

Transponder Antenna HG G-71910-C

1-dimensional, indoor

English, Revision 03

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Dev. by: WM/AK

Author(s): RAD



GÖTTING

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1

About this Document

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.

1.1 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. |

1.2 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 **L**etter **K**eys are indicated as such (for any programs of Götting KG small and capital letters are equally working).

2

Introduction

The described antenna is especially suited for vehicles in indoor areas. The electronic units are not sealed within the antenna cases, but varnished. Therefore it is possible that all important settings and adjustable values are effected after manufacturing. This leads to fair priced systems. Software updates can be effected via a serial interface.

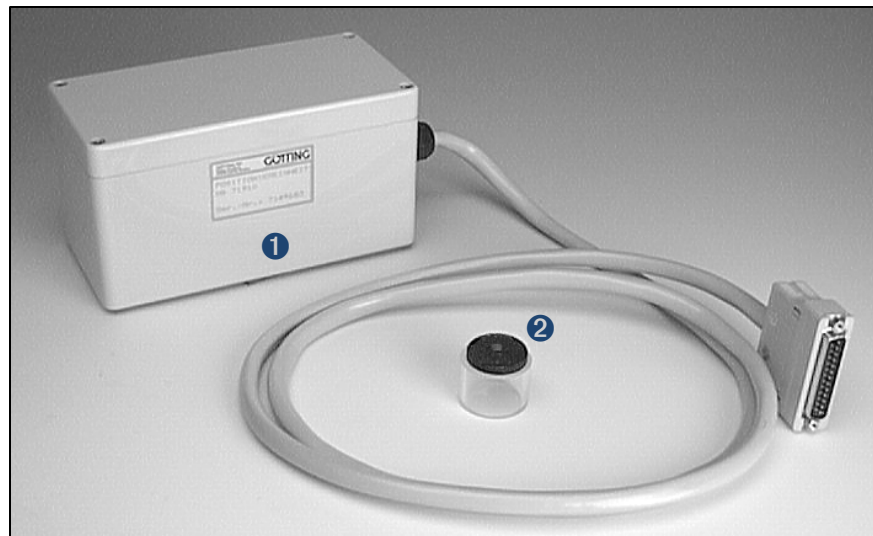
The **one-dimensional antenna HG G-71910-C** supplies the transponder code as a parallel signal as well as a midpoint crossover pulse, generated by an exactly measurable and reproducible phase alteration.

The transponders used in this system are HG G-71325 resp. HW DEV00095 (read / write). These transponders are fair priced and especially suited for the applications of this system (track guided or rail- mounted vehicles with fairly small reading distances). This manual refers to antennas with software version 1.43 or higher.

2.1 System Components

In addition to the positioning and identification antenna HG G-71910-C the following components are available:

Figure 1 System Components



1. Transceiver antenna with preamplifier and interpreter HG 71910-C (shown above is the version HG G-71910YC with a parallel interface)
2. Transponder HG G-71325 / HW DEV00095 (in the track)
3. Optional transponder programming device HG G-81830YA (not shown in picture)

2.2 Function

As the antenna passes over the transponder, it energizes the latter with an energy field of 128 kHz. So the transponder transmits his code at half of this frequency. The transponder position in relation to the antenna surface is measured by a coil with orientation in direction of travel.

The interpreter which is integrated within the antenna decodes the transponder code. Each crossing of the coordinate axis in driving direction generates a positioning pulse with an adjustable duration.

The serial output signal is a non isolated RS 232. Alternatively it is possible to use a CAN Bus. The positioning pulse is not galvanically separated but available as a +24 V (20 mA) operational voltage switched output. Optional a 15 bit parallel output for the code (24 Volt switched, non current limiting) can be effected.

Additionally transponders can be programmed. In order to do so the transponder has to stay in the antenna field for a minimum of 30 ms after the programming has been started.

3

Mounting

3.1 Metal-free Areas Around Transponder and Antenna

Metal close to transponder and antenna influences the range and accuracy of the reading system. We deal with the following cases:

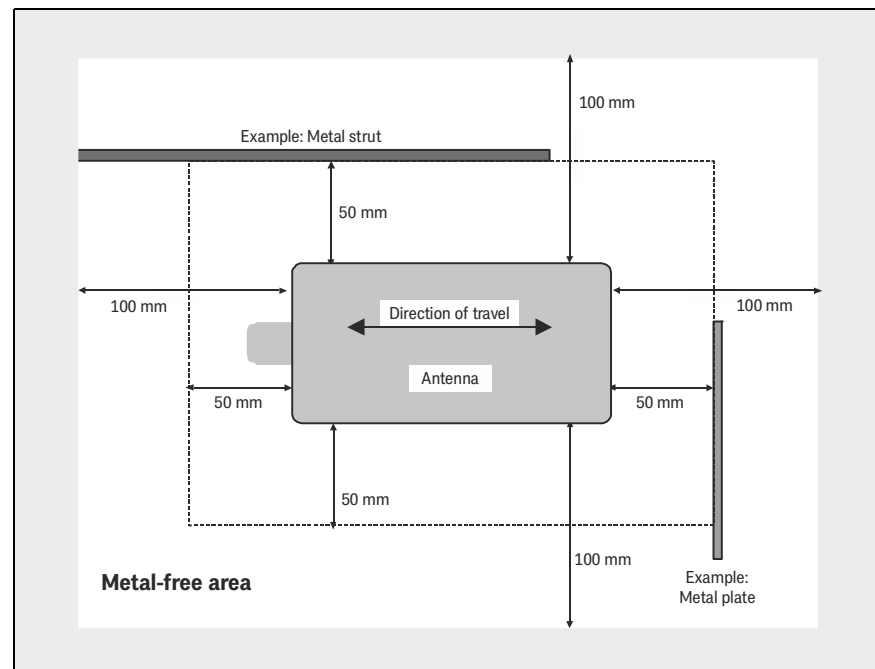
1. Smaller metallic structures that do not form a loop.
2. Closed metallic structures or smaller metallic structures that form loops.

The following minimum distances apply.

3.1.1 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.

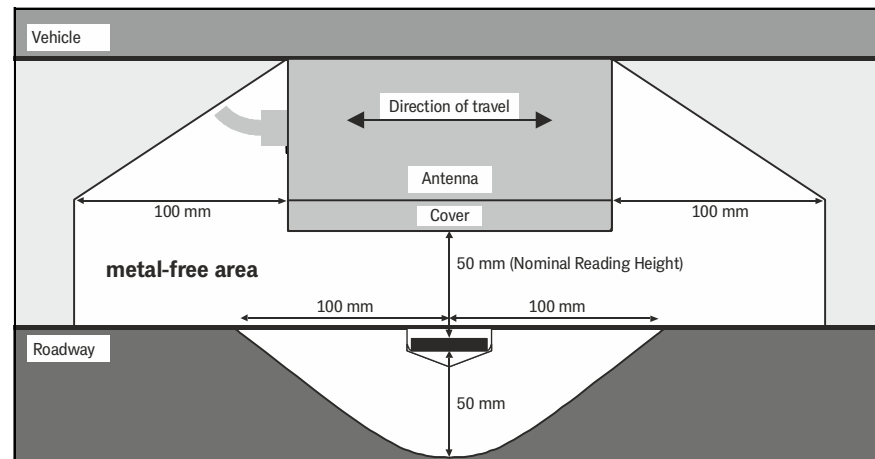
Figure 2 Metal-free space around the antenna for smaller metallic structures, top view



3.1.2 Closed Metallic Structures or Smaller Metallic Structures That Form Loops

The antenna can be mounted directly onto metal with its bottom. The following minimum distances for closed metallic and electrically conductive structures apply from the cover on the reading side.

Figure 3 Metal-free space around antenna and transponder with closed metallic structures or loops, side view (in the example: transponder in the roadway)



i Power cables (e.g. for charging stations) must not be installed in this area around the transponders, as any pulses could make code reading difficult or falsify the code!

3.2 Transponder

The maximum reading distance for all transponders can only be achieved when the minimum distance to metal surfaces is maintained. To clarify the configuration, it is essential to carry out tests!

As mentioned above, it is recommendable to maintain the minimum distances within the metal-free area (section 3.1.2 above). The impact on positioning accuracy and range also depends on the size and distance of metal parts.

Mounting possibilities for transponders:

- ♦ On the road surface.
- ♦ Flush in the carriageway with sealing compound.

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

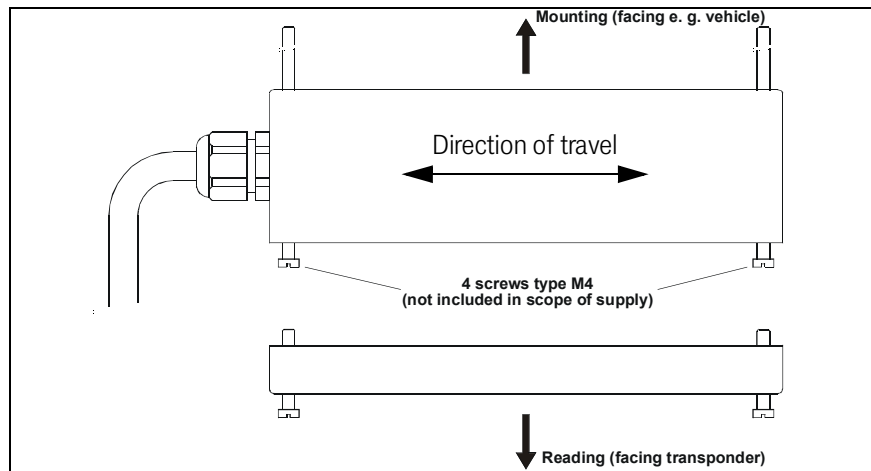
3.3 Antenna HG 71910-C

When mounting the antenna, first remove the cover. Inside there are four predrilled holes for 4 M4 screws. The antenna can be mounted directly onto a metal surface (e.g. the vehicle's underside).



Make sure that the antenna is mounted correctly with regard to its reading side!

Figure 4 Mounting possibilities for the antenna



In order to prevent any adverse effects on the system:

- ✓ The space around the antenna should be metal-free, see section 3.1 on page 9.
- ✓ Do not operate the reading antenna while the upper side (reading side) is located directly above a metal surface, as this would de-tune the antenna severely in such a way that the power consumption of the output stage would increase considerably.
- ✓ For an undisturbed operation of the transponder system it is essential that there are no interfering signals in the frequency range of 64 ± 4 kHz (e.g. pulsed engines, etc)!

4

Installation / Commissioning



Check the operating voltage before connecting! Although the RS 232 interface reacts largely insensitive to interferences, the cable should not lie directly beside power supply cables.

Connect all necessary cables. For the next commissioning steps connect a Laptop with the antenna. Then start the monitor program as described in section 6.3 on page 34.

Default values By default the system uses the values from the first file (`Mon3964r.txt`; as listed in section 6.3.1 on page 34) at 9,600 Baud. Please keep in mind, that another user might have changed those settings inside the antenna.

1. **Move a transponder into reception range.**

The voltage **S** should increase significantly. The code should be detected immediately and the number of readings have to be continuously counted up to 255. When moving the transponder in driving direction over the center axis of the antenna, a positioning pulse should be generated.

2. **Remove the transponder.**

The voltage **S** should decrease to very small values if there is no transponder within the field. The code display must disappear; the display of the number of readings will be preserved. If this is not the case, there are interferences in the frequency band of 64 kHz.

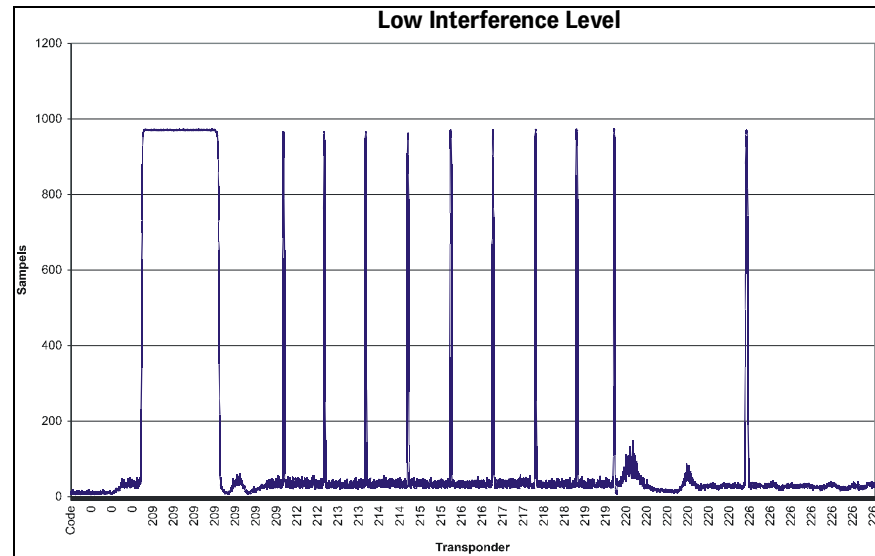
If no errors have occurred, exit the monitor program. Don't forget to save altered values. If certain parameters have been altered, a system reset will be necessary (switch off and reactivate the antenna) as mentioned in the corresponding sections of the monitor program (described in section 6.3).

Afterwards it is recommended to log a full trip through the site. Depending on the antenna variant there are different possibilities available to do so:

- ♦ Parallel Interface (antenna versions V, X, Y)
Here the serial interface can be used for logging (see section 6.3.2.6 on page 42).
- ♦ CAN-Bus (antenna version Z)
Here the serial interface (see section 6.3.2.6 on page 42) as well as the CAN-Bus Message Object 3 (see section 5.2.2.3.4 on page 22) can be used for logging.
- ♦ Serial Interface (antenna version U, Z)
Since the same serial interface is used for logging and user data output (version Z only when the serial interface is chosen, see above), you have to operate the vehicle in manual mode.

