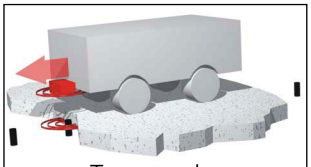
Device Description HG G-71915-A


Transponder

Transponder-Antenna

HG G-71915-A

1-dimensional | USB
CAN Bus (HG G-71915ZA) or PROFINET® (HG G-71915YA)

English, Revision 07	Date: 19.10.2023	Dev. by: LM	Author(s): RAD/LM

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Main Features

- Transponder antenna for the positioning of automated guided vehicles (AGV)
- Output of transponder code (via the bus) and PosiPulse (bus and digital)
- Operating frequency 128 kHz
- Protection class IP 65
- Reading distance 5-80 mm, depending on the transponder type
- Voltage supply 18 – 30 VDC
- max. crossing speed 2.0 m/s
- 3x M12 connectors
- Data interface: Depending on the variant CAN Basic / CAN Extended / CANopen® or PROFINET®
- Service interface: USB for configuration
- Display of operation state via LEDs, that illuminate the roadway
- Transponder programming

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The Götting KG in D-31275 Lehrte has a certified quality management system according to ISO 9001.

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1 About this Document

1.1 Validity

This device description applies to the transponder antenna HG G-71915-A.

It comprises information on correct mounting, electrical installation, commissioning, operation, maintenance and troubleshooting.

This device description refers to devices from Firmware 1.00 (see Figure 16 on page 34).

1.1.1 Target group

This device description is intended for

- developers, manufacturers or operators of systems who want to position moving parts or automatically guide vehicles with the support of the transponder antenna HG G-71915-A,
- any technical staff of a manufacturer planning to integrate the transponder antenna into an Automated Guided Vehicle (AGV) or to use the RFID-based position detection and identification function in another way,
- qualified persons who integrate the transponder antenna into a vehicle or mobile robot, put it into operation for the first time or configure it.

1.1.2 Additional Applicable Documents

This device description does not provide any information concerning the operation of the higher-level system, e.g. an Automated Guided Vehicle (AGV), in which the transponder antenna is integrated.

▶ Do not put the transponder antenna into operation until you have received the manual of the manufacturer or the system operator and have read and understood them.

Supplementary documents are available on request or directly from our website. The QR code on the right takes you to our homepage www.goetting-agv.com. The following links refer to specific product pages.

- Disc transponder HW DEV00095/00098
  http://www.goetting-agv.com/components/00095
- Rod transponder HG G-71325XA
  http://www.goetting-agv.com/components/71325
- Transponder programming device HG G-81840ZA
  http://www.goetting-agv.com/components/81840
- Connection box M12/USB HG G-20960ZA
  http://www.goetting-agv.com/components/20960

1.2 Declaration of Conformity

The product HG G-73350 complies with the relevant harmonisation legislation of the European Union. The relevant harmonized European standards and directives mentioned in the Declaration of Conformity were used to assess conformity.

You can request the EU declaration of conformity from Götting or download it from the following address

https://www.goetting-agv.com/components/71915

1.3 Presentation of Information

For you to be able to use your product simply and safely this device description uses consistent warning notices, symbols, terms and abbreviations. Those are described in the following sections.

1.3.1 Warning Notices

In this device description warning notices appear before sequences of actions that may lead to damage to persons or property. The listed actions for the danger prevention have to be observed.

Warning notices have the following structure:

SIGNAL WORD

Kind or source of the danger

Consequences

▶ Danger prevention

- The **warning symbol** (warning triangle) indicates danger to life or risk of injury.
- The **signal word** indicates the severity of the danger.
- The paragraph **kind or source of the danger** names the kind or source of the danger.
- The paragraph **consequences** describes the consequences of not observing the warning notice.
- The paragraphs for **danger prevention** explain, how to avoid the danger.

The signal words have the following meanings:

Table 1 *Hazard classification according to ANSI Z535.6-2006*

Warning Symbol, Signal Word	Meaning
DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE indicates property damage: The product or the environment could be damaged.

1.3.2 Symbols

In this device description the following symbols and formatting are used:

If this information is ignored the product may not be operated in an optimal way.

Indicates one or more links to the Internet.

- www.goetting.de/xxx
- www.goetting.de/yyy

Indicates tips for easier operation of the product.

✓ The check mark lists a requirement.

▶ The arrow shows an action step.

The indentation shows the result of an action or an action sequence.

- Program texts and variables are indicated through the use of `a fixed width font`.
- Menu items and parameters are shown in *cursive characters*.
- Whenever the pressing of letter keys is required for program entries, the required Letter Keys are indicated as such (for any programs of Götting KG small and capital letters are equally working).

1.4 Variants

The transponder antenna is available in two versions.

Table 2 *Variant overview*

Order No.		Features
HG G-71915	ZA	Data interface: CAN Basic / CAN Extended / CANopen®
	YA	Data interface: PROFINET®

1.5 Definitions

1.5.1 Reading and Mounting Side

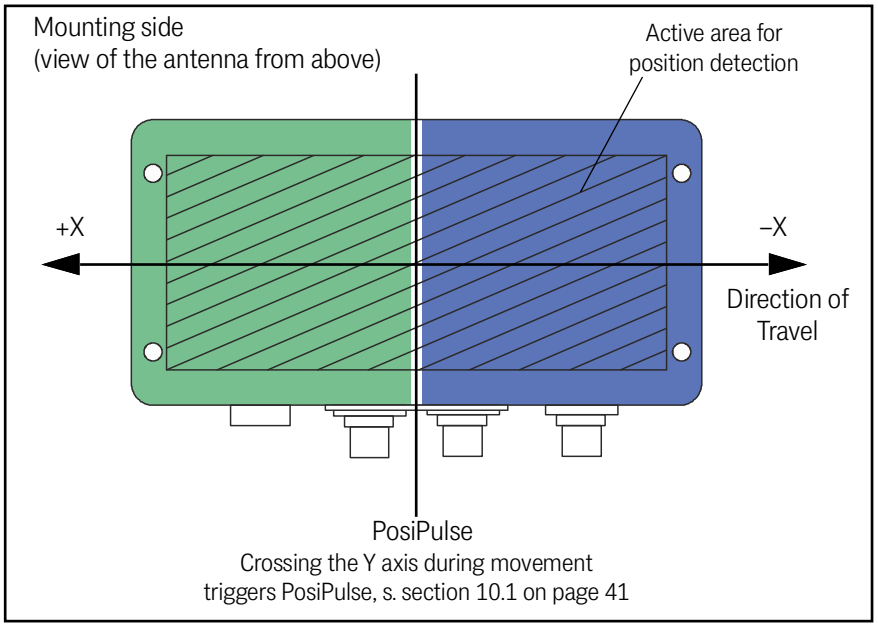
- The top of the housing is the *mounting side* with which the antenna is mounted, e.g. on the vehicle.
- The transparent cover is the *reading side*, which must face the transponder. When mounted under an AGV, it points to the ground.

Figure 1 *Reading and mounting side of the transponder antenna*

1.5.2 Coordinate System of the Antenna

The signs and coordinates given in this device description are defined as shown in the following figure.

Figure 2 *Output polarity (for sign and coordinate output)*



The colors in the picture show how all LEDs of the transponder antenna light up when a transponder is located under the corresponding sections. Further information can be found in section 5.2 on page 20.

1.6 Abbreviations

Table 3 *Abbreviations*

Abbreviation	Meaning
AGV	Automated Guided Vehicle
CAN	Controller Area Network
CANopen®	Controller Area Network open
EDS	Electronic Data Sheet
PDO	Process Data Object
PROFINET®	PROFINET® IO Device according to IEC61158
PLC	Programmable Logic Controller or PC that performs control functions
RFID	Radio-Frequency Identification
SDO	Service Data Object

2 Safety Instructions

Our product has been designed and manufactured in accordance with the generally recognized rules of technology. Nevertheless, there is a risk of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation thoroughly and completely before working with the product.
- Ensure that the documentation is kept in such a way that it is accessible to all users at all times.
- Always pass the product on to third-parties together with the relevant documentation.

2.1 Intended Use

The transponder antenna HG G-71915-A is designed to calculate the relative position of matching RFID tags (transponders) and to output it to a higher-level control system. Either the transponders or the antenna must be in a fixed position. Possible applications are:

- Position detection of an Automated Guided Vehicle (AGV), i.e. the antenna moves with the vehicle and the transponders have a fixed position.
- Position detection of moving parts (e.g. on mobile robots or electric monorail conveyors), i.e. the transponders move, the antenna is located at a fixed position.

The field of application of the transponder antenna HG G-71915-A is the position detection of Automated Guided Vehicles (AGV).

The transponder antenna HG G-71915-A may only be used by qualified personnel at the place of installation (e.g. vehicle) where it has been installed and commissioned for the first time by qualified personnel in accordance with these operating instructions. The operating conditions specified in this device description must be observed.

The transponder antenna HG G-71915-A does not contain any safety equipment and may therefore only be used in applications where the manufacturer or the system operator has ensured that sufficient measures are implemented for the protection of persons and the safe detection of obstacles.

2.2 Improper Use

Any use other than that described in the intended use is not in accordance with the intended use and is therefore not permitted.

Götting accepts no liability for damage resulting from improper use. The risks associated with improper use lie solely with the user.

The improper use of the product includes:

- The use of the transponder antenna in vehicles that are not equipped with safety devices for the protection of persons and the safe detection of obstacles.
- Leaving the track or the appearance of a person or an obstacle in the danger area must be safely detected at all times and immediate stopping of moving parts (e.g. vehicles) must be ensured in order to exclude damage to property or personal injury.

2.3 User Qualification

The operations described in this document require basic knowledge of mechanics and electrics as well as knowledge of the associated technical terms. To ensure safe use, these activities may therefore only be performed by an appropriate specialist or an instructed person under the direction of a specialist.

A specialist is someone who, on the basis of his technical training, knowledge and experience as well as his knowledge of the relevant regulations, is able to assess the work assigned to him, recognize possible hazards and take suitable safety measures. A specialist must comply with the relevant technical rules.

The personnel designated for the assembly, commissioning and configuration of the transponder antenna

- has received this device description.
- is familiar with the operation of the higher-level system (e.g. a vehicle).
- is competent to perform his activities and is sufficiently trained in the installation and configuration of the transponder antenna, if this is part of their activities.
- is – in case the CAN bus interface is to be used – familiar with the commissioning of and telegram exchange via CAN bus connections.
- is – in case the PROFINET® interface is to be used – familiar with the commissioning of and telegram exchange via PROFINET® connections.
- knows – in the event that the transponder antenna is to be used for position detection of automated vehicles – the dangers emanating from an automated guided vehicle (AGV) and has been sufficiently instructed in the handling of the vehicle and any necessary safety precautions to assess the safe working condition of the system.
- knows – in case other devices or systems with moving parts are used – the risks arising from the application and is sufficiently instructed in the safety precautions that may be necessary to assess the safe working condition of the system.

2.4 General Safety Instructions

- Ensure that the transponder antenna HG G-71915-A is used only in applications,
  - where sufficient measures for personal protection and safe detection of obstacles are implemented and
  - where it is reliably detected if the vehicle leaves the track or a person or obstacle appear in the danger zone at any time and all moving parts (e.g. vehicles) are immediately stopped.

- Ensure that interference in the ground or on the vehicle does not trigger a signal higher than 100 units in the antenna and that all transponders are read at a sufficiently high distance from this signal. Otherwise, false readings or unrecognized transponders may occur.
- Mount the transponder antenna so firmly on the vehicle that its position cannot change during normal operation. Otherwise, the position data will be incorrectly evaluated by the higher-level system and the vehicle may drive off track.
- Although dirt does not affect the position detection itself, the transponder antenna should be protected from dirt and moisture (e.g. splash water from the wheels of the vehicle) and cleaned regularly, otherwise wear and tear on the antenna will increase.

2.5 Obligations of the Operator

When using the transponder antenna, the operator must ensure that

- all persons within the area of influence of an automated system (e.g. automated guided vehicle (AGV)) are informed about the type of application and the associated hazards,
- the operating conditions specified in this device description are observed,
- the transponder antenna is in a technically perfect condition.

The operator must not modify or alter the transponder antenna without authorization. Otherwise, the operating permit will become invalid.

3 Scope of Delivery

The scope of supply includes:

- one transponder antenna HG G-71915-A
- this device description, available in electronic form at the following address:

www.goetting-agv.com/components/71915

3.1 Required Accessories

The transponder antenna alone is not sufficient for position detection of vehicles with transponders.

To operate a driverless transport system you also need:

- a connection cable for connecting the antenna to the vehicle electronics,
- several transponders in the ground.

The connection cables can be assembled by the customer (s. section 7.2 on page 23) or ordered from Götting (see below). No Götting cables are available for the PROFINET interface.

▶ Refer to Table 4 for the order numbers of the required accessories.

Not all cables are required in every project. Observe the compatibility with the antenna variant you use. For the transponder types, common alternatives with different characteristics and mounting options are listed. An overview of the achievable reading distances with the different transponder types can be found in Table 51 on page 64. A photo with most of the listed transponder types can be seen in Figure 4 on page 18.

