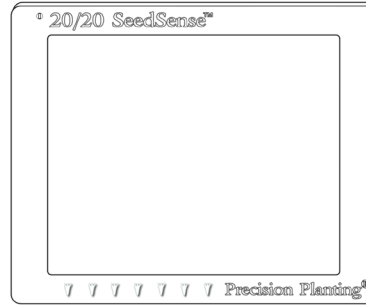
OR



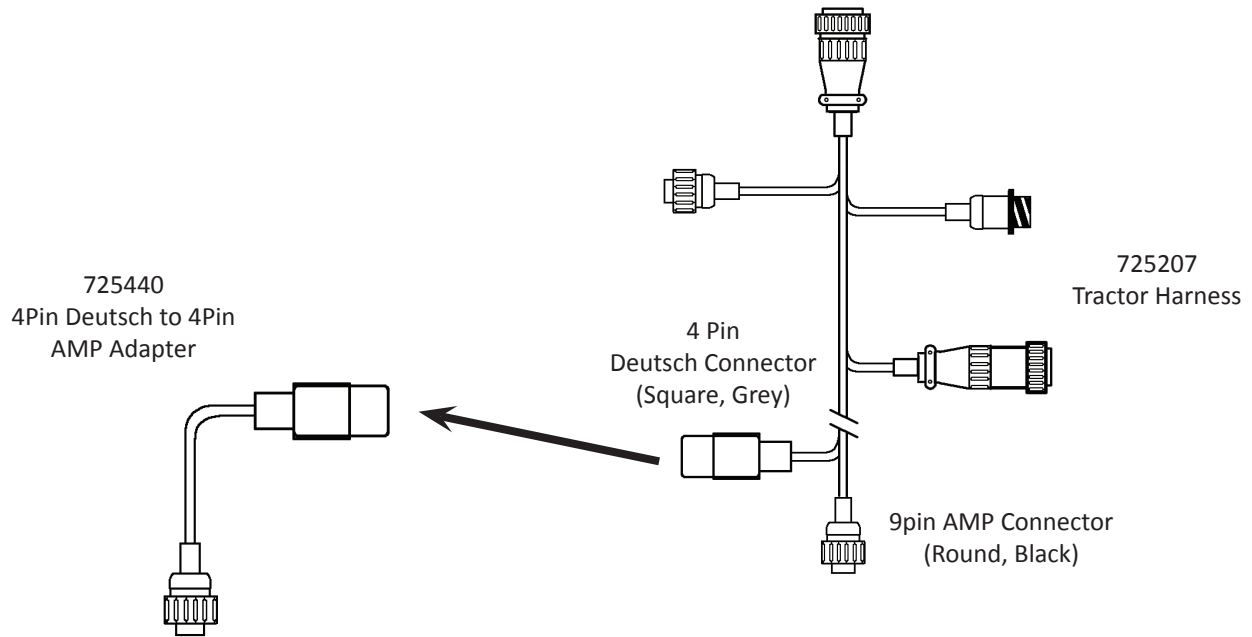
725201
Smart Connector

Connecting Communication in Parallel

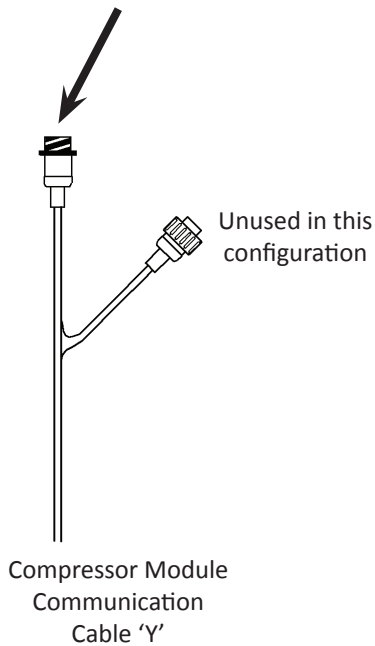
This configuration will apply primarily to systems sold prior to March 2009 using a Seed Star Monitor.



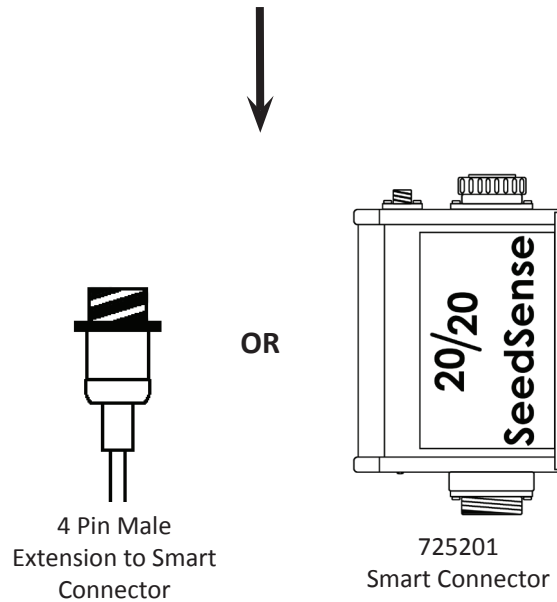
20/20 SeedSense Monitor



CONNECT TO:
AIRFORCE COMPONENTS



CONNECT TO:
SEEDSENSE COMPONENTS



Air Lines Information and Ordering Numbers

1/4" OD, .040" WALL D.O.T. TYPE A TUBING, SILVER, NYLON		
PART NUMBER	QTY (FT)	PACKAGE
726314	50	COIL
726316	100	COIL
726317	150	COIL
726318	200	COIL
726319	250	COIL
726336	1	BULK

1/4" OD, .040" WALL NYLON 11 TUBING, BLACK		
PART NUMBER	QTY (FT)	PACKAGE
726473	25	COIL
726321	50	COIL
726322	100	COIL
726323	150	COIL
726324	200	COIL
726337	1	BULK

3/8" OD, .050" WALL D.O.T. TYPE B TUBING, SILVER, NYLON		
PART NUMBER	QTY (FT)	PACKAGE
726326	25	COIL
726327	50	COIL
726328	100	COIL
726329	1	BULK

3/8" OD, .050" WALL NYLON 11 TUBING, BLACK		
PART NUMBER	QTY (FT)	PACKAGE
726331	25	COIL
726332	50	COIL
726333	100	COIL
726474	150	COIL
726334	1	BULK

1/8" OD, .016" WALL NYLON 11 TUBING, BLACK		
PART NUMBER	QTY (FT)	PACKAGE
726341	1	BULK

"COIL" PACKAGING IS LENGTH SPECIFIED +/- 1 FOOT, COILED AND EITHER TAPED, TIED, OR INSERTED INTO BAG TO ENSURE NEAT AND EASY HANDLING

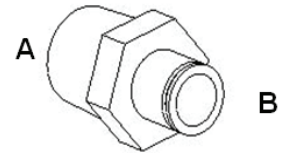
"BULK" PACKAGING IS ON SPOOL OF LENGTH TO BE DETERMINED BY SUPPLIER, AND IS ORDERED BY THE FOOT

Ordering Numbers (Continued)

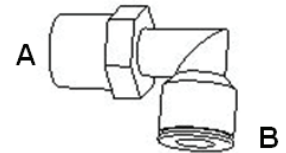
PART NUMBER	A	B	C	DESCRIPTION
726102	1/8			PTC PLUG
726103	1/4			PTC PLUG
726104	3/8			PTC PLUG



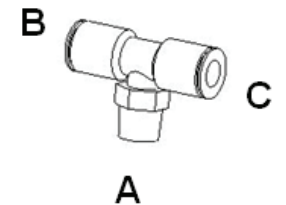
PART NUMBER	A	B	C	DESCRIPTION
726105	1/8 NPT	1/8 PTC		MALE NPT X PTC STRAIGHT
726106	1/8 NPT	1/4 PTC		MALE NPT X PTC STRAIGHT-BRASS
726107	1/4 NPT	1/4 PTC		MALE NPT X PTC STRAIGHT
726108	1/4 NPT	3/8 PTC		MALE NPT X PTC STRAIGHT



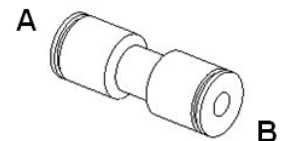
PART NUMBER	A	B	C	DESCRIPTION
726109	1/8 NPT	1/8 PTC		MALE NPT X PTC SWIVEL 90 ELBOW
726110	1/4 NPT	3/8 PTC		MALE NPT X PTC SWIVEL 90 ELBOW
726111	1/4 NPT	1/4 PTC		MALE NPT X PTC SWIVEL 90 ELBOW
726112	1/8 NPT	1/4 PTC		MALE NPT X PTC SWIVEL 90 ELBOW



PART NUMBER	A	B	C	DESCRIPTION
726113	1/8 NPT	1/4 PTC	1/4 PTC	MALE NPT X PTC SWIVEL TEE



PART NUMBER	A	B	C	DESCRIPTION
726189	1/8 PTC	1/8 PTC		PTC UNION
726171	1/4 PTC	1/4 PTC		PTC UNION
726173	1/4 PTC	3/8 PTC		PTC UNION
726172	3/8 PTC	3/8 PTC		PTC UNION

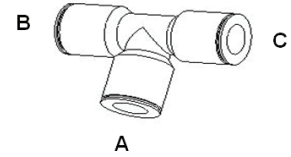


PART NUMBER	A	B	C	DESCRIPTION
726506	1/4 PTC	1/4 PTC		PTC 1/4 TURN VALVE (VENTED)
726507	3/8 PTC	3/8 PTC		PTC 3/8 TURN VALVE (VENTED)



Ordering Numbers (Continued)

PART NUMBER	A	B	C	DESCRIPTION
726114	3/8 PTC	1/4 PTC	1/4 PTC	PTC TEE
726115	1/4 PTC	1/4 PTC	1/4 PTC	PTC TEE
726116	3/8 PTC	3/8 PTC	3/8 PTC	PTC TEE
726296	1/4 PTC	3/8 PTC	3/8 PTC	PTC TEE

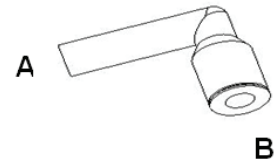


PART NUMBER	A	B	C	DESCRIPTION
726268	1/8 PTC			PTC CARTRIDGE FITTING
726269	1/4 PTC			PTC CARTRIDGE FITTING
726270	3/8 PTC			PTC CARTRIDGE FITTING

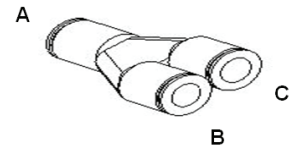


NOTE: THESE CARTRIDGE FITTINGS ARE NOT SERVICEABLE ITEMS, USED IN PP PRODUCTION ONLY

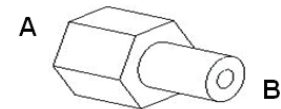
PART NUMBER	A	B	C	DESCRIPTION
726271	1/8	1/8 PTC		PLUG-IN ELBOW 90 DEGREE
726272	1/4	1/4 PTC		PLUG-IN ELBOW 90 DEGREE
726273	3/8	3/8 PTC		PLUG-IN ELBOW 90 DEGREE



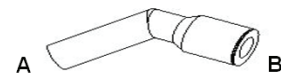
PART NUMBER	A	B	C	DESCRIPTION
726297	1/4 PTC	1/4 PTC	1/4 PTC	TUBE TO TUBE "Y"
726298	3/8 PTC	1/4 PTC	1/4 PTC	REDUCING "Y"
726299	3/8 PTC	3/8 PTC	3/8 PTC	TUBE TO TUBE "Y"



PART NUMBER	A	B	C	DESCRIPTION
726304	1/8 NPT	1/8 PTC		FEMALE CONNECTOR
726168	1/4 NPT	1/4 PTC		FEMALE CONNECTOR



PART NUMBER	A	B	C	DESCRIPTION
726303	3/8	3/8 PTC		PLUG-IN ELBOW 45 DEGREE

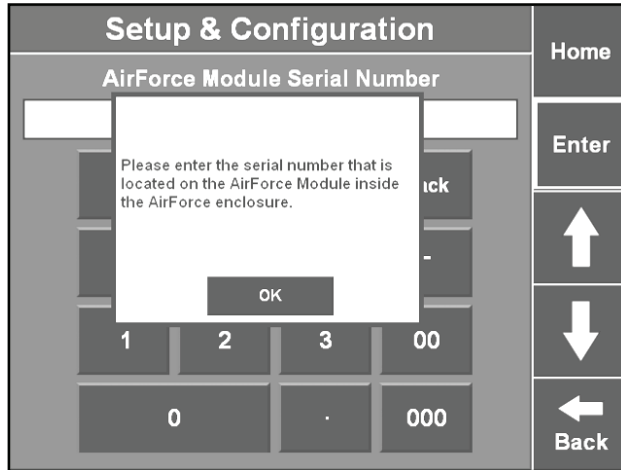


PART NUMBER	A	B	C	DESCRIPTION
726274				CAP - RED (LEGRIS)



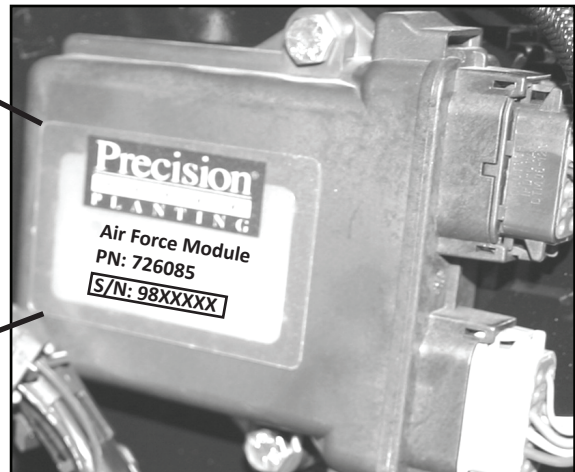
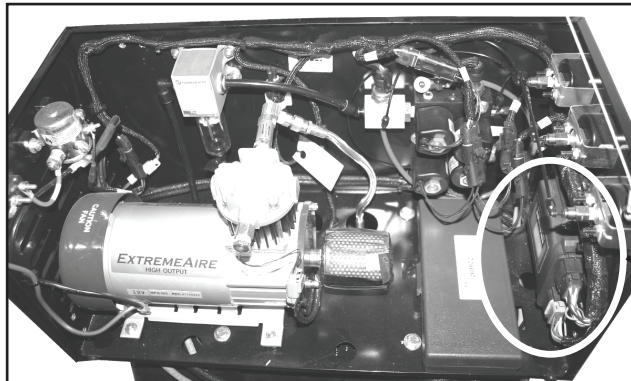
AFM Serial

Now that you've got the AirForce mounted, installed, and ready for use; let's walk through the initial set-up process.

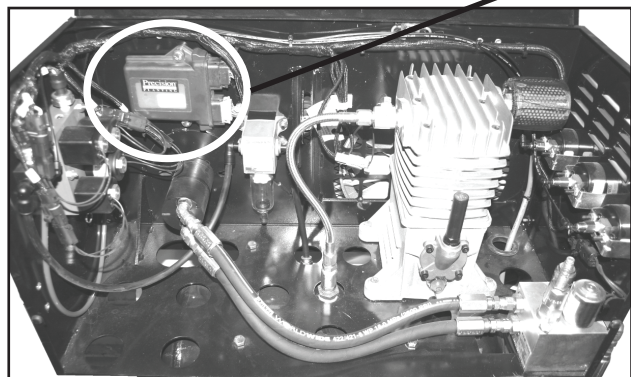


Upon installation of the AirForce - and more specifically communication with the AirForce Control Module (AFM) the SeedSense display unit will display the pop-up message shown at left. The system will request a serial number for the AFM in order to create a paired relationship between the two components. The serial number can be located on the outside of the AFM, shown below for both a 12V and Hydraulic compressor models.

