User Guide

ARE H9 HF
Pocket Reader

AEG ID

ARE H9 HF

MENU

1   Introduction

The ARE H9 HF is a RFID Pocket Reader designed to read passive transponders.
It has the ability to store the transponder codes in its internal database.
This Pocket Reader is equipped with a USB interface and optional Bluetooth or RS232 interface, which allows transmitting single transponder codes or its entire database to a computer.
The ARE H9 HF is capable to read the following transponder types:

- ISO 14443A
- ISO 15693

Before the initial use of this ARE H9 HF reader please study this manual carefully.

2   Elements of the ARE H9 HF

2x16 Character
LCD-Display

Menu option buttons
(left, menu, right)

Main button
(read, select)

AEG ID

ARE H9 HF

USB connector **)

Battery
compartment

**) RS232 cable in Rs232 version

3 Operation Guide

3.1 Installation of the battery

Slide door of the battery compartment to open it.
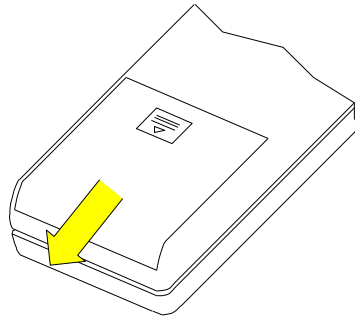
Attach the Battery to the connector inside. Put the Battery into the compartment.
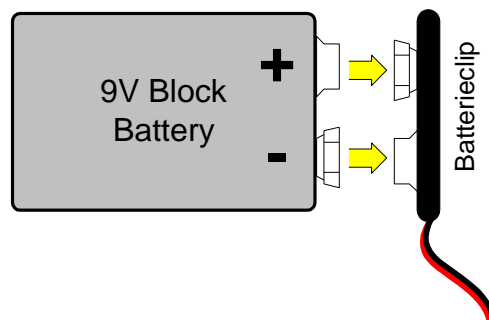
Slide the door back to close it. Use only 9V E-Block alkaline Batteries of the Type 6LR61.

3.2 Power on/off

The Pocket Reader is switched on by pressing the main button for 0,5s (default). The reader starts in reading mode.

The ARE H9 HF will switch off automatically after 20s (default) when no button has been pressed within this time.

3.3   Reading a transponder in standard mode

Press the main button to start the reading process.

The ARE H9 HF starts the reading process and the display shows:

actual
count

maximum
count

```
  0  of  2016
Scanning Nr.    1
```
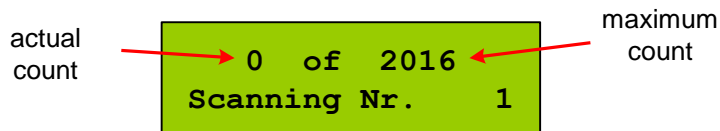
Approach a transponder within the readers reading range.

The reader emits a beep when the transponder has been read successfully, and the transponder code is shown on the display:

```
4E779B90
ISO-14443A
```
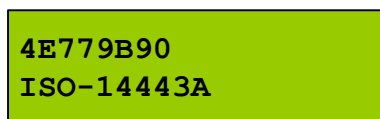
In case no transponder has been read within the given time frame, the reader stops its reading process and the display shows:

```
--- No Tag ---
```
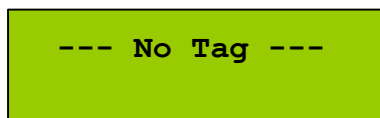
For further reading processes release the main button and press it again for each attempt.
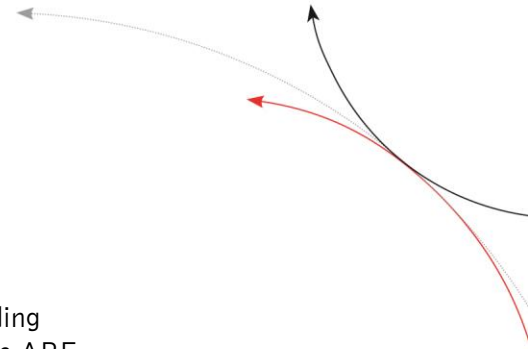
4   Reading range

The reading range and distance depends on the antenna type of the reading device, the transponder, its packaging and orientation to the reader. The ARE H9 HF is available ether with air coil antenna or ferrite antenna.
It is not possible to read two or more transponders at the same time.
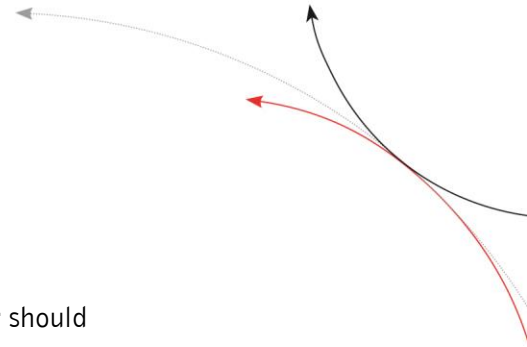
4.1   Orientation with air coil antenna

The following diagram shows the typical area where a card transponder should be read:
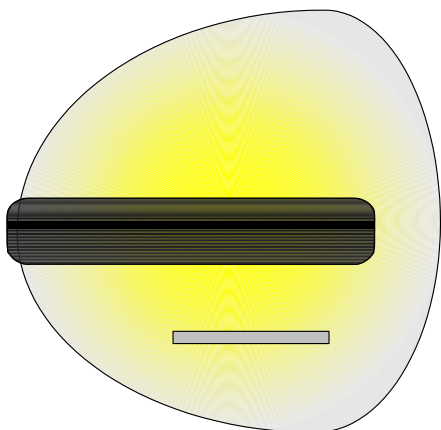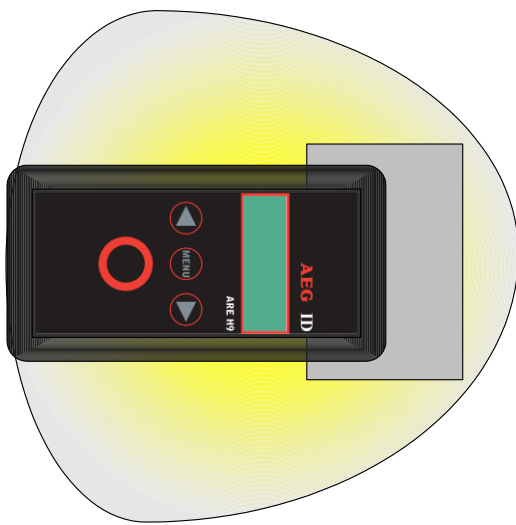
4.2 Orientation with ferrite antenna

The following diagram shows the typical area where a card transponder should be read:
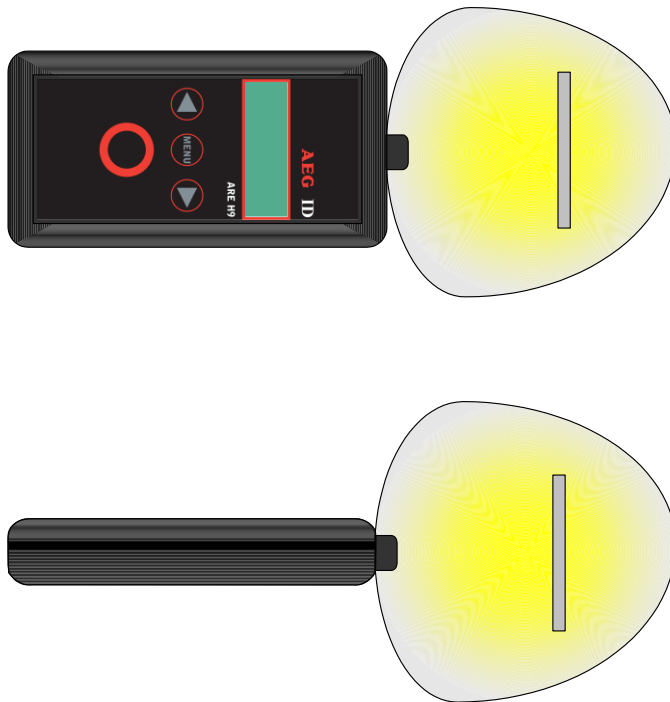
5 Database

When a reading had been accomplished successfully, in the standard operating mode, the ARE H9 HF internal database will be checked whether this transponder code is already stored.

If the new code, in combination with the attribute, is not found in the database, it will be stored as a new record. This record is composed of the ID-code, the transponder type and the selected attribute. With the optional real time clock module date and time of reading will be also stored.

If the new code is already stored in the database, it will be not stored again. In this case the reader emits 2 successive beeps.

The database is capable to store up to 2016 transponder codes. When the maximum of the storage is reached no further new code is stored. To store new codes in this case the database has to be erased.

On Power Loss the ARE H9 HF will keep its database data.

The database of the ARE H9 HF with all its actual records could be transmitted to a PC. Similary a modified database(e.g. with text for attributs or text for the UID) can be transmitted for a PC to the ARE H9 HF. This is done in the Database/USB mode.

6 Menu functions

6.1 Navigating trought the menu function

By pressing the menu button it can be chosen between the different menu functions. If the menu button is pressed again the ARE H9 HF cyclic changes to the next menu function.

Inside a menu function the setting for the function could be changed with the arrow buttons.
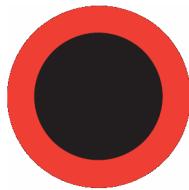
With the main button the actual menu function setting is selected and the ARE H9 HF changes back to the transponder reading mode.

6.2 Overview of the menu functions

```
--- No Tag ---            01 Jan '14
                          12:00:00

Set Attribute      Set Attribute     Set Attribute
←     #     →      ←     A     →      ←     Z     →

Operating Mode    Operating Mode    Operating Mode    Operating Mode
   Standard       ← Online/USB →    ← Online/USB H →  ← Database/USB →

Set Interface     Set Interface     Set Interface     Set Interface     Set Interface     Set Interface
←    USB    →     ← HID Keyboard →  ← Bluetooth HID → ← Bluetooth COM → ← Bluet. unpair → ← BT Autocon.off →

                                                      available only with
                                                      optional Bluetooth
                                                      module

Lock Up Reader    Lock Up Reader
   Unlocked       ←    Lock    →

Mirror Code       Mirror Code
←    Off    →     ←     On     →

Erase DB-Memory        Press both arrow
← Confirm ? →          buttons to erase
                       database memory

Reading Time      + 0.5 s
←    2.0 s   →     - 0.5 s

Turn-Off Time     + 5 s
←    20 s    →     - 5 s           Haupttaste
                                   drücken um die
Turn-On Delay     + 0.5 s          aktuelle Auswahl zu
←    0.5 s   →     - 0.5 s         übernehmen

Keyboard Sound    Keyboard Sound
←     On    →      ←    Off    →

Set Time
12:00:00

Set Date
01 Jan '14

Language/Sprache  Language/Sprache
←   English  →    ←   Deutsch  →

AEG ID-ARE H9 HF
V4.30018 F B
```

6.3 Set Attribute

With "Set Attribute" one of 27 attributes could be selected for the next read transponder.

The selection is done by the left/right arrow buttons and confirmed by pressing the main button.

```
Set Attribute
        #           →
```

In standard read mode this selected attribute will be stored together with the transponder ID-code of the next read transponder in the internal database of the ARE H9 HF.

Example of Transponder-ID with no attribute:
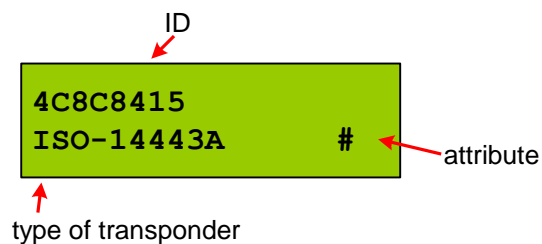
ID

```
4C8C8415
ISO-14443A      #
```
attribute

type of transponder
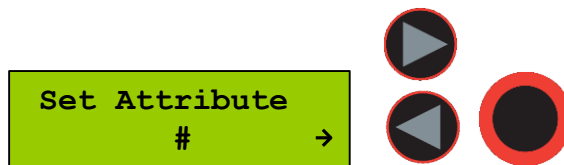
In the initial configuration all the 27 attributes available have a standard text assignment.

