USER MANUAL

HT EV400

HITAG™ Proximity Evaluation Kit

Product Description
Revision 2.1

January 1999

PHILIPS

hitag™

- is the name of one of the universal and powerful product lines of our 125 kHz family. The HITAG product family is used both in the proximity area (reading range up to about 200 mm) and in the long range area (reading range up to about 1000 mm).

Developing our HITAG products, utmost consideration was given to security and reliability. The use of cryptography guarantees highest data security.

Using optimized antennas and powerful transponders operating ranges of up to 1m can be achived.

The central part of every HITAG Read/Write Device is the HITAG Core Module, which ensures full compatibility for every HITAG Read/Write Device.

Easy integration and application of the HITAG Core Module is due to its:

- small size
- standard interfaces
- flexible supply voltage

To give you the possibility for an easy and quick start with our HITAG products we offer a HITAG Proximity Evaluation Kit.
Easy application certainly is an important factor in making the Proximity Evaluation Kit suitable for evaluation purposes. You will be able to present your ideas and demonstrate the performance of your system with the help of the HITAG Evaluation Kit.

hitag™ Proximity Evaluation Kit Description

TABLE OF CONTENTS

Definitions

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics section of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

Life support applications

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so on their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

1. General Remarks

1.1. Scope of Delivery

The Evaluation Kit comprises the following components:

- 1 HITAG proximity read/write device
- 1 Interface cable
- 1 Power supply cable
- 1 Floppy disc (3 ½") containing evaluation software
- Transponders
- User manual
- Data sheet containing 1 floppy disc (3 ½") with libraries and header files.

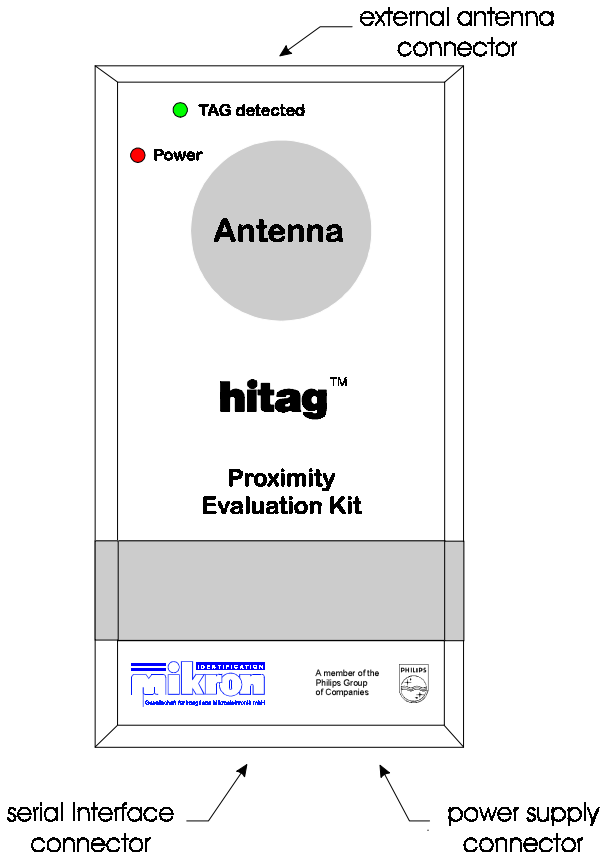
1.2. Specifications

- **Power supply**: 9 - 16 VDC
- **Supply current**: maximum 150 mA
- **Frequency**: 125 kHz
- **Temperature**: 0° - 70° C
- **Interface**: RS232

1.3. Hardware Startup

Metallic environment and electromagnetic interferences (e.g.: monitors, keyboards) have a negative effect on the reading and writing range!

1.3.1. Housing



1.3.2. Connecting the Read/Write Device to your PC and to the Power Supply

Connect the supplied interface cable to the serial interface (COM1 or COM2) on your IBM compatible PC (286 or higher). Plug the power supply-cable into a power supply unit (9 - 16 VDC).

1.3.3. Connecting an external Antenna

User derfined antennas may be connected at the external antenna connector.
Concering the design of proximity antennas please please refer to the document HT RM400 (HITAG Core Module) resp. HT RM440 (HITAG Proximity Reader Module).

1.4. Software Startup

1.4.1. System Requirements

In order to use the RFIDDEMO-Software the following system requirements must be satisfied:

- IBM-PC or compatible (minimum 286 processor)
- 640 kbyte RAM
- serial interface

1.4.2. Installation

1. Create a new directory on your PC for the Demo-Files (e.g.: C:\RFIDDEMO)
2. Copy all the files from the floppy disc into the directory you created in step 1.

1.4.3. Starting the Demo-Program

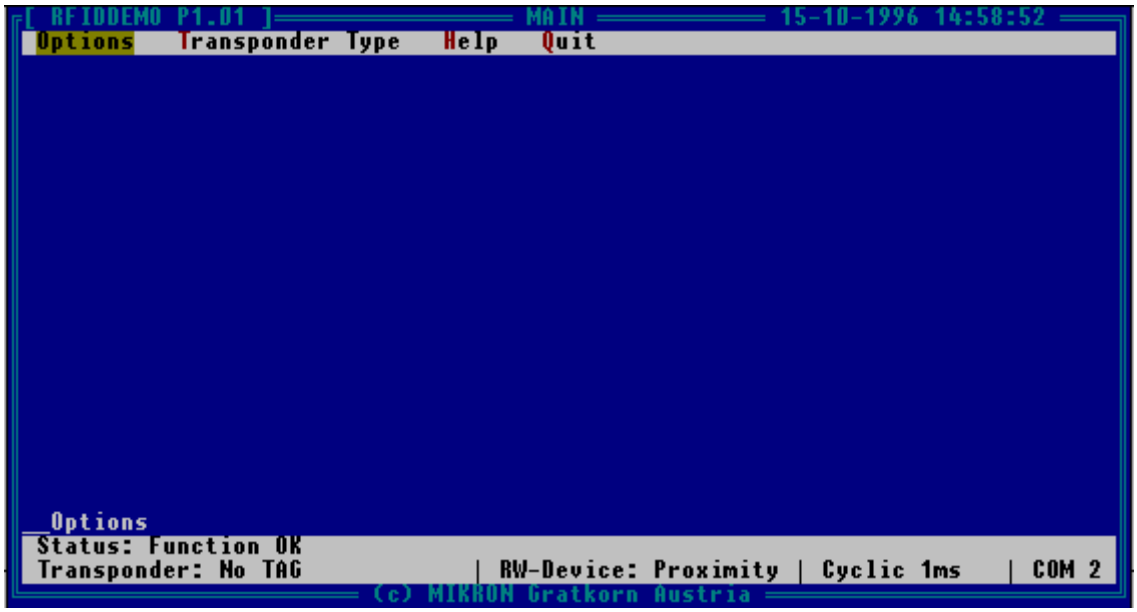
Start your Demo-Program by typing the command **RFIDDEMO.EXE**.

We strongly recommend to carefully read this description (especially chapters 9 and 10) before starting the Demo System! Inconsiderate use of individual menu options may result in unwanted irreversible changes in access rights.

2. General Definitions for the Demo-Software

- <ESC> quits a submenu.
- Scrolling the menubar is done with the cursor keys ↑ and ↓.
- <ALT F4> always quits the program.
- <ENTER> chooses the submenu shown with ➡.
- You can also use the hotkeys to select a submenu.
- All menu items coloured in blue are not enabled in the software.
- Upon starting the software checks which serial interface is used for communication with the read/write device. This may last for some seconds.
- To increase the data reliability accessing transponders the software includes double read and read after write.

3. Mainmenu



The two bottom lines display error messages, information about transponder, interface and read/write device.

Status: Displays error respectively status messages.

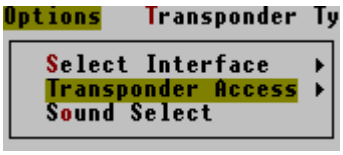
Transponder: Shows the chosen transponder (e.g.: HT2 Crypto)

RW-Device: Gives information about the type of connected read/write device (Proximity or Long Range)

Cyclic 1ms: Shows the mode of command repetition (Single or Cyclic access with delay time between end of first and beginning of the next command).
See chapter 3.1 (Options Transponder Access).

COM 2: Shows the used serial interface (COM 1 or COM 2)

3.1. Options

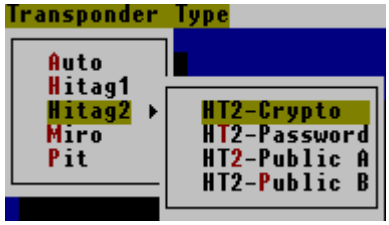


Select Interface: Chooses the serial interface (COM 1 or COM 2).

