



SBGUIDANCE

SMARTRAX MD

016-8000-098EN REV. A

Installation manual

(English) (Original)

PREFACE

This installation manual is intended for persons responsible for installing a SBGuidance Auto system. The manual contains important instructions that should be complied with when commissioning, operating and servicing the SBGuidance system.

This manual has been compiled with the utmost care. Raven Europe assumes no responsibility for any errors or omissions in this document.

Any comments or questions can be sent to service-eu@ravenind.com.

Raven Europe or any of its suppliers will accept no liability for physical or material damage caused whilst using the SBGuidance system.

The installed Raven system produces less than 70dB (A) noise.

This installation manual uses a number of concepts for extra attention to a few things:

**Tip!:**

Provides recommendations on how certain activities can be performed much easier.

**Please note!:**

Indicates certain problems that the user should take note of.

**Caution!:**

Indicates that the machine can be damaged.

**Warning!:**

Indicates a risk of injury.

DISCLAIMER

WARNING!

- The safety instructions contained in the manuals of the tractor or implements must be complied with at all times.
- Always switch off the tractor before installing or repairing hydraulic and electrical components of the SBGuidance system.
- It is strictly prohibited to use the SBGuidance system on public roads.
- It is strictly prohibited to leave a driving vehicle unattended when the SBGuidance system is switched on. The driver is always responsible for the direction and course of the vehicle.
- To prevent injury or fire, replace defective fuses only with fuses of the same type and amperage.
- The SBGuidance the operating system is not able to detect and avoid obstacles. If there is an obstacle in your path, you will always need to take action for it to be avoided.
- Only allow authorized/qualified persons to operate the system. Authorized/qualified persons are defined as: persons who have read and understood the manual, have been given instructions by a product specialist, and who are both physically and mentally fit and able to operate the system.
- The system contains moving parts! Make sure the immediate environment is clear of people before operating the system.
- In case of system failure or breakdown switch of the tractor and disconnect the electrical power source to avoid further damage. Contact your dealer for further instructions on how to repair your system.
- Always wear personal protective equipment when operating/adjusting/repairing the system outside of the tractor cab.
- In order to prevent power surges from occurring, always start the machine first, before initiating the SBGuidance control system.

PAY ATTENTION!

- Only touch the touch-screen with your finger or by using a special touch-screen stylus/pen. Operating the touch-screen with sharp objects may cause permanent damage to the screen.
- Always consult your supplier as to which products are best suited first before cleaning the touch-screen with chemicals or alcohol.
- If the terminal is not used for a long period, better remove the terminal from the tractor and store in a heated environment. This will extend the life span of the electronic components.
- To prevent theft, it is better to not let the terminal and GPS-antenna unattended in the tractor on the field.

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KIT CONTENTS

This section contains a list of the components that are included in the SmarTrax kit. Before beginning the SmarTrax installation, compare the items in the kit with the components on this list. If you have questions about the kit, contact your Raven dealer.

TABLE 1 OVERVIEW OF STANDARD ELECTRONICAL COMPONENTS

#	PART NUMBER	ITEM DESCRIPTION	QTY
1	11158000242	HRNS, STU, SBG SMARTRAX MD	1
2	11158000214	HRNS, CHASSIS, EXTENSION 2M	1
3	11158000063	HARNESS IN-CAB (DYNAMIQ ISO)	1
4	11158000064	HRNS, IN-CAB, TERMINAL, VIPER4	1
5	11158000141	HRNS, POWER, BASIC	1
5	11158000060	HRNS, POWER, IMPLEMENT READY	1
6	14084002131	IMPLEMENT SOCKET (IBBC)	1
7-1	11178000313	KIT, RADIO ANTENNA TRC, MAGNET	1
7-2	11218000010	GSM ANTENNA LAIRD - 3,5M	1
7-3	10638000015	FIELD HUB GPS PATCH ANTENNA 4,5M	1
8-1	11158000111	GPS ANTENNA CABLE TNC-TNC 4,5M	1
8-2	11150171890	CABLE 12' MODEM TO RECEIVER	1
8-3	11158000011	CABLE, 600S TO VIPER 4	1
9	10638000070	WHEEL ANGLE SENSOR 12V 90° 35CM	1
10	11158000226	HARNESS WHEEL ANGLE SENSOR 5M	1
11	10630173862	TRACTOR STEERING CONTROLLER SMARTRAX MD	1
12	10630173862	DYNAMIQ ISO – TRACTOR	1
-	11178000151	KIT SMARTRAX MD IR	1

TABLE 2 OVERVIEW OF STANDARD MECHANICAL COMPONENTS

#	PART NUMBER	ITEM DESCRIPTION	QTY
1	11078000006	BRACKET, IBBC, IR	1
2	11078000125	BRACKET, DYNAMIQ, V4	1
3	11078000081	BRACKET, GPS/RADIO ANT GENERIC	1
4	11178000311	KIT, BOLT AND NUT UNC, ANTENNA	1
5	14074001024	TNC DUMMY	1
6	11078000131	MOUNTINGPLATE, ANTENNA, ROOF	1
7	11030001040	MOUNT, 1" RAIL, RAM D	1
8	11078000072	BRACKET, WAS, AXLE	1
9	11078000071	BRACKET, WAS, STRIP	1
-	11178000341	KIT, MOUNTING, TRACTOR	1

**Tip!**

The provided mounting kit 11178000341 contains all fasteners for the components.

TABLE 3 OVERVIEW OF MAKE OR TYPE SPECIFIC MECHANICAL COMPONENTS

#	PART NUMBER	ITEM DESCRIPTION	QTY
1	11078000121	CNH – GPS-ANTENNA BRACKET (T6000, T7000, T6, T7 EN CASE MAXXUM/PUMA)	1
2	11078000070	FENDT SCR RAM BRACKET (VISIO PLUS CAB, 500 EN 700-SCR SERIES)	1
3	11078000069	FENDT RAM BRACKET (FENDT VARIO 400, 700, 800 EN 900-SERIES MET COM3-CAB)	1
4	11078000082	RAM MOUNTING BRACKET CAB E.G. FOR JD/CNH (FOR TRACTORS WITH UNIVERSAL (120MM) MOUNTING POINTS)	1
5	11078000007	DYNAMIQ ISO MOUNTING BRACKET V1 (UNIVERSAL)	1

TABLE 4 MAKE AND TYPE SPECIFIC WHEEL ANGLE SENSOR BRACKETS

#	PART NUMBER	ITEM DESCRIPTION	QTY
1	11078000073	WHEEL ANGLE SENSOR BRACKET 60X70 (JOHN DEERE 6X30 4-CYLINDER)	1
2	11078000074	WHEEL ANGLE SENSOR BRACKET 60X80 (FENDT 7XX-8XX)	1
3	11078000085	WHEEL ANGLE SENSOR BRACKET 60X90	1
4	11078000075	WHEEL ANGLE SENSOR BRACKET 66X66 (JOHN DEERE 6XXX 4-CYLINDER)	1
5	11078000076	WHEEL ANGLE SENSOR BRACKET 76X76 (JOHN DEERE 6X20/6X30 6-CYLINDER)	1
6	11078000077	WHEEL ANGLE SENSOR BRACKET 70X70 (FENDT 4XX, VALTRA 6X50, VALTRA N-SERIES & T-SERIES)	1
7	11078000118	WHEEL ANGLE SENSOR BRACKETS CARRARO FRONT AXLE V2	1
8	11078000078	WHEEL ANGLE SENSOR BRACKET PIPE 65.3 MM	1
9	11078000079	WHEEL ANGLE SENSOR BRACKET PIPE 88 MM	1
10	11078000080	WHEEL ANGLE SENSOR BRACKET PIPE 73.5 MM	1

**Tip!:**

The indicated measurements of the wheel angle sensor brackets are center bolt hole to center bolt hole

Intentionally left blank.

1 TRACTOR SET ASSEMBLY

It is recommended to assemble the tractor set in the following order:

1. Mount the entire wiring harness from the battery and steering controller.
2. Mount the wheel angle sensor and cable.
3. Mount the GPS antenna and radio/GSM antennas and all antenna cables.
4. Mount the DynamIQ ISO and STU
5. Mount the Mechanical Drive unit
6. Mount the terminal.



FIGURE 1 OVERVIEW SMARTRAX MD

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2 MOUNTING THE WIRING HARNESS

The total SBGuidance cable harness exist of several cables, from the battery to the terminal. Raven Europe offers two power harness options; the CAN Basic harness or the Implement Ready (IR) harness. As an in-cab terminal harness Raven Europe offers a harness to connect the Viper 4(+) or the older GeoStar terminal. With an adapter harness it is also possible to connect a Viper 4(+) to the GeoStar terminal harness.

2.1 CAN BASIC POWER HARNESS

The basic harness can only be used for tractor steering. If the tractor is fitted with this harness, it is not possible to use the tractor for implement steering (TWIN, plough).

2.2 CAN IMPLEMENT READY (IR) POWER HARNESS

With an Implement Ready harness the tractor can be used both for tractor and implement steering. The IBBC connector can be used to connect an implement (Figure 2). The Implement Ready power harness runs from the battery to the IBBC connector at the rear of the tractor. It branches off to connect the STU chassis harness and contains fuses near the split.



FIGURE 2 IBBC BRACKET WITH CONNECTOR.

2.3 INSTALLING THE CABLE HARNESSES

Both the CAN basic harness and the CAN implement ready harness are divided into the following harnesses (in order from the battery):

1. Power harness: an Implement Ready power harness is mounted from the battery to the IBBC connector at the back of the tractor. A Basic power harness is mounted from the battery to the STU SmarTrax MD Harness. Make sure that the relays and fuses are mounted in a dry, clean and accessible spot (Figure 3).
2. Extension Harness: this harness is connected with the power harness and the In-Cab DynamIQ harness. A branch is made to the STU SmarTrax MD Harness. This harness is wrapped in a hard casing.
3. STU SmarTrax MD Harness: this harness is connected with the extension harness. Connect the STU, the wheel angle sensor cable and the Mechanical Drive unit to this harness. The location of the STU and DynamIQ is shown in Figure 33.
4. In-cab harness (DynamIQ ISO): runs from the STU SmarTrax MD Harness into the cab and is wrapped in a braided sleeve casing. It branches off to the DynamIQ ISO.
5. Terminal harness: runs from the the In-Cab harness (DynamIQ ISO) to the terminal. The terminal harness is connected with two connectors to the in-cab harness (DynamIQ ISO). When using a Raven 600S GPS receiver, the 600S harness is connected to the terminal harness too (see Figure 50).

