

# CRG USER MANUAL



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Release Notice: This is the September 2022 release of the CRG User Manual. It is applicable to CRG firmware version 1.02.000 and later.

It is assumed that users of the products described herein have technical experience as well as an understanding of the fundamentals of agricultural machinery.

In this manual, “CRG” may refer to the CRG-FENDT, CRG-CLAAS, CRG-CAT, or other variants.

This manual and others related to the CRG may be found on the CRG product page:

<https://www.agra-gps.com/product/crg-chameleon-rtk-guidance>

## **Disclaimer**

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**DO NOT USE THE CRG IF YOU DISAGREE WITH THE DISCLAIMER.**

## Important Safety Information

Read this manual and the machine operation & safety instructions carefully before installing the CRG. Refer to Appendix A for Product Specifications.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your equipment, contact Agra-GPS for support.
- Follow all safety labels affixed to the system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact Agra-GPS.

When operating the machine after installing the CRG, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate the CRG system while impaired.
- Always remain in the operator's position in the machine when the CRG system is engaged.
- Determine and maintain a safe working distance away from other individuals. The operator is responsible for disabling the CRG system when a safe working distance has been diminished.
- Ensure the CRG is disabled prior to starting any maintenance work on the machine or parts of the CRG system.
- Follow all safety instructions from the host machine as well as the John Deere system.
- The CRG must only be used in the field, never on public roads.

## Electrical Safety

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Verify that all cables and connectors are not in contact with sharp edges or anything that could cause chafing, as this could result in power shorts and/or other malfunctions.
- Power is supplied to the CRG even when the key is off. Power can be removed in 3 different ways: 1) Remove the connector from the CRG, 2) Remove the fuse supplying circuit power, or 3) Remove a battery lead while the machine is off.

## Risk of Fire

- The circuit supplying 12 volt power for this product requires a fuse. The maximum fuse rating is 5 amps, and the minimum is 1 amp.

## **Introduction**

Congratulations on your purchase of the CRG! The CRG is designed to bridge the communication between agricultural machinery (of various makes) and a John Deere (JD) display (1800, 2600, 2630, 4240, or 4640). This allows a JD display to create maps in the John Deere format, and also provides autosteer functionality. The operator uses the JD display to create AB-lines or field documentation, or to handle any other GPS system input.

The CRG contains a) an RTK-capable GPS receiver, **AND** b) a full steering controller capable of steering a non-JD machine with a John Deere display! The specific machine that can be controlled by the CRG is dependent on the variant that was purchased: for example, a CRG-AGCO can control a Fendt tractor, but cannot control a Claas tractor. To control a Claas tractor, you would need to purchase a CRG-CLAAS.

This manual contains information generic to CRG setup and usage. For installation instructions for your particular machine, please consult the relevant Installation Manual.

## **NOTICE**

This manual is not intended to replace the manuals for the host machine nor the John Deere GPS system. The operator must read and understand the manuals and instructions of these systems, before using the CRG.

## **ISObus Apps**

The CRG comes with at least 2 ISObus VT applications (ISO apps) that will be loaded onto the John Deere monitor. The apps will automatically install themselves into the monitor after the first few minutes of the initial start-up. On subsequent power-ups the apps will load themselves from monitor memory much more quickly. The CRG apps include:

- Bridge/steering configurations
- Option to change work recording mode
- Option to change the machine type
- RTK configuration
- NMEA serial output configurations

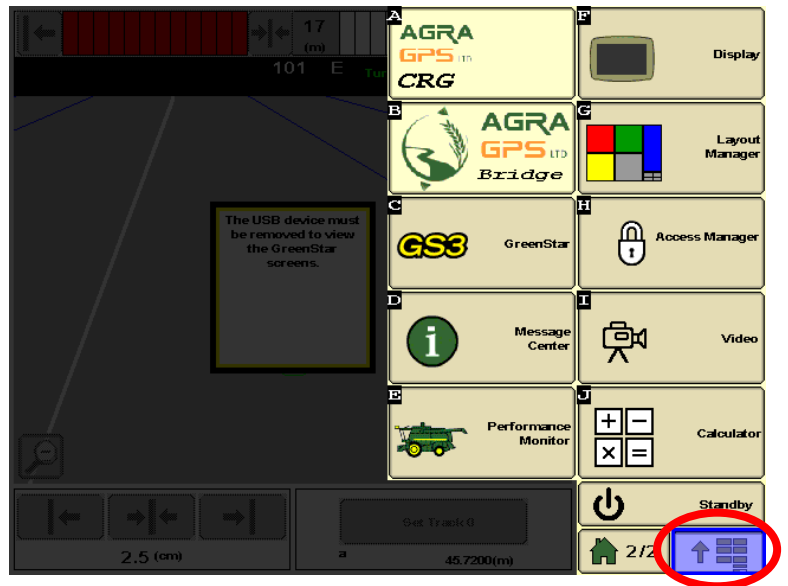
Depending on the model of JD monitor, the CRG ISO apps may be found in different locations.

On a John Deere Gen-4 monitor the application will be loaded in the ISObus VT section on the main page of the display.



On John Deere 1800, 2600, & 2630 the application will be shown in the side menu of the John Deere display. The side menu (shown below) is opened by pressing the button on the bottom right.

**NOTE:** John Deere 1800 and 2600 monitors do not show a loading bar for ISO applications, while 2630 and 4640 monitors do.



