5E9030.29

Technical documentation

Version: **1.00 (June 2016)**
5E9030.29

1 General information

Information:

B&R makes every effort to keep technical descriptions as current as possible. The latest version of this technical description can be downloaded in PDF format from the B&R website at www.br-automation.com.

1.1 Version information

Version	Date	Comment	Responsible
1.00	2016-06-14	First edition	Nadine Koch

Table 1: Version information

1.2 Safety guidelines

1.2.1 Intended use

Programmable logic controllers (PLCs), operating/monitoring devices (industrial PCs, Power Panels, Mobile Panels, etc.) and B&R uninterruptible power supplies have been designed, developed and manufactured for conventional use in industrial environments. They were not designed, developed and manufactured for any use involving serious risks or hazards that could lead to death, injury, serious physical damage or loss of any kind without the implementation of exceptionally stringent safety precautions. In particular, such risks and hazards include the use of these devices to monitor nuclear reactions in nuclear power plants, their use in flight control or flight safety systems as well as in the control of mass transportation systems, medical life support systems or weapons systems.

1.2.2 Protection against electrostatic discharge

Electrical components that can be damaged by electrostatic discharge (ESD) must be handled accordingly.

1.2.2.1 Packaging

- **Electrical components with a housing**
  ...do not require special ESD packaging but must be handled properly (see "Electrical components with a housing").
- **Electrical components without a housing**
  …are protected by ESD-suitable packaging.

1.2.2.2 Guidelines for proper ESD handling

Electrical components with a housing

- Do not touch the connector contacts on connected cables.
- Do not touch the contact tips on circuit boards.

Electrical components without a housing

The following points apply in addition to the points listed under "Electrical components with a housing":

- Any persons handling electrical components or devices with installed electrical components must be grounded.
- Components are only permitted to be touched on their narrow sides or front plate.
- Components should always be stored in a suitable medium (ESD packaging, conductive foam, etc.). Metallic surfaces are not suitable storage surfaces!
- Components should not be subjected to electrostatic discharge (e.g. through the use of charged plastics).
- Ensure a minimum distance of 10 cm from monitors and TV sets.
- Measuring instruments and equipment must be grounded.
- Probes on potential-free measuring instruments must be discharged on sufficiently grounded surfaces before taking measurements.

Individual components

- ESD protective measures for individual components are thoroughly integrated at B&R (conductive floors, footwear, arm bands, etc.).
- These increased ESD protective measures for individual components are not necessary for customers handling B&R products.

1.2.3 Policies and procedures

Electronic devices are never completely failsafe. If the programmable control system, operating/monitoring device or uninterruptible power supply fails, the user is responsible for ensuring that other connected devices, e.g. motors, are brought to a secure state.

When using programmable logic controllers or operating/monitoring devices as control systems together with a soft PLC (e.g. B&R Automation Runtime or comparable product) or slot PLC (e.g. B&R LS251 or comparable product), safety precautions relevant to industrial control systems (e.g. the provision of safety devices such as emergency stop circuits, etc.) must be observed in accordance with applicable national and international regulations. The same applies for all other devices connected to the system, such as drives.

All tasks such as the installation, commissioning and servicing of devices are only permitted to be carried out by qualified personnel. Qualified personnel are those familiar with the transport, mounting, installation, commissioning and operation of devices who also have the appropriate qualifications (e.g. IEC 60364). National accident prevention regulations must be observed.

The safety notices, connection descriptions (type plate and documentation) and limit values listed in the technical data are to be read carefully before installation and commissioning and must be observed.

1.2.4 Transport and storage

During transport and storage, devices must be protected against undue stress (mechanical loads, temperature, moisture, corrosive atmospheres, etc.).

1.2.5 Installation

- These devices are not ready for use upon delivery and must be installed and wired according to the specifications in this documentation in order for the EMC limit values to apply.
- Installation must be performed according to this documentation using suitable equipment and tools.
- Devices are only permitted to be installed by qualified personnel without voltage applied. Before installation, voltage to the control cabinet must be switched off and prevented from being switched on again.
- General safety guidelines and national accident prevention regulations must be observed.
- Electrical installation must be carried out in accordance with applicable guidelines (e.g. line cross sections, fuses, protective ground connections).

