User Guide
ARE H15 LF
Handheld Reader

1   Introduction

This document describes the RFID-reading device ARE H15 LF.

It consists of the PDA C5000 by the manufacturer Shenzhen Handheld-Wireless Technology Co., Ltd. with our AEG ID reader inside.

The C5000 is a smartphone with all the typical features like diverse mobile communication network standards (LTE, UMTS, GSM), WLAN, Bluetooth, GPS, Camera, ... It is running with Android OS 5.1.1 operation system. Please read the PDA specific documents for more details.
Its rugged design, the integrated barcode scanner and of course the integrated RFID reader make it ideal for professional users.

Our main focus lies on:

- hand-held design

- integrated RFID reader in a PDA allows direct electronic data processing of the reader results

- ideal to develop a user specific application with easy access to transponder information and easy integration of this data
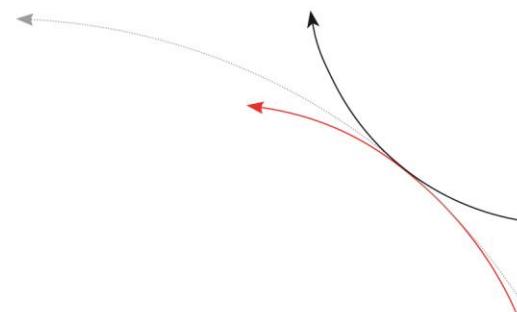
2 Startup and testing the reader

- Start the PDA

- Start the demo application "Terminal"

- Open the COM port to the reader (COM14, 19200 Baud) with the "Open" button. Edit the command to the reader in the input field beleow. Send the command to the reader with the "Send" button. Receive the answer of the reader in the text field below.
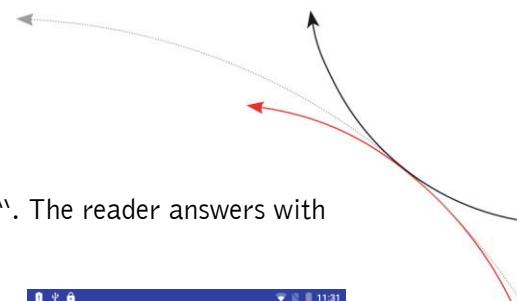
- To get the firmware version of the reader, send the command „VER". The reader answers with the firmware version string (e.g. AEG ID A1 V4.00008).
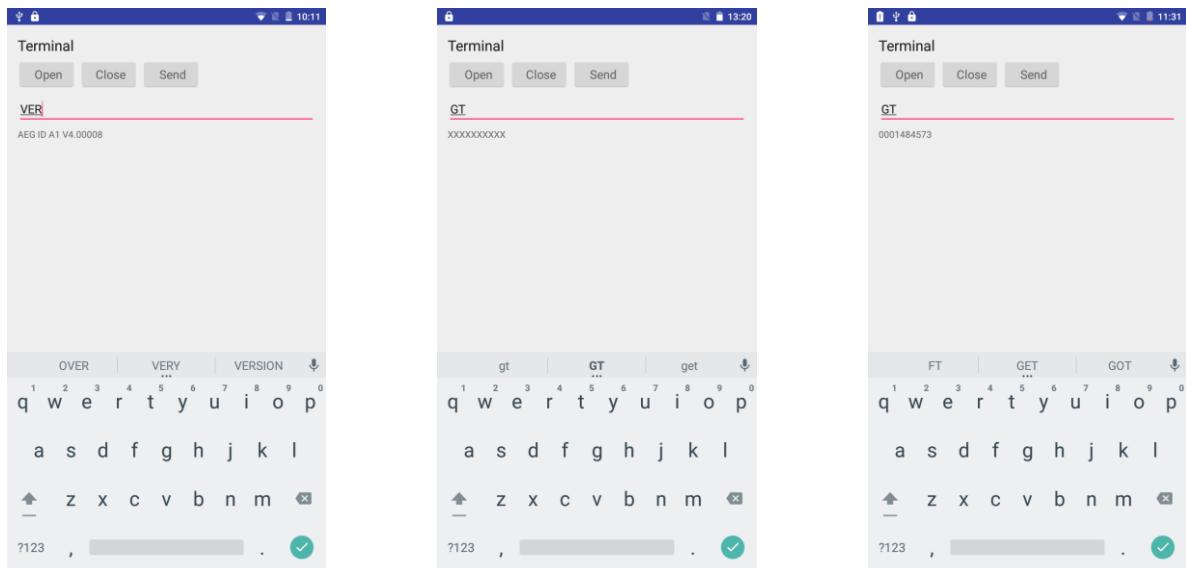
- Send the command "GT<CR>" to the reader. The reader sends a NoRead message (XXXXXXXX), while there is no transponder in the antenna field available (if CN parameter is 0). If there is a transponder present in the antenna field the reader sends its unique id.
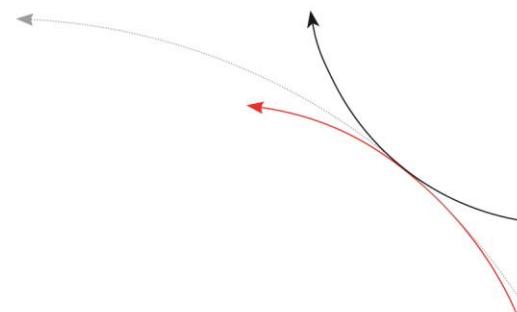
3   AEG ID instruction set

