AEG ID
INTELLIGENTIFICATION™

ARE DT1

Installation Guide

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1 Introduction

This document describes the RFID-reading device ARE DT1 and the set-up procedure.

The main features of the reader are listed below:

- integrated USB interface selectable either communications port (similar RS232) or HID
- USB powered (no external supply voltage necessary)
- compact design

2 Startup and testing the reader DT1

- Connect the reader with the USB interface from your notebook or pc
- In the device manager there will appear a new device (Silicon Labs CP210x USB to UART Bridge)
- In the brackets you see the port number of the device (e.g. COM5)
- Open the "Demo Terminal" on the CD
- Open the menu "Settings"
- You have to set the following settings: baud rate 19200 baud, 8 data bits, no parity, 1 stop bit, no flow control.
- Send the command „VER <CR>" to the reader. The reader answers with the actual firmware version (e.g. AEG ID Multi-ISO V2.034).
- Send the command „SI <SP> 0 <CR>" if you want to read a ISO 14443A transponder. If you want to read a ISO 15693 transponder you have to send the command „SI <SP> 1 <CR>".
- Send the command "MD <SP> 0 <CR>" to the reader. The reader sends No Read messages (XXXXXXXX), while there is no transponder in the antenna field available. If there is a transponder present in the antenna field the reader sends its serial.

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).

All numbers (e.g. sectors, blocks) are in the hexadecimal format (see chapter 9).

With the command CS you can change to the alternative instruction set. If the reader is set to alternative instruction set, you can change back to the AEG ID instruction set via the command AEG (see chapter 5.3.3).

3.1.1 Entering instuctions

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 #03 <CR>	EEPROM error
NAK #04 <CR>	wrong transponder type
NAK #05 <CR>	buffer overflow
NAK #06 <CR>	not logged in

NAK #08 <CR>	wrong password
NAK #10 <CR>	antenna failure
NAK #11 <CR>	anticollision error level 1
NAK #12 <CR>	anticollision error level 2
NAK #13 <CR>	select error level 1
NAK #14 <CR>	select error level 2
NAK #15 <CR>	transceiver IC error
NAK #16 <CR>	not acknowlegde
NAK #17 <CR>	no valid value block
NAK #18 <CR>	EEPROM full
NAK #19 <CR>	code already saved in EEPROM
NAK #20 <CR>	code not in EEPROM
NAK #21 <CR>	wrong standard
NAK #22 <CR>	wrong transpondercode length
NAK #23 <CR>	transpondercode length and transponder don't match
NAK #24 <CR>	data is not multiple of the block size
NAK #25 <CR>	data length shorter than block size
NAK #26 <CR>	no communication to AMP
NAK #27 <CR>	select error level 3
NAK #28 <CR>	anticollision error level 3
NAK #40 <CR>	ISO 15693 error 01h: command not supported
NAK #41 <CR>	ISO 15693 error 02h: command not recognized
NAK #42 <CR>	ISO 15693 error 03h: option not supported
NAK #43 <CR>	ISO 15693 error 0Fh: unknown error (default)
NAK #44 <CR>	ISO 15693 error 10h: block does not exist
NAK #45 <CR>	ISO 15693 error 11h: block already locked
NAK #46 <CR>	ISO 15693 error 12h: block cannot be changed (locked)
NAK #47 <CR>	ISO 15693 error 13h: not successfully programmed
NAK #48 <CR>	ISO 15693 error 14h: not successfully locked
NAK #49 <CR>	ISO 15693 error A0h-DFh: custom error codes
NAK #50 <CR>	all other ISO 15693 errors: RFU
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
4	57600 baud
5	115200 baud

3.2.2 HF – radio frequency

With the command HF you can switch the antenna field on and off.

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

Output (example): **1** <CR>

Parameter:

PARAMETER	FUNCTION
0	off
1	on

3.2.3 HID – human interface device/keyboard

The command switches the interface ether to HID or RS232 emulation.