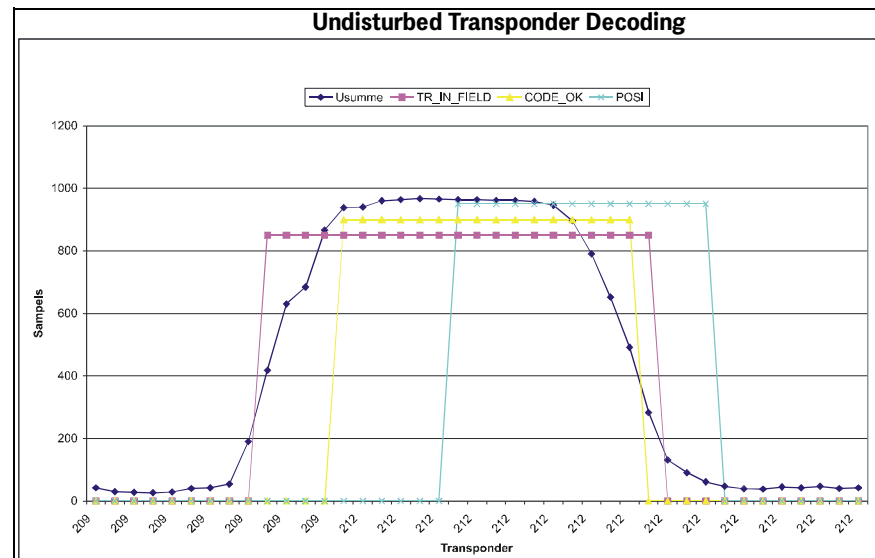
The following diagrams show examples of logged system data:

Figure 5 *Diagram: Commissioning Protocol / insignificant interference level; shown is the sum voltage over the travelled distance*



The above diagram shows the sum voltage (in units) over the travelled distance. The noise is in this case approx. 50 units, the transponder signal approx. 950 units. The transponder decoding is perfect, as also shown in the following diagram:

Figure 6 *Diagram: Commissioning Protocol / undisturbed Transponder decoding*

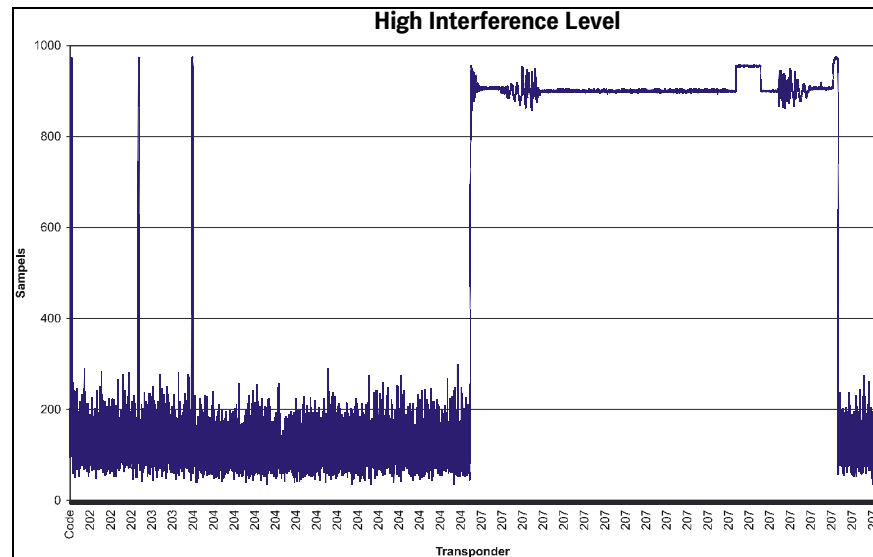


During each transponder crossing, the sum voltage increases initially. Once the threshold **Threshold for Decoding** has been exceeded, the bit **TRANS_IN_FIELD** is set. Following $4 \times 8 \text{ ms}$ ($= 4$ data points) the transponder code is decoded. The duration depends on the setting for **Number of Equal Codes** within the menu **Time & Code**. In this example, this parameter is $= 2$, i. e. the newly received code is compared to two codes which were already received.

Once the center of the antenna has been crossed, the **POSI Pulse** is generated. Its duration is adjustable. The bits **TRANS_IN_FIELD** and **CODE_OK** are deleted, whenever the sum voltage falls below the value for **Threshold for Decoding**. In the shown example there is spare time of $6 \times 8 \text{ ms}$ for the generation of the **POSI-Pulse**. The velocity of crossing was 1.1 m/s (180 mm antenna length / $(20 \times 8 \text{ ms})$).

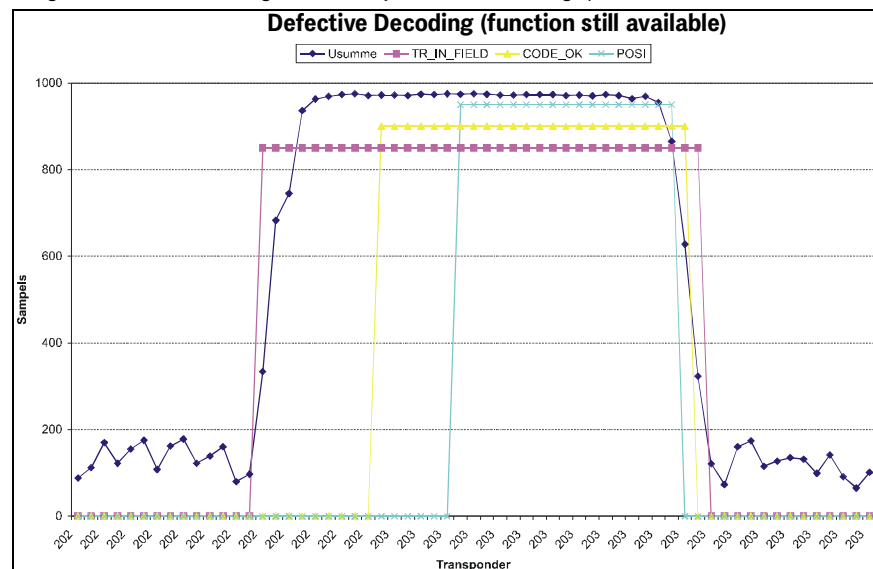
The following diagrams show the influences of high interference levels on the antenna performance.

Figure 7 Diagram: Commissioning Protocol / high interference level; shown is the sum voltage over the traveled distance



The interference level reaches up to 300 units. At transponder 207 the noise is at such a level that it even influences the transponder signal. As a result it takes 9 x 8 ms until the transponder 207 is decoded (see Figure 8 on page 14). For the slow crossing speed 0.5 m/s [140 mm / (33 x 8 m/s)] it is still sufficient for generating a POSI Pulse, but at high speed it would no longer be possible to decode this transponder with 3 m/s.

Figure 8 Diagram: Commissioning Protocol / jammed decoding (function still ensured)



The following diagram shows a case in which false POSI Pulses are generated through wrong parameters for Threshold for Decoding and/or Threshold for Positioning.

5

Components and Operation

5.1 Components in the Ground: Transponders

As reference markers transponders of the types HG G-71325 or HW DEV00095 can be used. Please refer to the corresponding data sheets to get more information about these transponders.

Range and accuracy of the system are influenced by:

- ♦ any large metal pieces (sheets) on the ground
- ♦ proximity of any floor reinforcement (see chapter 3 „Mounting“ on page 9, section 3.2 „Transponder“ on page 10)
- ♦ Inductive loops, as they are created e.g. by steel building mats have a great influence. Individual metal poles have little effect. Those may be partly within the metal-free area (see Figure 3 on page 10)
- ♦ Cable with pulsed currents with spectral parts between 64 kHz \pm 4 kHz.

The following environmental conditions have no effect on the system:

- ♦ Snow, ice, water
- ♦ Oil, tar, earth, dirt, etc.

Code structure

The system decodes and outputs the entire code string of 20 bits; when using the parallel interface only the 15 lowest bits are output. The data protection within the transponders is done by line (of 3 bit each) and column parity. To achieve a better data protection, it is therefore recommended to implement an additional code check. The transmission duration for one complete telegram is 8 ms.

5.2 Transponder Antenna (Versions)

Figure 10 Positioning antenna HG G-71910-C (version HG 71910YC with parallel interface)



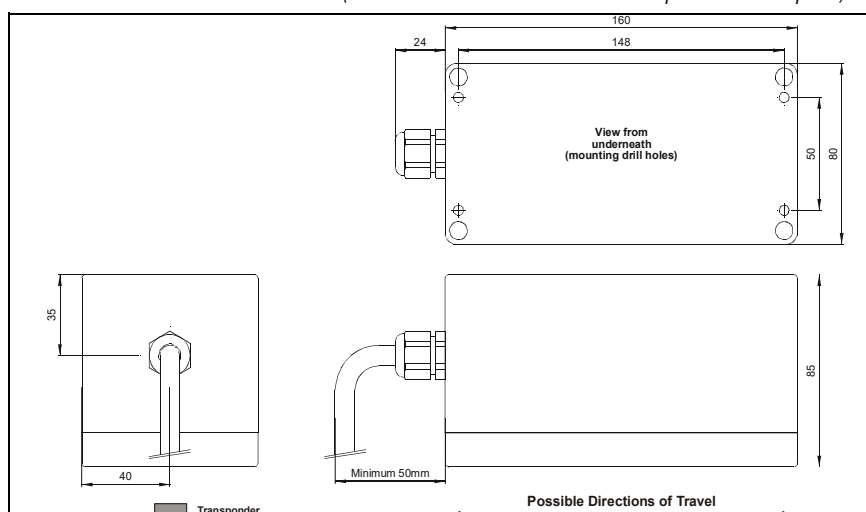
The antenna and interpreter electronics are housed in a 160 x 80 x 85 mm casing. The reading area is the upper side of the housing. The cover is located on top of the casing. The following table lists the available variants of the antenna with their respective interfaces and cable connections:

Table 2 Overview variants antenna HG G-71910-C

| Variant | Description |
|------------|--|
| HG G-71910 | ZC Serial interface and CAN-Bus on the narrow side of the antenna (Binder female connector 723 series) |
| | YC Parallel interface, cable entry on the narrow side of the antenna (25-pol. SUB-D male connector) |
| | XC Parallel interface, cable entry on the side of the antenna (25-pol. SUB-D male connector) |
| | VC Parallel interface, male connector on the narrow side of the antenna (25-pol. SUB-D male connector) |
| | UC Serial interface, cable entry on the narrow side of the antenna (Hirschmann male connector GO 51 WF) |



Drawings of all variants can be found in section 9.6 on page 51.

Figure 11 Outline antenna HG G-71910-C (version HG G-71910YC with a parallel interface)

5.2.1 Plug / Pin assignment

5.2.1.1 Connection plan of the 7-pin-socket (HG 71910ZC)

The allocation of the contacts is as follows:

Table 3 HG G-71910ZC: Connection plan of the 7-pin Binder antenna socket

| Contact | Description |
|---------|--------------|
| 1 | +24 V |
| 2 | GND |
| 3 | CAN H |
| 4 | CAN L |
| 5 | POSI |
| 6 | TxD (RS 232) |
| 7 | RxD (RS 232) |

5.2.1.2 Connection plan of the alternative 26-pin flat band round cable / of the SUB-D connector (HG G-71910YC/XC/VC)



The metal parts of the Sub-D connector are connected to the shielding of the cable.


Table 4 HG G-71910YC/XC/VC: Connection plan of the 26-pin flat band round cable / of the SUB-D connector

| Contact # (SUB-D) | Core # (cable) | Description | Contact # (SUB-D) | Core # (cable) | Description |
|-------------------|----------------|-------------|-------------------|----------------|-------------|
| 1 | 1 | Data Ready | 14 | 2 | D14 |
| 2 | 3 | D13 | 15 | 4 | D12 |
| 3 | 5 | D11 | 16 | 6 | D10 |
| 4 | 7 | D9 | 17 | 8 | D8 |
| 5 | 9 | D7 | 18 | 10 | D6 |
| 6 | 11 | D5 | 19 | 12 | D4 |
| 7 | 13 | D3 | 20 | 14 | D2 |
| 8 | 15 | D1 | 21 | 16 | D0 |
| 9 | 17 | TxD (RS232) | 22 | 18 | RxD (RS232) |
| 10 | 19 | POSI | 23 | 20 | Nc |
| 11 | 21 | +24V | 24 | 22 | +24V |
| 12 | 23 | GND | 25 | 24 | GND |
| 13 | 25 | Chassis | - | 26 | Chassis |

5.2.1.3 Connection Plan of the 6 Pin Hirschmann Connector (HG G-71910UC)

The allocation of the contacts is as follows:

Table 5 HG G-71910UC: Connection plan of the 6 pin Hirschmann connector

| Contact | Description |
|---|-------------|
| 1 | Shielding |
| 2 | +24 V |
| 3 | Rx (RS232) |
| 4 | Tx (RS232) |
| 5 | GND |
|  | Pos |



Rx (RS232) and Tx (RS232) refer to the data direction as seen from the antenna!

5.2.2 Interfaces

5.2.2.1 RS 232 (all Variants)

The serial output may be configured in several ways. The transmission rate is adjustable between 9600 and 19200 Baud, the output protocol may be chosen as either „transparent“ or „3964 R“ (see also sections 9.3 on page 49 and 9.2 on page 48). Apart from that, the content of the telegrams is configurable, as the user may choose from a list of parameters. Serial commands are used for activating a system monitor.