12V Compressor



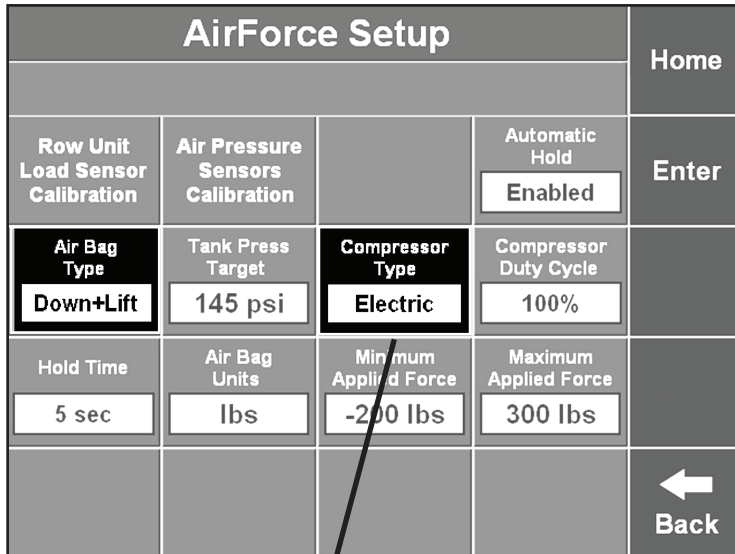
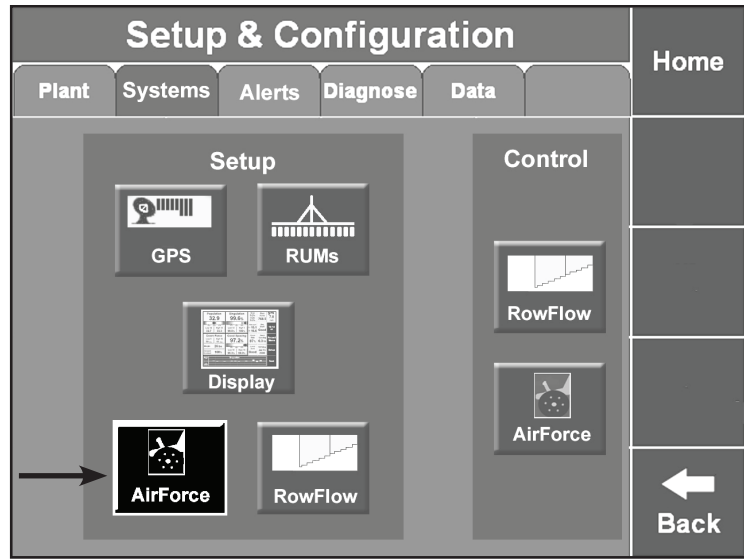
Hydraulic Compressor



Declaring Compressor Type

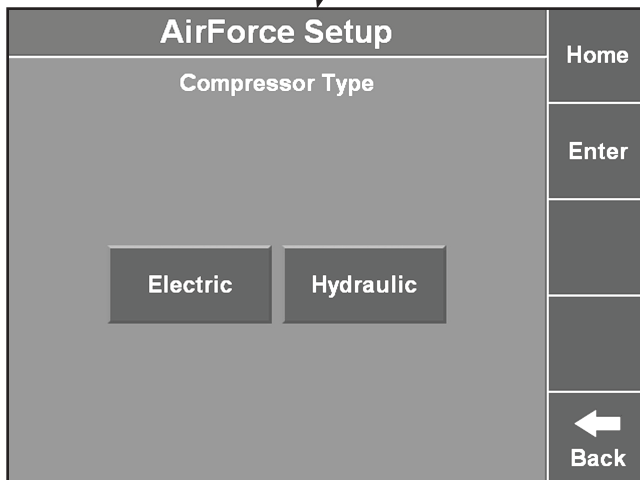
Once the AFM Serial Number has been entered and confirmed, the system will default to the *Setup & Configuration* page. Select the **'Systems'** Tab, and then select the **'AirForce'** button under the **Control** section as shown at right. This should bring you to the AirForce Setup Page.

You can also reach the AirForce Setup page from the Home Screen by pressing **Setup | Systems | AirForce**, or **AirForce** | then the **Setup** button.



This page primarily contains settings and parameters that will outline the control of AirForce. At this time we need to focus only on assigning values for the **Air Bag Type** and **Compressor Type**.

We will return to this page in greater detail once the system is 100% operational.

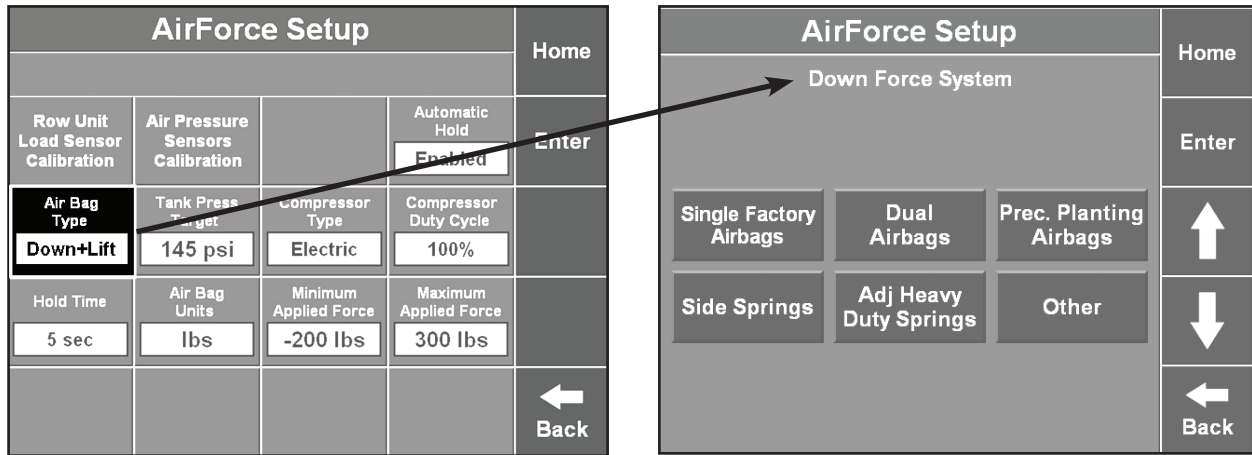


First, select the Compressor Type icon as shown. This will bring you to another screen that will allow you to declare which type of compressor the installed AirForce system has. Simply select the correct choice and the system will return you to the **AirForce Setup** with your selection displayed in the box.

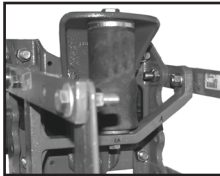
If you happen to touch the wrong compressor type, simply re-select the **Compressor Type** icon and repeat the process

Declaring Air Bag Type

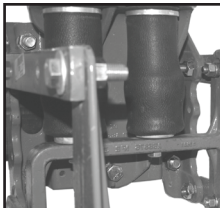
Once the Compressor Type has been set, the system will return you to the AirForce Setup page. The next step will be to declare the *Air Bag Type*. Select the **Air Bag Type** icon from this page.



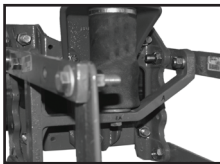
The first page of the Air Bag Type selection process is to declare which **DOWN FORCE SYSTEM** is on the planter. An example and description of the style of Down Force that each choice applies to are listed below.



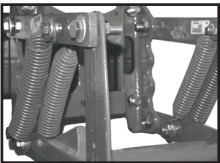
Single Factory Airbags: These are OEM / Dealer installed with a single Down Bag per row .



Dual Airbags: These are OEM / Dealer installed with two Down Air Bags per row.



Precision Planting Airbags: These are Down Air Bags purchased from Precision Planting and installed by the customer or by a Precision Planting representative.



Side Springs: These are the springs that connect to and alongside the parallel arms of the row unit, and may be Single (two springs per row) or Dual Side Springs (four springs per row - shown).

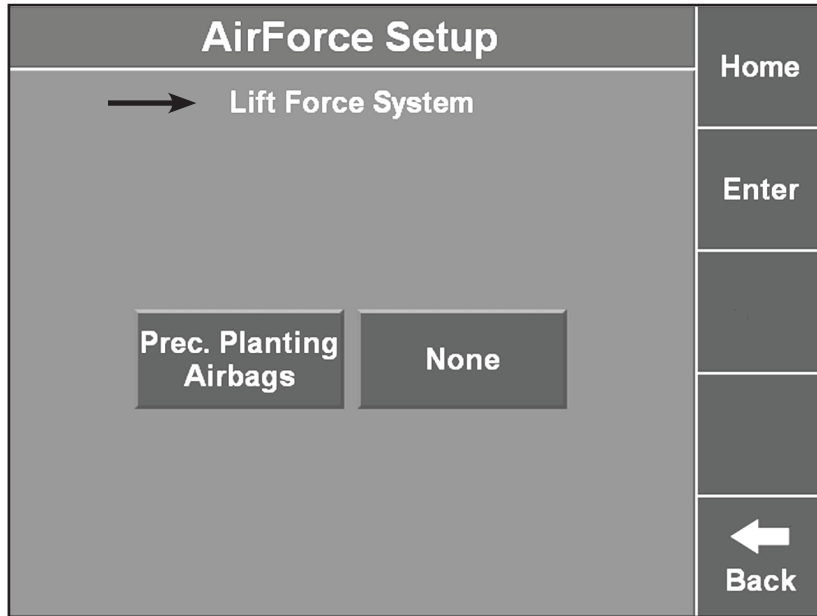


Adjustable Heavy Duty Springs: This style of springs has two to four springs placed in between the parallel arms of the row unit.

Other: When choosing this option the system will bring up an entry window that will allow you to name the type of Down Force System that you have. **NOTE:** by selecting this option you will be limiting the control options of the system to **LIFT ONLY**.

Declaring Air Bag Type (Continued)

Once the Down Force System has been selected, the system will continue to the next page where you will need to declare which Lift Force System the planter has installed on it.

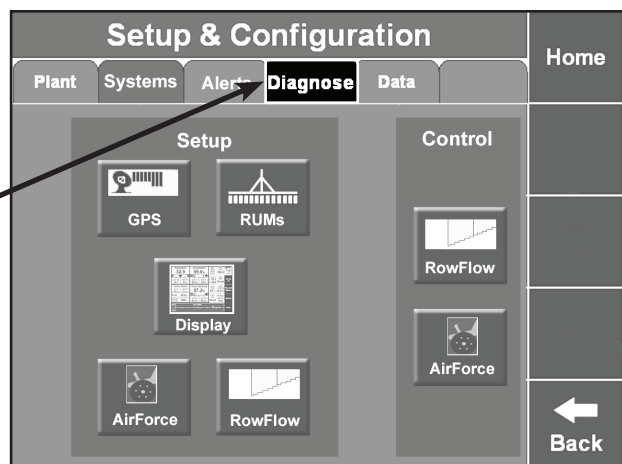


At this time Precision Planting is the only option available for applying a Lifting Force to the row unit. If you have purchased and installed a system to control Down and Lift Forces, select **Precision Planting Airbags**. If you have purchased and installed a system to control the Down Force only, select **None**.

Now that the Lift Force System has been selected the system will return to the AirForce Setup page. Review the Air Bag Type and Compressor Type selections you have made to ensure accuracy before moving forward. If you have made any mistakes, simply repeat the above process to make the appropriate changes.

Once you are satisfied with your choices, continue setting up your AirForce system by selecting the **Back** button in the lower right hand portion of the screen, followed by the **Diagnose Tab** on the following Page.

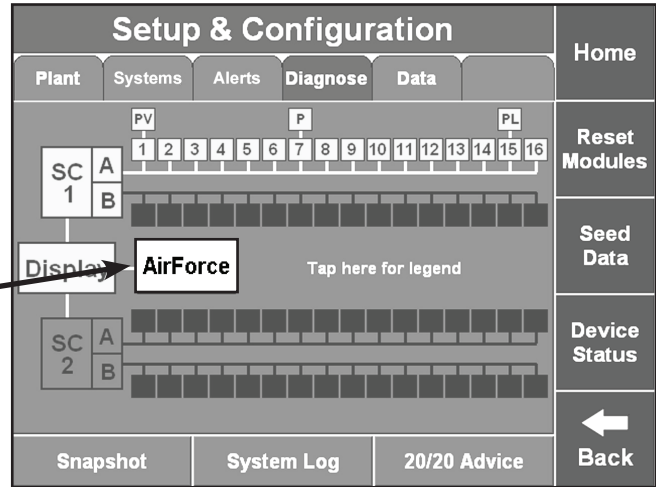
AirForce Setup				Home
Row Unit Load Sensor Calibration	Air Pressure Sensors Calibration		Automatic Hold Enabled	Enter
Air Bag Type Down+Lift	Tank Press Target 145 psi	Compressor Type Electric	Compressor Duty Cycle 100%	
Hold Time 5 sec	Air Bag Units lbs	Minimum Applied Force -200 lbs	Maximum Applied Force 300 lbs	
				Back



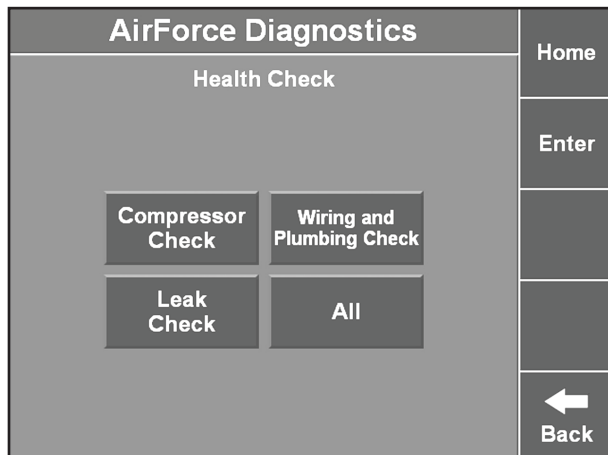
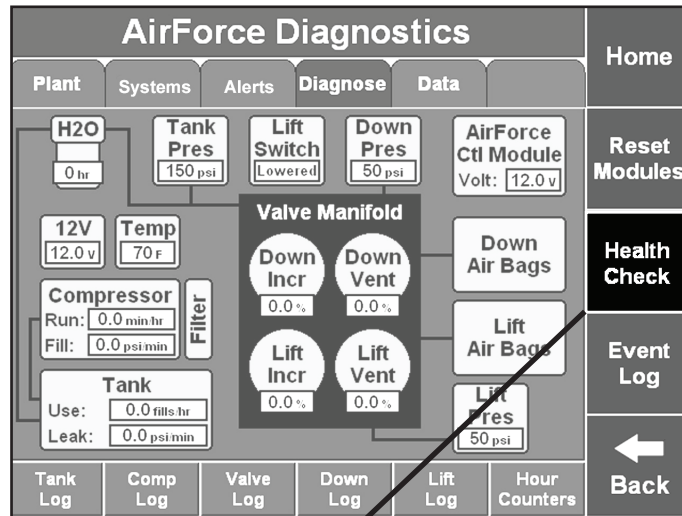
Running Health Check

The next steps require the tractor to be running, all power and communication cables connected, and the appropriate hydraulic circuit engaged (Hydraulic compressors only)

The Diagnose Tab will remain similar to the Base version of SeedSense, with the addition of an AirForce icon in the center of the screen, to the right of DISPLAY. This is an actionable icon that will open the AirForce Diagnostics page. Press this button to continue.



The AirForce Diagnostics screen, shown below, will be the primary destination for troubleshooting and system health updates. We will return to this page in greater detail once the system is 100% operational. For now, press the **Health Check** button on the right hand side of the page to continue.

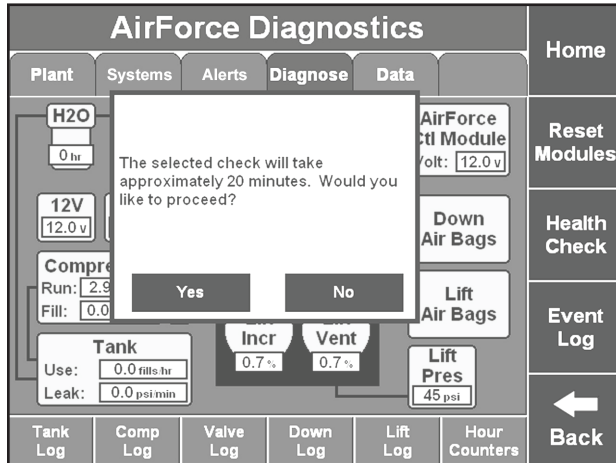


The system will direct you to the Health Check menu page. From here you can select to run individual or comprehensive system health checks. There are three main Health Checks. These may be performed individually by selecting the button for a specific check or all at once by selecting the **'ALL'** button.

For the initial system set-up it is recommended to begin with the **'All'** choice to check the entire system. Press the **'All'** button to continue.

