

Installation and operating instructions

GNSS Receiver NAV-900



Version: V4.20220214



3138990009-02-EN

Read and follow these instructions. Keep these instructions in a safe place for later reference. Please note that there might be a more recent version of these instructions on the homepage.

Company details

Document	Installation and operating instructions Product: GNSS Receiver NAV-900 Document number: 3138990009-02-EN Original instructions Original language: German
Copyright ©	Müller-Elektronik GmbH Franz-Kleine-Straße 18 33154 Salzkotten Germany Phone: ++49 (0) 5258 / 9834 - 0 Fax: ++49 (0) 5258 / 9834 - 90 Email: info@mueller-elektronik.de Homepage: http://www.mueller-elektronik.de

Table of contents

1	For your safety	5
1.1	Basic safety instructions	5
1.2	Intended use	5
1.3	Layout and meaning of warnings	5
1.4	Disposal	6
1.5	Cleaning	6
2	Product description	7
2.1	About the GNSS receiver	7
2.2	Connections on the GNSS receiver	7
2.3	Function overview	7
2.4	Meaning of the LED lights	8
3	Mounting and configuration	10
3.1	Mounting the GNSS receiver	10
3.1.1	Attaching the adhesive plates	10
3.1.2	Attaching the fastening plate	11
3.1.3	Installing the receiver on the roof	11
3.2	Connecting the GNSS receiver to a terminal	12
3.3	Activating the driver of the GNSS receiver on a terminal	13
3.4	Configuring the GNSS receiver	13
3.5	Activating licenses for the GNSS receiver	13
4	GNSS receiver NAV-900 with RV55 modem	14
4.1	Basic safety instructions	14
4.2	General information	14
4.3	Connecting the Wi-Fi antenna	15
4.4	Inserting SIM cards	15
4.5	Installing and connecting the GSM antenna	16
4.6	Connecting the modem to the GNSS receiver	17
4.7	Configuring the modem	17
4.8	LED status	18
5	Technical specifications	19
5.1	Technical specifications of the receiver	19
5.2	Pin assignment	20

5.2.1	4-pin M12 connection	20
5.2.2	5-pin M12 connection	20
5.2.3	12-pin Deutsch connection	21
6	Item overview	22

1 For your safety

1.1 Basic safety instructions



Please read the following safety instructions carefully before using the product for the first time.

- Do not make any unauthorized modifications to the product. Unauthorized modifications or use may impair safety and reduce the service life or operability of the unit. Modifications are considered unauthorized if they are not described in the product documentation.
- Comply with road traffic rules. Stop the vehicle before operating the receiver or connected components.

1.2 Intended use

The product is intended for accurate positioning of agricultural vehicles.

The product is only intended for use in the agricultural sector. The manufacturer shall not be held responsible for any other use of the system.

The operating instructions form part of the product. The product may only be used in accordance with these operating instructions.

The manufacturer cannot be held liable for any personal injury or property damage resulting from such non-compliance. All risk arising from improper use lies with the user.

1.3 Layout and meaning of warnings

All safety instructions found in these Operating Instructions are composed in accordance with the following pattern:

	WARNING
	<p>This signal word identifies medium-risk hazards, which could potentially cause death or serious physical injury, if not avoided.</p>

	CAUTION
	<p>This signal word identifies hazards that could potentially cause minor or moderate physical injury or damage to property, if not avoided.</p>

NOTICE
<p>This signal word identifies hazards that could potentially cause damage to property, if not avoided.</p>

There are some actions that need to be performed in several steps. If there is a risk involved in carrying out any of these steps, a safety warning appears in the instructions themselves.

Safety instructions always directly precede the step involving risk and can be identified by their bold font type and a signal word.

Example

1. **NOTICE!** This is a notice. It warns that there is a risk involved in the next step.
2. Step involving risk.

1.4**Disposal**

When it has reached the end of its service life, please dispose of this product as electronic scrap in accordance with all applicable waste management laws.

1.5**Cleaning**

Do **not** clean the product with a high pressure cleaner to prevent moisture from entering the connector.

2 Product description

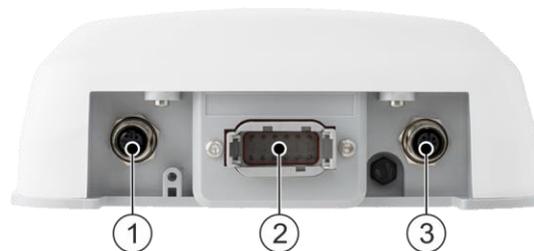
2.1 About the GNSS receiver



The NAV-900 is a GNSS receiver and steering job computer of the latest generation. The receiver works with a multitude of correction signals. As a result, the accuracy reaches the centimetre range.