5.2.2.1.1 List of System Data that may be Output

A telegram of the serial RS 232 output consists of max. 15 bytes. The minimum update rate at 9,6 KB is then calculated as follows:

Figure 12 Formula: Minimum update rate

$$15 \frac{\text{Byte}}{\text{Telegram}} \times 11 \frac{\text{Bit}}{\text{Byte}} / 9600 \frac{\text{Bit}}{\text{s}} = 17,2 \frac{\text{ms}}{\text{Telegram}}$$

As the transmission is binary, it is possible – when using the 3964R procedure – to add further (DLE) characters by this procedure.

All multiple- byte variables are output either with the highest byte or the lowest byte first (adjustable)! The 8 bit check sum is only output when using the transparent protocol. It then includes the start character. The start character, as well as the check sum (transparent protocol) cannot be removed from the data block.

The protocol is adjustable, irrespective of whether telegrams are output permanently by an adjustable update rate or whether one transponder is located within the field.

Table listing the data words of a telegram of 14(15) byte length:

Table 6 Data words in a telegram of 15 byte length (corresponding to 14 data byte)

| Byte # | Length | Valency | Type | Description |
|---------|--------|-----------|---------------|---|
| 1 | 1 Byte | 0000.0001 | unsigned char | Start character ASCII-061: „=“ |
| 2,3 | 2 Byte | 0000.0002 | signed int | Dummy value |
| 4,5,6,7 | 2 Byte | 0000.0004 | unsigned long | 32 Bit transponder code |
| 8,9 | 2 Byte | 0000.0008 | unsigned int | Voltage generated by the transponder within the frame antenna in samples |
| 10,11 | 2 Byte | 0000.0010 | signed int | Voltage generated by the transponder within the difference antenna in samples |
| 12 | 1 Byte | 0000.0020 | unsigned char | Number of code readings during the latest transponder crossing |
| 13,14 | 2 Byte | 0000.0040 | unsigned int | System status in binary encoding |
| (15) | 1 Byte | | unsigned char | Check sum, only for transparent protocol!! |

The following table shows a list of the binary codes used to describe the system status (for bytes # 13 and 14 from Table 6):

Table 7 Possible system status / error messages (part 1 of 2)

| Value | Name | Description |
|-------|--------------|--|
| 0001 | DEC_HW_ERROR | Decoder hardware error |
| 0002 | CODE_CRC_ERR | Reception of transponder code with longitudinal parity error |
| 0004 | CODE_PAR_ERR | Reception of transponder code with cross parity error |
| 0008 | CODE_NIB_ERR | Reception of RW transponder code with High- Nibble error |
| 0010 | EEPROM_ERROR | Parameter E ² not addressable |
| 0020 | PARAM_CRC_ER | Parameter block no longer safe |

Table 7 Possible system status / error messages (part 2 of 2)

| Value | Name | Description |
|--|----------------|--|
| 0040 | | |
| 0080 | | |
| 0100 | RW_TRANSPONDER | Transponder is writeable *) |
| 0200 | TRANS_IN_FIELD | Transponder is detected *) |
| 0400 | CODE_OK | Decoded code correct *) |
| 0800 | SEGMENT- | A transponder is located under the connector / cable side of the antenna |
| 1000 | POSIPULS | Transponder has crossed the center of the antenna *) |
| 2000 | | |
| 4000 | | |
| 8000 | RESET | Set after antenna is switched on *) |
| *) These bits are deleted when the transponder leaves the antenna field. | | |

Example:

Error 0006 stands for CODE_CRC_ERR and CODE_PAR_ERR.

Errors 0002 and 0004 may also arise during ordinary transponder crossings, if the code transmission is aborted due to decreasing power output level.

5.2.2.1.2 List of System Commands

A Command telegram always consists of four bytes, including the command itself, its parameters and at last the check sum (XOR relation of all bytes with starting sign). When choosing the procedure "transparent" (see appendix, section 9.3 on page 49) a start sign has to be sent as well.



The monitor mode should not be used during normal operation (e.g. from a PLC) as the following output is not carried out according to a transparent or 3964 R protocol but only suitable for display on a VT 52- terminal and used for the manual alteration of parameters.

There are 3 predefined commands:

Table 8 List of system commands

| No | Meaning | Procedure | Start sign | Command byte | Parameter | Check sum |
|----|--|-----------|------------|------------------|------------------|--|
| | Switch to monitor mode (described in 6.3 „System Monitor“ on page 34) | | HEX | | 4D ₁₆ | 4F ₁₆ 4E ₁₆ 49 ₁₆ |
| | | | ASCII | | M | ONI |
| | | | HEX | 3D ₁₆ | 4D ₁₆ | 4F ₁₆ 4E ₁₆ 49 ₁₆ |
| | | | ASCII | = | M | ONI |
| | Programming the code <u>tttt</u> x = reserved for future applications, at the moment variable | | HEX | | 50 ₁₆ | Code in the form x ₁₆ tt ₁₆ tt ₁₆ For the code „12345“ e.g. 01 ₁₆ 23 ₁₆ 45 ₁₆ |
| | | | HEX | 3D ₁₆ | 50 ₁₆ | 0A ₁₆ |
| | CLR_PROG, reset of the previous programming command | | HEX | | 00 ₁₆ | |
| | | | HEX | 3D ₁₆ | 00 ₁₆ | 00 ₁₆ 00 ₁₆ 00 ₁₆ |

5.2.2.1.3 Programming of Transponders (serial)

The programming procedure is started by sending 0050₁₆ in command byte 2. Put the code to be programmed into the 3 parameter bytes.

The one-time programming process lasts 100 to a maximum of 200 ms. Afterwards the new code can be read out immediately.

In case the programming process wasn't successful repeat the programming procedure. A new programming can only be initiated if the command 3 CLR_PROG has been sent first.

5.2.2.1.4 System Monitor

In monitor mode the system is configurable via a menu. Please refer to section 6.3 „System Monitor“ on page 34.



The monitor mode should not be used during normal operation (e.g. from a PLC) since the output is no longer according to the transparent or 3964R protocol but switches to a protocol suitable for the display on a VT52 terminal and only serves for the manual configuration of parameters.

5.2.2.2 Positioning Pulse (all Variants)

The digital positioning output indicates the crossing of the center line of the antenna in direction of travel (X-direction). Its duration is adjustable within a millisecond pattern. In addition it can be limited to one pulse per crossing.

5.2.2.3 CAN (Version HG G-71910ZC)



If the antenna is the last device on the CAN bus you need to activate a terminating resistor. You can find it on the board of the antenna, see section 6.3.2.5.2 on page 41.

5.2.2.3.1 Description

Either Basic- or Full-CAN mode is configurable. The system monitor is used for setting the CAN parameters (also refer to section 6.3.2.5.1 on page 40). The internal CAN module is based on the CAN specifications V2.0 part B. It is possible to transmit either standard or extended frames (adjustable). The system monitor is used for setting the bit timing as well as the identifier.

3 different CAN message objects can be output and 1 can be sent. In addition it is to be set whether telegrams are to be output permanently at the set update rate or only as long as a transponder is within range. Remote operation is also possible. Objects are activated within the CAN menu, through the input of an address unequal 0 (refer to section 6.3.2.5.1 on page 40).

5.2.2.3.2 CAN Message Object 1 (Send-Object)

Table 9 Structure of the CAN message object 1

| Byte # | Length | Type | Description |
|---------|--------|---------------|---|
| 1,2 | 2 Byte | unsigned int | Possible system status messages according to Table 7 on page 19 |
| 3,4,5,6 | 4 Byte | unsigned long | 32 bit transponder code |
| 7 | 1 Byte | unsigned char | Number of code readings of the last transponder crossing |

5.2.2.3.3 CAN Message Object 2 (Send-Object)

Table 10 Structure of the CAN message object 2

| Byte # | Length | Type | Description |
|---------|--------|---------------|---|
| 1,2 | 2 Byte | unsigned int | Possible system status messages according to Table 7 on page 19 |
| 3,4,5,6 | 4 Byte | unsigned long | 32 bit transponder code |
| 7,8 | 2 Byte | signed int | Dummy value |

5.2.2.3.4 CAN Message Object 3 (Send-Object)

Table 11 Structure of the CAN message object 3

| Byte # | Length | Type | Description |
|--------|--------|---------------|---|
| 1,2 | 2 Byte | unsigned int | Possible system status messages according to Table 7 on page 19 |
| 3,4 | 2 Byte | unsigned int | the lowest 16 bit of the transponder code |
| 5,6 | 2 Byte | unsigned int | voltage generated by transponder in frame antenna (in samples) |
| 7 | 1 Byte | unsigned char | number of code readings of the last transponder crossing |
| 8 | 1 Byte | unsigned char | number of mal readings since last transponder crossing |

5.2.2.3.5 CAN Message Object 4 (Reception-Object, Transponder Programming)

Via the reception Message Object 4 commands can be sent to the antenna. It has the same ID as the send object Message Object 1 and a length of 8 byte.

Table 12 Structure of CAN message object 4

| Byte # | Length | Type | Description |
|---------|--------|---------------|--------------------------------|
| 1,2,3,4 | 2 Byte | Unsigned int | Command (see Table 13 below) |
| 5,6,7,8 | 4 Byte | Unsigned long | Parameter (see Table 13 below) |

Table 13 Coding of the commands CAN message object 4

| Command | Description | Parameter |
|-------------------------|-----------------------------------|---|
| 0000.0000 ₁₆ | Reset Program Transponder command | |
| 0000.0001 ₁₆ | Program Transponder | Transponder Code in the area 0x0000.0000 ₁₆ to 0x000F.FFFF ₁₆ |

The programming procedure is started by sending 0000.0001₁₆ in the command byte of CAN message object 4. Put the code to be programmed into the 4 parameter bytes.

The one-time programming process lasts 100 to a maximum of 200 ms. Afterwards the new code can be read out immediately in the corresponding message object.

In case the programming process wasn't successful repeat the programming procedure. A new programming can only be initiated if the command byte has been switched from 0000.0001₁₆ to 0000.0000₁₆ in between.

5.2.2.4 CANopen®

The transponder antenna HG G-71910-C has a CAN interface with the so-called Basic CAN protocol. Starting with software version 1.43 the antenna software has been upgraded to include CANopen® functionality (DS 401). This was achieved by making use of a Micro CANopen library from the company Firma Embedded Systems Academy, that was specifically modified to work with the processor in use in the antenna.

The measured values of the system (transponder code, status, etc.) are transmitted via so-called TPDOs. The parametrization of all relevant parameters (including Node ID and CAN transmission rate) is realized over the SDO or the serial monitor. The CAN identifiers derive from the node address (1..127).

5.2.2.4.1 Defaults

The CAN baud rate defaults to 125Kbaud, the Node-ID to 1. Those defaults can either be altered with the help of a terminal program (e.g. Hyperterm on a PC) or via the SDOs of the CANopen® protocol.

5.2.2.4.2 Description of the Process Data Objects (PDO)

The PDO operational mode can be set to cyclical, synchronous or asynchronous mode. In order to avoid a bus load being too high due to constant changes during asynchronous mode with non-cyclical transmission (Event time = 0), the so-called Inhibit time can be set in the CAN menu of the serial monitor. A PDO can also be transmitted cyclically, therefore the event time has to be chosen correspondingly and 0 has to be chosen for inhibit time.

A TPDO can be activated permanently by choosing in the synchronous mode (255) inhibit time = 0, event_time = 0 and saving of the parameters. Additionally it can be (de)activated temporary by setting/deleting the highest bit in the corresponding PDO-COB identifier, e.g. [1800,01]. The measured values are assigned to fixed places in the PDO, a dynamic mapping is not possible.

5.2.2.4.3 PDO_1

PDO_1 is sent with Identifier 0x1800 + Node address. The PDO contains 6 bytes consisting of a 32 bit transponder code and a 16 bit status, which corresponds to the status shown on the serial monitor. The meaning of the data bits is shown in the following table:

Table 14 *Meaning of the PDO_1 data bytes*

| Value | Type | Value range (Hex) | Meaning |
|----------|------------|-------------------|---------------------------------|
| Code_0 | Unsigned 8 | 0..0xff | Low-order code bits 0..7 |
| Code_1 | Unsigned 8 | 0..0xff | Code bits 8..15 |
| Code_2 | Unsigned 8 | 0..0xff | Code bits 16..23 |
| Code_3 | Unsigned 8 | 0..0xff | High-order code bits 24..31 |
| Status_0 | Unsigned 8 | ./. | Low-order status bits 0..7 *) |
| Status_1 | Unsigned 8 | ./. | High-order status bits 8..15 *) |

*) The meaning of the status bits is explained in Table 7 on page 19.

5.2.2.4.4 PDO_2

PDO_2 is sent with Identifier 0x2800 + Node Address. It contains 8 byte according to the following table:

Table 15 *Meaning of PDO_2 data bytes*

| Value | Type | Value range (Hex) | Meaning |
|--------|-------------|-------------------|---|
| Status | Unsigned 16 | 0 ... 0xff | Status bits *) |
| Uref | Unsigned 16 | 0 ... 1023 | Voltage of the reference channel in units |
| Upos | Signed 16 | 0 ... ±1023 | Voltage of the positioning channel in units |
| N_READ | Unsigned 8 | 0 ... 255 | Number of code readings |
| N_ERR | Unsigned 8 | 0 ... 255 | Number of reading errors |

*) The meaning of the status bits is explained in Table 7 on page 19.