If the stability of the system is in question, the user can run a Health Check for the component in question, or rerun the **'All'** Health Check at any time.

Running Health Check (Continued)



Once you've selected which Health Check you'd like to run, a warning box will pop up asking you to verify your choice.

Note: The system will require the tractor to remain running and all circuits engaged for the entire duration of the test. Also, you will not be able to navigate away from the Diagnostics page until the test has completed.

Press **'Yes'** to continue and begin the Health Check.

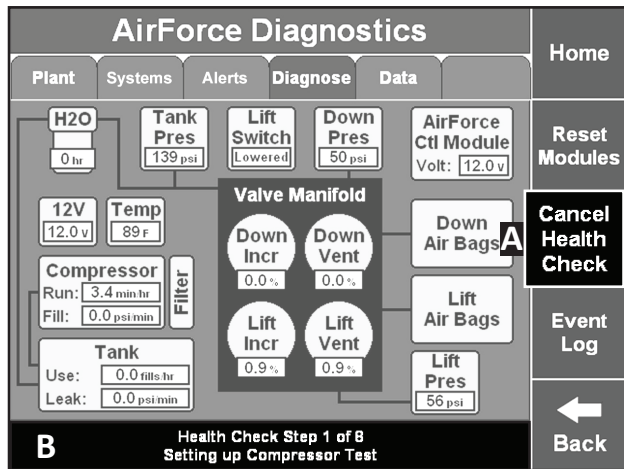
Once the Health Check has begun you will note the appearance of two new icons present during the test.

A

Cancel Health Check: If it becomes necessary to navigate away from the Diagnostic page or otherwise prematurely end a Health Check press this button. A dialog box will pop up asking you to verify your choice.

B

Health Check Progress: This bar will state the progress of the Health Check (a full check has 8 steps, approximately 20 minutes) and a brief description of the current step.



See below for a more detailed description of the individual Health Check steps.

Health Check

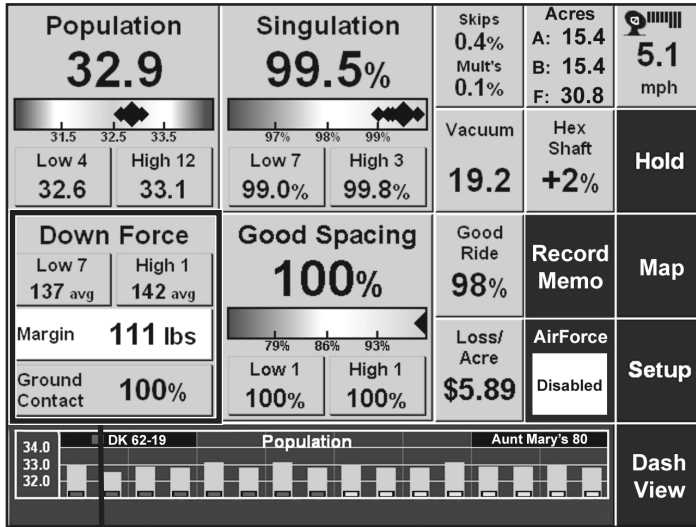
Step 1	Compressor Check	Setting up Compressor Check	Tank Pressure will drop to or below 100psi
Step 2		Building Tank Pressure to 130psi	System will verify build rate to 130psi
Step 3	Wiring and Plumbing Check - Down	Checking Down Circuit	System will build and release pressure between 20 & 100psi
Step 4	Wiring and Plumbing Check - Lift	Checking Lift Circuit	System will build and release pressure between 20 & 100psi
Step 5	Leak Check Tank	Checking Tank pressure	System will build pressure >120psi, measure decay
Step 6	Leak Check - Down	Checking Down Circuit Pressure	System will build pressure >100psi, measure decay
Step 7	Leak Check - Lift	Checking Lift Circuit Pressure	System will build pressure >100psi, measure decay
Step 8		Verify Gauges	System will prompt user to verify that Display Unit and Analog Gauges are within 5psi of each other

In a healthy system, no individual step or check should take longer than 7 minutes. If this happens, Cancel Health Check and press Reset Modules prior to a second attempt. After a second failed attempt, refer to the Troubleshooting index.

AirForce is now ready to use.
Please continue reading the Walk-through for more Operational training.

Down Force Details

Press the *Home* button in the upper right hand corner to return to the Home screen and begin the walk-through.



The AirForce system will be disabled upon startup and will automatically disable itself anytime power or communication to the system is reset or fluctuated. This is because the system will be controlling moving parts on the planter. It is a safety aspect of the system and cannot be bypassed.

In its Default configuration, AirForce will display on the Home screen with the Tank, Down, and Lift circuits displayed. The gauges on the enclosure are readings in psi of the respective circuits. The home screen uses the pounds of applied force because it is more intuitive and that it equates more fluently to the margin readings.

A note about the information displayed on the Home Screen as it pertains to AirForce:

The Down Force quadrant is primarily a display of the Input to AirForce. In other words, this is the information that AirForce will be basing it's decisions upon.



The specific row unit and Smart-Pin readings are displayed for both the Highest and Lowest average readings over the past 3 seconds

This button displays the percent GROUND CONTACT, and MARGIN (in lbs) as a planter-wide average.

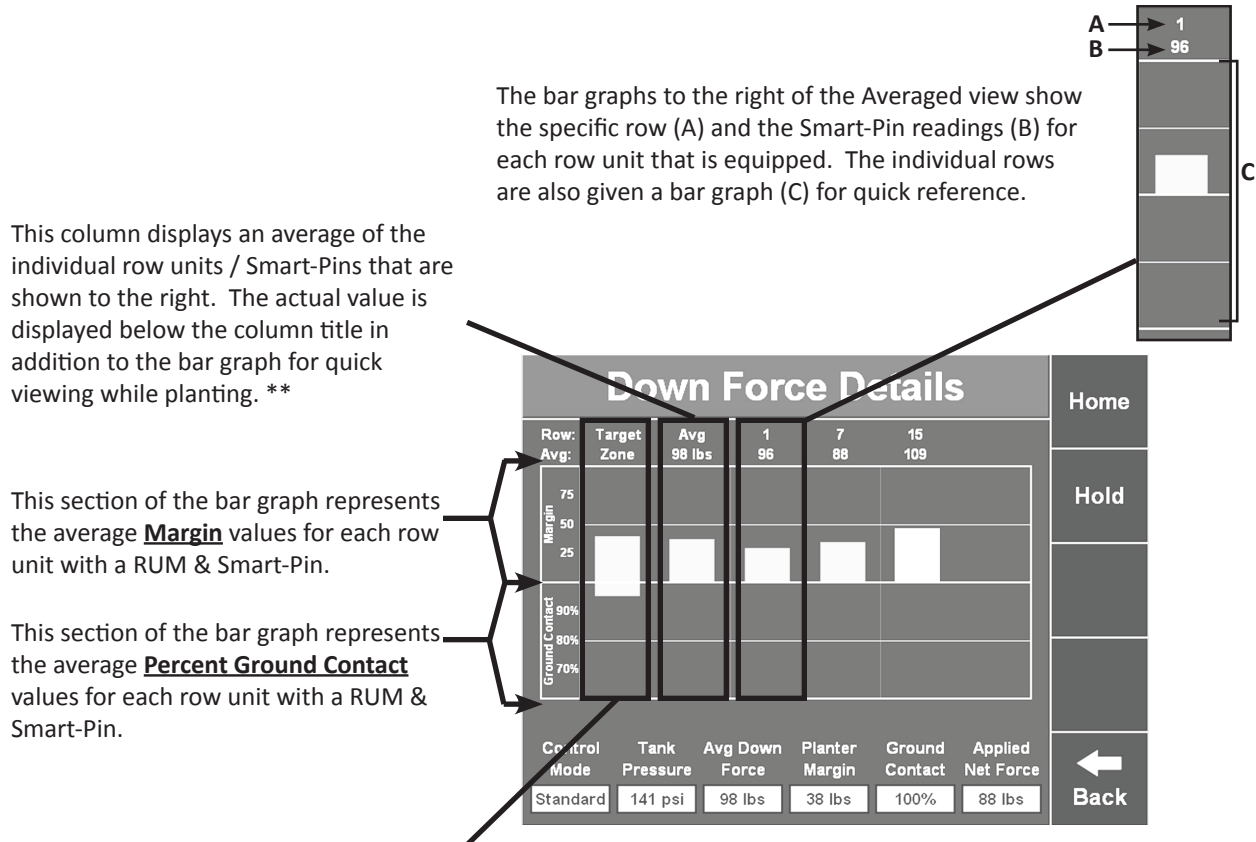
Pressing the Down Force button on the Home screen will open the Down Force Details page.



When operating an AirForce system, the Down Force details page will display additional information compared to the basic SeedSense. When AirForce control is **Enabled**, a new bar is added to the left side of the chart to show the target zone of the active control mode. The active control mode is displayed in the bottom left corner of the screen. Other new information displayed at the bottom of the screen includes Tank Pressure as well as Applied Net Force.

Down Force Details (Continued)

Let's look at the Down Force Details page in a little more detail:



The Target Zone is a graph of the Control Mode parameters that AirForce will attempt to manage the planter within. This graph will be present only when the system is **Enabled** and in an Automatic Control mode. This graph will disappear when AirForce is **Disabled** and while operating in the Manual Mode.

Control Mode:

This box displays the active Control Mode of the system. The display will read Manual when the system is in the Manual mode as well as when the system is Disabled.

Tank Pressure:

This box will display the current pressure in the Tank, displayed in psi. This reading should be within ± 7 psi of the Analog gauge on the front of the enclosure.

Average Down Force:

This box will display the Down Force as a planter-wide average of the individual Smart-Pin readings. This information is mirrored by the graph above. **

Planter Margin:

This box displays the Margin as a planter-wide value. This is determined as the amount of Down Force greater than that required by the opening discs to reach the prescribed planting depth. A simple means of interpreting this is simply; **Margin = extra weight**.

Ground Contact:

This box displays the percentage Ground Contact of the planter as a whole. This is determined as the amount of time that the gauge wheels have 5lbs or greater weight registering on them. This will be displayed graphically above when the value is below 100%.

Net Applied Force:

This box displays the net effect the system is placing on the row units (across the planter as a whole). This is based only on the forces being controlled, not the inherent weight of the row units themselves. The calculation for this is: **Down Force - Lift Force = Net Applied Force**

AirForce Control Center

At this point, press the *Home* button to return the Home screen

From here we will move into the control of the AirForce system. Press on the *AirForce* button on the home screen to access the AirForce Control Center.

The active Control Mode will be displayed in the upper left corner of the Display. The status of AirForce will be displayed in yellow when disabled. This view will switch to green highlighting when displaying the **active** control mode.



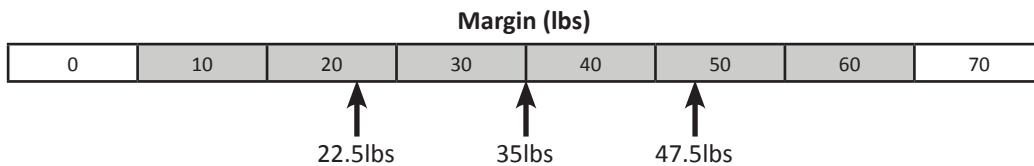
The AirForce Control Center interface is a grid of controls. At the top left is the "Control Mode" button, currently showing "Disabled". To its right are "Down Force Target" (250 lbs) and "Lift Force Target" (170 lbs), each with up and down arrow buttons. Below these are four "Auto Mode" buttons: Light, Standard, Heavy, and Custom. The bottom row contains "Compressor Hours" (0.0), "Compressor Duty Cycle" (0%), "Compressor Air Temp" (70 F), and "Compressor Voltage" (12.0 V). The bottom-most row shows "Tank" (150 psi / 145 psi), "Down" (50 psi / 50 psi), "Lift" (50 psi / 50 psi), and "Auto Control Hours" (0.0). On the right side, there are five vertical buttons: "Home", "Hold", "Enable Control", "Setup", and "Back".

The **Enable Control** button toggles on and off AirForce Control. The default state for AirForce is disabled (as shown). This is for safety reasons; human release prior to automated control.

Additional system settings and configurations are available by pressing the **Setup** button.

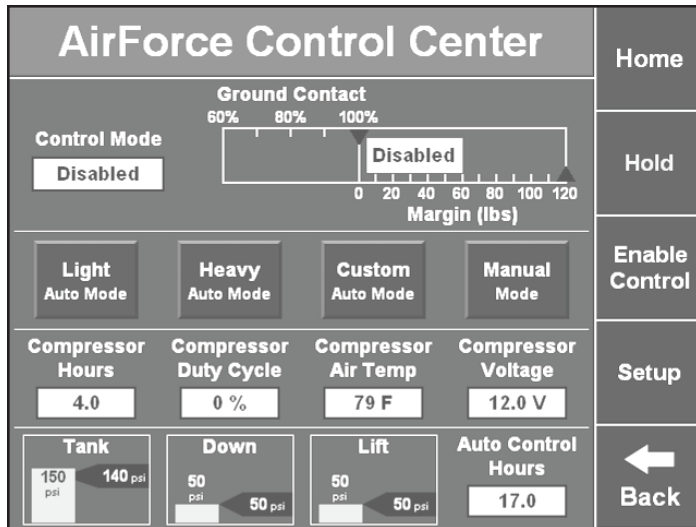
The target zone bar graph displays the percent of Ground Contact to the left of the median and the pounds of Margin to the right. The target zone is displayed by the green bar, the actual values are represented by the black triangles along the top and bottom.

All automatic modes will attempt to control to the median of the target zone. As the actual value moves away from the median of the target zone the system will take action once the value has passed half-way towards either extreme. Using the example below, the system is in Standard Automatic mode with a target zone between 10 & 60lbs of Margin. The arrow from 35lbs designates the median value. The arrows from 22.5 and 47.5lbs designate the point at which AirForce will take action to return the actual value to the median.



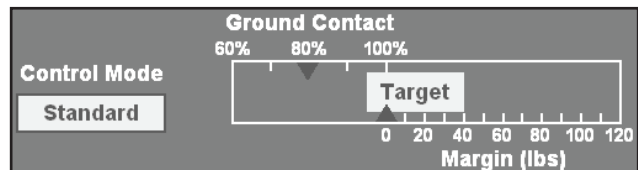
This becomes important as the control modes change, especially within the Custom Automatic mode. This allows the user an additional means of controlling the reactivity of the system. A wider target zone should have fewer reactions moving a larger force. A tighter target zone should have more reactions moving a smaller force.

AirForce Control Center (Continued)

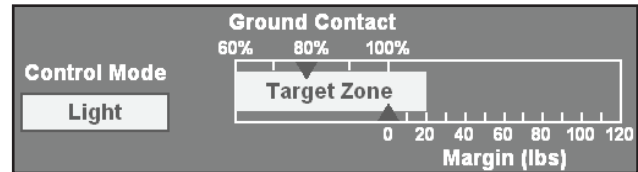


The AirForce Control Center is where you will choose the active control mode. The four available (not selected) control modes will be shown in the black boxes across the center of the page. Selecting any one of these will alter the display at the top right to reflect the target parameters of the new control mode.

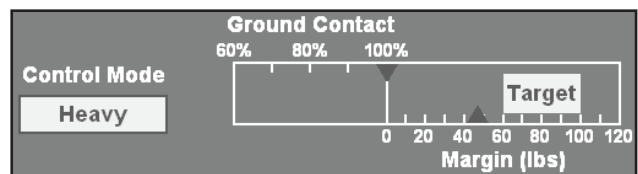
Standard Automatic: This is the most common setting for AirForce. The target range for this mode is set for 10-60 lbs of Margin with 100% Ground Contact.



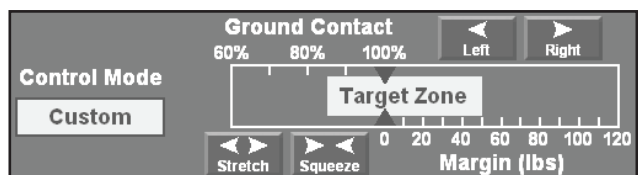
Light Automatic: This control mode moves the target range from 20lbs of Margin to a low of 60% Ground Contact. **This control mode will sacrifice Ground Contact - potential seeding depth - to ensure a minimum Margin!** Use this mode when uniform seeding depth and/or moisture are not as yield limiting as potential row compaction. Rarely used over an entire field, most commonly used for spot controlling small wet areas.