#,A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z

With a PC-software and using the Database/PC mode of the ARE H9 HF it is possible to assign each attribute a custom text with up to 14 ASCII characters.

Example:
A becomes "stable",
B becomes "pasture"
C becomes "vaccination"

Under "Set Attribute" at the ARE H9 HF it is now possible to select the attribute by this custom text.

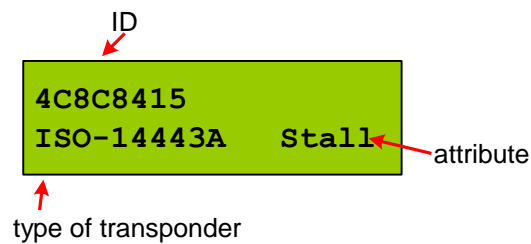When a transponder has been read with an attribute set up with a custom text, the text assigned to the attribute will now be shown on the lower line of the display, right justified, instead of the attribute.

Example of Transponder-ID with attribute and assigned text "Stall":

ID

```
4C8C8415
ISO-14443A   Stall
```

attribute

type of transponder

In addition you can allocate a text to a transpondercode. You can do this similar as the text allocation to a attribute. This can be done with changing the database on a PC (please refer the Reader Terminal manual).
If there is text assignment, you can see the text instead the type of transponder.

ID

```
4C8C8415
Elsa         Stall
```

attribute

text assignment
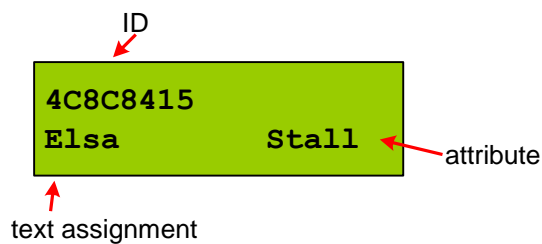
6.4 Operating Mode

The menu "Operating Mode" switches between the following modes:
Standard, Online/USB, Online/USB H und Datenbank/USB Mode

```
Operating Mode
  Standard    →
```
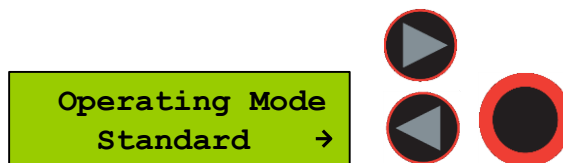
6.4.1 Standard mode

In the "Standard" mode will the read transponder codes stored into the internal database of the ARE H9 HF.

6.4.2 Online/USB, Online/BT[*] or Online/Ser. mode

In the online mode the transponder codes will not be stored into the internal database of the ARE H9 HF. The transponder codes are immediately transmitted via the USB interface to an attached PC, PDA, etc.

It is important that there is a USB [**] or Bluetooth[*] connection established to a host-device ready to receive the data; otherwise the read transponder codes are lost because they are not stored in this mode.

The reading process is the same as in standard mode; the second display-line shows the information of the selected "online/USB" [**] or "online/BT" mode in between the reading processes.

[*]only with optional Bluetooth module
[**] online/ser. for Rs232 version

Once the online mode is active, the ARE H9 HF will be automatically in the online mode when it switched on again after switched off.

```
--- No Tag ---
-  Online/USB  -
```

```
Scanning ...
-  Online/USB  -
```

```
4C8C1C84
-  Online/USB  -
```
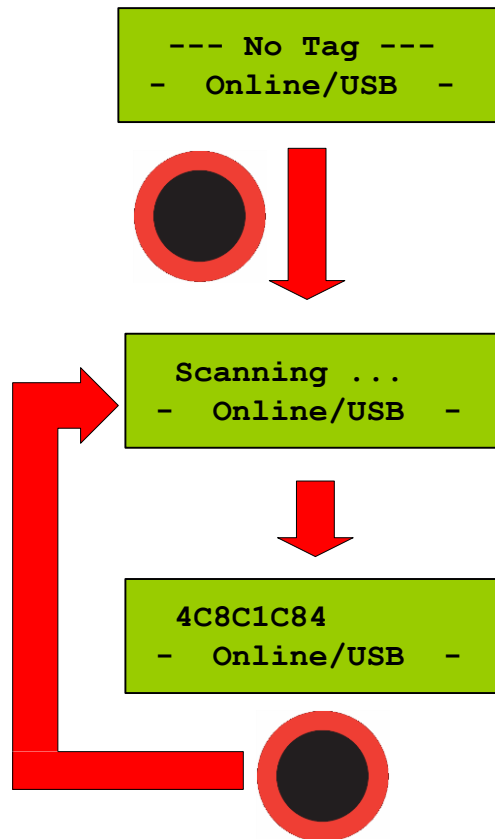
To leave the mode "Online/USB" under "Operating Mode" another mode has to be selected.

6.4.3 Online/USB H, Online/BT H$^{*)}$ or Online/Ser. H mode – handshake mode

The "online/USB H" or "online/BT H" mode is similar to the "online/USB" with the difference that a read transponder code will not be sent immediately to the host (PC, PDA, etc.).
First the reader checks if a connection to the host is established before it sends the transponder code.

$^{*)}$only with optional Bluetooth module
$^{**)}$ online/ser. for Rs232 version

For this transmission the following protocol is used:

ARE H9 HF	Host (PC, PDA, etc.)

<STX> <ETX>   ->
                                    <-   <STX> <ACK> <ETX>
<STX> < transponder data > <ETX>   ->
                                    <-   <STX> <ACK> <ETX>

If the transponder ID was read the following is displayed:

```
4C8C1C84
transmitting...
```

Does the host not answer to the <STX> <ETX> protocol of the ARE H9 HF, then the ARE H9 HF will cyclic transmit the <STX> <ETX> protocol until an answer of the host is received. During this the following display appears:

```
Await Connection
←     Abort ?     →
```

The user can cancel this waiting for a response of the host by pressing both arrow buttons, but in this case the transponder ID will not be transmitted.

## 6.4.4 Database/USB or Database/BT^{*)} mode

In the database mode it is not able to read a transponder. It is intended to transmit and receive record sets of the ARE H9 HF internal database to a host device as a PC, PDA, etc.
To exchange data in the database mode you find a software called reader-terminal on the CD.

The usage of this software is explained in an extra document included with the software.
You can find the description of the communication protocol in chapter 7.
The database mode can be terminated by pressing both arrow buttons simultaneously, or by initiating it by the PC communication.

```
Communic. Active
←    Abort ?    →
```
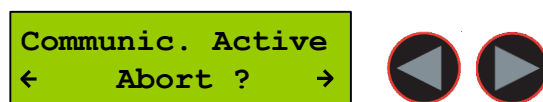
During the Database/PC mode the ARE H9 HF will not switch off automatically.

^{*)}only with optional Bluetooth module

6.5   Set interface

With this menu option you can choose the interface of the ARE H9 HF. If there is the optional Bluetooth module available, you also can choose the Bluetooth interface:

- USB ^{**)}
- HID Keyboard
- Bluetooth HID
- Bluetooth COM
- Bluetooth unpair
- Bluetooth Autoconnection on/off

The Bluetooth module used in ARE H9 HF has the following characteristics:

- Bluetooth 2.1 + EDR (Bluetooth Classic)
- Bluetooth class 2 radio
- Maximum transmit power +3 dBm
- Maximum receiver sensitivity -86 dBm
- Range 30m within line of sight

The ARE H9 HF Bluetooth supports the following Bluetooth profiles:

Serial Port Profile (SPP) as a serial connection
- The SPP connection profile provides the function of a serial connection
(RS232, USB-CDC) wirelessly via the Bluetooth connection to transfer data to
the connected receiver.

Human Interface Device (HID) as a keyboard
- The HID connection profile transmits the data from the reader wirelessly to the
connected receiver as keyboard scancodes (keyboard events).

Remark:

Range
- The environment of the installation site can influence the actual achievable
range, obstacles and objects as well as structural structures in buildings that lie
within the radio communication path can greatly reduce the range.

Pairing
- The ARE H9 HF can be connected via Bluetooth only to one receiving device at
the same time. Before you connect to another device, it is recommended to
disconnect the device from the previously connected device.

6.5.1 Interface USB **)

USB is the default configuration of the ARE H9 HF. With this option enabled
the complete communication to and from the ARE H9 HF is done by the USB
cable connection.
Choosing USB as interface automatically disables any active Bluetooth
connection.
The USB connection to the ARE H9 HF is established as an additional com port
via a USB bridge driver on the host PC. The protocol uses the RS232
specification with the settings:

19200 Baud, 8 Data bits, no party bit, one stop bit, no hardware handshake.

**) serial for Rs232 version

6.5.2 Interface HID Keyboard

If HID keyboard is selected as interface then every read transponder-ID will be sent as keyboard input to a connected PC.
When HID-keyboard is selected the operating mode of the ARE H9 HF changes automatically to the "Online/Keyboard" and there is no other "Mode of Operation" available.
If there is a Bluetooth connection active, the ARE H9 HF closes this connection.
By pressing the left button in the standard display the reader sends "carriage return" (13/0x0D).

6.5.3 Interface RS232 **)

If the ARE H9 HF Rs232 is used on a PC a RS232-crossover (lines Rxd, Txd are crossed) is necessary.
In operation mode "Database/Ser." and "online" are the following communication settings in use:

9600 baud, 8 data bits, no party bit, one stop bit, no hardware handshake

<div align="right">

**) only in Rs232 version

</div>

6.5.4 Interface Bluetooth

6.5.4.1 Bluetooth menu functions

The Bluetooth function of the ARE H9 HF is set via the interface submenu in the main menu. The following functions are available:

-      Bluetooth HID
       Change the ARE H9 HF interface to the Bluetooth HID keyboard
       connection profile

-      Bluetooth COM
       Change the ARE H9 HF interface to Bluetooth SPP connection profile.

-      Bluet. unpair
       Delete a Bluetooth device pairing stored on the ARE H9 HF. If the device
       paired with the ARE H9 HF is switched off or out of range, the pairing
       will be still stored at this device.

-      BTAutocon.off/on
       If the Bluetooth connection with a paired device has been disconnected
       and the device pairing is stored in the ARE H9 HF, the reader attempts
       to reconnect cyclically to the device partner.
       This function can be turned off via the menu function BTAutocon. Off,
       with BTAutocon. on the function can be reactivated.

The functions are selected using the arrow keys and the selection must be confirmed by pressing the main button.

6.5.4.2 Bluetooth connection status

The connection status screen "Await Connection" will be displayed while the reader is waiting for a Bluetooth connection.

```
Await Connection
←   Cancel ? X →
```

The connection status is displayed when:

- within the menu Interface menu a Bluetooth connection (HID or COM) has been selected
- the ARE H9 HF is switched on and the currently selected interface is a Bluetooth interface
- after reading a transponder while the Bluetooth interface is selected

This screen can be canceled by pressing both arrow buttons simultaneously, otherwise it will be displayed until an active Bluetooth connection is detected.

After selecting Bluetooth HID (keyboard) as the interface, the ARE H9 HF automatically switches to the operating mode "Online / BT HID".

As long as the HID keyboard is selected as interface, only the Online operating mode is available; the Select operating mode menu option will only be available again with another interface setting.

The Bluetooth COM interface connection is only detected as active when the corresponding COM port is opened on the device partner.

