Long-range UHF RFID Demo Kit for IDIC TAGIDU ATA5590

User Manual

Table of Contents

Section 1

Reader Demo Kit Description

This UHF reader demo kit supports wireless data transmission of Atmel's passive RFID IDIC® ATA5590, operating in the ISM frequency bands. Typical applications for this passive transponder device are supply chain, asset control, toll collection, or pallet tracking.

The kit contains a UDL500 long-range UHF reader from deister electronic GmbH, an interface converter, a power supply, and all other necessary components such as cables, a label set with different antennas (30 antennas in all) and the software required to build up a working UHF reader system. The reader system is available for the European ISM frequency band (ETSI compliant) and for the North American ISM frequency band (FCC compliant).

Order code for the European ISM-band-compatible reader (ETSI): ATAK559001-8

Order code for the American ISM-band-compatible reader (FCC): ATAK559001-9

Figure 1-1. Reader Demo Kit

Demo Kit Content:

- 1 UHF reader with 2 integrated antennas
- Label and tag set with TAGIDU™ ATA5590 (~30 parts)
- 1 SNG3 (interface converter: USB to RS485)
- 1 power supply 12V DC/240V AC (FCC version: 12V DC/110-240V AC)
- 1 USB cable
- 1 CD-ROM, *Demo Software*
- 1 Floppy disk containing drivers

Section 2

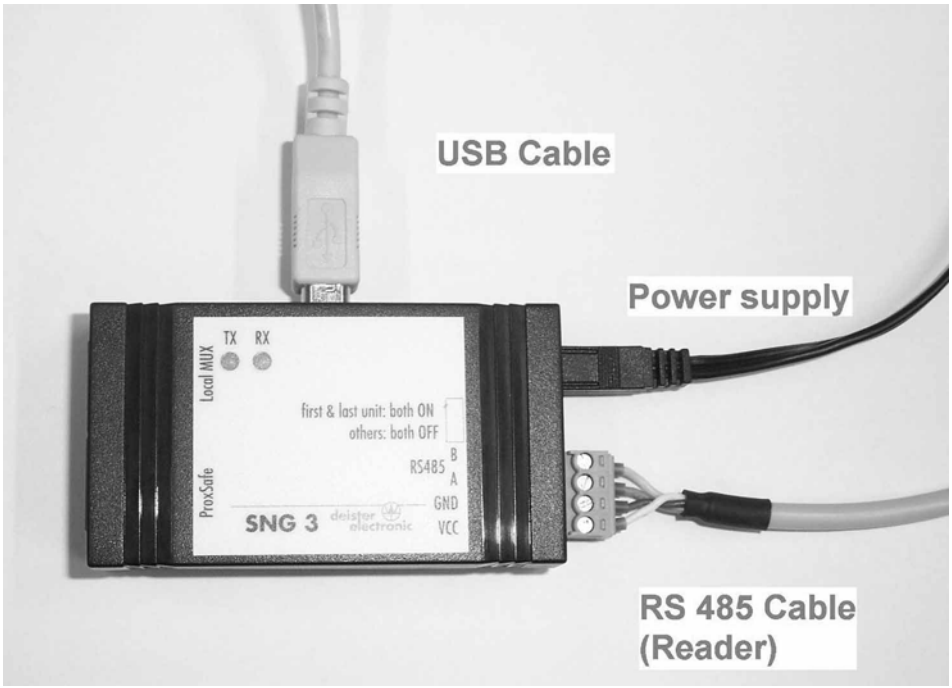
Getting Started

2.1 Built-up Hardware

Figure 2-1 shows the correct assembly of the SNG3 USB converter.

The TX LED indicates that the PC is sending command frames to the reader, and the RX LED shows that the reader is answering or sending the status back to the PC.

Figure 2-1. Built-up Hardware (SNG3 USB Converter)



2.2 Driver Installation

Before getting started, two hardware drivers, the *USB-RS485 Converter* and the *USB Serial Port*, have to be installed. The following steps describe the installation.

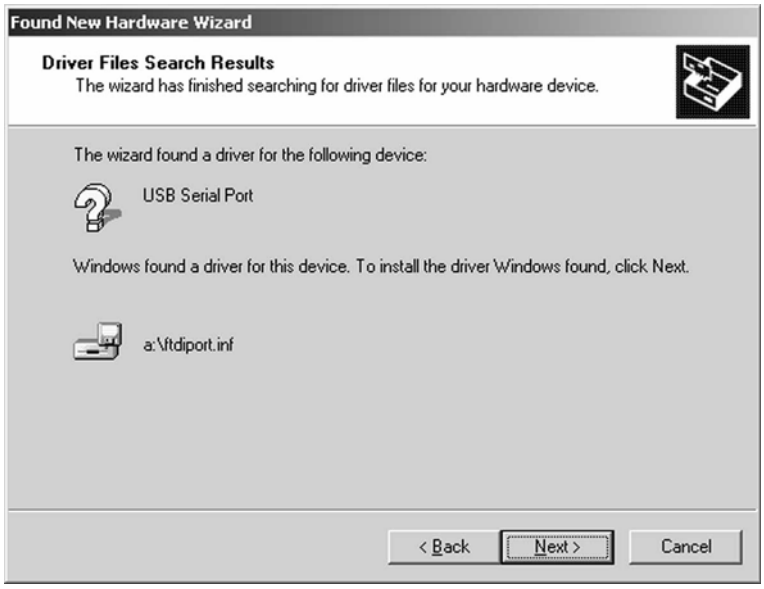
1. Plug the USB cable into the PC.
2. Normally, the USB-RS485 converter is automatically detected by the system. If this doesn't happen, the search for hardware can be started manually by clicking: *Start* -> *Settings* -> *Control Panel* -> *System* -> *Hardware* -> *Device Manager*. Select *USB Serial Port* (which is marked by a yellow question mark, indicating that the hardware is not correctly installed).
3. A message window will pop up indicating the beginning of the installation of the driver for the USB-RS485 converter. To continue the installation, click *Next*.
4. To have the installer search for a suitable hardware driver, choose *Search for a suitable driver for my device (recommended)*.
5. Insert the floppy disk into the floppy drive and in the *Optional search locations* menu select the item *Floppy disk drives*.
   The system will now search for the driver in the root directory of the floppy. The first installation will be the *USB-RS485 Converter*, see Figure 2-2.

Figure 2-2. Driver File Search Result for the USB-RS485 Converter

When the installation is finished, a message will appear stating that the installation of the USB serial converter was successful.

6. A second driver is needed for successful communication between the reader and PC, the *USB Serial Port* (see Figure 2-3).
   The procedure for the USB serial port installation is the same as for the USB-RS485 converter.

Figure 2-3. Driver Search Result for the USB Serial Port Installation



When the installation is finished, a message will appear stating that the installation of the USB serial port was successful.

7. After installing the drivers, the PC has to be rebooted.

2.3 Starting the Demo Software for the First Time

The first time the demo software is started, settings such as port selection, baud rate, reader address, etc. have to be set.

Port selection:

Select the port being used to communicate with the reader in the *Port* menu. If the port is unknown, choose *Special functions* -> *Search for serial ports* to scan all active COM ports on the host computer. Another possibility is to use the information provided by the OS, by selecting *Start* -> *Settings* -> *Control Panel* -> *System* -> *Hardware* -> *Interface* to determine which USB COM port the SNG3 adapter is attached to.

The first indication of proper communication between the reader and the host is a message from the reader. This can be observed in the *Monitor* window. Messages displayed in green are from the host to the reader, and red messages are from the reader to the host.

Baud rate:

The baud rate can be changed by browsing *View* -> *deBus Polling* and selecting *scan settings*. The *baud rate* setting can be changed as required by the reader device.

Note: If communication between the reader and host fails even though the correct COM port has been selected, it could be that the reader and the host have different baud rate settings, preventing communication. It is possible to run a scan to discover the baud rate being used by the reader device by selecting *View* -> *deBus Polling* -> *scan settings* -> *baudrate* -> *all* (no specific baud rate is selected), and clicking the button *detect reader(s)*. If the host finds a baud rate where communication with the reader device is possible, the result of the scan is displayed under *detected readers*.

Now there are two options:

1. Confirm that this reader and the settings detected (especially the baud rate) should be used by clicking the button *set as current reader*.

