



# Installation and User Manual

## CNH Patriot Agri-Steer

Automatic steering system





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Information and technical data detailed in this manual represent the latest version at the time of publication. Revisions to this document may be made without prior notice. This document is revision 3.0.

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## 1. Important User Information

### 1.1 The Agri-Steer

The Agri-Steer has been designed to convert steering commands coming from the GreenStar system into commands that the vehicle can understand without the need for an electrically driven steering system. It is a 'Plug and Play' solution.

### 1.2 The Installation and User Manual

This installation and user manual must be read and fully understood prior to using the Agri-Steer. This installation and user manual provides information regarding the correct use of the Agri-Steer. It is required that **all** safety instructions be read carefully, prior to using the Agri-Steer. It is advised that this manual always remains with the operator of the machine and is easily accessible.

This installation and user manual **does not** replace the user manuals of other manufacturers of tractors, agricultural equipment, and devices. These manuals must be carefully read and understood including all safety instructions prior to reading this manual.

Information regarding regulations for the prevention of accidents and protection of the environment must also be followed when conducting any work with the use of the Agri-Steer.

### 1.3 Intended Use

The Agri-Steer should only be used for steering applications in agricultural machines. The use of the Agri-Steer for other applications, making unauthorised changes, adding, or removing parts or any configurations to the software or hardware will be considered contrary to the intended use of the Agri-Steer.

The manufacturer is not liable for any damages or negative externalities resulting from these activities and therefore the risk lies solely with the user. The manufacturer disclaims any liability for damage or injury resulting from the failure to follow **all** instructions, cautions and warnings detailed in this manual.

It is required that the Agri-Steer is only used by authorised individuals who have been introduced to the functions of the product.

The product may only be used in conjunction with the information provided in this manual. The use of the Agri-Steer beyond what is stated in this manual may lead to personal injury, as well as machine damage.

Any safety and warning iconography used in this manual must be closely observed to ensure safe use of the Agri-Steer. It is important that the operator must contact SolSteer Ltd prior to use of the Agri-Steer, if any information provided in this manual is not fully understood by the operator.

## 1.4 Technical Support

SolSteer will assist with any technical support or information that is required. Support is available via telephone, email, and the internet from during business hours, Monday to Friday. Please contact SolSteer using the following contact information:

Address: SolSteer Limited, Link Farm, Pulborough, West Sussex, RH20 2EL, UK

Website: [www.solsteer.com](http://www.solsteer.com)

Email: [info@solsteer.com](mailto:info@solsteer.com)

## 1.5 Copyright

This document must be treated as confidential and its intended use is for the operator and installation technicians alone. Breaching this may result in legal action.

## EC Declaration of Conformity



The Manufacturer

SolSteer Limited  
Link Farm, Pulborough, West Sussex, RH20 2EL, UK

hereby declares under his sole responsibility that the product:

Agri-Steer ECU/001

is in conformity with the following standard:

- BS EN 61326-1:2013 - Electrical equipment for measurement & control. EMC requirements.

in compliance with the provisions of the following EU guidelines:

- Directive 2014/30/EU of the European Parliament and of the Council of 20<sup>th</sup> April 2016.
- Directive 2011/65/EU of the European Parliament of 8<sup>th</sup> June 2011 (2002/95/EC and successive amendments recast)
- EMC Directive 2004/108/EC (Electronic Compatibility)
- Commission Delegated Directive (EU) 2015/863 of 31<sup>st</sup> March 2015 amending to Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances

I hereby declare that the equipment above has been designed to comply with the relevant sections of the above referenced specifications. The product complies with all the essential requirements of the mentioned EU Directives.



Name: Chaunce Barrett-Crosdil  
Position: Director  
Place: Pulborough, UK  
Date: 11/08/2020





## 2. Safety

This manual contains basic safety information that must be followed during installation and operation. If safety instructions are not followed, you risk injury to yourself and others as well as risk of damage to the product, property, and the surrounding environment.

### 2.1 Symbols

The following symbols are used throughout this document to notify of safety instructions that must be carefully followed to avoid accidents, personal injuries, and damage to property.



#### **WARNING!**

A danger which may result in death or serious injury if instructions are not followed.



#### **CAUTION!**

A danger which may result in injury if instructions are not followed.



#### **ELECTRICAL HAZARD!**

An electrical hazard which may result in injury if instructions are not followed.



#### **FIRE HAZARD!**

A fire hazard which may result in injury if instructions are not followed.