Figure 48 and Figure 49 of the annexes show the schematic drawings of both the CAN basic harness and the CAN Implement harness.



FIGURE 3 RELAYS AND FUSES OF THE POWER HARNESS.

In addition, a number of guidelines have been established for the assembly of both types of cable harnesses:

- Mount the relays fixed and in a dry, clean and accessible spot (Figure 3).
- The red wire is + (12V). The black wire is (ground). Make sure that the first part of the red wire (part in between battery and fuses) cannot damage during operation.
- If necessary the positive and negative wires, in between the battery and the fuses, can be shortened. Be sure to use cable sockets with the correct size for proper connection.
- If a ground switch is used, connect the wiring harness behind the ground switch (not at the battery side of the ground switch!).
- If a main (12V) switch is used in the red wire, connect the wiring harness behind the main switch (not at the battery side of the main switch!).
- If no main switch is used, always connect the wiring harness directly to the battery.
- If the system is connected to a 24 Volt machine, always use a 24V to 12V converter. Never connect between the two batteries of a 24V machine!
- Lead the terminal harness along with the GPS and radio/GSM antenna cables through one pillar of the cab.
- Tie-wrap the wires so they are attached free from vibration and friction.

**Caution!:**

It is Important to ensure that the wiring harness is always connected to the battery AFTER installing all wires and controllers!

**Tip!:**

The pinning of the connectors in the wiring harness is described in section 9.1.

3 MOUNTING WHEEL ANGLE SENSOR

For a correct operation of the SBGuidance Smartrax MD system a wheel angle sensor is necessary. In various types of tractors a factory fitted wheel angle sensor is already mounted in the front axle. For different tractor types a 'spy cable' is available at Raven Europe to use the factory fitted wheel angle sensor for the Raven system. When a spy cable is used it is not necessary to install a wheel angle sensor. Ask Raven Europe for more information about the availability for a specific tractor brand or type.

3.1 MOUNTING SPY-CABLE

Take the following steps to mount a wheel angle sensor spy-cable:

1. Follow the cable from the wheel angle sensor on the front axle of the tractor to the first connection in this cable.
2. Disconnect the connectors.
3. Connect the spy-cable in between the connectors.
4. Connect the wheel angle sensor 5M cable to the M12 connector of the spy-cable.
5. Mount the spy-cable in a clean and dry position (Figure 4).



FIGURE 4 SPY CABLE MOUNTED ON A CNH TRACTOR.

3.2 MOUNTING THE WHEEL ANGLE SENSOR

Figure 5 and Figure 6 show a detailed view of the structure of a wheel angle sensor assembly. Table 5 also lists the components shown in Figure 5.

TABLE 5 WHEEL ANGLE SENSOR COMPONENTS.

Symbol	Description
1	Sensor housing
2	Sensor disc
3	Mounting bracket 3mm
4	Mounting strip 20x 3mm
5	2 x M5 x 16mm (countersunk head)
6	2 x M5 x 30mm

3.2.1 MOUNTING OF WHEEL ANGLE SENSOR HOUSING TO STANDARD FRONT AXLE

1. If the front wheels are straight, the screws of the sensor housing and sensor disc should be aligned with the front axle. In case of a 12V wheel angle sensor, it is also important that the sensor disc is rotated in such a way that the triangles in the disc and the sensor housing (Figure 7) are properly aligned. Only then will the wheel angle sensor produce a voltage reading.
2. The sensor housing and sensor disc must be aligned EXACTLY on the pivot point of the stub axle. The centre-to-centre distance of the mounting holes is 28 mm.

i Please note!:

With a 12V wheel angle sensor, the triangles on the sensor housing and sensor disc must be pointing in the same direction!

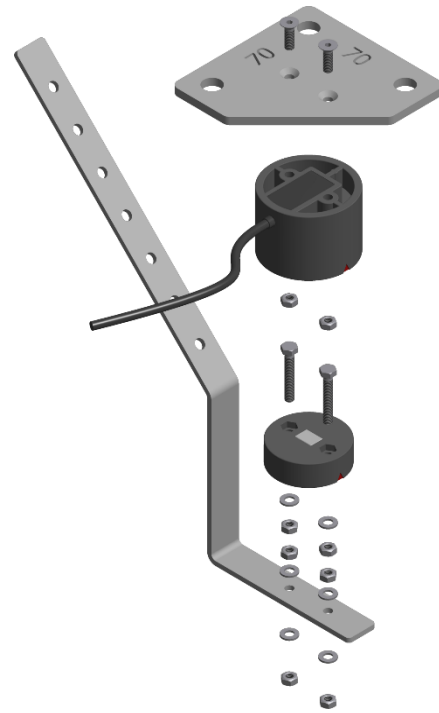


FIGURE 5 SCHEMATIC OVERVIEW OF WHEEL ANGLE SENSOR WITH MOUNTING BRACKET AND STRIP.

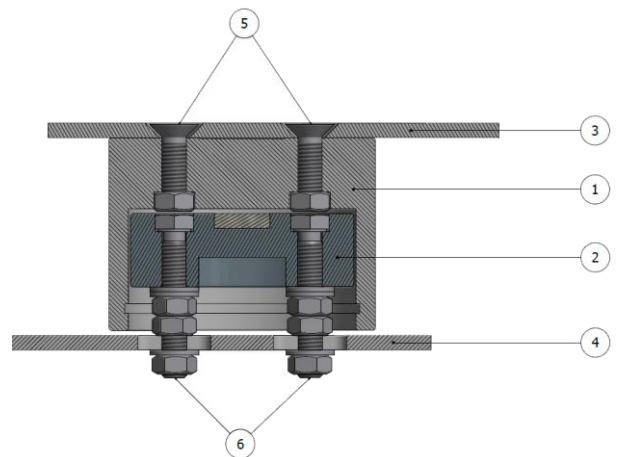


FIGURE 6 SCHEMATIC DRAWING OF WHEEL ANGLE SENSOR WHEN MOUNTED.

3. If there is a grease nipple at the bottom of the stub axle (stub axle with triangle), then a special U-shaped bracket is to be used for the wheel angle sensor housing (Figure 8 and Figure 9). See Kit Contents for the available wheel angle sensor mounting brackets.
4. It is recommended to assemble the sensor housing on the bottom side of the axle stub. Install the sensor housing with the wire pointing backwards.

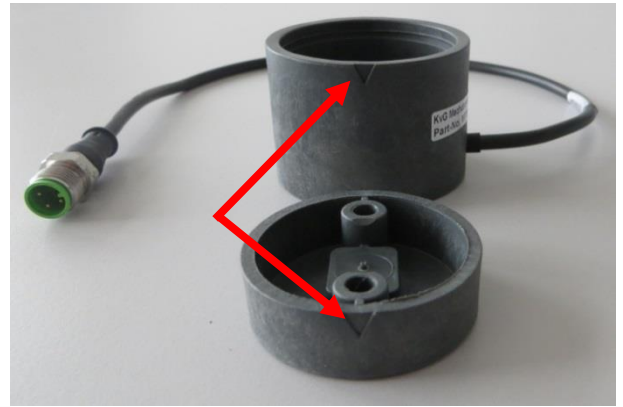


FIGURE 7 TRIANGULAR MARKINGS ON THE 12V WHEEL SENSOR.



Caution!

Sensor housing should always be mounted upright to prevent the accumulation of dirt.

5. Mount the sensor housing with the M5X16 bolts (allen bolt, countersunk head). Countersink the drill holes in the wheel angle sensor mounting bracket beforehand, so the heads of the M5 bolts are fully countersunk in the mounting bracket when tightened (Figure 6). To prevent damage to the inside of the the sensor housing, make sure the M5 bolts are not too long.
6. The connecting cable can be provided with a protective sleeve for longer life. Feed the cable via the stub axle and direct it over the top (stub axle/pivot point) of the front axle so that the wire is not pinched or constricted.



FIGURE 8 STEERING ANGLE SENSOR ON NEW HOLLAND.



FIGURE 9 STUB AXLE WITH GREASE NIPPLE.

3.2.2 MOUNTING THE SENSOR DISC

1. Mount the sensor disc without spacers on the provided 20x3 strip (Figure 10).
2. Mount the sensor disc in the sensor housing and mark where the first bend should be made (about 10 cm from the beginning). The first bend should be as close as possible to the sensor disc and be positioned as tight as possible against the stub axle housing to prevent damage by crops or soil (Figure 10 and Figure 11). The most extreme wheel position is usually the tightest position of the strip. Do not bend the strip too sharply.
3. Mark the position of the second bend in the strip until the sensor disc fits nice and flat in the sensor housing. On the other side, the strip must rest just underneath and against the front axle. The strip should rest on the sensor housing. Cut the strip to the correct length.
4. The wheel angle sensor strip should now be mounted to the bottom of the front axle (Figure 11). Mark the location of the holes on the strip and drill two 5 mm holes in the strip at approximately 30 mm apart.
5. Hold the strip with disc in the correct position and drill the first hole in the front axle with a 5 mm drill bit (about 10-15 mm deep). Drill into the thickest part of the front axle. Not too deep!



FIGURE 10 DISC ON THE STRIP WITHOUT SPACERS.



FIGURE 11 STRIP WITH SECOND BEND AND SHORTENED.



Caution!

Ensure that the hole does not wear out when drilling (drill clean and straight). When drilling, ensure that the strip is under tension when positioned against the sensor housing so as to prevent the strip from vibrating. So, drill slightly higher!

6. Tap the first thread in the hole drilled into the front axle using a M6 screw-thread tapping attachment. Now fasten the strip with one M6 bolt (Figure 12).
7. Drill the second hole in the front axle with a 5 mm drill bit. Remove the strip again and tap the second screw thread in the hole in the front axle.
8. Drill the second hole in the wheel angle sensor strip with 6 mm drill bit. Fasten the strip with two M6 bolts.
9. Make sure the sensor disc falls nice and flat into the sensor housing and the strip also lies flat and under tension on both sides of the disc positioned against the sensor housing. Press with your thumb against the end of the strip and check if the strip bounces back easily without friction (Figure 18 and Figure 19). The sensor disc may only have a little bit of friction in the sensor housing.
10. If necessary, bend the strip a little bit. Two Bahco's are useful tools to do this (Figure 13).
11. Remove the strip again and mount the sensor disc on the bottom of the strip (Figure 14).
12. Mount the strip again with two M6 bolts on the front axle.
13. Check if the sensor disc is properly centered with the sensor housing. The strip has to lie flat under slight pretention against the sensor housing (Figure 14). Also turn the wheels to make sure the sensor housing remains properly centered in various wheel positions.