5.2.2.4.5 Heartbeat

The device supports the heartbeat mode. If a heartbeat time > 0 is entered in the CAN menu with each end of the heartbeat timer, the device mode is transmitted via the identifier 0x700 + node address.

Table 16 *Codes of the Heartbeat mode*

| Device mode | Code |
|----------------|------|
| stopped | 0x04 |
| preoperational | 0x7f |
| operational | 0x05 |

5.2.2.4.6 Node-Guarding

If the heartbeat time is set to 0, the device answers to a remote-transmission-request (RTR) of the identifier (0x700 + node address) with the system status (see Table 16 above) in which the highest bit changes. The device does not check for the regular input of the RTR frames.

5.2.2.4.7 Description Of The Service Data Objects (SDOs)

For accessing the object directory, a SDO is used. It is transferred with a confirmation, that means that each reception is confirmed with a message. The identifiers for read and write access are:

Table 17 Identifiers for read and write access

| | |
|----------------|----------------------|
| Reading Access | 0x600 + Node address |
| Writing Access | 0x580 + Node address |

The SDO telegrams are described in the CiA® norm DS-301. The error codes caused by an erroneous communication are listed in the following table:

Table 18 Error codes - SDO telegrams

| Name | Number | Meaning |
|------------------------|------------|---|
| SDO_ABORT_UNSUPPORTED | 0x06010000 | Non-supported access to an object |
| SDO_ABORT_NOT_EXISTS | 0x06020000 | Object is not implemented |
| SDO_ABORT_READONLY | 0x06010002 | Writing access to a Read only object |
| SDO_ABORT_SIGNATURE | 0x08000020 | At saving or loading of the parameters the signature "save" resp. „load“ has not been used. |
| SDO_ABORT_PARA_VALUE | 0x06090030 | Value range of parameters exceeded |
| SDO_ABORT_PARA_TO_HIGH | 0x06090031 | Value of parameter too high |

5.2.2.4.8 Object Directory

In the CANopen® directory all relevant objects for the device are entered. Each entry is marked by a 16 bit index. Sub components are marked by a 8 bit subindex. The object directory is divided in the following sections:

- ♦ Read only entries are marked with RO, write only entries with WO.
- ♦ Communication parameters are marked with C.
- ♦ Manufacture parameters are marked with M.

Table 19 Communication specific entries between 0x1000 and 0x1FFF (part 1 of 2)

| Index | Subindex | Access | Content | EEProm |
|--------|----------|--------|--|--------|
| 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 | |
| 0x1010 | 0 | RO | Number of entries of Save Parameter | |
| | 1 | RW | Store all | |
| 0x1011 | 0 | RO | Number of entries of Restore Default Parameter | |
| | 1 | RW | Restore Default all | |
| | 2 | RW | Restore Default Communication Parameter | |
| | 3 | RW | Restore Default Manufacture Parameter | |
| 0x1017 | 0 | RW | Producer Heartbeat Time | C |

Table 19 Communication specific entries between 0x1000 and 0x1FFF (part 2 of 2)

| Index | Subindex | Access | Content | EEProm |
|--------|----------|--------|--|--------|
| 0x1018 | 0 | RO | Number of entries of Identity Object | |
| | 1 | RO | Vendor ID | |
| | 2 | RO | Product Code | |
| | 3 | RO | Revision | |
| | 4 | RO | Serial Number | |
| 0x1800 | 0 | RO | Number of entries of Transmit PDO_1 | |
| | 1 | RW*) | COB-ID | |
| | 2 | RO | Transmission Type | C |
| | 3 | RW | Inhibit Time | C |
| | 5 | RW | Event Time | C |
| 0x1801 | 0 | RO | Number of entries of Transmit PDO_2 | |
| | 1 | RW*) | COB-ID | |
| | 2 | RO | Transmission Type | C |
| | 3 | RW | Inhibit Time | C |
| | 5 | RW | Event Time | C |
| 0x1A00 | 0 | RO | Number of Objects mapped to Transmit PDO_1 | |
| | 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 | |
| 0x1A01 | 0 | RO | Number of Objects mapped to Transmit PDO_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 | |

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

Table 20 Manufacturer specific entries at 0x2000 (part 1 of 2)

| Index | Subindex | Access | Content | EEProm |
|--------|----------|--------|--|--------|
| 0x2000 | 0 | RO | Number of Parameter | |
| | 1 | RW | Transponder programming with 16 bit code | |
| | 2 | RW | Variable: Threshold for Decoding | M |
| | 3 | RW | Variable: Threshold for Positioning | M |
| | 4 | RW | Variable: Posipulse time | M |

Table 20 *Manufacturer specific entries at 0x2000 (part 2 of 2)*

| Index | Subindex | Access | Content | EEProm |
|--------|----------|--------|----------------------------------|--------|
| | 5 | RW | Variable: High Nibble of RW-Code | M |
| | 6 | RW | Variable: Number of equal codes | M |
| 0x2001 | 0 | RO | Number of Manufacture Parameter | |
| | 1 | RW | Node Baud rate | C |
| | 2 | RW | Node ID | C |

Table 21 *Standard Device Profile Range at 0x6100 to 0x6400*

| Index | Subindex | Access | Content |
|--------|----------|--------|---|
| 0x6000 | 0 | RO | Number of 8 Bit Inputs |
| | 1 | RO | Transponder code bits 0..7 (low-order) |
| | 2 | RO | Transponder code bits 8..15 |
| | 3 | RO | Transponder code bits 16..23 |
| | 4 | RO | Transponder code bits 24..31 (high-order) |
| | 5 | RO | Status bits 0..7 (low-order) |
| | 6 | RO | Status bits 8..15 (high-order) |
| | 7 | RO | Read Count |
| | 8 | RO | Error Count |
| 0x6100 | 0 | RO | Number of 16 Bit Inputs |
| | 1 | RO | Transponder code bits 0..15 |
| | 2 | RO | Transponder code bits 16..23 |
| | 3 | RO | Status bits 0..15 |
| 0x6400 | 0 | RO | Number of Elements |
| | 1 | RO | Ref signal |
| | 2 | RO | Pos signal |

5.2.2.4.9 Explanation of the Entries CANopen® Directory

Table 22 *Device Type*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------|-------------|-------|-----|------------|-------------------------|
| 1000 | 00 | Device Type | Unsigned 32 | RO | No | 0x00010191 | Digital Inputs - DS 401 |

Table 23 *Error Register*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|----------------|------------|-------|-----|---------|----------------|
| 1001 | 00 | Error Register | Unsigned 8 | RO | No | 0x00 | Error register |

Table 24 *COB-ID SYNC message*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------|-------------|-------|-----|------------|----------------------------------|
| 1005 | 00 | COB-ID SYNC | Unsigned 32 | RO | No | 0x80000080 | Sync Consumer, Sync ID = 0x80 |

Table 25 *Manufacturer Device Name*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|--------------------------|----------------|-------|-----|---------|-------------|
| 1008 | 00 | Manufacturer Device Name | Visible String | RO | No | 7191 | Device name |

Table 26 *Manufacturer Hardware Version*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------------------------|----------------|-------|-----|---------|---------------|
| 1009 | 00 | Manufacturer Hardware Version | Visible String | RO | No | A6 | Board version |

Table 27 *Manufacturer Software Version*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------------------------|----------------|-------|-----|---------|------------------|
| 100A | 00 | Manufacturer Software Version | Visible String | RO | No | 1.43 | Software version |

Table 28 *Save Parameter*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|----------------|-------------|-------|-----|------------|-----------------------|
| 1010 | 00 | Save Parameter | Unsigned 8 | RO | No | 0x01 | number of sub indexes |
| | 01 | Save All | Unsigned 32 | RW | No | 0x00000001 | Save All is possible |

By writing the signature `save` or `evas` in ASCII-Code (hex-Code: 0x65766173) on Sub Index 1 the current parameters are permanently saved. A successful saving operation is acknowledged via TxSDO (1. Byte = 0x60) after approx. 300 ms. While the saving operation takes place no CAN telegrams can be sent or received.

Table 29 *Restore Default Parameter*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-----------------------|-------------|-------|-----|------------|-----------------------------------|
| 1011 | 00 | Restore Parameter | Unsigned 8 | RO | No | 0x03 | Number of Sub Indexes |
| | 01 | Restore All | Unsigned 32 | RW | No | 0x00000001 | Restore All is possible |
| | 02 | Restore Communication | Unsigned 32 | RW | No | 0x00000001 | Restore Communication is possible |
| | 03 | Restore Manufacture | Unsigned 32 | RW | No | 0x00000001 | Restore Manufacture is possible |

By writing the signature `load` or `dao1` in ASCII-Code (hex-Code: 0x64616F6C) to Sub Index 1, 2 resp. 3 the corresponding default parameters are loaded. Afterwards an antenna reset should be carried out. In addition "Restore All" sets the Node-ID to 1 and the baud rate to 125 Kbaud.

Table 30 *Producer Heartbeat Time*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------------------|-------------|-------|-----|---------|--------------------------------|
| 1017 | 00 | Producer Heartbeat Time | Unsigned 16 | RW | No | 1000 | Heartbeat Time in ms (approx.) |

Setting the time to 0 disables this function.

Table 31 Identity Object

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-----------------|-------------|-------|-----|------------|--|
| 1018 | 00 | Identity Object | Unsigned 8 | RO | No | 0x03 | Number of Sub Indexes |
| | 01 | Vendor ID | Unsigned 32 | RO | No | 0x00000202 | manufacturer number determined by the CiA® |
| | 02 | Product Code | Unsigned 32 | RO | No | 0x00071910 | HG number 71910 |
| | 03 | Revision | Unsigned 32 | RO | No | 0x00000003 | Version 3 |
| | 04 | Serial Number | Unsigned 32 | RO | No | 99999 | Serial number |

Table 32 Transmit PDO_1 Parameter

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------------|-------------|-------|-----|----------------------|---|
| 1800 | 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 two 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 in order to temporarily (de)activate the PDO.

Table 33 Transmit PDO_2 Parameter

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|-------------------|-------------|-------|-----|----------------------|---|
| 1801 | 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 two 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 in order to temporarily (de)activate the PDO.

Table 34 Mapping TxPDO_1

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|--------------------------|-------------|-------|-----|------------|---|
| 1A00 | 00 | number of mapped objects | Unsigned 8 | RO | No | 0x06 | Number of Sub Indexes |
| | 01 | 1st mapped object | Unsigned 32 | RO | No | 0x60000108 | mapped to Index 0x6000,01 length 8 Bit (Code 0..7) |
| | 02 | 2nd mapped object | Unsigned 32 | RO | No | 0x60000208 | mapped to Index 0x6000,02 length 8 Bit (Code 8..15) |
| | 03 | 3rd mapped object | Unsigned 32 | RO | No | 0x60000308 | mapped to Index 0x6000,03 length 8 Bit (Code 16..23) |
| | 04 | 4th mapped object | Unsigned 32 | RO | No | 0x60000408 | mapped to Index 0x6000,04 length 8 Bit (Code 24..31) |
| | 05 | 5th mapped object | Unsigned 32 | RO | No | 0x60000508 | mapped to Index 0x6000,05 length 8 Bit (Status 0..7) |
| | 06 | 6th mapped object | Unsigned 32 | RO | No | 0x60000608 | mapped to Index 0x6000,06 length 8 Bit (Status 8..15) |

Table 35 Mapping TxPDO_2

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|--------------------------|-------------|-------|-----|------------|--|
| 1A01 | 00 | number of mapped objects | Unsigned 8 | RO | No | 0x05 | Number of Sub Indexes |
| | 01 | 1st mapped object | Unsigned 32 | RO | No | 0x60000310 | mapped to Index 0x6000,03 length 16 Bit (Status 0..15) |
| | 02 | 2nd mapped object | Unsigned 32 | RO | No | 0x64010110 | mapped to Index 0x6401,01 length 16 Bit (Ref signal) |
| | 03 | 3rd mapped object | Unsigned 32 | RO | No | 0x64010210 | mapped to Index 0x6401,02 length 16 Bit (Pos signal) |
| | 04 | 4th mapped object | Unsigned 32 | RO | No | 0x60000708 | mapped to Index 0x6000,07 length 8 Bit (Read count) |
| | 05 | 5th mapped object | Unsigned 32 | RO | No | 0x60000808 | mapped to Index 0x6000,08 length 8 Bit (Error count) |

Table 36 *Manufacture Parameter*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|---------------------------|-------------|-------|-----|---------|-----------------------------------|
| 2000 | 00 | number of parameters | Unsigned 8 | RO | No | 0x06 | Number of Sub Indexes |
| | 01 | Prog_Transponder | Unsigned 32 | RW | No | 0 | Transponder code to be programmed |
| | 02 | Threshold for Decoding | Unsigned 16 | RW | No | 200 | Range of values: 10..1023 |
| | 03 | Threshold for Positioning | Unsigned 16 | RW | No | 300 | Range of values: 10..1023 |
| | 04 | Posipulse time | Unsigned 16 | RW | No | 100 | Range of values: 1..1000 ms |
| | 05 | High Nibble of RW-Code | Unsigned 8 | RW | No | 16 | Range of values: 0..16 |
| | 06 | Number of equal codes | Unsigned 8 | RW | No | 1 | Range of values: 0..15 |

By writing a 32 Bit code to Sub-Index 1 that code is programmed into a transponder within the antenna field. The highest value is 0x000fffff respectively 1048575.