Transponder Access: Switches between single and periodically repeated commands. The specified value determines the time between the end of the first and the beginning of the next command.

Sound Select: Enables a signal tone after successful read commands.

3.2. Transponder Type



Auto: Initiates automatically transponder recognition (e.g.: HT2-Crypto) and pressing ENTER switches to the correct submenu.
Please note: HT2 Public A transponders may also be recognized as MIRO transponders. To access HT2 Public A transponders use the proper sub-menu *HT2-Public A.*

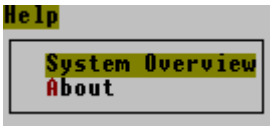
Hitag1: Provides access to HITAG 1 transponders.

Hitag2: Chooses between the four modes of this transponder, *Password*, *Crypto*, *Public A* and *Public B.*

Miro: Provides access to MIRO read only transponders.

Pit: Provides access to PCF793x transponders.

3.3. Help



System Overview: Gives a short overview on the 125kHz transponder system.

About: Gives short information about the software.

3.4. Quit

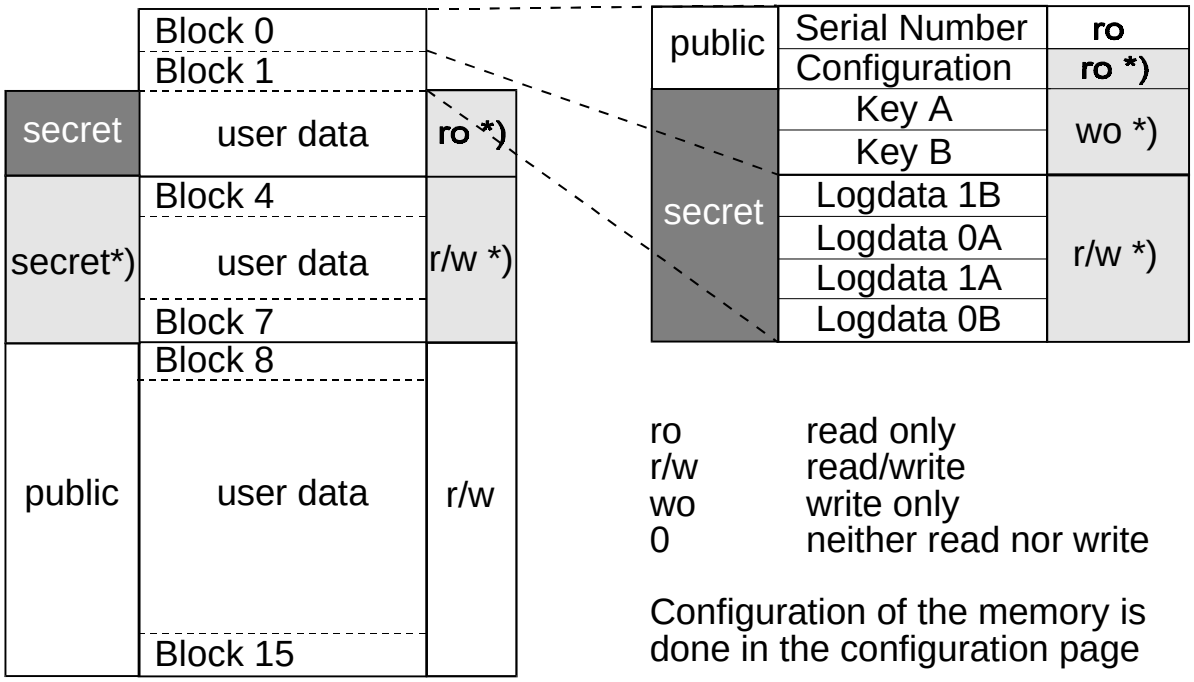
Use this command to exit the Demonstration Program.

4. HITAG 1 Transponders

4.1. Memory Partitioning

The 2 KBit EEPROM memory on the transponder is divided into 16 blocks. Every block consists of 4 pages with 4 bytes (at 8 bits) each.
Addressing is done page by page and access is gained either page by page or block by block entering the respective start address. In case of block read (or write) the transponder is processed from the start to the end of the block.

The drawing below describes the memory configuration on the Demokit transponder:



*) **Areas (or settings) marked with an asterisk *) may be configured by the client.**

The memory location described above and marked with an asterisk *) has been configured by Philips, whereby the content of some of the memory areas is free, some allocated.
Block 0 defines the serial number, the configuration of the memory area and the keys, Block 1 the logdata.

Memory locations marked with "secret" can only be accessed after a mutual authentication. An enciphered data communication is used in that area.

Memory locations marked with "public" can be accessed without mutual authentication, no encryption is used.

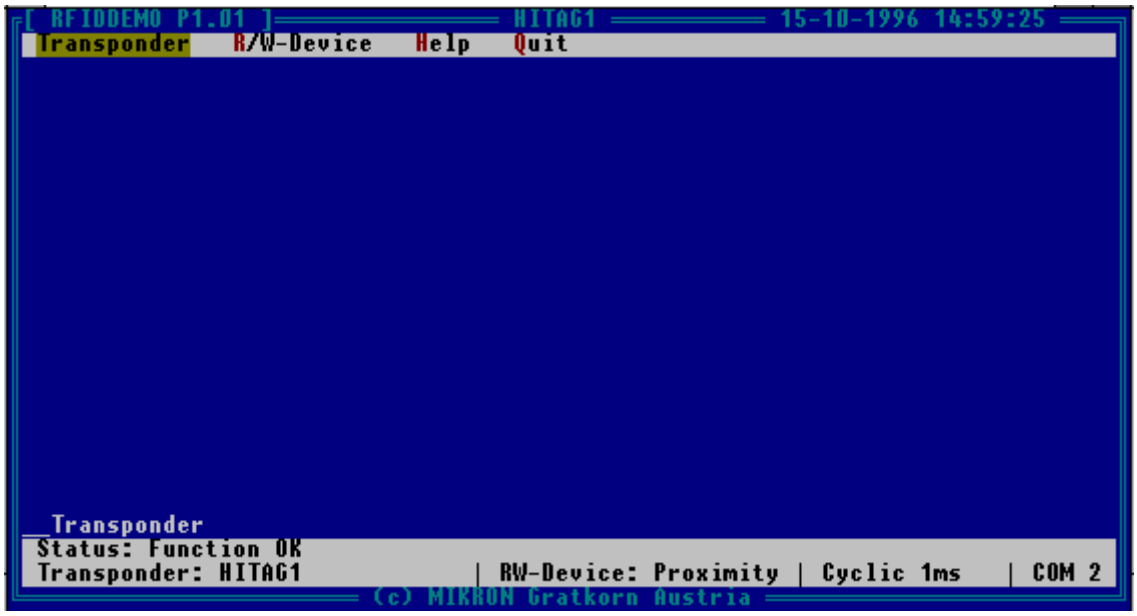
Transponders delivered with this Demokit are configured as follows:
Blocks 4 to 7 of the transponder are public and read-write.

The table shows that the logdata can be both written and read, keys can only be written. That means that keys and logdata can be changed.

Important! You have to be very careful when changing keys and logdata as inconsiderate use results in loss of access to the secret area on the transponder. See Chapter 10 for a detailed description.

4.2. Operating HITAG 1 Transponders

Operating a HITAG 1 transponder the screen will be displayed as follows:



4.3. Transponder

Get ID: Reads the ID number of the transponder located in the field of the antenna.

Get all ID:[*)] Reads the ID numbers of up to 10 transponders located in the field of the antenna. If more transponders are in the field, the total number is displayed in the bottom line of the window.

Read Page: On entering a page number (0-63) one page (4 bytes) of the transponder is read and displayed on the screen.

Read all Page:[*)] On entering a page number (0-63) the content of one page (4 bytes) of up to 10 transponders is read and displayed on the screen.

Read Block: On entering a block number (0-15) and a page number (0-3) one block (up to 16 bytes) of the transponder is read and displayed on the screen.

Write Page: On entering a page number (8-63) and 4 bytes of numbers one page (4 bytes) is written to the transponder.

Write Block: On entering a block number (2-15), a page number (0-3) and up to 16 bytes of numbers one block (up to 16 bytes) is written to the transponder.