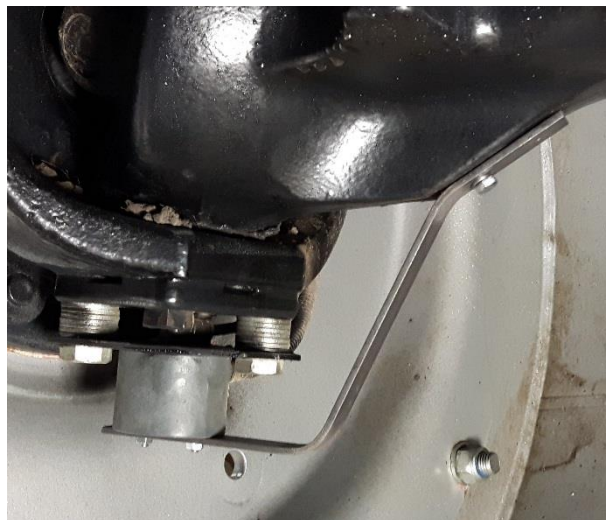


FIGURE 12 STRIP ON THE FRONT AXLE WITH ONE BOLT.



FIGURE 13 BEND THE STRIP WITH THE HELP OF TWO BAHCO'S.

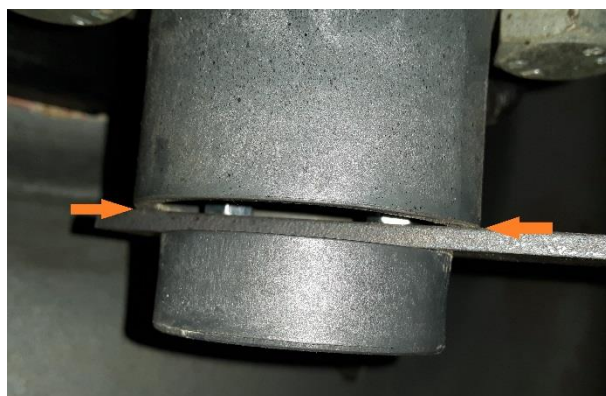


FIGURE 14 DISC AT THE OTHER SIDE OF THE STRIP.

14. Remove the strip again from the front axle. Then mount the strip again to the front axle with the aid of M5 X 30 bolts, raised with two nuts and two washers on each side. Mount on the proper side of the strip (Figure 15) and pay attention to the orientation of the disc (Figure 7). The triangular marker must be on the correct side.
15. Make sure the sensor magnet (Figure 16) in the sensor disc is completely clean (no iron fillings) before being mounted. Clean the sensor magnet with compressed air if necessary (Figure 17). Mount the strip back on the front axle.
16. Check again if the sensor disc lies under slight pretention against the sensor housing (Figure 18). Push with your thumb to the end of the wheel angle sensor strip to check this. The sensor disc may only have a little bit of friction in the sensor housing. The sensor disc should bounce back easily and without friction (Figure 19).



Caution!:

The sensor disc should be in a fully centered position within the sensor housing. The strip should be able to flex in a downward direction.

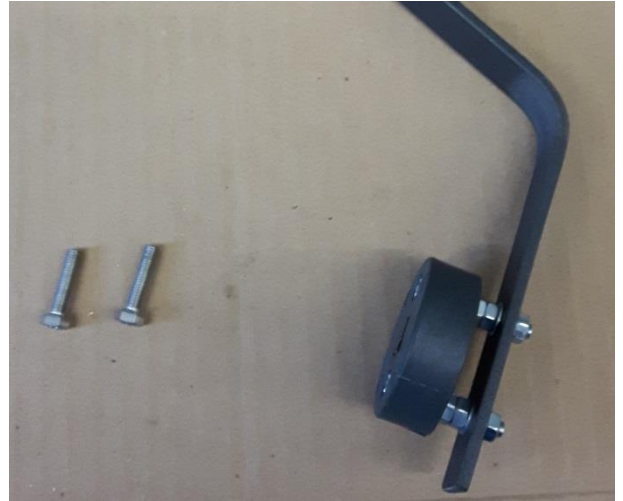


FIGURE 15 WHEEL ANGLE SENSOR DISC MOUNTED WITH SPACERS.



FIGURE 16 DIRTY WHEEL ANGLE SENSOR MAGNET.



FIGURE 17 CLEANING WHEEL ANGLE SENSOR



Tip!:

It is often useful to drill bigger holes (slots) in the wheel angle sensor strip for the sensor disc. Allow the nuts to be loose-fit when mounting the strip. The disc then centers itself automatically. Do not forget to tighten the nuts again.



Caution!:

Make sure the magnet of the wheel angle sensor is completely clean (no iron fillings) before mounting it. Cleaning the wheel angle sensor magnet with compressed air can prevent problems.

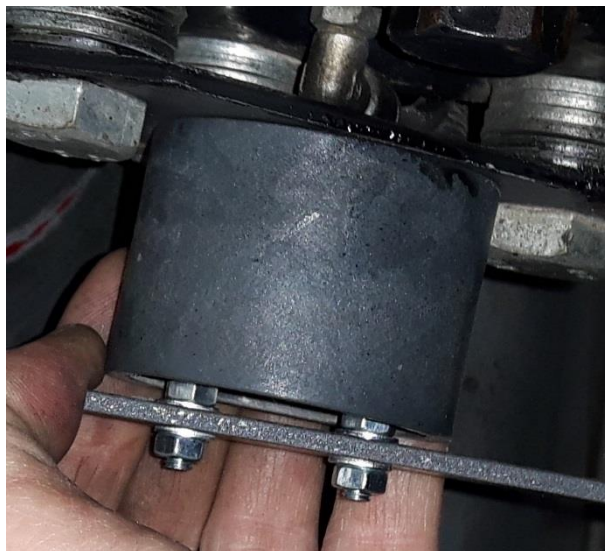


FIGURE 18 CENTRE AND FRICTION CHECK OF WHEEL ANGLE SENSOR.

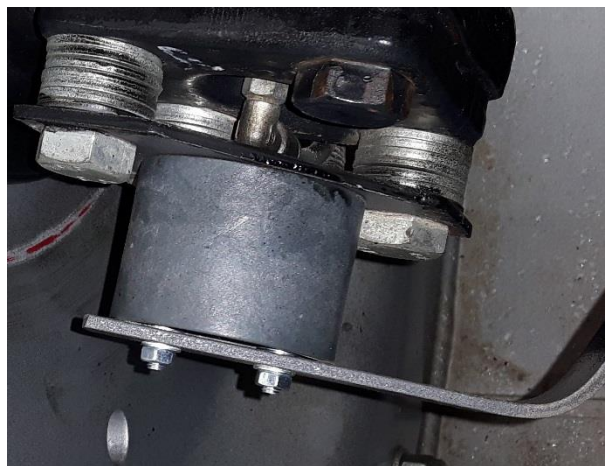


FIGURE 19 CORRECT MOUNTED WHEEL ANGLE SENSOR.

3.3 HEAVY-DUTY CARRARO FRONT AXLE WITH INDEPENDENT SUSPENSION

Tractors with the heaviest type of Carraro front axle with independent suspension must be fitted with a special wheel angle sensor bracket (Figure 20). This type of assembly requires a wheel angle sensor with a much wider range (180°) in connection with the larger wheel turn (blue coloured wheel angle sensor). The wheel angle sensor should be mounted at the right sight behind the front axle of the tractor (Figure 20).

Required parts:

- 180° wheel angle sensor
- Wheel angle sensor bracket
- M8 threaded stub with nuts
- 2x M8 ball joint
- Carraro front axle wheel angle sensor bracket
- Carraro front axle tie rod bracket

Method of mounting:

- Install the wheel angle sensor to the bracket.
- Mount the bracket to the front axle.
- Set the arm of the sensor approximately 20 degrees off center (Figure 21). This means that the ball and socket joint of the wheel angle sensor are flush with the ball joint of the control rod. This in order to prevent, when fully to the left, the arm of the sensor and the threaded rod with the ball joints scissors with each other.
- Cut the threaded rod to measure. The ball joints are center to center 180mm long. Fit the clamp to the tie rod and the threaded rod with ball joints.
- After mounting check the mechanism by steering fully left and right.



FIGURE 20 CARRARO FRONT AXLE.

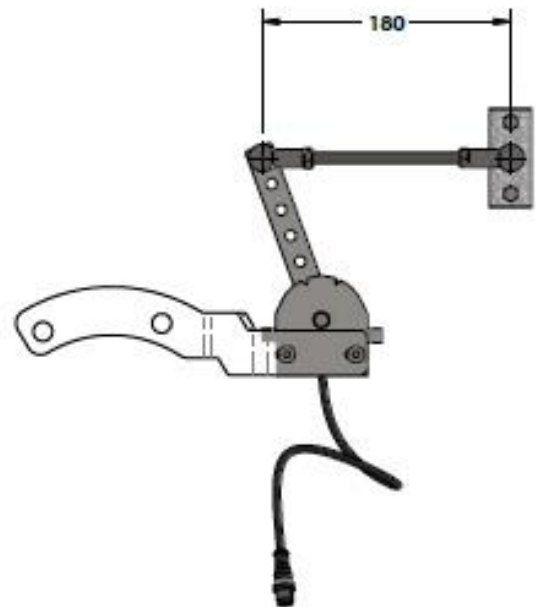


FIGURE 21 SENSOR WITH BRACKETS.

4 MOUNTING GPS AND RADIO/GSM ANTENNA

For receiving GPS satellites, a GPS antenna should be mounted (Figure 22 and Figure 23). Different antennas are available for receiving RTK corrections. Which antenna has to be mounted, is depending on the type of modem of the GPS terminal.

When using a built-in radio modem, a radio-antenna should be mounted. With a Slingshot modem, two GPRS / UMTS antennas and a GPS patch antenna should be mounted.

When all types of modems are used, all the antennas of above has to be mounted.

Label all the antenna cables with the correct label. This makes it easier for the operator, to connect the antennas to the correct connections on the modem and GPS terminal.