1.2.6 Operation

1.2.6.1 Protection against touching electrical parts

To operate programmable logic controllers, operating and monitoring devices, and uninterruptible power supplies, certain components must carry dangerous voltage levels over 42 VDC. Touching one of these parts can result in a life-threatening electric shock. This could lead to death, severe injury or damage to equipment.

Before turning on the programmable logic controller, operating/monitoring devices or uninterruptible power supply, the housing must be properly grounded (PE rail). Ground connections must be established even when testing or operating operating/monitoring devices or the uninterruptible power supply for a short time!

Before switching on the device, all parts that carry voltage must be securely covered. During operation, all covers must remain closed.

1.2.6.2 Environmental conditions - Dust, moisture, corrosive gases

The use of operating/monitoring devices (e.g. industrial PCs, Power Panels, Mobile Panels, etc.) and uninterruptible power supplies in very dusty environments should be avoided. Dust collection on the devices can affect functionality and may prevent sufficient cooling, especially in systems with active cooling systems (fans).

The presence of corrosive gases can also lead to malfunctions. When combined with high temperature and humidity, corrosive gases – e.g. with sulfur, nitrogen and chlorine components – can induce chemical reactions that can damage electronic components very quickly. Signs of the presence of corrosive gases are blackened copper surfaces and cable ends on existing equipment.

For operation in dusty or moist conditions, correctly installed (e.g. cutout installations) operating/monitoring devices like the Automation Panel or Power Panel are protected on the front. The back of all devices must be protected from dust and moisture and cleaned at suitable intervals.

1.2.6.3 Viruses and dangerous programs

This system is subject to potential risk each time data is exchanged or software is installed from a data medium (e.g. diskette, CD-ROM, USB flash drive, etc.), a network connection or the Internet. The user is responsible for assessing these dangers, implementing preventive measures such as virus protection programs, firewalls, etc. and making sure that software is only obtained from trusted sources.

1.2.7 Environmentally friendly disposal

All B&R programmable controllers, operating/monitoring devices and uninterruptible power supplies are designed to inflict as little harm as possible on the environment.

1.2.7.1 Separation of materials

It is necessary to separate different materials so the device can undergo an environmentally friendly recycling process.

Component	Disposal
Programmable logic controllers Operating/Monitoring devices Uninterruptible power supply Batteries and rechargeable batteries Cables	Electronics recycling
Cardboard box / Paper packaging	Cardboard box / Paper recycling
Plastic packaging	Plastic recycling

Disposal must comply with applicable legal regulations.

1.3 Order data

Model number	Short description	Figure
	Miscellaneous	
5E9030.29	Transponder 13.56 MHz, ISO 15693 and MIFARE Classic, read/write unit, mounting diameter 22.5 mm, USB cable length 1200 mm, IP65 protection	
	Optional accessories	
	Miscellaneous	
5A9010.43	Transponder tag, black housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.44	Transponder tag, white housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.45	Transponder tag, yellow housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.46	Transponder tag, red housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.47	Transponder tag, green housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.48	Transponder tag, blue housing, read/write, SLI, 1 kbit, 13.56 MHz	
5A9010.50	Transponder card color white, read / write, SLI, 1kBit, 13,56 MHz	
5A9020.43	Transponder tag, black housing, MIFARE Classic, 1kB, 13.56 MHz read/write	
5A9020.44	Transponder tag, white housing, MIFARE Classic, 1 kB, 13.56 MHz read/write	
5A9020.45	Transponder tag, yellow housing, MIFARE Classic, 1 kB, 13.56 MHz read/write	
5A9020.46	Transponder tag, red housing, MIFARE Classic, 1 kB, 13.56 MHz read/write	
5A9020.47	Transponder tag, green housing, MIFARE Classic, 1 kB, 13.56 MHz read/write	
5A9020.48	Transponder tag, blue housing, MIFARE Classic, 1 kB, 13.56 MHz read/write	
5A9020.50	Transponder card, white MIFARE Classic, 1 kB, 13.56 MHz read/write	