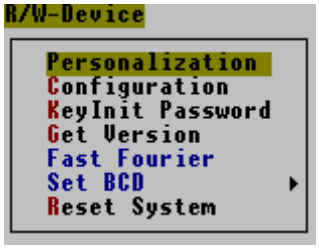
Attention: You can only write cyclically on a TAG that is in the field when you initiate the write command. To write to another TAG please repeat the write command.

Personalization: Gives access to key and passwords stored on the transponder (TAG) (see also chapter 10)

Configuration: Submenu used to change the configuration of the transponder (see also chapter 9).

*) The commands **Get all ID** and **Read all Page** are only enabled when using HITAG Long Range Read/Write Devices.

4.4. R/W-Device



Personalization: Submenu to change keys and passwords of the read/write device. (refer to chapter 10)

Configuration: Submenu used to change the configuration of the read/write device. (refer to chapter 9)

KeyInit Password: Use this submenu to change the password for the configuration and personalization (see chapters 9 and 10).

Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms. As a consequence the transponder in the antenna field is reset (e.g.: transponder that is in Halt Mode will respond again).

*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

5. HITAG 2 Transponders

5.1. Memory Partitioning

The memory of the transponder (TAG) consists of 256 bits EEPROM and is organized in 8 pages with 32 bits each. The READ and WRITE instructions always read or write a whole page, and the address transmitted by the base station represents the page address.

Depending on the mode of operation the EEPROM is organized in the following way:

crypto mode:

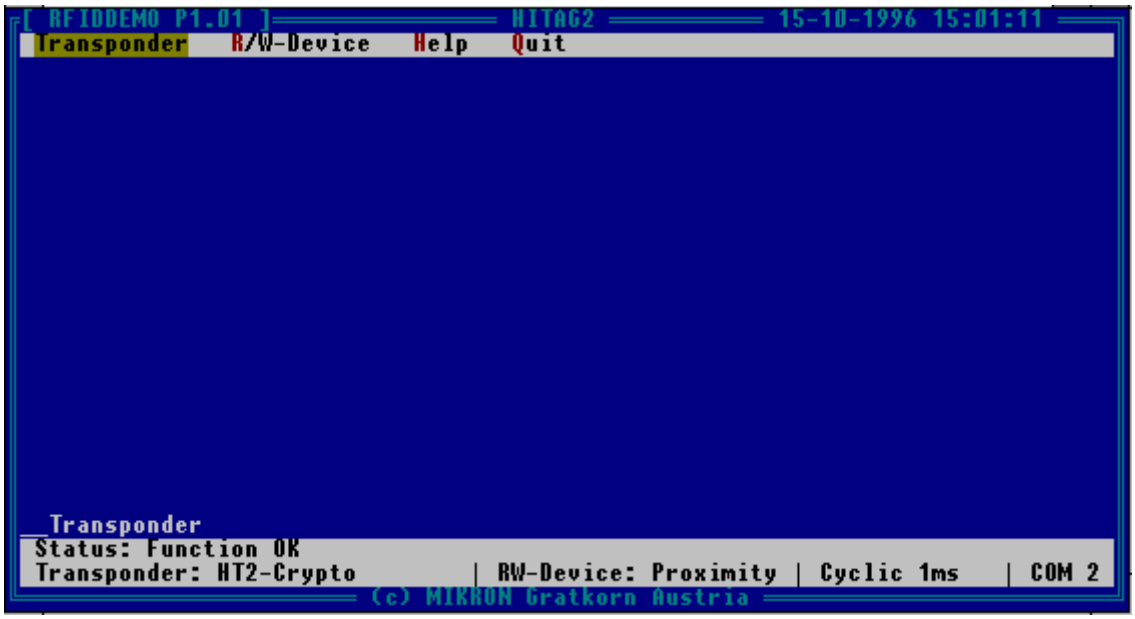
Page	Content
0	ID number
1	32 bit Key: "KEY LOW"
2	16 bit Key " KEY HIGH"
3	8 bit Configuration, 24 bit Password TAG
4	read/write Page
5	read/write Page
6	read/write Page
7	read/write Page

password mode:

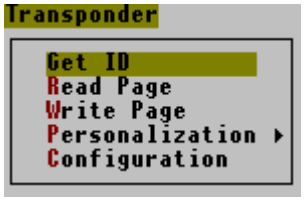
Page	Content
0	ID number
1	Password RWD
2	reserved
3	8 bit Configuration, 24 bit Password TAG
4	read/write Page
5	read/write Page
6	read/write Page
7	read/write Page

5.2. Crypto Mode

Operating a HITAG 2 transponder in crypto mode the screen will be displayed as follows:



5.2.1. Transponder



Get ID: Reads the ID number of the transponder located in the field of the antenna.

Read Page: On entering a page number (0-7) one page of the transponder is read and displayed on the screen.

Write Page: On entering a page number (4-7) and 4 bytes of numbers one page is written to the transponder.

Personalization: Gives access to the key and password stored on the transponder (TAG).

- Key is used to encrypt the data sent to and received from the transponder.
- Password TAG is sent from transponder to read/write device and can be verified by the latter depending on the configuration of the read/write device (see also chapter 10)

Configuration: Submenu used to change the configuration of the transponder. (see also chapter 9)

Attention: You can only write cyclically on a TAG that is in the field when you initiate the write command. To write to another TAG please repeat the write command.

5.2.2. R/W-Device

Personalization: Submenu to change keys and passwords of the read/write device. (see also chapter 10)

Configuration: Submenu used to change the configuration of the read/write device. (see also chapter 9)

KeyInit Password: Use this submenu to change the password for the configuration and personalization (see chapter 9 and 10).

Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

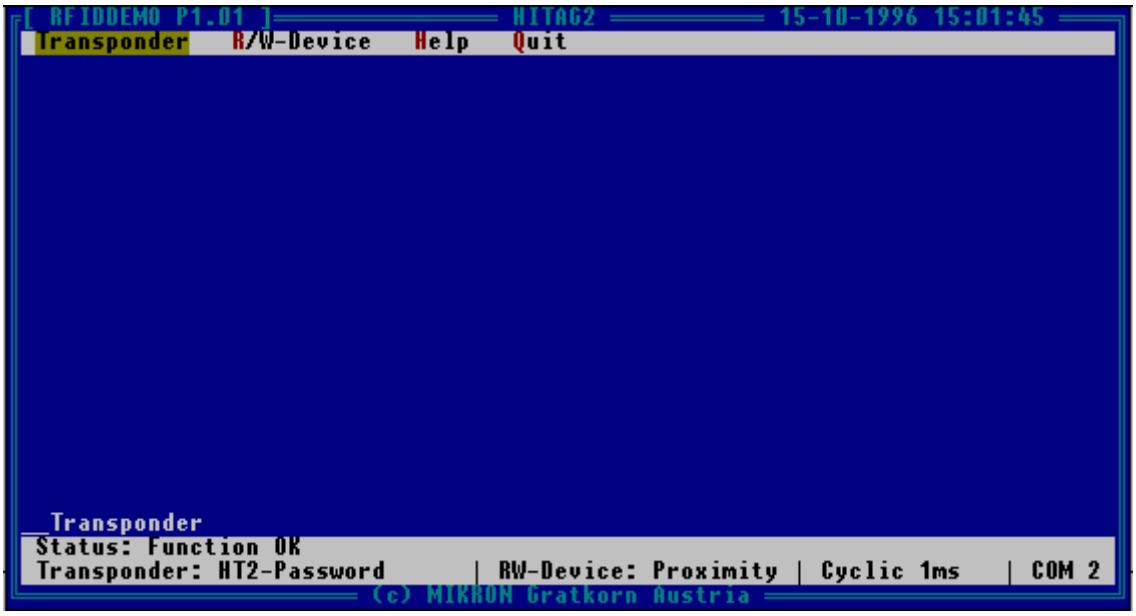
Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms. As a consequence the transponder in the antenna field is reset (e.g.: transponder that is in Halt Mode will respond again).

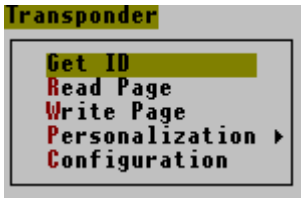
*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range read/write devices.

5.3. Password Mode

Operating a HITAG 2 transponder in password mode the screen will be displayed as follows:



5.3.1. Transponder



Get ID: Reads the ID number of the transponder located in the field of the antenna.

Read Page: On entering a page number (0-7) one page of the transponder is read and displayed on the screen.

Write Page: On entering a page number (4-7) and 4 bytes of numbers one page is written to the transponder.