3.1   General

The command set described below defines the transfer of data on the serial interface.

The commands consist of a command code and optionally of a parameter value. Commands are terminated by the control character <CR> (0Dh). The control character serves as command line terminator.

Command codes and parameters,including all letters and numerical values, are principally transmitted as a sequence of ASCII characters (the value 255 (decimal) consequently as 32H, 35H, 35H; the command RST as 52H, 53H, 54H).

3.1.1   Entering instructions

The protocol format is as follows

Command <SP> **parameter** <CR>

The space character <SP> separates commands from parameters and the <CR> character acts as command line terminator.

For commands without parameter values (e.g. GT) the <SP> character and parameter values are omitted. The command line is as short as this:

Command <CR>

3.1.2   Output format

Generally, every input terminated by <CR> is acknowledged by the reader. The following response protocols are different:

3.1.2.1 Instruction specific output
After entering a valid command without a parameter value, the system answers by sending the parameter value and <CR>. Example:

Command: **GT** <CR>
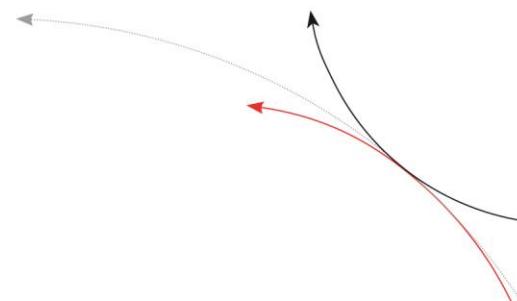
Output: Transponder number or No Read <CR>

3.1.2.2   Output after changing a parameter

After entering a valid command together with a parameter value, the system answers by sending the parameter value and <CR>. Example:

Command: **MD** <SP> **2** <CR>

Output: **2** <CR>

After entering an invalid parameter value, the system answers with the corresponding error code. Error message:

Command: **MD** <SP> **4** <CR>

Output: **NAK** <SP> **#02** <CR>

3.1.2.3   Output at parameter query

Parameter settings can be queried by sending the command without adding a parameter value. Example:

Command: **MD** <CR>

Output: **2** <CR>

3.1.3   Blank instuction

If a single <CR> is input, the reader answers with a single <CR>. Example:

Command: <CR>

Output: <CR>

3.1.4   Incorrect instruction / error codes

If a command is not entered correctly, the reader sends one of the following error codes:
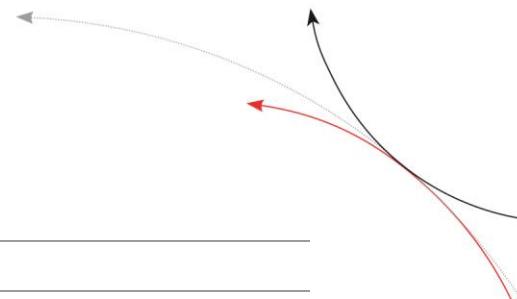
ERROR CODE	MEANING
NAK #00 <CR>	unknown command
NAK #02 <CR>	wrong parameter
NAK #10 <CR>	antenna failure
XXXXXXXX <CR>	no read
ACK	no error/acknowledge

3.1.5 Upper and lower case

The instruction set isn't case-sensitiv.