The receiver is designed for agricultural applications where high accuracy is required, e.g. for automatic section control, variable rate control, and field navigation. Thanks to the integrated steering job computer, the NAV-900 is also ideally suited for steering systems. The different interfaces enable flexible and future-proof potential applications. Thanks to the universal mounting options, quick and easy installation is possible on any machine.

2.2 Connections on the GNSS receiver



①	4-pin M12 connection Connection to the EXP-900L adapter	③	5-pin M12 connection Connection to the GSM or radio modem
②	12-pin Deutsch connection CAN connection to the vehicle or connection to the mechanical drive unit		

2.3 Function overview

The receiver supports the following satellite systems and correction signals:

Function	Transmission	Accuracy	Range	Costs
GPS Designation of the American global satellite navigation system.			Worldwide	Free of charge
GLONASS Designation of the Russian global satellite navigation system.			Worldwide	Free of charge
GALILEO			Worldwide	Free of charge

Function	Transmission	Accuracy	Range	Costs
Designation of the European global navigation system.				
BeiDou Designation of the Chinese global navigation system.			Worldwide	Free of charge
EGNOS/WAAS/MSAS/GAGAN Is a free correction signal that is transmitted by satellite. It is used for more simple field work, e.g. spraying, soil tillage, fertiliser spreading, slurry spreading and harvesting.	Satellite	Pass to pass: <25 cm	Europe, USA, Japan, India	Free of charge
xFill Based on Trimble's RTX technology, xFill enables seamless, centimetre-precise bridging of VRS or RTK signal failures.	Satellite	2.5 cm	Worldwide	xFill: Free of charge xFill Premium: Licence fees
RangePoint RTX Is a satellite-based correction service that is available virtually worldwide.	Satellite	15 cm	Worldwide	Licence fees
CenterPoint RTX Is a satellite-based correction service that is available virtually worldwide.	Satellite	Absolute: 2.5 cm	Worldwide	Licence fees
CenterPoint RTX fast Initialisation time of less than 1 minute. CenterPoint RTX fast is available in selected regions.	Satellite	Absolute: 2.5 cm	Europe, USA	Licence fees
CenterPoint RTX Refers to the correction method in which the RTK correction data is sent to the GNSS receiver by a local base station through a radio connection.	Base station	Absolute: 2.5 cm	Site- dependent	There may be license fees
CenterPoint VRS Refers to the correction method in which the RTK corrections are sent to the GNSS receiver per mobile Internet through a network consisting of base stations and servers.	GSM modem	Absolute: 2.5 cm	Depending on the mobile network	Licence fees

2.4

Meaning of the LED lights

Underneath the 4-pin M12 connection, there is an LED light that shows the respective status in three colours: red, orange and green. In the different modes, there are different status indications for the receiver, e.g. in case of problems with the hardware or the firmware. In addition, there are different status indications for the current status of the GNSS corrections (depending on the selected correction type).

Hardware and firmware status

LED status	Status of the hardware/firmware
Off	No power supply
Continuously lit red	Device is defective. Send it in for repairs.
Flashing red (1/s)	Device in monitor mode. Use FL200 to load valid firmware.
Rapidly flashing red, then continuously orange	Function as boot monitor. Main firmware is being loaded while the device is initialising.
Alternating red and green	Firmware is being uploaded or the file system of the flash memory is being formatted.

Status of the GNSS corrections

LED status	Autonomous	SBAS	RangePoint RTX	CenterPoint RTX (fs/ss)	CenterPoint RTX (GSM modem)	CenterPoint RTX/VRS
Rapidly flashing orange	No position	No position	No position	No position	No position	No position
Slowly flashing orange		Autonomous. No SBAS signal	Autonomous/D GPS. No RTX signal	Autonomous/D GPS. No RTX signal	Autonomous/D GPS. Not connected to the RTX server	Autonomous/D GPS. No CMR or RTCM3 corrections
Continuously lit orange		Autonomous. SBAS signal available	Autonomous/D GPS. RTX signal available	Autonomous/D GPS. RTX signal available	Autonomous/D GPS. Connected to the RTX server	Autonomous/D GPS. CMR or RTCM3 corrections are being received
Rapidly flashing green		DGPS, no SBAS signal. Using old correction data	Converged/not converged. Using all correction data.	Converged/not converged. Using all correction data.	Converged/not converged. Using all correction data.	Fixed/Float. Using old correction data.
Slowly flashing green		DGPS, no SBAS signal. Using more recent correction data	Not converged	Not converged	Not converged	Float
Continuously lit green	Autonomous position	DGPS, SBAS signal available	Converged	Converged	Converged	Fixed

A fatal error has occurred when the LED light flashes red rapidly and then is continuously lit orange or flashes orange and then rapidly flashes red.