Personalization: Gives access to the two passwords stored in the transponder (TAG).
(see also chapter 10)

- Password RWD is sent from read/write device to transponder and checked for identity by the latter
- Password TAG is sent from transponder to read/write device and can be verified by the latter depending on the configuration of the read/write device.

Configuration: Submenu used to change the configuration of the transponder.
(see also chapter 9)

Attention: You can only write cyclically on a TAG that is in the field when you initiate the write command. To write to another TAG please repeat the write command.

5.3.2. R/W-Device

Personalization: Submenu to change keys and passwords of the read/write device. (see also chapter 10)

Configuration: Submenu used to change the configuration of the read/write device. (see also chapter 9)

KeyInit Password: Use this option to change the password for the configuration and personalization (see chapter 9 and 10).

Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

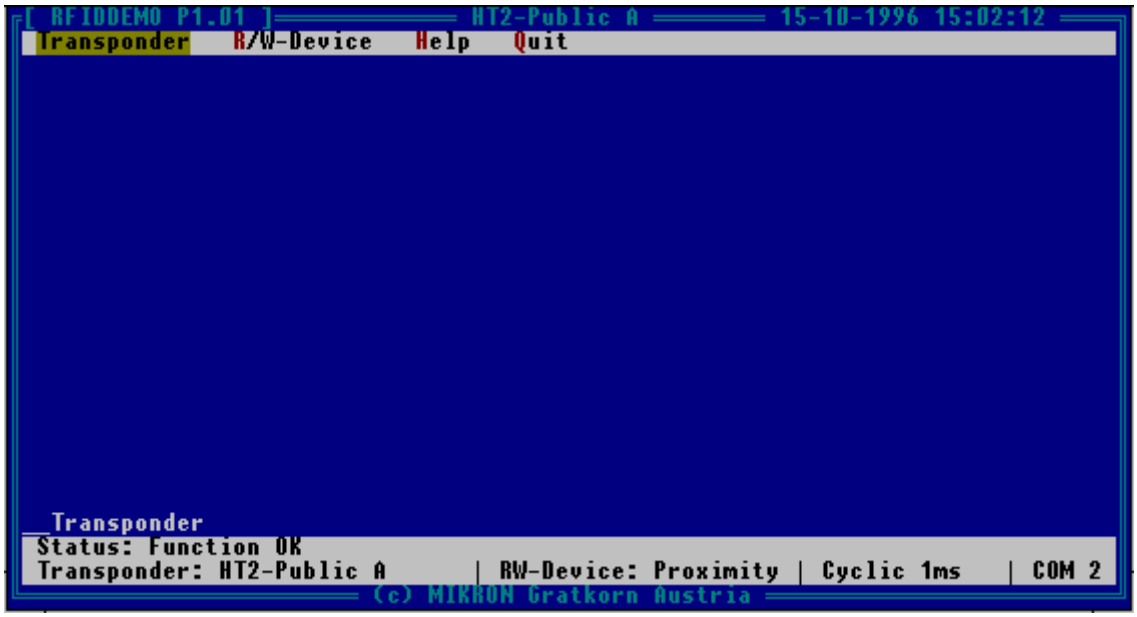
Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms. As a consequence the transponder in the antenna field is reset (e.g.: transponder that is in Halt Mode will respond again).

*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

5.4. Public Mode A

Operating a HITAG 2 transponder in Public Mode A the screen will be displayed as follows:



5.4.1. Transponder

Init: Opens a submenu to configure the HT2 transponder as HT2-Public A and allows you to write 5 bytes of data to the transponder.

Read: Reads the data of a HT2-Public A transponder.

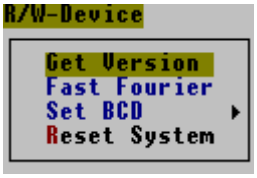
Copy: Opens a submenu to read the contents of a MIRO transponder, write these data to a HT2 transponder and set it into Public Mode A.

Configuration: Submenu used to change the configuration of the transponder.

Please note: If you set a HITAG 2 transponder to Public Mode A an **Init** procedure has to be carried out before reading the HT2-Public A transponder.

Otherwise you might get a **NOTAG** message.

5.4.2. R/W-Device



Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

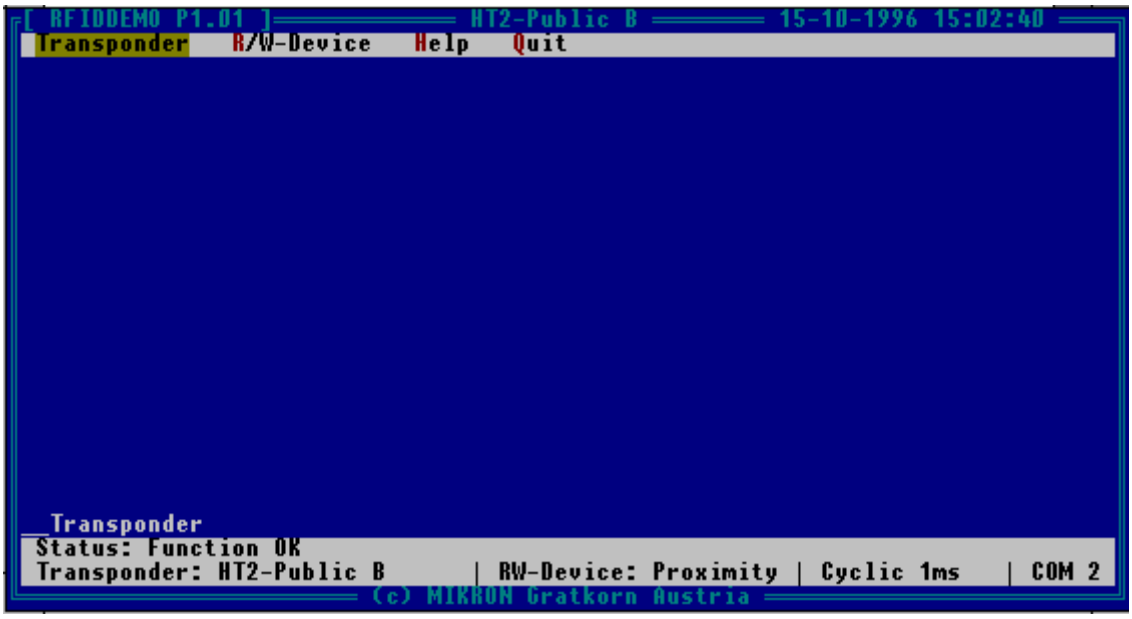
Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms.

*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

5.5. Public Mode B

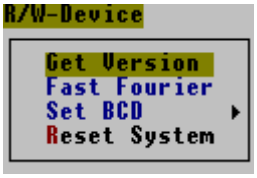
Operating a HITAG 2 transponder in Public Mode B the screen will be displayed as follows:



5.5.1. Transponder

Read: Reads the data of a HT2-Public B transponder.

5.5.2. R/W-Device



Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms.

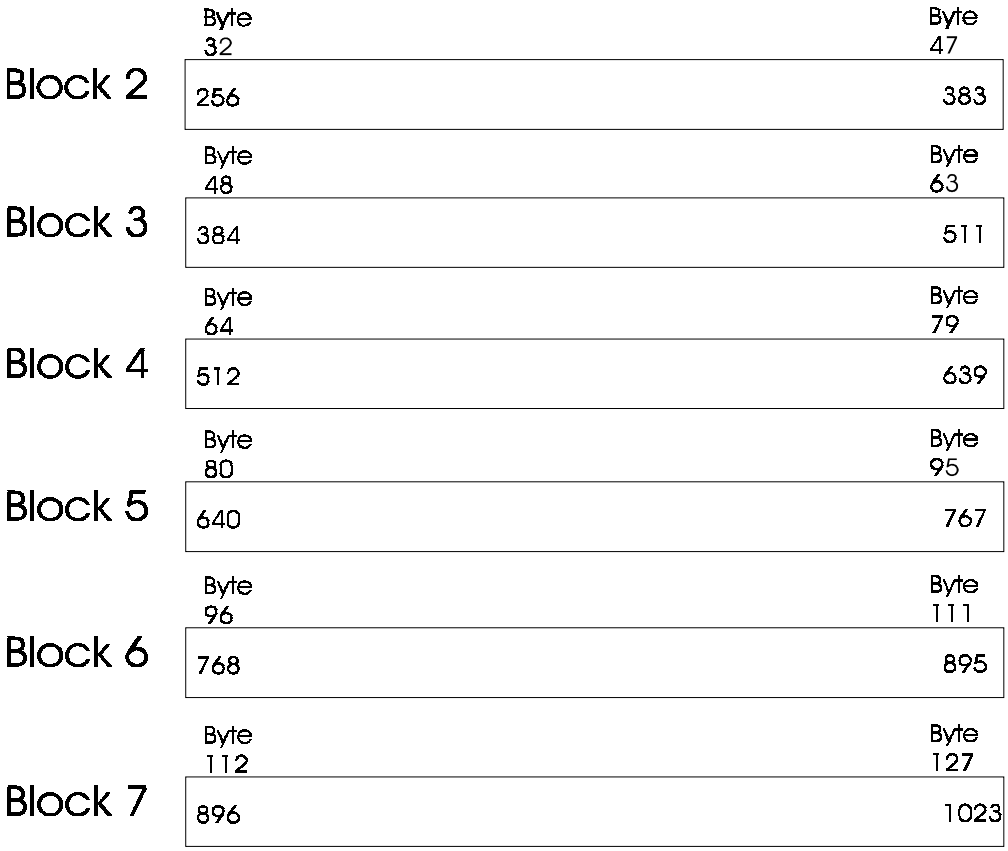
*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

