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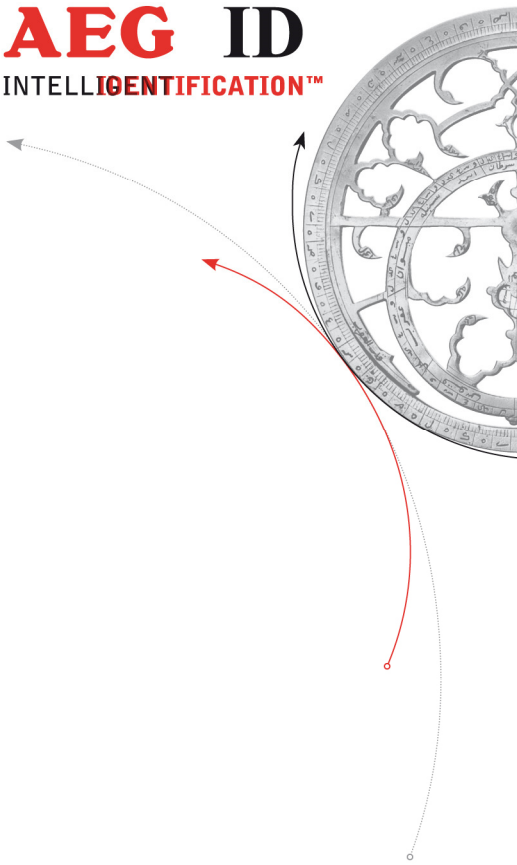


Manual for the RFID reader

ARE i5 – MTL – RS 232

Geschäftsführer | Managing Director
Reiner Wagner

Sitz der Gesellschaft | Headquarter
Ulm, Germany

Amtsgericht | Local Court
Ulm, Germany HRB 3423
USt-IdNr. DE 183095060
Steuer-Nr. | **Tax No.** 88001/11616

Bankverbindung | Banking account
Sparkasse Ulm
BLZ: 630 500 00 | Kto.-Nr.:21072952
SWIFT Code: SOLADES1ULM
IBAN-Nr.: DE31 6305 0000 0021 0729 52

AEG Identifikationssysteme GmbH
Hörvelsinger Weg 47, D-89081 Ulm
P: +49 (0)731 140088-0
F: +49 (0)731 140088-9000
E-mail: info@aegid.de, **www.aegid.de**

Content

Introduction

This document describes the technical features of the ARE i5 MTL reader with air-core coil and integrated decoding electronic. It contains instructions for start-up and successful and durable operation. To reach the maximal reading distance, a correct installation is essential.
The device can read transponders appropriate DIN/ISO 11784/11785: FDX-B, HDX, Destron, Datamars. Additional Trovan and transponders with ASK 64bit Manchester coding (e.g. Chip EM 4102).
The implemented command set is downward compatible to the standard command set ASB 1.0. The ARE i5 uses a subset of the ASB 1.0 command set.

Reader installation

Coordinate definition

In further description the following coordinate system is used:

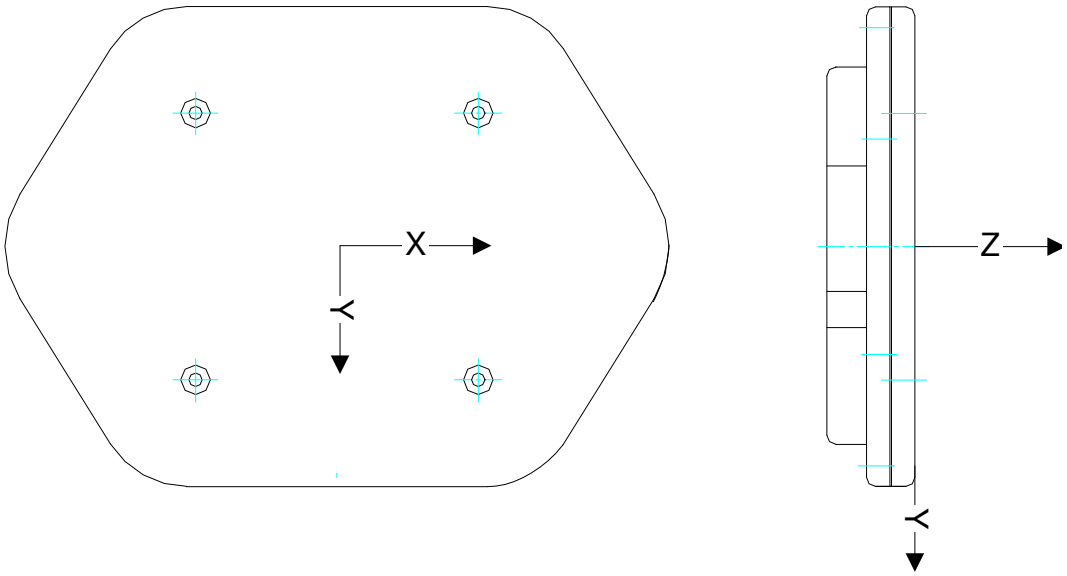


Figure 1: Definition of the coordinates; antenna center X=Y=0

Mounting options

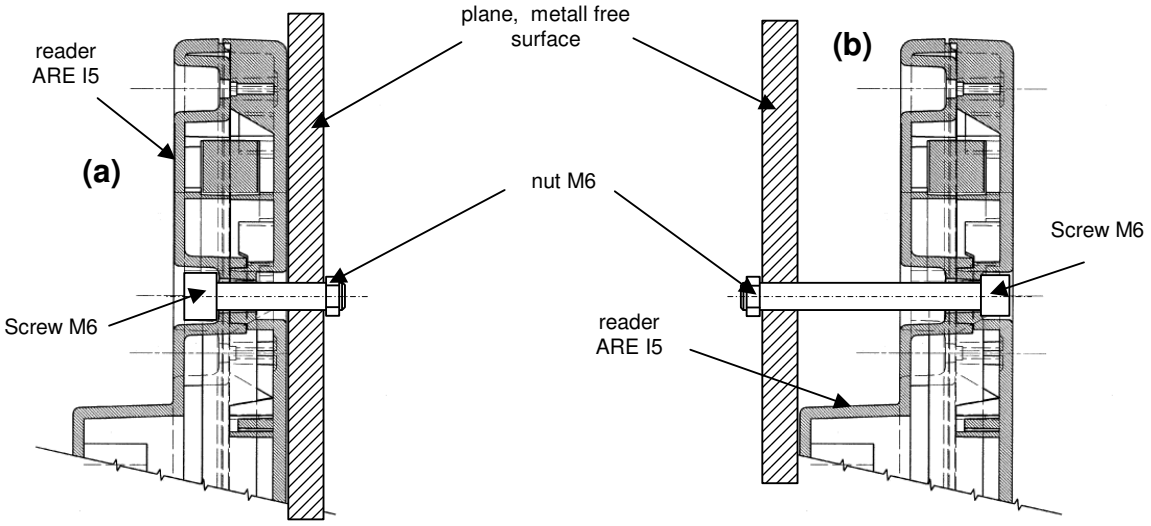


Figure 2: Front- (a) and rear side (b) mounting of the reader

The antenna can be attached through the mounting holes at a suitable plate. Don't exceed 2 [N/m] when tightening the screws.

Because of the functional principle it must be taken care that the antenna is not inductively short-circuited by the mounting construction. Especially the direct mounting on a frame or a plate of metal provoke such a short-circuit and can lead to a destruction of the antenna. When mounting on a concrete wall it is to notice that this wall may contain reinforcing iron in an unfavorable geometry. In this case only a power dissipation occurs because of the distance of the iron-structure, but not a complete short-circuit. In this configuration the reading range is lower than specified and the current consumption is higher than normal.

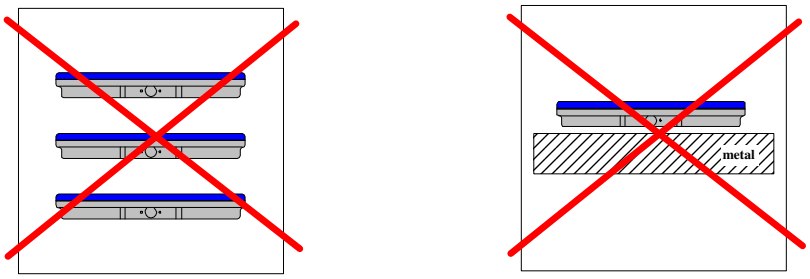


Figure 3: False handling of the antenna

When operating an antenna in laboratory it must be paid attention that the antenna in operation must not be laid on another antenna. In such a case also an inductively short-circuit takes place which may lead to a de-struction of the antenna.