Table 37 *Manufacture Parameter - Node parameter*

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|----------------------|------------|-------|-----|---------|--------------------------------|
| 2001 | 00 | number of parameters | Unsigned 8 | RO | No | 0x02 | Number of Sub Indexes |
| | 01 | Node Baud rate | Unsigned 8 | RW | No | 0x04 | 125 kbaud (see Table 38 below) |
| | 02 | Node ID | Unsigned 8 | RW | No | 0x01 | Node adress 1..127 |

Table 38 *Coding of the baud rates [kBaud]*

| Entered / read value | Baud rate / kbaud |
|----------------------|-------------------|
| 7 | 20 |
| 6 | 50 |
| 4 (Default) | 125 |
| 3 | 250 |
| 2 | 500 |
| 0 | 1000 |

Table 39 8 Bit Digital Inputs (transmitted in TxPDO 1)

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|------------------------|------------|-------|-----|---------|--------------------------------|
| 6000 | 00 | number of 8 bit inputs | Unsigned 8 | RO | No | 0x06 | Number of 8 Bit inputs |
| | 01 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Transponder code (Bits 0..7) |
| | 02 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Transponder code (Bits 8..15) |
| | 03 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Transponder code (Bits 16..23) |
| | 04 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Transponder code (Bits 24..31) |
| | 05 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Status (Bits 0..7) |
| | 06 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Status (Bits 8..15) |
| | 07 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Read Count |
| | 08 | 8 bit digital input | Unsigned 8 | RO | Yes | ./. | Error Count |

Table 40 16 Bit Digital Inputs

| Index | Sub Index | Name | Type | Attr. | Map | Default | Meaning |
|-------|-----------|---------------------------------|-------------|-------|-----|---------|---------------------------------|
| 6100 | 00 | number of 16 bit digital inputs | Unsigned 8 | RO | No | 0x03 | Number of digital 16 bit inputs |
| | 01 | 16 bit digital input | Unsigned 16 | RO | No | ./. | Transponder code (Bits 0..15) |
| | 02 | 16 bit digital input | Unsigned 16 | RO | No | ./. | Transponder code (Bits 16..23) |
| | 03 | 16 bit digital input | Unsigned 16 | RO | No | ./. | Status (Bits 0..15) |

Table 41 16 Bit Analog Inputs

| Index | Sub Index | Name | Type | Attr. | Map | Default | Bedeutung |
|-------|-----------|--------------------------------|-------------|-------|-----|---------|-----------------------------------|
| 6400 | 00 | number of 16 bit analog inputs | Unsigned 8 | RO | No | 0x02 | Number of analog 16 Bit inputs |
| | 01 | Ref Signal | Unsigned 16 | RO | Yes | ./. | Signal of the reference channel |
| | 02 | Pos Signal | Signed 16 | RO | Yes | ./. | Signal of the positioning channel |

5.2.2.5 Parallel Port (Versions HG 71910YC/XC/VC)

It is possible to select a parallel interface for simple applications (e.g. for a PLC without communication controller). The least significant 15 Code-bits and a Data-ready pulse will be output. This pulse with configurable duration is generated for each changing of code. Parallel data is permanently available.

In order to operate the system exclusively, all other signals and lines (except CAN) are available on the flat band cable as well. The outputs D0-D14 as well as Data-Ready are not current limited. The output POSI is realized via a switched 20 mA current source! The outputs apply 24 V and can thus be connected to a PLC.

A Timing diagram is shown in section 9.7 on page 53.

6

Software

The system can be configured via software programmed within the antenna. In order to use it start a terminal program on your PC.

6.1 Terminal Program

In the following we refer to the program **HyperTerminal®** (Hyperterm.exe), which is part of the scope of supply of Microsoft® Windows® 95/98/NT®. We use this program on one hand because many users dispose of it, and on the other hand because it is very easy to use thanks to the configuration files we deliver.



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

Nevertheless, any other terminal program can be utilized, provided that it contains VT52 emulation. If you should use a different program, please read the documentation and adjust it to the values shown below.


6.2 Parameter Presettings

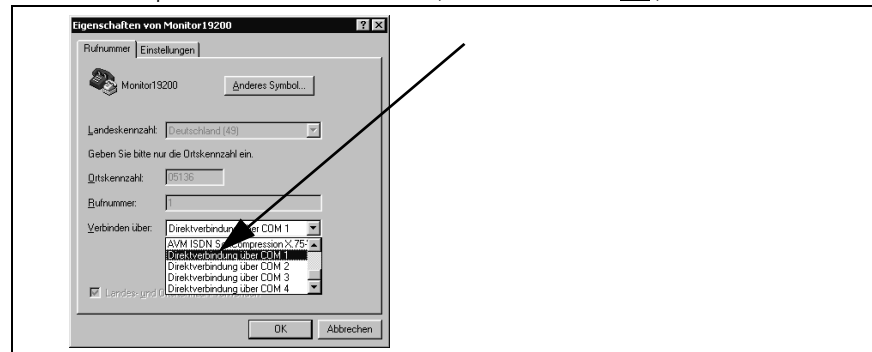
Dependent upon what you want to do (starting the monitor program or the software update), different parameters are necessary. When you are using HyperTerminal, you do not need to enter these and can go on to section 6.3 on page 34.

Table 42 *Terminal settings for the monitor program*

| Terminal settings monitor program (see section 6.3) | |
|---|---|
| Baud rate | 9600 or 19200 Baud depending on the system configuration |
| Terminal emulation | VT52 |
| Parity | Even |
| Data bits | 8 |
| Stop bits | 1 |
| Character delay | 1 ms |
| Line delay | 0 ms |
| PC-Interface (Port) | COM1 may vary depending on the PCs (see below) |

If you are using a different port than COM1 with HyperTerminal, then adjust the port as follows:

1. Select Properties from the menu file (or click the Icon ):



2. Choose the respective port via the direct to connection in the submenu. Confirm with **OK**. Save the altered values if you are asked for it when finishing HyperTerminal.

6.3 System Monitor

In the **monitor mode** the system can be configured with the help of a menu. To use the monitor mode you need to know which protocol is adjusted in your antenna.

6.3.1 How to start the monitor program

How to start the monitor mode depends on the active procedure (see section 6.3.2.3 on page 37).

6.3.1.1 Procedure 3964R or transparent

The command to switch to the monitor mode should be entered directly via a PC. Therefore, run your terminal program. In order to start the communication you need one of the configuration files described below. You can download those files from our internet server, the address is



<http://www.goetting-agv.com/components/transponderconf>

If you are using HyperTerminal it can now be started directly by double clicking the respective *.ht file (**Monitor9600.ht** at 9600 Baud and **Monitor19200.ht** at 19200 Baud). If necessary, adapt the COM-port.

In case the antenna is activated you can then transfer the appropriate text file from the disk by using your terminal program. The following four files are available.

6.3.1.2 Text Files for the Procedures

1. **Mon3964r.txt**

Transfer if the system is adjusted to procedure **3964R** with „**HighByte first**“.

The file contains the characters:

02 4D 4F 4E 49 10 03 16 in hexa-decimal notation

2. **Mon6439r.txt**

Transfer if the system is adjusted to procedure **3964R** with „**LowByte first**“.

The file contains the characters:

02 4F 4D 49 4E 10 03 16 in hexa-decimal notation

3. Montrans.txt

Transfer if the system is adjusted to procedure **Transparent** with „**HighByte first**“. The file contains the characters:
3D 4D 4F 4E 49 38 in hexa-decimal notation.

4. Transmon.txt

Transfer if the system is adjusted to procedure **Transparent** with „**LowByte first**“. The file contains the characters:
3D 4F 4D 49 4E 38 in hexa-decimal notation

With HyperTerminal the file is transferred as follows:

1. Choose **Send Text file** in the menu **Transfer**. The following window will be opened:



2. Switch to disk drive (in our example, the files are located on the hard disk) and select the respective *.txt file.
3. Click **Öffnen**. The file will be transferred and (if you have chosen the right file) the monitor program will be started. The menus will then appear directly in the HyperTerminal window. At first, you will see the main menu from Figure 13 on page 36.

6.3.2 How to work with the monitor program

NOTICE

Decreased positioning accuracy due to wrong values

False timing values can detune the antenna so that Transponders are no longer correctly read.

- Only alter values for the system interface.

Any change to the interface parameters will be activated after a system reset (switch the antenna off and on again). Afterwards it may be necessary to use a different file from the four given *.txt. documents for the monitor call!

Once the transfer of the *.txt.file (section 6.3.1) has been completed, the monitor program will start the main menu. If this is not the case, you have either based your settings on wrong system configuration or you are using a different terminal emulation or you did not adjust the character delay to 1 ms.

6.3.2.1 Main Menu

Figure 13 Main menu of the monitor program

```

S:0042   X:+0000   DELTA_X:   +0   Code: 00db93a1   Read:  44   E: 0000   N:   0

(P)assword
(C)alculation Coefficients
(S)erial Output
(T)ime & Code
Basic C(A)N-Parameters
CA(N)-Open-Parameters

(L)oad Values to EEPROM
(E)rror ?
CS(V) 38,4KB Code,Sum,Tr,Co,+-,Po,Rd,DTR,PCODE,Cnt<crLf>
(O)ut-Test
(W)rite Transponder
(U)pdate Firmware
Service (M)enu
(Q)uit Monitor

Software Version 71910A61.43 / 25.MAY 2011   Serial Number: 9999999

```

Each of the screen menus contains important system variables in the first line (see Table 43), as they also appear in the output telegram (described in section 5.2.2.1.1 on page 19). The last line on the screen contains possible status messages, if e.g. predetermined value ranges have not been observed during input.

Table 43 Description of the system variables (monitor program)

| Description of the system variables | |
|-------------------------------------|---|
| S | Measured voltage of the sum coil within the cover of the casing in samples (max. 1023). |
| X | Measured voltage of the difference coil within the cover of the casing in samples (max. ± 1023). |
| DELTA_X | Output value for the distance from the center axis of the antenna in direction of travel, including adjustable offset and gain (max. ± 31000). |
| Code | The 32 info bits of the transponder code in hexadecimal notation. |
| Read | Number of readings per transponder crossing. This value is preserved until another transponder is detected. It is also deleted through Noise. |
| E | State of system in hexadecimal notation. The meaning of each bit is explained in Table 7 on page 19. |
| N | Number of reading errors per transponder crossing. This value is stored until a new transponder has been detected. |

Other menus are activated by pressing the (characters in brackets). Before altered values are transferred into the permanent memory, the pass word **815** has to be entered by pressing **[P]**. This prevents unintended alterations of values. With **[L]** the values are saved after alteration and input of the password.

System errors are explained in plain text upon pressing **[E]**. Typing **[C]** deletes the error display. Quit the menu by pressing **[Q]**.

The sections mentioned below describe the menus one after the other:

- **[C]**alculation Coefficients (section 6.3.2.2)
- **[S]**erial Output (section 6.3.2.3 on page 37)
- **[T]**ime & Code (section 6.3.2.4 on page 38)

- ♦ Basic C(A)N-Parameter (section 6.3.2.5.1 on page 40)
- ♦ CA(N)-Open Parameter (section 6.3.2.5.3 on page 41)
- ♦ CS(V)-Out (section 6.3.2.6 on page 42)
- ♦ (O)ut-Test (section 6.3.2.7 on page 42)
- ♦ (W)rite Transponder (section 6.3.2.8 on page 42)
- ♦ (U)pdate Firmware

6.3.2.2 (C)alculation Coefficients



This menu is not in use anymore.

6.3.2.3 (S)erial Output

Alterations within this menu become effective by resetting the system (turn the antenna off and on). Dependent upon the alterations made, you might have to use a different baud rate / text document to start the monitor afterwards (section 6.3.1 on page 34).

Figure 14 Menu: (S)erial Output

```

S:0043  X:+0052  DELTA_X:  +0  Code: 00db93a1  Read:  44  E: 0000 N:  0

(B)audrate:                                9600
(O)rder of Data Transfer (0= HiByte first):  0

(T)elegram Content Mask [0..7F]:  00000045
(D)isplay Telegram Content
(C)har-Delaytime [100..220ms]:  220
(P)rozedur 3964R 1680
(A)ck-Delaytime (3964R) [100.1680ms]:  1680
Co(n)tinuous Telegrams 1
(S)erial Clock [1..1000ms]:  8

(Q)uit Menu
  
```

Input of **B** enables switching between 9600 and 19200 Baud. Via **O** it is possible to select, whether the highest byte is to be output first or last. When connecting this equipment with a Siemens PLC, this parameter has to be 0 (**H**igh **B**yte **F**irst).

T influences the composition of the output telegram. The check sum of the transponder protocol can not be removed.

Based on the values given in Table 6 „Data words in a telegram of 15 byte length (corresponding to 14 data byte)“ on page 19, you can define the desired elements of your telegram **T** by hexadecimal addition. The sequence of the parameters cannot be influenced. It will always comply with the sequence in the table!

Example You only want to display the code and the start character:

Enter the values 0000.0004 (according to the table) and 0000.0001 for the start character. The telegram length is 4 bytes for the code and 1 byte for the start character, adding up to **5**.

Using „**D**isplay Telegram Content“ it is possible to check the generated telegram (see Figure 15). In this example the mask has the value 0000.007f. Press any key to return to the menu **S**erial **O**utput.

Figure 15 Output „(D)isplay Telegram Content“

```

S:0030 X:+0054 DELTA_X: -245 Code: 00000000 Read: 35 E: 0000 N:0

STX          1 Bytes from Position: 1
Delta_X      2 Bytes from Position: 2
CODE         4 Bytes from Position: 4
SUM_1        2 Bytes from Position: 8
DIF_X        2 Bytes from Position: 10
CodesRd      1 Bytes from Position: 12
ERROR        2 Bytes from Position: 13

(Q)uit Menue

```

The parameter „**(C)**har Delaytime“ is the so-called character delay for the procedure 3964R (refer to appendix, section 9.2 „Procedure 3964R“ on page 48) and the time-out period for incoming characters for the transparent procedure (refer to appendix, section 9.3 „Procedure „transparent““ on page 49).