Table 4 *Accessories (part 1 of 2)*

Order No.	Description	Compatible with transponder antenna HG G-71915	
		ZA	YA
HW CAB00001	Plug X1: cable PUR, 5 m with M12 elbow socket, 5-pol., A-coded	✓	✓
HW CON00055	Plug X2: CAN terminating resistor (Terminator), M12 Plug 5-pol., A-coded	✓	
HW CAB00064	Plug X3: cable CAN-Bus, 10 m, with shielding, M12 socket 5-pol. straight, A-coded, open end	✓	

Table 4 *Accessories (part 2 of 2)*

Order No.	Description	Compatible with transponder antenna HG G-71915	
		ZA	YA
HG G-71325XA	rod transponder normally mounted within the ground	✓	✓
– HW DEV00095 – HW DEV00098 vorprogrammiert	disc transponder black, ø 30 mm x 3 mm	✓	✓
– HW DEV00090 – HW DEV00099 pre-programmed	disc transponder black, ø 25 mm x 3 mm	✓	✓
– HW DEV00130ZA – HW DEV00130VA pre-programmed	disc transponder white, ø 30 mm x 1,5 mm	✓	✓
– HW DEV00131ZA – HW DEV00131VA pre-programmed	disc transponder blue, ø 30 mm x 2,5 mm	✓	✓
HG G-70633ZB	glass transponder	✓	✓
HW DEV00162	transponder credit card sized white	✓	✓
HG G-70650VA	puck transponder grey, switching transponder	✓	✓
HG G-70652ZC	puck transponder black	✓	✓
HG G-70653ZA	puck transponder black	✓	✓
HG G-70654ZB	marking nail transponder yellow	✓	✓

3.2 Optional Accessories

▶ Refer to Table 5 for the order numbers of the optional accessories. Optional accessories are compatible with all variants of the transponder antenna.

Table 5 *Optional accessories*

Order No.	Description
HG G-20960ZA	Connection box M12/USB for the connection with the USB interface of a PC
HG G-73650ZD	Navigation controller (control unit) for calculating the courses of the vehicle
HG G-81840ZA	Transponder Programming Device for reading and programming of transponder codes i The transponders can also be programmed via the antenna, but this is more complicated when installed, as it usually requires driving the vehicle over the transponder to be programmed.

4 Device Overview

4.1 System Components

An Automated Guided Vehicle (AGV) requires at least one antenna, connection cables to the vehicle electronics and transponders in the ground. Optionally, you can use a transponder programmer.

If the vehicle manufacturer or the plant operator does not yet have a controller for calculating the paths of the vehicle, we recommend the navigation controller from Götting.

Figure 3 *System components (excerpt)*

1 Transponder antenna HG G-71915-A

2 Transponder programmer (optional)

Transponder for mounting in or on the roadway:

3 Disc transponder (normally in the roadway)

4 Rod transponder (normally on the roadway)

5 Glass transponder (normally in the roadway)

Figure 4 *Transponder types (excerpt)*

From left to right: Disc transponder (black and white), rod transponder, glass transponder, credit card transponder, puck transponder, marking nail, switching transponder.

A complete overview of all transponders compatible with the transponder antenna, including the order numbers, can be found in Table 4 on page 14.

4.2 Components in the Ground: Transponders

Transponders with trovan® coding are used as reference marks for the track guidance (see section 3.1 on page 14). Further documents can be obtained from our Internet server (see section 1.1.2 on page 6).

4.3 Transponder Antenna

Figure 5 *Transponder antenna HG G-71915-A*

1 Housing ventilation
2 Connector X3 (CAN)
3 Connector X2 (CAN)
4 Connector X1 (Power)

All cable connections are located on one side of the housing.

▶ For dimensions, see Figure 13 on page 27.

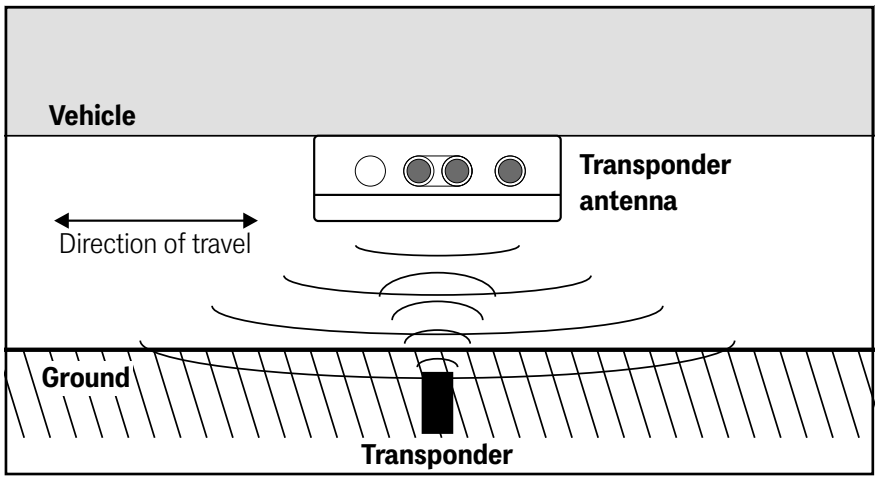
The antenna has three M12 connectors, the number of pins depends on the antenna variant. The pin assignments can be found in section 7.2 on page 23.

5 Operating Principle

The transponder antenna detects the position of moving parts by means of passive transponders. Downstream navigation systems (e.g. vehicle PLC, Götting navigation controller HG G-73650ZA), which process the data detected by the antennas, can be used to control automated guided vehicles (AGVs) contact-free.

All important settings, calibrations and updates can be made via the USB interface.

Figure 6 *Simplified principle of transponder positioning*



In position detection with transponders, a transponder antenna detects a transponder at the nominal reading distance and determines its position in the antenna field. Typically, the transponders are mounted at fixed positions on the ground and the antenna moves above them, e.g., by being attached to a vehicle moving over a course.

Alternatively, the antenna may be mounted at a fixed position and the plant part with transponder moves relative to it, e.g., an arm of a robot or an electric monorail.

In the following, we refer to the application on automated guided vehicles (AGVs) with transponders in or on the ground and the antenna installed on the vehicle.

5.1 Position Detection with Transponders

In position detection with transponders, the antenna permanently irradiates the area under its reading side with its transmission frequency. The transponders are passive and do not require an energy supply of their own. As soon as the antenna passes over a transponder, it is inductively supplied with energy via the antenna's energy field. It automatically wakes up and uses the received energy to send back its code at half the transmission frequency of the antenna. Thus, only pairings of antennas and transponders whose transmit and receive frequencies match are possible. Furthermore, there are other systems for transmitting and decoding the code which are not described in this device description.

Only one transponder at a time may be in the antenna's reading range. In addition to the transponder code, the antenna emits a positioning pulse (PosiPulse) when it moves over a transponder and the center axis of the antenna crosses the transponder. This enables the detection of predefined positions.

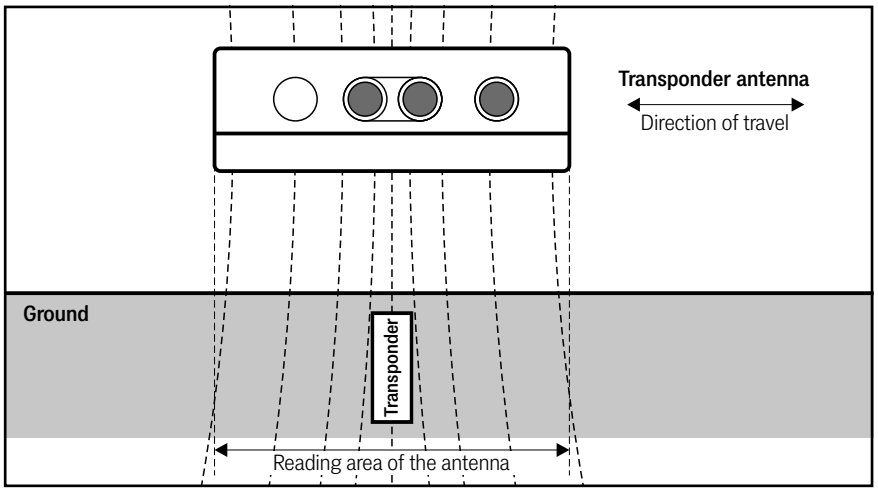
Due to the low operating frequencies (128/64kHz), transponder detection is practically not affected by non-conductive materials (liquids, gases or even solids).

The transponder code can be reprogrammed via the antenna for compatible read/write transponders. The programming process can alternatively be triggered via bus telegrams (section 10.3 on page 42) or the service interface (section 9.2.5 on page 39).

5.2 Reading Area and LEDs

The reading area comprises the entire area below the reading side of the antenna at the reading distance.

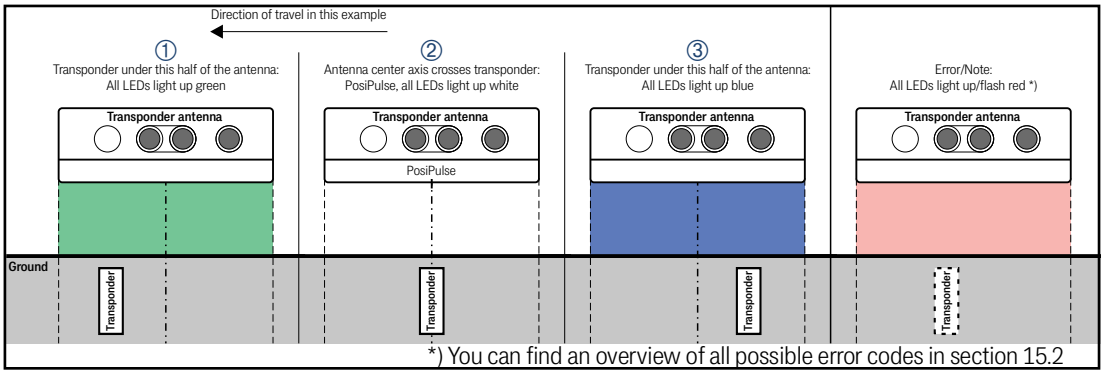
Figure 7 *Reading area*



The antenna is designed to be 1-dimensional. It detects a transponder in the reading range and generates a PosiPulse when the center of the antenna moves over the transponder. It can also detect under which half of the antenna a transponder is located.

The antenna indicates its operating status via LEDs that illuminate the lane. Thus, even when the antenna is mounted under a vehicle, one of the following states can be detected from the outside.

Figure 8 *Display of the operating status via LEDs*



6 Storage

NOTICE

Danger due to improper storage

The device can be damaged

- Observe the storage conditions.

The storage temperature is -40 °C to +85 °C.

- Store the device in closed rooms only.
- Make sure that the storage room is sufficiently ventilated and dry.
- Protect the device from damage caused by dirt, dust or moisture.

7 Mounting

NOTICE

Malfunction or detuning of the antenna

If you do not comply with the operating conditions, the position detection may be faulty or the antenna may fail completely.

- Always comply with the operating conditions specified in section 7.3 on page 25, in particular regarding metal-free areas and the routing of live cables around the antenna.

We recommend the following procedure for mounting the transponder antenna:

- First prepare the connection cables (see section 7.2 on page 23).
- Lay the connection cables in the vehicle.
- Then mount the antenna at the desired position (see section 7.3 on page 25).
- Close unused connectors with M12 closing caps.

7.1 Mounting the Transponders

7.1.1 Operating Conditions for Transponders

For all transponders, the maximum reading distance can be achieved if they are positioned away from metallic surfaces. Practical tests should be carried out to clarify the configuration!

Mounting options for the transponders:

- On the road surface.
- Flush in the roadway with grouting.

The reading distance is the distance between the reading side of the antenna and the top edge of the transponder.

Transponders may not be permanently mounted in standing water. The plastic can absorb water over a longer period of time and weaken the transponder signal.

Reinforcements laid tightly under the road surface can interfere not only with the transponders but also with the antennas and thus falsify the position detection. The influence on positioning accuracy and range depends on the size and distance of metal parts.

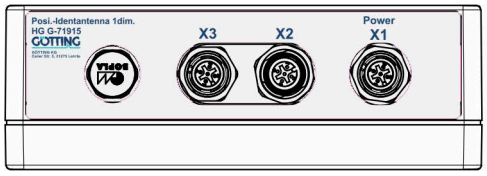
- Observe the minimum distances specified in the associated data sheets (see section 1.1.2 on page 6).
- Observe the recommended minimum distances in the metal-free space (section 7.3.4.2 on page 26). The influence on the position accuracy and range also depends on the size and distance of the metal parts.
- A minimum clearance of 240 mm is required between two transponders.

- Only one transponder may be in the reading range of the antenna at any time.
- Mount the transponders as horizontally (disc transponders) or vertically (rod transponders) as possible.

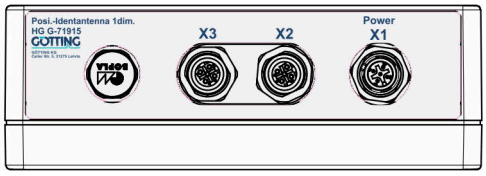
7.2 Preparation of Connection Cables

The antenna has three connectors, these differ depending on the variant. The pin assignments can be found in the tables below.

Figure 9 *Variants of the antenna and their connectors*



HG G-71915ZA – CAN
X1: M12, 5 pin, A coded, male
X2: M12, 5pin, A coded, female
X3: M12, 5pin, A coded, male



HG G-71915YA – PROFINET®
X1: M12, 5pin, A coded, male
X2 & X3: M12, 4pin, D coded, female

Connection cables are not part of the scope of delivery. Suitable cable types are available from Götting (see 3.1 on page 14). Compatible cables are also available from many manufacturers. Cables must be used that are suitable in terms of impedance and have a shield.

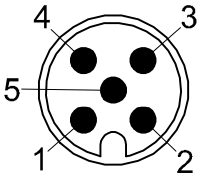
7.2.1 All Variants: Connecting X1 (Power)

The POWER connection contains the voltage supply, the USB interface and the positioning pulse. The output for the positioning pulse is supplied via +Ub and is limited to 20 mA.