Two adjacent antennas should have a distance of at least 50 cm to each other.

Metal free zone in immediate environment of the antenna

It must be followed to the minimum distances shown in figure 4 and figure 5!

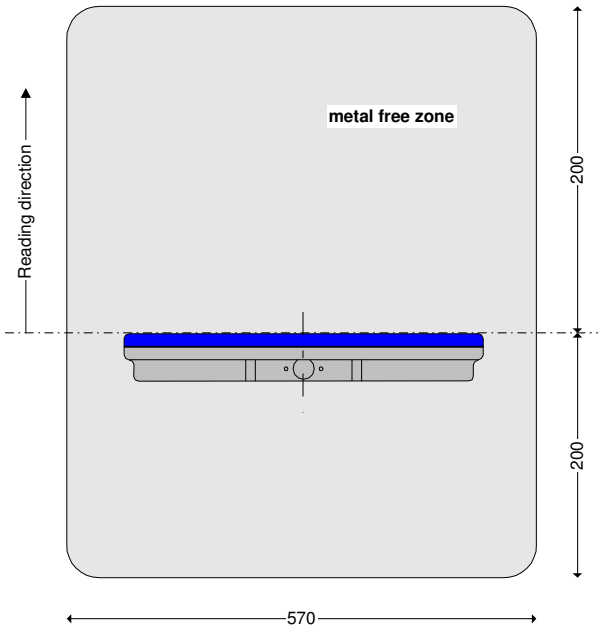


Figure 4: Minimum distance of the antenna to structures of metal – drawing in plane x-z

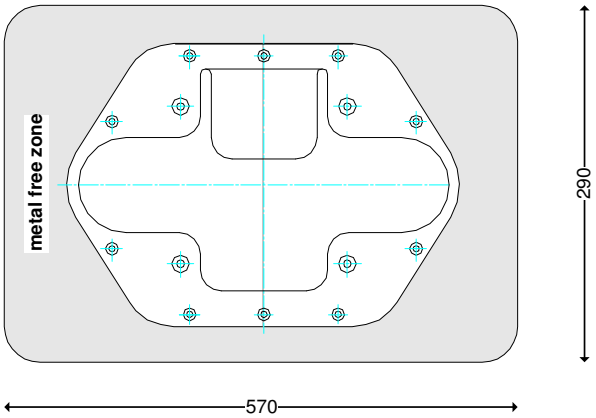


Figure 4: Minimum distance of the antenna to structures of metal – drawing in plane x-y

Optimal orientation of the antenna to the moving direction of the transponder

The antenna should be mounted as close as possible at the site of the transponder. As a rule a parallel orientation of the antenna to the transponder is favorable in regard of the reading range.

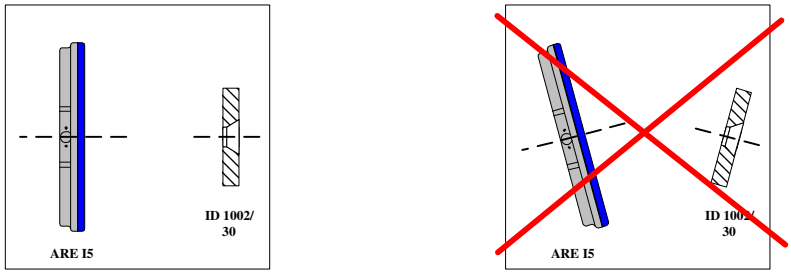


Figure 6: Optional orientation transponder – antenna

The reading field is a complex three-dimensional function which is relevantly influenced by the orientation of the transponder. With parallel orientation (see figure 6) and low interference the reading field in front of the antenna (shown in figure 7) results.