3 Mounting and configuration

3.1 Mounting the GNSS receiver

3.1.1 Attaching the adhesive plates

The adhesive plate can be used to attach the receiver later on the vehicle roof.

Procedure

1. Put the nuts on the bolt in the adhesive plate to adjust the height.



2. Insert the bolt through one of the three outer fastening holes on the fastening plate.



3. Put the washer and the lock washer on the screw.
4. Loosely screw on the remaining nuts.



- Repeat this procedure for the other two fastening points.



⇒ You can now fasten the receiver on the fastening plate.

3.1.2

Attaching the fastening plate

You have to attach a fastening plate on the receiver to then be able to fasten it on the roof.

Procedure

- Fasten the fastening plate on the underside of the receiver. To do so, use 4 M6 x 14 mm bolts with flat washers and lock washers.



3.1.3

Installing the receiver on the roof

NOTICE

The receiver needs an open view of the sky.

- Mount the receiver on the roof of the vehicle cab.
- Install the receiver as close as possible to the centre of the roof, at the position where the rear axle is located.
- Avoid shadowing the receiver's view of the sky.

Procedure

- The vehicle is standing on level ground.
- Find a suitable spot on the roof of the vehicle, which does not yield much and has the smallest possible height differences.
 - Use alcohol to clean the position on which will you will mount the receiver.
 - Mark the spot where you want to adhere the plate at all three positions.
 - Expose the adhesive surfaces of the magnetic plate.
 - Put the feet on the marked positions.

6. Adjust the nuts on the bolts so that the receiver is positioned horizontally.



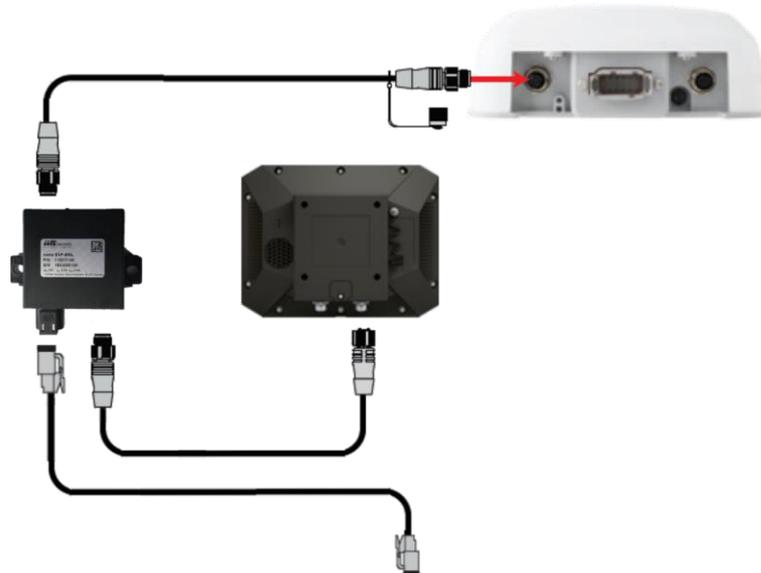
⇒ You have installed the receiver.

3.2

Connecting the GNSS receiver to a terminal

You always need the EXP-900L adapter to establish a connection between the receiver and the terminal.

The system is installed as follows:



NOTICE

Terminal connector supplying power

Potential damage to the terminal from a short-circuit.

- Switch the terminal off before plugging in or removing the connector.

Procedure

1. Switch off the terminal.
2. Guide the M12 connector cable of the receiver into the vehicle cab.

3. Connect the M12 connector cable of the receiver to the M12 socket of the EXP-900L adapter.
 4. Connect the EXP-900L adapter to the Ethernet connection of the terminal.
 5. Connect the adapter to the power supply using the Deutsch connection.
- ⇒ You have now connected the receiver to the terminal.