If the ISO application does not load:

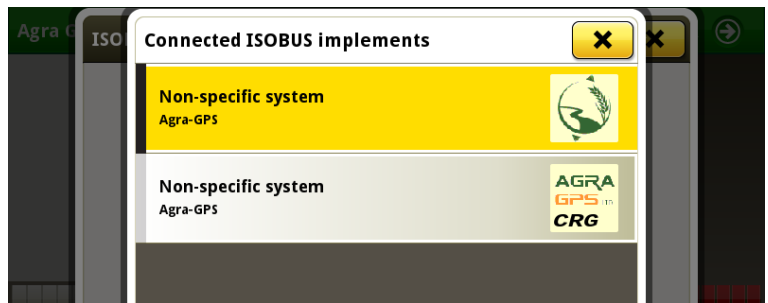
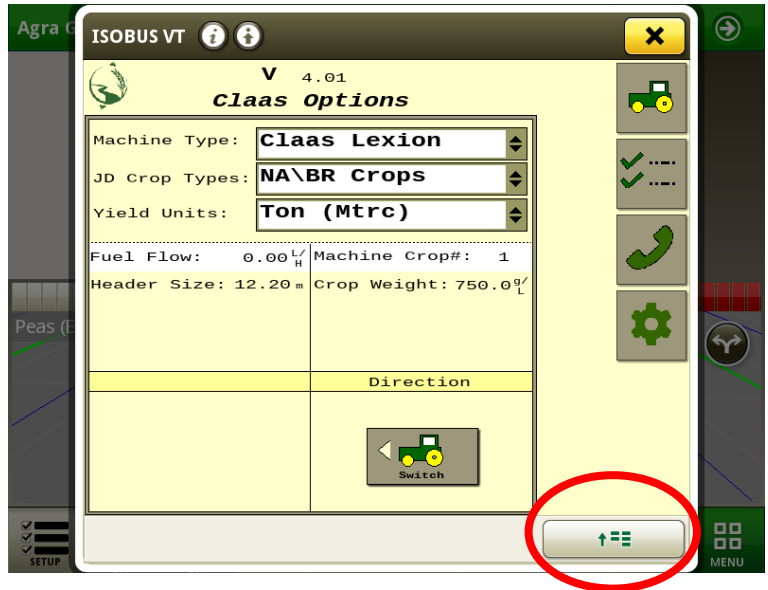
- Try clearing the monitor's memory. On 2630 monitors this can be done in the Message Center in the side menu. Go to the Cleanup tab, check controllers, then Begin Cleanup. On 4640 monitors this can be done in the info page of the ISObus VT. Navigate to the ISObus VT window and press the info (i) button at the top of the page, then press Clean Up ISObus VT.
- Do a hard reset of the John Deere monitor (Unplug it, then plug it back in).
- Do a full restart of the machine. Remember, the app may take a few minutes to load.

### Switching Between ISO Apps

When accessing ISObus VT, the first page viewed may be the CRG-Bridge app. Before setting up the Bridge parameters, it is necessary to setup the CRG-Receiver app. To do this, pull up the app page using the button circled.

Refer to page 11 for more information on configuring the Bridge app.

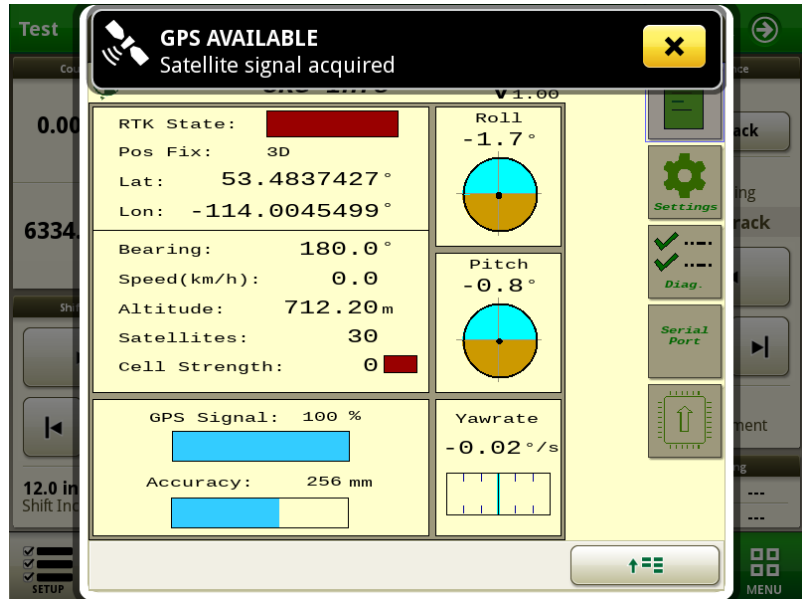
In the image, the top item (yellow) selects the CRG-Bridge app, and the bottom item (light grey) switches to the CRG-Receiver app.



## Configuring the CRG

The main screen of the CRG-Receiver app is the “CRG Info” page, as shown.

The minimum initial setup requirements include specifying the mount placement & completing the calibration procedure (refer to Mount Settings on page 6).



Refer to the following sections for more information:

### SETTINGS

MINIMUM SETUP →

- Page 5 ..... General Settings
- Page 6 ..... Mount Settings
- Page 8 ..... NTRIP Settings
- Page 8 ..... Modem Settings



- Page 9 DIAGNOSTICS

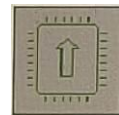


- Page 9 SERIAL PORT



### UPDATES

Refer to the CRG Firmware Update Manual



Use this button to switch between the CRG app and the Bridge app



## General Settings

**Minutes On After Power Off:** Delay for CRG to power down after machine is turned off. This will allow GPS satellite tracking to continue and allows for getting back to work quickly.