If you want to use the USB interface:

- Refer to section 8.1 on page 29 and chapter 9 on page 33.

Table 6 *Pin assignment X1 (Power)*

X1 (Power)	Pin	Signal	Comment
 M12, 5-Pin, A coded, male	1	+UB	Voltage supply
	2	PosiPuls out	Positioning pulse limited to 20 mA see section 10.1 on page 41
	3	D+	USB
	4	D-	USB
	5	GND	Ground (data and supply)

7.2.2 Variant HG G-71915ZA – CAN Bus: Connecting X2 & X3

The CAN bus is connected to the antenna via the two connectors X2 and X3. These connections can also be used for voltage supply. They have the following pin allocations:

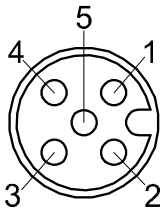
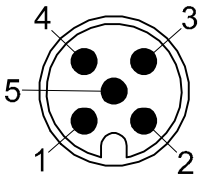
NOTICE

Damage to CAN bus devices

If voltage is applied to pin 4 or 5, other devices connected to the CAN bus may be damaged.

- ▶ Never connect voltage to pin 4 or 5.

Table 7 *CAN-Bus: Pin assignments X2 & X3*

X2	X3	Pin	Signal
 M12, 5-Pin, A coded, female	 M12, 5-Pin, A coded, male	1	Not connected
		2	+Ub (24 V)
		3	Ground
		4	CAN_H
		5	CAN_L

The connections via the inputs X2/X3 are connected in parallel, i.e. there is no input or output.

If the antenna is connected at the end of the bus:

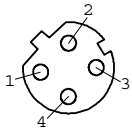
- ▶ Install a CAN terminator.

These terminators can be obtained from various manufacturers and are available in versions for many sockets and connectors. A terminator for the X2 socket is also offered by Götting (see section 3.1 on page 14).

7.2.3 Variant HG G-71915YA – PROFINET®: Connecting X2 & X3

PROFINET® is connected to the antenna via the two connectors X2 and X3. X2 and X3 are connected internally via a switch, they therefore have an identical pin assignment.

Table 8 *PROFINET®: Pin assignments X2 & X3*

X2 & X3	Pin	Signal
 M12, 4-Pin, D coded, female	1	TX+
	2	RX+
	3	TX-
	4	RX-

7.3 All Variants: Mounting the Transponder Antenna

7.3.1 Operating Conditions of the Antenna

The transponder antenna HG G-71915-A is approved for indoor and outdoor use. It may be used in a temperature range from -25 to +50° C. The relative humidity at 25° C may be max. 95 % (without condensation).

The transponder antenna must be mounted firmly on the vehicle so that its position cannot change during normal operation. Otherwise, the position data will be incorrectly evaluated by the higher-level system and the vehicle may e.g. drive off-track.

No interference signals from clocked motors etc. may be present in the frequency range 64 ±4 kHz. This also includes interference frequencies that lie on the metal body of the vehicle.

▶ Eliminate any interfering signals that may be present.

The transponder antenna must be mounted on the vehicle in such a way that the housing ventilation is not obstructed.

▶ Make sure that the air can circulate unhindered through the housing ventilation.

7.3.2 Minimum Distance Between Antenna and Transponder

The reading distance between the transponder antenna and the transponder is 5 to 60 or 80 mm depending on the transponder type (see Table 51 on page 64).

There must be no metal between the antenna and the transponder.

Non-conductive and non-shielding dirt on the road as well as water, fog, snow and ice have no influence on the accuracy of the position detection.

7.3.3 Minimum Distance Between Identical Transponder Antennas

Two or more transponder antennas operating at the frequencies 128/64 kHz must maintain a minimum distance from each other in order not to interfere with each other. The minimum distance between two HG G-71915-A transponder antennas is 240 mm.

If you suspect that magnetic fields are transmitted via the chassis construction:

▶ If in doubt, carry out tests before assembly.

7.3.4 Metal-free Areas Around Transponder and Antenna

Metal in the vicinity of the transponder and antenna affects the accuracy and range of the reading system. A distinction is made between:

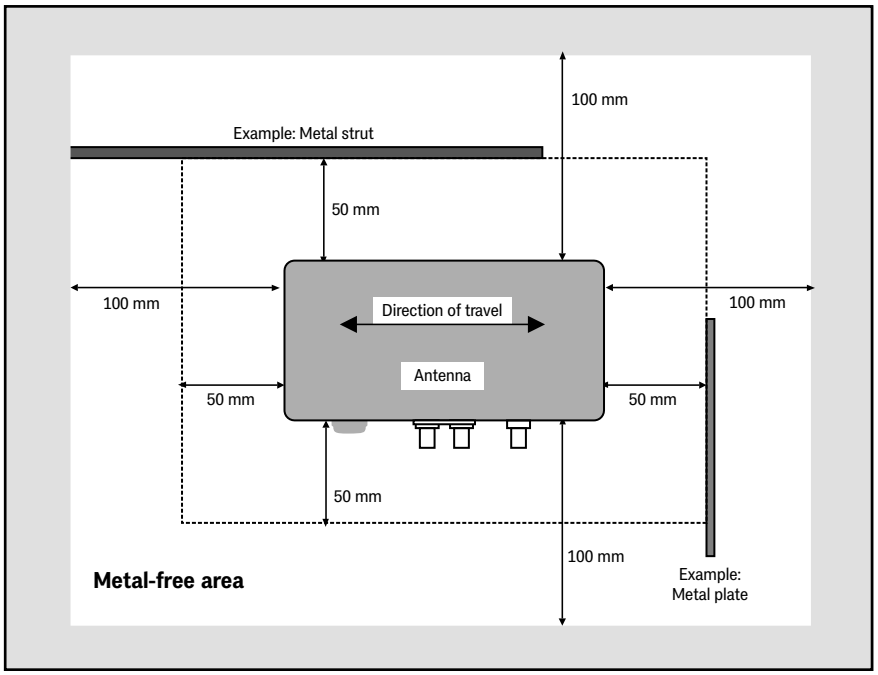
1. Smaller metallic structures that do not form a loop.
2. Closed metallic structures or smaller metallic structures that form loops.

The following minimum distances apply.

7.3.4.1 Smaller Metallic Structures that do not Form a Loop

Around the antenna, smaller metallic structures that do not form loops may violate the metal-free space. They must have a minimum distance of 50 mm.

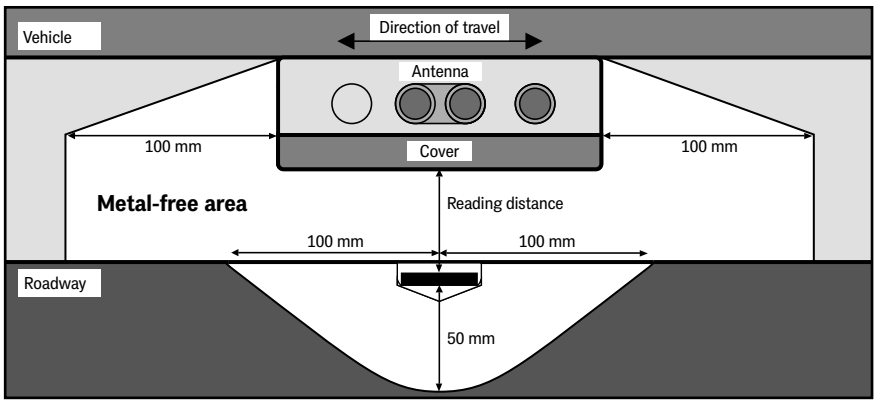
Figure 10 *Metal-free space around the antenna with smaller metallic structures, top view*



7.3.4.2 Closed Metallic or Electrically Conductive Structures

The antenna can be mounted with the mounting side directly on metal. From the cover on the reading side, the following minimum distances apply for closed metallic and electrically conductive structures.

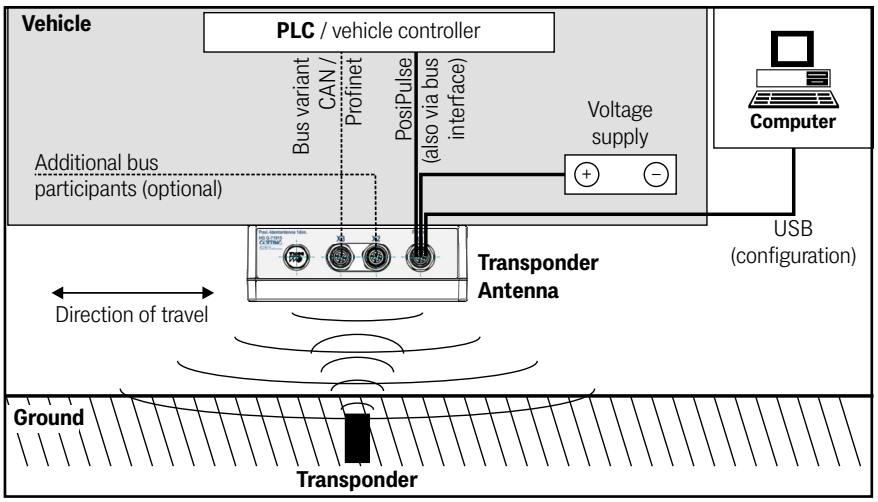
Figure 11 *Metal-free space around antenna and transponder with closed metallic structures or loops, side view (in the example: transponder in the roadway)*



Power lines (e.g. for charging stations) must not be laid in this area around the transponders, as any pulses could make the code readings more difficult or the code could be falsified!

7.3.5 Connection Example

Bild 12 *Sketch: Connection example*



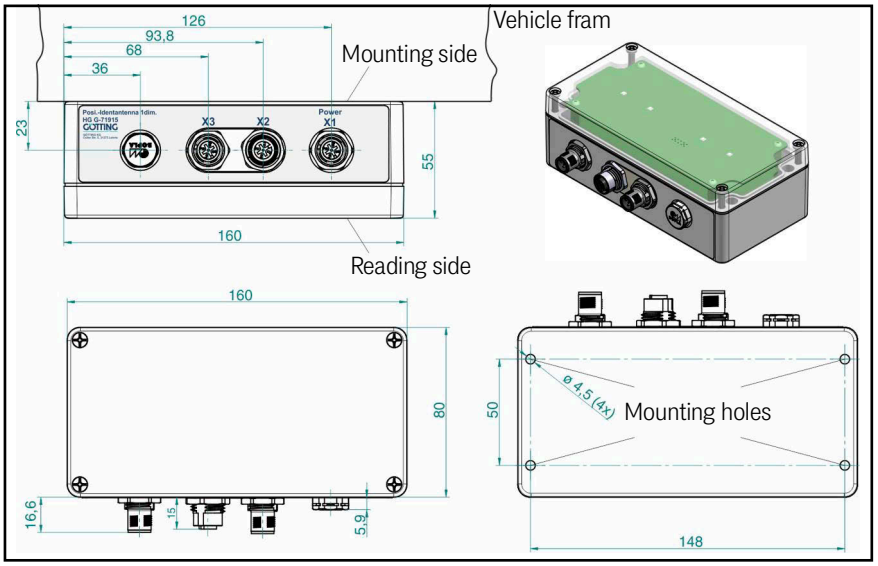
7.3.6 Mounting the Antenna on the Vehicle

The antenna can be mounted with the mounting side directly on metal. On the reading side of the antenna, the clearances mentioned in section 7.3.4 on page 25 apply.

To be able to mount the antenna, you have to unscrew the cover on the reading side. Then you will find the preparations for four M4 screws in the housing, see Figure 13.

Observe the orientation of the antenna when installing it!

Figure 13 *Mounting options for the antenna*



To ensure that the system characteristics are not impaired:

- ✓ Keep the mounting space around the antenna "metal-free", see section 7.3.4 on page 25.
- ✓ Do not operate the antenna with the reading side on metallic surfaces.

✓ For trouble-free operation of the transponder system it is very important that there are no interfering signals from clocked motors etc. in the frequency range 64 ±4 kHz!

7.3.7 Antenna Switch-On

After applying the operating voltage, the antenna switches on and is ready for operation after approx. 1 second.

8 Commissioning

WARNING

Danger due to lack of safety measures

The transponder antenna HG G-71915-A does not contain any safety devices.

▶ Only use this antenna in applications where sufficient measures for personal protection and safe detection of obstacles have been implemented.

Requirements:

✓ The antenna has to be wired correctly.

✓ The antenna must be connected to the voltage supply.

✓ Shielded cables should be used to protect the connection cables against interference.

✓ Observe the notes in section 7.3.4 on page 25.

The purpose of commissioning is to parameterize the transponder antenna for a specific application:

Commissioning consists of several steps

- Connection of the serial interface of a computer (e.g. laptop) to the USB interface of the antenna (see section 8.1 below)
- Starting the terminal program on the computer (see section 8.2 on page 30)
- Parameterization of the antenna using the antenna-internal monitor program (see 8.3 on page 31)
- Saving the values and restarting the system.

8.1 Connecting the Antenna to a Computer

You can configure the system using a software running in the antenna. To do so, you need a self-configured cable with the pin allocation shown in Figure 14.

Optionally the *connection box M12-5-8-USB* HG G-20960 can be connected between the antenna and the PC (see also section 3.2 on page 15). This allows the antenna to be connected via standard M12 cables and, in addition to the connection to the PC, also enables the antenna to be supplied with power.

For more information on the connection box, see
http://goetting-agv.com/components/20960

NOTICE

Damage to the transponder antenna or other devices connected via USB.