3.3 **Activating the driver of the GNSS receiver on a terminal**

Before you can use the receiver with a touch terminal, you have to activate a driver.

You can read how to activate a driver in the operating instructions for the terminal.

3.4 **Configuring the GNSS receiver**

You can configure various receiver parameters through the terminal.

Information on the available parameters and how they are configured can be found in the terminal operating instructions.

3.5 **Activating licenses for the GNSS receiver**

If you want to use the receiver with the steering system, you need the following license on the terminal:

- TRACK-Leader AUTO®

Moreover, you need the following licenses on the NAV-900. The corresponding licenses are available from Müller-Elektronik or your dealer.

- EZ-Pilot Pro
- Autopilot
- CAN Autopilot to Autopilot
- CAN Autopilot

To activate higher accuracies, you can purchase additional licenses, which can also be obtained from Müller-Elektronik or your dealer.

- Basic to High
Required for the CenterPoint RTK, CenterPoint VRS, CenterPoint RTX fast correction signals.
- Basic to Intermediate
Required for the CenterPoint RTX correction signals.
- Intermediate to High
Required for the CenterPoint RTK, CenterPoint VRS, CenterPoint RTX fast correction signals.

The licenses for additional correction signals are available through your dealer or through the Trimble online shop at:

<https://positioningservices.trimble.com/>

You can read how to activate a license in the operating instructions for the terminal.

4 GNSS receiver NAV-900 with RV55 modem

4.1 Basic safety instructions



Please read the following safety instructions carefully before using the product for the first time.

- If you wear a medical device, ask your doctor or the device manufacturer about how to prevent hazards. Medical devices such as pacemakers or hearing aids can be affected by the radio transmissions of modems.
- If you wear a pacemaker, keep the modem away from the pacemaker.
- Switch off the modem as soon as you are close to petrol stations, chemical plants, biogas plants or other locations where combustible gases or fumes can occur. These gases can be ignited by a spark and explode.
- Maintain a minimum distance of 20 cm (8 inches) between the antenna of the modem and your body.
- Never switch on the modem in an aircraft. Ensure that it is not accidentally switched on during flight.

4.2 General information



If you want to use the NAV-900 with CenterPoint VRS, you must always also connect an RV55 modem to the receiver. In addition to the modem and an additional connector cable (item no.: 3038990027), you also always need a SIM card, which you must insert in the modem.

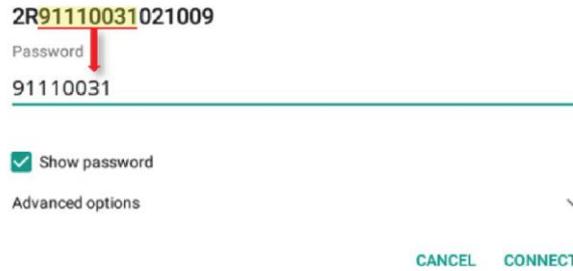
NOTICE

Deleting the Trimble firmware

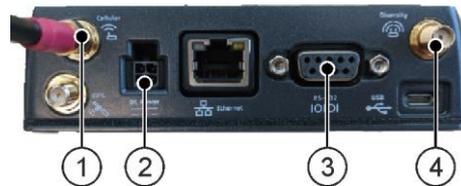
To prevent the Trimble firmware from being deleted on the modem, please always observe the following during use:

- Do not reset the modem to its factory settings.
- Do not press and hold the reset button on the front side of the modem.
- Do not use the web interface to update the firmware of the modem.

Moreover, you can use the modem as a WiFi hotspot. The password always consists of a portion of the digits from the respective serial number. The 8 digits behind the "2R" of the serial number are always used.



Connections on the modem



①	Cellular Connection for the primary GSM antenna.	③	Sub-D connection Connection for the Sub-D connector of the additional connector cable.
②	Molex connection Connection for the Molex connector of the additional connector cable.	④	Diversity Connection for the secondary GSM antenna.

4.3

Connecting the Wi-Fi antenna



Procedure

1. Connect the supplied Wi-Fi antenna to the “Wi-Fi A” connector on the front side of the modem.

4.4

Inserting SIM cards

If you want to use the modem, a SIM card with a data plan must be inserted into the modem. You need the SIM card to dial into the GSM network. Make sure that your provider offers high connection quality in your area. It may be possible to obtain a better GSM signal with a different provider.

You have to use a mini-sized SIM card.