3.1.6 Linefeed

The reader does never send a linefeed. If you use a terminal program it can add the linefeed. You have to choose the option "displace CR with CR LF".
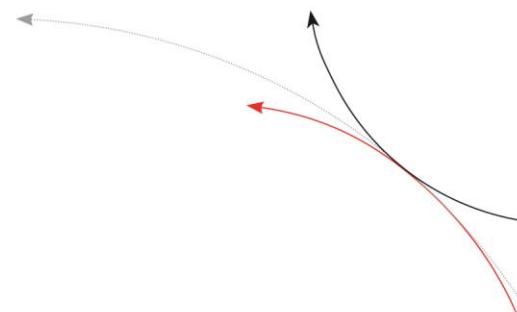
3.2   Instructions for the hardware settings

3.2.1 BD – baudrate

The command BD enables the change of the baud rate. The settings are directly effective.

Input format: **BD** <SP> **parameter** <CR>

Output (example):   **2** <CR>

Parameter:

PARAMETER	FUNCTION
0	4800 baud
1	9600 baud
2	19200 baud
3	38400 baud

3.2.2 RST – reset

With the command RST the reader does a warmstart and loads the saved settings from the internal EEPROM. The antenna field is off after the reset.

Input format: **RST** <CR>

Output (example):   **ACK** <CR>

3.2.3 VER – version

With the command VER the reader sends the actual firmware version.

Input format: **VER** <CR>

Output (example):   **AEG ID V1.22** <CR>
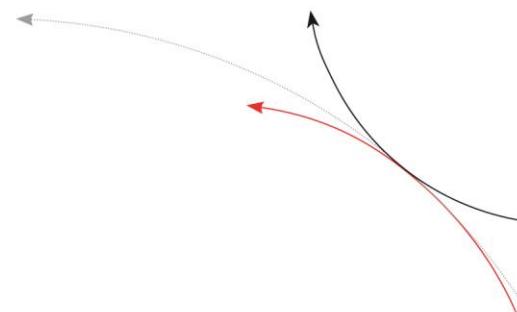
3.2.4 EC - Echo

The EC command allows to change the echo function.

Input format: **EC** <SP> **parameter** <CR>

Parameter:

PARAMETER	FUNCTION
0	Echo off
1	Echo on

Output (example):   **0** <CR>

3.2.5 HF – Antenna field

With the command HF, the antenna field can be set or reset manually.

Input format: **HF** <SP> **parameter** <CR>

Parameter:

PARAMETER	FUNCTION
0	Switch off antenna field (this stops automatic mode)
1	Switch on antenna field (this stops automatic mode)
2	Automaticmode, the antenne field is activated by reader to comunicate with the transponder, afterwards it is switched off automatically. Therefore it is not compatible with the pass-word mode.

The reader answers with the adopted antenna mode.

Input (examplel):   HF <SP> 2 <CR>
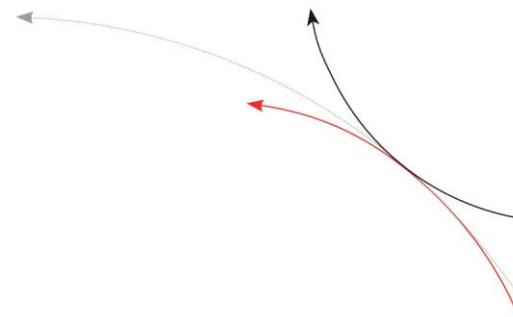
Output: 2 <CR>

3.3 Instructions for reading settings

3.3.1 CID – suppression of ID Codes

In the MD0 mode with CID=1 **only the first** of in succession identical transponder numbers is output on the serial interface. The possibly following identical transponder numbers are suppressed, as long as no new valid transponder number is received, processed and output. The get tag command is not influenced by this command. NoReads do not influence the data filtering. The leds are not influenced by this command.