#### **INFO**

Useful information and recommendations to ensure optimal product performance.

### 2.2 Important Safety Warnings

- The Agri-Steer **does not** avoid obstacles autonomously. The user of the Agri-Steer **must always** be in the operator seat of the vehicle to manually override the Agri-Steer system to avoid obstacles such as people, trees, pylons etc.
- The Agri-Steer **does not** control the speed of the vehicle. The user of the Agri-Steer **must always** manually control the speed of the vehicle while using the Agri-Steer system
- The Agri-Steer system **must not** be used when the vehicle is on public roads. The Agri-Steer system **must** be disconnected prior to the vehicle being driven on public roads

### 2.3 User Responsibility

The Agri-Steer is to be used solely for commercial applications and therefore the user is subject to statutory requirements for safety at work. The user must follow all safety instructions, the instructions for the prevention of accidents and the regulations for environmental protection.

The user must familiarize himself with all health and safety requirements and if necessary, carry out a risk assessment for the environment in which the product is used.

The user must ensure that any other persons using the Agri-Steer has read and understands this installation and user manual prior to use. Any other persons who use the Agri-Steer must also be familiarized with the functions of the product and of the potential risks associated with the product if the safety instructions are not followed.

The operator of the vehicle is solely responsible for safe operation of the vehicle which has the Agri-Steer installed.

The steering system **is not** designed to replace the role of the operator.



### 2.4 Operating Personnel

To prevent personal injury, damage to the product or damage to the environment persons using the Agri-Steer must satisfy the following requirements:

- Are physically capable of controlling the SolSteer user interface
- Can carry out work safely using the Agri-Steer following all instruction stated in this manual
- Understands the basic function of the product and can recognise and understand the dangers associated with the work
- Understands the contents of this manual and can safely apply this information when using the product
- Are competent with any other products, devices and machines associated with the Agri-Steer such as tractors, rear and front mounted implements, and navigation systems
- Have read and fully understood user and operator manuals of these associated products, devices, and machines prior to using the Agri-Steer. All safety instructions of these products, devices and machines must be fully understood and implemented prior to using the Agri-Steer
- Are instructed and trained to operate the machine and is aware of all preventative measures to eliminate potential risks and dangers.

### 2.5 Specialist Staff

Specialist staff are those who are permitted to carry out assigned tasks and can identify potential risks associated with the Agri-Steer by themselves. They are specialized individuals with the capable knowledge and experience of applicable regulations associated with the product. They have permission to install, diagnose and update software as well as make internal changes to the product. They are the **only** personnel permitted to carry out repairs. These individuals include but are not limited to the following:

- SolSteer staff and technicians
- SolSteer dealers
- Individually SolSteer trained personnel

### 2.6 Personal Protective Equipment (PPE)

When using the Agri-Steer and other associated products, devices, and machines it is vital that the following equipment are worn during use and installation of the Agri-Steer. Not wearing this equipment increases the risk of injury or serious health problems. The following are recommended while installing the Agri-Steer:

- Wear non-conductive, protective gloves
- Wear insulated protective footwear
- Wear protective clothing
- Never wear rings, chains, or jewellery
- Long hair must be tied up, or covered

### 2.7 General Safety Instructions and Accident Prevention Regulations

The Agri-Steer manufacturers and installers disclaim all responsibility for damage or physical harm caused by the failure to adhere to the following safety requirements.



To eliminate the risk of death or serious injury the following instructions **must** be strictly followed:

- **Never** leave the vehicle operator's seat with the Agri-Steer engaged
- **Never** allow people or obstacles near the vehicle during installation, start-up, calibration or tuning of the Agri-Steer system unless authorised
- **Never** drive on public roads with the Agri-Steer system engaged, ensure that it is shut down and fully disconnected prior to driving
- Ensure a stable position when installing the Agri-Steer system to the vehicle. If this is not possible use a step ladder to provide a safe working platform instead
- **Always** switch off the vehicle when installing or checking hardware near the Wheel Angle Sensor (WAS). Movements in the steering mechanism can result in death or serious injury



To eliminate the risk of electrical shock the following safety instructions **must** be strictly followed:

- **Always** disconnect the power supply when performing electrical works on the vehicle during installation and repairs. If there is no battery power switch, then disconnect the battery
- Carefully inspect wiring of equipment before each use. No exposed wiring should be visible
- Any damaged or frayed wiring, lack of insulation on wiring and any damaged plugs or connectors should be taken out of service immediately and reported and returned to SolSteer Ltd
- Know the location of isolator switches and how to operate them prior to use of the Agri-Steer
- Ensure any water or chemicals are not within the proximity of the Agri-Steer at all times
- Ensure any electrical conductors are not within the proximity of the Agri-Steer at all times
- When handling electrical equipment that is plugged in, dry non-conductive protective gloves and insulated protective footwear are recommended
- If working with only one hand, ensure that the other hand does not make contact with any conductive material
- If the product directly interacts with water or other chemical liquids, the equipment must be shut off at the main power and disconnected immediately
- If an individual comes into direct contact with a live electric source **do not** make contact with the individual, equipment, wiring or other connected devices. Disconnect the power source immediately by switching off the main power or disconnecting the main plug.



To eliminate the risk of a fire the following safety instructions **must** be strictly followed:

- Immediately disconnect the power source when a component exhibits abnormal heat generation
- Immediately disconnect the power source when a component starts sparking or smoking

### 3. Installation Guide

Prior to the installation of the Agri-Steer please verify with the vehicle manufacturer that the vehicle has the following:

- A factory installed steering system such as the John Deere AutoTrac Ready, the Case IH AccuGuide Ready, the New Holland IntelliSteer Ready, the AGCO AutoGuide Ready, the Fendt VarioGuide Ready or the Deutz Agrosky Ready.
- Calibrated factory installed components such as a steering valve, steering wheel encoder and wheel angle sensor.
- A steering system in good working order with no play and proportionally steers left and right.
- An electrical system and battery operating correctly and in good working condition.
- A clean internal environment within the vehicle cab to ensure safe installation of hardware and for safe cable routing.

If the vehicle does not satisfy any of the above requirements, then these must be rectified prior to installation of the SolSteer Agri-Steer. The SolSteer CNH Patriot Agri-Steer can be used on the following model series:

- Patriot SPX 3230, 3240, 3330, 3340, 4420 and 4430

The CNH Patriot Agri-Steer contains the following components:

Part Number	Quantity	Description
CNH/010	1	CNH Patriot Agri-Steer interface harness
CNH/007	1	CNH Valve Extension cable
S/GS3	1	GS3 harness
ECU/002	1	Agri-Steer TTC module

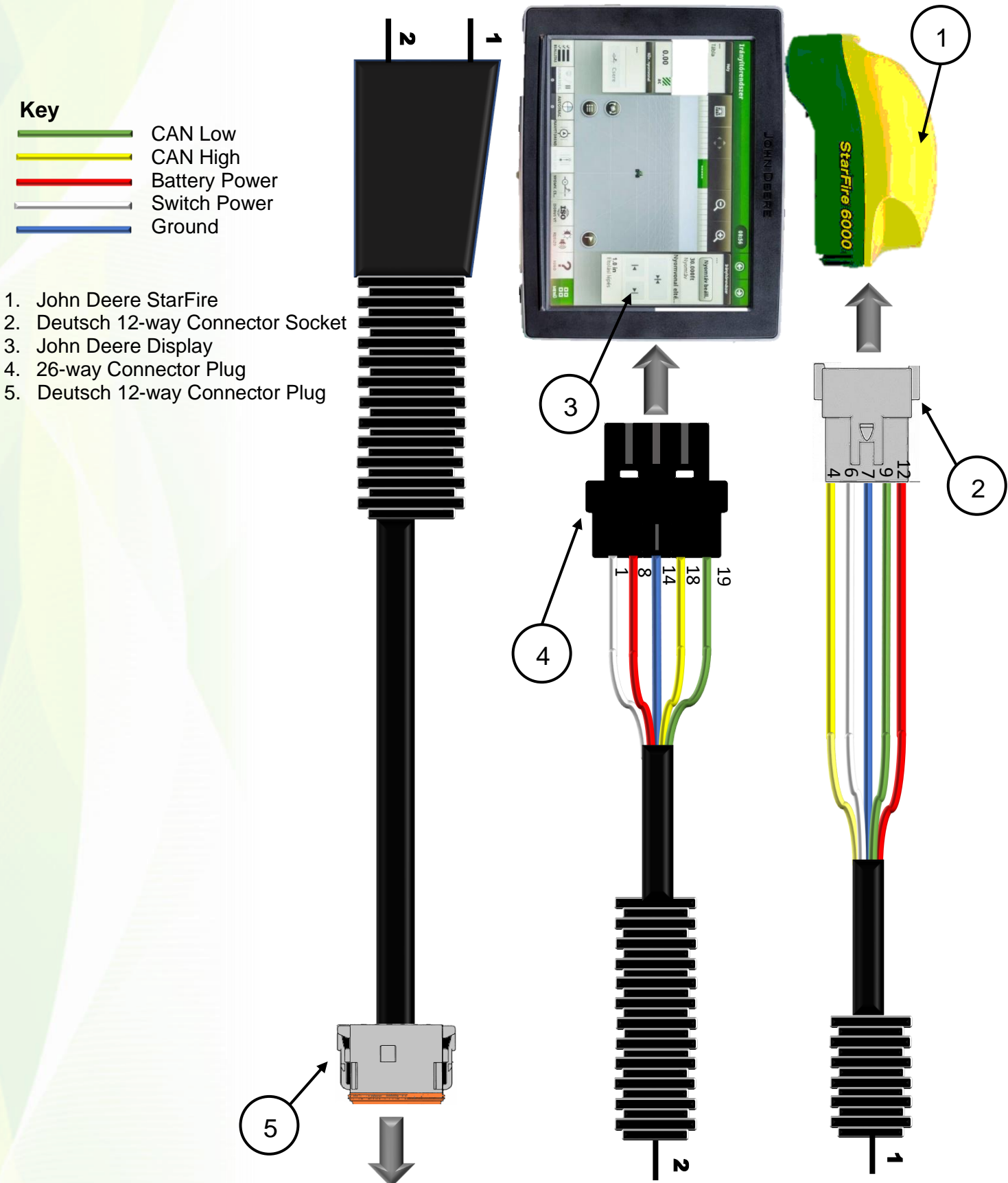
Additional parts not provided include:

- John Deere GreenStar display and mounting components
- John Deere StarFire receiver and mounting components

### 3. Installation Guide

#### The GS3 Harness (S/GS3)

Not to Scale





### 3. Installation Guide

#### CNH Patriot Interface Harness (CNH/010)

Not to Scale

##### Key

	CAN Low
	CAN High
	Battery Power
	Switch Power
	Ground

6. Deutsch 12-way Connector Socket (to GS3)

7. NMEA Male D-Sub connector

8. Enable wire

9. 5V wire

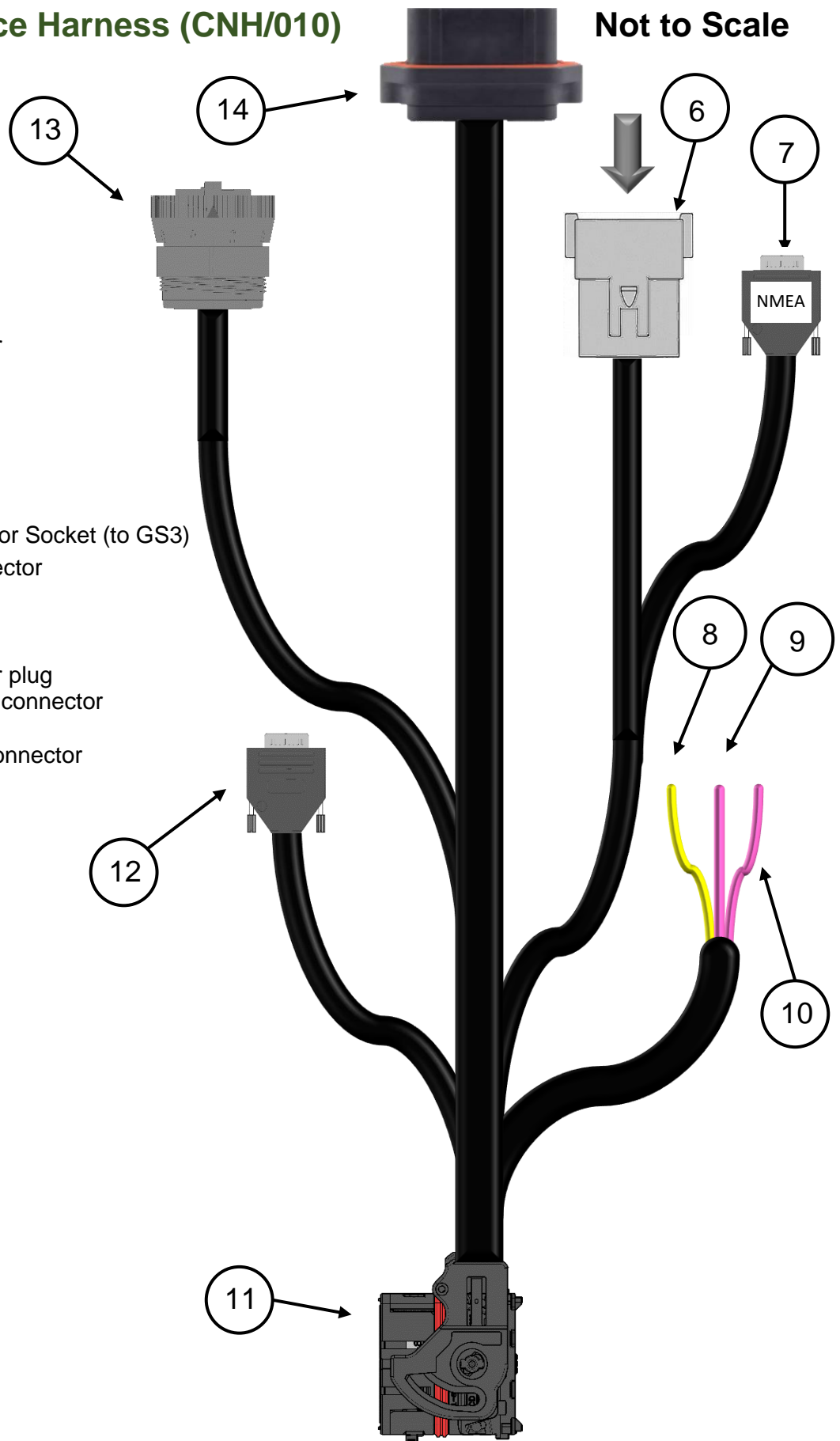
10. 5V wire

11. Molex 46 - way connector plug

12. GCAN/Diagnostic D- sub connector

13. J1939 connector

14. 40 - way male Deutsch connector



#### CNH Patriot Agri-Steer Valve Extension Cable (CNH/007)

**Not to Scale**

- 15. 2 - way male Deutsch connector plug
- 16. 2 - way female Deutsch connector socket



### 3. Installation Guide

To ensure safe and correct installation of the CNH Patriot Agri-Steer please adhere closely to the following instructions:



**1)** Begin by removing the passenger seat from the machine. This allows access to the steering controller compartment where the existing NAV controller is situated.



**2)** Locate the 40-way Deutsch connector. Plug the CNH Patriot interface harness (14) into this connector (an Allen key is also required to tighten it). Connect the Molex 46- way connector (11) into the ECU. Remove the Trimble NAV controller.

### 3. Installation Guide



**3)** Locate a permanent power source (+12V) for the system. Join the red wire from the CNH Patriot interface harness to the permanent 12V+ supply. This will provide power to the display and receiver.

**4)** Connect the diagnostic plug (13) into the far left diagnostic connector. Connect the other end to the GCAN D-Sub connector (12) of the CNH Patriot interface harness.

**5)** Locate the large round 'RAVEN' connector and remove the supplied blank mating side. Populate the loose pins of the CNH Patriot interface harness into this connector in the following locations.

16 -Remote Engage (Yellow)  