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

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

Parameter:

PARAMETER	FUNCTION
0	RS232 emulation
1	HID interface, keyboard

You have to unplug the device and plug the device in again to use the new setting. Don't forget to use the command VSAVE to save the new setting.

If the reader is in HID mode, you can not send any commands to the device. Because of that you have to use the Set-Up card – interface to switch the reader back from HID mode to serial interface mode.

1. Plug out the reader
2. Place card no reader
3. Plug in reader into USB-port
4. Wait for the beep tone from reader
5. Plug out reader
6. Remove card from reader

3.2.4 KL – keyboard language

With the command KL you can configure the language of the keyboard in HID mode.

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

Output (example): **07** <CR>

Parameter:

PARAMETER	FUNCTION
07	german

09	englisch
0A	spanish
0C	french
10	italien
13	dutch
16	portuguese
4B	canadian

3.2.5 RE – read EEPROM

You can read out the internal EEPROM with the RE command.

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

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

Parameter:

PARAMETER	FUNCTION
0000h..079Fh	address

3.2.6 LED – LED control

With the command LED you can control the LED ring of the ARE DT1.

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

Output (example): **1** <CR>

Parameter:

PARAMETER	FUNCTION
0	off
1	on
2	Buzzer beeps, LEDs flash final state =initial state

3.2.7 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>

3.2.8 WE – write EEPROM

Using the command WE you can write one byte to the internal EEPROM.

Input format: **WE** <SP> **parameter 1** <SP> **parameter 2** <CR>

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

Parameter:

PARAMETER 1	FUNCTION
0005h..079Fh	address

PARAMETER 2	FUNCTION
00h..FFh	data

3.2.9 VER – version

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

Input format: **VER** <CR>

Output (example): **AEG ID V1.22** <CR>

3.3 Instructions for reading settings

3.3.1 CE – convert error code

With CE=1 the reader sends no error codes, except the no read error, during the md0 mode or the commands Get Tag.

With CE=2 the reader sends the normal no read error (XXXXXXXX) if there is an error with the select or anticollision.

This command has only effect in the ISO 14443A standard.

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

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

Parameter:

PARAMETER	FUNCTION
0	No suppression
1	Suppression of error codes
2	Replacement with XXXXXXXX

3.3.2 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.

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**! The filter function CID has effect on the serial interface only.

3.3.3 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.

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

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

Parameter:

PARAMETER	FUNCTION
0	No suppression
1	Suppression of equal transponder numbers

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 LAA – LED automatic activity

The leds can be controlled by the reader or over the interface. You can set it up with the command LAA.

If the LEDs are controlled by the reader, the reader beeps and flashes after successful reading and writing.

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

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

Parameter:

PARAMETER	FUNCTION
0	manual controlling
1	controlled by reader

3.3.6 MC – mirror code

With this command you can change the output order of the bytes from a transpondercode.

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

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

Parameter:

PARAMETER	FUNCTION
0	normal sequence
1	mirrored sequence

3.3.7 RA – resend last answer

The command RA resends the last answer sent by the reader.

Input format: **RA** <CR>

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

3.3.8 TSC – time show code

With the command TSC you can define the time in ms, after that the transpondercode is shown again, when the CID parameter is set to 1. If TSC is 00, the code is not shown a second time.

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

Output (example): **00** <CR>

PARAMETER	FUNCTION
00	TSC is not active
01..FF	TSC time in ms

3.3.9 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

3.3.10 SI – set iso standard

With this command you can switch the iso standard of the reader.