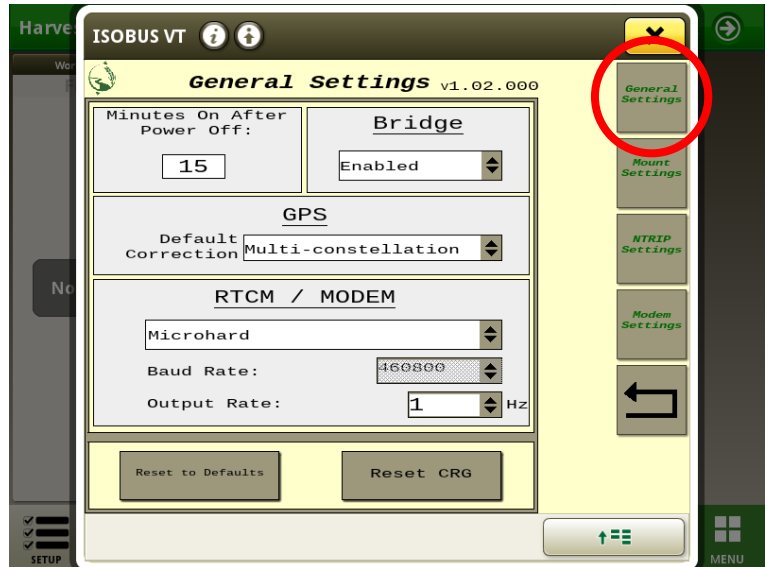
**Bridge:** Must be enabled to provide auto-steering on any non-JD machine. Set disabled if using the CRG as a receiver only. If using the CRG on a JD machine, the Bridge ISO app of the CRG is disabled automatically, even if this selection shows “Enabled”.

**Default Correction:** Multi-Constellation allows the CRG to use signals from any satellite system (GPS, GLONASS, Galileo, Beidou). SBAS restricts the receiver to WAAS (for North America) or EGNOS (for Europe).

**Modem Type:** If the CRG was purchased with an optional cellular modem, the make of the modem is selected here. The “NTRIP Settings” and “Modem Settings” buttons are invisible if no modem is selected.

**Reset to Defaults:** All parameters within the CRG Iso App are reset. The default settings take effect after the CRG is rebooted.

**Reset CRG:** The CRG device is rebooted. **WARNING:** Resetting the CRG while it is engaged will cause loss of machine control.





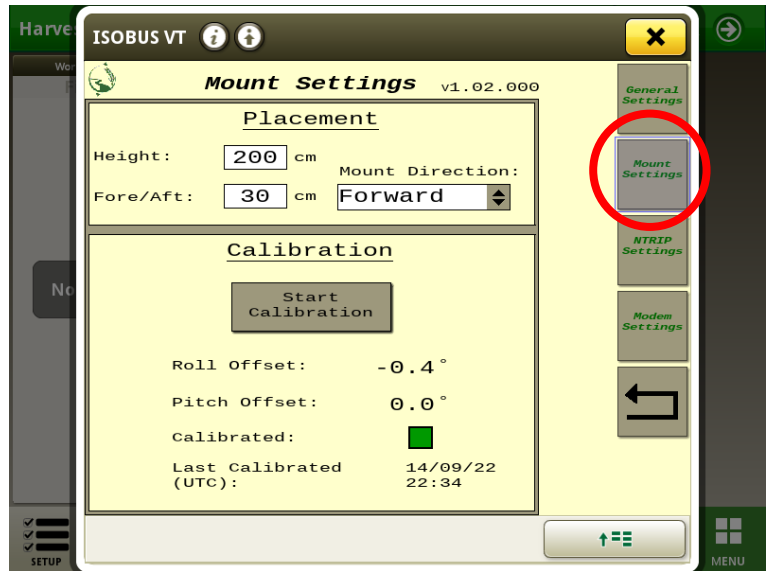
## Mount Settings

**Height:** the height from the ground to the bottom of the CRG.

**Fore/Aft:** the horizontal distance from the turning point to the CRG. For a tractor, usually the fixed/rear axle. For a combine or articulated tractor, the fixed axle would be the front axle, and for the articulated tractor, the CRG mount on top of the cab would be behind the front axle, so the setting will be negative. For most tractors, with the CRG mounted at the front of the cab roof, the value is positive because it is in front of the fixed axle.

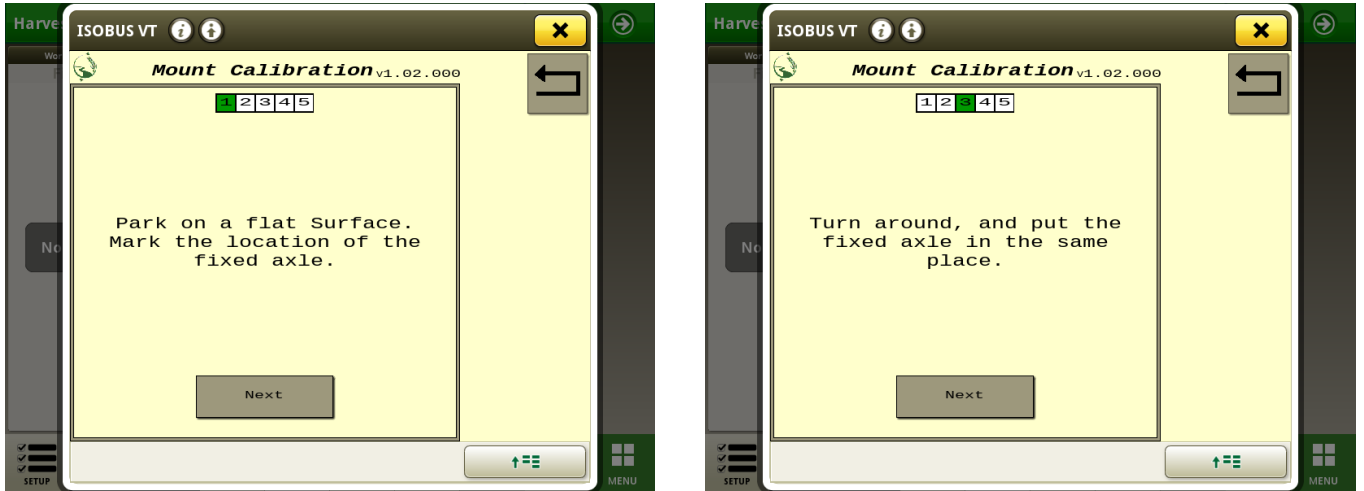
**Mount Direction:** the direction of the front of the CRG. For example, when facing forward in the driver’s seat, if the CRG connectors are to the left, the Mount Direction should be specified as Right. For most machines, Forward is the correct choice. An exception would be newer Fendt tractors where the CRG can be mounted inside the roof panel.