Select the desired procedure – 3964R or transparent – by pressing **[P]**. For procedure 3964R, the acknowledgement delay is adjustable additionally.

[N] When set to (1) this activates the permanent output, according to the **Clock for Sampling** (Menu Time&Code, refer to section 6.3.2.4 on page 38). When set to (0) the output is only generated when a transponder is decoded within the reading range of the antenna.

[S] defines the period of the serial and the CAN output. If you change this please keep in mind the duration and baud rate of the configured telegram (for the calculation refer to Figure 12 on page 19).

6.3.2.4 (T)ime & Code

This menu enables the setting of timing values for the transponder decoding, the position calculation and the positioning pulse.

Figure 16 Menu: (T)ime & Code

```

S:0041 X:+0054 DELTA_X: +0 Code: 00db93a1 Read: 44 E: 0000 N: 0

(H)igh-Nibble of RW-Code          [0..F,>F]: 10
(N)umber of equal Codes           [0..15]: 1
(T)hreshold for Decoding          [10..1023]: 200

(C)lear parallel Code              0
DT(R)-Pulse Time                  [n*1ms]: 100
DTR-(S)etup Time                  [n*1ms]: 50
(l) DTR - Pulse per Code           0

(L)evel for Positioning            [10..1023]: 300
PosiPulse (a)fter Decoding         1
(P)osi-Pulse Time                  [n*1ms]: 100
(O)ne Positioning Pulse per Crossing 0
(X) tuned POSI-DATA_RDY Pulse      1

(Q)uit Menue

```

Since the code transfer is only secured by a simple parity check, two additional safety strategies have been implemented in order to achieve a higher data protection:

1. When using RW transponders, the free high bits are searched for a preset value (0-F). This value may be preset under **[H]** and has to be programmed into the transponders together with the desired code. If a value > F is entered (e.g. 10), the monitoring is switched off.
2. For RO- and RW- transponders, the number of codes to be compared can be chosen within a range of 0 to 15 under **[N]**. If the number of codes is set to 0, any code is output immediately after detection; 1 effects that the received code is compared to precisely the one detected before, etc. **Please note that the maximum crossing speed decreases**, as the necessary transmission duration increases $(n+1) \times 8$ ms.

[T] determines at which voltage S the decoding starts, in order to avoid trials to decode a too weak signal, if necessary.

[C] defines whether the parallel code output is deleted as soon as the transponder leaves the antenna field.

You can adjust the duration of the positioning pulse (**[P]**) and the duration of the Data-Ready pulse DTR (**[R]**) in 1 ms steps. The DTR Setup Time (**[S]**) defines the amount of time that lies between the generation of the parallel code and the output of the DTR pulse (please refer to section 9.7 „Timing-Diagramm of the Parallel Interface“ on page 53 in the appendix).

[I] determines if only one transponder generates a DTR pulse by a new code (1) or if transponders – after leaving the detection area and reentering this area once again – are generating a DTR pulse once again (0).

[L] determines at which voltage S the positioning pulse is released to avoid wrong outputs generated by antenna side lobes.

[A] enables the output of a positioning pulse only when a transponder is decoded. Thus it is possible to avoid wrong positioning pulses in areas with parasitic frequencies.

Via **[O]** you define whether each crossing of the antenna center generates a positioning pulse (0; e.g. when switching between forward and backward operation while a transponder is directly underneath the antenna) or if only one pulse per crossing is generated (1). In this case the voltage S has to drop below the calculation threshold to generate a pulse for the same transponder again (Level for Positioning; see 6.3.2.4 on page 38).

With **[X]** you choose when the Posi and Data Ready pulses are deleted:

- ♦ (1) The pulses are deleted when the respective timers from **[R]** and **[P]** expire (see above).
- ♦ (0) The pulses are deleted as soon as the bit TRANS_IN_FIELD falls away (see Table 7 on page 19).

6.3.2.5 CAN

6.3.2.5.1 Basic C(A)N-Parameter

This menu enables setting the various Basic CAN Bus parameters. With **[C]** the BA-SIC-CAN interface is activated. Simultaneously CANopen is deactivated.

Figure 17 Menu: Basic C(A)N-Parameter

```

S:0057 X:+0064 DELTA_X: +0 Code: 00db93a1 Read: 44 E: 0000 N: 0
SR = 00: NO ERROR / / / /

(C)AN active NO
E(X)tended CAN STANDARD
(I)dentifier: TX/RX [0..2047]: 10
(A)-Identifier: TX [0..2047]: 0
(B)-Identifier: TX [0..2047]: 0
CAN-Baud(R)ate[20,50,125,250,500,1000 kB]: 125
Co(n)tinuous Telegrams 1
CAN on Re(m)ote Request 0
(D)ata Clock [1..1000ms]: 8

(Q)uit Menue

```

Entering X enables the generation of telegrams either as standard frames according to CAN2.0A or as extended frames according to CAN2.0B.

Correspondingly it is possible to either set the **[I]**dentifier (CAN address) as 11 bit value (0-2047) or as 29 bit value (0-536870911). With this Identifier the Message Objects 1 and 4 are addressed (see sections 5.2.2.3.2 on page 22 and 5.2.2.3.5 on page 22). **[A]** and **[B]** address the Message Objects 2 and 3 (see sections 5.2.2.3.3 on page 22 and 5.2.2.3.4 on page 22). With 0 the objects are disabled.

Via **[R]** you can choose the CAN baud rate.

[N] switches between a permanent output (1; according to the **Data Clock** set via **[D]**) and a mode where data is only output when a transponder is decoded in the field (0).

With **[M]** the remote mode is active at ed. Then the antenna only answers on Remote Frames with a corresponding address.

The header line lists the content of the CAN status register. You can use this data for simple diagnostics. Possible values are explained on page 23-7 of the aforementioned CAN manual.

6.3.2.5.2 CAN Terminating Resistor

The board of the antenna HG 71910-C includes a 120 Ohm terminating resistor. It can be activated by switching a jumper.

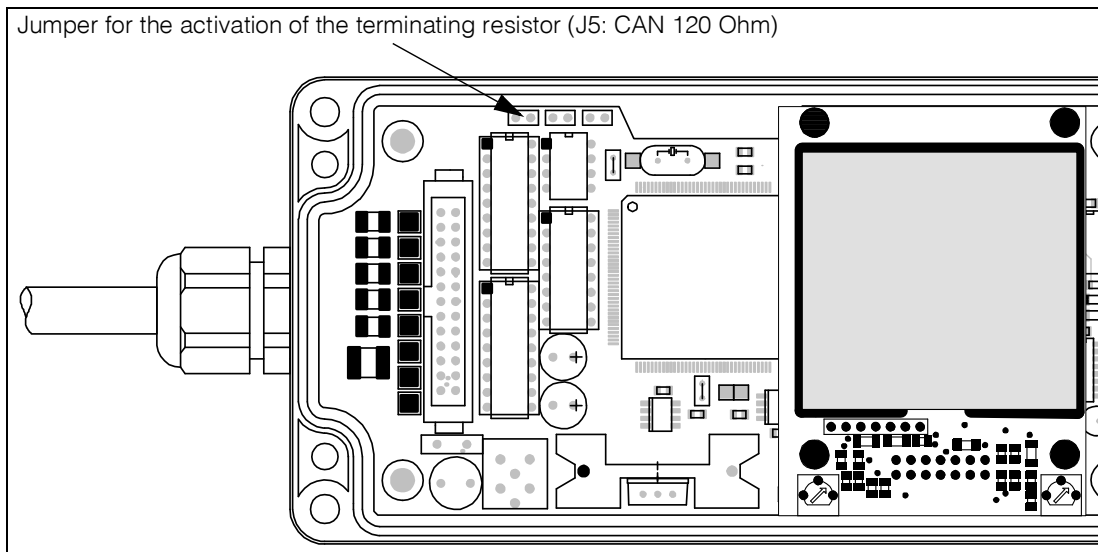


Figure 18 Position of the jumper for the activation of the terminating resistor

6.3.2.5.3 CA(N) open

Figure 19 Menu: CA(N) Open

```
Node ID [hex]: 04 / CAN online : Pre-Operational / int.Status: 0000
S:0958 X:-0624 DELTA_X: -4 Code: 000affe0 Read: 255 E: 8f00 N: 0

(C)ANopen active 1
(N)ode ID: [1..127]: 4
CAN-(B)audrate[20,50,125,250,500,1000 kB]: 500
(A)utostart 0
(T)PDO mode [1..240,255]: 255
TPDO (E)vent time [0,10..32000 ms]: 100
TPDO (I)nhhibit time [0,10..32000 ms]: 10

(H)eartbeat time [0,10..32000 ms]: 1000

(Q)uit Menue
```

The second line in the display shows the CANopen® state. This switches to offline when the CAN plug is disconnected or when the CAN controller goes into BUSOFF mode because of a missing terminating resistor. Next to this the current CANopen state is shown: stopped, preoperational or operational.

The internal status should usually be 0.

C activates CANopen (simultaneously Basic CAN is deactivated)

N enables setting the node address in the area 1..127

B enables setting the baud rate (Autobaud is not implemented)

A switches the autostart function on and off

- ♦ Autostart off: After switching the antenna on only the heartbeat message (if set) is transmitted; the device is in „preoperational“ mode.
- ♦ Autostart on: Immediately after switching the antenna on the PDO and the heartbeat message (if set) are transmitted; the device is in „operational“ mode.

Via **T** you can choose the PDO mode. Values from 1..240 set the synchronous, cyclical mode. 255 sets the asynchronous mode. The following two functions are only available in the asynchronous mode:

- **E** sets the cycle time of the PDO transmission.
- **I** sets the inhibit time of the PDO. This is the shortest possible period between two consecutive transmissions. If both **E** and **I** are set to 0 the PDO is not transmitted.

H changes the so-called heartbeat time. This sets the cycle time of the status message. Setting this to 0 disables the status message.

6.3.2.5.4 EDS File

The current version of the EDS file can be downloaded from our internet server.



Open the address <http://www.goetting-agv.com/components/71910> or enter 71910 in the search field.

6.3.2.6 CS(V) Output

For diagnosis purposes the output of the values **Code**, **Sum S1**, the status of **Transponder in Field**, **Code OK**, **Segment**, **PosiPuls** (see Table 7 on page 19), the number of code readings as well as a telegram counter can be started. The data is transmitted in the **CSV format** (Comma Separated Values; Text-only format that is especially suited for importing the data into common spreadsheet applications). The transmission parameters are 38.400 Baud, 8 Bit, even parity.



The transmission continues until a key is pressed. Afterwards the antenna is reset and starts back into the normal mode (with the stored transmission parameters), not the monitor mode.

The monitor program, e.g. HyperTerminal®, can be used to save the file to disk. This file should have the extension **.csv**, so that spreadsheet applications recognize it. The file can then be imported into applications like Microsoft® Excel®, Sun® StarCalc®, etc.

When opening the file, the spreadsheet application offers some options. Choose that the values are separated by comma. The data can then be processed into diagrammatic form or saved as a native spreadsheet analysis file.

6.3.2.7 (O)ut-Test

O enables setting all outputs to 1 or 0. The outputs DTR and Posipulse are activated according to each time adjusted. After leaving the monitor mode the outputs will be switched off again.

6.3.2.8 (W)rite Transponder

Transponders can be programmed both via the system command (see Table 8 on page 21) and this menu entry.

Enter the code (hex with a maximum of 5 digits) and place a RW transponder at nominal reading distance below the antenna. Then press **Shift** to start programming.

6.4 Firmware Update

The CPU inside the antenna can be updated via the serial interface. In order to do this connect the serial interface of a PC to the antenna. Then use the Software tool FLASH269 to program the antenna CPU as described below.

6.4.1 Installation of the Flash Program

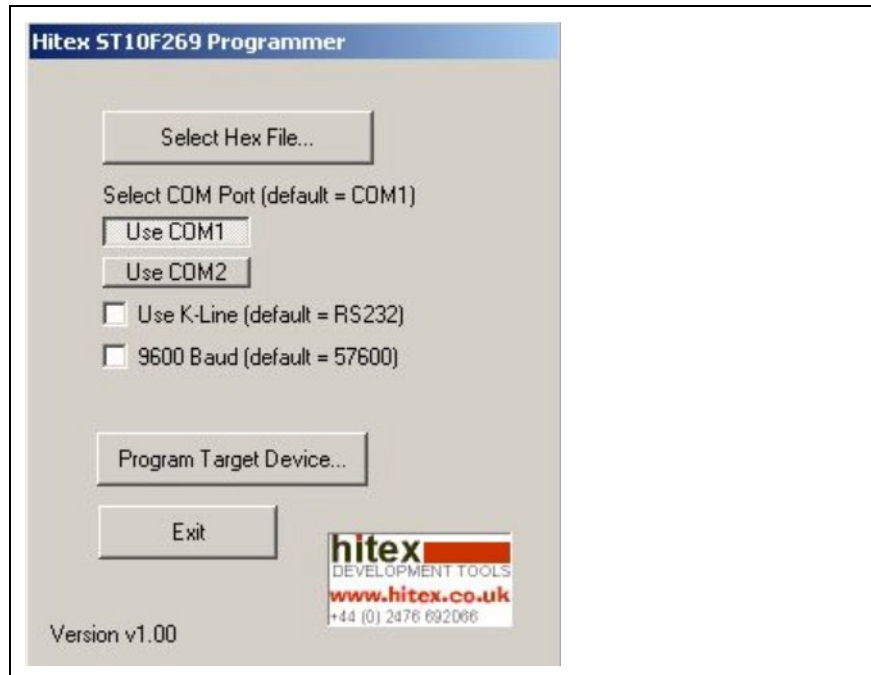
No real installation is necessary, rather copy the files onto your PC with the following steps:

1. Create a folder for the program.
2. Copy the program file FLASH269 . EXE into this folder.
3. Copy the file FLASH269 . DLL into the Windows system folder. The name of this folder varies according to the version of Windows in use.