6.5.4.3 Connect as HID Bluetooth keyboard on Windows

At the Microsoft Windows menu: Control Panel > Hardware and Sound > Devices and Printer > Bluetooth Devices click the button "Add a device" to search for the ARE H9 HF that should connected.
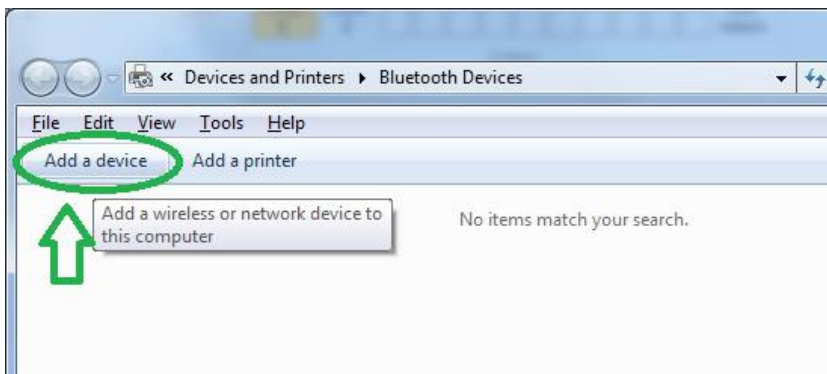

The ARE H9 HF should be in the list of found devices under the Name "RFID XXYYYY Bluetooth Keyboard", where "XXXYYY" stands for the ARE H9 HF device number.
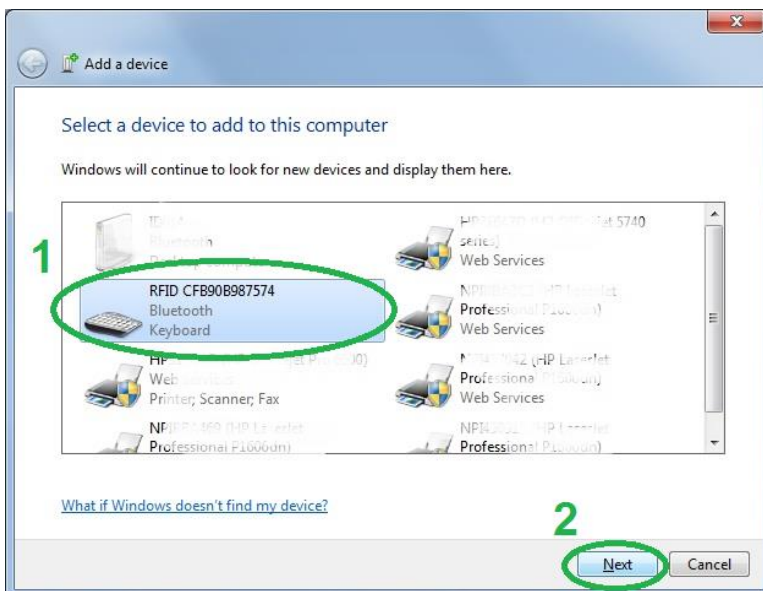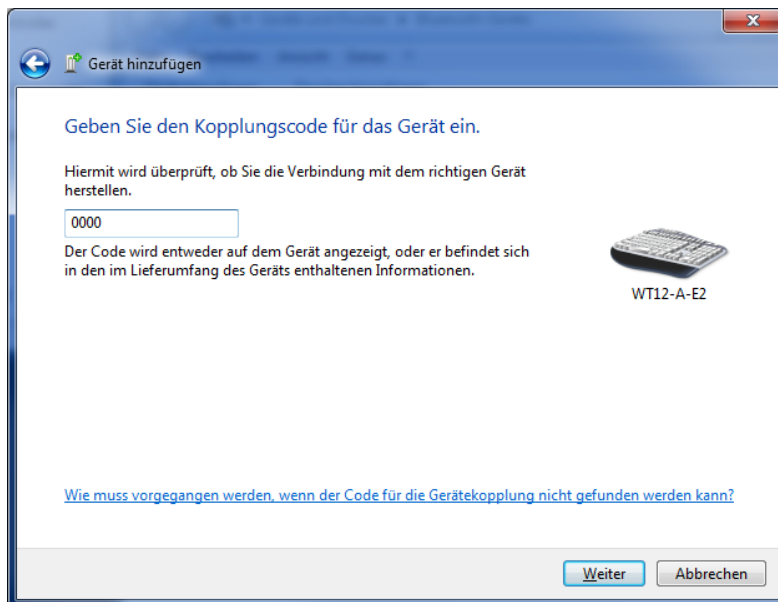

When the ARE H9 HF has been found, it has to be selected and then the "Next" button should be clicked to establish a connection to the ARE H9 HF.

During the connection setup, it may be necessary to enter the pairing code of the reader, in this case, select "Enter the pairing code of the device" in the following screen to continue.
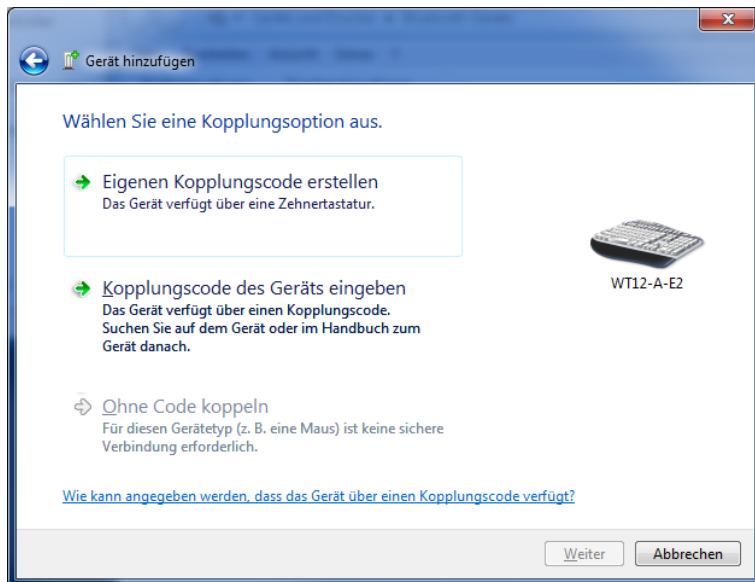
The pairing code "0000" must be entered in the input field of the following dialog box.

By selecting the "Next" button the connection will be configured.
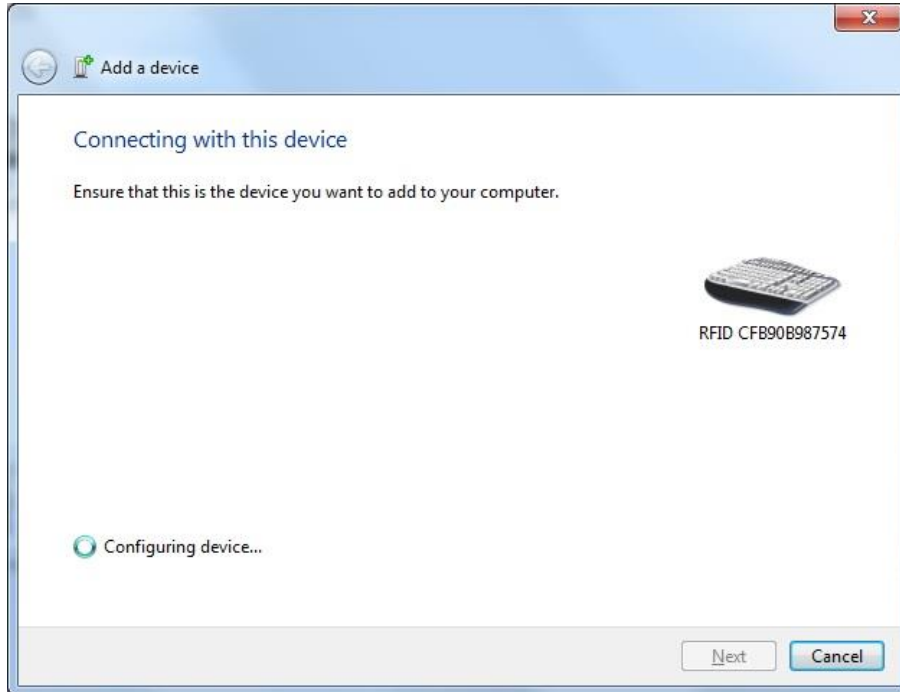
If the connection to the ARE H9 HF has been successfully added, transponder codes such as keystrokes can now be transferred to open input or text fields of the connected device.

6.5.4.4 Connect as Bluetooth COM port SPP on Windows

At the Microsoft Windows menu: Control Panel > Hardware and Sound > Devices and Printer > Bluetooth Devices click the button Add a device to search for the ARE H9 HF that should connected.

When the ARE H9 HF has been found, it has to be selected and then the Next button should be clicked to establish a connection to the ARE H9 HF.