**Start Calibration:** See next page. Calibration accounts for any imperfections in the mount.

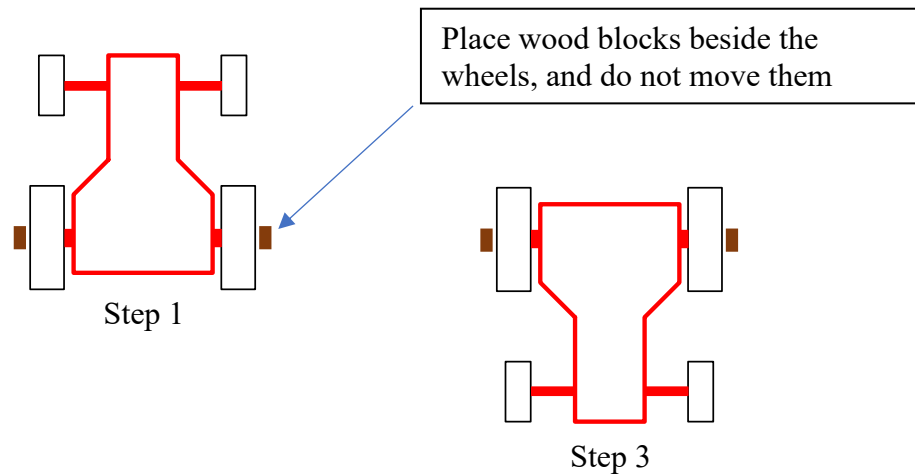


## Calibration

The tractor should be parked on a FLAT spot such as a concrete pad. Calibration in a field is usually not suitably flat. However, the flat spot chosen does not have to be perfectly level. After pressing “Start Calibration”, you will see the TCM calibration screen with instructions.



For a typical tractor, the fixed axle is the rear axle. For marking the location of the rear axle, you could use something like wood blocks placed next to the rear wheels, as shown:

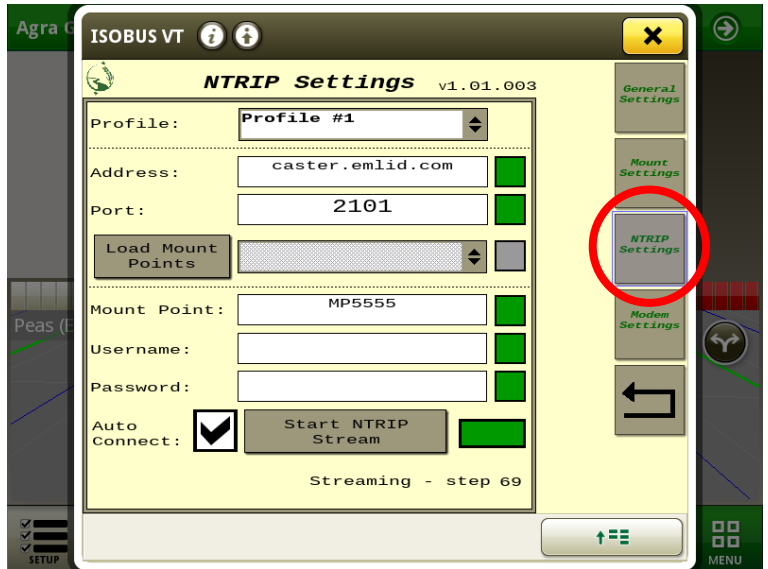


After initial readings are taken, you will be required to turn the tractor around (180°) and park it on exactly the same spot. The tractor must be stationary before pressing the ‘Next’ button.

### NTRIP and Modem Settings

There are 3 options for connecting to an NTRIP caster of your choice:

- You may have purchased the CRG with an internal cellular modem. This modem requires a SIM/data card to be installed.
- If you don't have a cellular modem, you may use our Agra-GPS app on your phone to connect to the CRG via Bluetooth® and get the RTCM correction data from an NTRIP caster. In this case, the IP address and other details of the NTRIP caster are specified within the phone app.

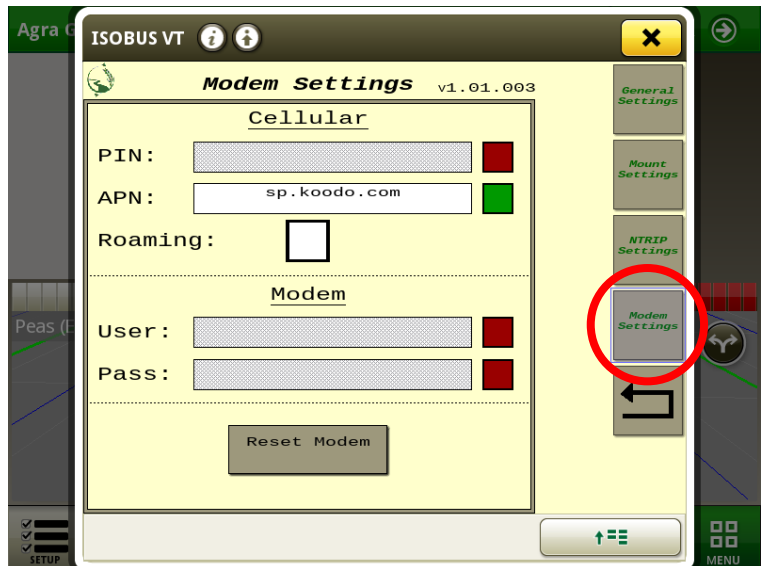


- You may connect an external radio modem. Consult with Agra-GPS for options.

If your CRG is equipped with an optional cellular modem, setup within ISOBUS VT is required. The NTRIP settings page allows you to connect to RTCM correction data via cellular connection.

The CRG also works without correction data; however, accuracy is not nearly as good as with an RTCM correction source.