2. Change the baud rate of the reader device by clicking the button *configure*.

These are the primary settings for communication between the reader device and the host PC. If, during or after power on, communication is not or is no longer possible, check these settings in the demo software and follow the steps above.

2.4 The First Communication Between the Tag and the Reader

This section outlines the capabilities of the system, and how to establish communication between the tag and host via the reader device.

Browsing to the menu *Reader* -> *Configuration* opens a new window, *reader configuration*. In this new window it is possible to set the main settings for the RF link, such as tag protocol selection, RF power, read/write mode, arbitration mode, trigger mode, etc.

Here is an example to get you started:

Arbitration on the UID of the ATA5590 (see Section 7).

1. ***Tags* (Protocol Selection)** Select the menu item *Reader* -> *Configuration*, then under the option *tags* choose the protocol *TAGIDU/ATA5590 with UID*

2. ***Trigger Mode*** Select *no trigger mode* (default setting)

3. ***Output Control*** Select *none* (default setting)

4. ***Buzzer*** Select either *off* (default setting) or the *read* setting, which causes the buzzer to sound when reading is successful

5. ***Tag Options*** Set *Tag timeout* to *10 ms*
(for this example it doesn't matter)

6. ***Temperature Sensor*** Select *80°C* (default setting)

7. ***RF Settings*** The RF power is adjustable in 10 steps (from 4W EIRP to 0.10W ERP) (for this example it doesn't matter, any RF setting can be selected)

8. ***Options*** Select options *arbitration* and *report mode*

9. ***Set Configuration*** Confirm this configuration by clicking the button *Set configuration*

10. ***RF ON*** The RF power of the reader device can be controlled via the menu *RF Interface*. The option *RF ON* switches on the RF power of the reader, making it possible to communicate with the tag. Verification that the tag is reading, writing or arbitrating can also be observed on the reader itself; the yellow and green LEDs will light if there is communication, see Section 3.

The result of the arbitration or read is displayed in the *Transponder data* window, here is an example:

ID	*Protocol*	*Read counter*
98FF00A70BF1	**[TAGIDU/ATA5590 with UID]**	**(2)**
UID from the tag	ATA5590 with arbitration on the UID	Indication of how often the tag has been read

Section 3

Hardware Description

The reader has three LEDs and one alarm that can be used to show if the reader is ready to receive and if a tag has been read.

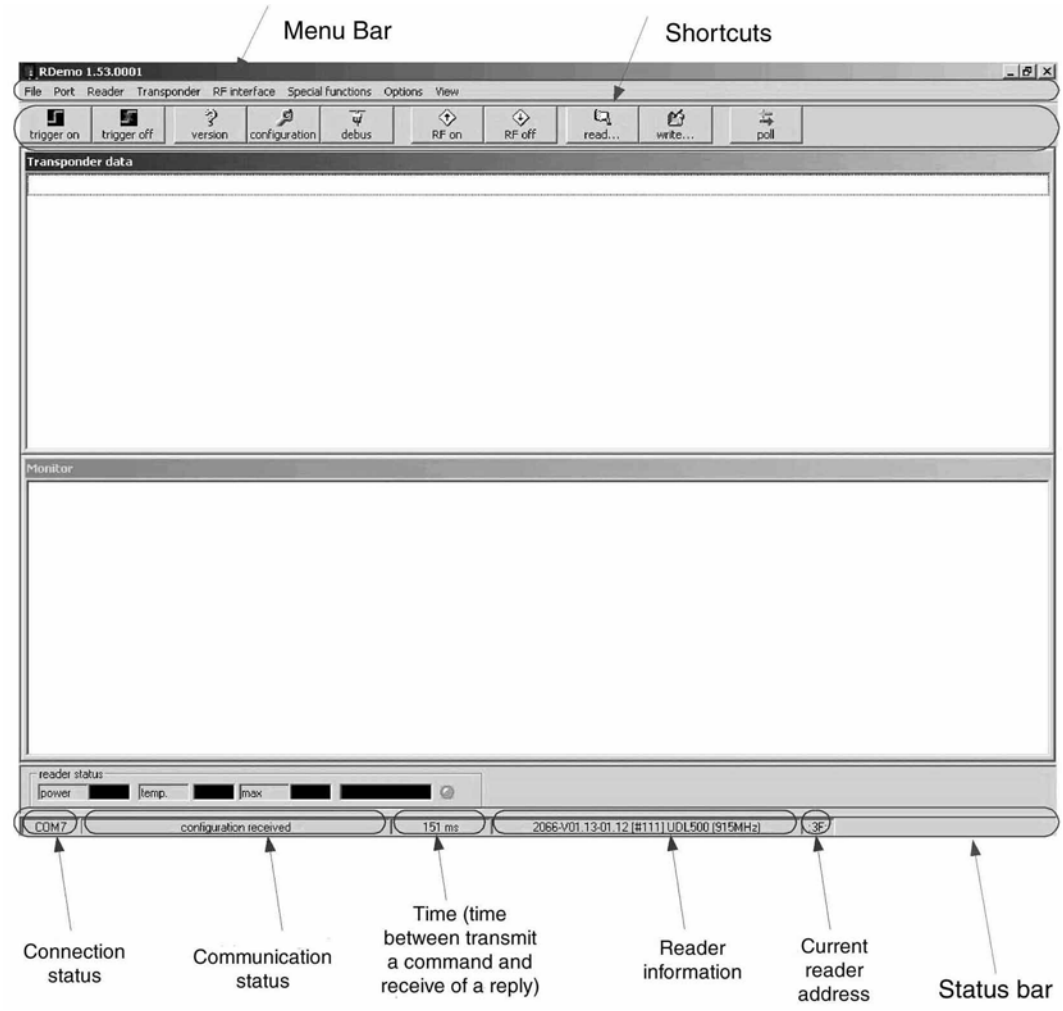
LEDs	Reader Status
Yellow: on Red and green: off	Reader is active, no read or write currently occuring, RF on
Yellow and red: on Green: off	Reader is active but RF is off; therefore, no communication is possible between the tag and reader
Yellow and green: on Red: off	Reader is active and RF is on; there is ongoing communication between the tag and reader (read, write or arbitration)
Green and red: on Yellow: off	Reader reset or powered up, RF off; system not ready for communication
Red: blinking and alarm sounding Green and yellow: off	Malfunction

Section 4

Software Description

Figure 4-1 shows the standard window after successful installation of the reader demo software. The window consists of a menu, a shortcut list, a status bar, and a work space.

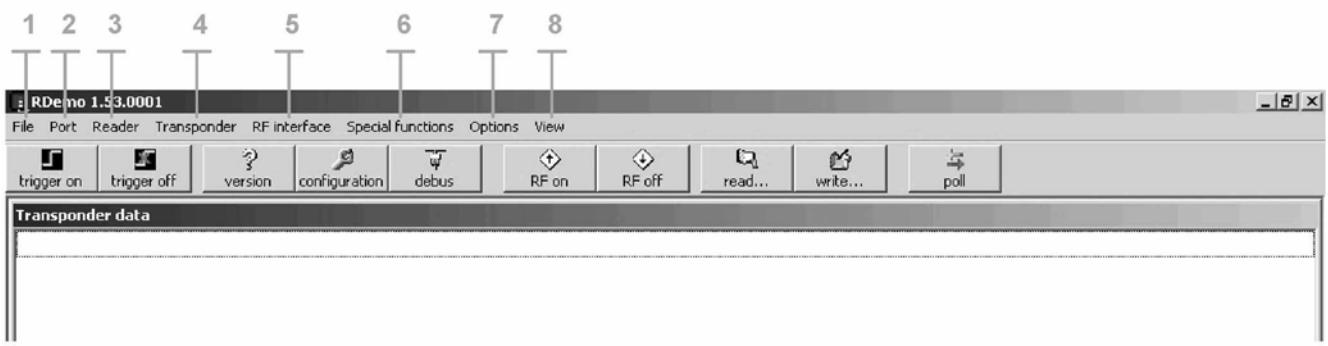
Figure 4-1. Graphical User Interface (GUI) of the Demo Software



4.1 Menu Options

This section gives an introduction to the demo software, the menu bar, and the submenus.