FIGURE 22 SEPTENTRIO GPS-ANTENNA.

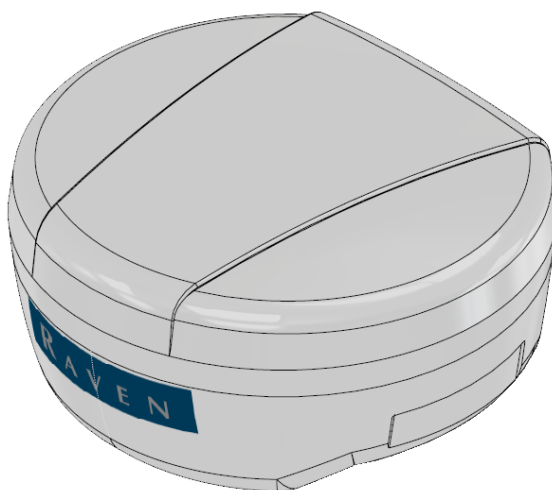


FIGURE 23 RAVEN 600S GPS-ANTENNA.

4.1 MOUNTING THE STANDARD GPS ANTENNA BRACKET

Figure 24 shows an example of the structure of standard GPS antenna equipment, which consists of a standard GPS antenna bracket, a GPS dummy and an UNC bolt + nut. The standard GPS antenna bracket can be taped to the cab roof using double-sided adhesive tape.

The following guidelines must be observed when installing the GPS antenna:

- The GPS antenna must be mounted at least 60 cm in front of the rear axle.
- Mount the GPS antenna in the centre of the tractor.
- Mount the GPS antenna using the UNC bolt included.
- Fasten the TNC-dummy to the GPS antenna bracket.
- Wire the antenna cable connector with the largest connector through to the inside of the cabin.
- Fasten the antenna cable so that it cannot become pinched anywhere and conceal inside the cabin upholstery, together with the GPS patch antenna cable, radio antenna cable or UMTS antenna cable.
- Mount the antenna cable in such a way that no water is allowed to flow along the cable into the cabin.
- Label the antenna cable inside the cabin with label 'GPS1'.



FIGURE 24 STANDARD GPS-ANTENNA BRACKET WITH UNC NUT AND BOLT AND TNC-DUMMY.

4.2 MOUNTING OF BRAND-DEPENDENT GPS ANTENNA BRACKET

If appropriate and available (check availability at Raven Europe!) a specific brand of GPS antenna bracket can be used. The same guidelines as described in section 4.1 apply to the installation.

4.3 MOUNTING ONE'S OWN DESIGN OF GPS ANTENNA BRACKET

When there is no brand-specific GPS antenna bracket available, and the mounting bracket of a standard GPS antenna bracket is not possible, you can design your own. For your own design, apply broadly the same guidelines as for a standard GPS antenna bracket (Section 4.1), with a number of additions:

- Always mount the GPS antenna on the UNC bolt (hole: Ø 16 mm) included.
- Mount the TNC dummy at all times (hole: Ø 9 mm).
- Optionally support the GPS antenna bracket with the aid of a vibration damper.

4.4 MOUNTING RAVEN 600S ANTENNA

It is also possible to use SBGuidance Auto in combination with a Raven 600S antenna (Figure 25).

In this manual the installation of the 600S antenna is explained. For the configuration of this antenna see the English configuration manual: '016-8000-025EN-A - Configuration manual – 600S smart antenna'.

On the bottom side of the 600S antenna, two magnets are built-in for attaching the antenna to steel surfaces. The new version of the GPS antenna bracket has a slope on both sides, so that the 600S antenna is well centered on the GPS antenna bracket (Figure 25). The GPS antenna bracket has to be mounted on the front of the cabin roof.

See Figure 50 for the connection schematics of the 600S cabling. An adapter/split cable is supplied with this antenna. The antenna is connected through this adapter cable and the '600S to Viper 4' cable to the terminal harness. The adapter cable should remain to the GPS antenna when it is removed from the tractor.

If also a Slingshot modem is used for RTK corrections, a 'modem to receiver' cable has to be connected. Make sure that the connectors on the roof are provided with protective caps (Figure 27). With these protective caps no dust and water can enter the connectors.

Furthermore, the following guidelines must be observed when installing the GPS antenna:

- Mount the GPS-antenna with the connectors backwards (Figure 26).
- Mount the GPS-antenna at least 60 centimetres in front of the rear axle.

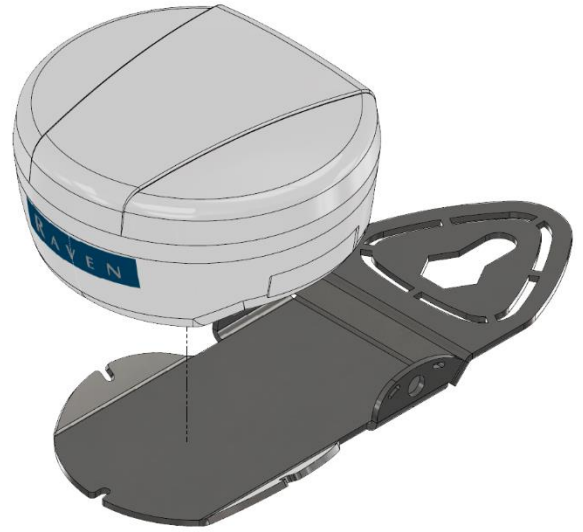


FIGURE 25 RAVEN 600S ANTENNE.



FIGURE 26 RAVEN 600S ANTENNA ON A CABIN.



FIGURE 27 CABLES TO THE RAVEN 600S ANTENNA.

4.5 MOUNTING THE RADIO ANTENNA

Figure 28 shows the standard radio antenna with magnetic base. Preferably, this standard antenna should be used. The components of this standard antenna are shown in Table 6.

TABLE 6 STANDARD PARTS FOR RADIO ANTENNA.

Symbol	Description
1	Radio antenna
2	Antenna cable
3	Magnetic base

A number of specific conditions should be met before mounting the radio antenna:

- Preferably mount the radio antenna with the magnetic base on the standard GPS antenna bracket (Figure 24).
- Do not mount the radio antenna next to a steel construction, but above it.
- Mount magnetic base on a sufficiently large steel surface (at least the size of the standard GPS antenna bracket). A larger steel base surface can improve signal strength and prevent problems, especially at greater distances (> 9 km).
- Label the antenna cable inside the cabin with label 'Radio'.



FIGURE 28 COMPONENTS RADIO ANTENNA.

4.6 MOUNTING THE GPRS/UMTS ANTENNA

If a SlingShot modem is used, in addition to the GPS-antenna, two GPRS / UMTS antennas and a GPS patch should be mounted.

The GPRS / UMTS-antennas should be mounted at least 100 cm of each other (like the CNH antenna-bracket in Figure 30). If a standard GPS-antenna bracket is mounted, one of the GPRS / UMTS-antennas should be mounted on this bracket (Figure 29). The second GPRS / UMTS-antenna should be mounted on a metal bracket on the cabin (Figure 31).

It is important that the following conditions are met at all times:

- The GPRS/UMTS antenna is equipped with a magnetic base and must be placed on top of the cabin.
- The antenna should have a clear reception all round.
- Label the antenna cables inside the cabin with labels 'Cellular' and 'Diversity' (Figure 32).
- Mount a grey SMA grip on both connectors (Figure 32).

4.7 MOUNTING GPS PATCH ANTENNA

When using a SlingShot modem also a GPS Patch antenna should be mounted (Figure 31). The GPS Patch antenna is magnetic. Mount the GPS Patch antenna always on the roof of the cabin. Be careful with mounting the GPS patch antenna; the GPS patch antenna cable is quite thin and fragile. Label the GPS Patch antenna cable inside the cabin with label 'GPS' and mount a blue SMA grip to the connector (Figure 32).



FIGURE 32 GPS ANTENNA BRACKET WITH A LAIRD UMTS ANTENNA.



FIGURE 29 CASE NEW HOLLAND WITH GPS-ANTENNA, GPS PATCH ANTENNA AND TWO GPRS/UMTS ANTENNA'S.



FIGURE 30 GPRS/UMTS-ANTENNA AND GPS PATCH ANTENNA ON A METAL BRACKET.



FIGURE 31 ANTENNA CABLES WITH LABELS AND SMA-GRIP SET.

5 MOUNTING DYNAMIQ ISO AND STU

The following guidelines have been established for mounting the DynamIQ ISO and STU:

- Preferably, place the STU and DynamIQ ISO next to and to the right of the seat. Use the standard DynamIQ ISO mounting bracket.
- Place the DynamIQ ISO on top of the STU.
- If it is not possible to attach the DynamIQ ISO to the seat bolts, the DynamIQ ISO should be attached in an appropriate place in the cabin that is free from vibrations. Also the STU has to be mounted somewhere else in the cabin.
- A DynamIQ ISO may only be mounted in a horizontal position (with the sticker side up). The connectors may be orientated in four directions (0, 90, 180, 270 degrees).
- By default, the orientation of the DynamIQ ISO is set to: horizontal position with connectors pointing towards the rear (as shown in Figure 33). Any other orientation should be set in the software!



FIGURE 33 DYNAMIQ ISO AND STU MOUNTED NEXT TO THE SEAT.

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6 MOUNTING MECHANICAL DRIVE UNIT

For mounting the mechanical drive unit (Figure 34), some specific manuals are available. These manuals are specific for the type of tractor.

Go to www.portal.ravenprecision.com to download the right manual. Click on Product Documentation in the right top corner. Click on Guidance & Steering at the left side, and click on SmarTrax MD. Search for the right manual (Figure 35).

If there is no manual available for the tractor you want to install SmarTrax MD please contact Raven Europe.