Heavy Automatic: This control mode moves the target range to 60-100lbs of Margin with 100% Ground Contact. Use this control mode when extra Down Force is required; dry conditions or cloddy seed-bed. **Note: crushing clods and minimizing Margin are opposing ideas!** Ensuring good seed to soil contact in dry or cloddy field conditions will outweigh any additional Margin concerns.



Custom Automatic: This control mode allows the user to create their own target zone within an automatic control. Once this mode is selected you will notice the addition of four buttons surrounding the target zone graph. To the upper right hand side are Right/Left buttons, used to move the zone back and forth across the graph. To the lower left hand side are Stretch/Squeeze buttons; used to control the size of the target zone.



Manual Mode: This control mode allows the user to designate a pressure or desired force for the system to maintain. This is a static setting that will not fluctuate throughout the field in response to soil-type or tillage changes. The units are selectable under the Setup button to view Pounds or Psi.



AirForce Control Center (Continued)

Additional system information is displayed below the available control mode icons.

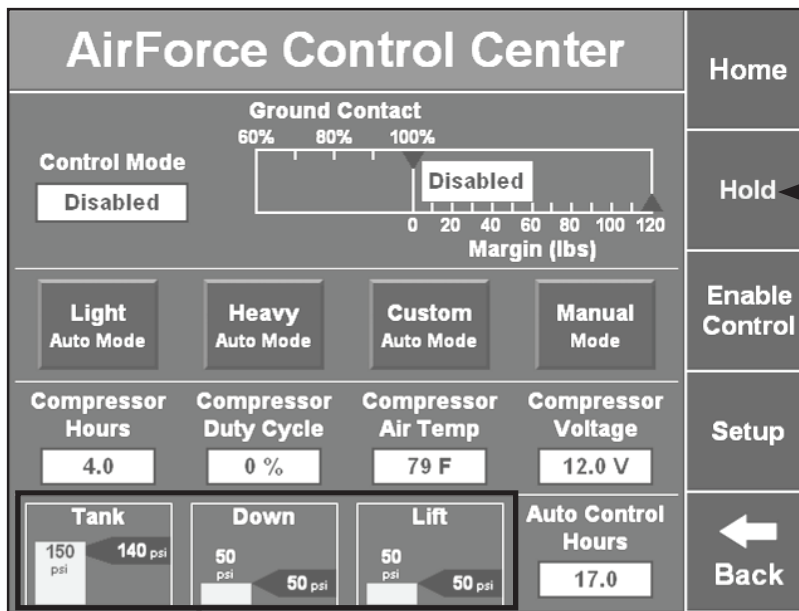
Compressor Hours - simply states running time of the compressor in hours

Compressor Duty Cycle - displays the run-time of the compressor figured as a percentage of time. The compressor is capable of sustaining a 100% duty cycle, however long periods of duty cycles $\geq 80\%$ will have lowered performance and should be investigated. This is can be caused by: leaks in the system, a system setting too reactive for field conditions, or a lowered compressor build rate.

Compressor Air Temperature - displays the temperature of the compressor head in degrees Fahrenheit (Celsius display is available under the Setup button). Normal operating range is from ambient temperatures up to 350°F. The system will show an alert when the temperature rises into the range of 350-400°F and will disable the system once the temperature exceeds 400°F.

Compressor Voltage - displays the voltage that the 12V compressor is drawing. This should fluctuate as the 12V compressor cycles on and off. This display will be inactive on systems with a Hydraulic compressor.

Auto Control Hours - simply displays the number of hours that the AirForce system has operated in any of the Automatic Control Modes; Light, Standard, Heavy, or Custom.



The **Hold** button allows the user to order the system to ignore Margin and Ground Contact values for a certain period of time. Once pressed, a count down timer will appear under the button title representing the length and progress of the Hold action. The length of time to Hold is configurable under by pressing the Setup button.

An example of the uses of this button would be waterways or ditches within the field. By pressing the hold button prior to entering the waterway the system will simply maintain the current pressures until the end of the hold cycle - hopefully on the other side of the waterway.

At the bottom of the page are three boxes displaying the status of the Tank, Down Circuit, & Lift Circuit. Each one of these boxes will display the actual value—represented by the green bar graph; as well as the target value—represented by the black arrow. These values are given in psi units.

The difference in units used throughout the monitor, pounds or psi, represents a difference in focus. Pounds (of force applied) equates more readily to the force readings from the Weight Sensors on the row units, Down Force and Margin. Pressure (in psi) of the tank or circuits is used to better describe the forces being applied within the air lines, bags, and tank. This can be equated to **psi being used to determine the health of the system, and pounds to display the output of the system.**

AirForce Setup

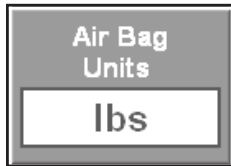
At this point, press the *Setup* button on the right to continue the walk-through.

The Air Bag Type and Compressor Type have been covered previously and will therefore be skipped at this point. Refer back to the initial start-up pages for further info on these buttons.

The **Hold Time** button was referenced within the AirForce Control Center and is the location where users can modify the default Hold Time.

The **Tank Press. Target** button allows the user to designate the pressure the system will aim to maintain within the 10 gallon supply tank. This is defaulted to 150psi from the factory and should remain there unless problems arise.

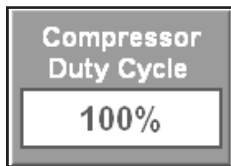
AirForce Setup				Home
Row Unit Load Sensor Calibration	Air Pressure Sensors Calibration		Automatic Hold Enabled	Enter
Air Bag Type Down+Lift	Tank Press Target 145 psi	Compressor Type Electric	Compressor Duty Cycle 100%	
Hold Time 5 sec	Air Bag Units lbs	Minimum Applied Force -200 lbs	Maximum Applied Force 300 lbs	
				← Back



The **Air Bag Units** button allows the user to toggle between lbs or psi as the displayed units of measure. The difference in units used throughout the monitor, pounds or psi, represents a difference in focus. Pounds (of force applied) equates more readily to the force readings from the Weight Sensors on the row units, Down Force and Margin. Pressure (in psi) of the tank or circuits is used to better describe the forces being applied within the air lines, bags, and tank. This can be equated to **psi being used to determine the health of the system, and pounds to display the output of the system.**



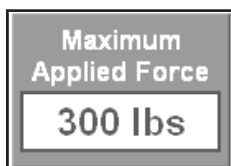
The **Automatic Hold** button allows the user to toggle on/off this control feature. The AirForce system will automatically place itself in a 'Hold' situation during non-planting times and row failures. This is designed to minimize the impact of AirForce on planting issues that are not Down Force related. It may be useful in fields with many and long point rows with extended 'clutched' rows to disable the Automatic Hold.



The **Compressor Duty Cycle** button allows the user to designate the maximum duty cycle of the compressor. AirForce is designed to run with ≤80%DC and will control the system to automatically optimize response time and duty cycle. This is defaulted to 100% from the factory and should remain there unless problems arise.



The **Minimum Applied Force** button allows the user to control the amount of force to be applied in the Lift direction. The defaulted value of -200lbs is the maximum amount of force that the Lift Bags are able to remove from the row unit. This value would be changed only if the user wanted to limit the Lift capacity of the system.



The **Maximum Applied Force** button allows the user to control the amount of force to be applied in the Down direction. The defaulted value of 300 lbs is just short of the maximum amount of force that the Down Bags are capable of adding to the row unit. This value would be changed only if the user wanted to limit the Down capacity of the system. An example of this is a planter that weighs less than the force the system is able to apply. 3000lb planter with 12 rows capable of a total of 3600pounds of force = the down bags will have the ability to physically lift the planter

AirForce Setup (Continued)

Down Force Calibration					Home
Row 1	Pin Reading	Cal Factor	Reference Value	Load Sensor	Zero All
	-42	85.0	32.69	Active	
Row 7	Pin Reading	Cal Factor	Reference Value	Load Sensor	
	-38	85.0	32.53	Active	↑
Row 15	Pin Reading	Cal Factor	Reference Value	Load Sensor	↓
	-25	85.0	32.73	Active	←
					Back

Reference Values: : this column displays a reference value for the system’s use of the Calibration Factor. Normal operating values should vary between 28 and 38. This column is modifiable, however should be done so under direction from Precision Planting during advanced technical service.

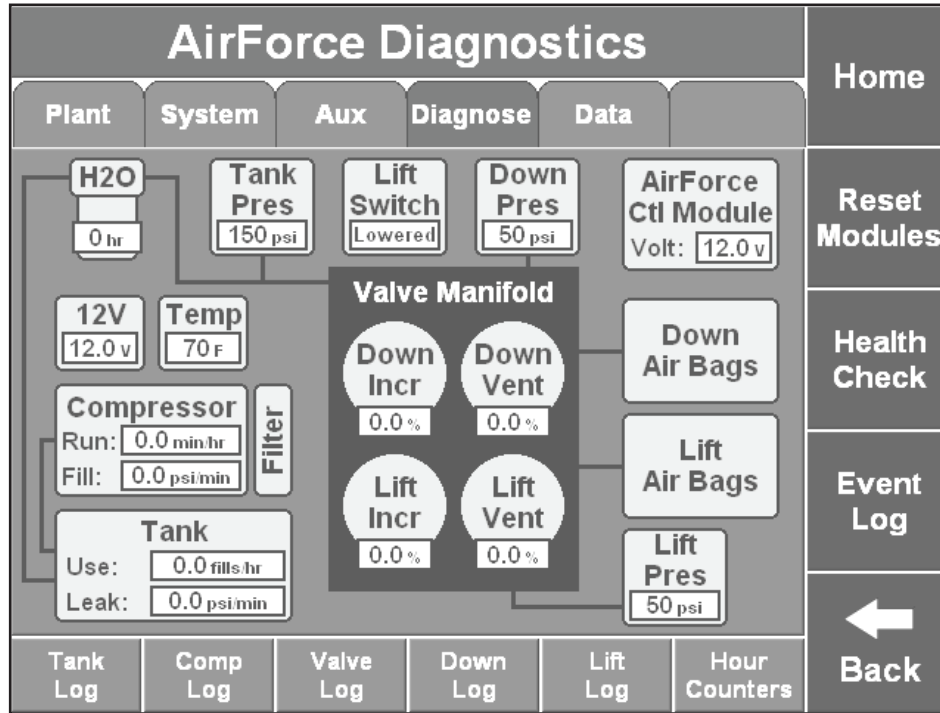
Load Sensor: this column displays the status of the load sensor for the given row. If an individual load sensor fails, or is producing readings that are statistically out of range, it is possible to ‘Ignore’ a row on-the-go. Simply press on the Active for the given row. A warning pop-up will appear asking the user to verify this choice. Pressing ‘Yes’ will highlight the entire row and change the wording to ‘Ignored’. While a load sensor is ignored, data from this sensor will be recorded and mapped, however will not be included in dashboard averages or AirForce Control.

Zero All: This button is located on the right hand side of the page in the black column and is used to ‘tare’ the load sensors. This will return the load sensor values to zero. To properly zero the load sensors, raise the planter, wait 10 seconds for the readings to settle, then press **Zero All**. This should be done at the start of the season and periodically throughout the season. The system will monitor these values and will “Auto-Zero” the sensors occasionally to assist in maintaining accurate readings. This process is also the first action a user should take to correct/diagnose load sensor issues.

AirForce Diagnostics

At this point we'll move to the **AirForce Diagnostics** page to continue the walkthrough. To access this page from the Home page press the **Setup** button, the **Diagnose** tab, and the **AirForce** icon in the center of the screen. The **AirForce Diagnostics** page will be the first and primary location for troubleshooting and monitoring the health of the AirForce system.

Overview: this page gives a visual representation of the AirForce components. The color of each item reflects the health or status of the component. A legend of the colors is available under the **Diagnose Tab**, disabled items will be displayed as grey instead of black due to background concerns.



H2O: displays the number of hours elapsed since the last time the water separator has been checked and cleared. If this is not green, check/clear the water separator then clear the prompt under the Hour Counters tab at the bottom of this page.

Tank Pressure: displays the current tank pressure. The value displayed here should be within ± 5 lbs from that displayed on the analog gauge at the front of the enclosure.

Lift Switch: this icon will display the current status of the Lift Switch; raised or lowered.

Down Pressure: displays the current pressure in the Down Circuit. The value displayed here should be within ± 5 lbs from that displayed on the analog gauge at the front of the enclosure.

Lift Pressure: displays the current pressure in the Lift Circuit. The value displayed here should be within ± 5 lbs from that displayed on the analog gauge at the front of the enclosure.

Down Air Bags: This icon displays the health status of the Down Circuit. The system will monitor the inputs/outputs and static values of the circuit and gauge those readings against expected values to determine the status of the circuits.

Lift Air Bags: this icon will be similar to the Down Air Bags icon for reflecting Lift Circuit health.

Temperature: displays the temperature of the compressor head in degrees Fahrenheit (Celsius display is available under the Setup button). Normal operating range is from ambient temperatures up to 350°F. The system will show an alert when the temperature rises into the range of 350-400°F and will disable the system once the temperature exceeds 400°F.

AirForce Diagnostics (Continued)

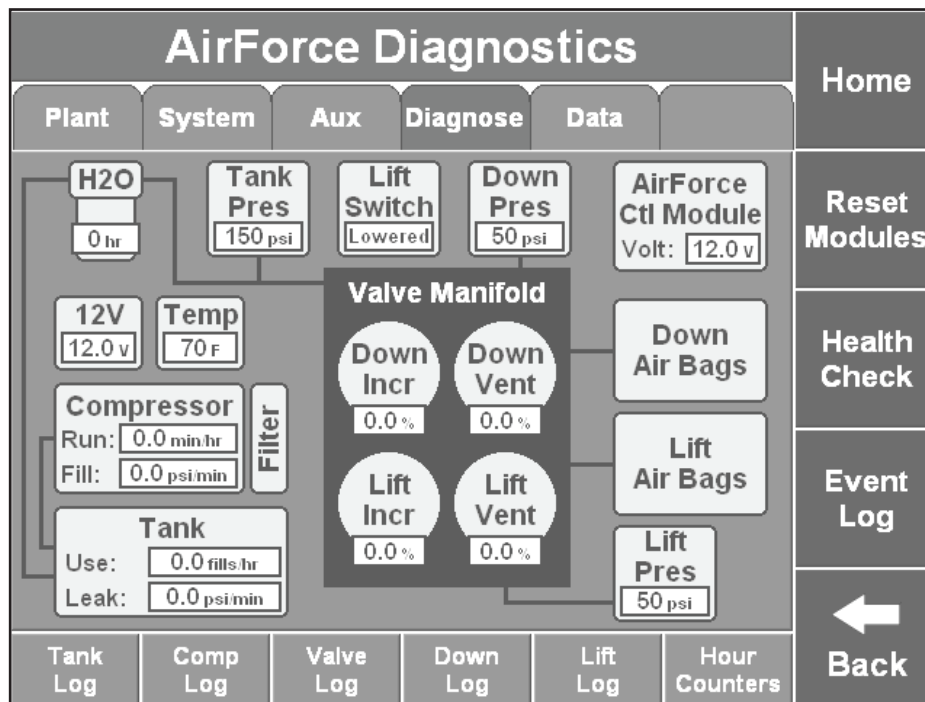
Voltages are displayed in two locations on the Diagnostics page; AirForce Control Module (AFM) voltage and 12V voltage. The AFM voltage will be displayed on all models however the 12V voltage will be displayed only on electric compressor models.

AirForce Control Module (AFM) - displays the voltage at the AFM. This voltage is keyed power through the SeedSense display unit and harness. Operating values for the AFM should be 11.5v to 14.0v and should not fluctuate greatly with the cycling of electric compressors.

12V - displays the voltage to the compressor through the tractor battery power cable (heavy 6ga wires), measured at the 80A contactor. AirForce will disable the system if this voltage does not remain above 11.5v when not running, 10.5v when the compressor is running.

Compressor - this icon displays the compressor status, using the color scheme, as well as displaying performance data on Run time and Fill rate.

Tank - similar to the compressor icon, the tank will display health using a color scheme, in addition to performance data on Use and Leak rates.