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

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

Parameter:

PARAMETER	FUNCTION
0	ISO 14443A
1	ISO 15693

3.3.11 VSAVE – variables save

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

AFI[2], BD, BS, CE[1], CID, CN, HID, KL, KM[1], KT[1], LAA, LED, MC, MD, SF, SI, TOR, TSC

Input format: **VSAVE** <CR>

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

[1] just available in the ISO 14443A standard
[2] just available in the ISO 15693 standard

3.3.12 VS – variables show

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

AFI[2], BD, BS, CE[1], CID, CN, HID, KL, KM[1], KT[1], LAA, LED, MC, MD, SF, SI, TOR, TSC

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.

[1] just available in the ISO 14443A standard
[2] just available in the ISO 15693 standard

3.4 General reading instructions

3.4.1 GA – get active

The command GA causes one reading cycle. There are different cycles for different transpondertypes. This command is only available in the ISO 14443A standard.

Mifare 4 byte UID: request (REQA)

anticollision

select

Mifare 7 byte UID: request (REQA)

anticollision level 1

select 1

anticollision level 2

select 2

The reader answers the UID of an active (non halt) transponder.

Input format: **GA** <CR>

Output (example): **625E562A** <CR>

3.4.2 GT – get tag

With the command GT you select a transponder. The command GT causes one reading cycle. There are different cycles for different transpondertypes.

Mifare 4 byte UID: request (WUPA)

anticollision

select

Mifare 7 byte UID: request (WUPA)

anticollision level 1

select 1

anticollision level 2

select 2

ISO 15693: inventory

The reader answers the UID of a transponder.

Input format: **GT** <CR>

Output (example): **625E562A** <CR>

3.4.3 HD – halt detected code

The command HD mutes the last selected transponder.

Input format: **HD** <CR>

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

3.4.4 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

3.4.5 RD – read page

With the command RD you can read out a page of the transponder. The command executes internally the commands get tag, if using mifare 1K/4K log in (with the key attuned to KM) and the reading command.

Input format mifare 1K/4K: **RD** <SP> **parameter 1** <SP> **parameter 2** <CR>

Input format ultralight: **RD** <SP> **parameter 2** <CR>

Input format ISO 15693 one block: **RD** <SP> **parameter 2** <CR>

Input format ISO 15693 multiple blocks: **RD** <SP> **parameter 2** <SP> **parameter 3** <CR>

Output: **parameter 4** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 or 2 characters	block/start block

PARAMETER 3	FUNCTION
1 or 2 characters	end block

PARAMETER 4	FUNCTION
32 characters	data (mifare 1K/4K)
8 characters	data (ultralight)
up to 64 characters	data (ISO 15693)

Note: The ISO 15693 regulates just the maximum length of one block. If there is no information about the block size available in the ISO 15693 transponder, you can set this value with the command "BS - block size" (chapter 3.6.2).

3.4.6 RDM – read page manual

With the command RDM you can read out a page of the transponder. The reading command is executed single. You have to do a get tag first. If you are using a mifare standard 1K/4K you have to log in, too.

Input format mifare 1K/4K: **RD** <SP> **parameter 1** <SP> **parameter 2** <CR>

Input format ultralight: **RD** <SP> **parameter 2** <CR>

Input format ISO 15693: **RD** <SP> **parameter 2** <CR>

Input format ISO 15693 multiple blocks: **RD** <SP> **parameter 2** <SP> **parameter 3** <CR>

Output: **parameter 4** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 or 2 characters	block/start block

PARAMETER 3	FUNCTION
1 or 2 characters	end block

PARAMETER 4	FUNCTION
32 characters	data (mifare 1K/4K)
8 characters	data (ultralight)
up to 64 characters	data (ISO 15693)

Note: The ISO 15693 regulates just the maximum length of one block. If there is no information about the block size available in the ISO 15693 transponder, you can set this value with the command "BS - block size" (chapter 3.6.2).

3.4.7 WD – write page

With the command WD you write one page to the transponder. The command executes internally the commands get tag, log in (with the key attuned to KM) and the writing command.