FIGURE 34 MECHANICAL DRIVE UNIT

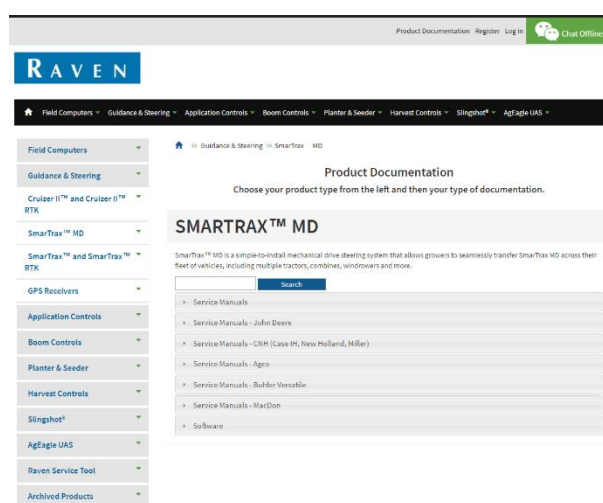


FIGURE 35 PORTAL RAVEN PRECISION

DESCRIPTION	PART NUMBER
SMARTRAX™ MD AGCO ROGATOR SS SERIES AND TERRAGATOR X1XX/X2XX SERIES INSTALLATION MANUAL	016-5030-040 REV. A
SMARTRAX™ MD BUHLER VERSATILE 4WD 305, 340, 375, 400 (SN 307000-LOWER) AND 435, 485, 535, 575 (SN 704000-LOWER)	016-5030-064 REV. A
SMARTRAX™ MD BUHLER VERSATILE 4WD, TIER IV (2012-NEWER)	016-5030-060 REV. A
SMARTRAX™ MD BUHLER VERSATILE 23XX-24XX, FORD VERSATILE 9X80, AND NEW HOLLAND 9X8X	016-5030-065 REV. A
SMARTRAX™ MD BUHLER VERSATILE 190-305, NEW HOLLAND GENESIS 8670A-8970A, AND FORD-NH GENESIS 8670-8970	016-5030-041 REV. A
SMARTRAX™ MD BUHLER VERSATILE 260, 290, AND 310 (MY2014 & NEWER)	016-5030-045 REV. A
SMARTRAX™ MD CASE IH 21XX, 23XX, 25XX, AND X088 SERIES	016-5030-052 REV. B
SMARTRAX™ MD CASE IH 91XX, 92XX, 93XX SERIES, BUHLER VERSATILE 8X6 AND 9X6 SERIES, AND FORD VERSATILE 8X6-9X6 SERIES, BIG BUD	016-5030-062 REV. A
SMARTRAX™ MD CASE IH AFX/X230 COMBINES, WINDROWER WD/WDX & NEW HOLLAND CR/CX COMBINES, WINDROWER H/HW SERIES	016-5030-051 REV. B
SMARTRAX™ MD CASE IH MAGNUM 72X0-89X0 SERIES INSTALLATION MANUAL	016-5030-031 REV. A

SMARTRAX™ MD CASE IH MX MAGNUM AND NEW HOLLAND T80X0/TG SERIES	016-5030-039 REV. B
SMARTRAX™ MD CASE IH MXM AND NEW HOLLAND TM SERIES	016-5030-046 REV. A
SMARTRAX™ MD CASE IH PUMA AND MAXXUM, NH 6000 SERIES, T7.XXX/T7000 AND TS SERIES	016-5030-032 REV. B
SMARTRAX™ MD CASE IH STX, STEIGER, QUADTRAC AND NEW HOLLAND TJ/T90X0/T9XXX	016-5030-061 REV. A
SMARTRAX™ MD CHALLENGER MT6X5C-D SERIES, MASSEY FERGUSON 86X0 SERIES, AND AGCO DT-B SERIES	016-5030-035 REV. B
SMARTRAX™ MD FENDT VARIO 700, 800 AND 900 SERIES	016-5030-043 REV. A
SMARTRAX™ MD JOHN DEERE 4X40, 4X50, 4X55, 4X60	016-5030-030 REV. A
SMARTRAX™ MD JOHN DEERE 6X20, 6X30, AND 7X20, 7X25, 7X30 SERIES	016-5030-034 REV. B
SMARTRAX™ MD JOHN DEERE 6X30 PREMIUM AND 7X30 PREMIUM	016-5030-042 REV. B
SMARTRAX™ MD JOHN DEERE 7X00/7X10	016-5030-038 REV. A
SMARTRAX™ MD JOHN DEERE 8X60/8X70 SERIES	016-5030-063 REV. A
SMARTRAX™ MD JOHN DEERE 9X50, 9X60, AND 9X70 SERIES INSTALLATION MANUAL	016-5030-050 REV. A
SMARTRAX™ MD JOHN DEERE 8000/9000 SERIES	016-5030-033 REV. A
SMARTRAX™ MD KRONE BIG M/BIG X INSTALLATION MANUAL	016-5030-090 REV. A
SMARTRAX™ MD KUBOTA M SERIES INSTALLATION MANUAL	016-5030-044 REV. A
SMARTRAX™ MD MACDON WINDROWER INSTALLATION MANUAL	016-5030-080 REV. A
SMARTRAX™ MD MASSEY FERGUSON/CHALLENGER WINDROWER WR SERIES	016-5030-082 REV. A
SMARTRAX™ MD NEW HOLLAND WINDROWER HW300, HW320, AND HW340 SERIES INSTALLATION MANUAL	016-5030-081 REV. A
SMARTRAX™ MD SMITCHCO SPRAY STAR 3180	016-9002-003 REV. A
SMARTRAX™ MD - SPRA-COUPÉ 3000-4000 SERIES - INSTALLATION MANUAL	016-5030-070 REV. A

7 MOUNTING THE TERMINAL

The following guidelines have been established for mounting the terminal (Figure 36):

- Always contact the customer about the terminal position in the cabin.
- Always use a RAM-D or RAM-C ball attachment.
- Mount the terminal free of vibrations with a solid bracket. A variety of mounting brackets are available for this purpose.
- Conceal all cables in one pillar (e.g. A-pillar or B-pillar).
- Mount in such a way that the display is directed straight towards the driver.
- Mount in such a way that driver has a clear view all around.



Tip!:

Mount the terminal in such a way that it does not obstruct the view of the driver over the top of the right-hand fender, but also so that the inside of the front wheel on the ground is still clearly visible.

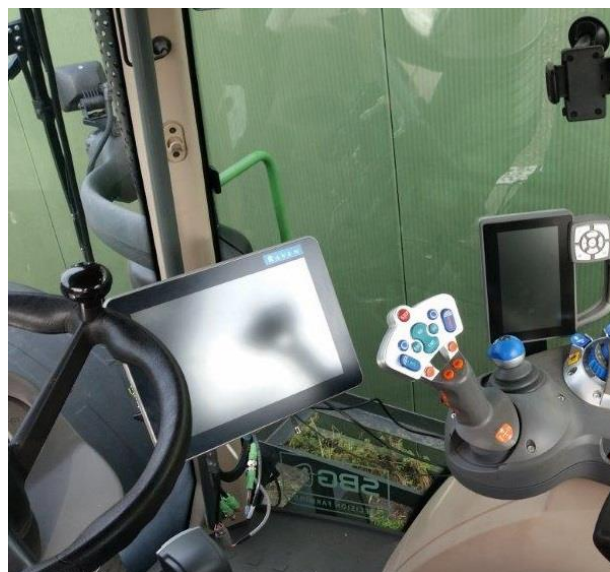


FIGURE 36 VIPER 4+ MOUNTED TO A-PILLAR.



FIGURE 37 GEOSTAR TERMINAL MOUNTED TO ISO ATTACHMENT OF A-PILLAR.

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8 CALIBRATION

For configuring a Smartrax MD machine profile, see general configuring manual – SBGuidance Auto – CAN – EN (016-8000-100EN-A). However, some settings in the CANTool are different. The different parts of configuring a tractor with SBGuidance Smartrax MD are described in this chapter.

8.1 CANTOOL

Start the Configurator (by pressing “Shift + SBGuidance” in the SBGuidance Loader). Go to Interfaces > CAN > CANTool to open the CANTool (Figure 38).

Choose the right Hardware manufacturer (Figure 39), and see the Table underneath for the correct type per terminal.

Terminal	Hardware manufacturer
GeoSTAR	SBG
Viper 4	Viper4
Viper 4+	Viper4+

Depending on the cabling and the terminal, choose the Hardware channel. Press ‘Initialize’ to get communication with the CANbus (Figure 39).

Make sure there is communication with the CANbus (received frames is running and Busload > 0%); see red rectangles in Figure 39.

Press on “Initialize”. After initializing the CAN-bus the busload and received frames will increase. The busload and received frames are visualized at the bottom side of the CAN-Tool. Check the cabling if the busload and received frames do not increase.

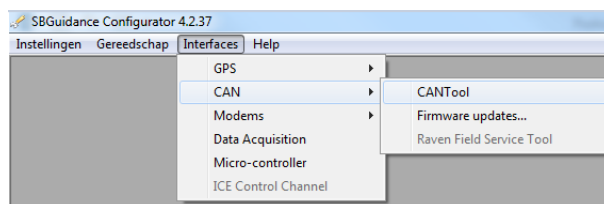


FIGURE 38 OPEN CAN-TOOL.

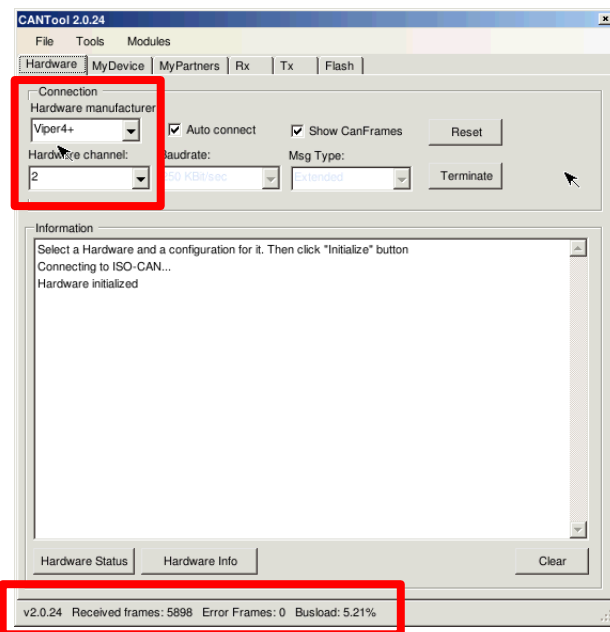


FIGURE 39 CANTOOL

Go to tab MyDevice (Figure 40) and select at Pre-selection “**Navigation Controller (tractor)**”. Select at Type “**SBGuidance**”. Push the Connect button.

8.2 CHECK FIRMWARE VERSIONS

The Steering Controller (STU) is the module that controls the Smartrax MD steering motor and reads in the wheel angle sensor value and the pressure sensor value.