Figure 4-2. Menu Bar



1. ***File***

Exit	Exit the demo software

2. ***Port***

COM X	Select the port to be used for communication; all available and installed ports are displayed
TCP/UDP	----
Disconnect	Connects or disconnects the communication link between the PC and reader
deBus	Standard settings for the deister reader
use BCC	When activated, a block check character (BCC) is transmitted for data validation; these settings are ignored if deBus is selected
show ASCII	When activated, the transponder's data is displayed in ASCII format

3. Reader

Soft trigger ON	Active a software trigger on command
Soft trigger OFF	Deactivates the trigger if the reader is in trigger mode and the software trigger is activated
Version request	Get the current reader firmware version information
Configuration	Menu options for the operation settings of the reader (see also Section 5.1)
Diagnostics	Activates the diagnosis function and displays all relevant reader data: – Temperature at the power amplifier – The current configuration for the power setting – Current configuration for the modulation depth – The minimum, the average, and the maximum noise level measured by the reader

Output ON	Activates the switching output from the reader
Output OFF	Deactivates the switching output from the reader
Poll command	Queries new messages from the reader devices in bus mode
Mode	– Polling mode: The reader has to ask the host to transmit data – Report mode: The reader works independently, meaning the reader does not have to ask the host to transmit data to the tags
Send reset	This command restarts the reader, equivalent to a power-on reset

4. ***Transponder***

Read	Setting of the read address and length of the data to be read out
Write	Setting of the write address and the storage information, see Section 6
Inventory	This command queries the serial numbers of all transponders within antenna range and reports those numbers
Lock block	This command is used to change the lock status of a transponder
Write AFI	The application family identifier (AFI) content can be written or modified (disabled for the ATA5590)
EPC read	Disabled for the ATA5590
EPC write	Disabled for the ATA5590
Tag functions	Disabled for the ATA5590

5. ***RF Interface***

RF ON	RF power on
RF OFF	RF power off
RF reset	The RF field will be switched off for 100 ms

6. ***Special Function***

Special functions	Provides a command line to send commands to the reader device in the protocol frame

Note: On the command line, the commands must be entered as hex values. The deBus protocol automatically adds the initial sequence “FFFF” and the end sequence “FE” to the data entered, and sends the command to the reader device.

clear list of transponders' serial numbers	Clears all detected serial numbers in the demo software
Search for serial ports	Scans all available serial ports on the host, and displays the result in a list when finished

7. ***Options***

Block Data Representation	*Display hex* – Data representation in hex format *Display ASCII* – Data representation in ASCII format
EPC Representation	*Display decimal numbers* – Display the transponder data in decimal format

8. **View Setting**

Toolbar	Frequently used functions can be provide by icons in the tool bar. To customize the application, you can add shortcuts to the toolbar. Also, a *Monitor* work space can be add to the default work spaces
Large Icons	Large or normal icon representation
Toolbar Align	*Top*
	Bottom
	Left
	Right
Buttons	*Inventory*
	RF ON
	RF OFF
	RF reset
	Security
	Read
	Write
	Diagnostics
	Noise monitor
	deBus
	Poll command
	Read EPC
	Write EPC
Show buttons captions	Button captions on/off
Clear all windows	Clears the information in the following windows: *Transponder data reader status* and *Monitor*
Arrange windows	All displayed monitors are uniformly aligned in the work space
Show monitor	The protocol transferred between PC and the reader can also be observed by activating the *Monitor* window. Clicking this makes the *Monitor* window appear

deBus polling	Configuration menu for the deBus polling mode
Show routing panel	Displays the *routing panel* in the menu bar
Show reader diagnostic window	Displays the *reader diagnostic window* in the work space
Noise Monitor	Displays the RMS value of the receiver sensitivity for information about the noise affecting the RX input
FFT window	Displays an FFT window, to show the spectrum of the ISM band

Section 5

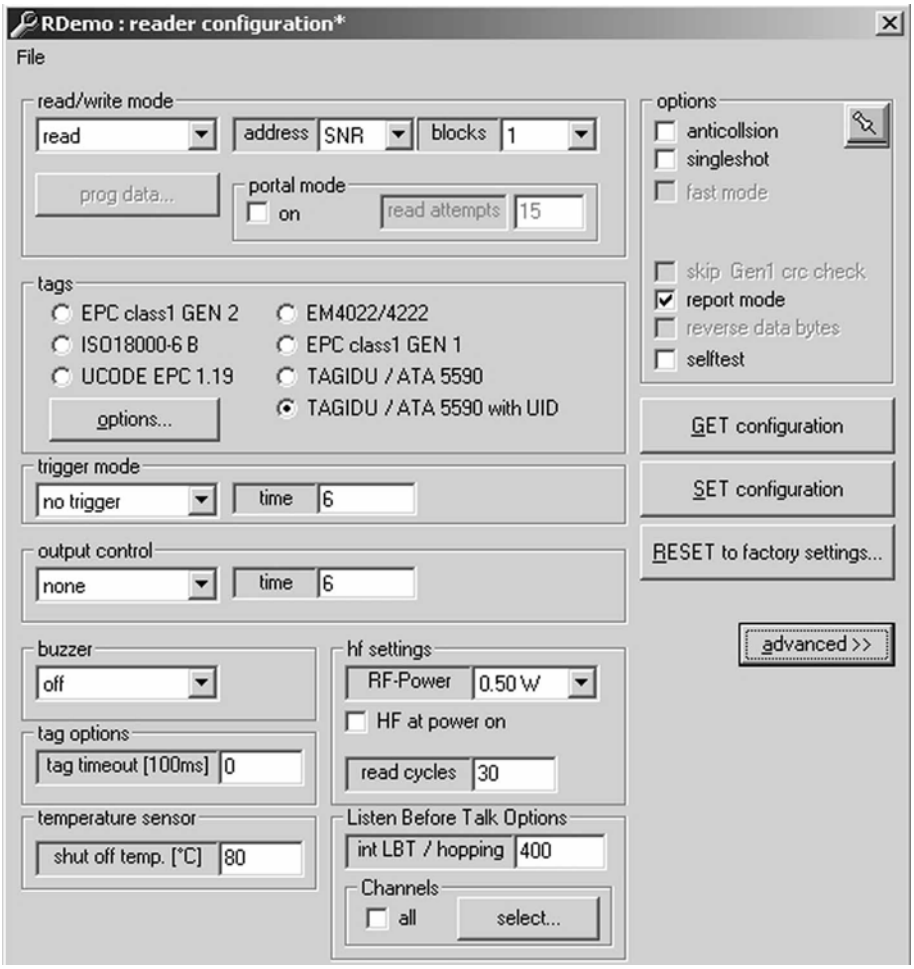
Operation

This section provides general information regarding the operation of the UDL500 long-range reader.

5.1 Reader Configuration

To configure the reader's main settings, select the configuration window (*Reader -> configuration*), see Figure 5-1.

Figure 5-1. Reader Configuration Menu



5.1.1 Read/Write Mode

Select between *read* or *write* mode, see Section 8-3.

5.1.2 Tags

Select the protocol from the list (the TAGIDU protocol is the default selection).

5.1.3 Trigger Mode

If trigger mode is activated, the reader only becomes active after being triggered by a hardware or software trigger. When the reader is not active, the UHF carrier is switched off and the reader waits for the next trigger. After becoming active, the reader first carries out LBT or frequency hopping before starting to read.

Note: A software trigger can only be reset by software or, in EN300220 mode, by the defined active time.

Four different hardware trigger events are possible:

- read while high level applied
- read for a defined period of time after rising edge
- read for a defined period of time after falling edge
- anticollision trigger (same as *inventory*, see the protocol specification)

If the reader is operated as a stand-alone reader, select *no trigger*.

5.1.4 Output Control

If output mode is activated, the reader sets or resets its digital output in four different ways:

- set output low after tag read
- set output low after no read
- set output high after tag read
- set output low after no read

Output mode is only available when trigger mode is activated.

The length of time the output is set to high or low level can be modified. The value is a multiple of 6.5 ms and has a tolerance of 6.5 ms.

If the reader is operated as a stand-alone reader, select *none*.

5.1.5 Buzzer

Disabled, or *only by reading a tag.*

5.1.6 Tag Options

Tag timeout defines the number of anticollision commands before a reset is sent. If this value is “0” the reader will never send a reset command to the tags.