Table 2: 5E9030.29 - Order data

2 Technical data - Overview

2.1 Description

The 5E9030.29 transponder is a read/write unit with the following specifications:

- 13.56 MHz read/write transponder unit
- ISO 15693 and MIFARE compatible
- USB interface

2.2 Technical data

Model number	5E9030.29
General information	
Certification	
CE	In preparation
Interfaces	
USB	
Type	USB 1.1
Design	Type A
Transfer rate	Low speed (1.5 Mbit/s), full speed (12 Mbit/s)
RFID read/write transponder unit	
Type	For I-Code SLI transponder with amplitude modulation and MIFARE Classic, carrier frequency 13.56 MHz
Read/Write range in air	Approx. 1 to 3 cm
Electrical characteristics	
Power consumption	Max. 0.5 W
Supply voltage	5 VDC ±20% (via USB)
Operating conditions	
EN 60529 protection	IP65
Environmental conditions	
Temperature	
Operation	0 to 50°C
Storage	-20 to 60°C
Transport	-20 to 60°C
Relative humidity	
Operation	5 to 90%, non-condensing
Storage	5 to 90%, non-condensing
Transport	5 to 90%, non-condensing
Mechanical characteristics	
Dimensions	
Width	34 mm
Height	34 mm
Depth	60 mm
Weight	59 g