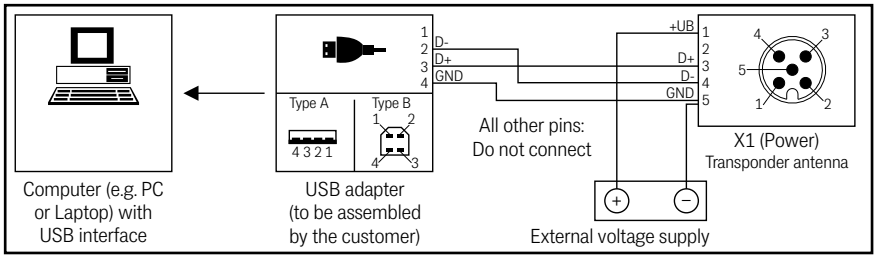
The USB interface does not have a leading ground contact. Plugging or unplugging USB connectors while the voltage supply is connected can cause voltage spikes that will damage devices connected via USB.

- Always disconnect the transponder antenna from the voltage supply before plugging or unplugging USB connectors. This applies, for example, to the USB connector on the computer and connector X1 (Power) on the transponder antenna.

To use the software:

- Connect the connector X1 (Power) of the antenna to a USB interface of your computer.
- Then start a terminal program on the computer.

Figure 14 *Connection example: Connection to the USB interface of a computer*



The USB interface in the antenna is addressed as a virtual serial interface (virtual COM port). Usually the corresponding virtual COM port driver is installed automatically under current versions of Microsoft® Windows®.

If the transponder antenna is not automatically recognized as virtual COM port after establishing the USB connection, the STM32 Virtual COM Port Driver (STSW-STM32102) must be installed manually. The driver can be downloaded at the following address:

http://www.st.com/en/development-tools/stsw-stm32102.html

8.2 Configuring the Terminal Program

Any compatible terminal program can be used, examples are HyperTerminal® or Tera Term®. HyperTerminal was included in earlier versions of Microsoft® Windows®. It can also be downloaded for all Windows® versions from the Internet at the following address:

https://www.hilgraeve.com/hyperterminal/

However, any other terminal program that can handle ANSI emulation can also be used. If you use another program, please refer to the documentation supplied with the program and set it to values mentioned below.

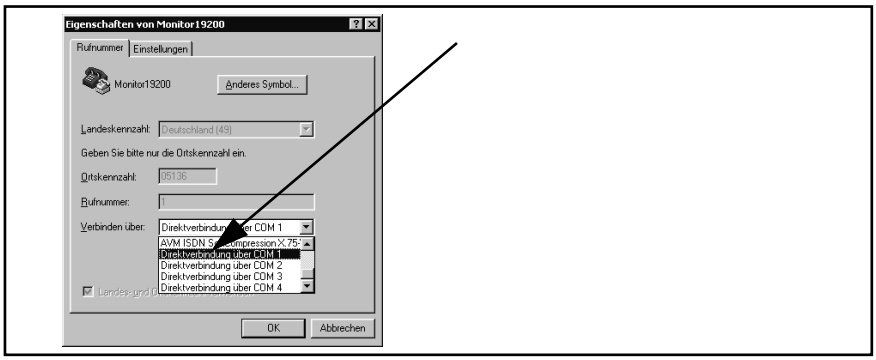
If you use another terminal program:

- Refer to the documentation supplied with the terminal program.

Choosing the COM port:

- In the *File* menu, select the *Properties* subitem (or click on the Icon). The following window opens:

Figure 15 *Setting the COM port in HyperTerminal*



- In the *Connect via* sub item, select *Direct connection via* the corresponding port and confirm with o.k. OK.
- Exit HyperTerminal. You will be prompted to save.
- Save the changed values.

  In the example the port `COM1` is now set.

8.3 Configuring the Antenna (Service Interface)

8.3.1 Set Parameters

Once a connection to the antenna is established via the terminal program (see abive), the antenna shows the main menu of the service interface, see section 9.2.1 on page 34.

To adjust the antenna:

- Set the required transmission parameters for the CAN bus (see section 9.2.3 on page 37).
- Position a transponder under the antenna and check whether all values arrive in your system via the corresponding interface. Also use the status display in the main menu for this purpose. In the status line, the Sum and Diff displays must increase significantly. The code must be recognized immediately and the number of readings must be counted up steadily to 255. When the transponder crosses the antenna center line in the direction of travel, a positioning pulse must be generated.

  If no errors have occurred, the antenna is now ready for operation.

8.3.2 Minimize Interferences

The influence of the interferences strongly depends on the level of the transponder signal. The transponder signal must be clearly above the interference signal.

To reduce interferences, please proceed as follows:

- Adjust the reception threshold specifically (see section 9.2.2 on page 36).

  Interferences are reduced.

In general you should avoid interference by keeping sources of interference at a sufficient distance from the transponder antenna and maintaining constant reading distances from the transponders.

8.4 Complete Commissioning

If no errors have occurred:

- Save the changed values (see ection 9.2.4 on page 38).

You must restart the system for the changes to become active.

- Disconnect the antenna from the operating voltage for a short time and reconnect it.

  The transponder antenna is now properly commissioned.

9 Configuration of the System via the Service Interface

The transponder antenna can be parameterized via the service interface. To be able to call up the service interface, a connection to the antenna must be established via the USB interface. Then a terminal program must be started, see 8.1 on page 29 and 8.2 on page 30. The basic menu can then be called up in the terminal program. This allows you to configure the antenna menu-driven.

9.1 Starting the Service Interface

As soon as the PC is connected to the antenna via the USB interface and the terminal program is running, the space bar can be used to trigger the rebuilding of the main menu. The menu shown in Figure 16 on page 34 is then displayed.

9.2 Using the Service Interface

The operation of the service interface is the same for all antenna variants, it differs only in the structure of the basic menu and for HG G-71915ZA (CAN) there is an additional menu for the interface.

NOTICE

Reduced positioning accuracy due to incorrect values

Incorrect threshold values can cause the antenna to be out of tune so that transponders are no longer read correctly.

- If possible, make a note of the values before you adjust them so that you can restore the original state if problems occur.

9.2.1 Main Menu

Figure 16 *HG G-71915ZA CAN: Main Menu of the Service Interface*

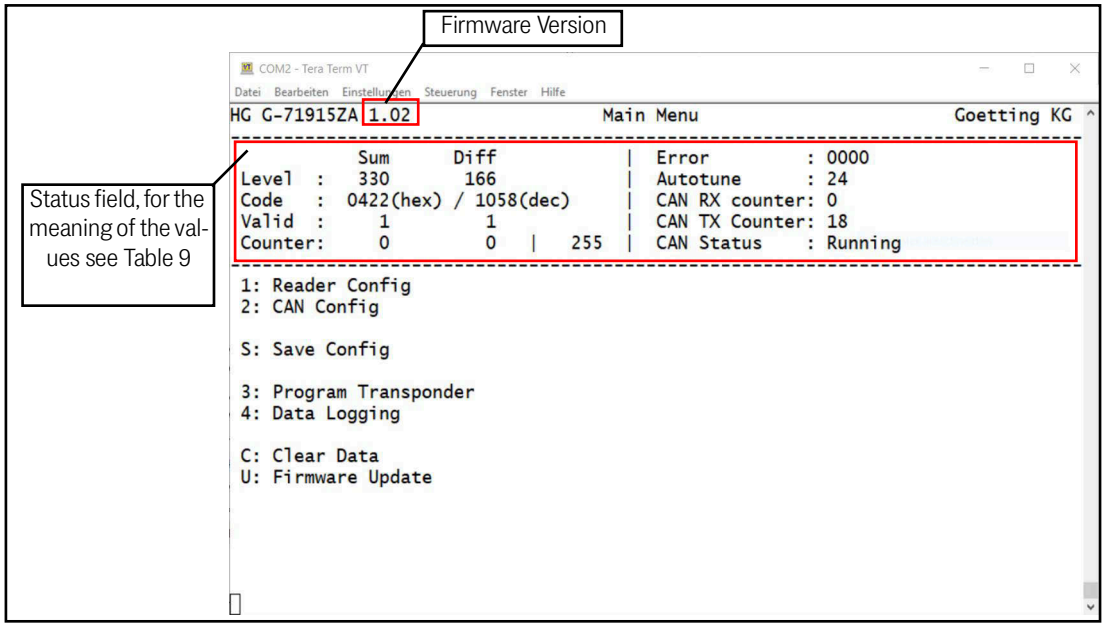
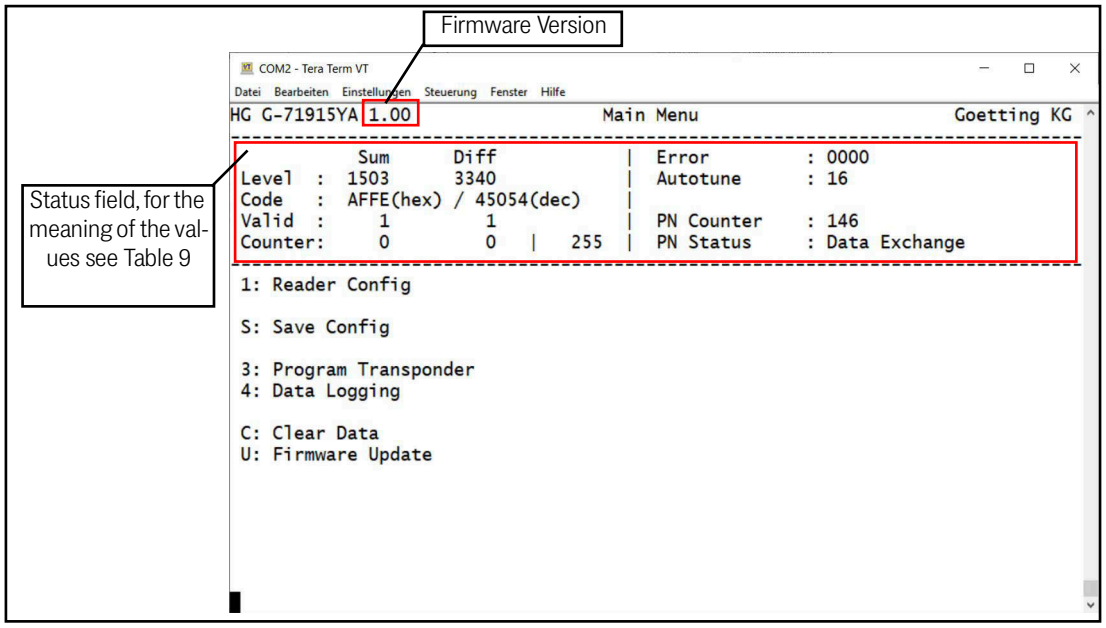


Figure 17 *HG G-71915YA PROFINET®: Main Menu of the Service Interface*



In each of the menu screens, a status field is output at the top (see Table 9). The other menu items are activated by entering the preceding number/character, e.g. 1 for Reader Config.

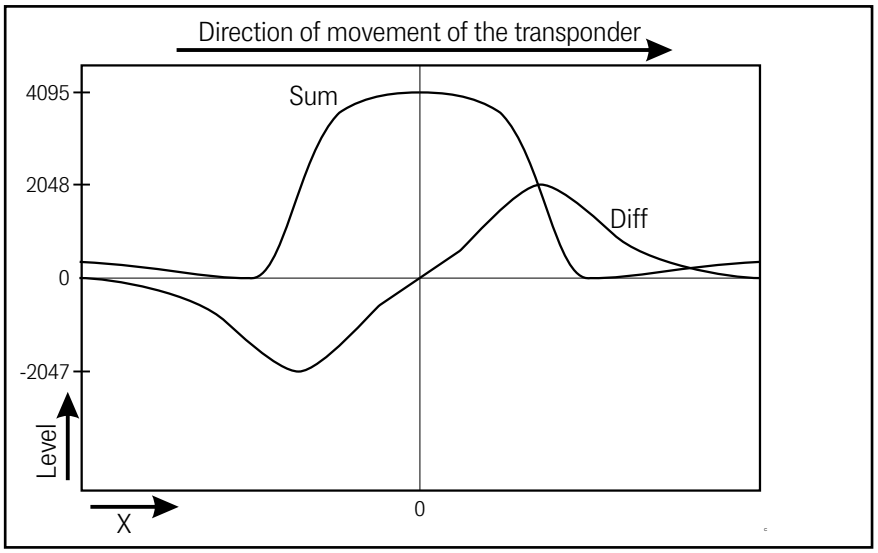
Table 9 *Meanings of the status outputs (service interface) (part 1 of 2)*

Status		Meaning
Level	Sum	Level of the sum signal (also see Figure 18 on page 36).
	Diff	Level of the difference signal, sign depending on which half of the antenna the transponder is located under (also see Figure 18 on page 36).