6.4.2 Using the Flash Program

Start the flash program by double clicking on FLASH269 . EXE in the folder you created above. The following program window is shown:

Figure 20 Screenshot Flash ST10F269



Use Select Hex File to select the firmware file from the disk. Then set the relevant COM port. Switch to the Terminal program and in monitor mode press **[P]** to enter the password 815. Then press **[U]** to prepare the antenna for the update process. Afterwards cut the connection to the antenna in the Terminal program and switch back to the Flash program. Here click on **Program Target Device** and confirm the dialog that opens. As soon as the programming is finished successfully reset the antenna by turning the power off and then on again. As soon as you re-connect the terminal program the new version number of the firmware should be shown in the main screen.

7

Trouble Shooting

The following list contains a list of errors that might occur. For each error, a symptom description is given. In the third column you will find a description how to locate and possibly correct the error.

If you should not be able to correct an error occurred, please use the table how to locate the source of the error as exactly as possible (nature of malfunction, at which point in time did the error occur, etc.) before consulting us.



Use the process described in chapter 4 „Installation / Commissioning“ on page 12 to protocol passages of the antenna throughout the site!

Table 44 *Trouble Shooting*

| Error | Possible Cause(s) | Diagnosis / Correction |
|--|--|--|
| No system function Even though a transponder is located within reception range, there is no serial output | Power supply is not sufficient. | Measure the voltage |
| No contact is possible; only unintelligible characters are sent. | <ol style="list-style-type: none"> 1. CAN+ exchanged with CAN- by mistake. 2. Incorrect setting of transfer parameters. 3. Incorrect transfer procedure selected. | <ol style="list-style-type: none"> 1. Check the corresponding connections. 2. Select only 9600 or 19200 Baud, 8 Bit, even parity. 3. Select the correct procedure, etc. with the PC and the system monitor program. |
| Output values are not reproducible; lack of accuracy. | Interferences | Check the value S in monitor mode. If it is over approx. 50, there could be interferences in the range 62 kHz. |
| No positioning pulse. | <ol style="list-style-type: none"> 1. Transponder defective. 2. Loose cable connections. 3. Interferences 4. Antenna defective. | Check the transponder (e. g. with the hand-held reader). |
| Permanent Positioning Pulses. | Interferences | Activate the link to decoding in the menu Time&Code (section 6.3.2.4 on page 38) |
| Only one transponder is read, subsequent ones are ignores | Interferences and/or thresholds set too low | Set the thresholds Threshold for Decoding , Level for Positioning higher than the interference level. If the interference level is too high the possible crossing speed is reduced. |

8

Technical Data

Table 45 Technical Data Antenna HG 71910-C

| Antenna HG 71910-C | |
|---|---|
| Casing | Dimensions see Figure 11 on page 17 |
| Effective antenna area | 140 x 70 mm (positioning range) |
| EMC | refer to Table 46 on page 46 |
| Cable length | The maximum length of the connection cable should not exceed 10 m! |
| Power supply | 24 V \pm 10 %, approx. 500 mA |
| Operating temperature | 0 to +50 °C |
| Mechanical stability | 5 g 11 ms / 2 g 10 to 55 Hz |
| Installation regulations | see Figure 4 on page 11 |
| Protection class | IP 65 (Version HG G-71910VC: IP 40) |
| Connectors | see variant overview in Table 2 on page 17 |
| Reading distance | 30 to 70 mm (distance transponder → underside reading antenna) |
| Nominal reading distance | 50 mm |
| Positioning accuracy | \pm 3 mm on the center axis |
| Repeat accuracy | 2 mm |
| Max. pass- over speed | – 1 m/s with positioning – 2 m/s without positioning |
| Programming time | approx. 30 ms |
| Serial interface | RS232 with 9600 or 19200, even parity, 1 stop bit, procedure 3964R or transparent |
| Crossing pulse | 24 V, 20 mA |
| CAN-Bus (Version HG G-71910ZC) | According to ISO/DIS 11898 Identifier, Data rate, Basic/Extended CAN; configurable via serial interface |
| Parallel output (Version HG G-71910YC) | Data output: 15+1, 24 V, no current limit! |

Table 46 *Electromagnetic Compatibility*

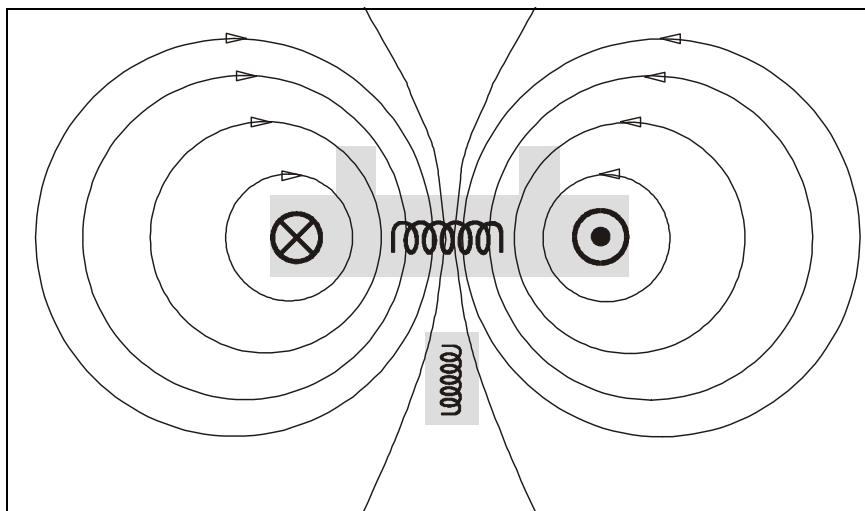
| Electromagnetic compatibility (EMV) | | |
|-------------------------------------|---|--|
| Examination of | | In accordance with European Testing Standard |
| Emitted interference | | |
| | Noise radiation | EN 55 022 class A |
| Stability | | |
| | Casing | |
| | Electromagnetic HF field, amplitude-modulated | EN 61000-4-3 |
| | Discharge of statical electricity | EN 61000-4-2 |
| Signal tap | | |
| | High frequency asymmetric | EN 61000-4-6 |
| | Fast transients | EN 61000-4-4 |

9

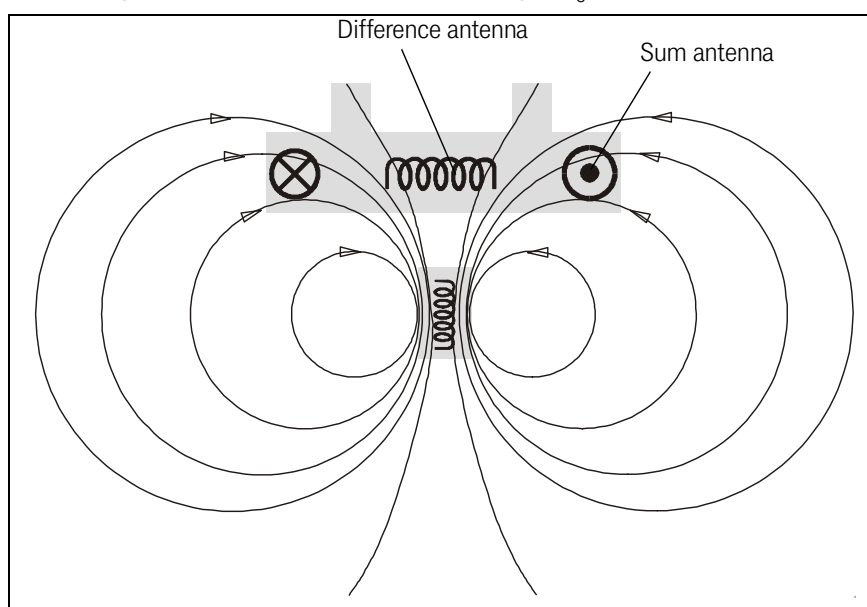
Appendix

9.1 Physical Basics

9.1.1 Field Arrangement of the Energy Field

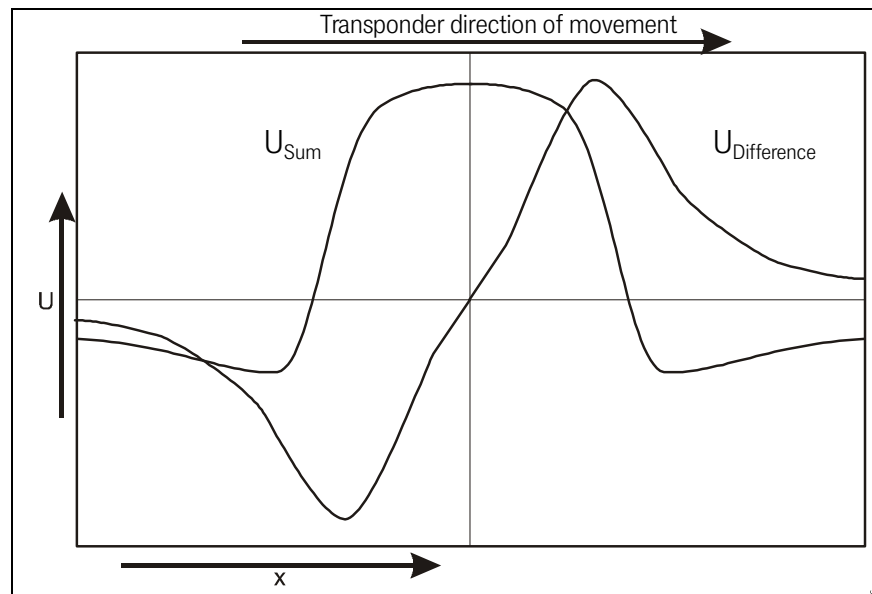
Figure 21 Field arrangement of the energy field $f_c=128$ kHz

9.1.2 Field Arrangement of the Transponder's Reverse Signal

Figure 22 Field arrangement of the transponder's reverse signal $f_c=64$ kHz

9.1.3 Induced Voltages in Sum and Difference Antenna

Figure 23 Induced voltages in sum- and difference antenna



9.2 Procedure 3964R

For the computer interconnection between antenna <--> PLC a 3964R-Protocol may be used. As the antenna outputs data cyclically, this results in some simplifications for the implementation of the 3964R. The following diagrams describe the procedure.

The following settings need to be observed:

- ♦ Transponder system has lower priority
- ♦ Data transfer is set to 1 start bit, 8 data bit, even parity, 1 stop bit, baud rate 9600 baud (default) or 19200 baud.

0.1 Data direction antenna -> PLC

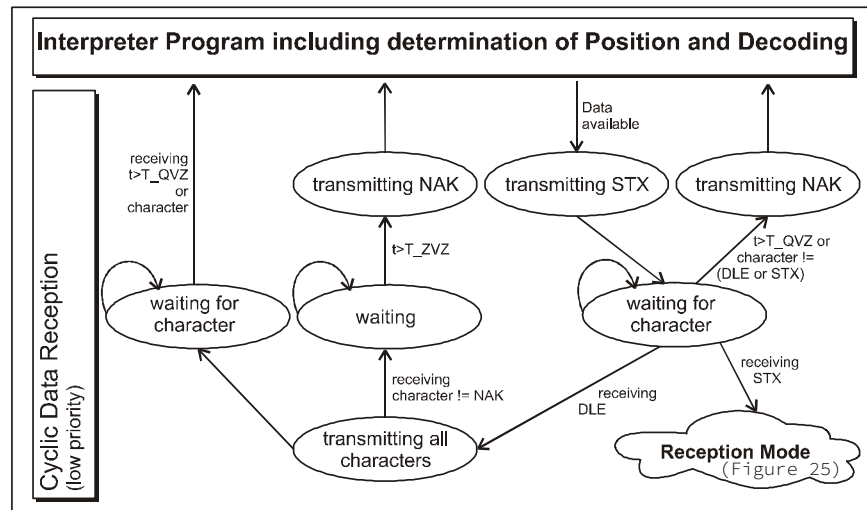
In this direction the antenna data is transmitted cyclically. A set of data always starts with an "="-character (hex 0x3d). The cycle time is parameterizeable and should be an integer part, or a multiple thereof, of the transponder code's transmission time. For this system, the duration for the transponder code transmission is 8 ms. The minimum cycle duration depends upon the telegram length, therefore on the baud rate and the selected telegram content.

In the following status diagram

T_ZVZ stands for the programmable character delay and

T_QVZ for the programmable acknowledgement delay.