Table 3: 5E9030.29 - Technical data

2.3 Views

Figure 1: 5E9030.29 - Oblique view

Figure 2: 5E9030.29 - Rear view

2.4 Dimensions
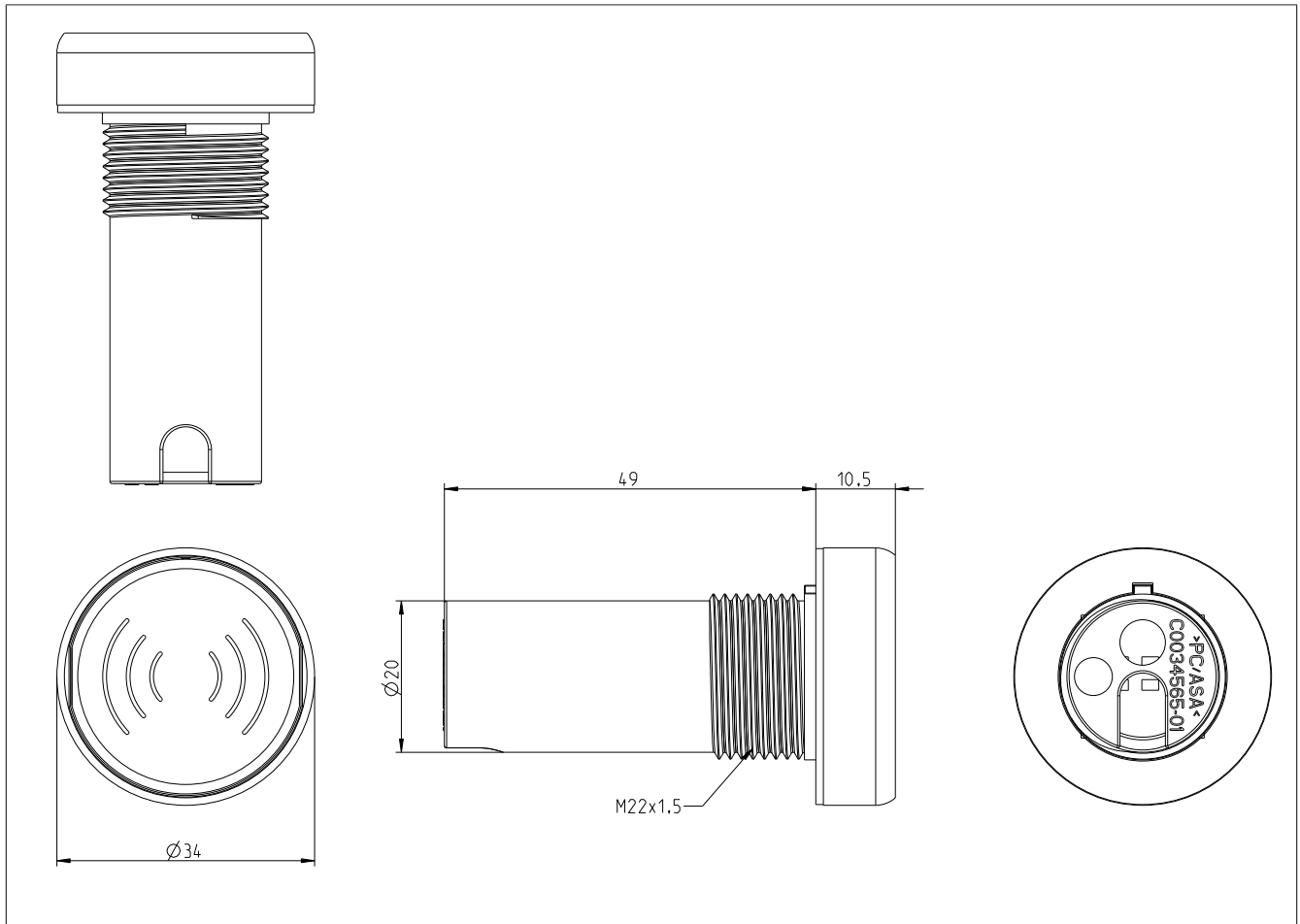
Figure 3: 5E9030.29 - Dimensions

2.5 Panel overlay design

Color description:

▬	= PANTONE 432 C
▭	= PANTONE 427 C

Important:
This image is not a true representation of the colors used on the panel ove
The actual colors may vary slightly.
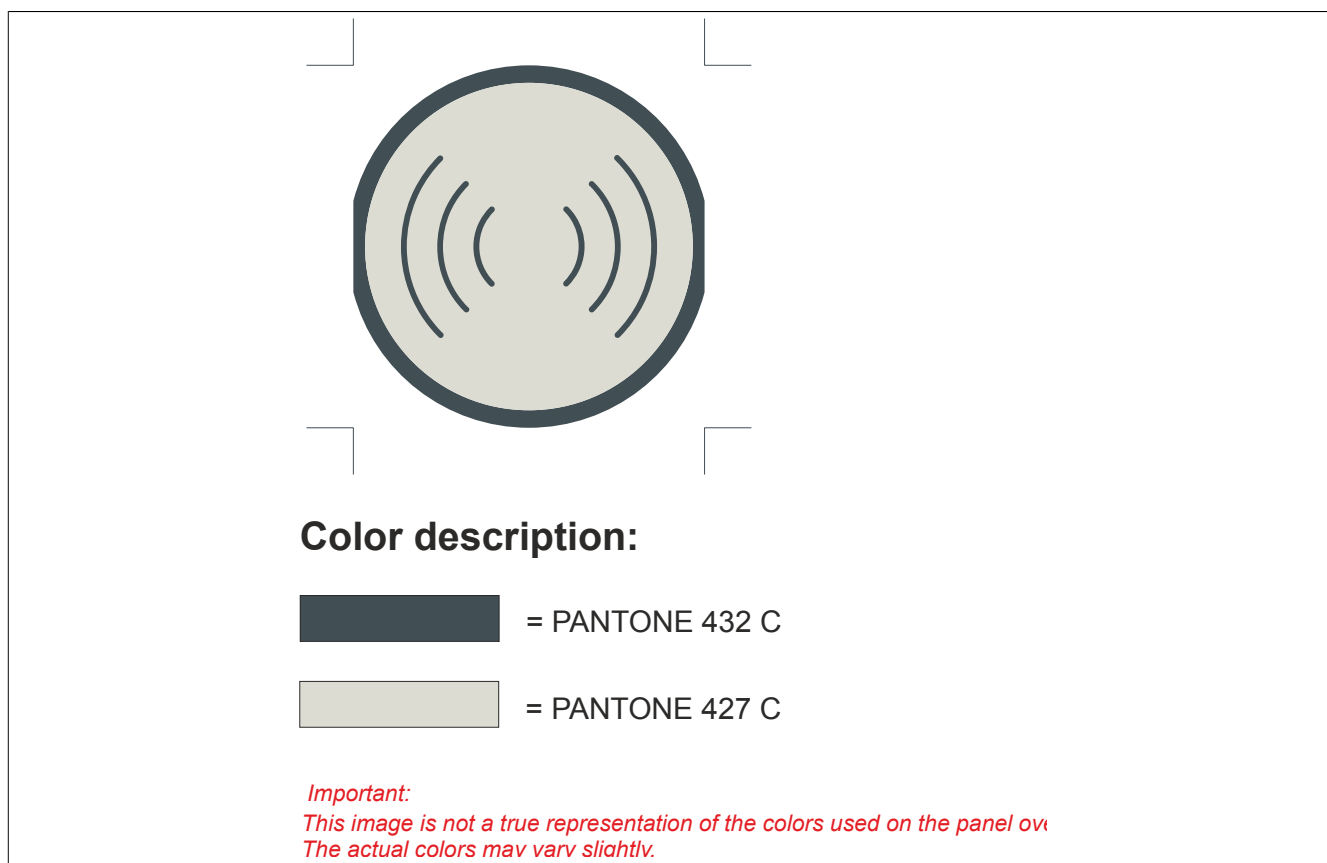
Figure 4: 5E9030.29 - Panel overlay design