Valve Manifold - The center of this screen is a representation of the control valve manifold within the enclosure. Each solenoid will display a basic view of health using the color scheme, in addition to displaying the duty cycle of each solenoid. Duty cycles will vary according to field situations and AirForce settings. Situations to be wary of include; exceptionally high duty cycles (>15%), no duty cycle (0.0% after 1hr of Automatic control), and extreme variance between down Increase and Vent solenoids (variance >5%). These situations may be indicators of inefficient system settings, leaks, or failed hardware.

On the following pages, we will go into detail on the Log and Hour Counter pages available at the bottom of the AirForce Diagnostics.

AirForce Log Pages

The AirForce Logs are an historical look at the performance and statistics of the system. All of the AirForce Log pages will follow the same primary format displaying the Planting Hours in the left-most column. The hours will be displayed in reverse order to highlight the most recently completed hour of planting at the top of the list. These logs are useful in tracking system performance, identifying trends, and assisting troubleshooting.

AirForce Tank Log						Home
Planting Hours	Avg Press (psi)	Leak Rate (psi/min)	Fill Rate (psi/min)	Usage Rate (min/tank)		
9	131	0.4	24.5	6.4	Enter	
8	131	0.3	21.6	6.1	↑	
7	131	0.4	20.9	6.7	↓	
6	134	0.4	22.7	6.8	←	
5	132	0.5	22.6	6.7		
4	132	0.5	20.7	6.9		
3	132	0.5	21.7	6.6		
2	131	0.4	24.1	6.5		
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Down Circuit Log						Home
Planting Hours	Avg Press (psi)	Max Press (psi)	Min Press (psi)	Down Ratio		
9	32	54	24	0.97	Enter	
8	32	51	18	0.97	↑	
7	31	55	17	0.98	↓	
6	37	56	20	0.98	←	
5	35	58	20	0.98		
4	34	60	16	0.98		
3	34	58	18	0.98		
2	33	55	23	0.97		
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Compressor Log						Home
Planting Hours	Voltage Drop (V)	Duty Cycle	Max Temp (F)	Min Temp (F)		
9	1.1	15.8	293	69	Enter	
8	1.1	12.0	281	66	↑	
7	1.1	17.1	279	72	↓	
6	1.2	18.7	286	73	←	
5	1.2	22.0	285	72		
4	1.2	24.4	278	74		
3	1.2	22.5	282	71		
2	1.2	17.2	291	70		
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Lift Circuit Log						Home
Planting Hours	Avg Press (psi)	Max Press (psi)	Min Press (psi)	Lift Ratio		
9	32	54	24	0.97	Enter	
8	32	51	18	0.97	↑	
7	31	55	17	0.98	↓	
6	37	56	20	0.98	←	
5	35	58	20	0.98		
4	34	60	16	0.98		
3	34	58	18	0.98		
2	33	55	23	0.97		
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Valve Log						Home
Planting Hours	Down Inc Duty Cycle	Down Vent Duty Cycle	Lift Inc Duty Cycle	Lift Vent Duty Cycle		
9	0.01	0.01	0.04	0.03	Enter	
8	0.01	0.01	0.03	0.03	↑	
7	0.01	0.01	0.03	0.04	↓	
6	0.02	0.02	0.04	0.04	←	
5	0.01	0.02	0.04	0.04		
4	0.01	0.02	0.03	0.04		
3	0.01	0.02	0.03	0.04		
2	0.01	0.01	0.04	0.03		
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Hour Counters						Home
Planting Hours	Tank Fills	Compressor On Time	Tank Limited Hours	Auto Control Hours		
19.0	160	4.0	1.5	17.0	Enter	
Total Control Hours						↑
Standard	Light	Heavy	Custom	Manual		
10.0	2.0	4.0	1.0	2.0	↓	
Stable Control Hours						←
Standard	Light	Heavy	Custom			
9.0	1.5	3.5	1.0			
Service Counters (Select to Reset)						←
H2O Filter			Compressor			
1.5			4.0			
Tank Log	Comp Log	Valve Log	Down Log	Lift Log	Hour Counters	Back

AirForce Troubleshooting Checklist

This guide should be your first avenue for problem solving and troubleshooting your AirForce system. Before continuing through detailed diagnostics, please verify the following:

- 20/20 SeedSense Monitor is on
- AirForce is 'Enabled'
- 60A Fuse on Tractor Battery Cable is not blown (12V Compressors only)
- Tank Pressure is >20psi (12V) or >10psi (HYD) below Target Tank Pressure
- Compressor Air Temp. is below 400° F
- Hydraulic hoses are connected & engaged with sufficient flow (HYD. Compressors only)
- Drive belt is tensioned and in good condition (HYD. Compressors only)
- Lift Switch is green on AF Diagnostics page, and reacts correctly as the planter is raised & lowered
- Harnesses: **Check** and **recheck** all harnesses, connections, and wires for loose, corroded, or otherwise poor conductivity. In addition, thoroughly check for pinches, cuts, or any other form of physical damage to the wiring.

****This is especially important for 12V compressors and will account for the majority compressor issues****

- Mode Compatibility:

Manual Mode:

Compressor: 12V - will run Raised or Lowered
HYD - will run only with the planter Lowered

Solenoids (to Down & Lift Circuits):
Will activate only when the planter is Lowered

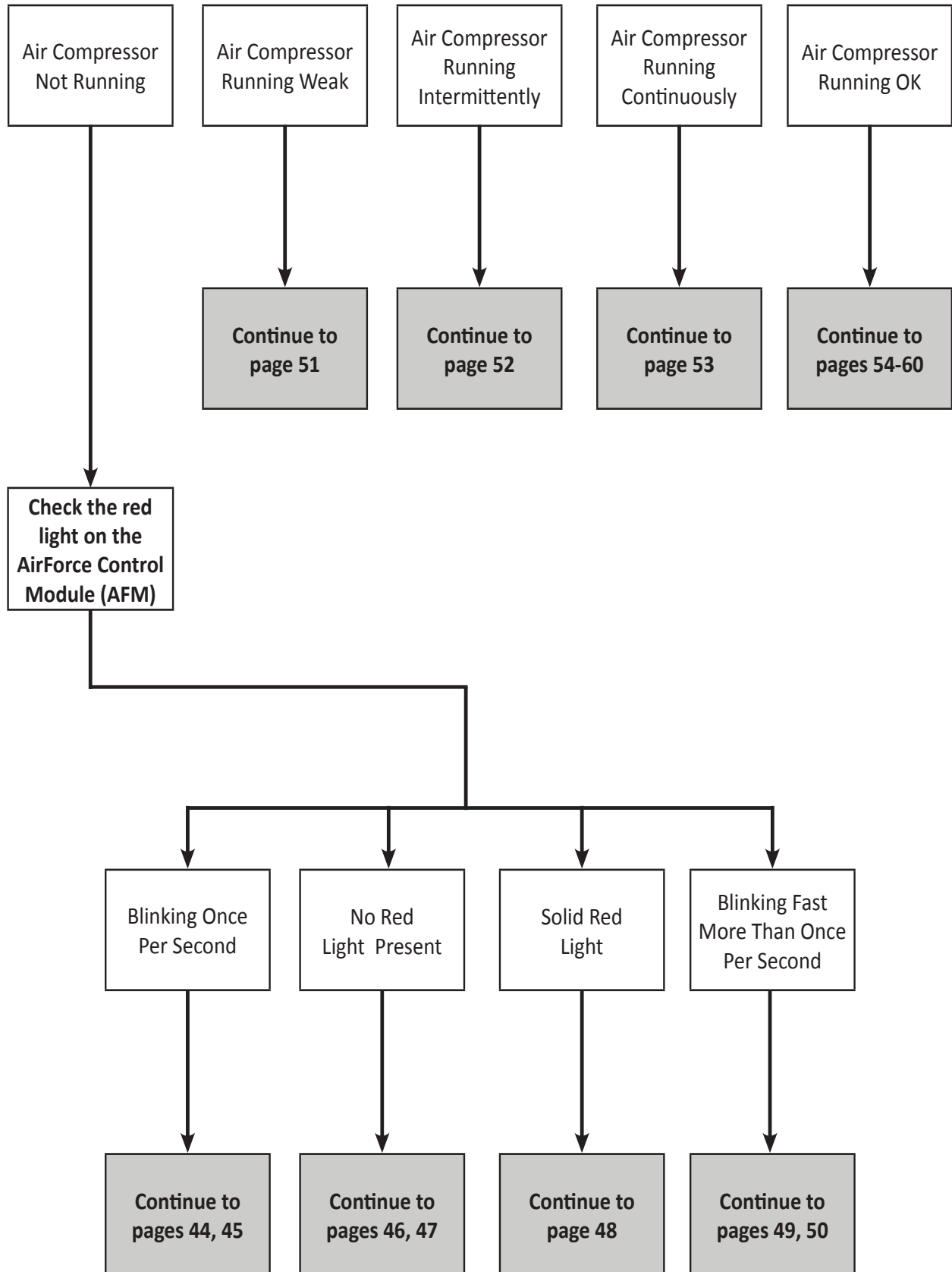
Automatic Modes:

Compressor & Solenoids will activate only when **actually planting**. This requires the system to recognize that the system is:

- 1) in the Lowered position,
- 2) moving forward – speed/GPS information,
- 3) seed tube data

AirForce Troubleshooting Guide

We will separate the AirForce Troubleshooting guide according to the operational state of the Air Compressor itself.

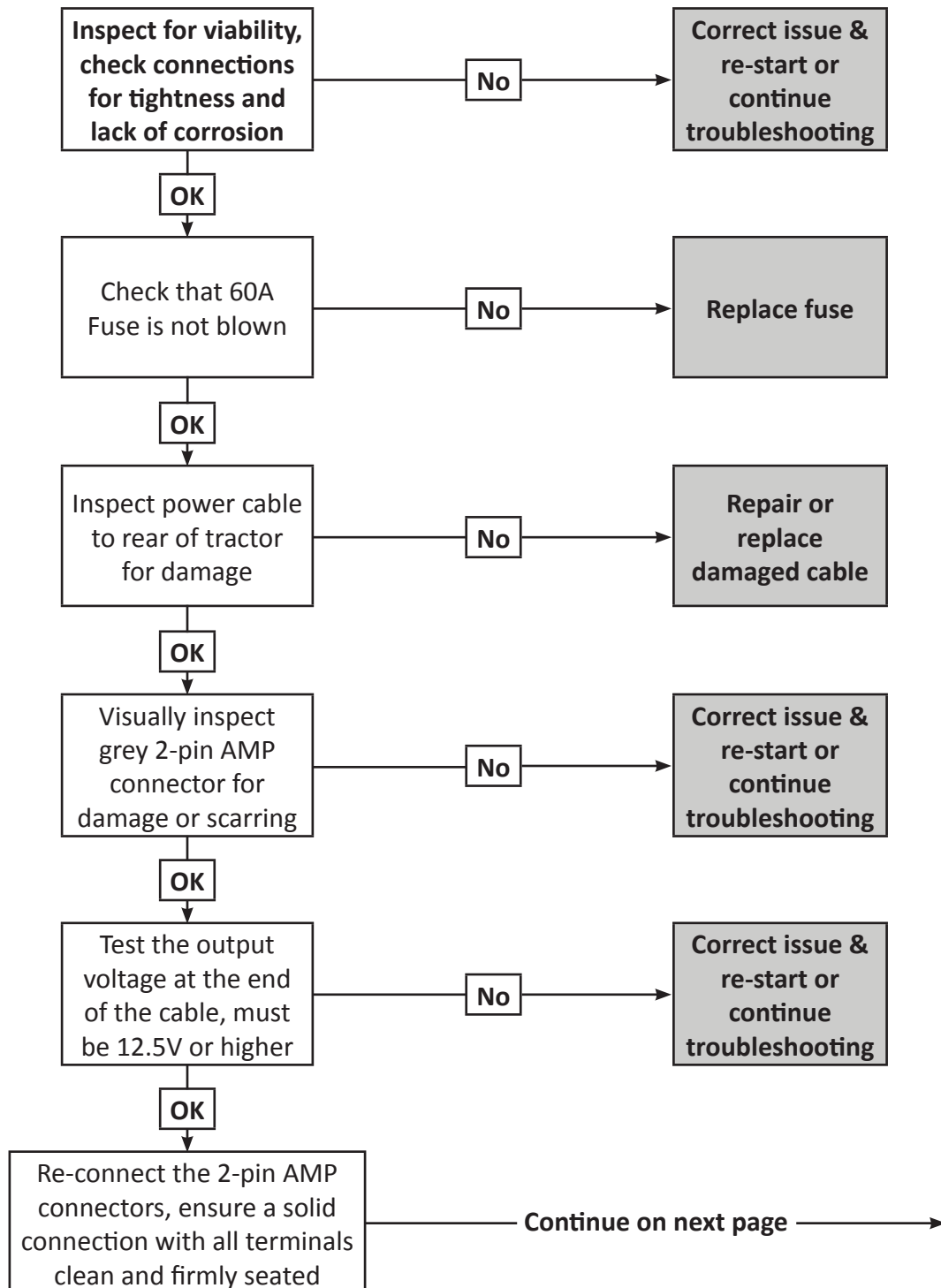


AirForce Troubleshooting (Continued)

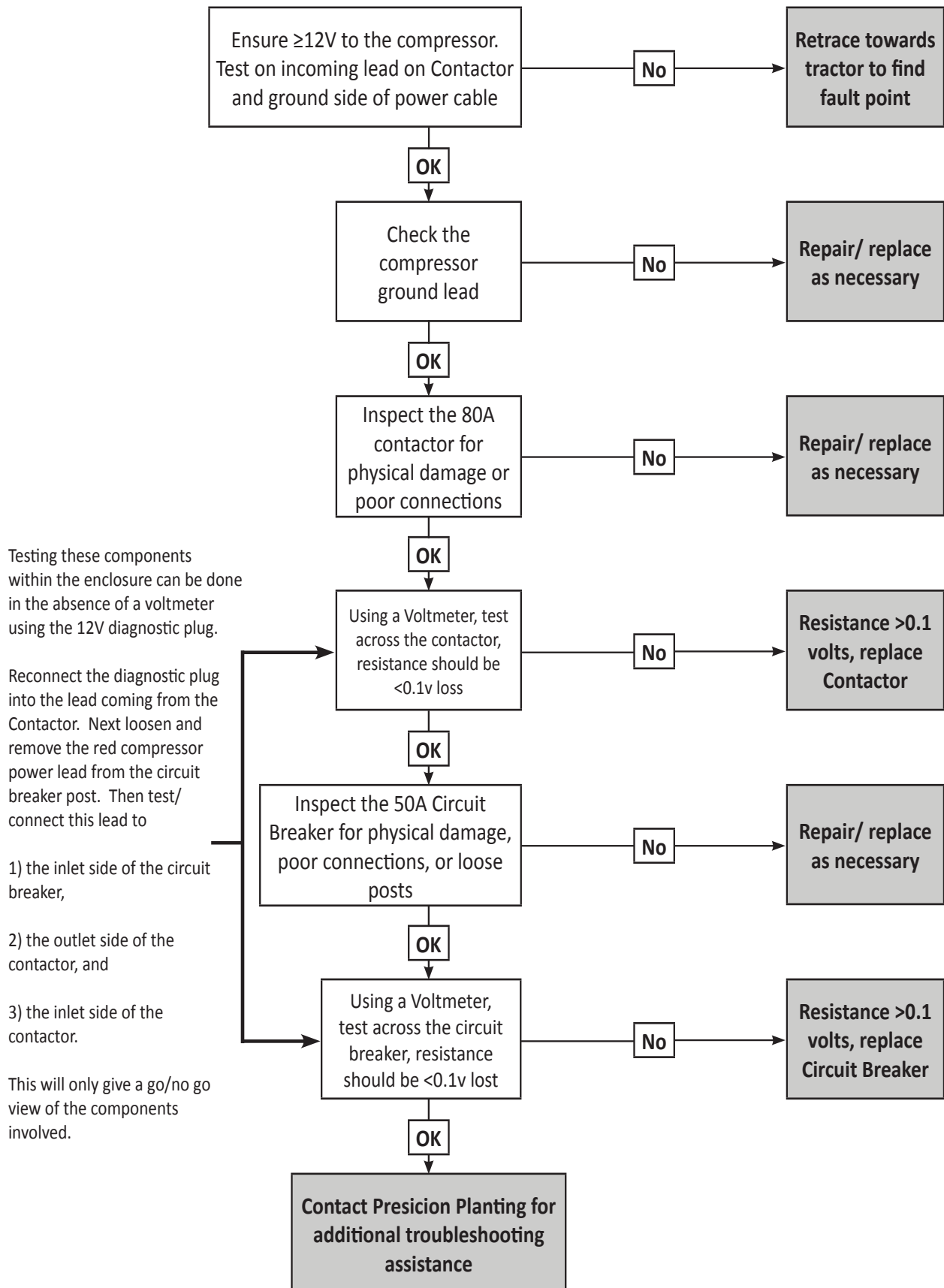
Compressor Not Running

AFM light blinking once per second = Good power & communication

Begin by verifying the situation is not dependent on signal from the AirForce Control Module (AFM). On the rear wall of the enclosure, locate and unclip the 12V Diagnostic Plug. **This plug has been provided for testing purposes only and should NEVER be left plugged into a circuit unattended.** This plug has 12V power direct from the tractor, unimpeded by the AFM. Locate the 2-pin WeatherPack connector coming from the Contactor to the Control Harness. Disconnect the Control Harness and replace with the Diagnostic Plug. If the compressor fails to start (or attempt to start), return the plugs to their original connection and continue through the trouble shooting below.