5.1.7 Temperature Sensor

The threshold level for temperature can be adjusted. The temperature has a precision of 0.25°C per step.

5.1.8 HF Settings

RF-Power: 10 different steps to adjust the output power of the reader, see Table 5-1.

Read cycles: Defines how many anticollision commands are sent before the next select command is sent.

5.1.9 Listen Before Talk Options

Int LBT / hopping: The time interval between the LBT measurements can be configured in steps of 1 ms. The inactive time is always at least 100 ms.

Channels: see Table 5-1.

5.1.10 Options

Under *option*, the arbitration options can be set.

- *anticollision*: Activate the anticollision function.

Note: *SNR* (page0 in the control memory) in the address selection bar indicates the serial number of the transponder.

- *singleshot*: If single shot mode is selected and a transponder stays in the read range for a longer time, the serial number of this transponder will be transmitted again after the time specified in tag time-out. The value is a multiple of 100 ms. If tag time-out is set to 0, the serial number will not be transmitted again.

Note: Single shot mode is not available in anticollision or portal mode!

- *fast mode*: ETSI compliant reader, fast mode shall be disabled for FCC compliant reader it is vice verse, see Table 5-2.
- *report mode*: by activation of the report mode the reader device send self-dependent telegram to the host system. If this option is deactivated, the reader is in the “OnLine mode” and answers on each request from the host system (bus operation mode).
- *selftest*: To test the reader for proper operation there is an integrated self test. This self test is done every time the reader is reset. During the self test the reader checks the functionality of its components. If there is a problem the reader’s red LED will start start blinking, and the alarm will sound.

Note: Not every component can be checked by the self test.

5.1.11 Get Configuration Get the current status of the reader.

5.1.12 Set Configuration Confirm the setting configuration of the reader.

5.1.13 Reset to Factory Settings Reset all reader settings to the factory settings.

Table 5-1. HF Setting and Channel Selection

RF Power	Output Power	Listen Before Talk Options – Channel Selection Versus European Radio Regulations	Frequency Hopping – North American Radio Regulation (FCC part 15)
	4W EIRP (US)	Channel 0 to 9	FCC part 15 with 50 available channels
	2W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	1.75W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	1.5W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	1.25W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	1W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	0.75W ERP	Channel 0 to 9 – (compliant with EN 302 208)	---
	0.5W ERP	Only channel 10 and 11 – (compliant with EN 300 220) or channel 0 to 11 – (compliant with EN 302 208)	---
	0.25W ERP	Only channel 10 and 11 – (compliant with EN 300 220) or channel 0 to 11 – (compliant with EN 302 208)	---
	0.1W ERP	Only channel 10 and 11 – (compliant with EN 300 220) or channel 0 to 11 – (compliant with EN 302 208)	---
	Supported regulations: 1. ETSI EN 302 208: 10 available channels (865.6 to 867.6) with a maximum output power of 2W ERP, and 12 channels at a maximum output power of 500 mW ERP. Channel bandwidth: 200 kHz 2. ETSI EN 300 220: With one available channel at 869.5 MHz and a maximum output power of 500 mW ERP. Channel bandwidth: 250 kHz 3. FCC part 15: 50 available channels (902 MHz to 928 MHz) with a maximum output power of 4W EIRP. Channel bandwidth: 500 kHz		

Note: For the European radio regulations the internal channel step is 100 kHz and for the North American regulation the internal channel step is 125 kHz; therefore, for the FCC part, every 4th channel is used (the FCC part has 200 internal channels and the ETSI part has 24 internal channels).

Table 5-2. Fast Mode

Tag	Data Rate Fast Mode	Data Rate Slow Mode
ATA5590	32 Kbit/s (US only – FCC 915 MHz)	16 Kbit/s (Europe only – ETSI 868 MHZ)

5.2 Reader Configuration Options (Tags)

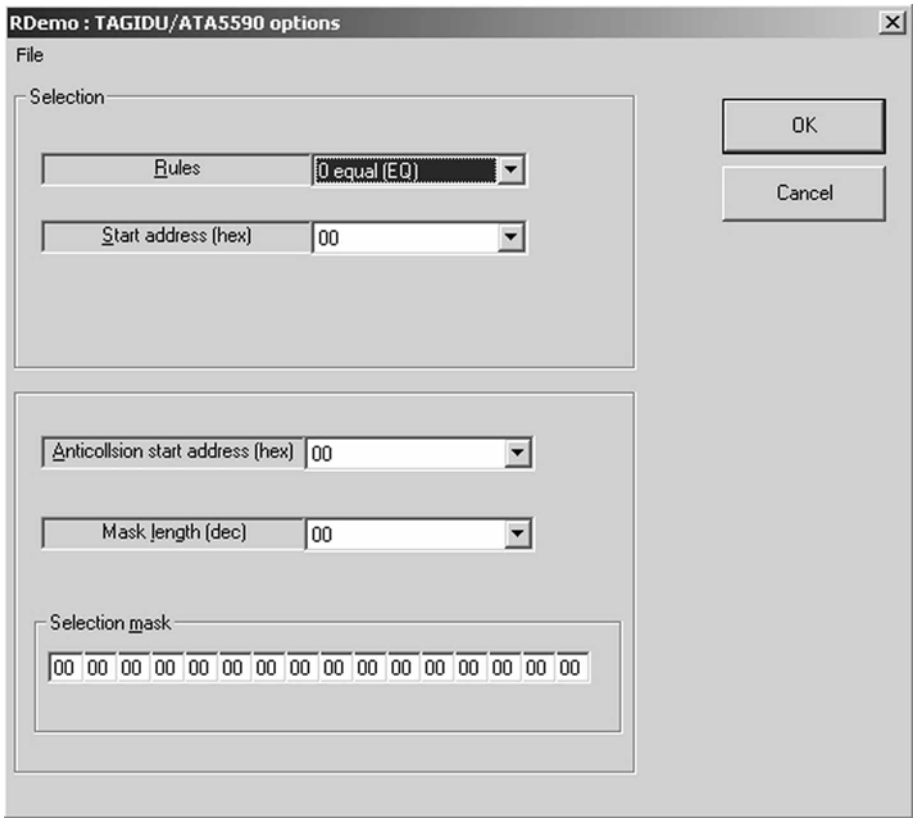
This section provides general information to arbitrate the ATA5590 with the UDL 500 reader.

The ATA5590 allows using a memory area other than the ID page for anticollision arbitration.

The length of the arbitration is always 16 bytes. The arbitration decrements from the selected start address. For example, if you choose block 6 as start address, the arbitration will be made over block 6 and block 5. The start address is the same as the address for read and write accesses.

Note: This function is not available if the tag type *ATA5590 with UID* is selected. That type always does an arbitration over the lower six bytes of block 20, which contain the UID.

Figure 5-2. Arbitration Option Menu



5.2.1 Rules

There are four different rules for selection:

- *0: equal (EQ)*: *Selection Mask* must be equal to the transponder memory
- *1: lower than or equal to (LTE)*: *Selection Mask* must be lower than or equal to the value in the transponder memory
- *2: equal (EQ)*: *Selection Mask* must be equal to the transponder memory
- *3: greater than or equal to (GTE)*: *Selection Mask* must be greater than or equal to the value in the transponder memory

5.2.2 Start Address (hex)

Defines the memory start address for the selection. If “0” is chosen, the selection is made over the 12 lower bytes of the ID page. The start address is the same address as used for read or write accesses. Block size is eight bytes.

5.2.3 Anticollision Start Address (hex)

It is also possible to arbitrate over a memory area other than the ID page. *Anticollision start address* defines the start address for arbitration as a block address with block size of 8 bytes. This is the same address format as for the read block and write block commands. The length of the arbitration is always 16 bytes.

Note: If the tag type *ATA5590 with UID* is selected, it is not possible to make the arbitration over a memory area other than the UID.

5.2.4 Mask Length (dec)

If the value of the selection mask length is “0”, no selection command is sent by the reader.

5.2.5 Selection Mask

This mask defines which of the 16 bytes in the selection mask is used for comparison. A “1” in the byte mask will activate the comparison for the corresponding selection mask byte. Bit number 7 of the byte mask corresponds to the first byte of the selection mask and bit number 0 corresponds to the last byte of the selection mask.

Section 6

Memory Organization

6.1 Overview

Table 6-1 shows the memory addresses of the ATA5590 which can be addressed by the reader.