6. Transponders PCF793x (PIT)

6.1. Memory Partitioning

The EEPROM provides a memory capacity of 128 bytes. It is organized in 8 blocks, each block consisting of 16 bytes. This capacity is split into 6 blocks (=96 bytes) for reading/writing of user data and into 2 blocks (=32 bytes) for the control of the memory access.

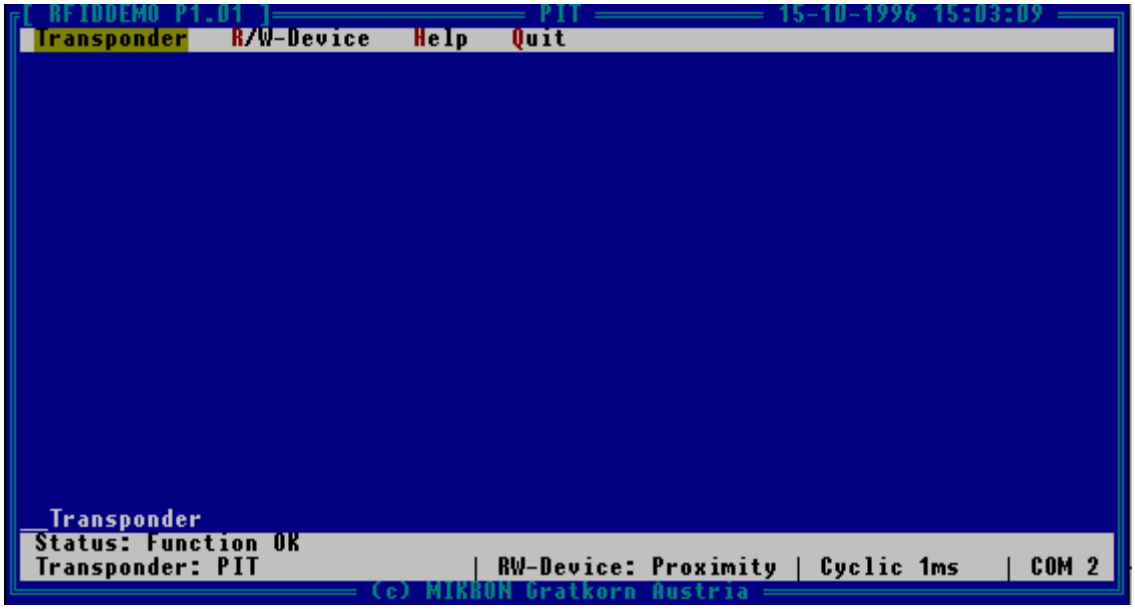
The user memory partitioning is shown below.



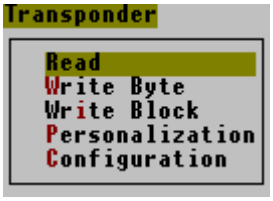
Blocks 0 and 1 store information for read/write access control. The intention of these blocks is to provide some flexibility for different applications in terms of data security and access to relevant information.

6.2. Operating PIT Transponders

Operating a PIT transponder the screen will be displayed as follows:



6.3. Transponder



Read: Reads all 8 data blocks of the transponder.

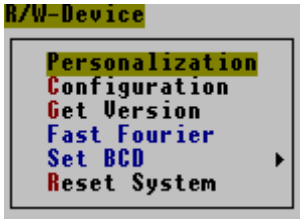
Write Byte: On entering a byte address (32 - 127) and one byte this data are written to the transponder.

Write Block: On entering a block address (2 - 7) and 16 bytes these data are written to the transponder.

Personalization: Submenu to change the password stored in the transponder.

Configuration: Submenu used to change the status of the password checkbit of the transponder for write access.

6.4. R/W-Device



Personalization: Submenu to change the password of the read/write device.

Configuration: Submenu used to change the password status of the read/write device for write access to the transponder.
The current status cannot be read from the read/write device.

Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms.

*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

Attention: PIT transponders can only be accessed using the proximity read/write device !

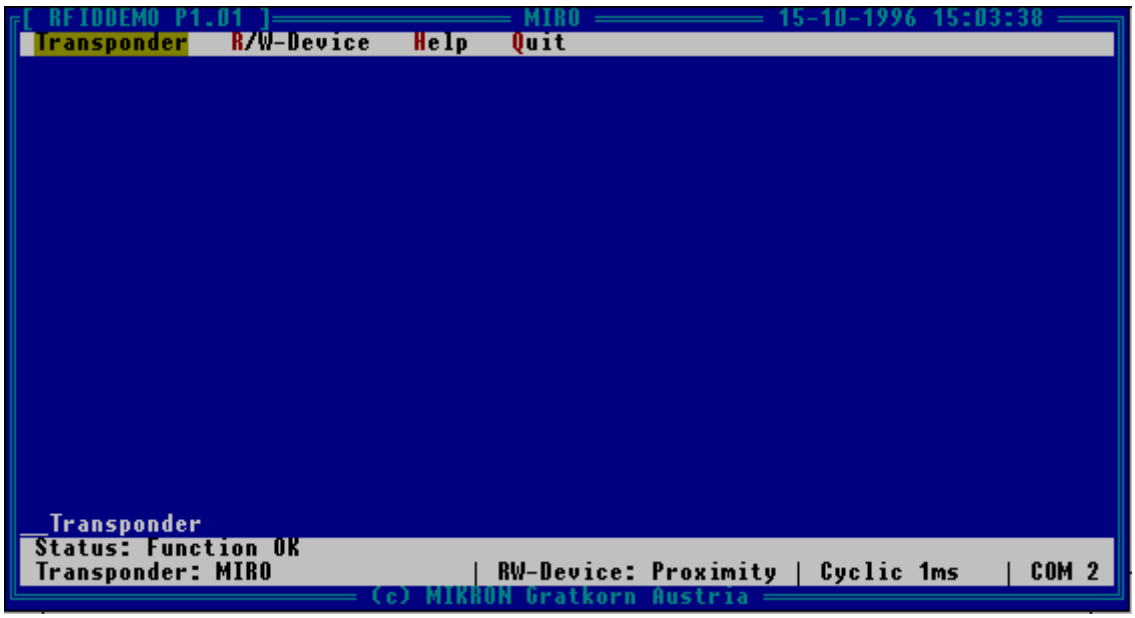
7. MIRO Transponders

7.1. Memory size

In the 64 bit memory the unique 40 bit serial numer of the transponder is stored as well as 24 bits header and parity bits. The data are read only and cannot be changed.

7.2. Operating MIRO Transponders

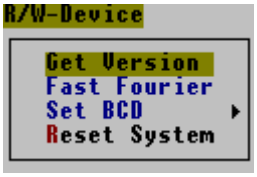
Operating a MIRO transponder the screen will be displayed as follows:



7.3. Transponder

Read Miro: Reads the serial number of a MIRO read only transponder.

7.4. R/W-Device



Get Version: Reads the version and programming date of the firmware and the serial number of the Core Module.

Fast Fourier:*) This command starts the Fast Fourier Transformation (FFT) of the Digital Signal Processor. This command is to be used as often as required depending on the noisefloor of the environment.

Set BCD:*) This command adjusts the timing of the read/write device to the antenna. The command has to be operated once, when an antenna is connected for the first time or changed.

Reset System: Resets the read/write device and switches off high frequency for 100 ms.

*) The commands **Fast Fourier** and **Set BCD** are only enabled when using HITAG Long Range Read/Write Devices.