AirForce Troubleshooting (Continued)



AirForce Troubleshooting (Continued)

Compressor Not Running

No Red light on AFM = AFM not receiving 12V power nor communication from Display Unit

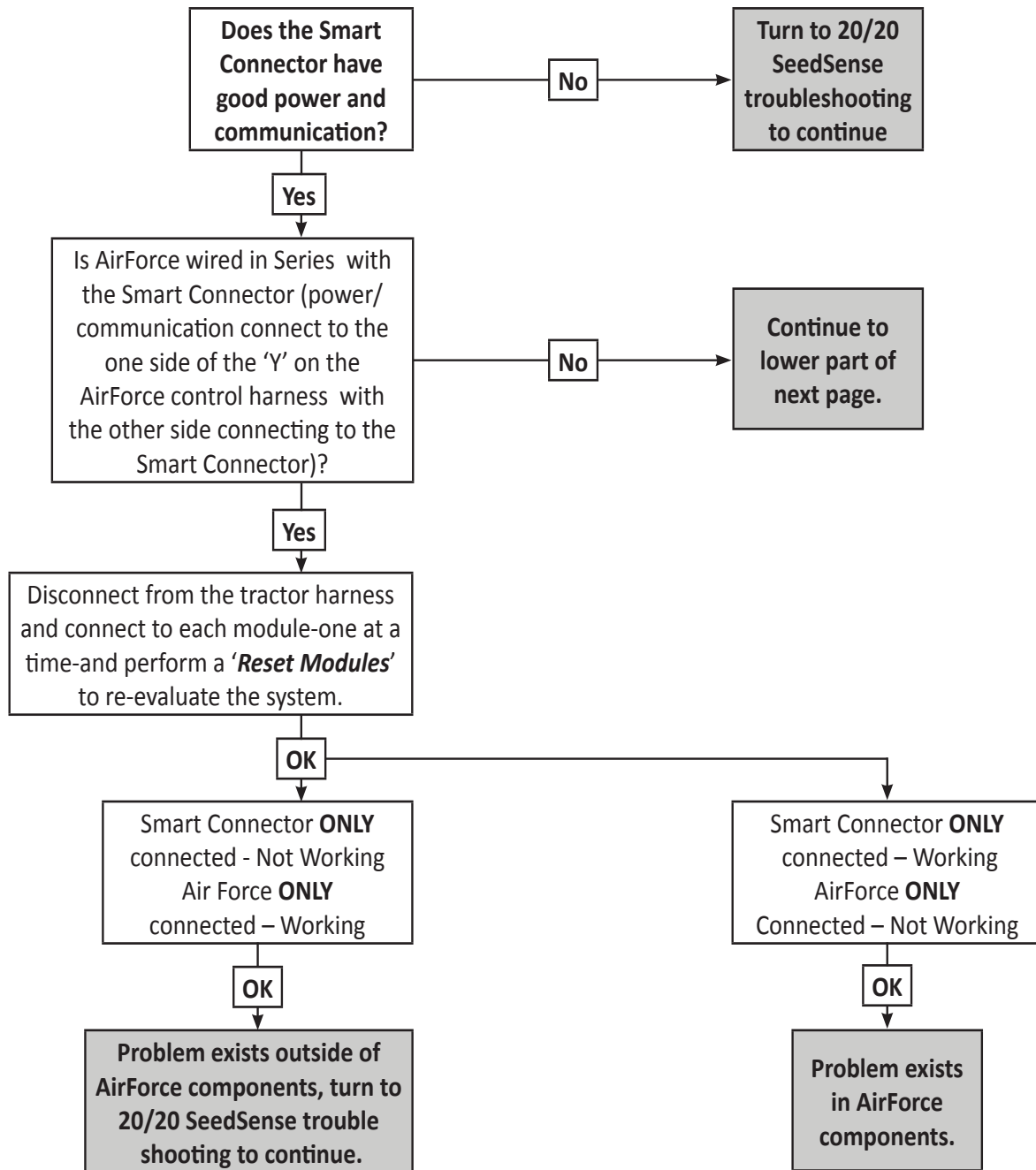
Begin at the Display Unit and trace the harness through the cab to the rear of the tractor; visually inspecting the cable for physical damage.

Check all in-line fuse as well as the 7.5A fuse in the AirForce enclosure.

Inspect the connections at the rear of the tractor for physical damage, solid connection, presence of water in the connector, etc...

Using a voltmeter, vtest the connection at the end of the tractor harness for power and communication:

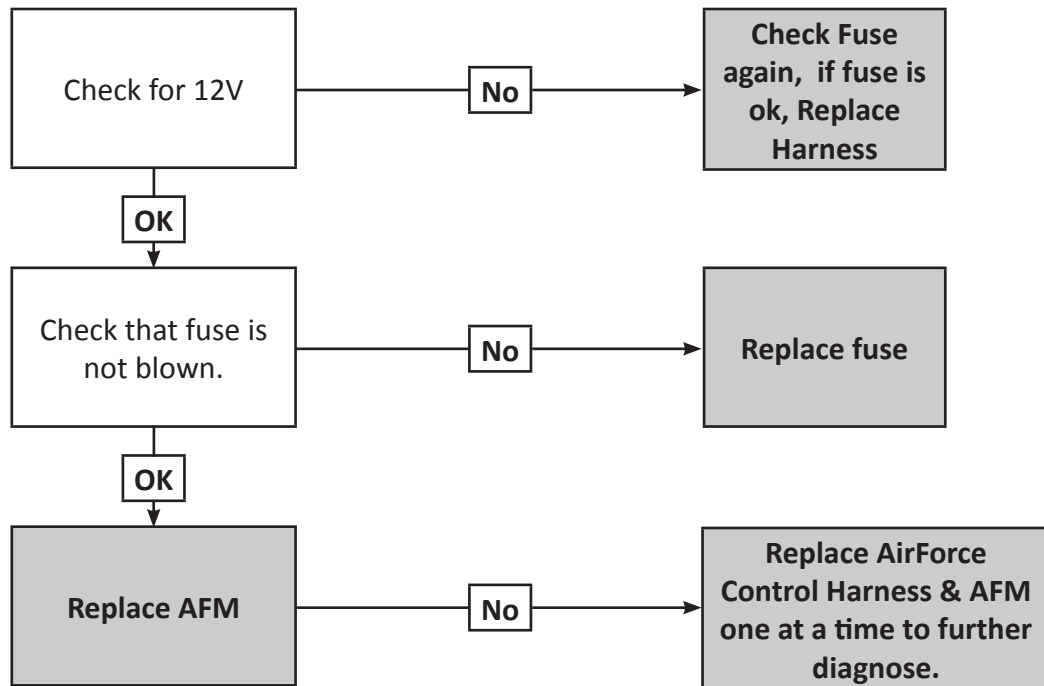
- Pin1 – Ground
- Pin2 – Communication
- Pin3 – Communication
- Pin4 – Power 12V



Continue on next page →

AirForce Troubleshooting (Continued)

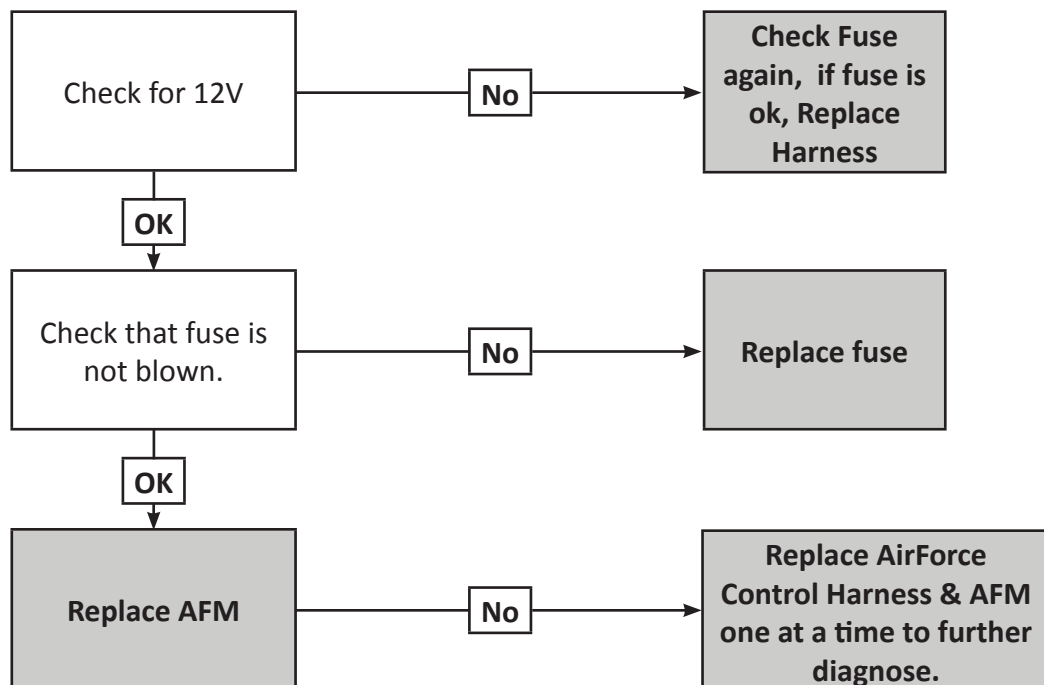
Inside the AirForce enclosure, locate the Diagnostic test plug (should be simply clipped to the rear wall of the enclosure, not connected to any other components) Use a voltmeter to test across the two pins:



Call your Precision Planting Representative for further assistance.

Air Force is wired in Parallel with the Smart Connector (AirForce and SeedSense modules have independent lines connecting to the tractor harness).

Inside the AirForce enclosure, locate the Diagnostic test plug (should be simply clipped to the rear wall of the enclosure, not connected to any other components) Use a voltmeter to test across the two pins:



Call your Precision Planting Representative for further assistance.

AirForce Troubleshooting (Continued)

Compressor Not Running

Solid Red Light on AFM = AFM has power, is booting up, updating firmware, or stuck in boot process

Step 1: Allow more time for AFM to finish boot cycle or firmware update

Step 2: Reboot the system: ***Home | Setup | Systems | Display | Reboot Display Unit***

Step 3: Is Smart Connector and / or RUMs exhibiting similar symptoms?

Yes:

Turn to 20/20 SeedSense troubleshooting to continue. Diagnose SeedSense problem first, then return to AirForce if problem continues.

No:

A. Starting at the Display Unit; trace the harness through the cab to the rear of the tractor visually inspecting the cable for physical damage.

B. Check all in-line fuses. Check the 7.5A fuse in AirForce enclosure.

C. Inspect connections at rear of tractor for physical damage, solid connection, presence of water in connector, etc...

D. Using a voltmeter, test the connection at the end of the tractor harness for power and communication:

Pin1 – Ground

Pin2 – Communication (+)

Pin3 – Communication (-)

Pin4 – Power 12V

Step 4: If Communication lines are shorted to ground or power – Replace Tractor Harness.

Step 5: Inside the AirForce Enclosure; check the control harness for continuity and communication: remove both the grey and black 12pin Deutsch connectors.

Black 12 pin Connector

Pin 4 – Ground

Pin 6 – Communication (-)

Pin 7 – Communication (+)

Grey 12 pin Connector

Pin 8 – Power 12V

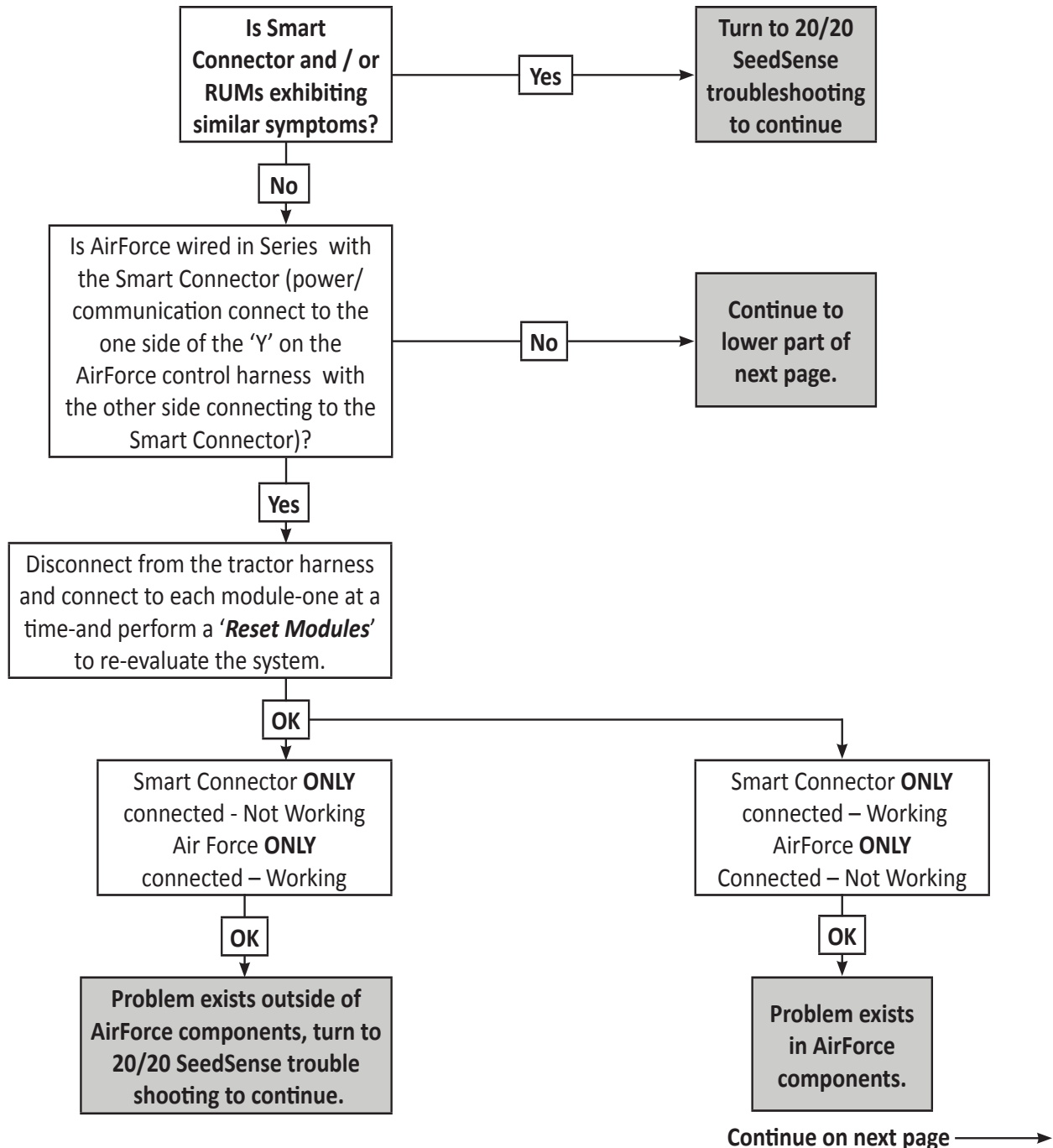
Step 6: If Control Harness is good, replace AFM Module.

If problem persists contact Precision Planting for further assistance.