Table 9 *Meanings of the status outputs (service interface) (part 2 of 2)*

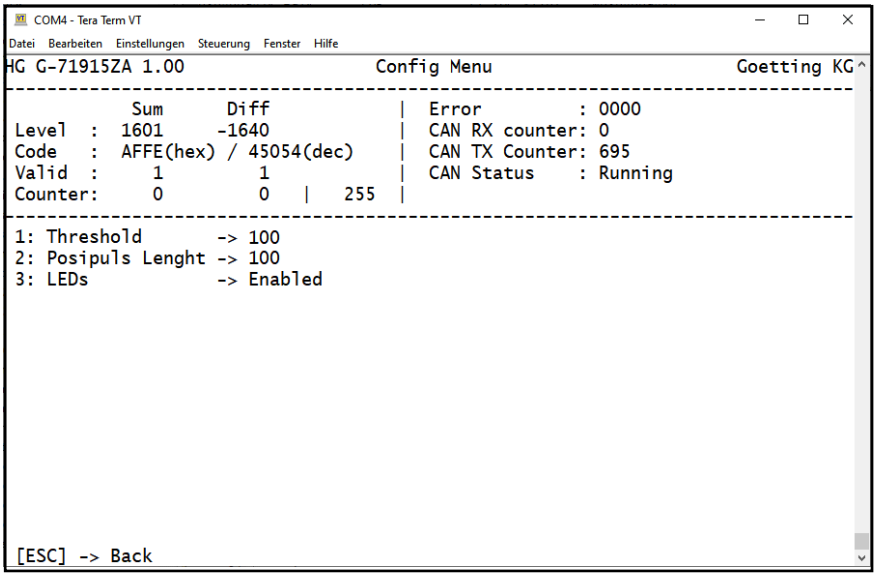
Status		Meaning
Code	Sum	Last decoded transponder code in HEX
	Diff	Last decoded transponder code in DEC
Valid	Sum	Valid transponder code detected at the sum signal.
	Diff	Valid transponder code detected at the difference signal.
Counter	Sum	Number of incorrect decoding attempts for the sum signal.
	Diff	Number of incorrect decoding attempts for the difference signal.
	Zahl	Number of successful code readings from the sum or difference signal.
Error		Output of the following error states: **Tabelle 10** *Status error states* **Value** / **Meaning** 0x001 – BUS error 0x002 – Parameter error 0x004 – USB error 0x008 – Internal time base error The antenna also indicates the same error conditions via red flashing codes of the LEDs, see section 15.2 on page 62. Possible causes and remedies are also described there.
Autotune		Determined value for the automatic adjustment of the transmitter output stage
HG G-71915ZA CAN		
CAN RX counter		Counter for received CAN bus telegrams.
CAN TX Counter		Counter for transmitted CAN bus telegrams.
CAN Status		– for CAN Standard/Extended → Running, Offline – for CANopen® → Operational, Preoperational, Stop, Offline
HG G-71915YA PROFINET®		
PN Counter		Counter for transmitted PROFINET® telegrams.
CAN Status		– Data Exchange – Offline

Figure 18 *Level for Sum and Diff depending on the position of the transponder under the antenna*



9.2.2 1: Reader Config

Figure 19 *Menu: Reader Config using the example of HG G-71915ZA CAN*



1 Threshold: Minimum threshold for the sum signal for transponder evaluation.

The default value of 100 has proven itself in test series and should only be changed in special cases. A value that is set too high (maximum value = 999) reduces the read range. A value that is selected too low leads to interference.

2 Posipuls Length: Duration of the PosiPulse in milliseconds.

3 LEDs: Activation or deactivation of the optical signaling via the LEDs.

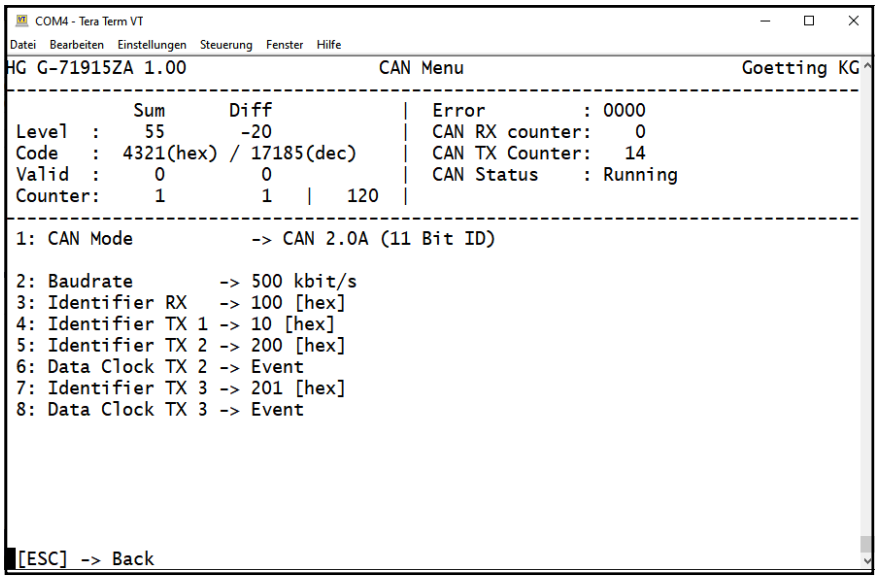
If an error is present, it is always output in the form of flash codes in red color, regardless of this setting (see section 15.2 on page 62).

9.2.3 Only Variant HG G-71915ZA: 2: CAN Config

9.2.3.1 CAN 2.0A / 2.0B

In this menu the different parameters for the CAN bus can be set:

Figure 20 *Menu: CAN Config*



1 CAN Mode: Setting in which mode the CAN interface runs. The following are available for selection:

- CAN 2.0A (selected in the screenshot)
- CAN 2.0B
- CANopen® s. section 9.2.3.2 on page 38

2 Baudrate: 100 kBit/s, 125 kBit/s, 250 kBit/s, 500 kBit/s, 1 Mbit/s

3 Identifier RX: Identifier of the reception box
CAN 2.0A: 0..7FF | CAN 2.0B: 0..1FFFFFFF

4 Identifier TX 1: Identifier of transmission box 1
CAN 2.0A: 0..7FF | CAN 2.0B: 0..1FFFFFFF

5 Identifier TX 2: Identifier of transmission box 2
CAN 2.0A: 0..7FF | CAN 2.0B: 0..1FFFFFFF

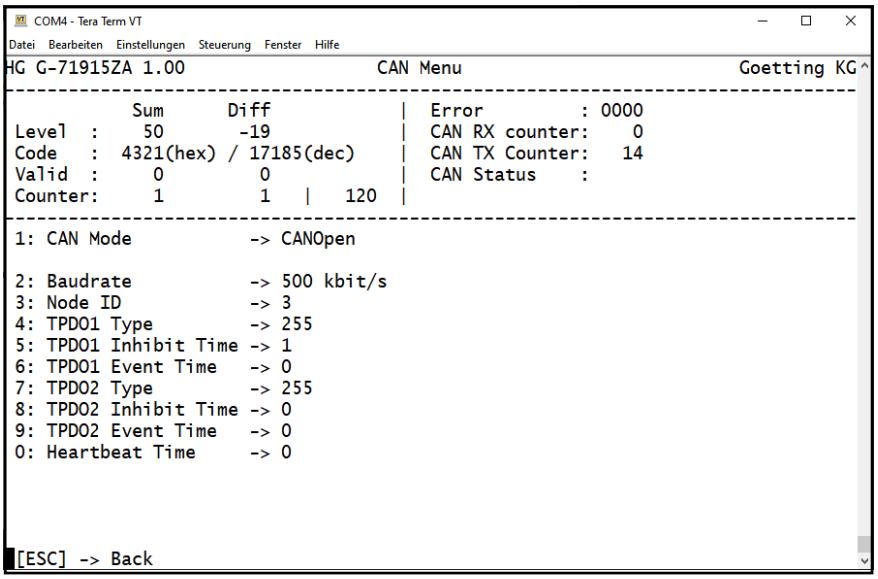
6 Data Clock TX 2: 0 → acyclic when the data changes (Event)
1..1000 [ms] → cyclic

7 Identifier TX 3: Identifier of transmission box 3
CAN 2.0A: 0..7FF | CAN 2.0B: 0..1FFFFFFF

8 Data Clock TX 3: 0 → acyclic when the data changes (Event)
1..1000 [ms] → cyclic

9.2.3.2 CANopen®

Figure 21 *Menu: CANopen® Config*



1 CAN Mode: Setting in which mode the CAN interface runs. The following are available for selection:

- CAN 2.0A
- CAN 2.0B
- CANopen® (selected in the screenshot)

2 Baudrate: 100 kBit/s, 125 kBit/s, 250 kBit/s, 500 kBit/s, 1 Mbit/s

3 Node ID: Participant address (1 .. 127)

4 TPDO1 Type: 0 .. 240, 255

5 TPDO1 Inhibit Time: 0 .. 100 [ms]

6 TPDO1 Event Time: 0 .. 1000 [ms]

7 TPDO2 Type: 0 .. 240, 255

8 TPDO2 Inhibit Time: 0 .. 100 [ms]

9 TPDO2 Event Time: 0 .. 1000 [ms]

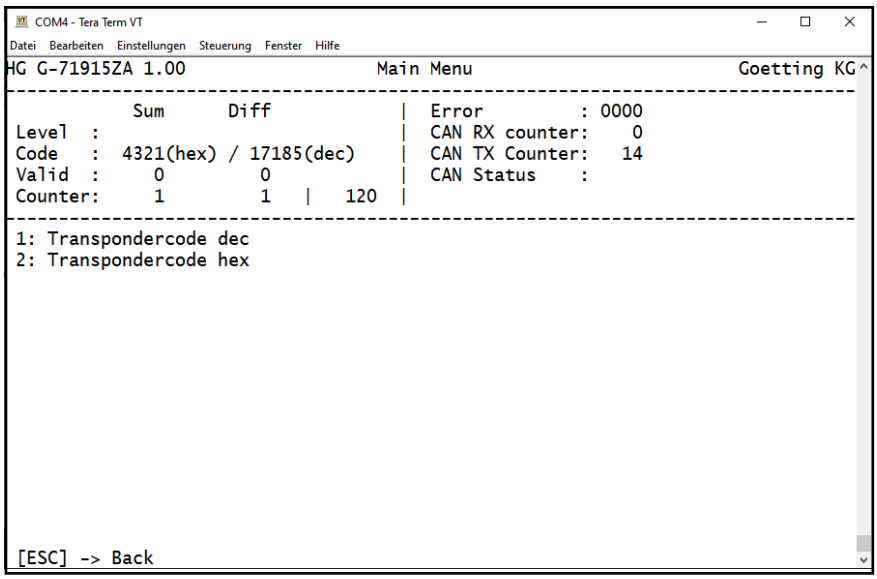
0 Heartbeat Time: 0 .. 1000 [ms]

9.2.4 S: Save Config

Pressing the S key in the main menu permanently saves all parameters. The device is then automatically restarted with the new settings.

9.2.5 3: Program Transponder

Figure 22 *Menu: Program Transponder using the example of HG G-71915ZA CAN*



1 Transpondercode dec: decimal input of the new transponder code.

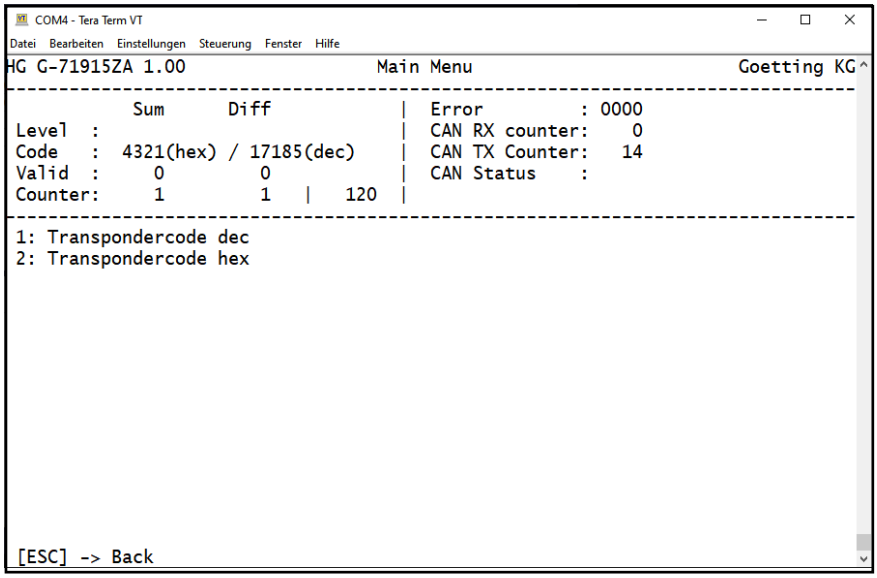
2 Transpondercode hex: hexadecimal input of the new transponder code.

✓ The prerequisite for programming is that there is exactly one compatible transponder in the antenna field.

The programming process is started after entering the new transponder code by pressing the Enter (ENTER) key.

9.2.6 4: Data Logging

Figure 23 *Menu: Data Logging using the example of HG G-71915ZA CAN*



For diagnostic purposes, the following values can be output via the service interface. Via the terminal program, the values can be saved in **CSV-Format** (Comma Separated Values; text file specially formatted for reading into spreadsheets). The following data are recorded:

Timer [ms], level sum signal, level difference signal, code reading sum signal valid, code reading difference signal valid, code reading total valid, timer posipulse, transponder code sum signal, transponder code difference signal, issued transponder code.

The recording is ended by pressing the Esc key (ESC). The antenna is then restarted automatically.

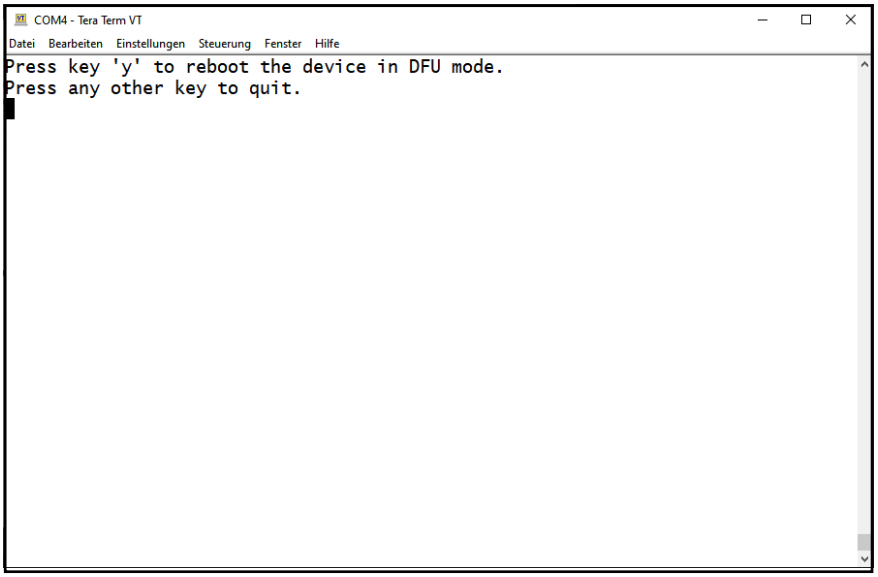
After the *.csv file is recorded, it can be opened in a spreadsheet (e.g. Microsoft® Excel®, OpenOffice®, ...). When opening the file, the spreadsheet will ask for some options. Specify there that the values are comma-separated. Afterwards, the data can be prepared in chart form or saved as a native spreadsheet file for sharing.