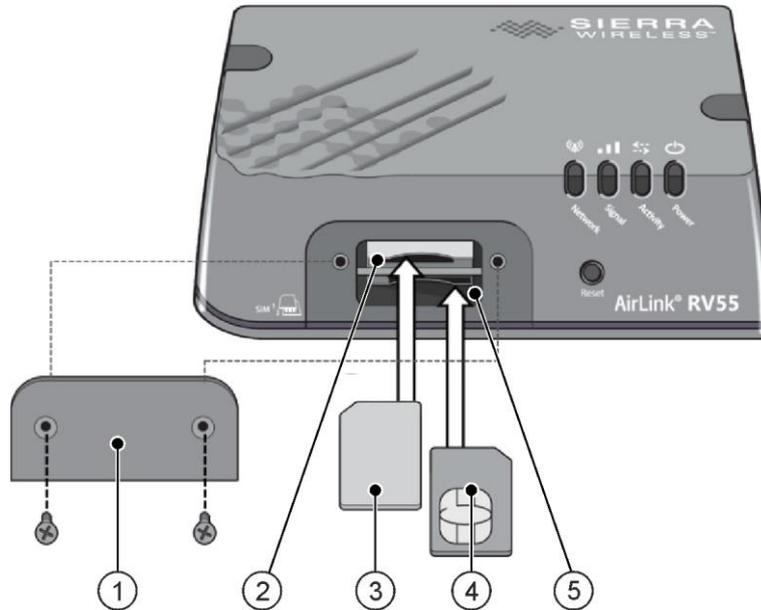
NOTICE

Data volume is too low

The data volume supplied by your provider is too low. To find out what happens when your data volume is used up, contact your provider.

- Make sure that you have sufficient data volume.

The RV55 modem has slots for 2 SIM cards. You can use a second SIM card if, for example, you work in areas with patchy reception.



①	SIM card cover	④	SIM card 2
②	Slot for SIM card 1	⑤	Slot for SIM card 2
③	SIM card 1		

Procedure

The modem is switched off.

1. Remove the SIM card cover.
2. Insert the SIM card in the upper slot. The gold contacts of the upper SIM card must be facing down. The notch must be on the left side.
3. As an option, you can insert a second SIM card in the bottom slot. The gold contacts must be facing up. The notch must be on the right side.
4. Fasten the SIM card cover.

⇒ You have successfully inserted the SIM card(s).

4.5

Installing and connecting the GSM antenna

The modem is always delivered with one GSM antenna. To ensure optimal mobile network reception, you must connect both connections of the GSM antenna to the modem.

Procedure

The modem is switched off.

1. Connect the connection labelled “LTE-1” to the “Cellular” connection of the modem.
2. Connect the connection labelled “LTE-2” to the “Diversity” connection of the modem.

3. Fasten the GSM antenna onto the vehicle. When fastening, please ensure that the GSM antenna is fastened far enough from the NAV-900 and that it has a clear view to the sky.
You can use one of the two adhesive strips to fasten the antenna.



- ⇒ - The antenna is permanently fastened.



- ⇒ - The antenna is fastened but is removable.

4.6

Connecting the modem to the GNSS receiver

Procedure

- The modem is switched off.
 - The terminal is switched off.
 - You have the additional connector cable (item no.: 3038990027) close at hand.
1. Connect the Sub-D connector of the additional connector cable to the Sub-D connection on the modem.
 2. Connect the Molex connector of the additional connector cable to the Molex connection on the modem.
 3. Connect the M12 connector of the additional connector cable to the M12 connection on the GNSS receiver.
- ⇒ You have connected the modem to the GNSS receiver.

4.7

Configuring the modem

You can configure the “CenterPoint VRS” parameter for the modem via the terminal.

You can read how to configure this parameter in the operating instructions for the terminal.

4.8 LED status

On the RV55 modem, the following LED statuses are possible.