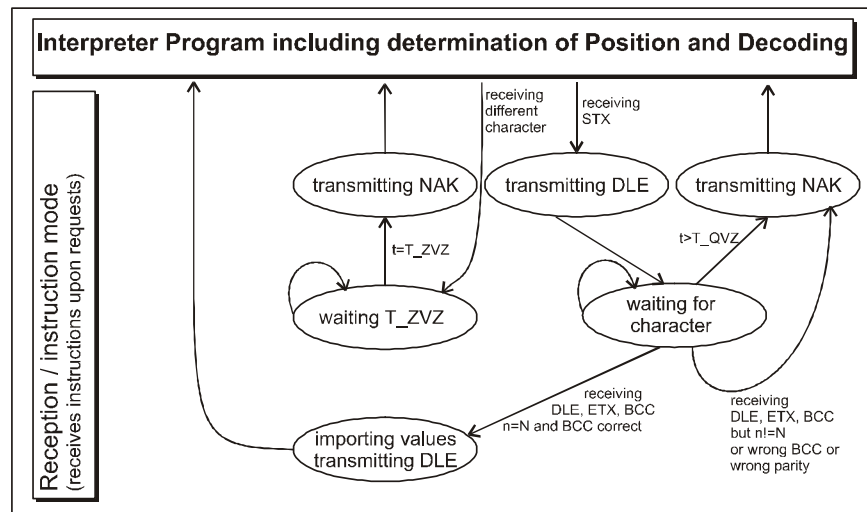
Figure 24 Status diagram procedure 3964R; Antenna → PLC



9.2.1 Data direction PLC → Antenna

In this direction, commands are transmitted only when required (in this system two commands are implemented; see section 5.2.2.1.2 on page 20). To overcome the frequent cyclical data output of the antenna, the 3964R of the antenna has a lower priority (see Figure 24).

Figure 25 Status diagram procedure 3964R; PLC → Antenna



9.3 Procedure „transparent“

For the interconnection antenna ↔ PLC a transparent protocol can be used. The following settings have to be observed for the data transmission:

- 1 start bit, 8 data bit, parity even, 1 stop bit, Baud rate 9600 Baud (default) or 19200 Baud.

9.3.1 Data direction antenna → PLC

In this direction, cyclical antenna data is transmitted. The duration is configurable, it should take an integral part or multiple of the transponder code transmission. The minimum cycle duration depends upon the telegram length, the Baud rate and the chosen telegram content.

The data sentence always starts with an „=“-character (hex 0x3d). Then the parameters chosen from the respective menu follow. The telegram is to be quit with an 8 bit check sum over all characters. This check character is the result of ex-oring all characters. The characters are transmitted without delay.

9.3.2 Data direction SPS -> antenna

Commands are transmitted into this direction if necessary. Each command must start with a „=“-character (hex 0x3d). The format of the commands is described in Table 8 „List of system commands“ on page 21. The telegram is to be quit with a 8 bit check sum (XOR) over all characters. The characters are sent without delay. The characters must be received within the parameterizeable character delay time. Otherwise the telegram will be chopped.

9.4 Parallel Output

After decoding of the transponder code valid the lower 15 bit will be set to the corresponding outputs. The appropriate transponders of the driver circuit are set up to 24 V. Additionally the DTR -output is activated for the duration adjustable. The increasing edge / slope of this pulse can be used for the storage of the parallel data, e.g. of an PLC. The edge (duration adjustable via Time&Code -> DTR Setup Time; see 6.3.2.4 on page 38) will be started after applying the code to the parallel output. A (possible) 0 code does not lead to the activation of the DTR output. A multiple receiver leads to the activation of the output, if this one is deallocated in the corresponding menu (6.3.2.4 on page 38).

9.5 Positioning Pulse

After crossing the center of the antenna a current limited output is set up to 24 V for an adjustable time. Via the corresponding set up menu (6.3.2.4 on page 38) it is possible to set whether the crossing of the antenna's center generates a positioning pulse or if only one pulse per crossing is output.

Additionally it is possible to set that the positioning pulse is only deallocated after a transponder has been decoded.

Figure 28 Casing and dimensions: Antenna HG G-71910XC / Interface: Parallel / cable entry on the antenna side, 25 pin SUB-D male connector

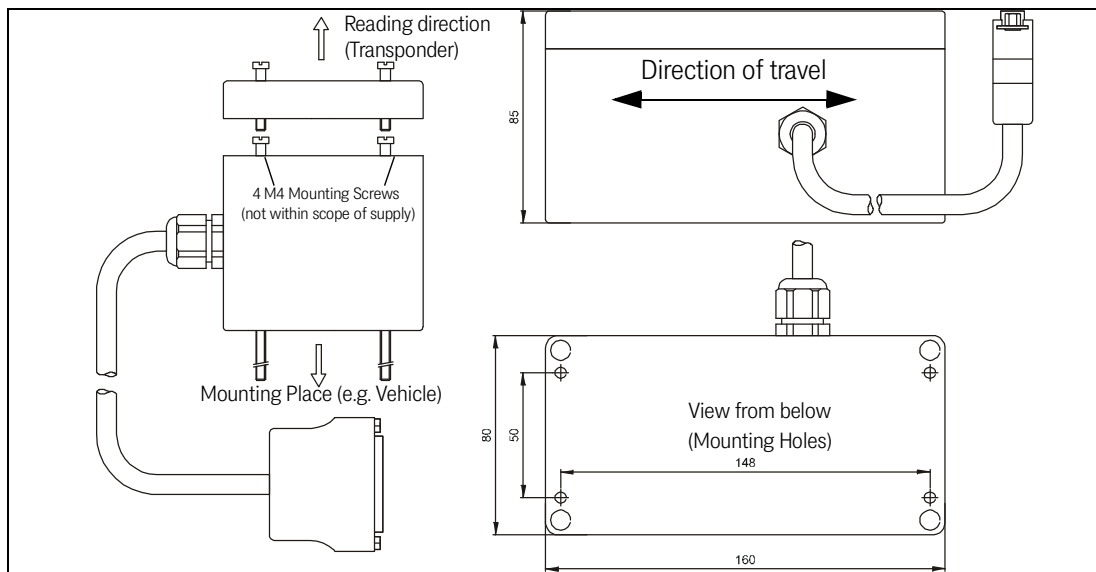


Figure 29 Casing and dimensions: Antenna HG G-71910VC / Interface: Parallel / 25 pin SUB-D male connector on the narrow side of the antenna

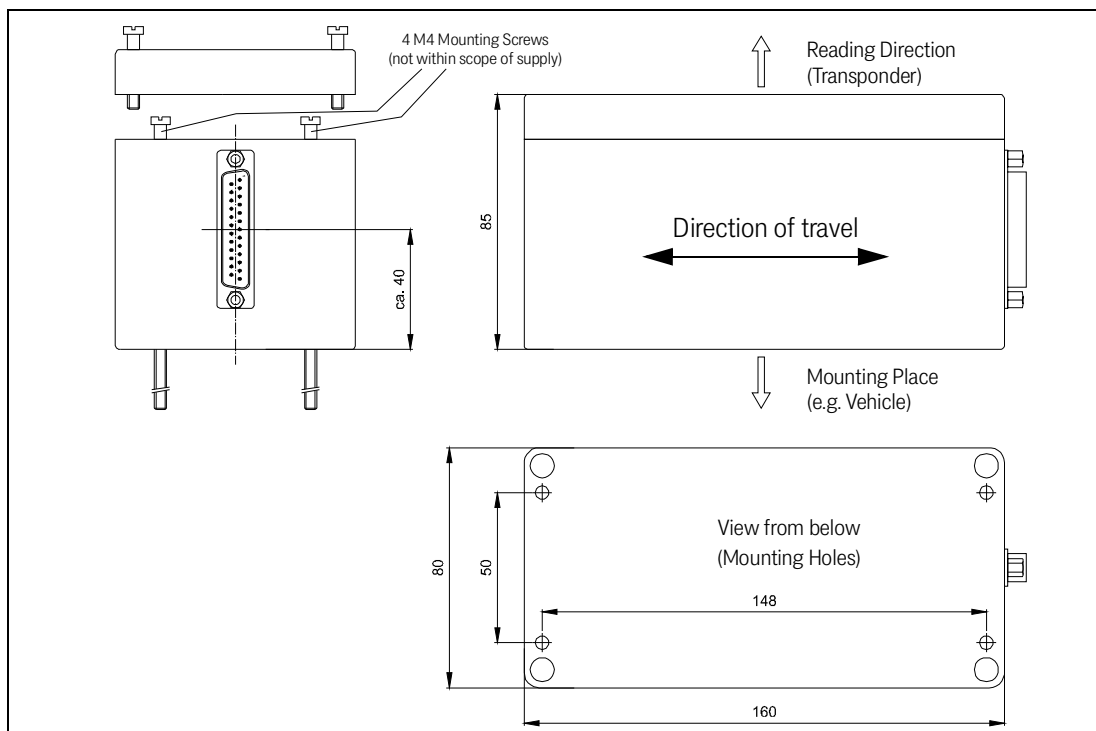
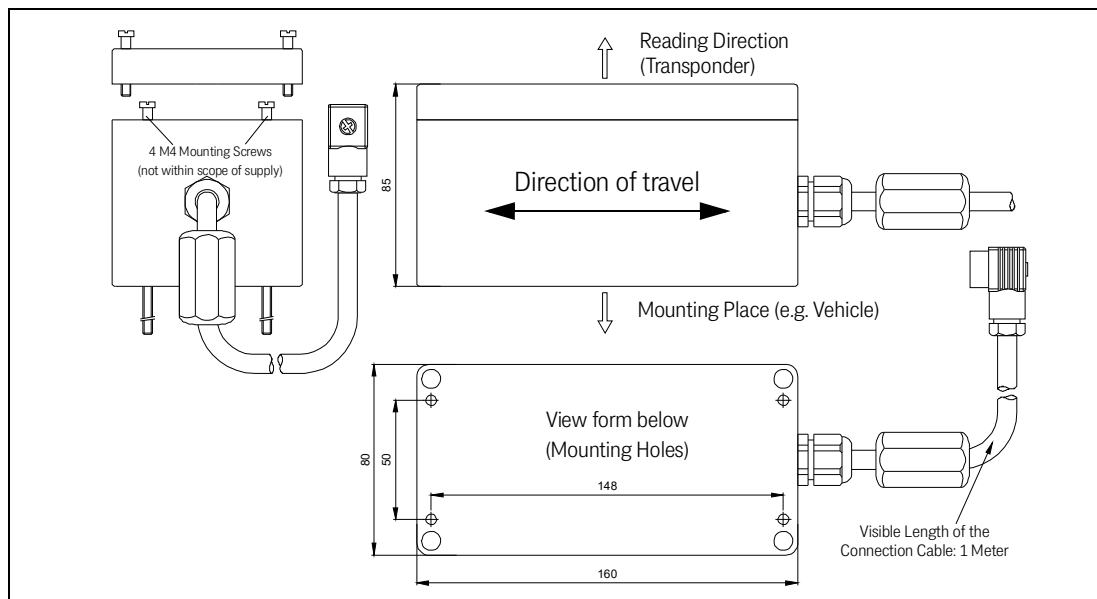
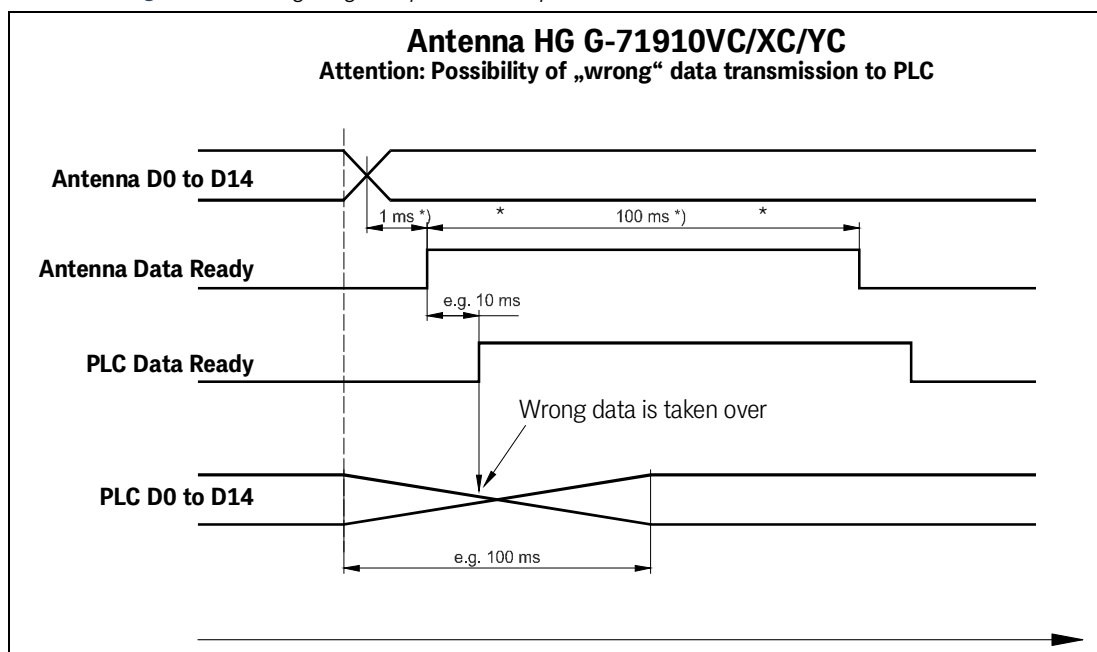


Figure 30 Casing and dimensions: Antenna HG G-71910UC / Interface: Serial / Hirschmann male connector / cable entry on the narrow side of the antenna



9.7 Timing-Diagramm of the Parallel Interface

Figure 31 Timing diagram: parallel interface



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Götting KG

Celler Str. 5 | D-31275 Lehrte

Tel. +49 (0) 5136 / 8096 -0

Fax +49(0) 5136 / 8096 -80

info@goetting-agv.com | www.goetting-agv.com



www.goetting-agv.com