Refer to the [CRG Modem Guide](#) for further instructions.

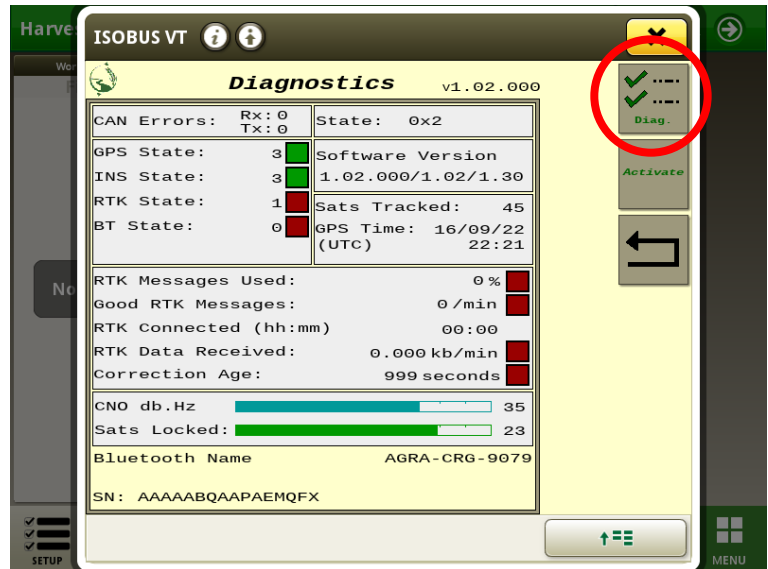


### Diagnostics

The diagnostics page is useful for determining proper operation of the CRG.

When connecting with Bluetooth, please note the name displayed near the bottom. This name should appear on your phone on the Bluetooth connections page. Each CRG will have a unique Bluetooth name (the last 4 characters will differ).

Refer to page 13 for notes on normal indications and/or troubleshooting.



### Serial Port

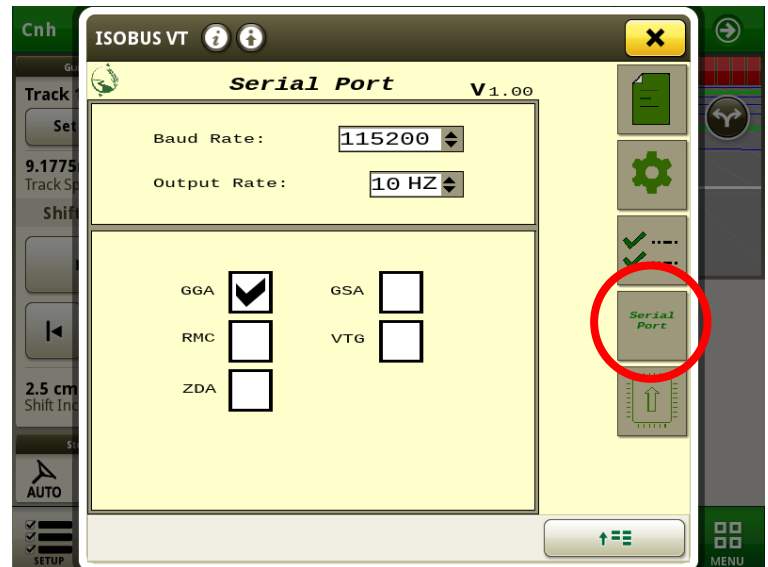
The CRG can send out serial NMEA text data, which may be used by various implements for tasks such as section control or application rate control.

Serial format:

- 8 data bits, no parity, 1 stop bit
- Baud Rate as specified on screen

Output Rate: 10 HZ means “10 sentences per second”

Various NMEA sentence formats such as GGA and VTG may be selected for transmission. Multiple formats may be selected at one time.



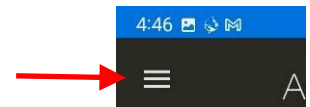
The plug on which the NMEA data is available will vary by machine. For example, on the newer Fendt tractors, it is sent to the 9-pin D-sub connector to the upper right of the operator seat.

## Bluetooth App

The Agra-GPS app provides RTCM correction streaming via Bluetooth, through your mobile phone. Be aware that you will require a reliable cellular network signal at your work site.

**NOTE:** Streaming data through your phone may cause extra data charges from your mobile phone network provider, depending on your data limits. However, the data rate is fairly low: for example, a typical 30kb/min streaming rate means that it will take almost 600 hours to consume 1 gigabyte (GB) of data.

- 1) Ensure the Bluetooth service on your mobile phone is enabled.
- 2) Android: Go to the Google Play Store  
iPhone: Go to the App Store
  - Search for the Agra-GPS app and install it.
- 3) Start the app, and using the upper left menu, go to the Settings page.
- 4) Under Settings → NTRIP, specify the caster parameters, for example:
  - Host                                   caster.emlid.com:2101
  - Mount Point                       MP9999 (the mount point represents a particular base station)
  - Login                                   u12345
  - NMEA Source                       Receiver



- The Host can also be specified with an IP address, e.g. 159.89.221.86:2101
- 2101 refers to the “Port Number” and must be separated from the address with a colon.
- A list of Mount Points may also be obtained by typing the Host name (along with port number) into a web browser like Google Chrome or Safari.
- The Login username must be obtained from your NTRIP service provider.
- The NMEA Source may also be specified manually in terms of Lat/Long/Altitude position. This must be the precise location of the stationary base station receiver.

- 5) Under Settings → Receiver, select the CRG device such as “AGRA-CRG-xxxx”, where xxxx is a unique identifier for your CRG. The CRG must be powered on in order to be found by your mobile phone. If you have multiple CRGs on different machines, you will need to reset this parameter each time you move to a different machine.
- 6) User Profile: this is a way to store different NTRIP settings. If you work in multiple different locations, you may need to change to a different mount point or even a different caster. By saving a different profile for different locations, it makes changing the setup easier.
- 7) Return to the Home screen and press Connect. RTCM data from the caster should start streaming to the CRG. In ideal conditions an RTK fix can be achieved in under 10 seconds. Your phone screen can be turned off and streaming will continue. For long workdays, it is recommended to keep your phone plugged into a charger so there is no interruption due to the phone battery dying.