9.2.7 C: Clear Data

Pressing the C key in the main menu resets all values in the status field.

9.2.8 U: Firmware Update

Figure 24 *Menu: Firmware Update*



Y: With Y the antenna starts in the DFU mode, in which a new firmware can be imported. The further procedure is described in chapter 12 on page 57.

All other keys quit the dialog.

10 Interfaces

10.1 PosiPulse (Positioning Pulse)

After crossing the center of the antenna, a 20 mA current limited output is switched to +UB, available at pin 2 of the POWER connector. The duration of the PosiPulse can be set via the service interface (see section 9.2.2 on page 36).

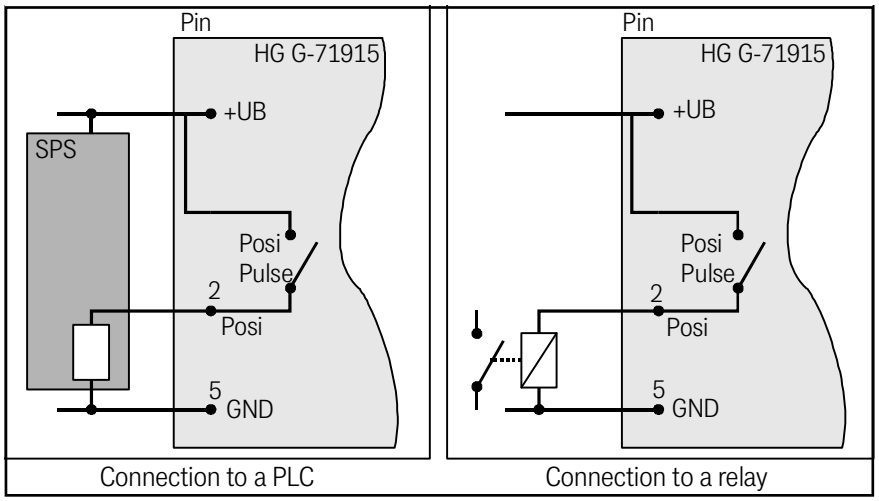
The following applies to the PosiPulse:

- ✓ A positioning pulse is generated only after prior decoding of a transponder.
- ♦ Exactly one PosiPulse is triggered for a transponder crossing.
- ♦ For a PosiPulse to be triggered again for a transponder that has already been read, the transponder must have left the reading range in the meantime.

The PosiPuls is transmitted alternatively to the way described here in the status of the CAN telegram. However, the latency time of the data output period must be taken into account. In addition, a CAN telegram without data content can also be triggered directly by the positioning pulse, see section 10.3.2.2 on page 43.

The positioning pulse output is internally connected to +UB (no potential separation). For safety reasons, a 20 mA current limit is implemented in the antenna for this output. If, for example, a +UB voltage output is required, pin 2 can be connected to GND via a resistor of 1 kOhm as shown in the following figure.

Figure 25 *Connection options positioning pulse*



10.2 System States Status 1 and Status 2

The system can output several states or also error messages via the bus interface.

Table 11 *Status 1: Possible systems states / error messages*

Bit	Meaning
0	Error internal time base
1	Error CRC transponder code
2	Error USB interface
3	
4	
5	Parameter error
6	
7	
8	Current transponder is readable and writable
9	Transponder is in the reading area
10	Transponder code can be read
11	Differential signal is negative (LEDs are green)
12	PosiPulse (LEDs are white)
13	
14	
15	

Table 12 *Status 2*

Bit	Daten
1	At the sum signal a valid transponder code can be decoded
2	At the difference signal a valid transponder code can be decoded

10.3 Variant HG G-71915ZA: CAN-Bus

10.3.1 CAN Basics

The CAN or CANopen® configuration is structured according to ISO 11898 or EN 50325-4. As an aid, important terms and abbreviations are explained in this chapter. For more detailed information, you can refer to the standards.

The technical specifications of the CANopen® standard can be downloaded from the following link after a free registration:

http://www.can-cia.org/en/standardization/technical-documents/

Note that a CAN identifier or, in the case of CANopen®, the combination of CAN identifier and node identifier must always be unique!

10.3.2 CAN 2.0A und CAN 2.0B

CAN 2.0A (Basic, 11 bit identifier) or CAN 2.0B (Extended, 29 bit identifier) can be configured. The CAN parameters can be set via the service interface (see section 9.2.3.1 on page 37). Standard or Extended frames are sent and received (adjustable). The bit timing as well as the identifier can be set via the service interface.

3 different CAN Message Objects can be sent and 1 can be received. It is configurable whether telegrams are issued permanently with the adjustable update rate or only when a transponder is in the field.

The objects are activated by entering an address other than 0 in the CAN menu (see section 9.2.3.1 on page 37).

10.3.2.1 Reception Box Transponder Programming (Vehicle Controller –> Transponder Antenna)

Length: 4 Byte

Table 13 *CAN Basic: Structure of the reception box transponder programming*

Byte	Data
1	New transponder code (bit 0 - 7)
2	New transponder code (bit 8 - 15)
3	New transponder code (bit 16 - 23)
4	New transponder code (bit 24 - 31)

Used to program a new transponder code. The programming procedure is described in chapter 11 on page 56.

10.3.2.2 Transmission Box 1 PosiPulse (Transponder Antenna –> Vehicle Controller)

Length: 0 Byte

No data, signals a Posipulse.

With the help of this telegram, e.g. a PLC can detect a PosiPulse via the CAN bus without having to connect the corresponding output of the POWER connector.

10.3.2.3 Transmission Box 2 Status & Code (Transponder Antenna –> Vehicle Controller)

Length: 7 Byte

Table 14 *CAN Basic: Structure of the transmission box 2 Status & Code*

Byte	Data	
1	Status 1 (Bit 0 - 7)	See Table 11 on page 42
2	Status 1 (Bit 8 - 15)	
3	Transponder code (Bit 0 - 7)	
4	Transponder code (Bit 8 - 15)	
5	Transponder code (Bit 16 - 23)	
6	Transponder code (Bit 24 - 31)	
7	Number of code readings since the last transponder crossing	

10.3.2.4 Transmission Box 3 Level & Counter (Transponder Antenna –> Vehicle Controller)

Length: 8 Byte

Table 15 *CAN Basic: Structure of transmission box 3 Level & Counter*

Byte	Data
1	Level sum signal (bit 0 - 7)
2	Level sum signal (bit 8 - 15)
3	Level difference signal (bit 0 - 7, signed/two's complement)
4	Level difference signal (bit 8 - 15, signed/two's complement)
5	Counter for valid code readings
6	Counter for faulty readings of the sum signal
7	Counter for faulty readings of the difference signal
8	Status 2 (see Table 12 on page 42)

10.3.3 CANopen®

In addition to Basic CAN, CANopen® (DS 401) is available for selection. The measured values of the system (transponder code, status, etc.) are transmitted via so-called TPDOs. The CAN identifiers are derived from the node address (1..127).

Table 16 *Definitions CANopen®*

Abkürzung	Name	Bedeutung
PDO	Process data object	Maximum 8 bytes process data
TPDO	Transmit PDO	The process data sent by a device
RPDO	Receive PDO	The process data received by a device
SDO	Service data objects	Used to read and write device parameters. No size limit.
Sync	Synchronization telegram	Bus-wide telegram sent by the CANopen® master
–	CAN-Identifier	The address on which a PDO, SDO is sent
–	Node ID	For CANopen® the address of the device, which is added to the CAN identifier

10.3.3.1 Operating Modes and States

Table 17 *CANopen®: Parameter PDO operating mode*

Value	cyclic	acyclic	synchro-nous	asynchro-nous	only on request (RTR)
0		x	x		
1-240	x		x		
241-251	reserved				
252			x		x
253				x	x
254				x	
255				x	

Note that not every device supports every operating mode. Devices from Götting normally support the operating modes 1 to 240 and 255.

Table 18 *CANopen®: PDO operating modes*

Operating mode	Explanation
Cyclic	Data is transmitted every nth sync telegram
Acylic	Transmits if an event has occurred since the last Sync telegram
Synchronous	Data is transmitted after receipt of a sync telegram
Asynchronous	Data is transmitted event-driven
RTR	Only on request by a remote frame
Inhibit Time	Minimum time period which has to pass before the next transmis-sion of the same PDO
Event Time	Triggers an event on expiry. Is re-started after each event.

Table 19 *CANopen® Operation mode*

Name	Maaning
Stopped	Only network management services executable
Pre-Operational	Full configuration possible, no sending of PDOs
Operational	Full configuration possible, set PDOs are sent

10.3.3.2 EDS File

For Götting devices that support CANopen®, EDS files (Electronic Data Sheet) are available for download on the Götting KG website. The complete configuration is stored in these files. The current version of the EDS file for the transponder antenna can be downloaded from our Internet server at the following address:

http://www.goetting-agv.com/components/71915

To access EDS files, you can e.g. use CANopen Magic from PEAK System.

http://www.canopenmagic.com

10.3.3.3 Presettings

The CAN baud rate and the node ID can be changed using the service interface (see section 9.2.3 on page 37).

10.3.3.4 Description of the Process Data Objects (PDO)

The measured values are assigned to fixed positions in the PDO, dynamic mapping is not supported. You can set the PDO operating mode to cyclic, synchronous or asynchronous. To avoid a too high bus load by constant changes in the asynchronous operation mode with non-cyclic transmission (Event-Time = 0), you can set the so-called Inhibit Time in the CAN menu of the monitor program. The PDO can also be transmitted cyclically. For this you must select the Event-Time accordingly and enter 0 for the Inhibit Time.

You can permanently deactivate a TxPDO by selecting the asynchronous operating mode (255) with Inhibit-Time = 0, Event_time = 0 and saving the parameters. In addition, you can temporarily de-/activate a TxPDO by setting or deleting the most significant bit in the associated PDO COB identifier, e.g. [1800,01].

10.3.3.5 TxPDO_1 Status & Code (Transponder Antenna –> Vehicle Controller)

Length: 7 Byte

TxPDO_1 is transmitted with identifier 0x180 + node address.

Table 20 *CANopen®: Structure of TxPDO_1 Status & Code*

Byte	Type	Data	
1	Unsigned 16	Status 1 (bit 0 - 7)	See Table 11 on page 42
2		Status 1 (bit 8 - 15)	
3	Unsigned 32	Transponder code (bit 0 - 7)	
4		Transponder code (bit 8 - 15)	
5		Transponder code (bit 16 - 23)	
6		Transponder code (bit 24 - 31)	
7	Unsigned 8	Number of code readings since the last transponder crossing	

10.3.3.6 TxPDO_2 Level & Counter (Transponder Antenna –> Vehicle Controller)

Length: 8 Byte

TxPDO_2 is transmitted with identifier 0x280 + node address.

Table 21 *CANopen®: Structure of TxPDO_2 Level & Counter*

Byte	Type	Data
1	Unsigned 16	Level sum signal (bit 0 - 7)
2		Level sum signal (bit 8 - 15)
3	Signed 16	Level difference signal (bit 0 - 7, signed/two's complement)

Table 21 *CANopen®: Structure of TxPDO_2 Level & Counter*

Byte	Type	Data
4	Signed 16	Level difference signal (bit 8 - 15, signed/two's complement)
5	Unsigned 8	Debug counter
6	Unsigned 8	Counter for faulty readings of the sum signal
7	Unsigned 8	Counter for faulty readings of the difference signal
9	Unsigned 8	Status 2 (see Table 12 on page 42)

10.3.3.7 RxPDO_1 Transponder Programming (Vehicle Controller –> Transponder Antenna)

Length: 4 Byte

Table 22 *CANopen®: Structure of RxPDO_1 transponder programming*

Byte	Type	Data
1	Unsigned 32	New transponder code (bit 0 - 7)
2		New transponder code (bit 8 - 15)
3		New transponder code (bit 16 - 23)
4		New transponder code (bit 24 - 31)

Used to program a new transponder code. The programming procedure is described in chapter 11 on page 56.

10.3.3.8 Heartbeat

The device supports the heartbeat mode. If in the CANopen® menu (see section 9.2.3.2 on page 38) a heartbeat time > 0 is set, with each expiration of the heartbeat timer the device state is sent under the identifier 0x700 + node address.