During the connection setup, it may be necessary to enter the pairing code of the reader, in this case, select "Enter the pairing code of the device" in the following screen to continue.
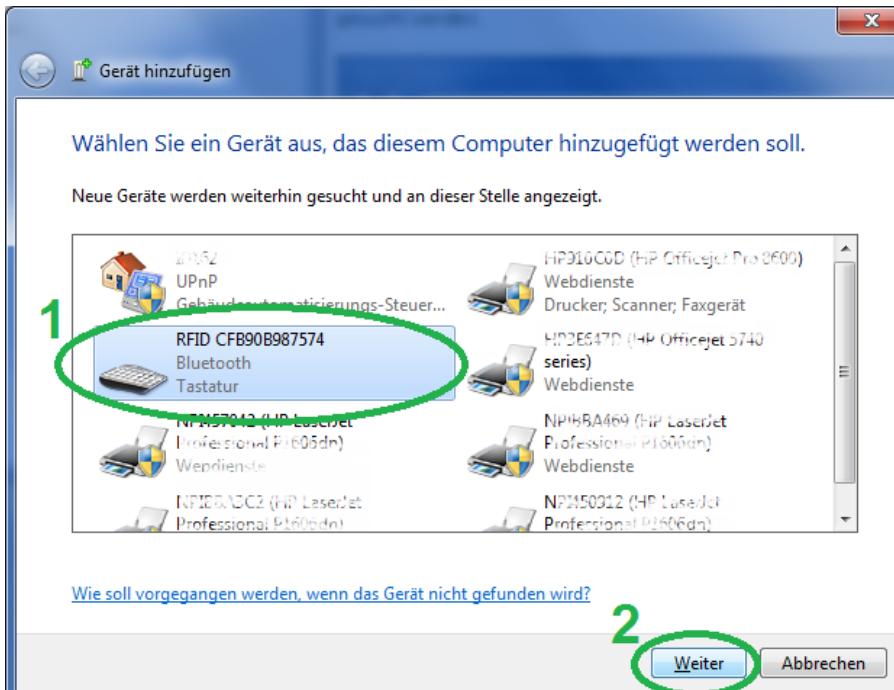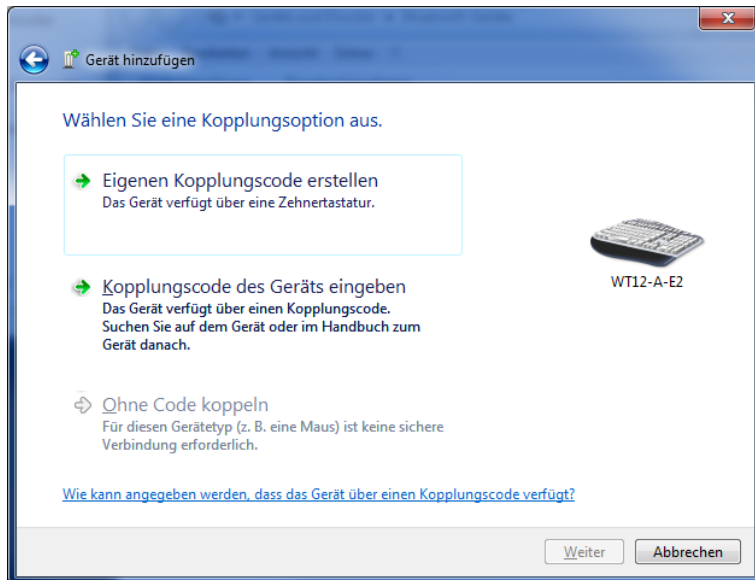
The pairing code "0000" must be entered in the input field of the following dialog box.
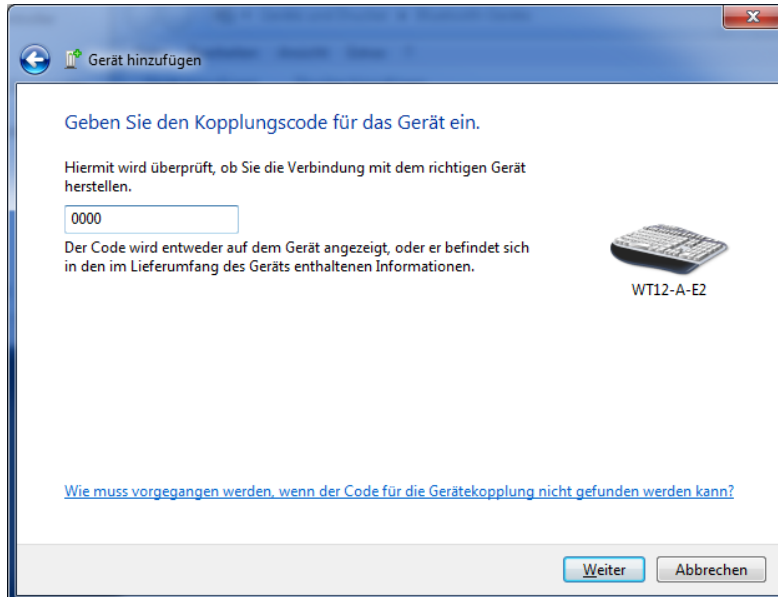
By selecting the "Next" button the connection will be configured.
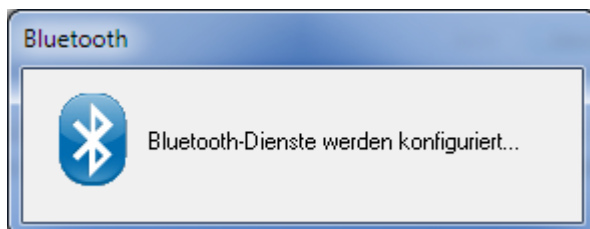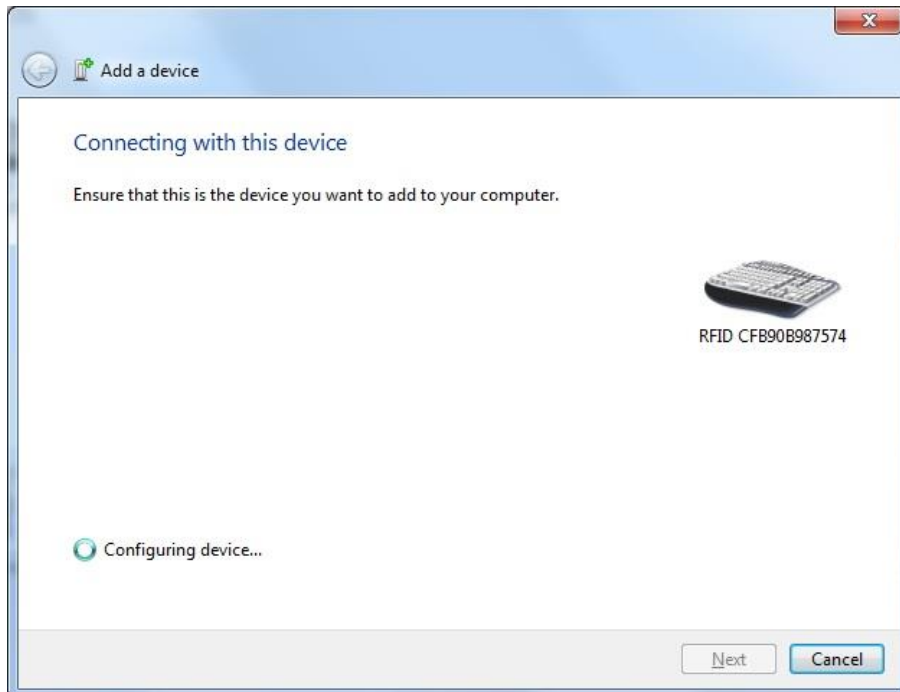
If the Bluetooth COM interface has been set up, a dialog will follow in which the assigned COM interface number is shown (COM 93 in the following example).
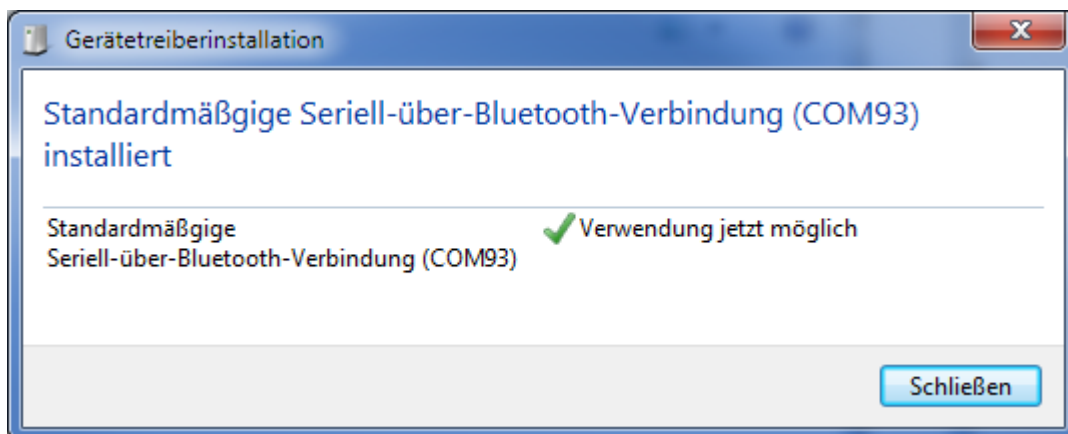
The assigned COM interface number can be requested at any time via the properties of the Bluetooth connection. For this in the Microsoft Windows menu: System control> All system control elements> Devices and printers> Bluetooth devices

Select the Bluetooth device and call up the device's properties dialog via File-> Properties or context menu> Properties.

The COM interface connected to the device is displayed under the tab services.
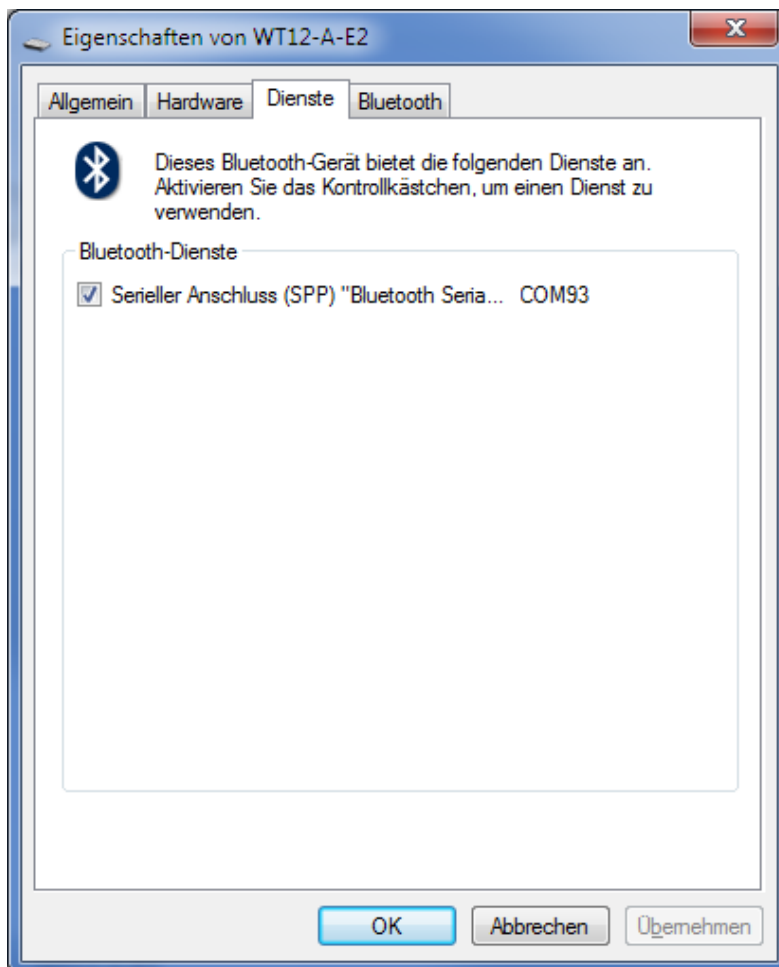
As long as the COM port interface under Windows has not been opened by a program, the ARE H9 HF still shows the connection status screen "Await Connection".

Only when the COM port interface is opened the dialog will disappear and the device is ready for data exchange by a terminal program.

```
Connected as
BT Serial COM
```

6.5.4.5 Remove the ARE H9 HF on Windows

To connect the ARE H9 HF to another device it is necessary to disconnect and unpair the device.

In the Microsoft Windows menu: System control> All system control elements> Devices and printers> Bluetooth devices select the ARE H9 HF and use the "Remove device" button to initiate the separation.
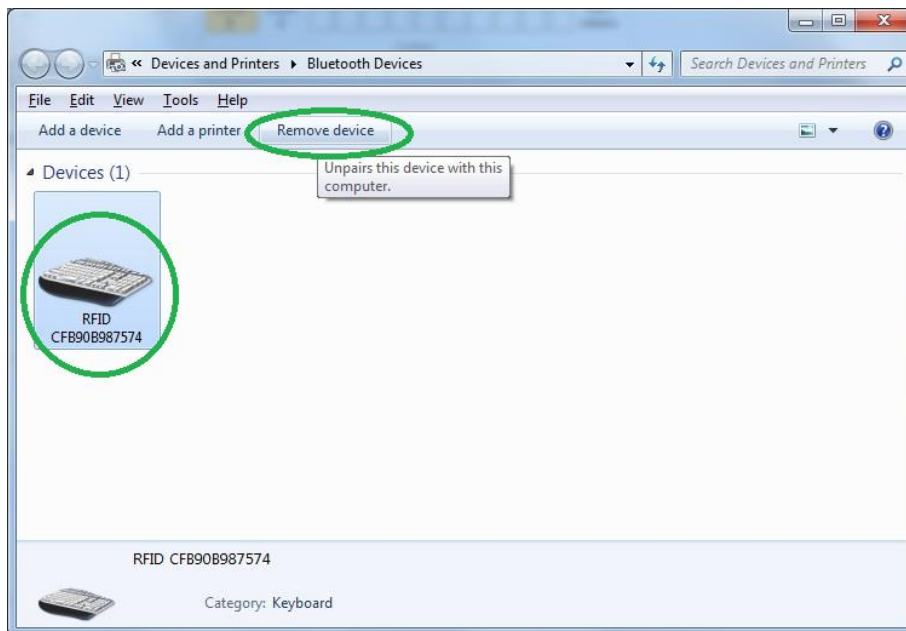
Click "Yes" in the following dialog box to confirm.
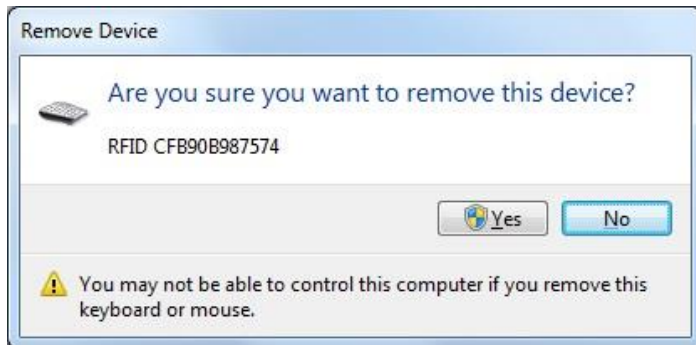
The connection to the ARE H9 HF is now disconnected and the device is removed in the system configuration.

After removing (unpaired) a connection to a device, the device can be reconnected again with either a new or the same device.
The ARE H9 HF BLE always takes only one active connection with a device.
The connection will remain active as long as the connection is not released (unpaired) even during the radio link is not active.