3 Commissioning

3.1 Connection

The reader can be used on any conventional type A USB interface that fulfills the specifications listed in the "5E9030.29 - Technical data".

3.2 Driver installation

The driver for the USB communication device class (CDC) must be installed before you can use the transponder.

After the driver installation, the reader is identified as a serial COMx device.

> **Information:**
>
> **This driver can be downloaded from the B&R website (www.br-automation.com).**

3.3 Port settings

The following port settings are necessary for communication:

Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

3.4 Terminal program

An appropriate terminal program (please note "Port settings") can be used to communicate with the reader. In Windows, the freeware tools RealTerm or TeraTerm can be used, for example.

> **Information:**
>
> **Depending on the configuration of the terminal program, it may be necessary to enable input echoing ("echo_on" command) to see input on the screen.**

3.5 RFID command set

The transponder reads and writes MIFARE and ISO 15693 tags. The corresponding commands and parameters are valid depending on the tag being used. When a tag comes within range of the antenna, the PiccSelect message and serial number of the tag are output. When the tag is removed, the PiccRemove message and serial number of the tag are output.

```
*********************************
********* SW_ResetSTART **********
** Mifare **
** B&R Automation **
** S/W Rev. 0.7 **
**ENTER 'helpme' for information**
*********************************
PiccSelect: 3B7CF4E0
PiccRemove: 3B7CF4E0
```

1. "Command syntax" command

2. The executed command in plain text

3. Response

`read,a,ff ff ff ff ff ff,5`

"read" command: Data in block 5 in HEX=000000000000000000000000000000000

"Error: <ErrorNumber> (error syntax)"

There is a difference between operating errors and RFID stack error messages. See section "Error codes".

4 Commands

4.1 General commands

Command	Description	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Info_On	Outputs command confirmation	--	--	--	--	--
Info_Off	Does not output command confirmation (default)	--	--	--	--	--
Show_Config	Displays current settings	--	--	--	--	--
Show_Revision	Displays software and hardware revision information	--	--	--	--	--
Show_Status	Displays the RFID stack error	--	--	--	--	--
Show_SN	Displays the active tag number	--	--	--	--	--
Show_Key	Displays the active key	--	--	--	--	--
Echo_On	Displays an input echo for the output	--	--	--	--	--
Echo_Off	Suppresses the input echo for the output (default)	--	--	--	--	--
Startup	Displays the startup message	--	--	--	--	--
Life	Life command --> Returns OK	--	--	--	--	--
Helpme	Displays a list of all commands	--	--	--	--	--
Show_Error	Shows error details	--	--	--	--	--
Restart	Restarts the reader	--	--	--	--	--