Input format mifare 1K/4K:	**WD** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>
Input format ultralight:	**WD** <SP> **parameter 2** <SP> **parameter 3** <CR>
Input format ISO 15693:	**WD** <SP> **parameter 2** <SP> **parameter 3** <CR>
Output (example):	**ACK** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 or 2 character	block

PARAMETER 3	FUNCTION
32 characters	mifare 1K/4K
8 characters	ultralight
up to 32 characters	ISO 15693

Note: The ISO 15693 regulates just the maximum length of one block. With the write instruction you can write multiple blocks at once. The datalenght has to be at least the block size or a multiple of the block size. If there is no information about the block size available in the ISO 15693 transponder, you can set this value with the command "BS - block size" (chapter 3.6.2).

3.4.8 WDM – write page manual

With the command WDM you write one page to the transponder. The writing command is executed alone. You have to select the transponder first. If you are using a mifare standard 1K/4K you have to log in, too.

Input format mifare 1K/4K: **WD** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>

Input format ultralight: **WD** <SP> **parameter 2** <SP> **parameter 3** <CR>

Input format ISO 15693: **WD** <SP> **parameter 2** <SP> **parameter 3** <CR>

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

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 or 2 characters	block

PARAMETER 3	FUNCTION
32 characters	mifare 1K/4K
8 characters	ultralight
up to 32 characters	ISO 15693

Note: The ISO 15693 regulates just the maximum length of one block. With the write instruction you can write multiple blocks at once. The datalenght has to be at least the block size or a multiple of the block size. If there is no information about the block size available in the ISO 15693 transponder, you can set this value with the command "BS - block size" (chapter 3.6.2).

3.5 Mifare instructions

3.5.1 AC – anticollision

With the command AC the reader executes the anticollision level 1 command.

Input format: **AC** <CR>

Output (example): **595B1B80** <CR>

3.5.2 AC2 – anticollision level 2

With the command AC2 the reader executes the anticollision level 2 command.

Input format: **AC2** <CR>

Output (example): **595B1B80** <CR>

3.5.3 KM – key mode

With the command KM you switch the key that is used by the commands RD and WD. It is possible to use the default key or one of the keys saved with the command WK.

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

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

PARAMETER	FUNCTION
0	use default key (FFFFFFFFFFFF)
1..8	use saved key 1 to 8

3.5.4 KT – key type

With this command you switch if the key that is used with the commands RD and WD is type A or B.

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

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

PARAMETER	FUNCTION
A	key type A
B	key type B

3.5.5 LOG – transponder log in

The command LOG is only valid with mifare standard 1K/4K transponders. The log in is necessary to read or write a page:

Input format: **LOG** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>

Input (example): **LOG** <SP> **A** <SP> **1** <SP> **FFFFFFFFFFFF** <CR>

Output (example): ACK <CR>

Parameters:

PARAMETER 1	FUNCTION
A or B	type of the key

PARAMETER 2	FUNCTION
1 or 2 characters	sector

PARAMETER 3	FUNCTION
12 characters	key

3.5.6 PBU – purse backup

With this command it is possible to copy a purse value to an other block of the same sector. This command is only valid with mifare standard 1K/4K. You have to log in first.

Input format: **PBU** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>

Output: **parameter 4** <SP> **parameter 5** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 character	source block

PARAMETER 3	FUNCTION
1 character	target block

PARAMETER 4	FUNCTION
8 characters	new purse value

PARAMETER 5	FUNCTION
2 character	optional address

3.5.7 PDC – purse decrement

With this command you can decrement a value. This command is only valid with mifare standard 1K/4K. You have to log in first.

Input format: **PDC** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>

Output: **parameter 4** <SP> **parameter 5** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 character	block

PARAMETER 3	FUNCTION
8 characters	value change

PARAMETER 4	FUNCTION
8 characters	new purse value

PARAMETER 5	FUNCTION
2 character	optional address

3.5.8 PIC – purse increment

With this command you can increment a value. This command is only valid with mifare standard 1K/4K. You have to log in first.