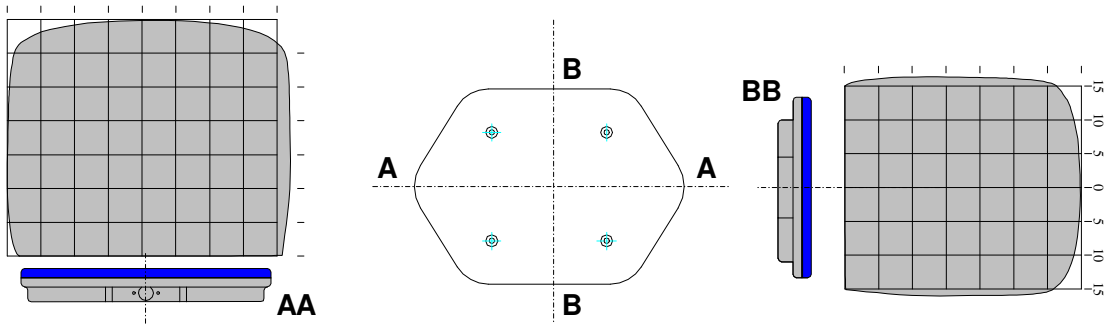


Figure 7: Reading field above the longitudinal axis (AA) and transverse axis (BB)

Therefore the antenna should be mounted in such a way, that the transponder moves along the longitudinal axis AA - see figure 8.

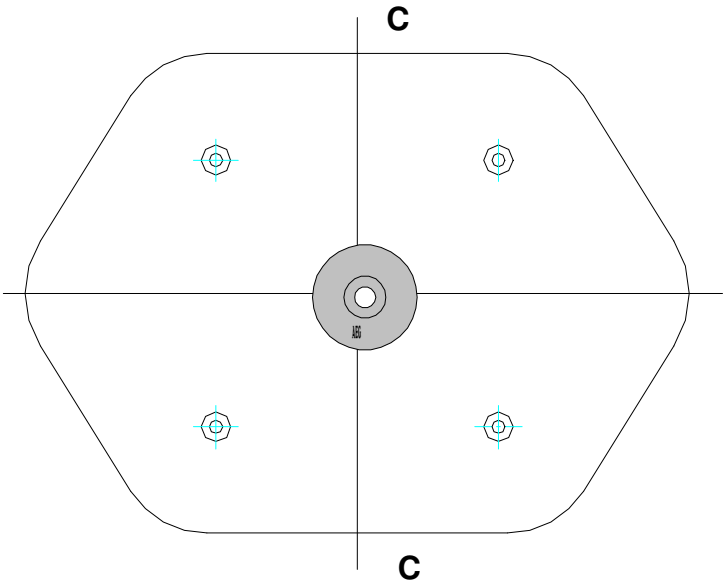


Figure 8: Optimal position of the transponder above the antenna (static)

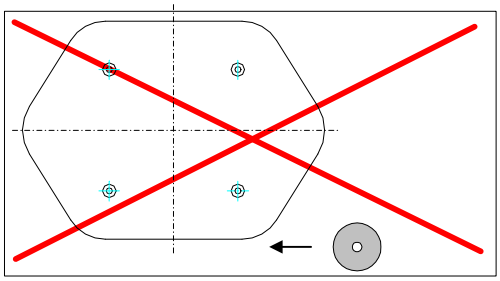


Figure 9: Disadvantageous motion paths of the transponder over the antenna

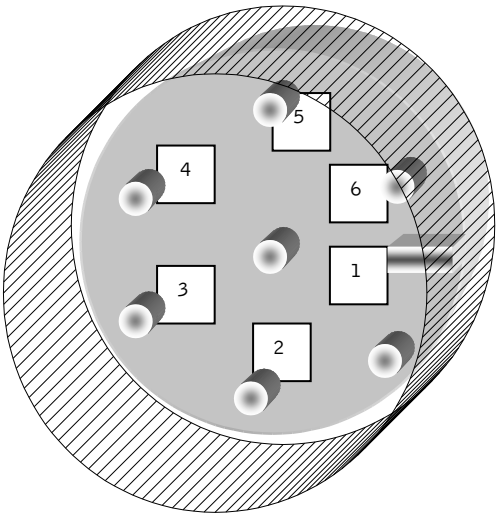
A transponder has to be long enough in the active reading area to achieve a reliable reading result. The maximum reading distance will be achieved only in stationary operation. The reading range is reduced with a transponder in motion. Therefore the transponder has to be passed closer at the antenna.

Figure 10: Distance of the transponder to the antenna center / [cm]

Plug

The reader is connected to the control unit (PC or SPS) with a RS232 interface.
For power supply 12 or 24 VDC are necessary. Check the identification plate.
The corresponding signals are connected to a 7-pin Hiraschmann plug on the reader side.
The plug is IP 65 protected.