Table 23 *CANopen®: Codes of the heartbeat modes*

Device state	Code
stopped	0x04
preoperational	0x7f
operational	0x05

10.3.3.9 Description of the Service Data Objects (SDOs)

The service data object is used for accessing the object directory. An SDO is transmitted acknowledged, i.e. each reception of a message is acknowledged. The identifiers for read and write access are:

Table 24 *CANopen®: Identifier for read and write access*

Read access	0x600 + node address
Write access	0x580 + node address

The SDO telegrams are described in the CiA standard DS-301. The error codes due to faulty communication are listed in the following table:

Table 25 *CANopen@: Possible SDO error codes*

Name	Number	Meaning
SDO_ABORT_UNSUPPORTED	0x06010000	Unsupported access to an object
SDO_ABORT_NOT_EXISTS	0x06020000	Object not implemented
SDO_ABORT_READONLY	0x06010002	Write access to a readonly object
SDO_ABORT_SIGNATURE	0x08000020	When saving or loading parameters, the "save" or "load" signature was not used.
SDO_ABORT_PARA_VALUE	0x06090030	Parameter value range exceeded
SDO_ABORT_PARA_TO_HIGH	0x06090031	Parameter value too high

10.3.3.10 Object Directory

All objects of the antenna are listed in the CANopen® Object Index. Each entry is a 16-bit index. Sub components are identified by an 8-bit subindex. RO indicates entries that are read only.

- Communication parameters are marked by a C.
- Manufacture parameters are marked by an M.

The object directory is divided into the following sections:

Table 26 *CANopen® object directory: Communication specific entries in the range 0x1000 to 0x1FFF (part 1 of 2)*

Index	Sub Index	Access	Content
0x1000	0	RO	Device Type
0x1001	0	RO	Error Register
0x1005	0	RO	COB ID Sync Message
0x1008	0	RO	Manufacturer Device Name
0x1009	0	RO	Manufacturer Hardware Version
0x100A	0	RO	Manufacturer Software Version
0x1017	0	RW	Producer Heartbeat Time
0x1018	0	RO	Number of entries of Identity Object
	1	RO	Vendor ID
	2	RO	Product Code
	3	RO	Revision
0x1600	0	RO	Number of Objects mapped to RxPDO_1
	1	RO	Specification of Appl. Object 1
0x1800	0	RO	Number of entries of TxPDO_1
	1	RW***)**	COB-ID
	2	RO	Transmission Type
	3	RW	Inhibit Time
	5	RW	Event Time

Table 26 *CANopen® object directory: Communication specific entries in the range 0x1000 to 0x1FFF (part 2 of 2)*

Index	Sub Index	Access	Content
0x1801	0	RO	Number of entries of TxPDO_2
	1	RW*)	COB-ID
	2	RO	Transmission Type
	3	RW	Inhibit Time
	5	RW	Event Time
0x1A00	0	RO	Number of Objects mapped to TxPDO_1
	1	RO	Specification of Appl. Object 1
	2	RO	Specification of Appl. Object 2
	3	RO	Specification of Appl. Object 3
0x1A01	0	RO	Number of Objects mapped to TxPDO_2
	1	RO	Specification of Appl. Object 1
	2	RO	Specification of Appl. Object 2
	3	RO	Specification of Appl. Object 3
	4	RO	Specification of Appl. Object 4
	5	RO	Specification of Appl. Object 5
	6	RO	Specification of Appl. Object 6
*) Only the highest bit may be changed to temporarily (de)activate the PDO			

Table 27 *CANopen®: Standardized device profile range 0x6000 bis 0x6400*

Index	Sub Index	Access	Content
0x6000	0	RO	Number of 8 Bit Inputs (Digital)
	1	RO	Number of Code Readings of the last Transponder Crossing
	2	RO	Debug Counter
	3	RO	Counter for faulty readings of the sum signal
	4	RO	Counter for faulty readings of the difference signal
	5	RO	Status 2
0x6100	0	RO	Number of 16 Bit Inputs (Digital)
	1	RO	Status 1
0x6120	0	RO	Number of 32 Bit Inputs (Digital)
	1	RO	Transponder Code
0x6320	0	RO	Number of 32 Bit Inputs (Digital)
	1	RO	New Transponder Code
0x6401	0	RO	Number of 16 Bit Inputs (Analog)
	1	RO	Level Sum Signal
	2	RO	Level Difference Signal

10.3.3.11 CANopen® Directory

Table 28 *CANopen®: Device Type*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1000	00	Device Type	Unsigned 32	RO	No	0x00010191	Digital Inputs - DS 401

Table 29 *CANopen®: Error Register*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1001	00	Error Register	Unsigned 8	RO	No	0x00	Error Register

Table 30 *CANopen®: COB-ID SYNC message*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1005	00	COB-ID SYNC	Unsigned 32	RO	No	0x80000080	Sync Consumer, Sync ID = 0x80

Table 31 *CANopen®: Manufacturer Device Name*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1008	00	Manufacturer Device Name	Visible String	RO	No	7191	Gerätebezeichnung

Table 32 *CANopen®: Manufacturer Hardware Version*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1009	00	Manufacturer Hardware Version	Visible String	RO	No	A6	Boardversion

Table 33 *CANopen®: Manufacturer Software Version*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x100A	00	Manufacturer Software Version	Visible String	RO	No	1.43	Software version

Table 34 *CANopen®: Producer Heartbeat Time*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1017	00	Producer Heartbeat Time	Unsigned 16	RW	No	1000	Heartbeat-Zeit in ms (approx.)

If 0 is entered for the time, this function is switched off.

Table 35 *CANopen®: Identity Object*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1018	00	Identity Object	Unsigned 8	RO	No	0x03	Number of sub indexes
	01	Vendor ID	Unsigned 32	RO	No	0x00000202	Manufacturer number given by CiA
	02	Product Code	Unsigned 32	RO	No	0x00071915	HG number 71915
	03	Revision	Unsigned 32	RO	No	0x00000001	Version 1

Table 36 *CANopen®: RxPDO_1 Parameter*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1600	00	Number of mapped objects	Unsigned 8	RO	No	1	Number of sub indexes
	01	1st mapped object	Unsigned 32	RO	No	0x63200120	Mapped on index 0x6320.01 with 32 bit length

Table 37 *CANopen®: TxPDO_1 Parameter*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1800	00	TxPDO Parameter	Unsigned 8	RO	No	0x05	Number of sub indexes
	01	COB ID	Unsigned 32	RW***)**	No	0x40000180 + Node-ID	PDO_1 valid, ID = 0x180 + Node-ID
	02	Transmission Type	Unsigned 8	RW	No	1..240,255	Synchronous or asynchronous
	03	Inhibit Time	Unsigned 16	RW	No	10	Shortest time between transmissions in ms
	04	Dummy					
	05	Event Time	Unsigned 16	RW	No	100	Cycle time in ms

***)** Here only the highest bit can be changed to (de)activate the PDO temporarily.

Table 38 *CANopen®: TxPDO_2 Parameter*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1801	00	TxPDO Parameter	Unsigned 8	RO	No	0x05	Number of sub indexes
	01	COB ID	Unsigned 32	RW*)	No	0x40000180 + Node-ID	PDO_2 valid, ID = 0x280 + Node-ID
	02	Transmission Type	Unsigned 8	RW	No	1..240,255	Synchronous or asynchronous
	03	Inhibit Time	Unsigned 16	RW	No	10	Shortest time between transmissions in ms
	04	Dummy					
	05	Event Time	Unsigned 16	RW	No	100	Cycle time in ms
*) Here only the highest bit can be changed to (de)activate the PDO temporarily.							

Table 39 *CANopen®: Mapping TxPDO_1*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1A00	00	number of mapped objects	Unsigned 8	RO	No	3	Number of sub indexes
	01	1st mapped object	Unsigned 16	RO	No	0x61000110	Mapped to Index 0x6100.01 with 16 Bit lebgth
	02	2nd mapped object	Unsigned 32	RO	No	0x61200120	Mapped to Index 0x6120.01 with 32 Bit length
	03	3rd mapped object	Unsigned 8	RO	No	0x60000108	Mapped to Index 0x6000.01 with 8 Bit length

Table 40 *CANopen®: Mapping TxPDO_2*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x1A01	00	number of mapped objects	Unsigned 8	RO	No	6	Number of sub indexes
	01	1st mapped object	Unsigned 16	RO	No	0x64010110	Mapped to Index 0x6401.01 with 16 Bit length
	02	2nd mapped object	Unsigned 16	RO	No	0x64010210	Mapped to Index 0x6401.02 with 16 Bit length
	03	3rd mapped object	Unsigned 8	RO	No	0x60000208	Mapped to Index 0x6000.02 with 8 Bit length
	04	4th mapped object	Unsigned 8	RO	No	0x60000308	Mapped to Index 0x6000.03 with 8 Bit length
	05	5th mapped object	Unsigned 8	RO	No	0x60000408	Mapped to Index 0x6000.04 with 8 Bit length
	05	56th mapped object	Unsigned 8	RO	No	0x60000508	Mapped to Index 0x6000.05 with 8 Bit length

Table 41 *CANopen®: 8 Bit Digital Inputs (übertragen in TxPDO 1)*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x6000	00	number of 8 bit inputs	Unsigned 8	RO	No	5	Number of 8 Bit Inputs
	01	8 bit digital input	Unsigned 8	RO	Yes		Number of code readings of the last transponder crossing
	02	8 bit digital input	Unsigned 8	RO	Yes		Debug counter
	03	8 bit digital input	Unsigned 8	RO	Yes		Counter for faulty readings of the sum signal
	04	8 bit digital input	Unsigned 8	RO	Yes		Counter for faulty readings of the difference signal
	05	8 bit digital input	Unsigned 8	RO	Yes		Status 2

Table 42 *CANopen®: 16 Bit Digital Inputs*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x6100	00	number of 16 bit digital inputs	Unsigned 8	RO	No	1	Number of digital 16 Bit Inputs
	01	16 bit digital input	Unsigned 16	RO	Yes		Status 1

Table 43 *CANopen®: 32 Bit Digital Input*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x6120	00	Number of 32 bit inputs	Unsigned 8	RO	No	1	Number of 32 Bit Inputs
	01	32 bit digital input	Unsigned 32	RO	Yes	./.	Transponder code

Table 44 *CANopen®: 32 Bit Digital Output*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x6320	00	Number of 32 bit inputs	Unsigned 8	RO	No	1	Number of 32 Bit Inputs
	01	32 bit digital output	Unsigned 32	RO	Yes	./.	New transponder code

Table 45 *CANopen®: 16 Bit Analog Inputs*

Index	Sub Index	Name	Type	Attr.	Map	Default	Meaning
0x6401	00	Number of 16 bit inputs	Unsigned 8	RO	No	2	Number of 16 Bit Inputs
	01	16 bit analog input	Unsigned 16	RO	Yes		Level sum signal
	02	16 bit analog input	Signed 16	RO	Yes		Level difference signal

10.4 Variant HG G-71915YA: PROFINET®

The PROFINET® interface is configured using the GSDML file (see section 10.4.4 on page 55).

10.4.1 Input Bytes

Table 46 *Structure of the PROFINET® Input Bytes*

Byte #	Data	
1	Status 1 (Bit 0 - 7)	see Table 11 on page 42
2	Status 1 (Bit 8 - 15)	
3	Transponder Code (Bit 0 - 7)	
4	Transponder Code (Bit 8 - 15)	
5	Transponder Code (Bit 16 - 23)	
6	Transponder Code (Bit 24 - 31)	
7	Number of Code readings	
8	Level Sum Signal (Bit 0 - 7)	
9	Level Sum Signal (Bit 8 - 15)	
10	Level Difference Signal (Bit 0 - 7, signed/two's complement)	
11	Level Difference Signal (Bit 8 - 15, signed/two's complement)	
12	Telegram Counter	

10.4.2 Output Bytes

Table 47 *Structure of the PROFINET® Output Bytes*

Byte #	Data
1	New Transponder Code (Bit 0 - 7)
2	New Transponder Code (Bit 8 - 15)
3	New Transponder Code (Bit 16 - 23)
4	New Transponder Code (Bit 24 - 31)

10.4.3 Transponder Programming

Transponders can be programmed via the INPUT bytes of the PROFINET® interface. This is described in chapter 11 on page 56.

10.4.4 GSDML File

You can download the latest version of the GSDML file for the PROFINET® configuration from our Internet server.

http://www.goetting-agv.com/components/71915

11 Transponder Programming

✓ The prerequisite for programming is always that there is exactly one compatible transponder in the antenna field.

There are two ways to program a new code into a transponder:

1. Via the service interface.
2. Via the bus interface, depending on the antenna variant CAN (HG G-71915ZA) or PROFINET® (HG G-71915YA).

11.1 Programming via the service interface

The procedure is described in section 9.2.5 on page 39.

11.2 Programming via the bus interface

The procedure for programming via the bus interface is the same for CAN and PROFINET®.

In order to trigger the programming process:

✓ There is a compatible transponder in the antenna field.

✓ The code to be programmed in the input bytes of the bus interface changes. The change of the code is the signal for the antenna to perform a programming process.

✓ The new code in the input bytes differs from the code currently stored in the transponder.

▶ If all conditions are met, the antenna programs the transponder with the new code. This takes approx. 50 ms. Via Status 1 it can be checked whether the transponder sends the new code.

As soon as the new code is received via Status 1, the programming process is finished.

As long as the code in the input bytes does not change, further transponders that come into the antenna field, e.g. when a vehicle moves, are not reprogrammed.

After an antenna reset, the code 0000 is in the memory of the antenna. If the code 0000 is to be programmed, it is recommended to send another code and then send the 0000 again.

In the case that another transponder is to be programmed with the same code, a different code must be transmitted in the meantime via the input bytes and then the original code again. Both code changes trigger a programming process.

12 Updating the Antenna Firmware

First call up the service interface (see section 9.1 on page 33).