Input format: **PDC** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <CR>

Output: **parameter 4** <SP> **parameter 5** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 character	block

PARAMETER 3	FUNCTION
8 characters	value change

PARAMETER 4	FUNCTION
8 characters	new purse value

PARAMETER 5	FUNCTION
2 character	optional address

3.5.9 PIV – purse init value

With this command you can initialize a value. This command is only valid with mifare standard 1K/4K. You have to log in first.

Input format: **PIV** <SP> **parameter 1** <SP> **parameter 2** <SP> **parameter 3** <SP> **parameter 4** <CR>

Output: **parameter 3** <SP> **parameter 4** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 character	block

PARAMETER 3	FUNCTION
8 characters	value

PARAMETER 4	FUNCTION
2 characters	optional address

3.5.10 PRV – purse read value

With this command you can read out a value. This command is only valid with mifare standard 1K/4K. You have to log in first.

Input format: **PRV** <SP> **parameter 1** <SP> **parameter 2** <CR>

Output: **parameter 3** <SP> **parameter 4** <CR>

Parameters:

PARAMETER 1	FUNCTION
1 or 2 characters	sector

PARAMETER 2	FUNCTION
1 character	block

PARAMETER 3	FUNCTION
8 characters	value

PARAMETER 4	FUNCTION
2 characters	optional address

3.5.11 RQ – request

The RQ command answers with the ATQA answer of the transponder.

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

Output (example): **4400** <CR>

Parameters:

PARAMETER	FUNCTION
0	non halt transponders
1	all transponders

3.5.12 SE – select

The command SE selects that transponder that answered at the anticollision. For ultralight and DESFire transponders it is select level 1 command. The answer is the SAK of the transponder.

Input format: **SE** <CR>

Output (example): **18** <CR>

3.5.13 SE2 – select level 2

The command SE2 selects that transponder that answered at the anticollision level 2. For ultralight and DESFire transponders it is select level 2 command.

Input format: **SE2** <CR>

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

3.5.14 WK – write key

With the command WK you save a key to the EEPROM. You can save 8 different keys. It is not possible to read out the saved keys.

Input: **WK** <SP> **parameter 1** <SP> **parameter 2** <CR>

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

Parameters:

PARAMETER 1	FUNCTION
1..8	key number

PARAMETER 2	FUNCTION
12 characters	6 byte key

3.6 ISO 15693 instructions

3.6.1 AFI – application family identifier

With this command you can change the application family identifier of the reader. The reader reads only transponders, with the same application family identifier as the reader. If the application family identifier is set to 00h the reader reads each transponder.

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

Output (example): **00** <CR>

Parameter:

PARAMETER	FUNCTION
00	every transponder is read
01h..FFh	just transponders with the same application identifier are read

3.6.2 BS – block size

With the command BS you can choose the block size of the used transponder. If the ISO 15693 transponders support the "get system information" command, the parameter BS is not used. Only if there is no information of the block size of the transponder available, the parameter regulates the reading process. The block size is defined in the ISO 15693, e.g. parameter 00H means the blocksize is 1 byte.

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

Output (example): **00** <CR>

PARAMETER	FUNCTION
00h..1Fh	1 byte..32bytes

3.6.3 GMS – get multiple block security

This commands shows if one/multiple blocks of a transponder are locked or not. You have to do a get tag first.

Input format one block: **GMS** <SP> **parameter 1** <CR>

Input format multiple blocks: **GMS** <SP> **parameter 1** <SP> **parameter 2** <CR>

Output (example): parameter 3 <CR>

Parameter:

PARAMETER 1	FUNCTION
1 or 2 characters	block/start block number

PARAMETER 2	FUNCTION
1 or 2 characters	end block number

PARAMETER 3	FUNCTION
00h	block is not locked
01h	block is locked

3.6.4 GS – get system information

This command sends the get system information to the transponder. The answer format is described in the ISO 15693 chapter 9.3.12. You have to do a get tag first.