AirForce Troubleshooting (Continued)

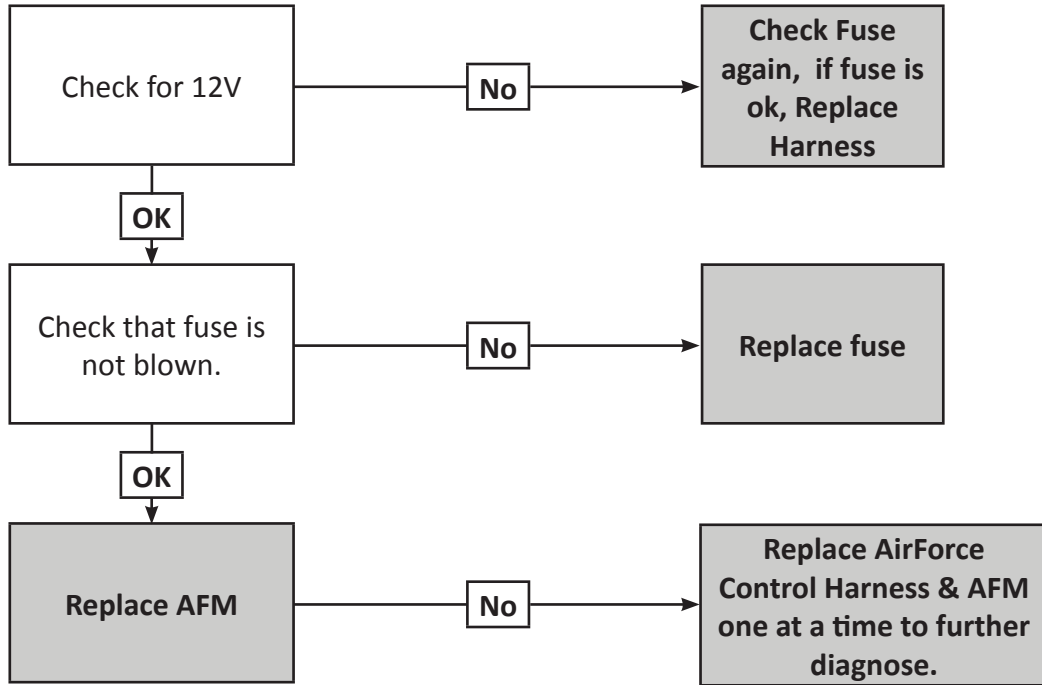
Compressor Not Running

Red Light present, blinking fast, >1 blink per second = AFM has power, no communication



AirForce Troubleshooting (Continued)

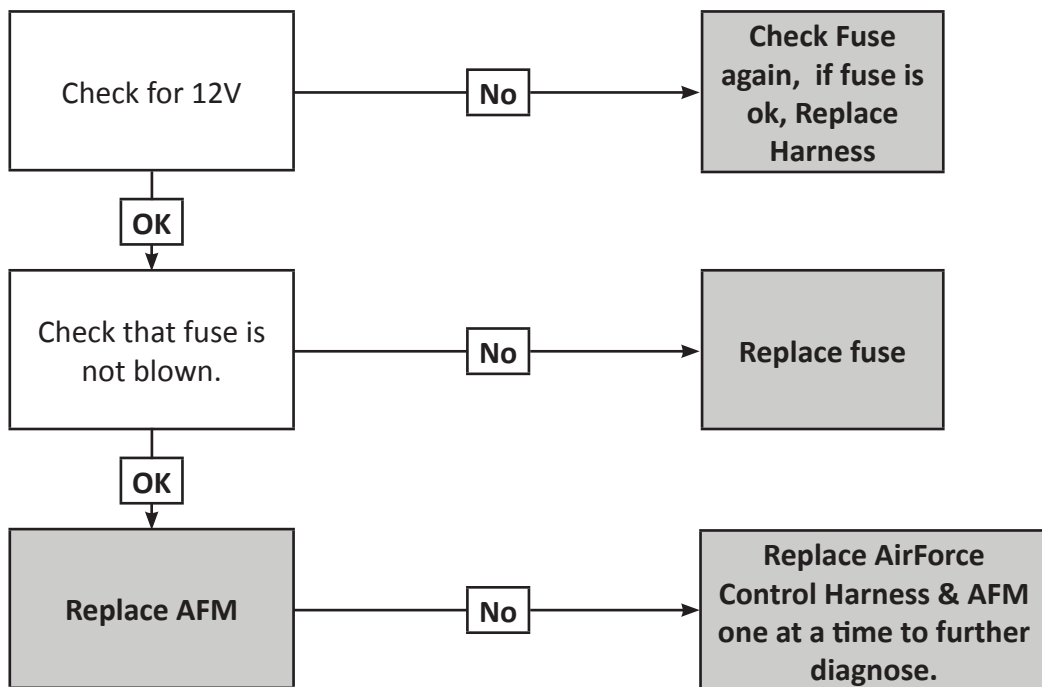
Inside the AirForce enclosure, locate the Diagnostic test plug (should be simply clipped to the rear wall of the enclosure, not connected to any other components) Use a voltmeter to test across the two pins:



Call your Precision Planting Representative for further assistance.

Air Force is wired in Parallel with the Smart Connector (AirForce and SeedSense modules have independent lines connecting to the tractor harness).

Inside the AirForce enclosure, locate the Diagnostic test plug (should be simply clipped to the rear wall of the enclosure, not connected to any other components) Use a voltmeter to test across the two pins:



Call your Precision Planting Representative for further assistance.

AirForce Troubleshooting (Continued)

Compressor running weak

Symptoms will be primarily audible:

- Running at much slower speeds
- Compressor has a drastically higher or lower pitch when running
- Compressor sounds 'weak' or 'struggling'

Verify that sufficient power is available to the Compressor

12V: Display Unit; AirForce Control Center – Compressor voltage should be 12.5v or higher in standby mode, 11.5v or higher when running. To trace problem:

1. Begin at the battery/starter and inspect the connections for corrosion and tightness.
2. Check the 60A fuse.
3. Follow the cable to the rear of the tractor, visually inspecting for physical damage to the lines.
4. At the grey 2 pin TYCO-AMP connector test the voltage- should be 12.5v or higher with the tractor running.
5. Reconnect the TYCO-AMP, ensure a solid connection and that all terminals are clean and firmly seated.
6. Check 12V Contactor: Test by replacing the harness 2pin-WP connection to the contactor with the 12V Diagnostic Plug. A solid clicking noise should be audible.
7. Check the 50A Circuit Breaker: Visually inspect the connections for tightness, and ensure that the posts are firmly set.

Both vi. & vii. tests can be done without a voltmeter by loosening and removing the red compressor power lead from the Circuit Breaker post. Then testing/connecting to:

1. The inlet side of the Circuit Breaker.
2. The outlet side of the Contactor.
3. The inlet side of the Contactor.

This will give only a go/no go view of the components involved.

8. Check the yellow Spade connector on the Compressor Ground lead.

Initial setup on system

Run Compressor Health Check **Home | Setup | Diagnose Tab | AirForce Icon | Health Check;** on right hand side, middle button in black column.

If problem persists contact Precision Planting.

System has functioned properly prior to symptoms

At display unit – navigate to AF diagnostic page **Home | Setup | Diagnose Tab | AirForce icon.** AirForce Diagnostics - At the bottom of this page, select:

Compressor Log: Review Voltage Drop (V): values should be between 0.9-1.7volts. Consistent readings significantly above the operating range could have permanently damaged compressor.

Replace Compressor – Upon installation of the new compressor steps should be taken to verify voltage drop is within normal operating ranges through new compressor prior to running full time.

Call your Precision Planting Dealer for additional assistance.

AirForce Troubleshooting (Continued)

Compressor running intermittently

Compressor Runs for 1-5seconds then off for 5-15 seconds

AFM detects a serious voltage drop – Shuts off compressor

Check harness and components for loose or poor connections between compressor and battery.

Note: The display unit may show adequate voltage on the screen while the compressor is not running. To verify, at the display unit navigate to AirForce control Center. With AirForce Disabled, note the Compressor Voltage-wait 10 to 15 sec for consistent reading. Watching this reading closely for 60 sec, Enable AirForce. You should note a pattern of the compressor turning on and dropping the voltage significantly (usually well below 10.5V)

Runs for 1-30 seconds then off for 30-120 seconds or greater

Current is too high – Tripping 50A circuit breaker

Check harness and components for loose or poor connections between compressor and battery.

Note: This is caused by a significant voltage drop in the system and should be treated the same as the above case. The component causing the shut-off is simply different.

System will pulse or run then off, both for less than 5 seconds

Update Software to newest version

Call your Precision Planting Representative for further assistance.

AirForce Troubleshooting (Continued)

Compressor running continuously

Compressor is able to build tank pressure greater than 130psi.

Check with planter lowered, not moving in Std. Mode.

Compressor reaches target pressure and stops while not moving, but problem persists while planting or in Manual Mode.

Cause: Air use is greater than tank pressure build rate.

Check for leaks in system (physically inspect and/or run a Leak check under Health Check menu).

Update software to newest available.

If symptom persists while stationary, in Manual Mode, and passes leak check; contact Precision Planting for further assistance.

Verify AirForce control gains.

Try lowering Tank Target Pressure to 140psi – this is a short to moderate term fix that would allow the system to stay above the necessary air requirements while lowering duty cycles. If this is a new symptom caused by a change in fields or tillage practices, try modifying AirForce settings to lower air use/duty cycle.

Tank pressure will build to 165+ (on analog gauge), then drop significantly and repeat.

Problem exists in Tank Pressure sensor, disable AirForce and replace Tank Pressure sensor. A simple way to verify this fix is to unplug and swap the tank sensor with either the Down or Lift Pressure sensor and re-enable AirForce.

Compressor is unable to build tank pressure greater than 130psi.

Initial setup on system.

Run Compressor Health Check: **Home** | **Setup** | **Diagnose** Tab | **AirForce** Icon | **Health Check**; on right hand side, middle button in black column.

If problem persists contact Precision Planting.

System has functioned properly prior to symptoms.

At display unit – navigate to AF diagnostic page **Home** | **Setup** | **Diagnose** Tab | **AirForce** icon. AirForce Diagnostics - At the bottom of this page, select:

Tank Log

Verify Leak rate is below 1.0psi/mi

Look for a trend of gradually lower Average Tank Pressure (psi)

Compressor Log

Check Voltage Drop – should be 0.9 to 1.7 volts

Duty Cycle – Look for a trend of gradually increasing values that corresponds to the lower Avg. Tank Pressure

Max Temperature (F) – Look for a trend of gradually lowering maximum temperatures that correspond to the lower

Avg. Tank Pressure

If the trends above exist in some form or another - Compressor head/piston are damaged – install the 12V Compressor rebuild kit as well as a new air filter (almost all compressor heads that go bad will be due to a compromised air filter allowing dust into the system)

AirForce Troubleshooting (Continued)

Compressor Running OK

If the Compressor is running correctly, refer to the System Log (under the Diagnose Tab), the Even Log (within AirForce Diagnostics) for system information and failure causes. The tables below give the cause, warning text, and a recommendation.

Event Code	Component	Warning Pop-Up Text	Recommendation
405	Lift Switch	A lift switch is not present, AirForce operation will be degraded.	A lift switch is not detected, AirForce will internally estimate lift. Ensure lift switch is connected. Check for pinched or cut wire.
406		A Row Unit Module has experienced multiple unexpected resets.	
407		A Row Unit Module has experienced multiple unexpected resets. Refer to the Device Status screen for more details.	
408		A Row Unit Module has experienced multiple unexpected resets.	
409	Lift Switch	The lift switch indicates the planter is always lowered. Disabling AirForce operation.	Confirm lift switch is correctly mounted and attached or replace the lift switch.
410	Lift Switch	Lift switch indicates the planter is always lifted. Disabling AirForce operation.	Confirm lift switch is correctly mounted and attached or replace the lift switch.
411	Load Pins	Row __ load sensor is reading a negative load. Lift planter and re-zero all sensors.	Load sensor reading is less than -10 lbs while planting. Lift planter and re-zero all sensors.
412	Load Pins	Row __ load sensor reading is greater than 800 lbs. Verify load sensor calibration factor.	Load sensor reading is greater than 800 lbs while planting. Verify load sensor calibration factor.
413	Load Pins	Excessive load variation on row __.	Load variation is greater than 300 lbs while planting. Check for a pinched load sensor wire or failed load sensor.
414	Load Pins	Low load variation on row __ while planting.	Load variation is less than 4 lbs while planting. Check for a pinched load sensor wire or failed load sensor.
415	Load Pins	Row __ load sensor reading is more than 100 lbs different from other rows.	Load difference compared to all other rows is greater than 100 lbs while planting. Verify load sensor calibration factor.
500	Air Force Module	The system was unable to update the firmware on the AirForce Module. After checking the planter harness for damage, perform a Reset Modules operation from the Diagnostics Tab.	The system was unable to update the firmware on the AirForce Module. After checking the planter harness for damage, perform a Reset Modules operation from the Diagnostics Tab.
501	Air Force Module	The system was unable to detect an AirForce Module. Do you want the system to assume that AirForce is not installed?	The system was unable to detect an AirForce Module. Check the connections and confirm the AirForce Module is connected correctly.
502	Air Force Module	The AirForce Module has experienced multiple unexpected resets. Refer to the Device Status screen for more details.	The AirForce Module has experienced multiple unexpected resets. Refer to the Device Status screen for more details.
503	Air Force Module	The AirForce Module system voltage is too low. The AFM will disable when voltage drops below 8.5 Volts. Check for high resistance in the wiring.	Check for high resistance in the wiring.
504	Air Force Module	The AirForce Module system voltage is too high.	Check power supply: harnesses, battery, alternator etc...

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
505	Air Force Module	The AirForce Module sensor supply voltage is low. Pressure sensor readings will be inaccurate. Check the supply voltage to the AFM.	Check the supply voltage to the AFM.
506	Air Force Module	The AirForce Module sensor supply voltage is high. Pressure sensor readings will be inaccurate. Check the supply voltage to the AFM.	Check the supply voltage to the AFM.
507	Compressor	The AirForce compressor voltage is too low. The compressor will be available when voltage is above 12 Volts.	Check for low battery voltage Check for high resistance in the compressor wiring.
508	Compressor	The AirForce compressor voltage is too high.	Check power supply: harnesses, battery, alternator etc...
509	Compressor	The AirForce compressor coil is not present. The system is unable to build tank pressure. Check for a disconnected connector or a loose terminal.	Check for disconnected connector. Check for loose terminal.
510	Compressor	The AirForce compressor voltage is too low when running. Check for high resistance in the compressor connections or wiring.	Check for high resistance in the compressor connections or wiring.
511	Compressor	The AirForce compressor power is intermittent. Check for a loose connector or terminal.	Check for loose connector. Check for loose terminal.
512	Compressor	The AirForce compressor is continuously running. Check if the compressor is connected to the diagnostic connector or if there is a shorted wire.	Check if the compressor is connected to the diagnostic connector. Check for shorted wire.
513	Temperature Sensor	The AirForce compressor temperature sensor is shorted. The system is unable to measure the compressor temperature. Check the resistance between the wires, repair the wiring, or replace the sensor.	Check the resistance between the wires. Repair the wiring. Replace the sensor.
514	Temperature Sensor	The AirForce compressor temperature sensor is open. The system is unable to measure the compressor temperature. Check for a cut wire or replace the sensor.	Check for a cut wire or replace the sensor.
515	Temperature Sensor	The AirForce compressor temperature sensor is intermittent. Check for a loose connection or cut in the wiring.	Check for a loose connection or cut in the wiring.
516	Temperature Sensor	The AirForce compressor temperature is too high.	Compressor temperature is > 400°F. Increase air flow to and around the compressor. Lower duty cycle. Remove dust/dirt buildup from compressor.
517	Temperature Sensor	The AirForce compressor is getting hot.	Compressor temperature is in upper ranges of operating temps; (350°-400°F) Increase air flow to and around the compressor. Lower duty cycle. Remove dust/dirt buildup from compressor.
569	Temperature Sensor	Unresponsive Compressor Temperature Sensor	Check for a loose compressor temperature sensor
518	Tank Pressure Sensor	The AirForce tank pressure sensor voltage is shorted low. Check for a disconnected sensor, short between sense wire and ground, a cut power wire, or a cut sense wire.	Check for disconnected sensor. Check for a short between sense wire and ground. Check for a cut power wire. Check for a cut sense wire.