Check www.raveneurope.com and go to Dealer >> Software for the most recent CAN-tool and STU firmware.

Use **CAN-tool 2.0.33** or higher.

Use **STU firmware 4.1.6** or higher. This can be checked and confirmed in the tab **Flash**.

If using a DynamIQ ISO (10630173890 or 10630173862): use **DynamIQ firmware 3.0.248** or higher.

If using a DynamIQ (SBG10911 or SBG10911-01): use **DynamIQ firmware 2.0.6** or higher.

Please note!:

For updating the Steering Controller and/or the DynamIQ (ISO) check the Configuration manual – CANbus controllers on the SBG Website.

Go to tab MyPartners (Figure 41). Select at steering controller “**SBGuidance**” and press *Add*. The Steering Controller wizard opens as shown in Figure 42.

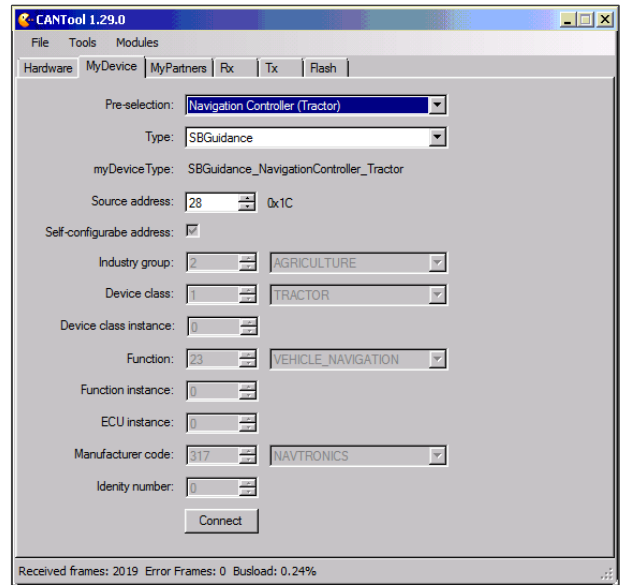


FIGURE 40 CAN-TOOL MYDEVICE

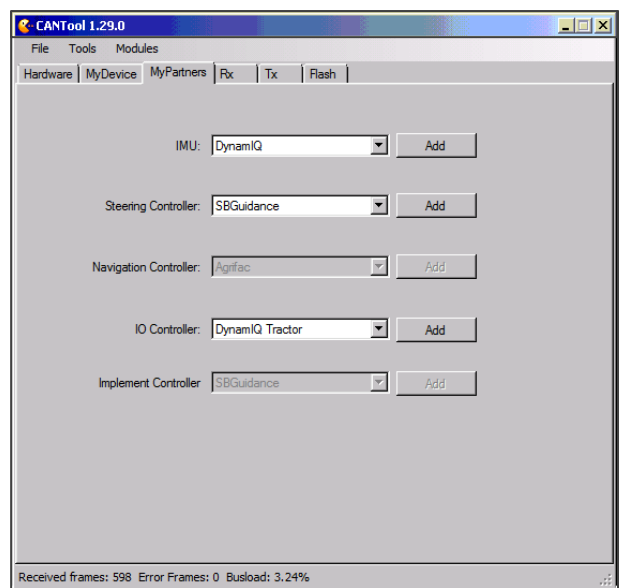


FIGURE 41 CANTOOL MYPARTNERS

8.3 STEERING



Warning!

Steering wheel and wheels will be turning in the next steps!

In this tab, set the **Actuator Type** from *PWM* to **Smartrax MD**.

Check **“L/R Inverted”** (Figure 42) if left and right steering is inverted. Use the **“Test”** buttons on the left side (Min.) to manually check the minimal steering percentages. Check the left and right minimal steering percentages independently and make sure the minimal steering percentages match ca. 0.04 V/sec (visualized under “Current Rate”). Use the **“Test”** buttons on the right side (Max.) to set the maximal steering percentages. Normally, this ones can be hold on 70. When the behavior in the field is too aggressive, this ones can be lowered to lower the maximum steering speed.

The tab **Calibration** can be used to let the system determine the minimum steering speeds automatically. When opening this tab, press the **Start** button and the system starts calibrating. After pressing start, make sure you have enough room around the tractor. Drive with 1 km/h and around 1000rpm when calibrating. Press the **Save** button afterwards to save the calibrated values. Always check this values manually by pressing the **Test** buttons in the Steering tab!

8.4 BOARD STATUS

Check the board status before calibrating the Steering controller. To do this, go to tab “Board Status” (Figure 43). Check the ECU and ACT Power voltages. These voltages should be around 14V (when engine is started). The value for Sensor Power should be around 4,9V.

If one of these values shows 0,00V, do not proceed with the calibration procedure and first fix the underlying issue (check fuses, relays, cabling etc.).

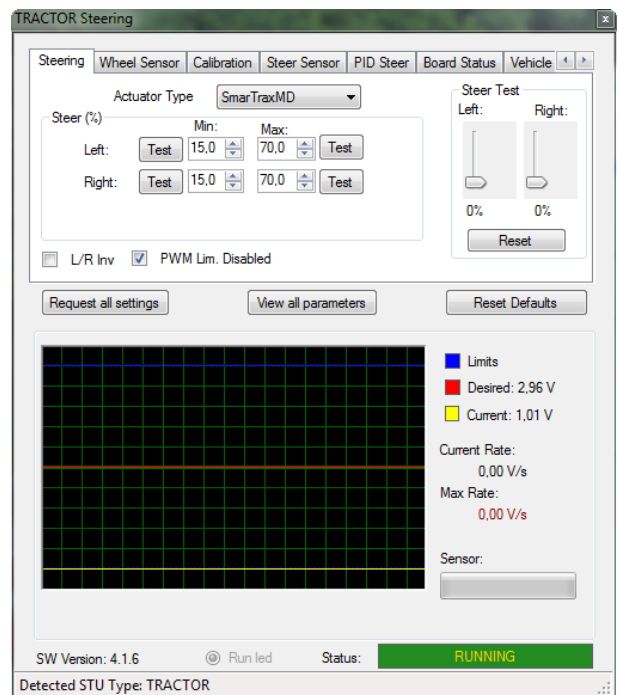


FIGURE 42 CAN-TOOL STEERING CONTROLLER WIZARD.

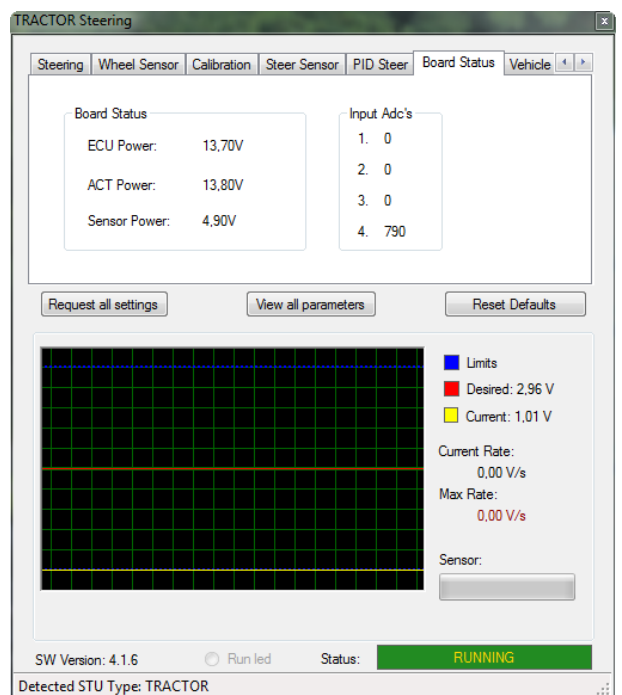


FIGURE 43 BOARD STATUS TAB.

8.5 WHEEL SENSOR

Go to the tab Wheel Sensor (Figure 44). Turn the wheels of the machine completely to the left. Press the button beneath “**Left**”, to set the outer left limit of the wheel angle sensor.

Turn the wheels of the machine completely to the right. Press the button beneath “**Right**”, to set the outer right limit of the wheel angle sensor.

To set the center value of the wheel angle sensor, first search for a location where it is possible to drive at least a straight line of 100 meters. Choose a fixed point at the end of the line and drive manually, with about 15-20 km/h, towards this point as straight as possible. Check while driving the value of the wheel angle sensor (showed behind Current in Figure 44) and take the average value to set as the center value (normally this average value will be around 2,5V).

Thereafter stop the machine, turn the wheels manually to the average wheel angle sensor position and press the button beneath “**Center**”. The center position of the wheel angle sensor is now set. Also indicate the position of the wheel angle sensor to the front axle (left or right).

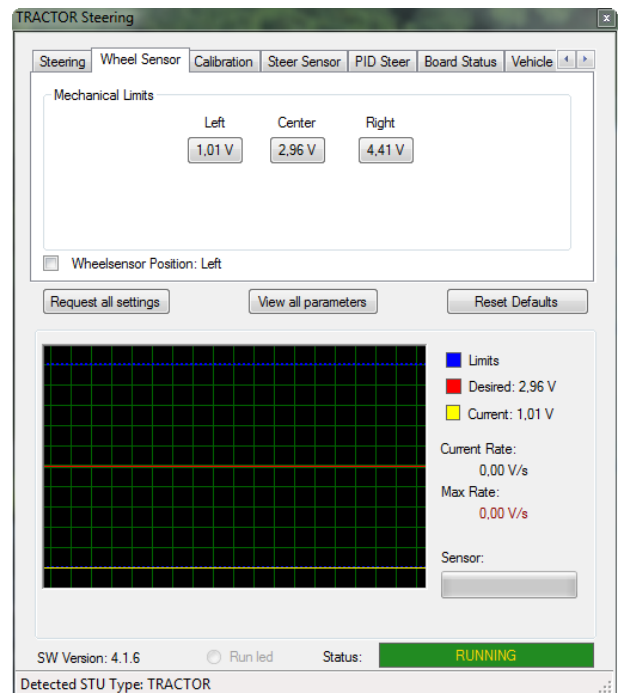


FIGURE 44 WHEEL SENSOR TAB.

8.6 STEER SENSOR

In the tab **Steer Sensor** the disengage value can be calibrated. This can be done automatically by pressing the **Start** button (Figure 45).



Warning!:

Steering wheel and wheels will be turning in the next steps!