Table 6-1. Reader Implementation of Memory Organization

Memory Organization						
Address	**Blocks**	**Memory Size**	**Lock Block**	**Comment**	**User Memory**	**System Memory**
0	1	64 bits/8 bytes		Page 0 (bit 64 to bit 1)	X	
1	1	64 bits/8 bytes	Lock bit (MSB)	Page 0 (bit 128 to bit 65)	X	
2	1	64 bits/8 bytes		Page 1 (bit 64 to bit 1)	X	
3	1	64 bits/8 bytes	Lock bit (MSB)	Page 1 (bit 128 to bit 65)	X	
4	1	64 bits/8 bytes		Page 2 (bit 64 to bit 1)	X	
5	1	64 bits/8 bytes	Lock bit (MSB)	Page 2 (bit 128 to bit 65)	X	
6	1	64 bits/8 bytes		Page 3 (bit 64 to bit 1)	X	
7	1	64 bits/8 bytes	Lock bit (MSB)	Page 3 (bit 128 to bit 65)	X	
8	1	64 bits/8 bytes		Page 4 (bit 64 to bit 1)	X	
9	1	64 bits/8 bytes	Lock bit (MSB)	Page 4 (bit 128 to bit 65)	X	
10	1	64 bits/8 bytes		Page 5 (bit 64 to bit 1)	X	
11	1	64 bits/8 bytes	Lock bit (MSB)	Page 5 (bit 128 to bit 65)	X	
12	1	64 bits/8 bytes		Page 6 (bit 64 to bit 1)	X	
13	1	64 bits/8 bytes	Lock bit (MSB)	Page 6 (bit 128 to bit 65)	X	
14	1	64 bits/8 bytes		Page 7 (bit 64 to bit 1)	X	
15	1	64 bits/8 bytes	Lock bit (MSB)	Page 7 (bit 128 to bit 65)	X	
16	1	64 bits/8 bytes		Page 0 (ID page: bit 64 to bit 1)		X
17	1	64 bits/8 bytes	Lock bit (MSB)	Page 0 (ID page: bit 128 to bit 65)		X
18	1	64 bits/8 bytes		Page 1 (User system info: bit 64 to bit 1)		X
19	1	64 bits/8 bytes	Lock bit (MSB)	Page 1 (User system info: bit 128 to bit 65)		X

Note: Most significant bit (MSB) always indicates the upper bit

6.2 Summary

6.2.1 ATA5590: Readable and Writable Transponder

Memory	128 bytes user memory + 40 bytes system memory including 16 bytes tag id
Length of serial number	128 bits = 16 bytes
Length of serial number for block write and block read commands	16 bytes
Block size read	8 bytes
Block size write	4 or 8 bytes
Block size lock and query lock	8 bytes

Note: Although the block size is 8 bytes, the lock and query-lock operation is performed across 16 bytes.

Serial number	Stored in Blocks 16 and 17, see Table 6-1.

6.2.2 ATA5590 with UID: Readable and Writable Transponder

Memory	128 bytes user memory + 40 bytes system memory
Length of serial number	48 bits = 6 bytes
Length of serial number for block-write and block-read commands	6 bytes
Block size read	8 bytes
Block size write	4 or 8 bytes
Block size lock and query lock	8 bytes

Note: Although the block size is 8 bytes, the lock and query-lock operation is performed across 16 bytes.

Serial number	Stored in Blocks 16 and 17, see Table 6-1.

Section 7

UID: Atmel Secure Locked Programmed ID

The traceability data is an ID, or number, provided by Atmel which can be used be the user as a unique ID (UID). The traceability data blocks are programmed and locked by Atmel during the production test. After sawing, the data content can't be changed. This process is irreversible!

7.1 UID Organization

Table 7-1. UID Page in the Control Memory (Page 2)

31	32	30	...	24	23	22	21	20	19	18	...	14	13	...	0
EAS		RFU			Tag type		RFU	IC rev. number		**LOTID character**			**LOTID number**		
RFU		TUNE	**CRC5**		**LOTID number**			**Wafer number**					**Die number**		
31	32	30	29	...	24	23	21	20	...	16	15	...			0

The UID page (see Table 7-1 and also Table 12-1), consists of 48 bits of manufacturer data reporting the production lot, and 16 status bits. The manufacturer data includes a lot ID character and a 5-digit lot number.

7.1.1 Traceability Data

LOTID character:	Lot character. Example: Z
LOTID number:	5-digit lot number. Example: 13711
Wafer number:	2-digit wafer number. Example: 12
Die number:	Die per wafer. Example: 3512
CRC5:	Cyclic redundancy check (CRC5) – 5 bits to check the data content after programming the UID in the EEPROM

7.2 UID Arbitration

The ATA5590 has the capability of arbitrating over memory areas other than the ID page. The arbitration length is always 16 bytes.

It is also possible to arbitrate on the UID page of the ATA5590. This has some advantages for the end user; first, this ID can be used by the user – it is not necessary to program a new ID in page 0 in the control memory. Second, it is possible in the field to program virgin tags which have no ID stored in page 0 in the control memory. Therefore it is possible to select each tag, no matter how it is necessary to program an ID.

Note: If the tag type *ATA5590 with UID* is selected, it is not possible to arbitrate over a memory area other than the UID.

The UID arbitration can be selected via the menu Reader -> Configuration, see Section 5-1 and Figure 7-1.

Figure 7-1. Selection for the TAGIDU UID Arbitration

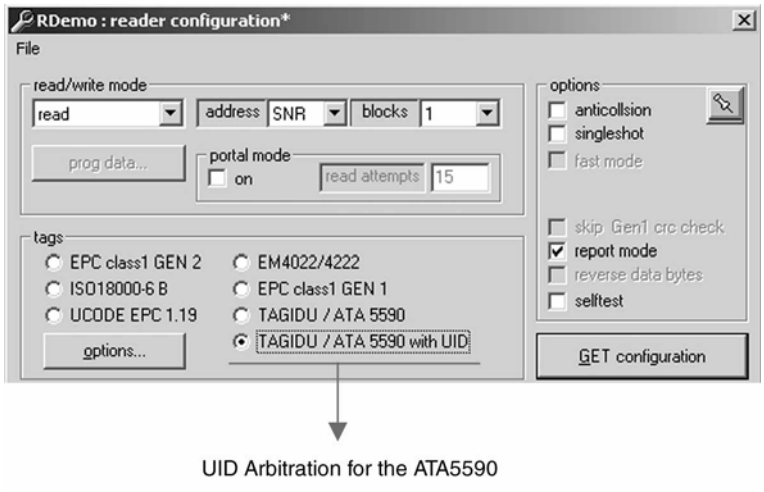


Table 7-2. Example Using ArbitrationTAGIDU/ATA5590 with UID, UID Number Shown (Transponder Data Window): 98EE001810AA

Hex value	00								06								**98**								**EE**							
Binary value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**0**
Description	EAS		RFU						Tag type		TUNE	IC rev.		LOTID character			LOTID number															

Hex value	**00**								**18**								**10**								**AA**							
Binary value	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Description	RFU		TUNE	CRC5					LOTID number			Wafer number					Die number															

UID summary (overall):

LOTID character: Z (hex value: 1A; binary value: 11010)

LOTID number: 51056 (hex value: C770; binary value: 01100011101110000)

Wafer number: 24 (hex value: 18; binary value: 11000)

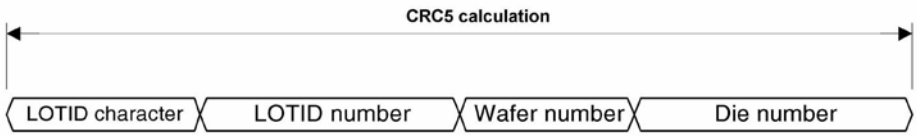
Die number: 4266 (hex value: 10AA; binary value: 0001000010101010)

The compete UID page in the control memory can be read out using a read command.

7.3 CRC5 Calculation

CRC5 is a security feature for checking the data contents after programming the UID in the EEPROM. The CRC5 value is stored non-inverted in the memory. The calculation of the CRC5 value includes the LOTID character, LOTID number, wafer number, and die number, see Figure 7-2.