23 -5V (Pink) Engage Power  
31 -5V (Pink) WAS Power

Reconnect the 'RAVEN' connector.

**6)** Loosen the cable pass-through located in the rear right-hand corner from the underside of the cab. Connect the Valve Extension cable to the CNH Patriot Agri-steer interface adaptor with the female 2-way Deutsch connector (16).

**7)** Route the valve extension cable across the rear of the cab through the cavity behind the fuse compartment. Access the opposite side of this compartment by opening the right-hand window. Route the male 2-way Deutsch connector (15) through the floor and route to the steering valve located on the underside of the cab.

**8)** Disconnect the existing two-way Deutsch labelled 'enable' or 'activate' from the solenoid. Plug in the male two- way Deutsch connector from the CNH valve extension cable (15). Secure all harnessing and tighten the pass-through accordingly.

**9)** Remove the two plugs from the GS3 harness and tape the pins together to allow easier routing. Route the harness along the back of the rear-left cab upright and behind the plastic storage compartment in the roof lining. Removing this plastic compartment allows access to route the harness through the roof cavity and through to a convenient location where you can pass through to the outer roof area.

**10)** Loosen the outer roof shell by removing the bolts on the top of the cabin. There are also 2 bolts in the center at the front and rear of the cab that will need to be accessed from below. Lift the roof shell from the entry door side and route the harness to the mirror mount. Refit the plugs to the harness using the diagram shown on page 12.