Input format: GS <CR>

Output (example): 0F7FAA9006000104E000201B0301 <CR>

3.6.5 LA – lock AFI

This command locks the AFI of a transponder. You have to do a get tag first.

Input format: LA <CR>

Output (example): ACK <CR>

3.6.6 LD – lock data

This command locks the data of a block. You have to do a get tag first.

Input format: LD <SP> parameter <CR>

Output (example): ACK <CR>

Parameter:

PARAMETER	FUNCTION
0h..FFh	block number

3.6.7 LDS – lock DSFID

This command locks the DSFID of a transponder. You have to do a get tag first.

Input format: **LDS** <CR>

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

3.6.8 RTR – reset to ready

With this command the transponder enteres the ready state. A muted transponder answers again after this command.

Input format: **RTR** <CR>

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

3.6.9 SF – set flag

You can change the flags for different ISO 15693 commands with the command SF. For the meaning of the flags have a look in the ISO 15693 part 3.

Input format: **SF** <SP> **parameter 1** <SP> **parameter 2** <CR>

Output (example): **00** <CR>

Parameter:

PARAMETER 1	FUNCTION
0	inventory
1	stay quiet
2	reset to ready
3	read
4	write
5	lock block
6	write/lock AFI/DSFID
7	get system information / get multiple block security

PARAMETER 2	FUNCTION
2 characters	ISO 15693 flags

3.6.10 WA – write AFI

With this command the reader writes the AFI into the transponder. You have to do a get tag first.

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

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

Parameter:

PARAMETER	FUNCTION
00h..FFh	AFI

3.6.11 WDS – write DSFID

With this command the reader writes the DSFID into the transponder. You have to do a get tag first.

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

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

Parameter:

PARAMETER	FUNCTION
00h..FFh	DSFID

4 Reader EEPROM organisation

4.1 EEPROM overview

The ARE 110 contains an internal 2048 byte EEPROM. In the following table you can see the memory map.

ADDRESS	AEG IN-STRUCTION SET
0000h..0002h	SNR read only
0003h..0004h	internal use, read only
0005h..0009h	USER
000Ah..002Fh	do not chan-ge
0030h..007Fh	USER
0080h..00FFh	USER
0100h..079Fh	USER
07A0h..07FFh	not useable

5 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.

5.1 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.

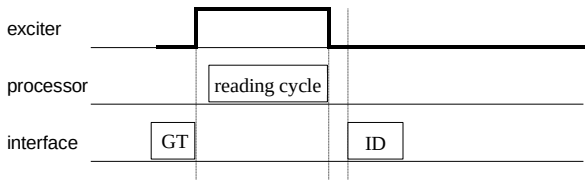

Figure 9: Software triggered reading operation

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.

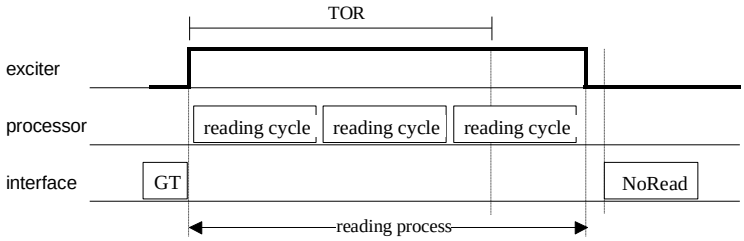

Figure 10: Software triggered reading operation with TOR>0

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!

5.2 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

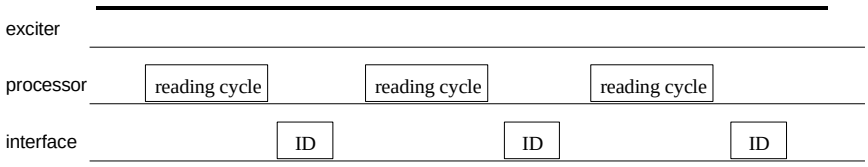

Figure 11: continuous operation

6 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.