Figure 7-2. CRC5 Calculation



Section 8

Using the Reader

8.1 Introduction

The reader can be operated in two different modes:

- Polling mode
- Report mode

The mode can be changed via the menu *Reader -> Mode*. When *Report mode* is selected, if the reader is in arbitration mode it continuously reads (or scans) tags which are in the reader's range. *Polling mode* allows the host to fully control the reader. This means that the reader is told by the host which command or information to transmit.

8.2 Polling Mode

While in polling mode there are four commands in the *Transponder* menu for communication with the tags: *Read*, *Write*, *Inventory,* and *Lock Block*.

8.2.1 Read

The *Read* command enables the interrogator to read out all memory areas of the ATA5590 and the traceability data or UID of the tag (this option is only enabled in polling mode). A shortcut item can be created under the menu item *View –> Buttons –> Read*.

Figure 8-1. Read Command, Polling Mode

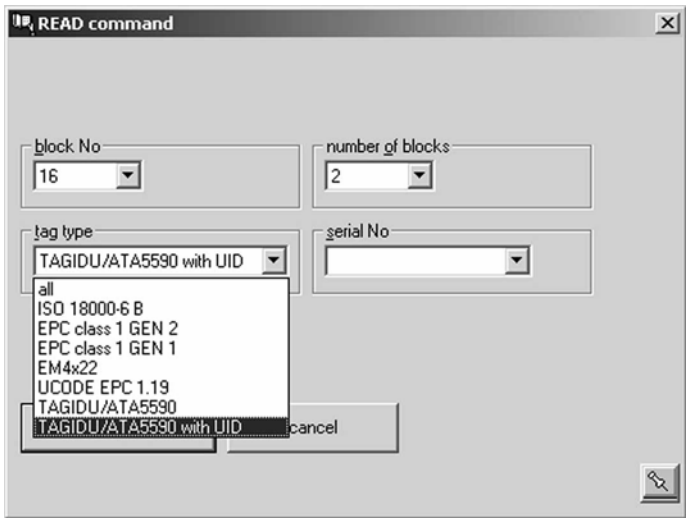


Table 8-1.

Block Number	Number of Blocks	Comment
0 to 20	Min. 1	21 × 64 bits = 1344 bits
0 to 3	Max. 18	(4 × 64 bits) + (17 × 64 bits) = 1344 bits

tag type Protocol selection

serial No All detected tags are listed here with their unique ID. To interrogate a transponder, the serial number must first be known.

Note: Clears all detected serial numbers in the demo software

8.2.2 Write

The *Write* command enables the interrogator to read out all memory areas of the ATA5590, plus the traceability data or UID of the tag (only enabled in Polling mode). A shortcut item can be created under the menu item *View –> Buttons –> Write*.

Figure 8-2. Write Command, Polling Mode

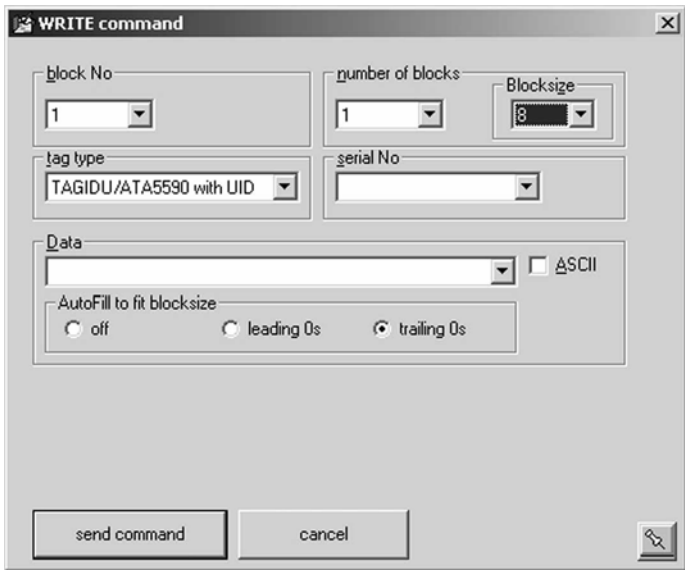


Table 8-2.

Block Number	Number of Blocks	Block Size [Byte]	Comment
0 to 39	Min. 1	Min. 4	40 × 32 bits = 1280 bits
0 to 22	Max. 18	Min. 4	(23 × 32 bits) + (17 × 32 bits) = 1280 bits
0 to 19	Min. 1	Max. 8	20 × 64 bits = 1280 bits
0 to 2	Max. 18	Max. 8	(3 × 64 bits) + (17 × 64 bits) = 1280 bits

tag type Protocol selection

serial No All detected tags are listed here with their unique ID. To interrogate a transponder, the serial number must first be known.

Note: Clears all detected serial numbers in the demo software

8.2.2.1 Data

AutoFill to fit block size:

- *Off*: turn off the automatic function to fill with zeros (the data size must be exactly the same as the desired block size)
- *leading 0s*: fill with zeros before the provided data (if the data size is not the desired block size)
- *trailing 0s*: fill with zeros after the provided data (if the data size is not the desired block size)

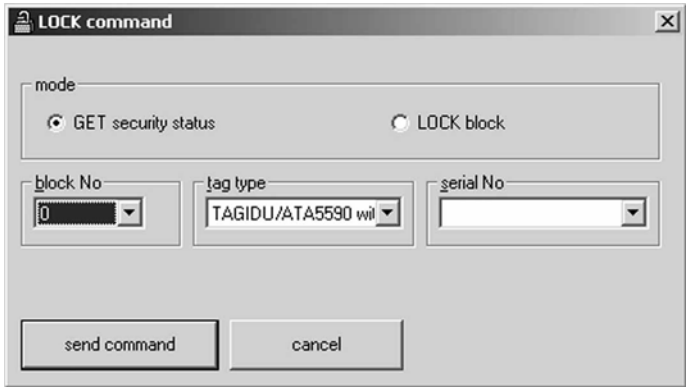
8.2.3 Inventory

The command *Inventory* tries to detect the serial numbers of all transponders within the range of the reader as the tags transmit their serial numbers. A shortcut item can be created under the menu item *View –> Buttons –> Inventory*.

8.2.4 LOCK Block

LOCK command is used to lock or read out the security status to get write permission for specified blocks. The action *LOCK block* is irreversible. A shortcut item can be created under the menu item *View –> Buttons –> Security*.

Figure 8-3. Lock Command, Polling Mode



GET security status Determines the actual block security status.

LOCK block Sets the lock bit of a page.

Note: This action is irreversible.

block No Block/page selection for locking, see Table 6-1.

tag type Protocol selection

serial No All detected tags are listed here with their unique ID. To interrogate a transponder, the serial number must first be known.

Note: Clears all detected serial numbers in the demo software

8.3 Report Mode

Report mode can either be activated via the menu *Reader –> Mode –> Switching to report mode* or *Reader –> configuration –> options (*by selecting *report mode)*. In this mode the reader works independently from the host, meaning that the reader works continuously (read; anticollision in write mode; if there is a successful write, the reader stops the transmission).

In 1 block, 64 bits can be written or read out of the EEPROM, see Table 8-3 and Table 8-4.

Table 8-3. Reader Configuration Setting, Read Command

Command: READ		
Address Range	**Blocks**	**Comment**
SNR – 20	Min. 1	21 × 64 bits = 1344 bits
SNR – 12	Max. 9	(13 × 64 bits) + (8 × 64 bits) = 1344 bits

The maximum number of bits which can be read out is 576 bits (64 bits × 9 blocks = 576 bits). The upper address range when reading 9 blocks is 13. The minimum number of bits that can transferred are 64 bits (1 block), the upper address range is thus 21.

Table 8-4. Reader Configuration Setting, Write Command

Command: WRITE		
Address Range	**Blocks**	**Comment**
0 – 19	Min. 1	20 × 64 bits = 1280 bits
0 – 16	Max. 4	(17 × 64 bits) + (3 × 64 bits) = 1280 bits

In write mode, the maximum number of bits which can be transferred is 256 bits (64 bits × 4 blocks = 256 bits, see Figure 8-4), the upper address range is 16. The minimum number of transferred bits and also the address range is the same as in read mode.