6.5.4.6 Add the ARE H9 HF as keyboard device on Android

To add the ARE H9 HF on the Android device as a keyboard in the Bluetooth menu the available devices should be detected and selected.
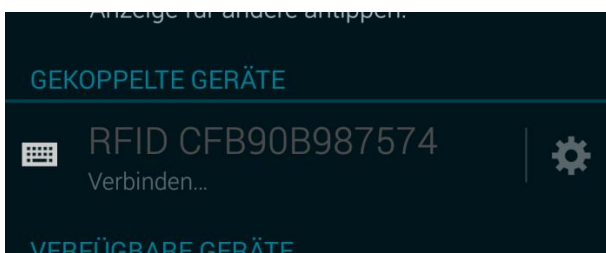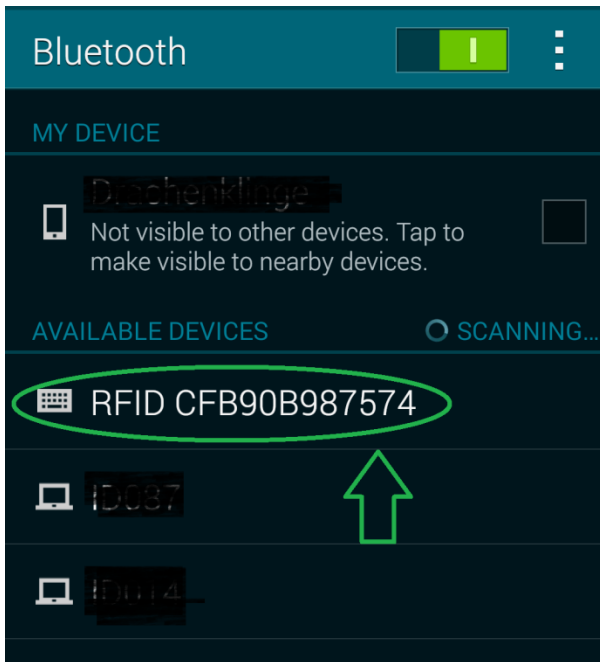
After selecting the ARE H9 HF the connection should displayed as "Paired".
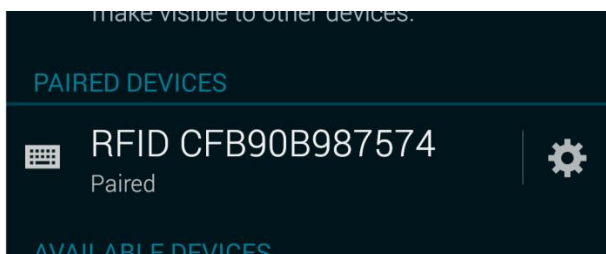
By selecting the settings icon the ARE H9 HF could be activated as a keyboard for inputs.
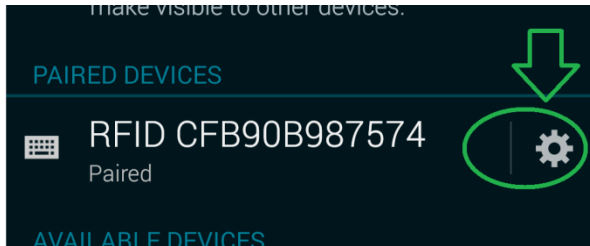
For this purpose in the following menu the hook is set at "Input Device".
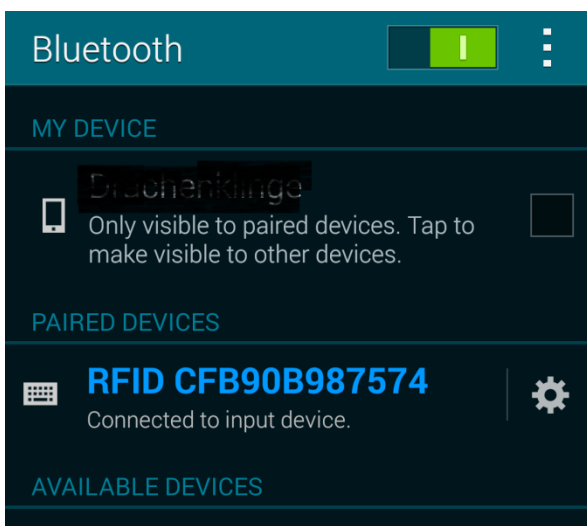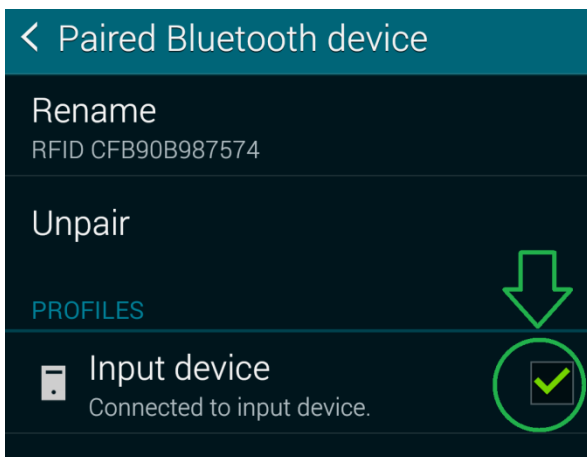
6.5.4.7 Remove the ARE H9 HF keyboard on Android

To remove the ARE H9 HF from an Android device in the menu for connected Bluetooth devices that ARE H9 HF should be selected and then the button "Unpair" clicked.
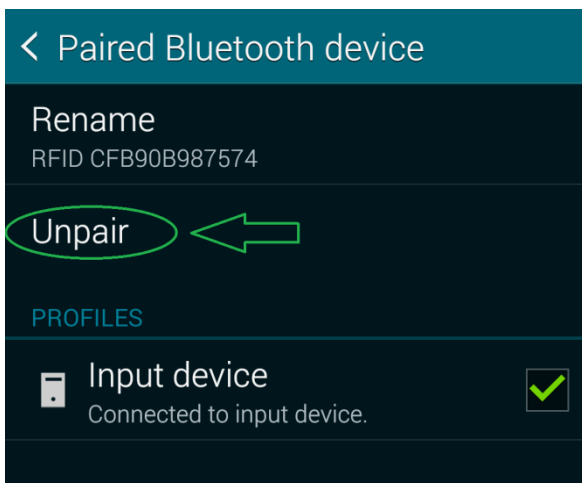
6.6 Lock up reader

When lock up reader is activated the ARE H9 HF switches of immediately. After switching on the pocked reader again it shows that it is locked.
During the ARE H9 HF is locked neither a reading process could started nor the menu could be accessed.
While it is not unlocked, it will switch off again after 5 (default) seconds no button is pressed.
To leave this mode press both arrow buttons simultaneously.
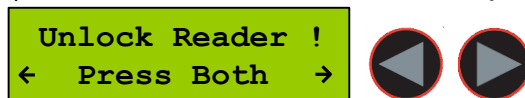
6.7 Mirror Code

This function allows to mirror the transpondercode byte by byte. It is done in the reading routine. That means that the code is stored in the database in the same format as it is shown on the display or is sent via the interface. One transponder with "Mirror Code" on/off is treated like two different transpondercodes.
Example: -"Mirror Code" off: 12345678
                   -"Mirror Code" on: 78563412

6.8 Erase memory

This function allows deleting all records in the internal database of the ARE H9 HF. For safety reasons this function is activated only when both arrow buttons are pressed simultaneously.

```
Erase DB-Memory
←    Confirm ?    →
```

~15
seconds

```
Erase DB-Memory
    erasing...
```

```
Erase DB-Memory
   DB erased  !
```

```
--- No Tag ---
```
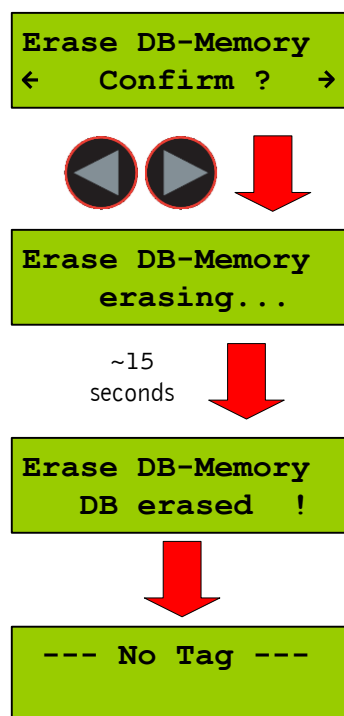
The erasing of the database memory can take several seconds.

!   Do not disconnect the ARE H9 HF from the power supply during this erase operation; this could lead to damaging the database function of the reader.

After the erase operation has finished the device will return to the standard operating mode.

6.9   Reading time

This sets the time frame for one reading attempt. The time could be changed with the arrow buttons in 0,5s steps. A new time is set by pressing the main button.

```
┌─────────────────────────┐
│      Reading Time       │
│  ←        2.0 s      →   │
└─────────────────────────┘
```
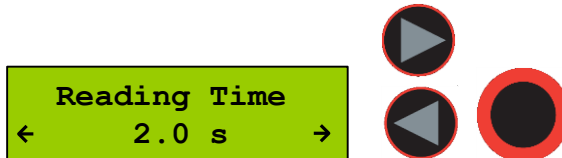
Default value	4 s
min. value	0,5 s
max. value	12,5 s

This setting is stored in the device and is still valid after power off/on operation. For optimal reading performance this setting is recommended to be between 2-4 seconds.

6.10 Turn-off time

Sets the time until the ARE H9 HF will automatically shut off while no button is pressed or activity lasts. It could be change with the arrow buttons in 5s steps.

```
┌─────────────────────────┐
│      Turn-Off Time      │
│  ←        20 s       →   │
└─────────────────────────┘
```
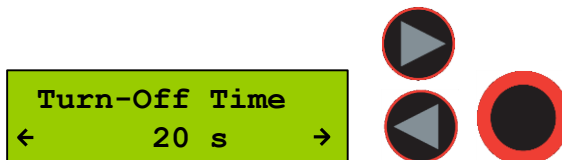
A new time is set by pressing the main button.

Default value	20 s
min. value	10 s
max. value	300 s

This setting is stored in the device and is still valid after power off/on operation.

6.11 Turn-on delay

Sets the time the main button is to be pressed to switch on the ARE H9 HF.
The time could be changed with the arrow keys in 0,5s steps.

```
┌────────────────────────────┐
│     Turn-On Delay           │
│  ←        0.5 s        →     │
└────────────────────────────┘
```
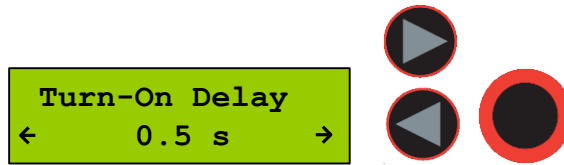
A new time is set by pressing the main button.

Default value	0,5 s
min. value	0 s
max. value	5 s

This setting is stored in the device and is still valid after power off/on operation.

6.12 Keyboard sound

Here the beep sound of the keyboard could turn on or off.

```
┌────────────────────────────┐
│     Keyboard Sound          │
│         On            →      │
└────────────────────────────┘
```
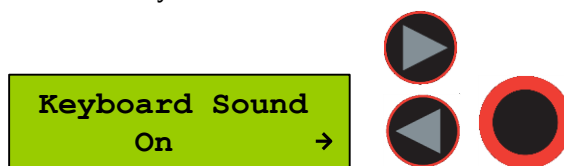
This setting is stored in the device and is still valid after power off/on operation.