The steering wheel will be turned to the left and to the right. After that, the system calculates a typical Disengage sensitivity. This one can be highered or lowered in case the disengaging value is not at the right point.

Press **Save** after the calibration is done or after the disengage sensitivity is changed.

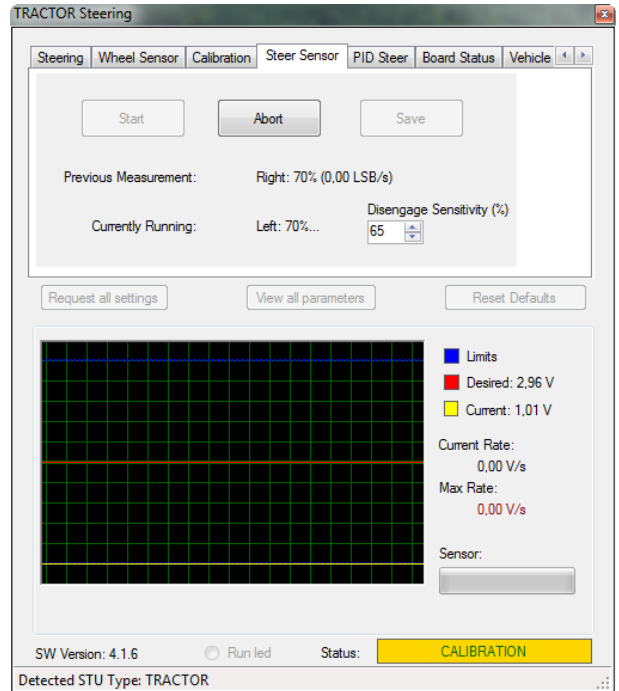


FIGURE 45 CALIBRATING DISENGAGE SENSOR

8.7 PID STEER

Open the PID Steer tab (Figure 46) to optimize PID controller settings. The settings on this tab influence the aggressiveness of the steering system. Always tune the “Proportional Gain” and leave the “Dealer Gain” at 100%!

1. Start the manual steering as described in Chapter 8.8.
2. Slide the slide bar in the Simulation tab (Figure 47) from the center to $\frac{3}{4}$ right or left. Judge the performance of the steering system when the wheels move to the desired position. The wheels should reach the desired wheel position without a lot of exceedance, but as quickly as possible.
3. If the wheels wobble several times around the desired wheel position, then decrease the “**Proportional Gain**” by 25%. If the desired wheel position is obtained without overshoot, increase the “**Proportional Gain**” by 25%.
4. Keep increasing or decreasing the “**Proportional Gain**” by 25% until the wheels steer quickly to the desired wheel position and with a little overshoot. See the Table on the right for an overview of the P-setting range under normal conditions. The I and D settings are always set to 0.01 and 100, respectively.

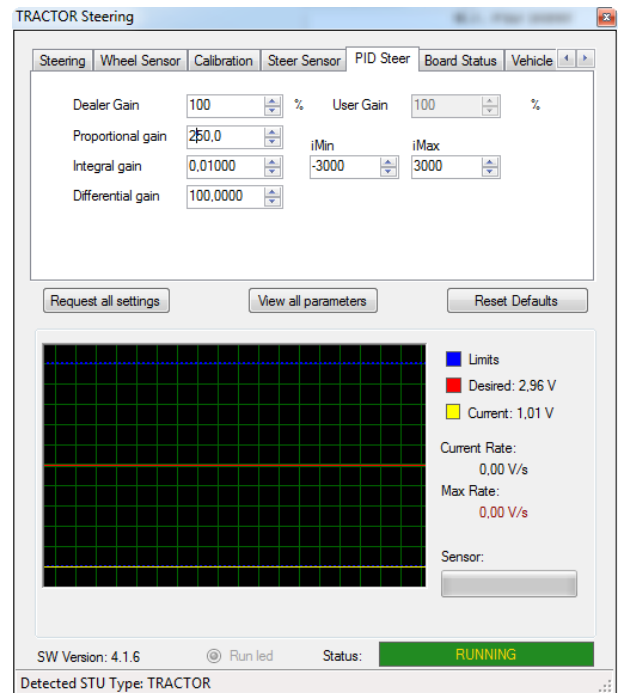


FIGURE 46 PID STEER TAB.

	Standard-Value	Range
Proportional gain	250	150 - 400
Integral gain	0,01	-
Differential gain	100	-

8.8 MANUAL STEERING

In the graph, shown in Figure 47, the red line indicates the desired position of the wheels which can be altered by sliding the slide bar (see "2" in Figure 47) left/right. The yellow line represents the actual position of the wheels measured by the wheel angle sensor.

Steering the wheels manually for tuning purposes can be done as followed. Press the "UNLOCK"-button [1] (Figure 47) to activate the steering system. Slide the slide bar [2] to change the desired wheel position (wheels will start moving). Do this while driving slowly and repeat several times. With the green button [3] the wheels go back to the center position. Judge how the wheels steer to the desired wheel position. The wheels should reach the desired wheel position without a lot of exceedance, but as quickly and smooth as possible. When the desired wheel position is reached the yellow line should exactly be on top of the red line (red line is no longer visible at that point).

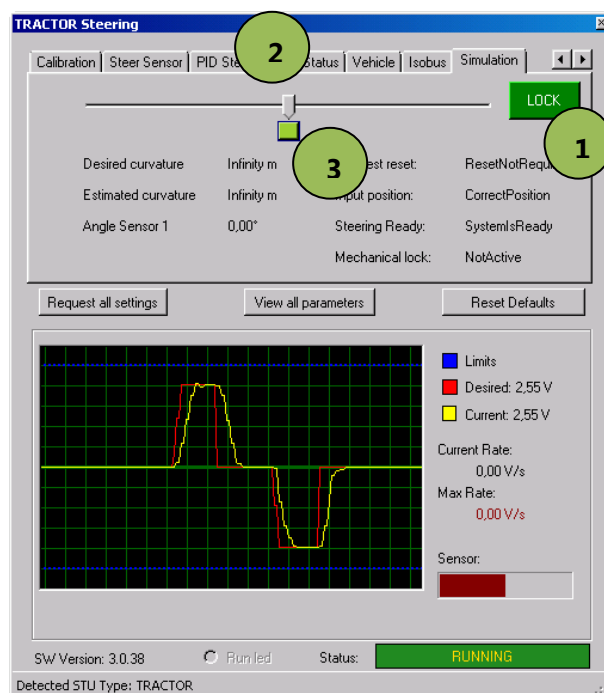


FIGURE 47 SIMULATION TAB.

Make sure all the other steps in calibrating a tractor (Manual 016-8000-100EN-A) are completed!

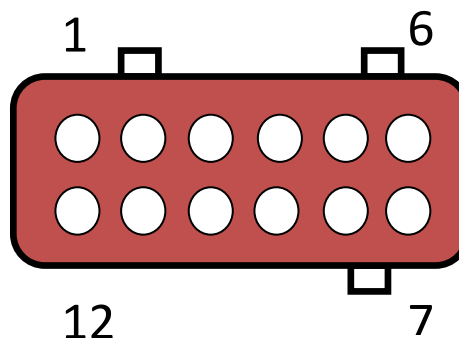
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9 ANNEXES

9.1 PIN-OUT STEERING CONTROLLER

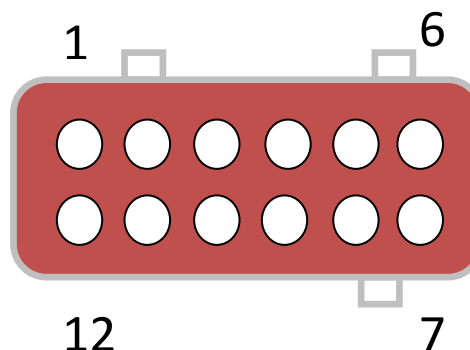
BLACK CONNECTOR:

Pin	Description	Colour
1	VCC / PWM	Black
2	Actuator ground	Black
3	Shut-off valve	Black
4	Pressure sensor (12V)	Black
5	Pressure sensor signal	Green/yellow
6	Wheel angle sensor power (+5V)	Black
7	Wheel angle sensor signal	Black
8	N.C.	N.C.
9	Wheel angle sensor power (+12V)	Black
10	ECU ground	Green/yellow
11	Actuator ground	Green/yellow
12	VCC / PWM	Black



GREY CONNECTOR:

Pin	Description	Colour
1	Actuator power	Red
2	Actuator power	Red
3	ECU power	Red
4	N.C.	N.C.
5	N.C.	N.C.
6	CAN High	Yellow
7	CAN Low	Green
8	N.C.	N.C.
9	N.C.	N.C.
10	ECU ground	Black
11	Actuator ground	Black
12	Actuator ground	Black