**11)** Run the 12-way connector of the GS3 harness along the roof (2) and plug in the display using the 26-way connector plug (4). Connect the 12-way connectors of the GS3 harness and the CNH Magnum interface harnesses together (5 & 7). **IMPORTANT!** Do not connect the GS3 harness to the CNH Magnum interface harness until the CNH Magnum interface harness has been fitted. This could result in a short circuit occurring!

**12)** Mount the Starfire receiver on the roof as far forward and as central as possible. Plug the 12-way connector of the GS3 harness into the Starfire receiver (2). Note: the Starfire roof bracket is not included. Installation is now complete.



### 4. Linear Potentiometer Fitting Guide

**1)** Remove the split pins and nuts from the right-hand steering cylinder and install the wheel angle sensor mounting plates.

**2)** Bend the anti-rotations tabs against the cylinder yokes using a hammer and punch to ensure the plates remain in-line with the bolts.

**3)** Fit the provided 50 x 50mm stainless steel bolts to the brackets and use the two plain nuts to tighten.

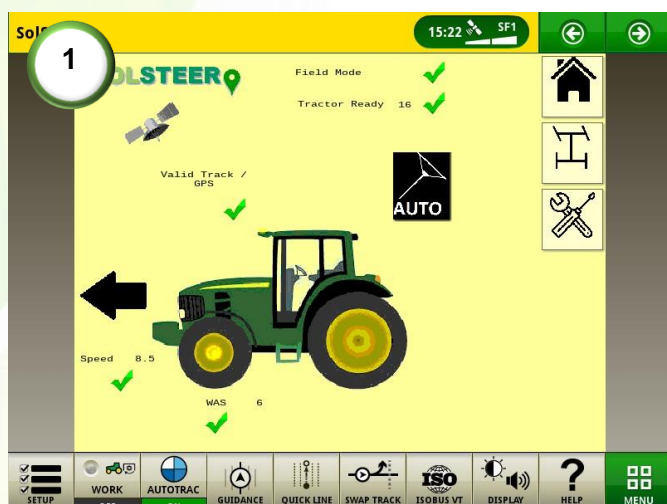
**4)** Fit the wheel angle sensor to the bolts using the nylock locking nuts to fix firmly. **Note:** ensure that the cable end of the sensor is facing towards the wheel.



**5)** The linear potentiometer should be installed as shown. Disconnect the existing 'AUTONSENSE' sensor at the 4-way connector and connect the new sensor, ensuring to affix the harnessing in such a way that it cannot be damaged.



## 5. Set-up Guide



1) When there is a valid track is selected, a valid GPS signal and the vehicle is ready to engage, all pre-acquisitions should be ticked.

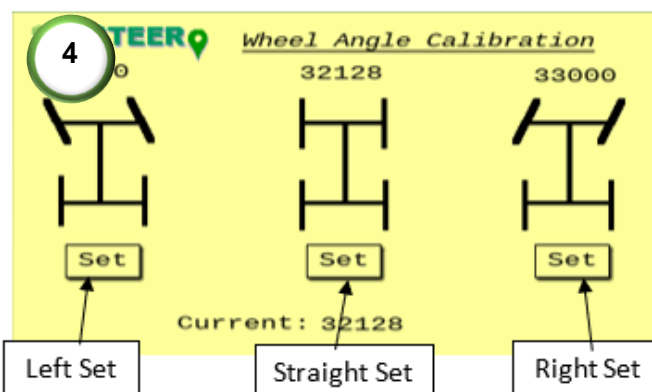


2) Once an A-B line is set, arm the GreenStar for steering. This is done by pressing the 'AUTOTRAC' button at the bottom of the screen. Once three-quarters of the circle are filled the system is ready to engage.

**IMPORTANT!** Disarm the GreenStar steering with two-quarters of the circle full when travelling on public roads.

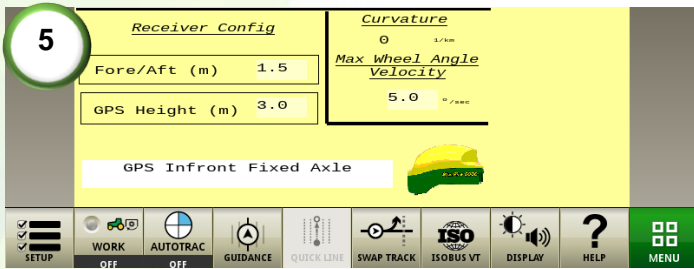


3) Access the setup and dealer lever diagnostics page. Enter the code 835 into the debug field.