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
519	Tank Pressure Sensor	The AirForce tank pressure sensor voltage is too high. Check for a short between sense wire and power or a cut ground wire.	Check for a short between sense wire and power. Check for a cut ground wire.
520	Tank Pressure Sensor	The AirForce tank pressure has exceeded its pressure limit.	Confirm enclosure gauge pressure equals the pressure on the 20/20. Confirm increase solenoids are closing properly. If pressure did not exceed 300 psi the sensor is not damaged. If pressure sensor exceeded 300 psi replace the sensor.
521	Tank Pressure Sensor	The AirForce tank pressure has fallen below its pressure range.	Confirm enclosure gauge pressure equals the pressure on the 20/20. Confirm increase solenoids are closing properly. Check for high resistance on the sense wire. Replace sensor if no wiring concerns.
522	Tank Pressure Sensor	The AirForce tank pressure is intermittent. Check for a loose pressure sensor connection, wire harness damage, or a loose terminal.	Check for a loose pressure sensor connection. Check for wire harness damage or a loose terminal.
523	Down Circuit Pressure Sensor	The AirForce down pressure sensor voltage is shorted low. Check for a disconnected sensor, short between sense wire and ground, a cut power wire, or a cut sense wire.	Check for disconnected sensor. Check for a short between sense wire and ground. Check for a cut power wire. Check for a cut sense wire.
524	Down Circuit Pressure Sensor	The AirForce down pressure sensor voltage is too high. Check for a short between sense wire and power or a cut ground wire.	Check for a short between sense wire and power. Check for a cut ground wire.
525	Down Circuit Pressure Sensor	The AirForce down pressure has exceeded its pressure limit.	Confirm that the enclosure gauge pressure equals the pressure on the 20/20. Confirm that the increase solenoid is closing properly. If pressure did not exceed 300 psi, the sensor is not damaged. If pressure sensor exceeded 300 psi, replace the sensor.
526	Down Circuit Pressure Sensor	The AirForce down pressure has fallen below its pressure range.	Confirm that the enclosure gauge pressure equals the pressure on the 20/20. Confirm that the vent solenoid is closing properly. Check for high resistance on the sense wire. Replace the sensor if no wiring concerns.
527	Down Circuit Pressure Sensor	The AirForce down pressure is intermittent. Check for a loose pressure sensor connection, wire harness damage, or a loose terminal.	Check for loose pressure sensor connection. Check for wire harness damage or loose terminal.
528	Lift Circuit Pressure Sensor	The AirForce lift pressure sensor voltage is shorted low. Check for a disconnected sensor, short between sense wire and ground, a cut power wire, or a cut sense wire.	Check for disconnected sensor. Check for a short between sense wire and ground. Check for a cut power wire. Check for a cut sense wire.
529	Lift Circuit Pressure Sensor	The AirForce lift pressure sensor voltage is too high. Check for a short between sense wire and power or a cut ground wire.	Check for a short between sense wire and power. Check for a cut ground wire.

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
530	Lift Circuit Pressure Sensor	The AirForce lift pressure has exceeded its pressure limit.	Confirm that the enclosure gauge pressure equals the pressure on the 20/20. Confirm that the increase solenoid is closing properly. If pressure did not exceed 300 psi, the sensor is not damaged. If pressure sensor exceeded 300 psi, replace the sensor.
531	Lift Circuit Pressure Sensor	The AirForce lift pressure has fallen below its pressure range.	Confirm that the enclosure gauge pressure equals the pressure on the 20/20. Confirm that the vent solenoid is closing properly. Check for high resistance on the sense wire. Replace the sensor if no wiring concerns.
532	Lift Circuit Pressure Sensor	The AirForce lift pressure is intermittent. Check for a loose pressure sensor connection, wire harness damage, or a loose terminal.	Check for loose pressure sensor connection. Check for wire harness damage or loose terminal.
533	Down Increase Solenoid	The AirForce down increase solenoid is not present. The system is unable to build down pressure. Check for a loose or disconnected solenoid pin or connector.	Check for a loose or disconnected solenoid pin or connector.
534	Down Increase Solenoid	The AirForce down increase solenoid power is intermittent. Check for a loose connector or terminal.	Check for loose connector. Check for loose terminal.
535	Down Increase Solenoid	Down pressure is increasing slowly or is unresponsive. Check for a leak in the circuit or blockage in the manifold.	Confirm the solenoid is energized and provides no pressure change. Check for a leak in the circuit. Check for blockage in the manifold.
536	Down Increase Solenoid	The system detected a down increase solenoid even though the AirForce System Type is LIFT ONLY. The system will be disabled until the problem is corrected.	Confirm the solenoid wire is connected correctly.
537	Down Vent Solenoid	The AirForce down vent solenoid is not present. The system is unable to control down pressure. Check for a loose or disconnected solenoid pin or connector.	Check for a loose or disconnected solenoid pin or connector.
538	Down Vent Solenoid	The AirForce down vent solenoid power is intermittent. Check for a loose connector or terminal.	Check for loose connector. Check for loose terminal.
539	Down Vent Solenoid	Down pressure is decreasing slowly or is unresponsive. Check for a leak in the circuit or blockage in the manifold.	Confirm the solenoid is energized and provides no pressure change. Check for blockage in the manifold.
540	Down Vent Solenoid	The system detected a down vent solenoid even though the AirForce System Type is LIFT ONLY. The system will be disabled until the problem is corrected.	Confirm the solenoid wire is connected correctly.
541	Lift Increase Solenoid	The AirForce lift increase solenoid is not present. The system is unable to build lift pressure. Check for a loose or disconnected solenoid pin or connector.	Check for a loose or disconnected solenoid pin or connector.

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
542	Lift Increase Solenoid	The AirForce lift increase solenoid power is intermittent. Check for a loose connector or terminal.	Check for loose connector. Check for loose terminal.
543	Lift Increase Solenoid	Lift pressure is increasing slowly or is unresponsive. Check for a leak in the circuit or blockage in the manifold.	Confirm the solenoid is energized and provides no pressure change. Check for a leak in the circuit. Check for blockage in the manifold.
544	Lift Increase Solenoid	The system detected a lift increase solenoid even though the AirForce System Type is DOWN ONLY. The system will be disabled until the problem is corrected.	Confirm the solenoid wire is connected correctly.
545	Lift Vent Solenoid	The AirForce lift vent solenoid is not present. The system is unable to control lift pressure. Check for a loose or disconnected solenoid pin or connector.	Check for a loose or disconnected solenoid pin or connector.
546	Lift Vent Solenoid	The AirForce lift vent solenoid power is intermittent. Check for a loose connector or terminal.	Check for loose connector. Check for loose terminal.
547	Lift Vent Solenoid	Lift pressure is decreasing slowly or is unresponsive. Check for a leak in the circuit or blockage in the manifold.	Confirm the solenoid is energized and provides no pressure change. Check for blockage in the manifold.
548	Lift Vent Solenoid	The system detected a lift vent solenoid even though the AirForce System Type is DOWN ONLY. The system will be disabled until the problem is corrected.	Confirm the solenoid wire is connected correctly.
549	Tank Pressure Circuit	A major leak was detected in the AirForce tank circuit. Check for a disconnected air line or fitting.	Check for a disconnected air line or fitting. Run the Leak Detection Health Check routine to confirm leak has been corrected.
550	Tank Pressure Circuit	A slow leak was detected in the AirForce tank circuit. Check for leaks in the air line connections or fittings. Check for loose or worn fittings.	Check for leaks in the air line connections or fittings. Check for loose or worn fittings. Run the Leak Detection Health Check routine to confirm leak has been corrected.
551	Tank Pressure Circuit	The AirForce system detected a pressure increase in the tank circuit when an increase was not commanded.	Check for shorted, or cross-connected wires. Check for a loose connector. Refer to the enclosure diagrams to verify solenoids are connected to the correct ports in the harness.
552	Tank Pressure Circuit	The AirForce tank pressure is unresponsive when the compressor is running. Check the tank for leaks.	Confirm the compressor is energized and provides no pressure change. Check the tank for leaks.
563	Tank Pressure Circuit	The AirForce tank pressure is building more slowly than expected. Check the tank for leaks.	Check the tank for leaks. Rebuild the compressor head to improve the pressure build rate of the compressor.
553	Tank Pressure Circuit	Drain the water separator and the water from the tank.	Drain water from the system every 4 hours of compressor run time.
554	Tank Pressure Circuit	The AirForce tank circuit pressure is excessively high. Confirm that the compressor is not connected to the jumper wire and check for a short on the compressor relay wire.	Confirm that the compressor is not connected to the jumper wire. Check for a short on the compressor relay wire.

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
564	Tank Pressure Circuit	The AirForce manifold check valve is leaking excessively.	
555	Down Pressure Circuit	A major leak was detected in the AirForce down circuit. Check for a disconnected air line or fitting.	Check for a disconnected air line or fitting. Run the Leak Detection Health Check routine to confirm leak has been corrected.
556	Down Pressure Circuit	A slow leak was detected in the AirForce down circuit. Check for leaks in the air line connections or fittings. Check for loose or worn fittings.	Check for leaks in the air line connections or fittings. Check for loose or worn fittings. Run the Leak Detection Health Check routine to confirm leak has been corrected.
557	Down Pressure Circuit	The AirForce system detected a pressure increase in the down circuit when an increase was not commanded.	Run the Plumbing and Wiring Health Check Routine to confirm plumbing is not crossed
558	Down Pressure Circuit	The AirForce down circuit pressure is excessively high. Confirm that the increase solenoid is not connected to the jumper wire and is not shorted.	Confirm that the increase solenoid is not connected to the jumper wire. Check for a short on the increase solenoid wire.
559	Lift Pressure Circuit	A major leak was detected in the AirForce lift circuit. Check for a disconnected air line or fitting.	Check for a disconnected air line or fitting. Run the Leak Detection Health Check routine to confirm leak has been corrected.
560	Lift Pressure Circuit	A slow leak was detected in the AirForce lift circuit. Check for leaks in the air line connections or fittings. Check for loose or worn fittings.	Check for leaks in the air line connections or fittings. Check for loose or worn fittings. Run the Leak Detection Health Check routine to confirm leak has been corrected.
561	Lift Pressure Circuit	The AirForce system detected a pressure increase in the lift circuit when an increase was not commanded.	Run the Plumbing and Wiring Health Check Routine to confirm plumbing is not crossed
562	Lift Pressure Circuit	The AirForce lift circuit pressure is excessively high. Confirm that the increase solenoid is not connected to the jumper wire and is not shorted.	Confirm that the increase solenoid is not connected to the jumper wire. Check for a short on the increase solenoid wire.
565	Down Pressure Circuit	The desired applied down force from the AirForce system is exceeding the weight of the planter bar. Increase the weight of the planter bar or limit the max applied down force setting on the AirForce Setup screen.	Increase the weight of the planter bar Limit the max applied down force setting on the AirForce Setup screen.
566	Lift Pressure Circuit	The AirForce lift air bag pressure is consistently high through 90% of the last 2 passes. Consider decreasing the down spring force.	Consider decreasing the down spring force.
567	Lift Pressure Circuit	The AirForce lift air bag pressure is consistently low through 90% of the last 2 passes. Consider increasing the down spring force.	Consider increasing the down spring force.
568	Compressor	Compressor disabled: Duty Cycle is greater than the MAX Limit	Confirm Max Duty Cycle is set correctly Run the system in manual mode until the compressor duty cycle has decreased

AirForce Troubleshooting (Continued)

Event Code	Component	Warning Pop-Up Text	Recommendation
575		The AirForce enclosure pressure gauges do not match the pressure sensor readings.**	These are simply notification of events and will not prompt a Pop-up text. To view these event codes navigate to Setup Diagnose AirForce Event Log
576		The AirForce compressor health check passed.**	
577		The AirForce compressor health check failed.**	
578		The AirForce wiring and plumbing health check passed.**	
579		The AirForce wiring and plumbing health check failed.**	
580		The AirForce leak health check passed.**	
581		The AirForce leak health check failed.**	
582		The AirForce tank drain health check passed.**	
583		The AirForce tank drain health check failed.**	
559	Lift Pressure Circuit	A major leak was detected in the AirForce lift circuit. Check for a disconnected air line or fitting.	
560	Lift Pressure Circuit	A slow leak was detected in the AirForce lift circuit. Check for leaks in the air line connections or fittings. Check for loose or warn fittings.	Check for leaks in the air line connections or fittings. Check for loose or warn fittings. Run the Leak Detection Health Check routine to confirm leak has been corrected.
561	Lift Pressure Circuit	The AirForce system detected a pressure increase in the lift circuit when an increase was not commanded.	Run the Plumbing and Wiring Health Check Routine to confirm plumbing is not crossed
584	Air Force Module	The planter AirForce system settings indicate that neither down nor lift airbags are present. From the main screen, select Setup / Systems / AirForce to set up the Air bag type.	From the main screen, select Setup / Systems / AirForce to set up the Air bag type.
585	Air Force Module	The AirForce Module has experienced an unexpected reset.	These are simply notification of events and will not prompt a Pop-up text. To view these event codes navigate to Setup Diagnose AirForce Event Log
586	Tank Pressure Circuit	User reset water filter service counter.	
587	Compressor	User reset compressor service counter.	
588	Air Force Module	Continue planting with AirForce disabled?	

Pneumatic Springs

When storing machine:

IMPORTANT: Do not remove air from system, air springs should be pressurized and may be allowed to leak down slowly to 0 psi. Park machine with a minimum of 6 psi of air pressure in the system.

When removing from storage:

CAUTION: Avoid serious injury from exploding parts due to over-pressurization or operating the system without all components in place.

Do not inflate system above 120 psi.

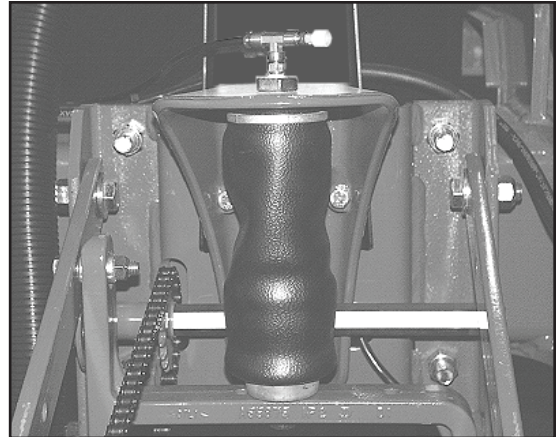
Do not remove pressure relief valve.

Do not pressurize system unless all row unit components are in place.

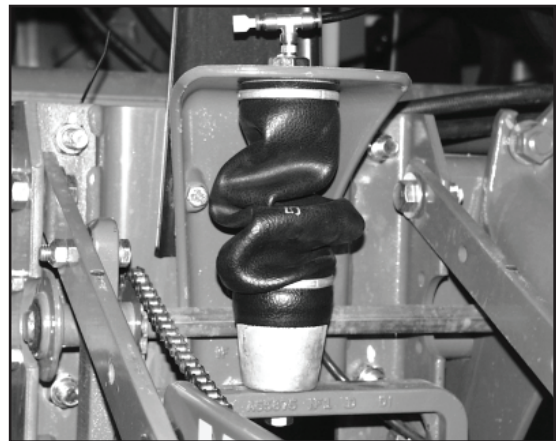
IMPORTANT: Do not operate a pinched or unrolled air spring. Should this occur, lower system pressure until springs can be rolled by hand. Roll spring back over lower piston. Incremental lowering of machine may be required to get rubber started rolling over the lower piston.

Pressurize system to a minimum of 6 psi before raising or lowering machine.

Minimum system pressure during operation is 6 psi. Failure to hold 6 psi during operation will result in damage to air springs.



Properly Rolled Air Bag



Improperly Rolled Air Bag

Down Force Applied by Spring Type and Position

Model	Spring Type	Position	Down Force (in lbs)
Kinze	"K"	None	0
		1	57
		2	122
		3	245
		4	380
JD 7000	"A"	None	0
		2.5"	60
		2.0"	80
		1.5"	90
		1.0"	110
		Tight	125
	"B"	Loose	160
		Tight	360
	"C"	No Bolt	80
		1	145
		2	220
JD 7200	"D"		70
			220
	"E"	1	340
		2	240
		3	160
		4	95
	"G"	1	90
		2	150
		3	205
		4	270
		5	345

Spring type referenced by system selection guide front page designations