6.13 Set time

This menu option sets the time of the Real-Time-Clock module expansion. With this expansion module it is possibly to add the time and date code of reading to the transponder ID in the database. The Real-Time Clock module is equipped with a own backup-battery to hold the time and date even if the ARE H9 HF is switched off or the main battery of the ARE H9 HF has to be changed.
To set the time press select this option with the main button, now is it possible to change the hours with the left/right arrow button. The hour setting is accepted by pressing the main button; then the minutes and seconds can be changed. The minute and second setting is working in the same way as the hour setting. After setting the second the Real-Time-Clock will be synchronized with this new time.
To abort the processes during Set Time press the menu button.

```
Set Time
12:00:00
```

```
Set Hour
←12→00:00
```
+ 1 h
- 1 h

```
Set Minute
12←00→00
```
+ 1 m
- 1 m

```
Set Second
12:00←00→
```
+ 1 s
- 1 s
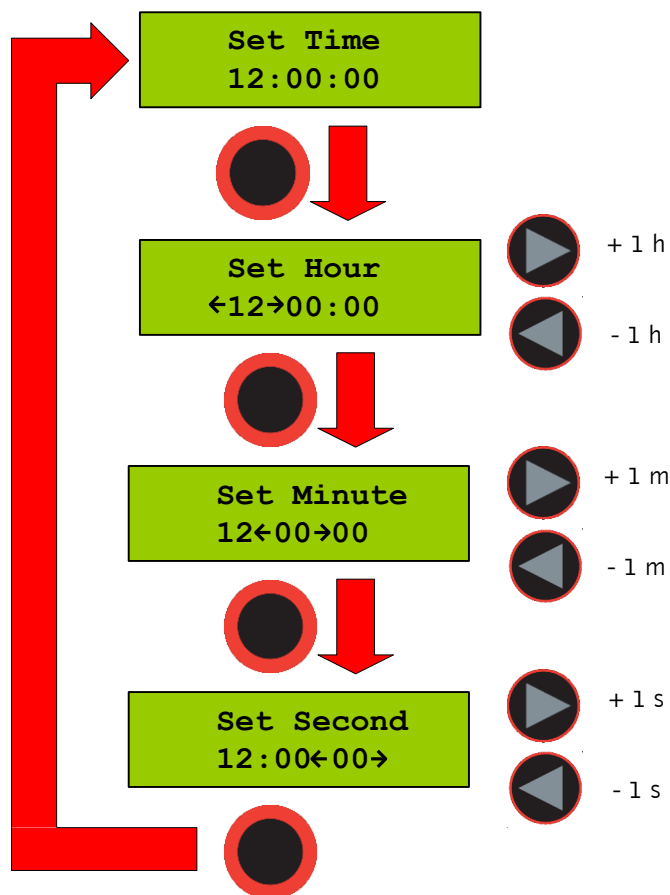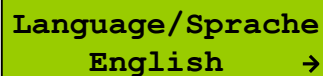
6.14 Set date

This menu option sets the date of the Real-Time-Clock module expansion.
To set the date select this option with the main button, now is it possible to change the day of month with the left/right arrow button. The day setting is accepted by pressing the main button; then the months and years can be changed. The month and year setting is working in the same way as the day setting. After setting the second the Real-Time-Clock will be synchronized with this new date.
To abort the processes during Set Date press the menu button.

```
Set Date
01 Jan '10
```

```
Set Day
←01→Jan '10
```
+ 1 d
- 1 d

```
Set Month
01←Jan→'10
```
+ 1 m
- 1 m

```
Set Year
01 Jan ←10→
```
+ 1 y
- 1 y
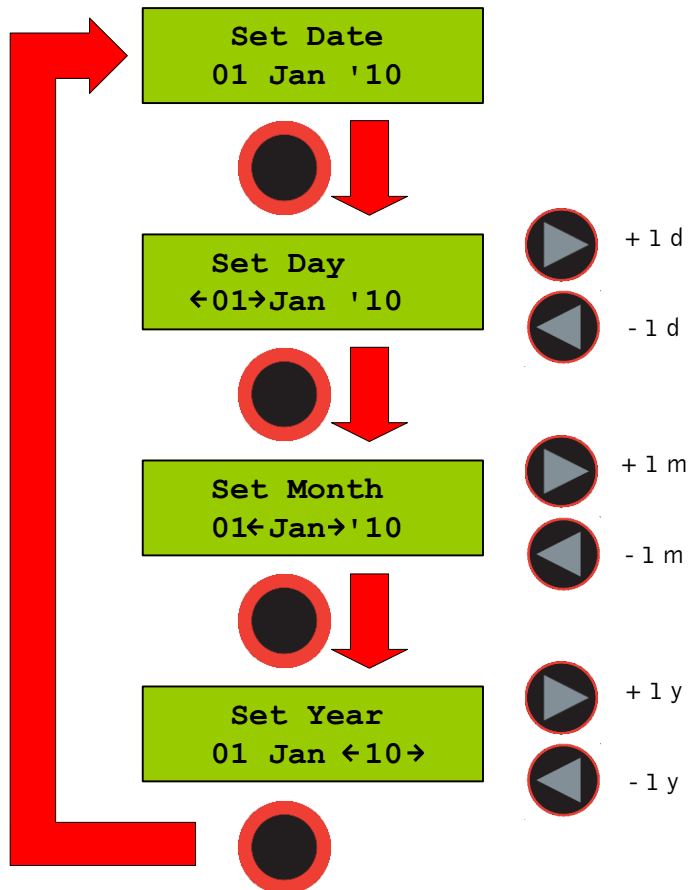
6.15 Language/Sprache – select display language
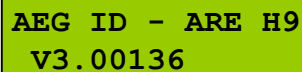
With this menu option is it possible to change the language of the ARE H9 HF menu-display.

```
Language/Sprache
English       →
```

6.16 Reader version

This menu option shows the Firmware Revision of the ARE H9 HF.

```
AEG ID - ARE H9
 V3.00136
```

7   Data exchange protocol

7.1   Set of commands

It includes the following commands:

ET: check, whether Flash memory is empty
EC: clear Flash memory
RP: set Pointer on the first Record of stored data in the memory
RN: read the stored Record and increase the Pointer
RL: repeat the previous reading (RN) of stored Record without changing the Pointer
WP: set Pointer on the next free position in the memory
W: write a Record into Flash memory and increase Pointer
SV: read Software Version
XT: stop communication, abandon operating mode database/USB and go change to the standard read mode.
R: Set date and time
T: attach Text (with up to 14 characters) with attributes 'A' to 'Z' (e.g. 'Gate' instead of 'A')

7.2 Protocol structure

All the commands have the following structure:

STX, command in ASCII, CRC in ASCII, ETX

The following answers are possible:

A Record with the structure given above,
ACK
BEL
NAK

Except STX and ETX, the total content of the commands are composed in
ASCII characters.
This procedure has been chosen explicitly, as a large number of host Operating
Systems react with their own functions, when they see characters outside of 0x20
to 0x7F.

The CRC is applied only on the characters of the „command", STX and ETX are
not   included.
The 4 nibbles of the CRC are transmitted in form of 4 ASCII characters. By
doing so, the CRC is in conformance with the ASCII standard as well.

Control characters	Hex code	Designation	Function
STX	0x02	Start Of Text	Begin of a Records
ETX	0x03	End Of Text	End of a Records
BEL	0x07	buzzer (bell)	Signaling a specific condition, e.g.. if the interrogated memory site is not occupied.
CR	0x0D	Carriage Return	End of string
ACK	0x06	Acknowledge	The command has been executed successfully
NAK	0x15	Negative Acknowledge	The command was not recognized and consequently has not been executed (syntax error)
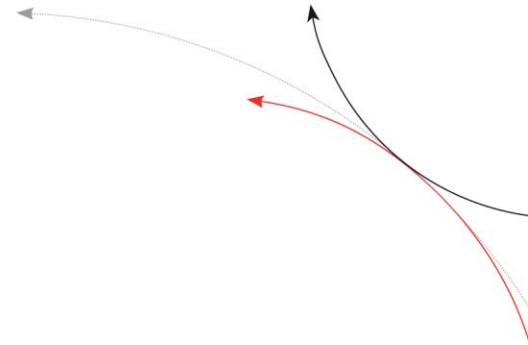
7.3   Checksum CRC

The check sum (CRC=cyclic redundancy check) is generated using the standardized
ISO-Polynomial (or CRC-CCITT) 0x1021; $P(X) = X^{16} + X^{12} + X^5 + 1$.

CRC-CCIT Polynom	0x1021
CRC order	16 Bit
Initial CRC-value	0x0000
data stream	reverse each data byte (process from LSB to MSB)
CRC	reverse CRC result before final XOR

Example in ANSI C:
The CRC checksum in this software example is implemented as a reverse CRC-CCITT:

```c
// **********************************************************************
// Function to calculate the CRC from a protocol buffer with
// the given length
// **********************************************************************
unsigned int build_crc(unsigned char length, unsigned char* protocol)
{
        // the initial CRC value
        #define CRC_PRESET      0x0000
        // the reverse CRC-CCIT pollynomial
        #define CRC_POLYNOM     0x8408

        unsigned char i,k;
        unsigned int crc;
        unsigned char crc_in;

        crc CRC_PRESET;             // initial value
        for(i=0;i< length;i++)      // loop trough the protocol
        {
                crc_in = protocol[i];    // get next protocol byte
                for (k=0;k<=7;k++)       // loop trough one byte LSB to MSB
                {
                        // test each Bit for CRC calculation
                        if((((crc_in>>k)&0x01)^(crc&0x0001))==1)
                        { crc=crc>>1; crc=crc^0x8408; }
                        else
                        { crc=crc>>1;}
                }
        }
        return(crc);
}
```

The check sum is always composed out of 4 hex characters (values from 0x0000 to 0x FFFF). These 4 hex characters are transmitted in ASCII code from '0' .. '9' and 'A' to 'F' .
Example: The check sum 0E2A is transmitted as CHR(0x30), CHR(0x45), CHR(0x32), CHR(0x41).
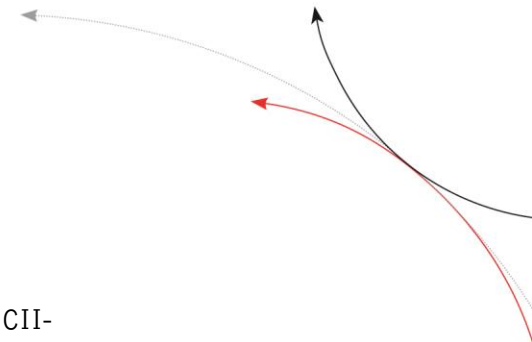
7.4 Structure of the data base

1 Byte for Attribute (# = no attribute, 'A' ... 'Z') - transmitted as 1 ASCII-character

6 Byte for Date/clock in BCD-Format - transmitted as 12 ASCII- characters

1 Byte for Code length (1 ... 16) - transmitted as 1 ASCII- character '0' .. '9', 'A' .. 'F'

> The code length is encoded as follows: Value of the ASCII-character = hex character describing (length – 1).
>
> Example: length =16; length - 1 =15; hex character = 0xF; ASCII-character = 'F' = CHR(0x46).

8 Byte for the Code (up to 16 nibbles, starting left) - transmitted as 16 ASCII-characters

1 Byte for Type of transponder - transmitted as 1 ASCII- character

> 0 = no known transponder
> 1 = ISO-FDX
> 2 = ASK 64Bit
> 3 = Trovan
> 4 = Datamars
> 5 = Destron
> 6 = ISO-Hdx
> 7 = Hitag 1/S
> 8 = Hitag 2
> 9 = Pontech
> A = PSK 2
> B = PSK 1
> C = PSK 2
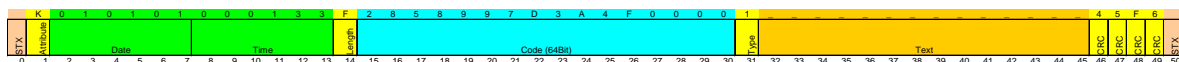> D = BDE FDX
> E = BDE HDX
> F = ISO 14443A 4 Byte
> G = ISO 14443A 7 Byte
> H = ISO 15693
> U = EM 4305

14 Byte for Text (up to 14ASCII's in the range 0x20 ... 0x7F) - transmitted as 14 ASCII- character

Example: description of a record – (sequence of characters at the interface):
STX 'K010101000133F2858997D3A4F00001_____46F6' ETX

The meaning is as follows:

K = Attribute 'K'
010101 = 1.1.2001
000133 = 00:01:33 time
F = Code length = 16
2858997D3A4F0000 = Code
1 = Type of transponder: ISO-FDX
_____ = 14 characters for text (not used = '_')
46F6 is the relevant CRC-check sum

7.5   Simplified read out procedure, without programming the CRC-routine

In order to get a quick output of data from the hand held reader, programming the CRC may be omitted. In this case the following values have to be used:

Command	CRC in Hex
'ET'	0x2C7F
'EC'	0x 4841
'RP'	0x B2C2
'RN'	0x4B3D
'RL'	0x682F
'WP'	0xCC7A
'SV'	0xCE2C
'XT'	0x0996

Example:
In order to read the software version out of the hand held reader , the following command has to be sent from the PC to the reader: STX 'SVCE2C ' ETX . In case of a valid result, the answer is for example STX '610CE8E' ETX, where '610' stands for the Version and 'CE8E' for the check sum belonging to it.