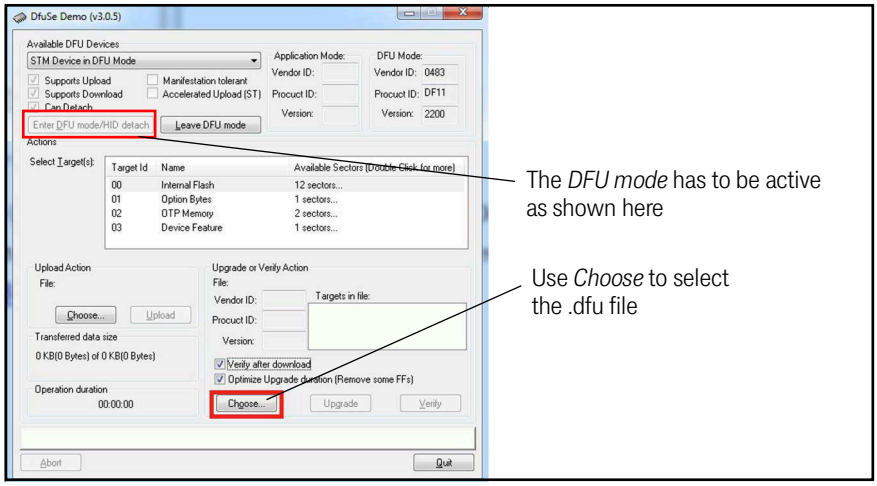
- Set the device to DFU mode (Device Firmware Upgrade) by pressing the U key.
- Close the connection via the COM port in the terminal program (hang up/ disconnect).

For the further steps the firmware as *.dfu* file, as well as the software *DfuSe* from ST Microelectronics is needed. The firmware file is available on request from Götting KG. The *DfuSE* software can be downloaded at the following address:

http://www.st.com/en/development-tools/stsw-stm32080.html

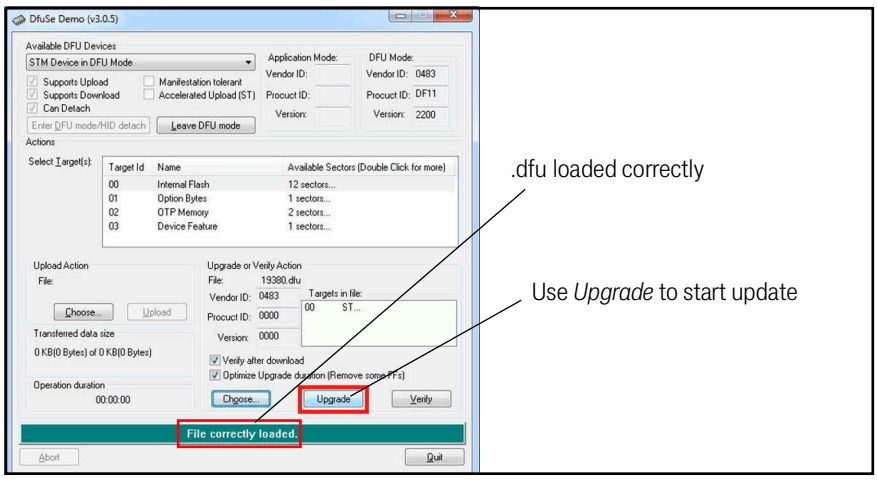
- Download *DfuSE*, install the program and start it. It starts in Demo GUI mode, which is sufficient for the firmware update.
- Use *Choose* to select the *.dfu* firmware update file provided by Götting KG.

Figure 26 *Firmware update – file selection*



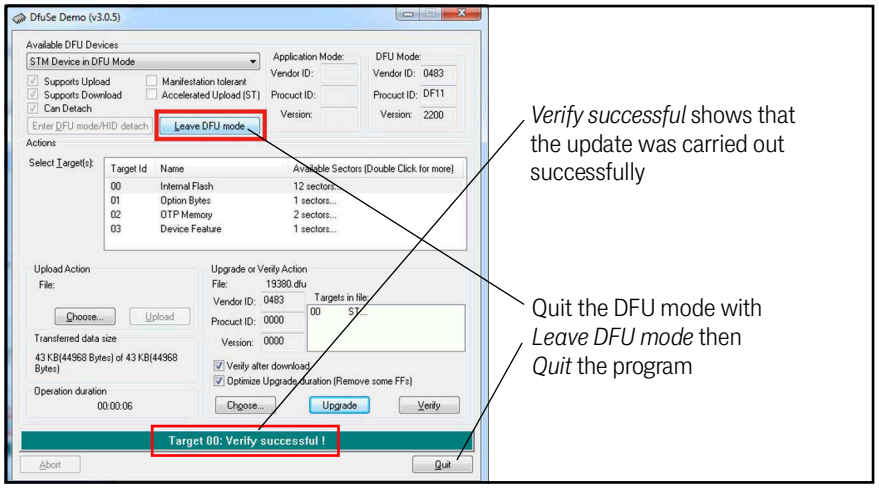
- If the file was loaded correctly (display: *File correctly loaded*) execute the firmware update via *Upgrade*.

Figure 27 *Firmware update – starting the upgrade*



- After successful update (display: *Verify successful*) the DFU mode can be left via *Leave DFU mode* and the program can be closed.

Figure 28 *Firmware update – leave DFU mode*



Afterwards, the connection can be re-established in the terminal program and the main menu of the service interface can be called up.

13 Maintenance

The system is largely maintenance-free. The maintenance is limited to

- the visual inspection of the antennas (tight fit of all screws, cables and plugs properly fastened).
- cleaning the antenna if it is dirty.

New firmware files are only provided by Götting KG if necessary. If you have received a firmware update from us:

- ▶ Check the version of the current antenna software in the main menu (see section 9.2.1 on page 34).
- ▶ If necessary, update the operating software (see section 9.2.8 on page 40 and chapter 12 on page 57).

14 Disposal

- Dispose of the transponder antenna in accordance with the legal requirements of your country.

For EU countries only:

- Do not dispose of the transponder antenna in household waste. Collect used electrical equipment separately in compliance with European Directive 2012/19/EU on Waste Electrical and Electronic Equipment and recycle it in an environmentally friendly manner via a local recycling company

15 Troubleshooting

In the following you will find a tabular list of possible errors. A possible cause is given for each error in the second column. In the third column, you will find instructions on how to narrow down the error and, ideally, how to correct it.

- If you are unable to correct an error, please use the table to narrow it down as precisely as possible (type of malfunction, time of occurrence) before contacting us. You will find the address of Götting KG on the back of these instructions.

15.1 Error Table

Table 48 *Error table (part 1 of 2)*

Error		Possible cause(s)	Possible Diagnosis/Remedy
1.	– No system function – No output, although there is a transponder within the detection range	Voltage supply too low	Measure the input voltage
2.	– Output values not reproducible – lack of accuracy – faulty positioning pulses	Interference	– Check the Sum value in the service interface (see 9.2.1 on page 34). If this is not below approx. 100 without a transponder in the detection range, there could be interference frequencies in the 64 kHz range. – Set the threshold (Threshold Level, see 9.2.2 on page 36) above the interference level. A too high interference level reduces the possible traversing speed.
3.	No positioning pulse	1. Transponder defective 2. Loose cable connection 3. Interference frequencies 4. Antenna defective	5. Check the transponder (e.g. with the transponder programmer, see 3.2 on page 15). 6. Check the cable connections 7. See error 2. above 8. If you suspect a defective antenna, please contact the service department of Götting KG.
4.	Only one transponder is read, others are ignored	Interference frequencies and/or thresholds set too low	See error 2. above

Table 48 *Error table (part 2 of 2)*

Error		Possible cause(s)	Possible Diagnosis/Remedy
5.	– No BUS communication – BUS error (indicated via LEDs, see 15.2 below)	1. CAN: CAN+ interchanged with CAN-. 2. CAN: Wrong CAN protocol selected 3. CAN: Wrong parameters for CAN protocol selected 4. PROFINET®: Cable incorrectly connected 5. All variants: Internal processor error	1. Check the corresponding connections 2. Set the correct protocol or parameters using a PC and the service interface 3. Hardware defect, please contact the support of Götting KG
6.	Parameter error (indicated via LEDs, s. 15.2 below)	1. Voltage failure during save attempt 2. Internal processor error	3. Try to save the parameters again 4. Hardware defect, please contact the support of Götting KG
7.	USB error (indicated via LEDs, s. 15.2 below)	Internal processor error	Hardware defect, please contact the support of Götting KG
8.	Error internal time base (indicated via LEDs, s. 15.2 below)		

15.2 Error Codes (LEDs)

If an error occurs, all LEDs flash red cyclically. This can be used to indicate the following error situations.

Table 49 *LEDs: Blink codes for errors*

Flashing sequence *)	Meaning	Diagnossis/Remedy
✹——	BUS error	s. Table 48 above
✹-✹——	Parameter error	
✹-✹-✹——	USB error	
✹-✹-✹-✹——	Error internal time base	

*)
– ✹ = The LEDs light up red for 200 ms
– - = short pause 300 ms
– —— = long pause 1000 ms

A list of all status outputs of the antenna via the bus telegrams and the service interface can be found in Table 11 on page 42.

16 Technical Data

Table 50 *Technical Data Antenna HG G-71915-A*

Antenna HG G-71915-A	
Dimensions	160 mm x 80 mm (plus connectors) x 55 mm (B x T x H), see Figure 13 on page 27
Casing	Polycarbonate
Effective antenna area	140 x 60 mm (functional area positioning)
Weight	450 g
Protection class	IP 65
Reading distance	5 – 80 mm, depending on the transponder type in use, s. Table 51 on page 64 (distance transponder - bottom side reading antenna)
Relative humidity	95 % at 25° C (without condensation)
Temperature ranges	– Operation: -25° C to +50° C – Storage: -40° C to +85° C
Supply voltage +UB	+18 VDC to +30 VDC, nominal voltage + 24 VDC
Current consumption	130 mA @ 24 VDC
Operating frequency	128 kHz
Code length	20 Bit (Trovan™)
max. crossing speed	2,0 m/s
Repeat accuracy	±2 mm at 0.5 m/s with interference-free environment
Outputs	– Via bus telegrams: Transponder code and PosiPulse PROFINET® or CAN, depending on the antenna variant – Digital output: PosiPulse +UB / 20 mA current source, configurable duration
Connectors	– 3x M12 circular connectors, pin allocation see section 7.2 on page 23 – ables for several – interfaces available as Götting accessories (see section 3.1 on page 14)
Configuration	Via USB service interface in connector X1, USB Virtual COM Por
EMC	see Table 52 on page 64
Mechanical load capacity	5 g 11 ms / 2 g 10 to 55 Hz
Positioning accuracy	±3 mm on the center axis
Recurrence accuracy	2 mm
Programming duration	ca. 30 ms

16.1 Compatible Transponder Types and Reading Distances

A more detailed description of the individual transponder types can be found in Table 4 on page 14.

Table 51 *Transponder Types and Reading Distances*

Transponder Type	Description	Reading distance	Note
HG G-71325XA	Rod transponder	5 – 60 mm	
HG G-70633ZB	Glass transponder	5 – 80 mm	
HW DEV00095 / 98	Disc transponder	5 – 60 mm	
HW DEV00090 / 99	Disc transponder	5 – 60 mm	
HW DEV00130ZA / VA	Disc transponder	5 – 60 mm	
HW DEV00131ZA / VA	Disc transponder	5 – 60 mm	
HW DEV00162	Transponder credit card format	5 – 80 mm	
HG G-70650VA	Puck transponder	5 – 80 mm	read only
HG G-70652ZC	Puck transponder	5 – 80 mm	
HG G-70653ZA	Puck transponder	15 – 80 mm	read only
HG G-70654ZB	Marking nail	5 – 80 mm	read only

16.2 Electromagnetic Compatibility (EMC)

Table 52 *EMC test*

Electromagnetic compatibility (EMC)			
Testing of			Fulfilled test standard
Interference emission			
	Radio interference radiation		EN 55 022 class A
Interference resistance			
	Casing		
		Electromagnetic RF field, amplitude modulated	EN 61000-4-3
		Static electricity discharge	EN 61000-4-2
	Signal connections		
		High frequency asymmetrical	EN 61000-4-6
		Fast transients	EN 61000-4-4

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20 Document Changelog

The following table lists the revisions of this device description that have been published so far with the most important changes in each case.

Table 53 *Document changelog*

Revision	Edited by	Description of changes
01 Date: 16.07.2021	RAD/LM	Initial device description, translation of DE Rev. 03.
02 Date: 13.04.2022	RAD/LM	Based on DE Rev. 05 – Revision warning notice USB – Layout adapted to A-Products design
03 Date: 29.11.2022	RAD/LM	Minor changes according to note LM.
04 Date: 08.02.203	RAD	Changeover from HG G-71915ZA to HG G-71915-A, in addition to variant ZA (CAN) integration of variant YA (Profinet).
05 Date: 24.02.2023	RAD/GW	Conversion of CAD drawings to bitmap instead of vector after notice by GW on artifacts in the images.
06 Date: 17.08.2023	RAD/LM	Minor changes according to note LM.
07 Date: 19.10.2023	RAD/LM	– Section 1.3 CE declaration with link inserted – Code length in technical data changed from 16 to 20 bits – Chapter 20 document changelog inserted

21 Copyright and Terms of Liability

21.1 Copyright

This device description is protected by copyright. All rights reserved. Violations are subject to penal legislation of the Copyright.

21.2 Exclusion of Liability

Any information given is to be understood as system description only, but is not to be taken as guaranteed features. Any values are reference values. The product characteristics are only valid if the systems are used according to the description.

This instruction manual has been drawn up to the best of our knowledge. Installation, setup and operation of the device will be on the customer's own risk. Liability for consequential defects is excluded. We reserve the right for changes encouraging technical improvements. We also reserve the right to change the contents of this manual without having to give notice to any third party.

21.3 Trade Marks and Company Names

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Innovation through Guidance

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