## The CRG-Bridge ISO App

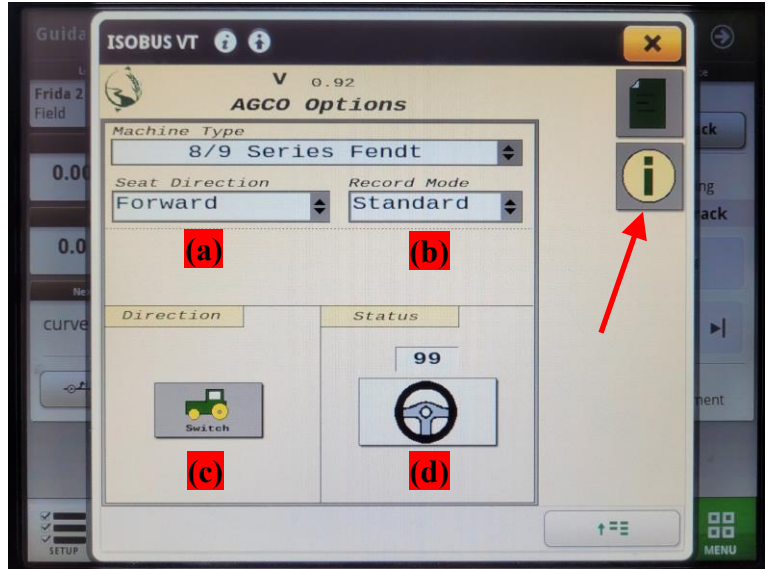
Each CRG comes with a Bridge ISO app tailored to a particular type of machine. If the CRG is connected to a John Deere machine, this Bridge app will not be visible or selectable. If on a non-JD machine, the Bridge app will only be selectable if Bridge = Enabled on the General Settings page.

Refer to your installation manual for Bridge setup options for your particular machine.

There are also likely other settings within the machine itself that may need adjustment, and these will be described in your installation manual.




Nevertheless, many options are very similar between different Bridge types. Here are a few examples of common options:

Press the button indicated by “ i ” to access other information pages.

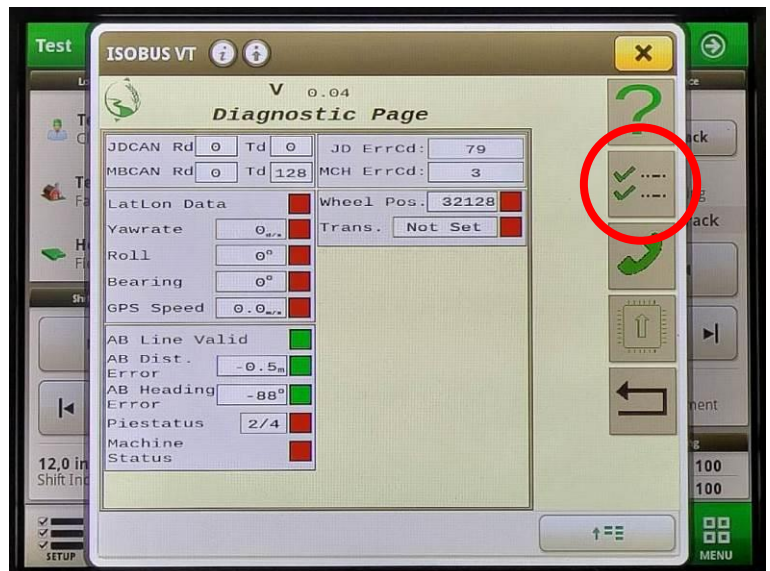


AGCO Bridge home page

- a) Ensure the Machine Type and Seat Direction are appropriate for your machine.
- b) Record Mode refers to the recording of the work area of the field completed by the implement. Record Mode selects between “Standard” and “On Resume”, where “On Resume” can be triggered by hydraulics (for example, it only records work area when the implement in the ground and not when raised).
- c) While driving, if the direction of the machine is detected incorrectly, you can force it to change it here.
- d) You can see how the CRG detects the steering wheel angle from here.

Other commonly available information pages include Help , Contact , and Firmware Update  (refer to the CRG Firmware Update Manual)

The button for accessing the Diagnostic page is circled.



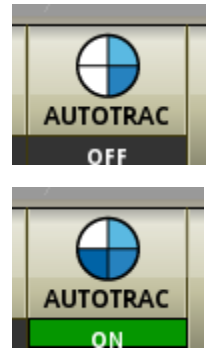
## Auto-Steer Operation

Note the AutoTrac Pie indicator on the JD monitor screen. With the CRG attached, you will usually see 2 quarters of the Pie displayed if everything is normal (Installed and Configured).

To move the Pie to 3 quarters (Enabled), try pressing the Pie on screen. On some machines, you may have to select a physical enabling switch or button, often located on the armrest or overhead. There are also requirements on some machines for minimum speed, detection of steering wheel movement, and on some combines threshing must be engaged. For further instructions, refer to the Installation document for your particular machine.

To engage auto-steering, you will find an Engage (also known as Resume) button to activate it (bringing the Pie to 4 quarters), usually located on the control stick or armrest. It will engage only if all other conditions are met, such as minimum speed, etc.