7 FCC Information

Federal Communications Commissions (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8 Converting decimal to hexadecimal

DECIMAL	HEX	DECIMAL	HEX	DECIMAL	HEX
1	01	44	2C	87	57
2	02	45	2D	88	58
3	03	46	2E	89	59
4	04	47	2F	90	5A
5	05	48	30	91	5B
6	06	49	31	92	5C
7	07	50	32	93	5D
8	08	51	33	94	5E
9	09	52	34	95	5F
10	0A	53	35	96	60
11	0B	54	36	97	61
12	0C	55	37	98	62
13	0D	56	38	99	63
14	0E	57	39	100	64
15	0F	58	3A	101	65
16	10	59	3B	102	66
17	11	60	3C	103	67
18	12	61	3D	104	68
19	13	62	3E	105	69
20	14	63	3F	106	6A
21	15	64	40	107	6B
22	16	65	41	108	6C
23	17	66	42	109	6D
24	18	67	43	110	6E
25	19	68	44	111	6F
26	1A	69	45	112	70
27	1B	70	46	113	71
28	1C	71	47	114	72
29	1D	72	48	115	73
30	1E	73	49	116	74
31	1F	74	4A	117	75
32	20	75	4B	118	76
33	21	76	4C	119	77
34	22	77	4D	120	78
35	23	78	4E	121	79
36	24	79	4F	122	7A
37	25	80	50	123	7B
38	26	81	51	124	7C
39	27	82	52	125	7D
40	28	83	53	126	7E
41	29	84	54	127	7F
42	2A	85	55	128	80
43	2B	86	56	129	81

DECIMAL	HEX
130	82
131	83
132	84
133	85
134	86
135	87
136	88
137	89
138	8A
139	8B
140	8C
141	8D
142	8E
143	8F
144	90
145	91
146	92
147	93
148	94
149	95
150	96
151	97
152	98
153	99
154	9A
155	9B
156	9C
157	9D
158	9E
159	9F
160	A0
161	A1
162	A2
163	A3
164	A4
165	A5
166	A6
167	A7
168	A8
169	A9
170	AA
171	AB
172	AC

DECIMAL	HEX
173	AD
174	AE
175	AF
176	B0
177	B1
178	B2
179	B3
180	B4
181	B5
182	B6
183	B7
184	B8
185	B9
186	BA
187	BB
188	BC
189	BD
190	BE
191	BF
192	C0
193	C1
194	C2
195	C3
196	C4
197	C5
198	C6
199	C7
200	C8
201	C9
202	CA
203	CB
204	CC
205	CD
206	CE
207	CF
208	D0
209	D1
210	D2
211	D3
212	D4
213	D5
214	D6
215	D7

DECIMAL	HEX
216	D8
217	D9
218	DA
219	DB
220	DC
221	DD
222	DE
223	DF
224	E0
225	E1
226	E2
227	E3
228	E4
229	E5
230	E6
231	E7
232	E8
233	E9
234	EA
235	EB
236	EC
237	ED
238	EE
239	EF
240	F0
241	F1
242	F2
243	F3
244	F4
245	F5
246	F6
247	F7
248	F8
249	F9
250	FA
251	FB
252	FC
253	FD
254	FE
255	FF

9 Hotline

If there are questions or suggestions please call the hotline:

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10 Revisions

11.01.13	Revision 00:	initial edition
30.01.13	Revision 01:	chapter 3.3.9 „TSC time show code" added
		chapter 3.6.9 „SF set flag" added
09.12.13	Revision 02:	new software conformation
12.02.14	Revision 03:	"RF" changed in "HF"
18.05.16	Revision 04:	FCC information
22.06.16	Revision 05:	FCC information correction
11.09.18	Revision 06:	chapter "SE" modified