8. Error Messages

Error messages and the message ***function OK*** are displayed in the status line.

- Function OK — System is working correctly.
- Serial error — Error on the serial interface.
- NOTAG — There is no transponder in the communication field of the antenna
  or a not initialized HT2 Public A or B is in the communication field of the antenna
  or a HT2 Crypto was accessed using the wrong key.
- TIMEOUT error — There is not enough energy to write to the transponder.
- AUTHENT error — An error occured during the authentication process.
- QUIT error — The acknowledgement was not received correctly.
- CRYPTO not initialized — A cryptographic command was transmitted without authentication.
- HT2 authentication error — No conformity between password RWD stored in the read/write device and password RWD stored on the transponder,
  or a HT2-Crypto Tag was accessed using the Password mode.
- incorrect password TAG — No conformity between password TAG stored in the read/write device and password TAG stored on the transponder.
- EEPROM error — Read/write device EEPROM check sum error.
- EEPROM wrong old data — On comparison old and new data (for keys and passwords) prove inconsistent.
- EEPROM write protected — Parts of the EEPROM on the read/write device were locked using the configuration menu and a write access to this part was tried.
- EEPROM read protected — Parts of the EEPROM on the read/write device were locked using the configuration menu and a read access to this part was tried.

9. Configuration of hitag™ Transponders

9.1. Security Mechanism

All the data necessary for the authentication of the transponder and the read/write device as well as data needed for encryption can be protected from being read and from being written on the read/write device using special commands.

This mechanism has 3 levels:

Level 0: All security relevant data can be read and written.

Level 1: The data cannot be read any more. If you want to change an entry, you have to know the old value. Otherwise writing access will be denied.

Level 2: The internal data are locked and can neither be read nor written. At this level it is impossible for the user to change the stored data.

The following data are subject to the mechanism described above:

- Key information A and B
- Logdata 0A, 0B
- Logdata 1A, 1B

} for HITAG 1 transponders

- Key information
- Password TAG
- Password RWD

} for HITAG 2 transponders

You cannot reset levels, e.g. from level 2 to level 1. Once a security level has been chosen it becomes irreversible.

If you want to write the key and passwords to or read them from the read/write device you have to enter the KeyInit Password.

If you do not know this password, you will not be able to enter the personalization and configuration submenus of the read/write device as you cannot read this password from the read/write device.

To change the KeyInit Password you have to know the current value.

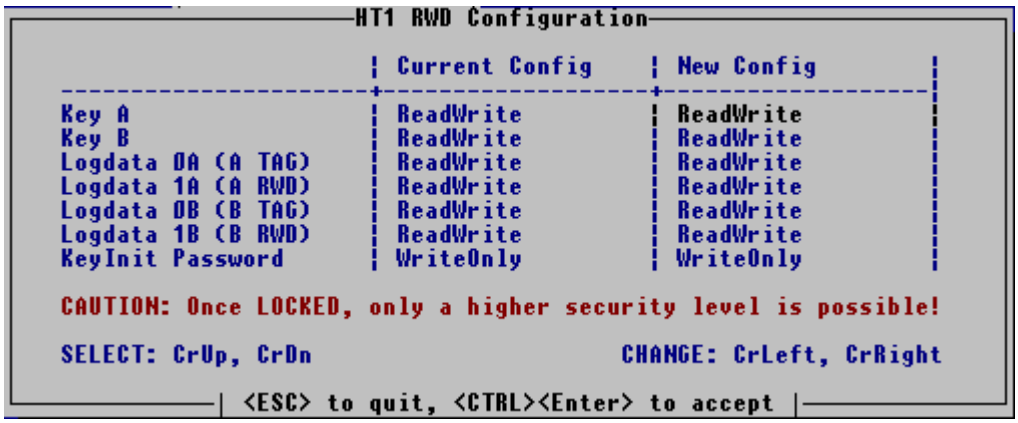
The default password is set to 0x00000000 by Philips.

After entering the correct KeyInit Password access to the personalization and configuration submenus of the read/write device is granted.

9.2. HITAG 1 Transponders

Using HITAG 1 transponders you are able to configure the following items:

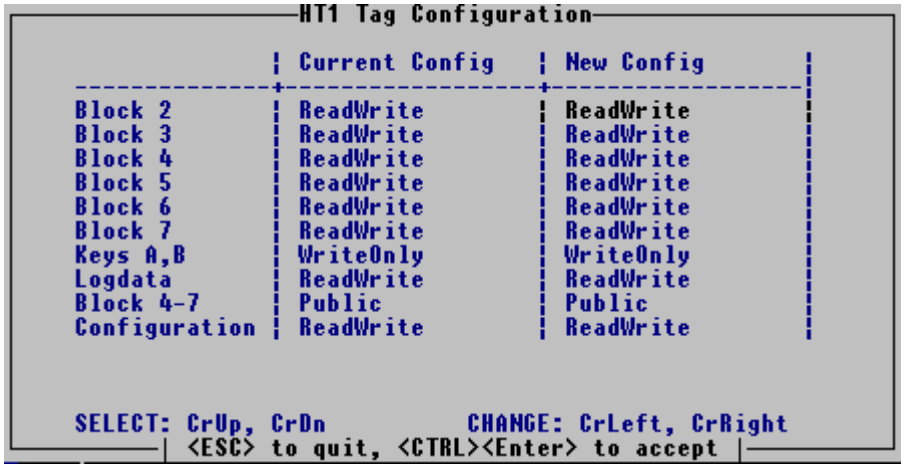
9.2.1. Read/Write Device



Key A:
Key B:
Logdata 0A (A TAG):
Logdata 1A (A RWD):
Logdata 0B (B TAG):
Logdata 1B (B RWD):
KeyInit Password:

Lets you choose among the 3 security levels, as described before. ReadWrite, WriteOnly and NoAccess (see chapter 9.1, resp. 10.1.1)

9.2.2. Transponder



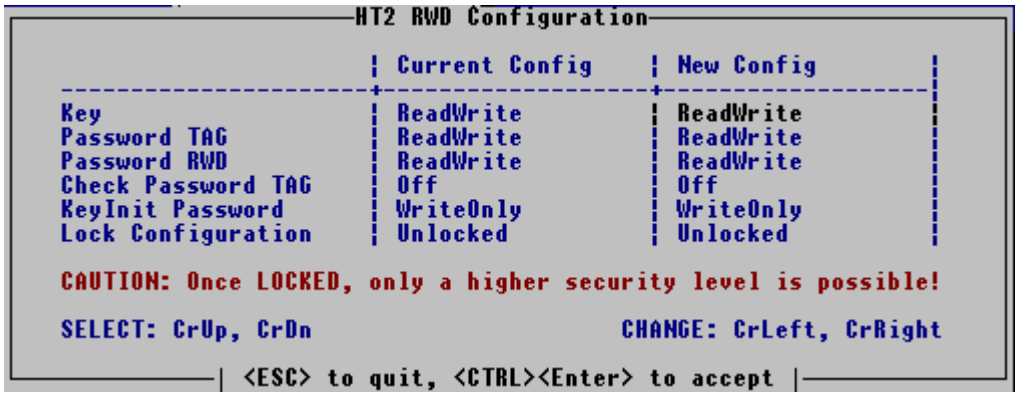
Block 2:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Block 3:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Block 4:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Block 5:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Block 6:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Block 7:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Keys A,B:	Can be set to WriteOnly or Locked.	(Default :	WriteOnly)
Logdata:	Can be set to ReadWrite or Locked.	(Default :	ReadWrite)
Block 4-7	Can be set to Public or Secret access.	(Default :	Public)
Configuration:	Locks the configuration of the transponder.	(Default :	ReadWrite)

If you set the state of *Configuration* to *Locked* you <u>cannot reset</u> this setting back to *ReadWrite*.