9.2 SCHEMATIC OVERVIEW BASIC HARNESS

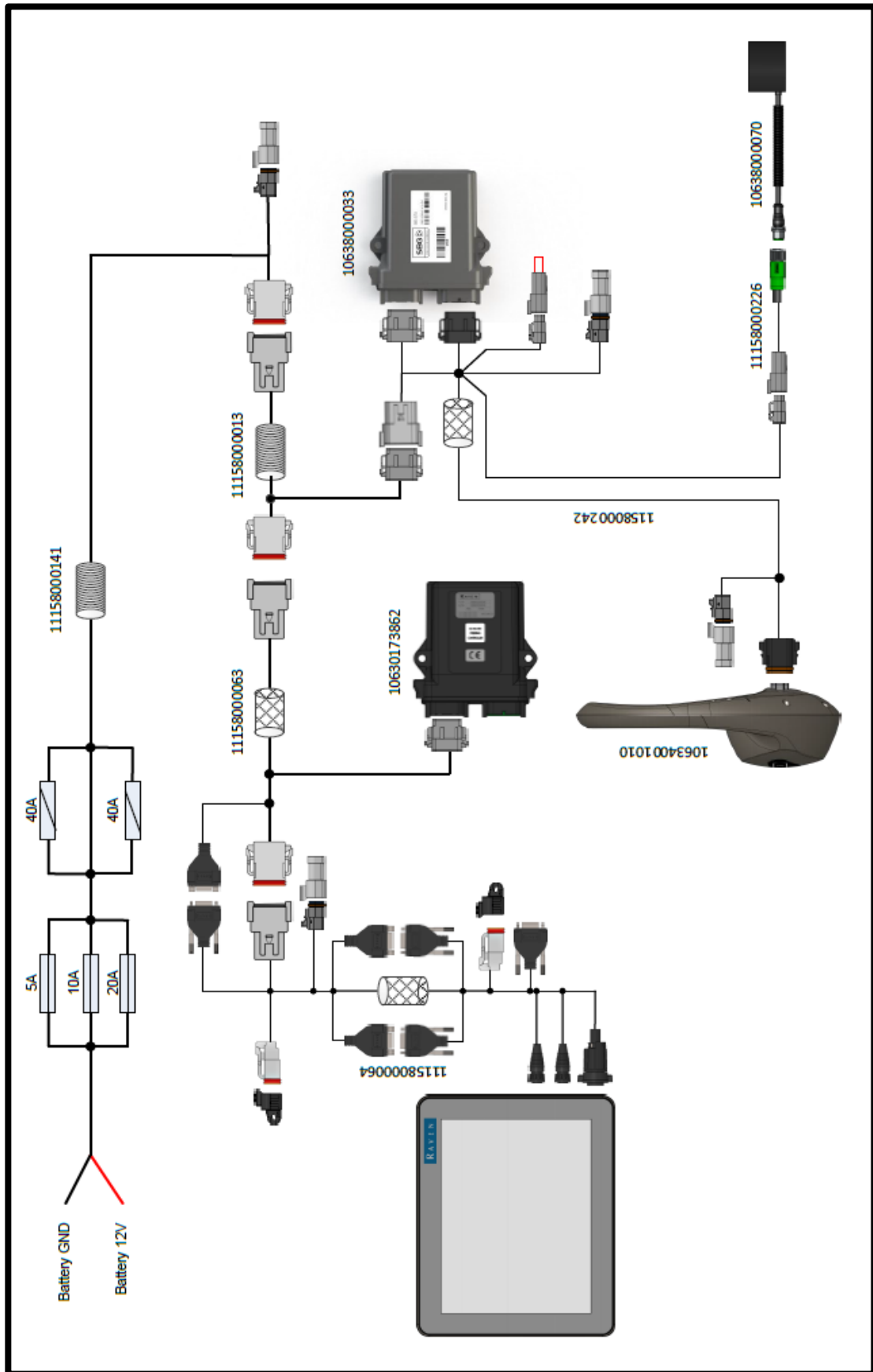


FIGURE 48 SYSTEM OVERVIEW

9.3 SCHEMATIC OVERVIEW IMPLEMENT READY

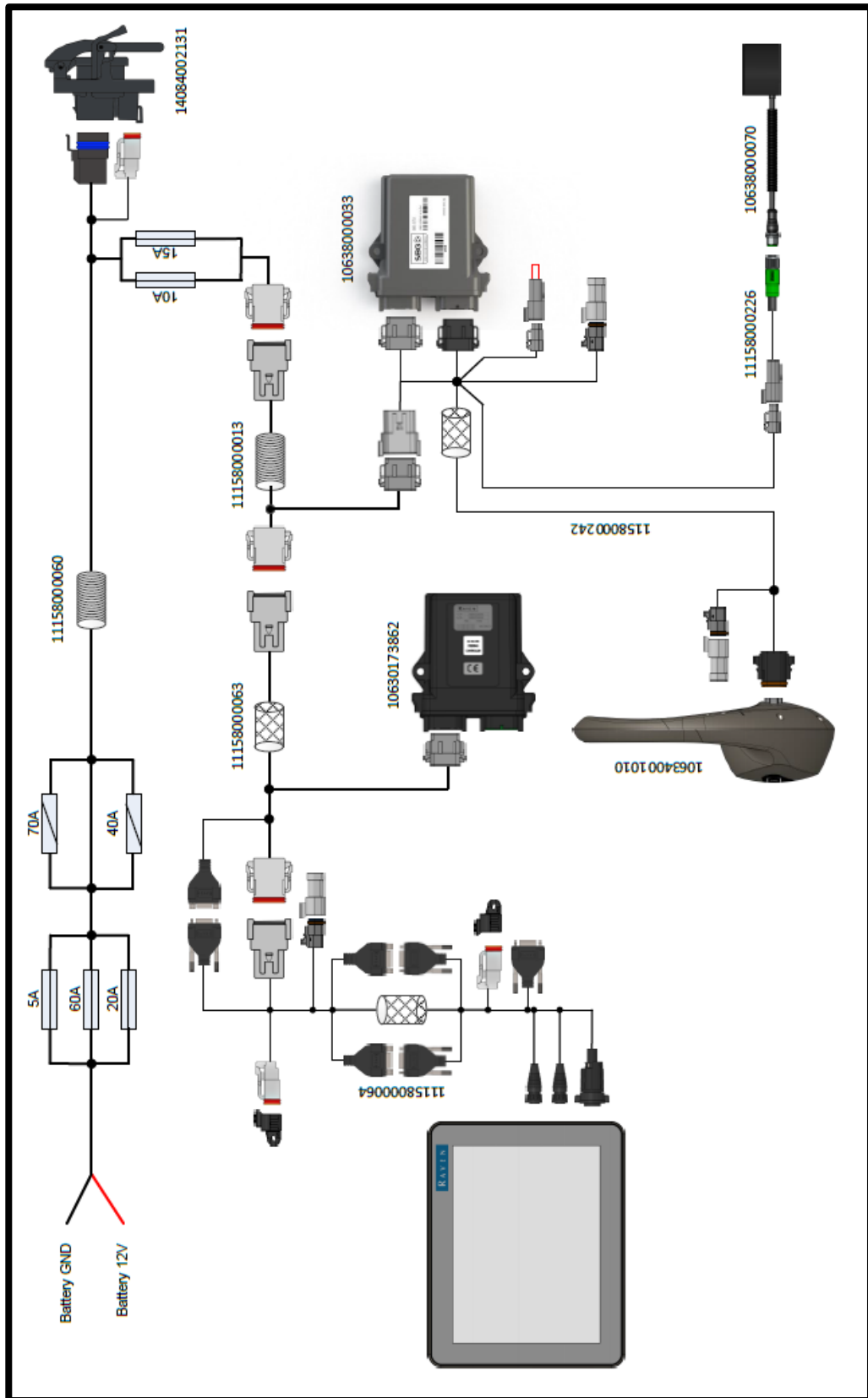
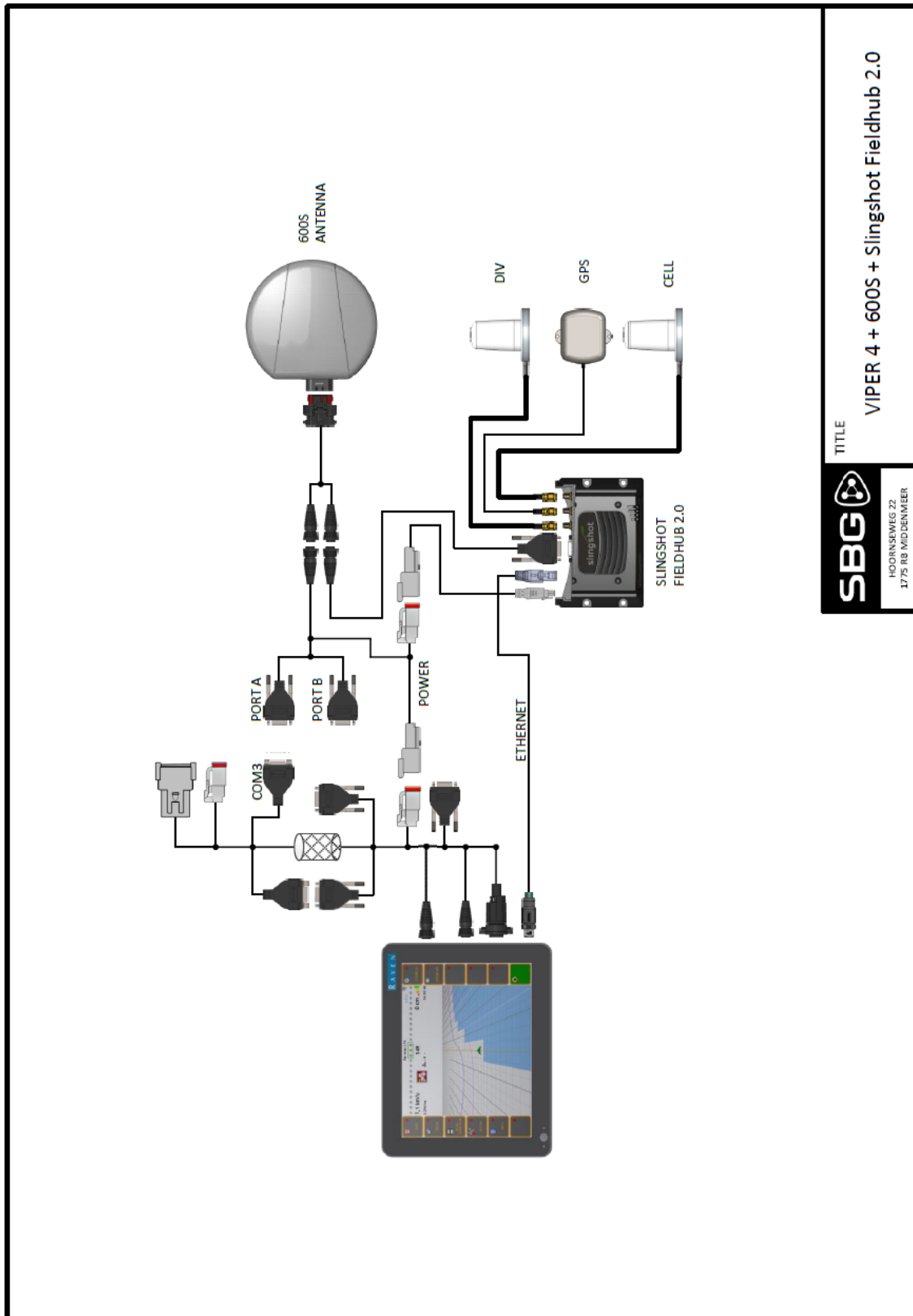


FIGURE 49 SYSTEM OVERVIEW IMPLEMENT READY

9.4 MOUNTING 600S GPS-ANTENNA



SBCG
 HOORNSEWEG 22
 1775 RB MADDENMEER

TITLE
VIPER 4 + 600S + Slingshot Fieldhub 2.0

FIGURE 50 MOUNTING 600S ANTENNA.

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