Input format: **CID** <SP> **parameter** <CR>

Output (example):   **0** <CR>

Parameter:

PARAMETER	FUNCTION
0	No suppression
1	Suppression of equal transponder numbers

Example: A, B, C are different transponder codes, N is NoRead error code:

Sequence of reading cycles	Output sequence after filtering with CN=0 und CID=1	Output sequence after filtering with CN=1 und CID=1
N, N, ...,N, A, A, A, ...A, N,N, ...	N, N, ...,N, A, N, N, ...	A
N. N, N, A, A, A, N, A, A, B, A, C, C, C, ...	N. N, N, A, N, B, A, C, ...	A, B, A, C

The settings are directly effective.
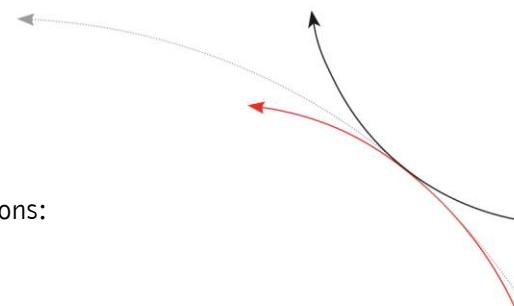
Note: The internal reference number is deleted in the following conditions:

- after a cold start

- after a warm start (command line RST <CR>)

- after entering the command line CID <SP> 1 <CR>

This causes that the next transponder code is output definitely.

Note: The filter function CID picks up the results of the complete **reading cycles**, while the parameter NID proceeds from the results of single **readings**! The filter function CID has effect on the serial interface only.

3.3.2 CN – suppression of No Reads

Through the setting CN=1 the NoRead results after a get tag command or in MD0 mode are suppressed on the serial interface. The leds are not influenced by this command.

Input format: **CN** <SP> **parameter** <CR>

Output (example):   **0** <CR>

Parameter:

PARAMETER	FUNCTION
0	No suppression
1	Suppression of equal transponder numbers

3.3.3 NID – Failure Protection

NID specifies the number of identical transponder numbers, which have to appear for the result "successful reading" within a reading cycle. In the setting NID = 1, two successive readings have to show the same transponder number.

Input format: **NID** <SP> **parameter** <CR>

Parameter:

PARAMETER	FUNCTION
0	One out of one
1	Two out of two
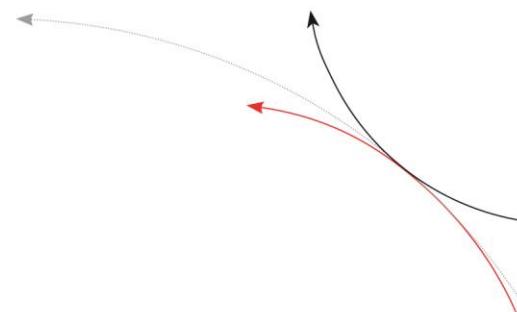
Output (example): **1** <CR>

Sequence of readings	Lenght of the reading cycle	Result of the reading cycle
NoRead	1 reading	NoRead
0000125ED1, 0000125ED1	2 readings	0000125ED1
0000125ED1, 0000126ED1	2 readings	NoRead

3.3.4 INIT – initialization

With the command INIT all paramters of this command set are set to the default values. After that you can save the settings with the command VSAVE.

Input format: **INIT** <CR>

Output (example): **ACK** <CR>
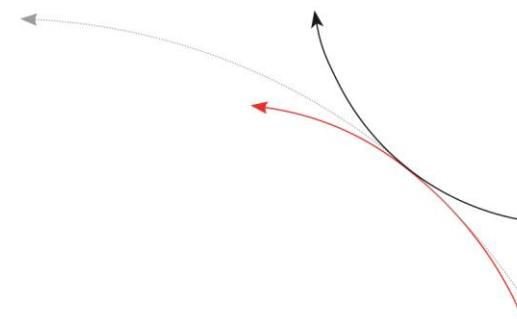
3.3.5 TOR – maximum reading time

TOR is the timeout time for the reader. TOR is used in operation mode 2 as maximum gating time for a reading process. The length of the maximum gating time results from the equation $gating\_time = TOR * TB$.

The time constant TB (time base) has always the default value 100ms.

Input format: **TOR** <SP> parameter <CR>

Output (example):   **05** <CR>

Parameter:

PARAMETER	FUNCTION
00h	limits the reading process duration of exactly one reading cycle
01h..FFh	limits the reading process duration to maximum 1..256 times TB

3.3.6 VSAVE – variables save

With the command VSAVE the following parameters are saved to the internal EEPROM:

ACT, AFI[2], AM, BD, CE[1], CID, CN, KM[1], KT[1], LAA, MD, SI, TL[1], TOR

Input format: **VSAVE** <CR>

Output (example):   **ACK** <CR>

[1] just available in the ISO 14443A standard
[2] just available in the ISO 15693 standard
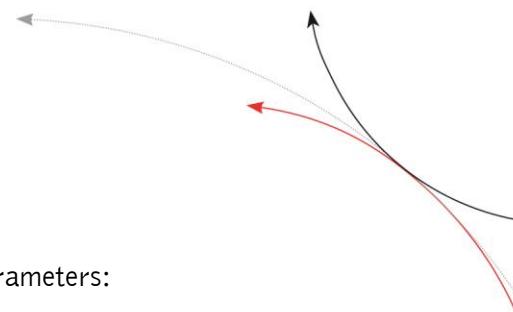
3.3.7 VS – variables show

With the command VS the reader shows the settings of the following parameters:

BD, CID, CN, EC, MD, NID, TOR

Input format: **VS** <CR>

Output (example):   **BD** <SP> **0** <SP>

                             …

Note: The function VS shows just the settings that are used in the actual ISO standard.

3.3.8 ALGO – algorithm selection

With the command ALGO the algorithm can be selected. Depending on the algorithm, the reader adapts its communication to the transponder suitable for the chip type respectively data format that shall be used. In some algorithms specific commands are provided additionally. For example the selective read and write commands (RD, WD) are only supported with read write transponders and its algorithms. This algorithm specific commands are listed in the "Addon_A.." documents. Depending on reader hard- and software not all parameters may be supported. A reader designed for only one algorithm, does not allow a change.

Input format: **ALGO**<SP>**parameter**<CR>

Output (example):   **4**<CR>

Parameter:

PARAMETER	FUNCTION (CHIP, FORMAT)
1	Trovan und PSK1
4	ASK 64 Bit
5	ISO FDX
6	HiTag1 und HiTagS
8	HiTag2
9	P4150, 4450 und 4550
14	EM 4569 und 4305
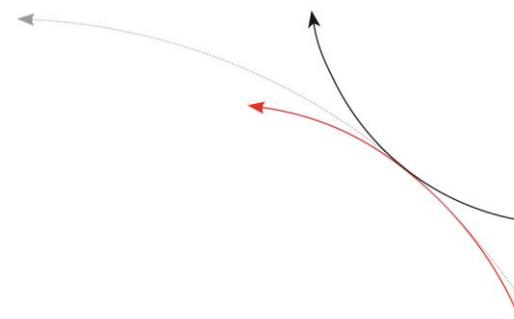
3.4 General reading instructions

3.4.1 GT – get tag

The instruction GT executes one reading and sends back the transponder code of a transponder or the No Read error code (e.g. „FFFFFFFFFF" oder „XXXXXXXXXX").

Input format: **GT** <CR>

Output (example):   **0420212E5F** <CR>

3.4.2 MD – mode of operation

There a two modes of operation available. It is possible, that the reader reads constantly or triggered by an instruction.

Input format: **MD** <SP> **parameter** <CR>

Output (example):   **2** <CR>

Parameter:

PARAMETER	FUNCTION
0	constant reading mode
2	single reading mode

3.4.3 Basic data exchange process

The master has to send an software command to start an read or write process of the reader. After doing all the necessary work at the readers site, the result of the reading or writing process or an failure code is sent back to the master.

If there is used an read/write transponder, only the serial number of the transponder will be read if the basic read command „Get Tag" („GT <CR>") is applied.
The data exchange of the whole memory can only be done, if the reader is set to the Mode 2 („selective Read (RD) " and „write (WD)").
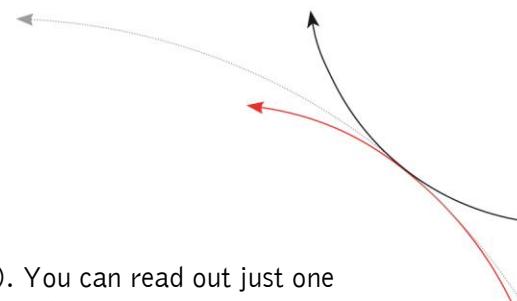
3.4.4 RD – read page

- Start the reader with the command RD plus parameters (plus <CR>). You can read out just one block (with one parameter) or several blocks (with two parameters, first and last block number).

- Wait for the answer

- Analyse the received answer: 8 characters plus <CR>. Allowed characters 0 to F.
The NoRead code is set to („XXXXXXXX").

The result of the reading process may also be seen at the LED's.

- LED L2 lit, if there was a successful read.