9.3. HITAG 2 Transponders

Using HITAG 2 transponders you are able to configure the following items:

9.3.1. Read/Write Device

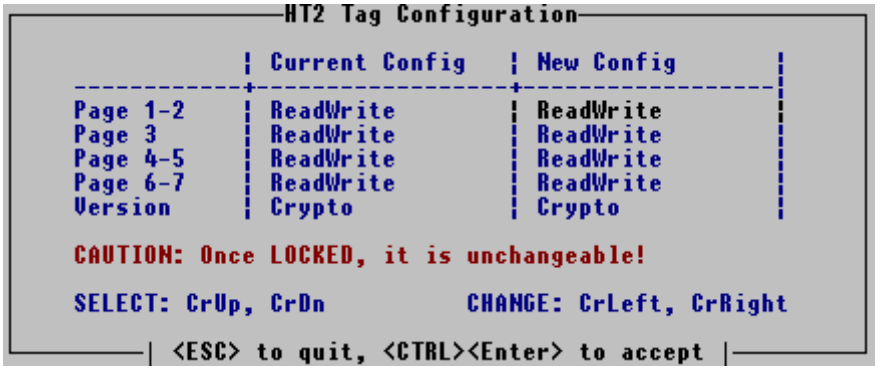


Key:
Password TAG:
Password RWD:
Lets you choose among the 3 security levels, as described before. ReadWrite, WriteOnly and NoAccess (see chapter 9.1 resp. 10.1.2)

Check Password TAG: Enables checking of the *Password TAG*.
KeyInit Password: Can be set to WriteOnly or Locked.
Configuration: Locks the configuration of the read/write device.

If you set the state of *CheckPasswordTag* to *ON* or *Configuration* to *LOCKED* you <u>cannot reset</u> these settings.

9.3.2. Transponder



Page 1-2:	Can be set to ReadWrite or NoAccess/Locked.	(Default :	ReadWrite)
Page 3:	Can be set to ReadWrite or ReadOnly/Locked.	(Default :	ReadWrite)
Page 4-5:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)
Page 6-7:	Can be set to ReadWrite or ReadOnly.	(Default :	ReadWrite)

Version: Changes between Password, Crypto, Public A and Public B mode. (Default: Password)

If you set the state of Pages 1-2 to *NoAccess/LOCKED* or the state of Page 3 to *ReadOnly/LOCKED* you cannot reset these settings back to *ReadWrite*.
Page 3 locks the complete configuration of the transponder. Once set to *ReadOnly/LOCKED* you cannot reset this setting back to *ReadWrite*.

10. Personalizing your Read/Write Device and the Transponders

Note: It is NOT NECESSARY to personalize the read/write device and the transponders in order to operate the Evaluation Kit! A pre - personalization was done by Philips.

In order to profit from the full functionality of the HITAG system, the Evaluation Kit, however, supports all cryptographic features.

This requires the use of some secret data (keys, logdata and passwords). The process of **loading these data** into the **read/write device** is called **personalization**. The same personalization procedure has to be carried out on your transponders. The read/write device and the transponders are personalized by Philips by means of defined **Transport Keys, Transport Logdata** and **Transport Passwords** (HITAG 1 Keys and Logdata are set to 0x00000000, HITAG 2 Key is set to 0x4D494B524F4E, HITAG 2 Password TAG to 0xAA4854 and HITAG 2 Password RWD to 0x4D494B52).
Therefore you can operate the Evaluation Kit without changing any data. If you want to use own keys, logdata or passwords you have to personalize read/write device and transponders as it is described in the following chapters.

Make sure you are in a safe environment while writing secret data to the transponder or the read/write device. This prevents possible listening in to the communication between HOST and read/write device.

On the next few pages you find a description of how to personalize your read/write device. In Chapter 10.3. the loading of own keys, logdata and passwords into the read/write device and the transponder is described in exact order.

10.1. General Definitions

In order to be able to read data from the secret area of a transponder, you have to carry out a procedure called authentication. To do this you need special data (keys).
After transmitting the according command the authentication is automatically carried out by the HITAG Read/Write Device.

10.1.1. HITAG 1 Transponders

10.1.1.1. Definition of the Keys

Keys are cryptographic codes, which determine data encryption during data transfer between read/write device and transponder.
Two keys (Key A and Key B) which you can use independently of each other, have been installed for security and flexibility reasons. The identity of either Key A or Key B on the read/write device and on the transponder is sufficient (see table under 10.1.1.2.).

The keys are predefined by Philips by means of defined Transport Keys (both keys show the same bit map). They can be written only.

10.1.1.2. Definition of the Logdata

Logdata represent "passwords" needed to gain access to secret areas on the transponder. A pair of logdata is included with every cryptographic key (Key A and Key B). This logdata pair has to be identical both on the transponder and the read/write device.

ad Key A:	Logdata 0 A	"Password" which the transponder sends to the read/write device and which is verified by the latter.
	Logdata 1 A	"Password" which the read/write device sends to the transponder and which is checked for identity by the latter.
ad Key B:	Logdata 0 B and Logdata 1 B	analogous to Key A

The logdata are also predefined by Philips using defined Transport Logdata (all logdata show the same bit map). They can be read and written. Logdata 0A and 1A, as well as Logdata 0B and 1B do not have to show the same values, but all Logdata have to be identical on the read/write device and on the transponder!

So it is important that the following values are in accordance with each other, i.e. the respective data on the read/write device and on the transponder have to be identical pairs:

on the read/write device		**on the trans-ponder**	
KEY A	⇔	KEY A	⎫
LOGDATA 0A	⇔	LOGDATA 0A	⎬ Set A
LOGDATA 1A	⇔	LOGDATA 1A	⎭
KEY B	⇔	KEY B	⎫
LOGDATA 0B	⇔	LOGDATA 0B	⎬ Set B
LOGDATA 1B	⇔	LOGDATA 1B	⎭

Attention: Keys and Logdata only can be changed if the Transport Keys and the Transport Logdata are known!

10.1.2. HITAG 2 Transponders

10.1.2.1. Definition of the Keys

Keys are cryptographic codes, which determine data encryption during data transfer between read/write device and transponder.

The key is predefined by Philips by means of a defined transport key.

10.1.2.2. Definition of the Passwords

Passwords are needed to gain access to the transponder. A pair of passwords is stored in every transponder. This password pair has to be identical both on the transponder and the read/write device.

Password TAG: Password that the transponder sends to the read/write device and which may be verified by the latter (depending of the configuration of the read/write device).

Password RWD: Password that the read/write device sends to the transponder and which is checked for identity by the latter.

The passwords are also predefined by Philips using defined transport passwords. They can be read and written. *Password TAG* and *Password RWD* do not have to show the same values, but all passwords have to be identical on the read/write device and on the transponder!

The passwords are predefined by Philips by means of defined transport passwords.

So it is important that the following values are in accordance with each other, i.e. the respective data on the read/write device and on the transponder have to be identical pairs:

on the read/write device		**on the transponder**
KEY	⇔	KEY
Password TAG	⇔	Password TAG
Password RWD	⇔	Password RWD

10.2. Personalization Concept

To enable utmost security and flexibility Philips worked out a personalization concept that shall be shortly described in the following:

The first stage is a test that is done by the producer respectively Philips. Here the unique serial number is fixed and transport keys and transport passwords are pre-programmed.
In the next stage the customers program their own keys and passwords (so nobody besides them can access the transponders) and configure the memory of the transponders. We recommend to lock sensitive areas, that means for example to prevent the possibility to change keys and passwords for the user.
In the last stage the user just reads from and writes to the memory of the transponders.

10.3. Changing Keys and Passwords

You can change keys and passwords using the menu options in the **personalization** submenu for the read/write device and for the transponders. You have to be careful when carrying out such a change.
Entering the personalization submenu for the read/write device requires a password you have to enter only once when running the demosoftware. The default password is set to **0x00000000** by Philips.

You do <u>not</u> have to change this data in order to operate the Demonstration Kit!

<u>If you want to change keys and passwords, please, strictly follow the steps below:</u>

- ***Set Transponder Access to Single access! (See chapter 3.1)***
- ***Place transponders one after the other directly on the antenna or hold them directly to it! (0-distance)***

10.3.1. HITAG 1 Transponders

10.3.1.1. Changing Keys

Please, note the order of the steps!

1. Access the transponder (using the Transport Keys).
2. Change a key (e.g.: Key A) on the transponder, i.e., using transponder personalization submenu, see chapter 4.3.
3. Change Key A on the read/write device to the new value (using the Personalization submenu, see Chapter 4.4).

Caution: On the transponder the key can only be written, which means that you cannot call up the entry! Moreover, you need to know the old value if you want to change the key on the read/write device! (If you enter wrong values the message *Wrong old data* is displayed.)

Only after carrying out correctly steps 1 through to 3 may the second key be changed following the steps described above. Conveniently you change both keys to the same value!

10.3.1.2. Incorrect Procedures Changing Keys

- You change both keys on the read/write device and then try to access the transponder. This is not possible (the status line displays the message *Authentication error*) because there is no identity between any of the keys on the transponder and the read/write device.
- You change only one key (e.g.: Key A) on the read/write device; the second key (in this example B) remains the Transport Key. Then you try again to access the transponder. In this case you will gain access because one key (here it is Key B) on the transponder and the read/write device is still identical. Therefore, the status line briefly displays the message *Authentication error* (after the first failed attempt to gain access using the changed key) then the message *Function OK* appears.