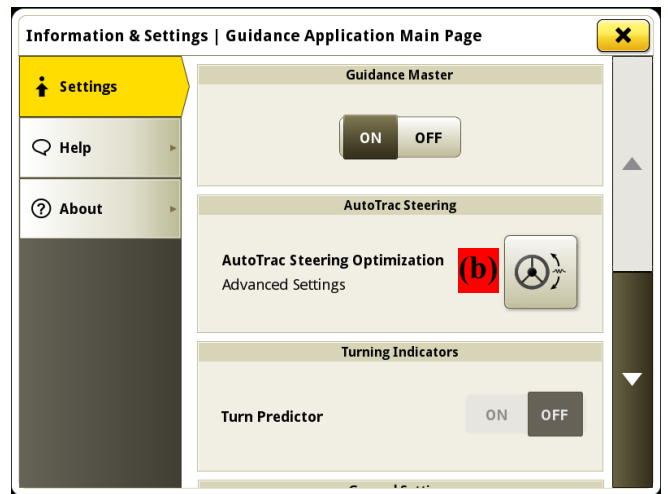
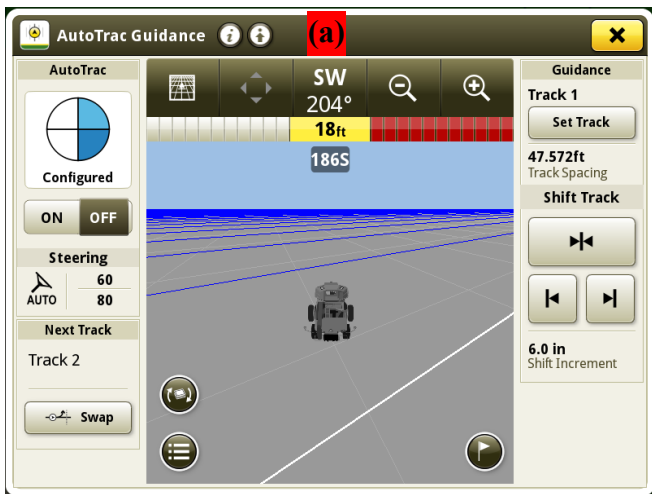
You can press the Engage button again to disengage, or simply turn the steering wheel. On all machines, forcing the steering wheel will automatically disengage auto-steering.



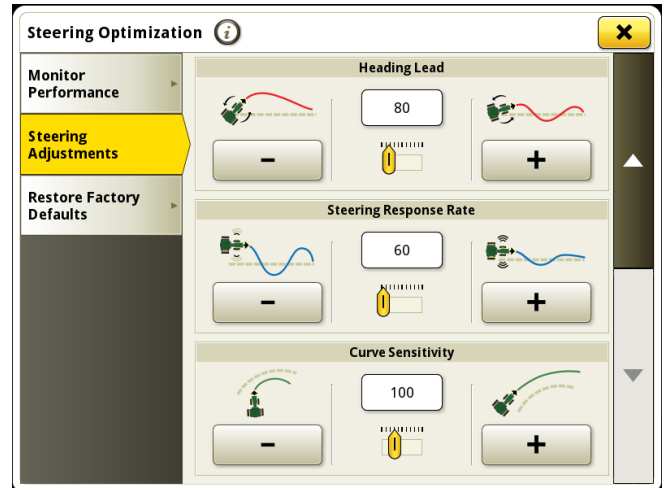
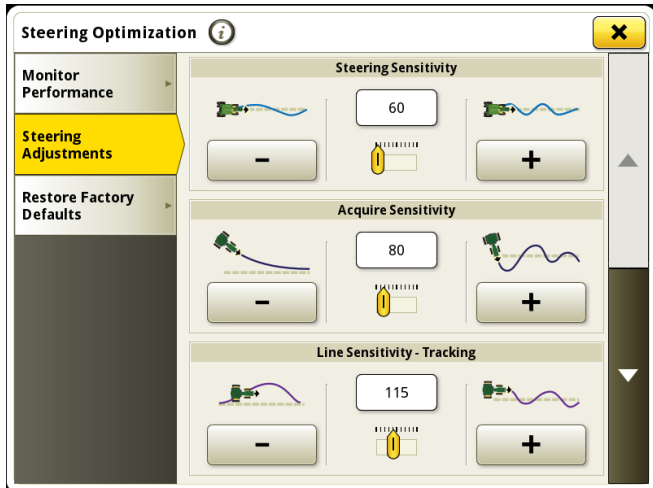
## Auto-Steer Optimization

Using the JD display you may adjust your steering performance. The steering optimization screen may be accessed as follows:

- a) Press on the top bar of the AutoTrac Guidance screen
- b) Access Steering Optimization settings



Most machines will perform optimally with all JD settings centred. If a change is required, find an open area where you can travel at target speed and adjust one parameter at a time until you are satisfied with the steering performance.



### SF1 & RTK Indicators

In order to communicate with a John Deere monitor, the CRG identifies itself as having an SF1 signal at all times, even when no satellite signals are available. This does NOT mean you are receiving an SF1 signal, and also does NOT mean you have an SF1 license.



When receiving a correction stream and in RTK Fix mode, the JD monitor will show that RTK is enabled.



When in RTK Float mode, the JD monitor will show RTK-X.

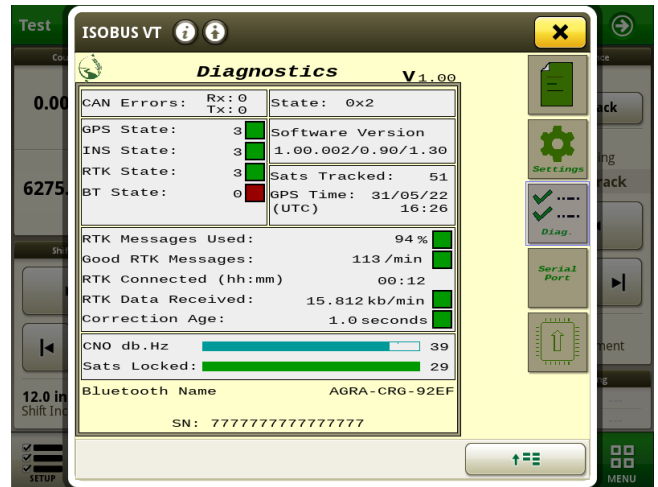


NOTE: When the CRG switches from RTK Float to RTK Fix mode, auto-steering will disengage. This is normal and expected behaviour, and prevents a sudden unexpected path change. Press the Engage (or Resume) button to re-engage.