LED	Colour/state	Description
Power 	Off	No power or input voltage ≥ 36 VDC ≤ 7 VDC.
	Steady green	Power supply is available.
Signal 	Steady green	Good signal (corresponds to 4-5 bars).
	Steady yellow	Moderate signal (corresponds to 2-3 bars).
	Flashing yellow	Poor signal (corresponds to 1 bar). If possible, position the modem somewhere with a better signal.
	Flashing red	Insufficient signal (corresponds to 0 bars). Position the modem somewhere with a better signal.
Note: The quality of the signal strength is measured using parameters suitable for radio technology.		
Network 	Steady green	Connected to an LTE network.
	Steady yellow	Connected to a 3G or 2G network.
	Flashing yellow	Connected to a network.
	Flashing yellow (3 s on and 1 s off)	Network ready – WAN via Wi-Fi (router is in Wi-Fi client mode).
	Flashing red	No available network.
	Flashing red/yellow	Network operator change is activated, but the router is not able to find the required firmware.
Activity 	Flashing green	Data traffic is transmitted or received via the WAN interface.
	Flashing red	Data traffic is transmitted or received via the serial interface. This behaviour only occurs when the RV55 modem is configured accordingly.
	Flashing yellow	Data traffic is transmitted or received via the WAN and serial interface. This behaviour only occurs when the RV55 modem is configured accordingly.
All	Continuous green	Radio module reconfiguration / firmware update or network operator change in progress.
	Continuous yellow	Software update in progress.
	Continuous red	Restore mode.

5 Technical specifications

5.1 Technical specifications of the receiver

GNSS receiver specifications

Receiver type	L1, L2, L5 multi-constellation GNSS receiver
GNSS signals	GPS, GLONASS, Galileo, Beidou, QZSS
SBAS support	WAAS, EGNOS, MSAS
Cold start	<60 s (no almanac, position and time)
Warm start	<30 s (almanac, approximate position and time, no ephemeris)
Hot start	<2 s (ephemeris, approximate position and time)
Maximum speed	515 m/s (1,854 km/h)
Maximum height	18,000 m (48,600 ft)
Installation	Universal mounting bracket, quick-change bracket
Humidity	Up to 100 % condensing
Input/Output protection	Overvoltage and short-circuit protection
Dimensions	180 mm diameter, 74 mm height
Weight	640 g (22.6 oz)
LED	Multi-colour LED
Connector	Deutsch DTM-12P, 5-pin M12 A-code, 4-pin M12 D-code

Power

Input voltage	9-16 V DC
Power input	5.5 W 17.5 W with connected external accessories

Environmental conditions

Operating temperature	-30 °C - + 70 °C
Storage temperature	-40 °C - + 85 °C

Connectivity

Serial interfaces	3 serial interfaces (2.5 permanent)
CAN interfaces	2 full duplex CAN interfaces with 120 Ohm termination
BroadR-Reach	Full duplex at 100 Mbps

5.2**Pin assignment****5.2.1****4-pin M12 connection**

Pin	Signal
1	BroadR-Reach +
2	Power In
3	BroadR-Reach -
4	GND

5.2.2**5-pin M12 connection**

Pin	Signal	Signal description
1	Port 3 RS-232 Tx	Output from the NAV-900 to the connected Rx device connection
2	Power Out	12 V nominal, 1 V limit
3	Port 3 RS-232 Rx	Input from the NAV-900 to the connected Rx device connection
4	GND	
5	Signal GND	

5.2.3

12-pin Deutsch connection

Pin	Signal	Signal description
1	CAN_A_High	
2	Port 1 RS-232 Tx	
3	Port 1 RS-232 Rx	
4	DIGI/O1/Analn1	7.2 V Sonalert = Standard / 3V output PPS (+)
5	Signal GND	
6	CAN_B_H	
7	CAN_B_L	
8	Port 2 RS-232 Tx	NMEA Out
9	AD I/O or Port 2 RS-232 Rx	AD I/O = Standard
10	V+	12 V DC nominal, 9 V-16 V
11	V-	
12	CAN_A_Low	

6 Item overview

Item number	Item name
3038990002	10-day test license for EZ-Pilot Pro
3038990003	Autopilot license
3038990004	CAN Autopilot license
3038990005	CAN Autopilot to Autopilot license
3038990006	EZ-Pilot Pro license
3038990009	10-day test license for Basic to High
3038990010	Basic to High license
3038990011	Basic to Intermediate license
3038990012	Intermediate to High license
3132259000	EXP-900L connection kit for the NAV-900 with power cable and Ethernet cable
3032254900	EXP-900L adapter
3132259001	Power cable for EXP-900L adapter
3132259002	Ethernet cable for EXP-900L adapter, 1 m
3038990039	RV55 Ntrip modem with LTE antenna
3038990027	Connector cable for NAV-900 to RV55 modem for touch terminals
3038990030	Power cable for RV55 modem
3138990005	Connector cable for RV55 modem with Sub-D connector
3138990006	Connector cable for NAV-900 to 6-pin DT connector
3138990007	Fastening plate for NAV-900
3138990008	Adhesive base for NAV-900