4) Calibrate the wheel angle sensor (WAS) limits. Ensure the current reading angle is not reading 0. Turn the steering wheel full lock left and press the left set button. Turn the wheel full lock right and press the right set button. Turn the wheel to dead straight and press the straight set button. Check the values above each set point to see if they've changed. Repeat the straight calibration using the WAS calibration procedure in step 6 next page.

## 5. Set-up Guide



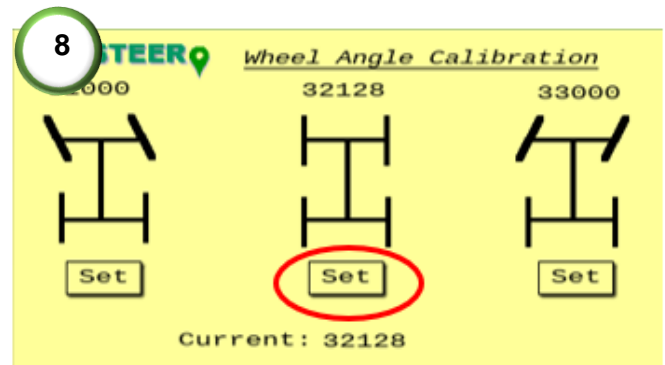
5) Ensure the receiver config settings are correct. Fore/Aft is the distance between the center of the fixed axle to the receiver. A TCM calibration will be required after changing these values. The maximum speed that the wheels can be turn can be set under 'Max Wheel Angle Velocity'. Default is 5°/sec.



6) To steer, ensure the 'AUTO' rocker switch on the right-hand pillar is switched up. **IMPORTANT!** Ensure this switch is in the OFF position during road travel to prevent accidental engagement.



7) Engage the steering and drive at about 4kph. Wait for the cross-track error to be holding a stable value around 0cm.



8) While tracking on-line, press the straight set button in the setup page. This will then save the dead center point of the wheel angle sensor (WAS).

For further set-up information and calibration details please refer to the TTC User Manual.

## 6. Steering Tuning

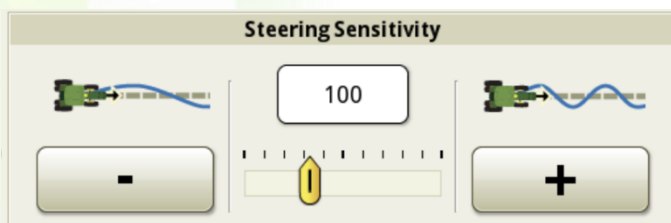
The SolSteer Agri-Steer module uploads to the John Deere Greenstar display the optimal steering adjustment settings for your specific vehicle. However, if for any reason you wish to adjust these values, these can be changed following the steps below.



1) Select the guidance icon shown.

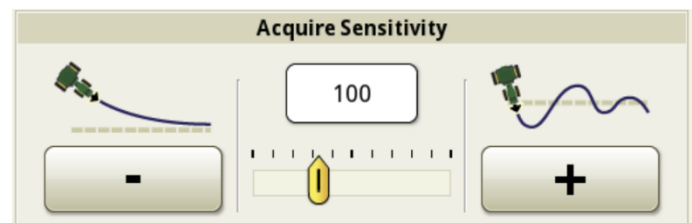


2) Select the steering icon shown. On the menu select 'steering adjustments'. The following options can be adjusted.



3) Adjust this parameter to make the system more aggressive. The higher this number, the more the wheels will turn for the same amount of error.

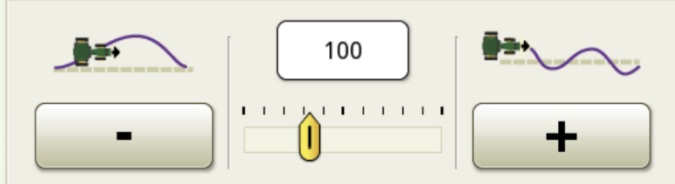
**NOTE:** If this value is too high, the wheels can over-oscillate.



4) Adjust this parameter until the acquisition is satisfactory. The higher this number, the more aggressive the vehicle will turn onto the line.