Pin assignment:

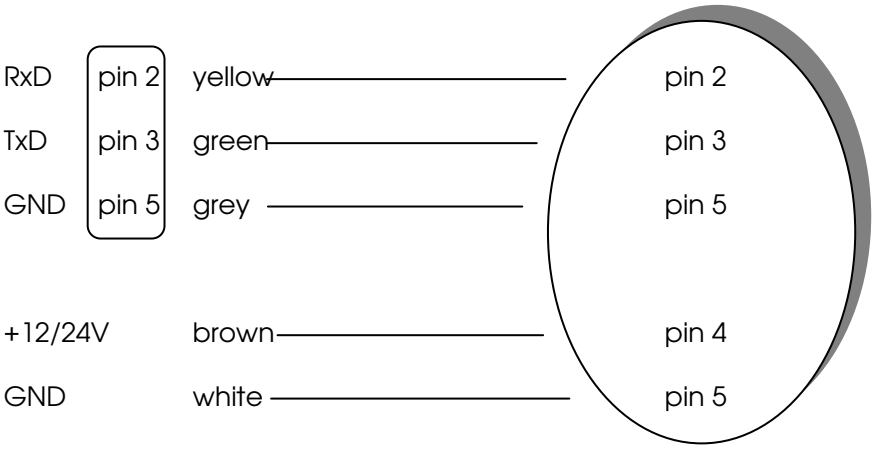


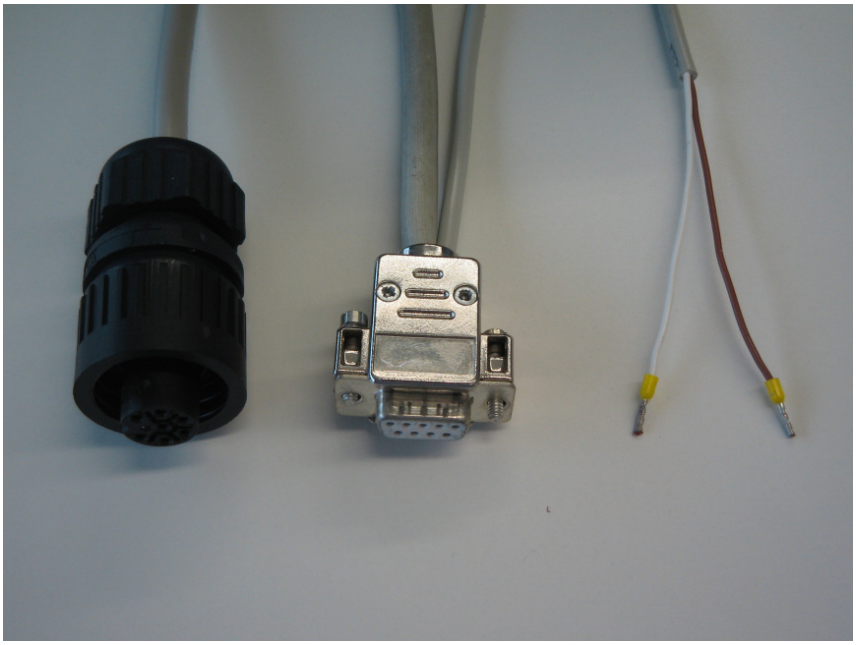
4	+12/24 V
5	GND
2	RxD
3	TxD
5	GND

Cable

The cable, to provide power supply to the reader, and connection between control unit and reader, is 5m long.
On the reader side it has a 7-pin Hirschmann socket matching to the plug at the reader.
For the control unit side, the RS232 interface signals are connected to a 9-pin Sub D socket.
Power supply has to be connected to two single strands with cord end terminals.
Pay attention not to get inductive coupled interfering signals via the cables. Do not install it along cables carrying signals with high power and frequencies.

Pin assignment:





Case

Material	Pocan
Protection class	IP 65
Dimensions	365 x 265 x 50mm
Weight	approx. 2.0kg
Working temperature	0° C to +70°C
Storage temperature	-20°C to +70°C
Maximal humidity	95% at +50°C (non-condensing)

Electric requirements

Supply voltage	12V ± 0.3V (Id 1000495, 1000496) 24V ± 0.3V (Id 1002492, 1003745, 1004083) Check the identification plate
Maximal current	approx. 1.2A for 12V device approx.. 1A for 24V device
Current consumption in standby mode (antenna off)	approx. 0.15A
Interface	RS 232
Power supply	Don't use a switched-mode, but a linear regulated power supply.