- LED L3 lit, if there was a No Read.

Example:	**RD** <SP> **20** <CR>	read block 20
	RD <SP> **16** <SP> **33** <CR>	read all blocks from 16 to 33

Allowed values (block numbers of the transponder IC):

ALGO 9 (1 kBit; P4150, P4450, P4550)	3 … 33
ALGO 6 (2 kBit; Hitag 1)	16 … 63
ALGO 14 (2, 4; kBitEM4305, EM4569)	5 … 15
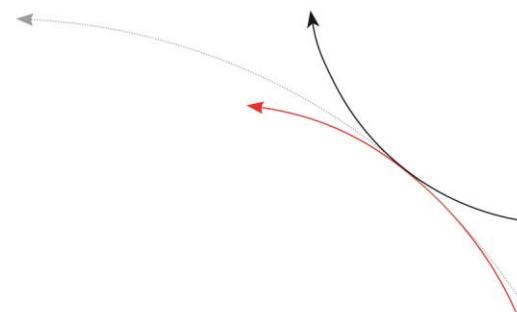
3.4.5 WD – write page

The memory of the transponder is organised in blocks, containing 32 bits. The data's of every single block must be changed separately.

- Start the reader with the command WD plus parameters (plus <CR>). The sent parameter consists of the block address and writing data's (8 ASCII characters).

- Wait for the answer

- Analyse the received answer: 3 characters plus <CR>.

ACK <CR>   Writing process was successful
NAK <CR>   Writing process was not successful.
NOT <CR>   The response of the transponder was not readable.

Example: WD <SP> 20 <SP> < 0 1 2 7 A C D F > <CR>   write to block 20

Allowed values (block numbers of the transponder IC):

      ALGO 9 (1 kBit; P4150, P4450, P4550)   3 … 33

      ALGO 6 (2 kBit; Hitag 1)   16 … 63

      ALGO 14 (2, 4; kBitEM4305, EM4569)   5 … 15

3.5   Additional parameters

LED, LAA, TSC, HID and KL are parameters that are not supported with the H14 hardware. LAA (LED Automatic Activation) must stay on 0. Because while the reader tries to accesses the LED it does not work off further commands, twarts them.

TI, TO, TP, TZ, TS, TT are parameters used to write or are algorithm specific. They are described int the documents „Addon_Schreibparameter", „Addon A14", ….
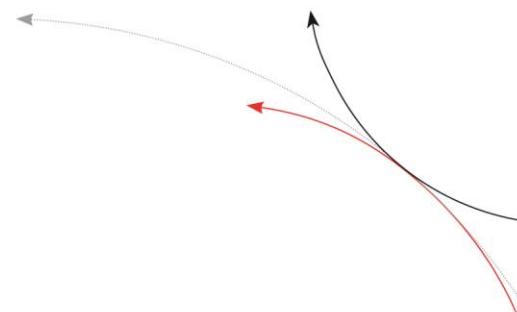
4 Operating modes of the reader

In the AEG instruction set there are two operational modes defined:

- MD 0 - continuous mode

- MD 2 - the reading process is triggered by the serial interface

In the next capters can you find a detailed functional description.

The default mode is MD 2.

4.1 MD 2 - triggered by an software command

The master sends the command to read a transponder code. The reader answers with the code or an error code.

You can execute specific commands "Read" (RD) and "Write" (WD) just in mode MD2.

In operating mode 2, the exciter is always turned off. Triggered by the software command (GT; RD; WD), the exciter is activated. After successful reading or writing of a transponder number the exciter is turned off automatically.

```
exciter     ____┌──────┐_____
                │      │
processor   ____│ reading cycle │_____
                └──────┘
interface   __│ GT │_____│ ID │_____
```
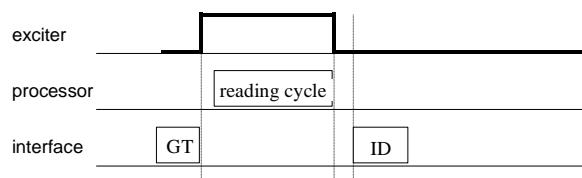
Figure 9: Software triggered reading operation