The same scenario applies if you first change one or both of the keys on the transponder but leave the keys on the read/write device unchanged (transport keys).

10.3.1.3. Changing Logdata

Change logdata using the same procedure as described for changing keys. Be careful to change them by pairs (on the read/write device and on the transponder):

1. Change, for example, Logdata 0A on the transponder (by overwriting Page 5).
2. Change Logdata 0A on the read/write device to the new value.
3. Change Logdata 1A on the transponder (by overwriting Page 6).
4. Change Logdata 1A on the read/write device to the new value.

Again, you need to know the old values before they can be changed on the read/write device. Therefore, we recommend that you use a table to record changed keys and logdata during the first phase of getting to know the system!

When you change a key, this does not mean that you also have to change the corresponding logdata and the other way round.

10.3.2. HITAG 2 Transponders

10.3.2.1. Changing the Key

Please, note the order of the steps!

1. Access the transponder in crypto mode (using the Transport Key).
2. Change the key on the transponder, using the transponder personalization submenu (see chapter 5.2.1). You do not need to change the password.
3. Change the key on the read/write device to the new value (using the RW-Device personalization submenu, see chapter 5.2.2).

Only after carrying out correctly steps 1 through to 3 the transponders are accessible with the new key.

10.3.2.2. Incorrect Procedures Changing the Key

- You change the key on the read/write device and then try to access the transponder. This is not possible (the status line displays the message *NOTAG*) because there is no identity between the keys on the transponder and the read/write device.

The same scenario applies if you first change the key on the transponder but leave the key on the read/write device unchanged (transport key).

10.3.2.3. Changing Passwords

Change passwords using the same procedure as described for changing the key. Be careful to change them by pairs (on the read/write device and on the transponder).

1. Access the transponders in password mode.
2. Change one Password (e.g.: *Password TAG*) on the transponders using the transponder personalization submenu (see chapter 5.3.1).
3. Change *Password TAG* on the read/write device to the new value (using the RW-Device personalization submenu, see chapter 5.3.2).

Only after carrying out correctly steps 1 through to 3 (executing a read-access test the message **Function OK** has to be displayed in the status line) may the second password be changed following the same steps described above.

When you change e.g. *Password TAG*, this does not mean that you also have to change *Password RWD* and the other way round.

10.3.2.4. Incorrect Procedures Changing Passwords

- You change the *Password RWD* on the read/write device and then try to access the transponder. This is not possible (the status line displays the message *incorrect Password RWD*) because there is no identity between the *Password RWD* on the transponder and on the read/write device.
- You change the *Password TAG* on the read/write device and then try to access the transponder. This is not possible (the status line displays the message *incorrect Password TAG*) because there is no identity between the *Password TAG* on the transponder and on the read/write device. This only applies, if you enabled checking of the *Password TAG* (see chapter 9.3.1) in the read/write device.

The same scenario applies if you change the passwords on the transponders but leave the passwords on the read/write device unchanged (transport passwords).

11. Ordering Information

Type Name	Description	Ordering Number
HT EV400	HITAG Proximity Evaluation Kit	9352 341 40122

Philips Semiconductors - a worldwide company

Argentina: see South America
Australia: 34 Waterloo Road, NORTHRYDE, NSW 2113,
Tel. +612 9805 4455, Fax. +612 9805 4466
Austria: Computerstraße 6, A-1101 WIEN, P.O.Box 213,
Tel. +431 60 101, Fax. +431 30 101 1210
Belarus: Hotel Minsk Business Centre, Bld. 3, r.1211, Volodarski Str. 6,
220050 MINSK, Tel. +375172 200 733, Fax. +375172 200 773
Belgium: see The Netherlands
Brazil: see South America
Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA
Tel. +3592 689 211, Fax. +3592 689 102
Canada: Philips Semiconductors/Components,
Tel. +1800 234 7381
China/Hong Kong: 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +85223 19 7888, Fax. +85223 19 7700
Colombia: see South America
Czech Republic: see Austria
Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,
Tel. +4532 88 2636, Fax. +4531 57 1949
Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +3589 61 5800, Fax. +3589 61 580/xxx
France: 4 Rue du Port-aux-Vins, BP 317, 92156 SURESNES Cedex,
Tel. +331 40 99 6161, Fax. +331 40 99 6427
Germany: Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +4940 23 53 60, Fax. +4940 23 536 300
Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,
Tel. +301 4894 339/239, Fax. +301 4814 240
Hungary: see Austria
India: Philips INDIA Ltd., Shivsagar Estate, A Block, Dr. Annie Besant Rd.
Worli, MUMBAI 400018, Tel. +9122 4938 541, Fax. +9122 4938 722
Indonesia: see Singapore
Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. +3531 7640 000, Fax. +3531 7640 200
Israel: RAPAC Electronics, 7 Kehilat Saloniki St., TEL AVIV 61180,
Tel. +9723 645 0444, Fax. +9723 649 1007
Italy: Philips Semiconductors, Piazza IV Novembre 3,
20124 MILANO, Tel. +392 6752 2531, Fax. +392 6752 2557
Japan: Philips Bldg. 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,
Tel. +813 3740 5130,Fax. +813 3740 5077
Korea: Philips House, 260-199, Itaewon-dong, Yonsan-ku, SEOUL,
Tel. +822 709 1412, Fax. +822 709 1415
Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, Selangor,
Tel. +60 3750 5214, Fax. +603 757 4880
Mexico: 5900 Gateway East, Suite 200, EL PASO, Texas 79905,
Tel. +9 5800 234 7381
Middle East: see Italy
Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +3140 27 82785, Fax +3140 27 88399
New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +649 849 4160, Fax. +649 849 7811
Norway: Box 1, Manglerud 0612, OSLO,
Tel. +4722 74 8000, Fax. +4722 74 8341
Philippines: Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O.Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +632 816 6380, Fax. +632 817 3474
Poland: Ul. Lukiska 10, PL 04-123 WARSZWA,
Tel. +4822 612 2831, Fax. +4822 612 2327
Portugal: see Spain
Romania: see Italy
Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7095 247 9145, Fax. +7095 247 9144
Singapore: Lorong 1, Toa Payoh, SINGAPORE 1231,
Tel. +65350 2538, Fax. +65251 6500
Slovakia: see Austria
Slovenia: see Italy
South Africa: S.A. Philips Pty Ltd., 195-215 Main Road Martindale,
2092 JOHANNESBURG, P.O.Box 7430 Johannesburg 2000,
Tel. +2711 470 5911, Fax. +2711 470 5494
South America: Rua do Rocio 220, 5th floor, Suite 51,
04552-903 Sao Paulo, SAO PAULO - SP, Brazil,
Tel. +5511 821 2333, Fax. +5511 829 1849
Spain: Balmes 22, 08007 BARCELONA,
Tel. +343 301 6312, Fax. +343 301 4107
Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +468 632 2000, Fax. +468 632 2745
Switzerland: Allmendstraße 140, CH-8027 ZÜRICH,
Tel. +411 488 2686, Fax. +411 481 7730
Taiwan: Philips Taiwan Ltd., 2330F, 66,
Chung Hsiao West Road, Sec. 1, P.O.Box 22978,
TAIPEI 100, Tel. +8862 382 4443, Fax. +8862 382 4444
Thailand: Philips Electronics (Thailand) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +662 745 4090, Fax. +662 398 0793
Turkey: Talapasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. +90212 279 2770, Fax. +90212 282 6707
Ukraine: Philips Ukraine, 4 Patrice Lumumba Str., Building B, Floor 7,
252042 KIEV, Tel. +38044 264 2776, Fax. +38044 268 0461
United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UM3 5BX, Tel. +44181 730 5000, Fax. +44181 754 8421
United States: 811 Argues Avenue, SUNNYVALE, CA94088-3409,
Tel. +1800 234 7381
Uruguay: see South America
Vietnam: see Singapore
Yugoslavia: Philips, Trg N. Pasica 5/v, 11000 BEOGRAD,
Tel. +38111 625 344, Fax. +38111 635 777

Published by:
Philips Semiconductors Gratkorn GmbH, Mikron-Weg 1, A-8101 Gratkorn, Austria
Fax: +43 3124 299 - 270

For all other countries apply to: Philips Semiconductors, Marketing & Sales Communications,
Building BE-p, P.O.Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax: +3140 27 24825

Internet: http://www.semiconductors.philips.com

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