Interface – RS 232

Via the serial interface the ARE i5 is communicating with it's control unit (e.g. with a terminal program on the PC). The configuration parameters must be 19200 Baud transfer rate, 8 data bits, no parity and one stop bit (8N1). There is no hardware handshake (Xon/Xoff or RTS/CTS) supported.

Cold start

After a cold start the reader is initialized with the parameters saved in the internal nonvolatile memory. Every changed parameter is automatically saved. The device starts with the same configuration it was switched off.

Command set of the reader / command format

General

The command set, described in this chapter, defines the data exchange via the serial interface.
The commands consist of a command code and optional a parameter value. A command is completed by a carriage return <CR>. It is used to detect the end of a command line.
Commands and parameters, that means letters and numbers, are transferred as ASCII code (e.g. the value 255 (decimal) is transferred as 0x32 (hex), 0x35, 0x35; the command RST as 0x52, 0x53, 0x54).

Input

The protocol has the following format:

<Command> <SP> <Parameter> <CR>

The space character <SP> is used as partition between command and parameter. The <CR> character is used as end of the command.

Commands without parameters (e.g. GT or RST) are shorter:

<Command> <CR>

Output

Every input, that ends with a <CR>, is answered by the reader.
Following different answers are possible:

Command specific answer

After correct input of a command without parameter, the reader answers command specific e.g:

Command:	GT <CR>
Answer:	<Transponder number or no read message> <CR>
Command:	MD <CR>
Answer:	<Parameter, in this case operation mode value, 0 or 2> <CR>

Answer to a parameter input

After input of a valid parameter value, the reader answers with the new parameter value and a <CR>. The new parameter value has been saved. Example:

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

After input of a invalid parameter value, the reader answers with the actual valid parameter:

Command:	MD <SP> 4 <CR>
Answer:	2 <CR>

Answer to a parameter request

Parameter values can be read by using the parameter command without a parameter value. Example:

Command:	MD <CR>
Answer:	2 <CR>

Empty input line

If only a <CR> sent, the reader answers with a <CR>. Example:

Command:	<CR>
Answer:	<CR>

Capital and small letters

The reader interface does not act case sensitive. Captial and small letters are treated the same.

Carriage return

The reader does not send a line feed <LF>. Our terminal programs replace the <CR> by a <CR><LF>. Some programs like the "HyperTerminal" provide this as an option.

VER – Software version of the reader

The command VER asks the reader for its software version.

Input format: VER <CR>
Output: i5_XXXXX <CR>
e.g. i5_MTR09 <CR>

MD – Operation mode

The operation mode of the reader is changed with the command MD.

Input format: MD <SP> <Parameter> <CR>
Parameter:

Parameter	Function
0	Continuous reading mode
2	Command mode

Output (e.g.): 2 <CR>

Note: In software version MTR15 MD parameter is not saved. The reader is starting in command mode. If it is changed to continuous reading mode the reader does not respond to commands any longer. It is exclusively sending transponder codes or no read messages. To switch it back to command mode it has to be restarted.

GT – Reading command get tag

The command GT starts a reading attempt. See chapter "Operation modes" "MD 2 – Command mode".

Input format: GT <CR>
Output (Example): Depending on the parameter settings and the read transponder signal there are three different answers possible:

- Transponder number, e.g. 001F37BD92 <CR>
- No read message, XXXXXXXXXX <CR>
- <CR> as a command acknowledgement, if a filter function is active, that suppresses transponder code or the no read message.

CID – Suppression of equal ID codes

If the parameter CID is on value 1 the transponder code is only sent once, if the same transponder is read several times. Only with a new transponder the new code is sent back after a successful reading. No reads do not affect this function.

Input format: CID <SP> Parameter <CR>

Parameter:

Parameter	Function
0	No filter function
1	Suppression of multiple read equal IDs

Output (Example): 0 <CR>

Annotation: In operation mode MD 2 suppression of equal ID codes is not allowed.

Example: A, B, C are different transponder numbers, N is a no read:

Sequence of reading cycles	Output sequence after filtering with CN=0 and CID =1	Output sequence after filtering with CN=1 and 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

Table 1: Example for the effect of the filter function CID

Effect: The filter is active immediately after the command CID <SP> 1 <CR>.