Figure 8-4. ProgData in the Reader Configuration Menu – Programming Data

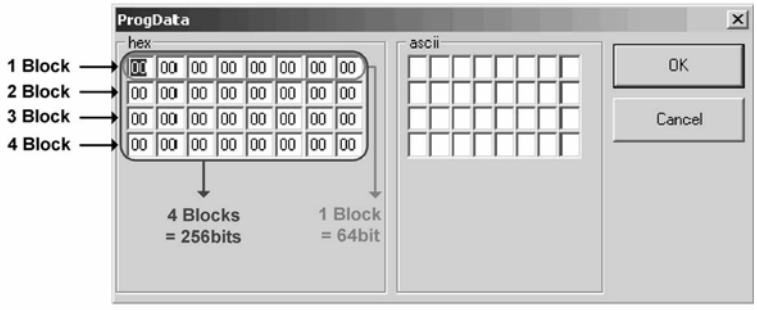


Table 8-5 shows the write or programming possibilities for the control memory.

Table 8-5. Reader Configuration, Programming Possibilities

Write to System Memory			
Option 1			
Address	**Blocks**	**Memory Size**	**Comment**
16	2	128 bits/16 bytes	Page 0 (ID page) – System memory
16	4	256 bits/32 bytes	Page 0 and 1 (ID page + User system info) – System memory
Option 2			
Address	**Blocks**	**Memory Size**	**Comment**
16	1	64 bits/8 bytes	Page 0 (ID page) – System memory
17	1	64 bits/8 bytes	Page 0 (ID page) – System memory
18	1	64 bits/8 bytes	Page 1 (User system info) – System memory
19	1	64 bits/8 bytes	Page 1 (User system info) – System memory

8.4 ID Page Programming (System Memory – Page 0)

8.4.1 Polling Mode

Figure 8-5 shows an example of the *WRITE command* in polling mode programming an ID in page 0 of the control memory, see Table 8-6 and Table 8-7 on page 6.

Figure 8-5. Example of Programming an ID in Polling Mode

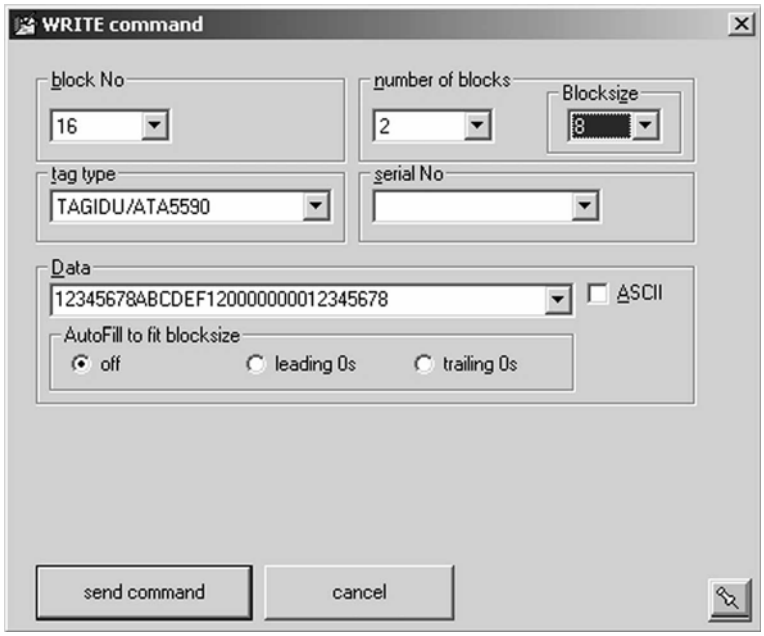


Table 8-6. ID-programming Example, Polling Mode; Block Size = 8

Data					Comments
Number of blocks	1		1		Reader setting (ID can be programmed in 2 steps)
Block size [bytes]	8		8		Reader setting
Block number	16		17		Reader setting
Number of blocks	2				Reader setting (ID can be programmed in 1 step)
Block size	8				Reader setting
Block number	16		---		Reader setting
Page address[1]	0 (ID page: Control memory)				Physical address
Block address[2]	1	0	3	2	Physical address
	12345678	ABCDEF12	00000000[3]	12345678	Data format in hex

1. For the page address, see Table 12-1
2. For the block address, see Table 12-1
3. A description of the block configuration can be found in Table 12-1

Table 8-7. ID-programming Example, Polling Mode; Block Size = 4

Data					Comments
Number of blocks	1	1	1	1	Reader setting (ID can be programmed in 4 steps)
Block size [bytes]	4	4	4	4	Reader setting
Block number	16	16	17	17	Reader setting
Number of blocks	2		2		Reader setting (ID can be programmed in 2 steps)
Block size [bytes]	4		4		Reader setting
Block number	16		17		Reader setting
Number of blocks	4				Reader setting (ID can be programmed in 1 step)
Block size [bytes]	4				Reader setting
Block number	16		---		Reader setting
Page address[1]	0 (ID page: Control memory)				Physical address
Block address[2]	1	0	3	2	Physical address
	12345678	ABCDEF12	00000000[3]	12345678	Data format in hex

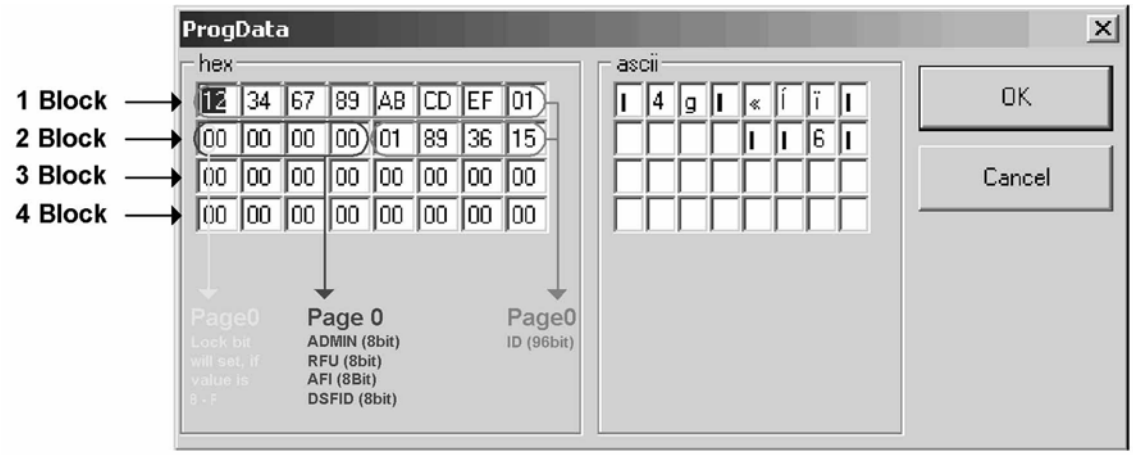
Notes: 1. For the page address, see Table 12-1
2. For the block address, see Table 12-1
3. A description of the block configuration can be found in Table 12-1

Note: The memory contents can be protected with a lock bit – this operation is irreversible! The lock bit is located at the most significant bit (MSB) in Page 0 of the control memory (see Table 8-7). Therefore, the lock bit should be set in an additional step or as the last command during the programming of a page (applies to all pages in the system and user memory).

8.4.2 Report Mode: Reader –> Configuration

Figure 8-6 shows the setting in the *ProgData* menu for programming an ID in Page 0 of the control memory.

Figure 8-6. *ProgData* Menu Item – Programming of Page 0 (96-bit ID)



The same settings as shown in Table 8-6 and Table 8-7 are also valid for Report mode.

Section 9

Arbitration

The ATA5590 supports anticollision arbitration over memory areas other than the ID page. The length of the arbitration is always 16 bytes. The search algorithm used is deterministic (binary tree) arbitration (advantage: faster then Aloha). In Polling mode, up to 135 transponder serial numbers can be stored in the UDL reader device. If there is no polling command before the reader runs out of memory, new serial numbers will be lost. These serial numbers are filtered to avoid having the same serial number stored twice. Only one serial number will be transmitted in a message.

Note: If the tag type ATA5590 with UID is selected, it is not possible to make the arbitration over another memory area than the UID!

9.1 Arbitration in Polling Mode

The *Inventory* command (*Transponder -> Inventory*) tries to detect the serial numbers of all transponders within the range of the reader as the tags transmit their serial numbers (see Section 8.2.3).