The disadvantage of this method is: The command 'W' can not be executed because the check sum is computed out of the entire Record (including the command and the code number). The consequence is, that every command in conjunction with a code number has is own check sum.

7.6   The command structure in detail

7.6.1 EEPROM (flash memory) empty test
STX , „ET" , „CRC" , ETX

answer: ACK = EEPROM contains data
                 BEL = EEPROM contains no data
                 NAK = Error

This command checks if the database is empty.

7.6.2 EEPROM clear
... „EC" ...

answer: ACK = executed
                 NAK = Error

7.6.3 Set pointer to first full EEPROM record
... „RP" ...

answer: ACK = executed
                 NAK = Error

> Note: It is <u>absolutely necessary</u>, that this command is executed , before a
> readout or clearing command is given. Otherwise the position of the
> pointer is undefined.

7.6.4 Read (new) record
... „RN" ...

answer: STX, „record in ASCII" , „CRC in ASCII" , ETX
                 NAK = Error

The output of the reader is a record ,but, after completion, the pointer is
incremented as well. Consequently at the next "RN" command the following
record will be transmitted.

7.6.5 Read last record
... „RL" ...

answer: STX, „record in ASCII" , „CRC in ASCII" , ETX
                  NAK = Error

The reader repeats the output of the record, that was transmitted with the previous "RN" command. The position of the pointer remains unchanged (as set by the previous "RN" command). This command is sent by the host only , if the CRC from the last record gives a wrong result.

7.6.6 Set pointer to first empty EEPROM record
... „WP" ...

answer: ACK = executed
                  NAK = Error

Note: It is <u>absolutely necessary</u>, that this command is executed , before a load or write command is given. Otherwise the position of the pointer is undefined.

<u>Caution: stored records may be overwritten.</u>

7.6.7 Write record
STX, „W" , „record in ASCII" , „CRC in ASCII" , ETX

answer: ACK = executed
                  NAK = Error

This command writes the record into the EEPROM memory, provided that length, syntax, and CRC have been identified as true. After completion, the pointer is incremented as well. Consequently at the next "W" command the new record will be written into the next position.

7.6.8 Software version
... „SV" ...

answer: STX, „503" , „CRC in ASCII" , ETX
                  NAK = Error

7.6.9 Exit communication mode
... „XT" ...

answer: ACK = executed

NAK = Error

7.7 Parameter changing commands

7.7.1 Change parameters

In the operation mode database/PC of the reader it is also possible to change some parameter of the reader itself e.g. reading time, switch off time etc.

This is done by the command „s":

Format:
STX, „s" , „Address = 3xASCII-chr", „Value = 2xASCII-chr " , „crc = 4xASCII-chr" , ETX.

Address	Name	Options/Values	Parameter-Range	Default Value
0x003	Language	Language of the device	0x00 english 0x01 german	0x00
0x00E	Turn-off time	Time until the device will automatically shut off. Set in 5 second steps (Parameter 0xFF=the device didn't switch off)	0x02-0x3C (2-60) 0xFF (255)	0x04 (4)
0x00F	Turn-on delay	The time the main-button is to be pressed to switch on the reader. value*0.5s	0x00-0x0A (0-10)	0x01 (1)
0x010	Reading time	Sets the time frame for one reading attempt Value*500ms	0x01 – 0x19 (1 – 25)	0x04 (4)
0x011	Baudrate	0x01 = 9600 Baud 0x02 = 19200 Baud 0x03 = 38400 Baud	0x01 – 0x03	0x02 (19200)
0x012	Keyboard sound	Activates the Keyboard sounds 0x00 = off ; 0x01 = on	0x00, 0x01 (0, 1)	0x01 (1)
0x013	Mirror Code	Activates the Mirror Code 0x00 = off ; 0x01 = on	0x00, 0x01 (0, 1)	0x00 (0)
0x081	HID-keyboard language	The keyboard-layout is changed for different languages 0x07 german 0x09 english 0x0A spanish 0x0C french 0x10 italian 0x13 dutch	0x07 0x09, 0x0A,0x0C, 0x10,0x13,0 x16,0x4B	0x07 (german)

		0x16 portuguese 0x4B canadian		
0x082	Specialver sion	Activate specialversion	0x00-0xFF	0x00 – no 0x4D – F12
0x090	CW Value	ISO 15693	0x00-0xFF	
0x091	CW Value	ISO 14443A	0x00-0xFF	

Answer from reader:
ACK = command executed
NAK = command or parameter error

Example:
Set Reading Time to 4,5 seconds

⇨ 9*500 = 4500ms = 4,5s

<STX>s01019C872<ETX>

7.7.2 Read parameters

The parameters stored in the ARE H9 HF could be read with the command „S".

Format:
STX, „S", „Address = 3xASCII-chr",crc = 4xASCII-chr", ETX.

Answer from reader:
STX, „Value 2xASCII-chr", „CRC 4xASCII-chr", ETX

7.7.3 Set time and date

„r" is the command to set the time and date with a Real-Time-Clock-module present in the ARE H9 HF.
Date and time are coded as BCD-values and transmitted in ASCII-characters.

Format:
STX, „r", „Date and Time in ASCII BCD", „CRC 4xASCII-chr", ETX

Answer from reader:
ACK = command executed
NAK = command or parameter error

Example:
Set the clock to 15.11.2002, 10:02:16

<STX>r1511021002162CA5<ETX> with CRC = 2CA5

7.8   Attributes

7.8.1 Assign text to attributes

The database in the ARE H9 HF is capable to assign 27 attributes to transponder-IDs.

In the initial configuration all the 27 attributes available have a standard text assignment.

#, A, B, C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z

Using the Database/PC mode of the ARE H9 HF it is possible to assign each attribute a custom text with up to 14 ASCII characters.

Example:
A becomes "stable",
B becomes "pasture"
C becomes "vaccination"

A new text could be assigned to an attribute with the command „t".

Format:
STX, „t", „Attribute = 1xASCII-chr",,,Text = 14xASCII-chr",,,crc =
4xASCII-chr", ETX.

Answer from reader:
ACK = command executed
NAK = command or parameter error

The text must be minimum three characters and at least 14 characters long. Only
characters of the ASCII-table are allowed in the text.

Should no text be assigned, or an assigned text should be cleared, three „_"-
characters are sent instead of the text.

Example:
To change the attribute a to the text „Stall" the following protocol has to be
sent:

<STX>tAStall02C9<ETX>

To clear the text of the attribute „A" the following protocol has to be sent:

<STX>tA___0186<ETX>

7.8.2 Read attribute text assignments

The text assignments to the attributes at the ARE H9 HF could be read by using the
command „T"

Format:
STX, „T" , „Attribute = 1xASCII-chr",,,crc = 4xASCII-chr" , ETX.

Answer from reader:
STX, „Attribute = 1xASCII-chr",,,Text = 14xASCII-chr",,,crc = 4xASCII-chr" ,
ETX.
NAK = command or parameter error

Example:
To read the text of the attribute „A" following protocol has to be sent:

<STX>TAE71A<ETX>
Answer:
 <STX>A538D<ETX>   => no text assigned
or
<STX>Stall7A09<ETX>   => assigned text „Stall"


8 Control characters used in the online mode

character	value hexadecimal	Function
<NL>	0x00	zero character, terminates text element
<STX>	0x02	start of text
<ETX>	0x03	end of text
<ACK>	0x06	acknowledge
<CR>	0x0D	carriage return
<LF>	0x0A	line feed

9 USB driver installation

To use the online and the database mode the ARE H9 HF is connected via USB to a host PC. Before the USB connection could be used a USB to RS232 bridge drive has to be installed.
If you want to use the USB-HID interface the standard keyboard driver is used.

Insert the driver disc supplied with the ARE H9 HF into your CD-Rom or DVD-Drive of the host PC you want to use with the pocket reader. Connect the ARE H9 HF with the supplied USB cable to a free USB port of your PC (USB1.1 and USB2.0 ports are supported).

USB connection cable

ARE H9

PC
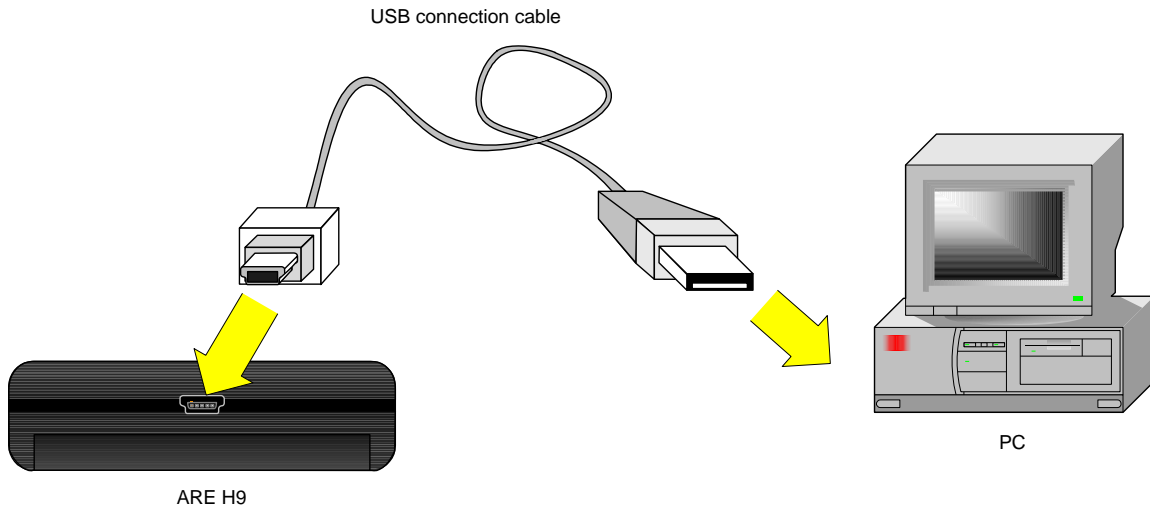
The PC will detect a new hardware; Windows opens the Found New Hardware Wizard.
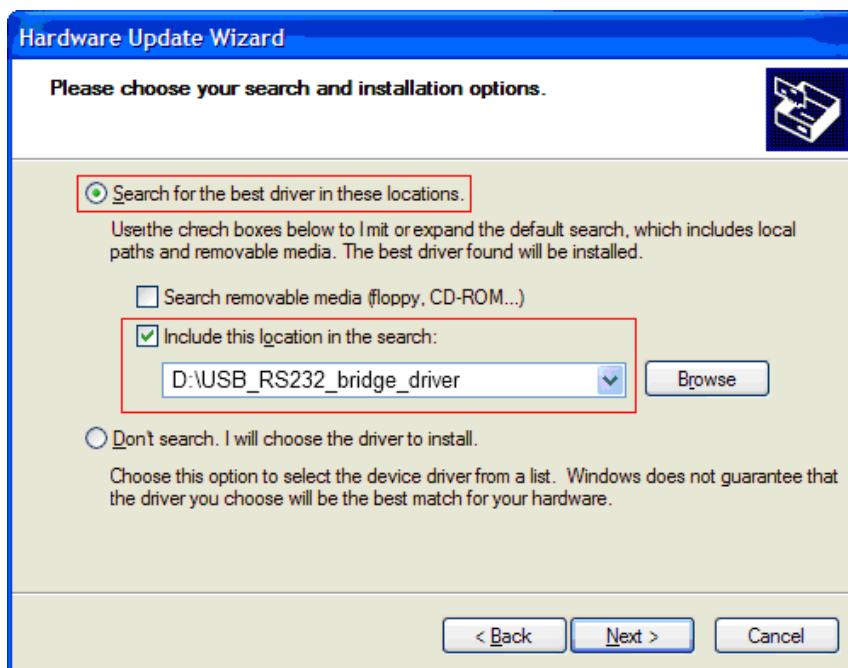