Annotation: In the following cases the comparison number is deleted:

- After a cold start.
- After input of the command line CID <SP> 1 <CR>.

The transponder read next is shown for sure.

Attention: The filter function CID analyzes several reading cycles. The Parameter NID only has an effect on one reading result. With CID active the reading is executed but the result is eventually not sent to the serial interface.

CN – Suppression of no reads

When the parameter CN is on value 1, the no read messages on the serial interface are suppressed.
Input format: CN <SP> Parameter <CR>
Parameter:

Parameter	Function
0	No reads output on the serial interface
1	Suppression of no reads on the serial interface

Output (Example): 0 <CR>

Annotation: In operation mode MD 2 a suppression of the no reads is not allowed. If it is activated anyway, in MD 2 mode only a <CR> is sent to the interface, when normally a no read appears.

NID- Error protection on reader level

NID specifies the amount of equal reading results necessary for a successful reading cycle. If the parameter NID is set to the value 1, the reader internally has to read two times the same transponder number before sending one successful reading result.
Input format: NID <SP> Parameter <CR>
Parameter:

Parameter	Function
0	One out of one (no effect)
1	Two out of two

Output (Example): 1 <CR>

Sequence of single readings	Length of one reading cycle	Result of one reading cycle
NoRead	1 reading	No read
0000125ED1, 0000125ED1	2 readings	0000125ED1
0000125ED1, 0000126ED1	2 readings	No read

Table 2: Example of reading cycles with NID=1

TOR – Maximal reading time

TOR is a timing parameter of the reader. It is used in operation mode 2 to limit the reading attempts. The maximal time for one reading cycle is TOR * TB. The timing parameter TB (Time base) has the default value 100 ms. One reading cycle can consist of several single reading attempts, until one is successful, or TOR time is expired. From external one reading cycle looks like one single reading.

Input format: TOR <SP> Parameter <CR>
Parameter:

Parameter	Function
2	Limitation of the reading attempts to approx.2 times TB
3	Limitation of the reading attempts to approx.3 times TB
...	
999	Limitation of the reading attempts to approx. 999 times TB

Output (Example): 2 <CR>

BUZ – Buzzer

The successful reading of a transponder can be shown by an acoustic signal. The buzzer is activated or deactivated with the BUZ command.

Input format: BUZ <SP> Parameter <CR>
Parameter:

Parameter	Function
0	Buzzer off
1	Buzzer on, output in Good and Bad Read case
2	Buzzer on, Good Read indication only (Default value)

Output (Example): 2 <CR>

ALGO – Algorithm

The reader supports 8 algorithms respectively transponder formats. With the parameter ALGO every single algorithm can be activated or deactivated. With the hexadecimal format of the parameter, every possible combination of algorithms can be masked. 00 means no algorithm, FF means all 8 algorithms.

Input format: ALGO <SP> Parameter <CR>
Parameter:

Parameter	Function
01	Trovan
02	Marin, ASK 64 Bit
04	Datamars
08	Destron
10	ISO Hdx
20	ISO Fdx
40	PSK2
80	PSK1
03	Trovan + Marin
...	
FF	All Algorithms activated (Default value)

Output (Example): FF <CR>

CM – Measurement signal strength of the transponder, noise level

The output of the antenna receive path is used to calculate a RMS value. The source of this signal is the transmission power of a transponder, or the background noise if there is no transponder in the antenna field.

Input format: CM <CR>
Output (Example): 4 hex characters <CR>

CD – Code presentation

The code presentation of a ISO transponder can be changed by changing the CD parameter:

Input format: CD <SP> Parameter <CR>
Parameter:

Parameter	Function
0	Hexadecimal e.g. 145A1000004F0001
1	ISO animal e.g. 968 000000547368
2	ISO industry
3	ISO BDE

Output (Example): 2 <CR>

Operation modes

Two operation modes are defined:

- Operation mode 0 – Command mode
- Operation mode 2 – Continuous reading mode

In the following chapters their functionality is described.

MD 2 – Command mode

The communication partner is sending the command „Get tag" („GT<CR>") to start a reading attempt. The result, the transponder code or a no read message, is sent back.
In operation mode 2 the exciter is normally switched off. Triggered by the GT command input the exciter is activated. When the reading cycle is finished, it is switched off again.