9.2 Arbitration in Report Mode

Arbitration in report mode can be adjusted via the menu item *Reader -> Configuration*, (see Section 5-1).

Arbitration options are in the *Configuration* menu (see the explanation in Section 5-2).

Selection: *Reader -> Configuration* (see also Section 5-1)

9.2.1 Anticollision

Activate the anticollision function. The arbitration algorithm used is based on the binary tree or deterministic arbitration concept.

Note: *SNR* (page 0 of the control memory) in the address selection bar indicates the serial number of the transponder.

9.2.2 Single Shot

If single shot mode is selected and a transponder stays in the read range for a longer time, the serial number of this transponder will be transmitted again after the time specified in *tag timeout*. The *Value* is a multiple of 100 ms. If *tag timeout* is “0”, the serial number will not be transmitted again.

Note: Single shot mode is not available in anticollision or portal mode!

9.2.3 Tag Options

Tag timeout defines the number of anticollision commands before a reset is sent. If this value is “0”, the reader will never send a reset command to the tags.

9.2.4 Read Cycles

This option defines how many anticollision commands are sent before the next *select* command is sent.

Selection: *Reader* -> *Configuration* -> *Options* (see Section 5-2)

This menu item is an extension to the normal arbitration. The ATA5590 can arbitrate on memory areas other than the ID page and with different selection rules.

Section 10

Additional Information

Detailed information is available in the introductory document Einfuehrung_UDL500_em.pdf, on the CD from deister and included in the application kit. Some application notes from deister are also available on the CD.

Reader information is in the Deister directory on the CD under the following paths.

Reader Description:

Product/13.56 MHz to 868 MHz LogIdent/868 MHz passive transpondertechnology/UDL500

Product/13.56--868 MHz LogIdent/868 MHz passive transponder technology/UHF_portal

Protocol Description:

Protocol/PROTOCOL_UDxxx_deBus_v1_10_GB.pdf

Application Notes:

Software /RDemo software for configuration the readers/application_note

Software/RDemo software for configuration the readers/RDemo discription

Software Update:

Software/update software for readers

Section 11

Error Handling/FAQ

11.1 Problem

No communication between PC and UDL 500 reader.

11.1.1 Actions

- Verify that the correct port is selected. If the correct port is selected and no communication is possible, check the current reader address. The current reader address can be adjusted in the demo software. (In the menu bar under the item *View -> deBus Polling*.)
- Check the scan settings: Verify that the correct baud rate is chosen. If the correct baud rate and address is unknown, set the baud rate setting to *all*. This setting tells the reader to scan all possible baud rates and addresses.
- All identified readers are displayed in the *detected reader* window. Choose the appropriate entry, and confirm with *set as current reader*.

Section 12

Appendix

Table 12-1. Physical Address Description of the ATA5590 Control Memory

Physical address	Block address	Byte3 31	30	29	28	27	26	25	24	Byte2 23	22	21	20	19	18	17	16	Byte1 15	14	13	12	11	10	9	8	Byte0 7	6	5	4	3	2	1	0
2	1	Manufacturer System Info – 8th byte								Manufacturer System Info – 7th byte								Traceability Data Structure – 6th byte								Traceability Data Structure – 5th byte							
		EAS_en	EAS(0)	RFU	RFU	RFU	RFU	RFU	RFU	TAG TYPE	TAG TYPE	TUNE	IC Rev. Nr.	IC Rev. Nr.	LotID Character	LotID Character	LotID Character	LotID Character	LotID Character	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number	LotID Number
										0h		0	0h		LC#			LC#		LotID #						LotID #							
	0	Traceability Data Structure – 4th byte								Traceability Data Structure – 3rd byte								Traceability Data Structure – 2nd byte								Traceability Data Structure – 1st byte							
		RFU	RFU	TUNE	CRC5	CRC5	CRC5	CRC5	CRC5	LotID Number	LotID Number	LotID Number	Water Number	Water Number	Water Number	Water Number	Water Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number	Die Number
		0h		0	Crc5#					LotID #			Wafer #					die on wafer #								die on wafer #							
1	3	User System Info - Admin								User System Info								User System Info								User System Info							
		Lock Bit (User sys.)																															
	2	User System Info								User System Info								User System Info								User System Info							
	1	User System Info								User System Info								User System Info								User System Info							
	0	User System Info								User System Info								User System Info								User System Info							
0	3	ADMIN								RFU								AFI (ISO/IEC15962) [1]								DSFID (ISO/IEC15962)							
		LOCK ID PAGE	PRIVATE	DSFID_nAc	DSFID_ISO	AFI	DSFID	LID	CRC									ApplicationFamily	ApplicationFamily	ApplicationFamily	ApplicationFamily	ApplicationFamily	ApplicationFamily	ApplicationFamily	ApplicationFamily	AccessMethod	AccessMethod	RFU	DataFormat	DataFormat	DataFormat	DataFormat	DataFormat
	2	Upper Byte ID																															
		ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
	1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
	0																									Lower Byte ID							
		ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

ProgNbyte (tag must be selected)
Blocked after sawing
Can be locked (when locked it can't be reprogrammed) - OTP mechanism

[1]: List of Application Family Identifiers are defined in ISO/IEC 15961.

Table 12-2. Description of Various Memory Areas in the Control Memory

Manufacturer System Info 7th Byte, Page 2	**Tag Type (1:0)** 0h: backscatter RF-powered tag 1h: backscatter battery-powered tag 2h: active tag, AM RSSI 3h: active receiver IC Rev. Nr. (3:5) 0h: V2.1 1h: V2.1

ADMIN 16th Byte, Page 0	**Lock ID Page:**	Locks the whole page. No change of the page possible after setting to “1”
	Private:	If set to “1”, the user is using custom structure and flags. If set to “0”, the user is using the following flags.
	DSFID_nAC:	If set to “1”, a DSFID info is stored at byte 0 of block 3. If set to “0”, the Allocation Class info is stored at byte 0 of block 3.
	DSFID_ISO:	If set to “1”, the DSFID coding structure is not compliant with ISO15962 regulations.
	DSFID:	Indicates whether the DSFID information is stored in the Tag ID page. The content is stored at byte 0 or byte 2 depending on DSFID_nAC.
	AFI:	Indicates that the AFI is stored in the Tag ID page. The construction of AFI corresponds with ISO 18000-6 FDIS.
	LID:	Indicates that a Tag ID has a size larger than 96 bits. The other bits can be stored from page 7 down to page 0 of the user memory
	CRC:	Indicates that a CRC value is supported. The CRC value can be stored after the administration part (byte 2), if the location is not used for storing the DSFID value.

DSFID 13th Byte, Page 0	**Access Method (1:0) -> ISO/IEC15691 defined in 7.1.2.4** 0h: no directory 1h: directory 2h: selfMappingTag 3h: RFU **Data Format (4:0) -> ISO/IEC 15691 defined in 7.1.2.5** 00h: noFormatted 01h: fulFeatured 02h: rootOidEncoded 03h: iso15434 04h: iso6523 05h: iso15459 06h: reserved 07h: reserved 08h: iso15961Combined 09h: ean-ucc 0Ah: di 0Bh: upu 0Ch: iata 0Dh to 1Fh: reserved

	AFI (7:4)	AFI (3:0)	Meaning
	0	0	All families and sub-families
	x	0	All sub-families of family X
	x	y	Only the Yth sub-families of family X
	0	y	Proprietary sub-family only
	1	0, y	Transport
	2	0, y	Financial
	3	0, y	Identification
	4	0, y	Telecommunication
AFI	5	0, y	Medical
14th Byte, Page 0	6	0, y	Multimedia
	7	0, y	Gaming
	8	0, y	Data storage
	9	0, y	Item management
	A	0, y	Express parcels
	B	0, y	Postal services
	C	0, y	Airline bags
	D	0, y	RFU
	E	0, y	RFU
	F	0, y	RFU

Note: x and y each represent any single-digit hexadecimal value between 1 and F

Table 12-3. Physical Address Description of the Control Memory of the ATA5590

Physical address	Block address	Byte3								Byte2								Byte1								Byte0							
		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7	3	Lock Bit																															
	2																																
	1																																
	0																																
0	3	Lock Bit																															
	2																																
	1																																
	0																																

Page can be locked (when locked it can't be reprogrammed) - OTP mechanism

Note: Whole page usable for expanded ID

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