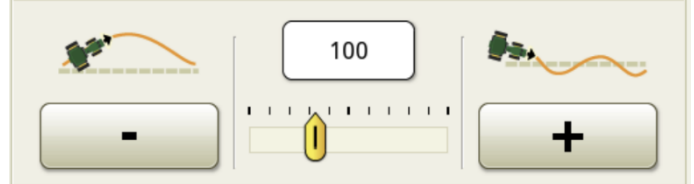
## 6. Steering tuning

### Line Sensitivity - Tracking



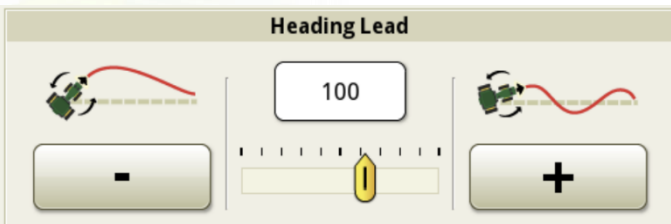
**5)** If the machine moves too far from the A-B line increase the tracking line sensitivity. If the machine is unstable on AB line decrease this value.

### Line Sensitivity - Heading



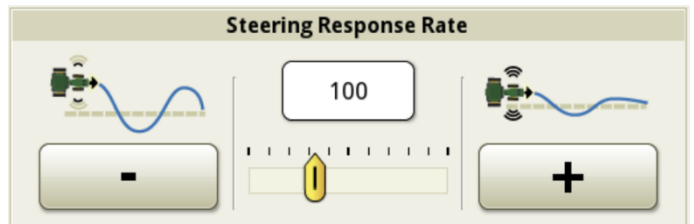
**6)** Adjust this parameter if the heading error is oscillating, the higher the number, the more sensitive to heading error the system will become.

### Heading Lead



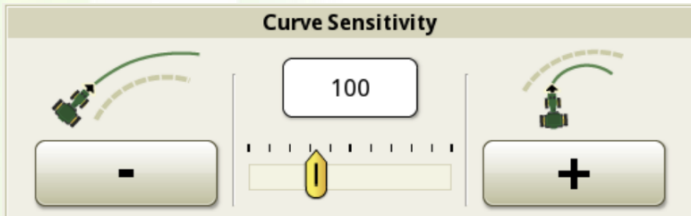
**7)** This parameter changes the look-ahead function. The lower the number the further the system will look-ahead on the line. This can improve the online tracking performance and stability of the system.

### Steering Response Rate



**8)** If the tracking performance is poor due to the system being too slow, increase the steering response rate. Increasing this too much, can result in jittery behavior.

### Curve Sensitivity



**9)** This parameter adjusts how sensitive the system is to curves on the track. The higher the number the more the vehicle will undercut the line. Adjust this to improve the tracking performance when driving around a curve.

## 7. Troubleshooting



The following contains a series of common problems, their causes and the solutions to be carried out to resolve them. The problems and causes are listed in order of likelihood in occurring.

### The SolSteer ISO user interface won't display

Causes	Solutions
ISOBUS is disabled in the John Deere Display	Check ISOBUS is enabled in the John Deere Display
The priority number is incorrect	Check the priority number and set it as the highest priority number possible
The CANBUS connection is faulty on the GCAN side of the steering controller	Check CANBUS connections are working with 2.5 volts on CAN high and CAN low respectively

### Steering won't engage with ¾ pie chart

Causes	Solutions
Trial has expired	Request unlock code from SolSteer
The engage switch is faulty	Check wiring to the switch, or contact SolSteer to install an engage switch
Tractor isn't ready to engage	Check the diagnostic code in the Solsteer page under tractor ready

### 0 pie chart with steering controller not detected

Causes	Solutions
GCAN and SCAN are the wrong way round	Correct GCAN and SCAN connections
No connection with steering valve ('Tractor' LED is red) usually due to faulty wiring	Contact SolSteer Ltd for wiring diagram
No connection with Greenstar display ('Greenstar' LED is red) usually due to faulty wiring	Contact SolSteer Ltd for wiring diagram. Check GS3 pinouts from section 3 page 12



### Constant cross track error

Causes	Solutions
Incorrect wheel angle sensor (WAS) calibration	Calibrate the wheel angle sensor (see step 6, page 18)

### Full pie chart on the Auto Trac circle but wheels aren't steering

Causes	Solutions
Third party navigation is interfering	Disconnect third party navigation control

### Tractor ready diagnostic table

0	Steering wheel moving
16	Tractor is ready to steer
20	Tractor is steering
32	Waiting for steering wheel to move
80	Reset required
61	System lockout (road mode or valve not enabled)