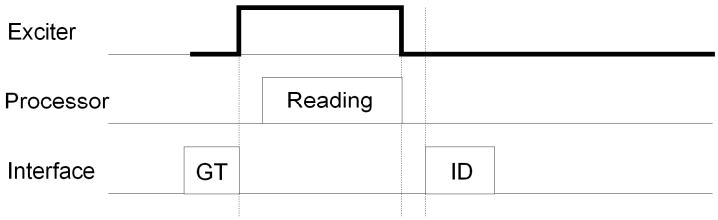


Figure 11: Software triggered reading mode

If the first reading attempt is not successful there are more reading attempts until the TOR time is expired or one reading attempt was successful (reader received the ID code by the transponder). During the whole reading cycle the exciter stays on. If all reading attempts stay unsuccessful a no read message is sent to the communication partner. If reading was successful the ID code is sent.

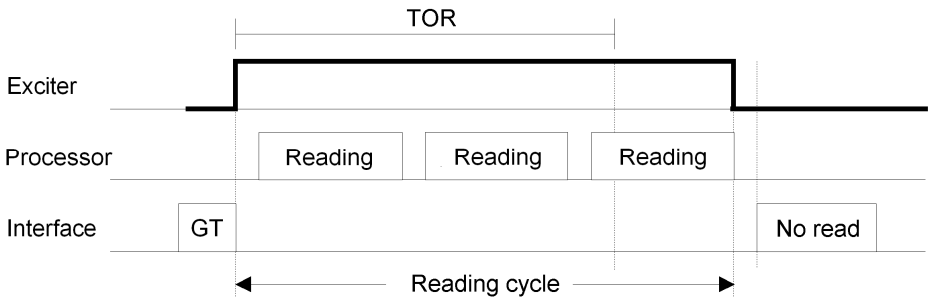


Figure 12: Software triggered reading mode with TOR > 0

Attention: During a reading cycle, during the TOR time, there is no no read output in operation mode 2!

This operation mode is factory setting. For further configuration and adaption to the application, use the following commands:

MD 2	Command mode
CID 0	No suppression of equal ID codes
CN 0	No suppression of no read messages
TOR XYZ	Maximal time the exciter is on. Maximal reading time x 0,1s. It takes this time until a no read message is sent. TOR 5 – factory setting
NID X	Additional error protection. Internal comparison of the transponder codes. NID 1 – 2 out of 2 selection NID 0 – 1 out of 1 selection (no error protection on reader level)

MD 0 – Continuous reading mode

The reader tries continuously to power up a transponder and to read it's code. External triggering is not necessary.

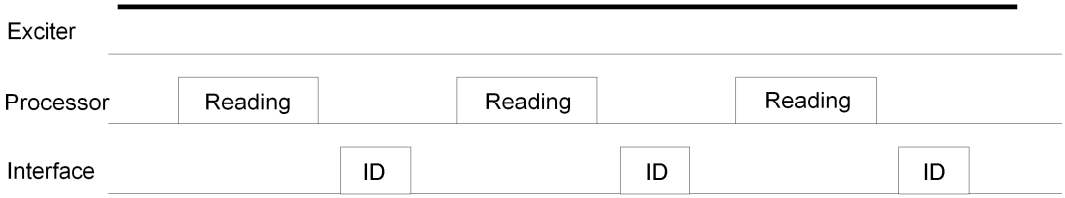


Figure 13: Continuous reading process

This operation mode can be configured with the following commands:

MD 0 – Continuous reading

CID X - Setting of the equal ID code suppression.
CID 0 Equal ID codes are read several times.
CID 1 Suppression of equal ID codes.

CN X - Setting of the no read message output.
CN 0 No suppression of no read messages.
CN 1 Suppression of no read messages.

NID X Additional error protection. Internal comparison of the transponder.
NID 0 - 1 out of 1 selection
NID 1 2 out of 2 selection

Contacts

To improve our products, as well as its documentation is our permanent effort.
For any questions, feedback or comments please call:

Sales und Marketing:	++49 (0)731-140088-0
Fax:	++49 (0)731-140088-9000
e-mail:	sales@aegid.de
http:\	www.aegid.de

Notification of changes

revision	Date	description of changes	Editor
00	29.08.2007	First revision	
01	31.01.2011	English translation	MK
02	01.06.2012	New parameter ALGO	MK
03	16.12.2016	12 and 24 V reader manual in one, MD parameter is not saved in MTR15 version	MK