If the first reading cycle yields no result (NoRead), the on-time of the exciter is limited by the parameter TOR (time out reader): Reading cycles are continuously started until either a transponder is read successfully or the time span corresponding to the value of the parameter TOR has expired. The reader will not interrupt the last running readout cycle. If no transponder number has been read, a NoRead is output.
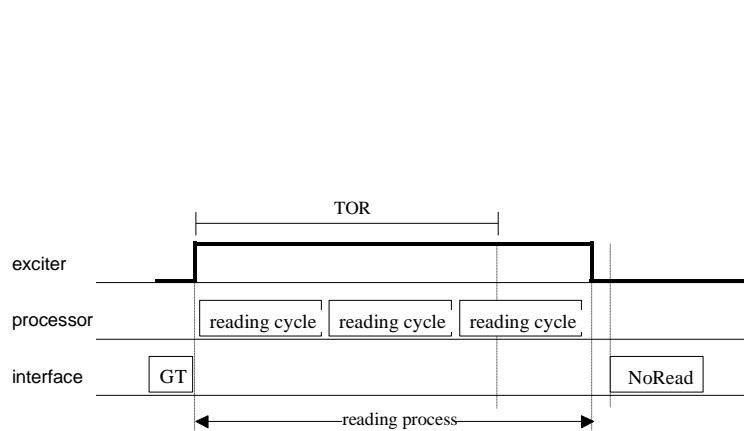
Figure 10: Software triggered reading operation with TOR>0

Please note: The TOR parameter is only active, if the GT-Command is applied. Within the time span defined by the value of TOR no NoRead will be output on the interface!

4.2   MD 0 - continuous reading

When operating continuously the exciter is switched on permanently. The reading cycles are initiated periodically.

After an accomplished reading cycle the reading information is evaluated. After that data (either transponder number or NoRead code) is output to the serial interface
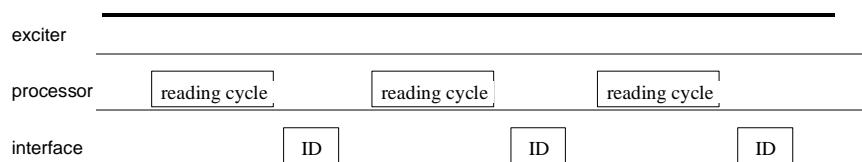

Figure 11: continuous operation
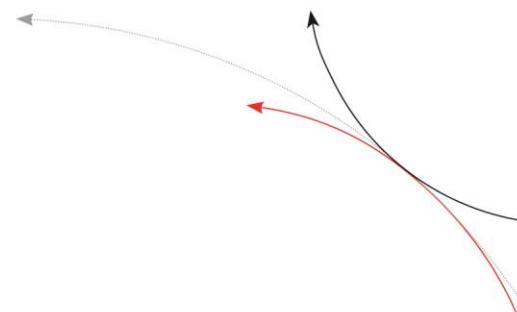
5 Instructions

To avoid any reduction of the reading distance of the reader, the reader must not be brought next to a metal surface (e.g. don't put metallic sticker to the reader). This could lead to a significant change of the properties of the antenna circuit, which in turn reduces the reading range considerably or causes reading holes!

To get reliable readings, the distance between reader and transponder must be within the specified reading volume.

The reading characteristic in front of the reader is not isotropic. It depends also strongly on the orientation between Reader and Transponder. To get the maximum reading distance, the orientation between reader and transponder must be well suited.

To get a reliable readings or writings, the time of transponder while crossing the sensitive area of the antenna must be coordinated to the data transfer characteristics of transponder
In general the time depends on the speed of the transponder, the size of the transponder and the way the transponder is mounted on the vehicle and must be verified by field tests.

Environmental electromagnetic noise may also reduce the read and write range considerably.

Arrangement to eliminate such troubles must be done specific to the application by the help of engineers of the manufacturer.
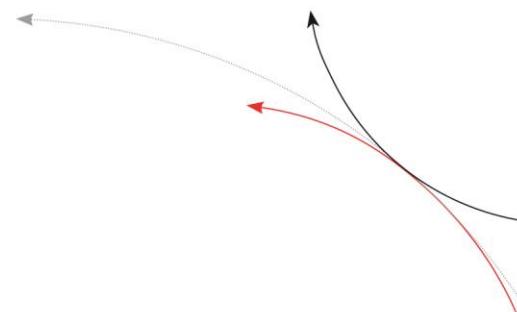
6 Hotline

If there are questions or suggestions please call the hotline:

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http://www.aegid.de

7 Revisions

12/19/2017   Revision 01:   initial edition   MK