If the Found New Hardware Wizard asks to connect to Windows Update, select „**No, not this time**", then click „**Next**".
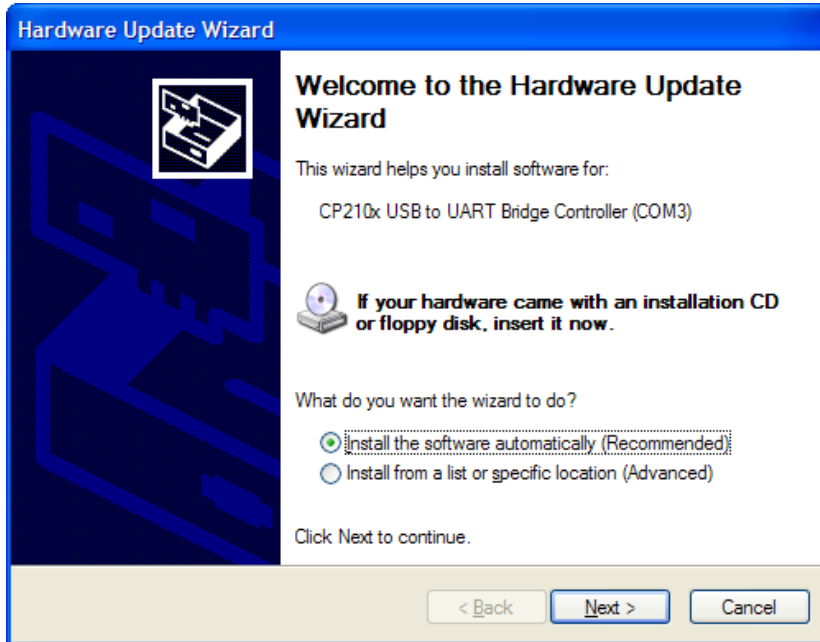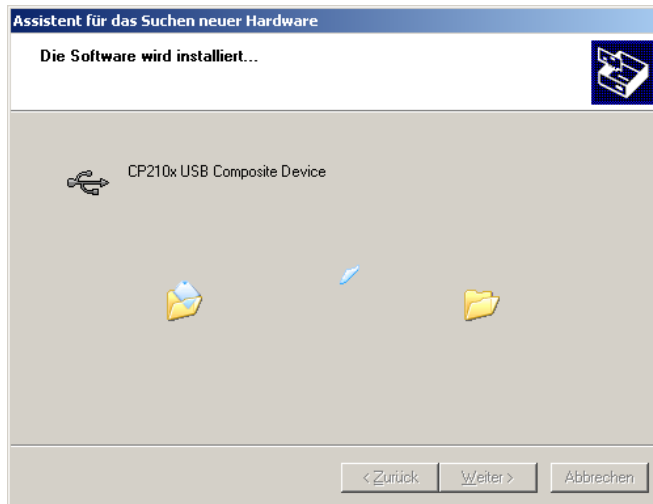
In the next windows of the Hardware Update Wizard select „ **Install from a list or specific location (Advanced)**".

In the search dialog choose „**Search for best driver in these locations**". Specify the CP210x driver located in the CD folder „**..\USB_RS232_bridge_driver**".
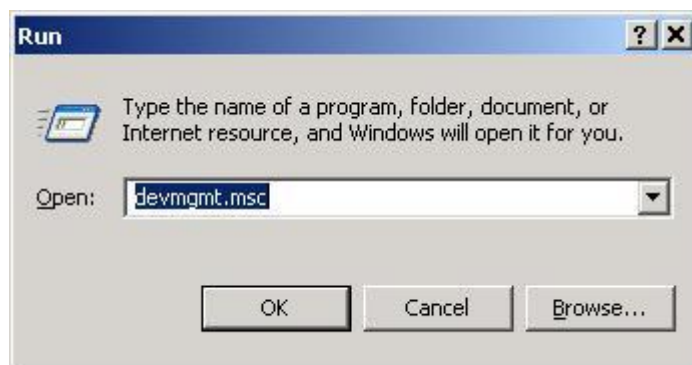
Click „**Next**"after setting the path to the driver location

This completes the installation of the USB Device Driver.
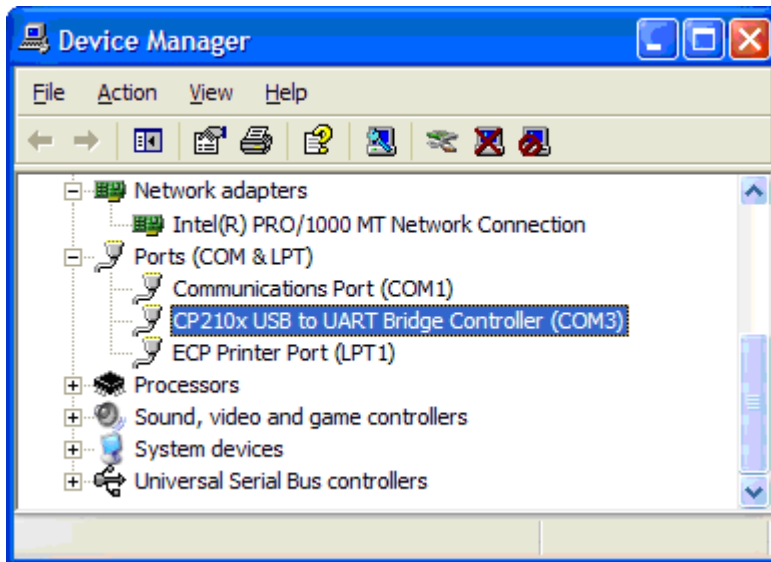
After the installation of the USB Device Driver the COM port setting could be set and verified by the Windows Device Manager.

Open the Device Manager using start button -> select Run, type in the text field „**devmgmt.msc**"and click „**OK**".

Another method is to access the Windows Device Manager is: Start -> Control Panel -> System -> Hardware -> Device Manager.

The COM driver for the ARE H9 HF is located under Port (COM & LPT):

„CP2101 USB to UART Bridge Controller (COMx)"

COMx stands for the COM port selected by the driver, this COM port could used in the software
to communicate with the ARE H9 HF.

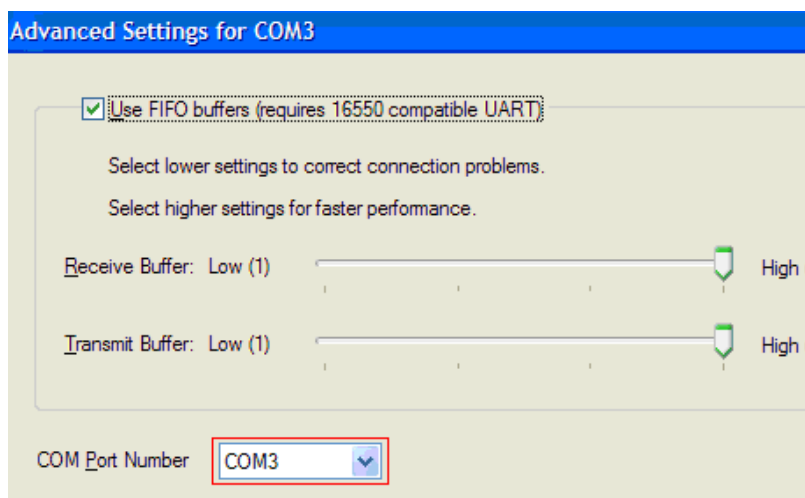In case there is a COM port conflict or another port number is needed, the COM port number has to be changed.

To change the COM port, double click on „**Ports (COM & LPT) - CP210x USB to UART Bridge Controller** ".The Properties dialog will open.
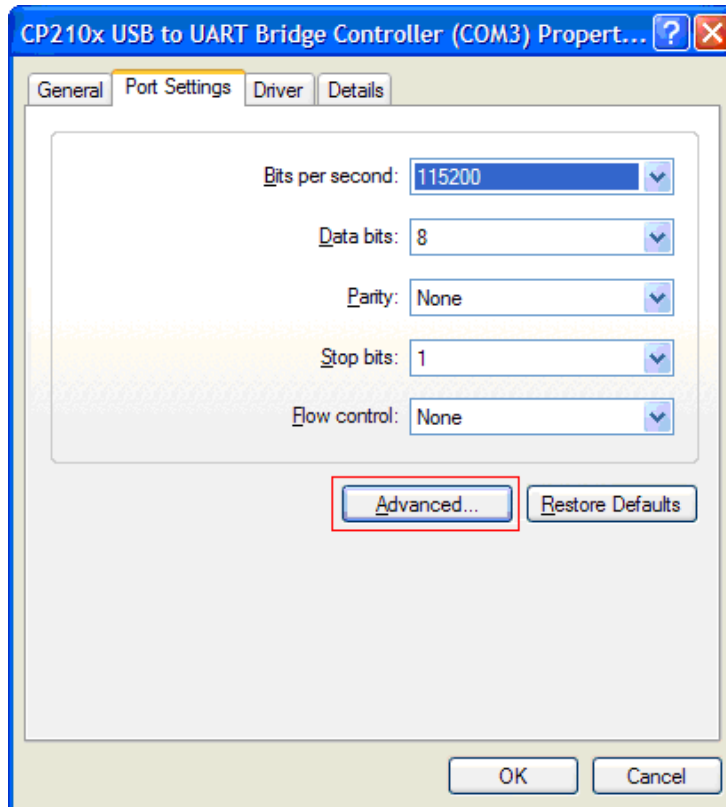
Select the „**Port Settings**" tab and click on the „**Advanced**" button.

Select under „**COM Port Number**" the port number to use, then clock „**OK**".

10   Technical specifications

Electrical characteristics	
Reading system	ISO 14443A, ISO 15693 UID
Operational frequency	13,56 MHz
Display	LCD: 2-Zeilen mit 16 Zeichen
Interface	USB, USB-HID, Bluetooth, RS232
Power supply	9V Alkali Batterien vom Typ 6LR61
Environment	
Storage temperature	-10°C bis +70°C
Operation temperature	0°C bis +55°C
Housing protection	IP 50
Dimensions	
Weight	185 g
Length	135 mm
Width	70 mm
Height	24 mm
Material	ABS

11   Operation with other RFID equipment

As there may be electromagnetic interference between different readers, this reader shall not be operated within a distance of 3m from any other RFID reader. Otherwise a proper reading result cannot be guaranteed.

12   Safety instruction

The manufacturer can not be held liable for damages caused by improper use or abuse, lack of reasonable care, or manipulations contrary to the recommendations given in this manual.
Do not open the reader! There are several spots inside the device, where high voltage is generated during the scanning process.
The ARE H9 HF Reader does not contain any parts to be repaired by the user. Any attempt to open the reader may damage the device. Therefore it may be repaired only by authorized personal.
Protect the USB interface socket against dirt, moisture and dust.
For cleaning of the reader and cable use a moistened towel. Never use chemical solvents like e.g. acetone.
Do not submerge the reader in water.

13   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.

14   Notification of changes

Ausgabe	Datum	Beschreibung der Änderung	Autor
001	01.10.2014	First revision	FW
002	30.04.2015	Mirror Code added HID left button ``carriage return'' added	FW
003	09.12.2015	Reader Terminal	MM
004	01.04.2016	Orientation ferrite antenna added	FW
005	19.05.2016	FCC Information	MK
006	22.06.2016	FCC Information correction	MK
007	02.06.2017	Chapter 7.7.1 0x003 removed 0x004 added	FW
008	16.11.2017	Bluetooth connection added	FW
009	05.12.2018	Chapter 7.7.1 0x090, 0x091 added	FW

15   Contacts

To improve our products, as well as its documentation is our permanent effort.
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