## Troubleshooting

- Normal values for RTK Data Received should be between 15 to 40 kb/min, depending on the base stations (i.e. mount point) configuration. If RTK message indicators are yellow, this means data has stopped flowing within the past minute. Once 1 minute has elapsed without a valid RTCM correction stream, indicators will show red.
- RTK State will show yellow in Float mode.
- If an inappropriate mount point is chosen (for example, from a receiver that is too far away), the RTK State may not be able to obtain a Fix, but will stay in Float mode. The accuracy in float mode is not reliable, and in some cases, non-RTK positioning might even be better than Float.
- If “Good RTK Messages” shows purple, this is because an information message was received from the caster, which is usually an error message. This can happen if the caster believes you are outside of the service area for the selected mount point.
- CNO refers to “Carrier to Noise” ratio, which is a measure of satellite signal strength. Anything over 35 is normally acceptable for an RTK fix.



## Status Light

The back side of the CRG (the connector side) contains a coloured status LED. The LED should always be showing at least one colour, usually in a fading pulse. If multiple colours are flashing, then multiple failures have occurred.

- Red flash (fast): ISO/Implement bus failure (connecting to the JD monitor)
- Red pulse (slow): INS failure
- Purple pulse: GPS failure
- Light pulse: GPS signal is too weak
- Green pulse: All systems normal

During firmware upgrade, the LED will display different colours when the CRG reboots. While the firmware is updating, various colours will appear in a fast flash. **DO NOT REMOVE POWER UNTIL THE FIRMWARE UPDATE IS COMPLETE.** To determine if the update is complete, wait for the LED to show a “fading pulse” colour. Refer to the *CRG Firmware Upload Manual* for more details.

## NTRIP Caster Setup

The NTRIP caster is a remote internet server that provides an RTCM correction stream, which allows an RTK Fix to be achieved. The caster will usually offer many “mount points”, each of which essentially represents a GPS receiver with its location known precisely. The receiver (base station) must usually be located within 35km (22 miles) of your work site in order for RTK to work adequately. Accuracy decreases as your position moves further from the base station.

To connect to a caster, you will need to find a local service provider who will give you an IP address, port number, mount point identifier, and mount point login name and password. There may be privately owned casters with base stations in your area that will charge a subscription fee, or there may even be publicly available casters, sponsored by industry groups or government.

Alternatively, you can choose to setup your own base station by purchasing a product like Emlid Reach RS2 or similar ([www.emlid.com](http://www.emlid.com)). As part of Emlid's product offering, you can create a mount point for your base station at [caster.emlid.com](http://caster.emlid.com). It is also possible to register your base station with a different caster service such as [rtk2go.com](http://rtk2go.com).

Setting up your own caster is possible, but this is more technically challenging. Software such as that found at [www.use-snip.com](http://www.use-snip.com) can be used freely, or with a paid license for unlocking extra features.

Typical RTCM message streams may be set up as follows:

(A)

1004, 1012 at 1 message/second; and 1005, 1033 at 1 msg every 5 seconds (data rate: 15 kb/min)

- This setup only includes corrections for GPS and GLONASS

(B)

1006, 1074, 1084, 1094, 1230 all at 1 message/second (data rate: 41 kb/min)

- This setup includes corrections for GPS, GLONASS, and Galileo

**Refer to the Base Station Setup Manual for more information:**

<https://www.agra-gps.com/product/emlid-reach-rs2-base-station/>

## Appendix A: Product Specifications

|                          |                                     |
|--------------------------|-------------------------------------|
| Operating Voltage Range: | 10 to 16 VDC, 12V nominal           |
| Power Consumption:       | less than 3W                        |
| Operating Temperature:   | -20°C to +40°C ambient              |
| Weatherproof:            | NEMA 3X, IP65                       |
| Supported:               | Bluetooth® BLE, RTCM-3.x, NTRIP 2.0 |

NOTE: Circuit protection fuse is required: 1A minimum, 5A maximum

## COMPLIANCE

This product is in compliance with the following standards:

### EMC

- FCC 47 CFR Part 15B: Radio Frequency Devices – Unintentional Radiators
- ICES-003 Issue 7 (2020-10): Information Technology Equipment (including Digital Apparatus)
- EN ISO 14982 (2009): Agricultural and Forestry Machinery – Electromagnetic Compatibility
- ETSI EN 301 489-17 V3.2.4 (2020-09): Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services (Part 17: Specific conditions for Broadband Data Transmission Systems)
- ETSI EN 301 489-1 V2.2.3 (2019-11): Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services (Part 1: Common technical requirements)

### SAFETY

- EN 62368-1 (2014): Audio/video, information and communication technology equipment (Part 1: Safety requirements)
- IEC 60950-22 (2016): Information technology equipment – Safety (Part 22: Equipment to be installed outdoors)
- IEC 60529-1 (2001): Degrees of protection provided by enclosures. (IP code)

## ***Electromagnetic Compatibility Statements***

### RF Exposure

The integrated Bluetooth® device operates at an output power level which is within the ISED SAR test exemption limits at any user distance. Maximum output (Class 2 Bluetooth® LE): +10 dBm (+1.5 dBm typical). Frequency range: 2.402 GHz to 2.480 GHz. Maximum gain (integral chip antenna): 1.63 dBi.

### USA: FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in the specified installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**\*\*DO NOT MODIFY\*\*** Changes or modifications not expressly approved by Agra-GPS Ltd could void the user's authority to operate the equipment.

### Canada: ISED

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage ;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### EU & UK

Hereby, Agra-GPS Ltd, declares that the Bluetooth® module has been installed in accordance with the installation instructions, and in equivalent assessment conditions as tested for compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU, and the essential requirements and other relevant provisions of UK Radio Equipment Regulations 2017.