Table 4: General commands

4.2 Upgrade commands

Command	Description	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Firmware_Upgrade	Switches the transponder reader to USB mass memory update mode	--	--	--	--	--
Firmware_Info	Displays information about the current firmware	--	--	--	--	--

Table 5: Update commands

4.2.1 Upgrade procedure

The following are necessary in order to upgrade the device firmware:

- Exclusive connection to the USB transponder reader
- Firmware file (e.g. firmware_0.80.bin)
- Terminal program with active connection to the transponder reader (see "Commissioning")
- Direct access to the USB port is an advantage (reconnection).

Procedure in Windows:

1 Enter the command "Firmware_Upgrade" to put the transponder reader in upgrade mode.
2 Depending on the Windows system settings, the transponder reader will automatically be registered as a USB mass storage device.
3 A new drive will appear in Windows Explorer (e.g. D:\).
4 Open the new drive in Windows Explorer.
5 Delete the firmware.bin file located there.
6 Copy the new firmware file (e.g. firmware_80.bin) to the drive.
7 The transponder reader should now be modified by the new firmware.
8 Restart the transponder reader to complete the upgrade procedure. This is possible by disconnecting and reconnecting the USB cable or simply switching the device off and back on again.
9 After restarting, you can check the firmware version with the "show_revision" or "firmware_info" command.

5 MIFARE

5.1 MIFARE commands

Command	Description	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Read	Reads a 16-byte block from PICC	"A" or "B"	See table Access rights (parameter 2)	Source block	--	--
Read_Blocks	Reads the specified range of blocks from PICC	"A" or "B"	See table Access rights (parameter 2)	Starting block	Ending block	--
Write	Writes a 16-byte block to PICC	"A" or "B"	See table Access rights (parameter 2)	Destination block	16-byte data in hex 00h	--
Decr	Takes the value of the source value block, subtracts the specified value and writes the result to the destination block	"A" or "B"	See table Access rights (parameter 2)	Source block	Destination block	Value
Incr	Takes the value of the source value block, adds the specified value and writes the result to the destination block	"A" or "B"	See table Access rights (parameter 2)	Source block	Destination block	Value
Restore	Copies a value block	"A" or "B"	See table Access rights (parameter 2)	Source block	Destination block	--
InitZero	Initializes a value block with the value 0	"A" or "B"	See table Access rights (parameter 2)	Destination block	--	--
Store_Key_EEPROM	Stores a 6-byte key in EEPROM	"A" or "B"	Sector for key in reader's EEPROM	6-byte key		
Store_Key_Temp	Stores a 6-byte key in the transponder reader temporarily until switched off	6-byte key	--	--	--	--
Connect	Connects manually to a specific tag	4-byte SNr	--	--	--	--
Disconnect	Automatically restores a connection to the best tag	--	--	--	--	--
Key_CMD	Sends a key directly with each command (default)	--	--	--	--	--
Key_EEPROM	Uses the key from EEPROM	--	--	--	--	--
Key_TEMP	Uses the temporary key	--	--	--	--	--

Table 6: MIFARE commands

5.2 Authentication

The keys needed for authentication can be stored either in EEPROM or temporarily in the transponder. Alternatively, the authentication keys can be transferred with the command.

The Key_EEPROM, Key_TEMP and Key_CMD commands are used to set the storage location or to send the authentication keys.

The following commands are used to store the authentication key in the transponder.

MIFARE commands - Authentication key storage					
Command	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Store_key_eeprom	"A" or "B"	Sector for key in reader's EEPROM	6-byte key	--	--
Store_key_temp	6-byte key	--	--	--	--

Table 7: MIFARE commands - Authentication key storage

```
store_key_eeprom,a,0,ff ff ff ff ff ff
```

"store_key_eeprom" command: The key is written to EEPROM sector 0.

Default key (when tags are delivered): 0xFF FF FF FF FF FF

Up to 16 keys (0 to 15) can be stored in EEPROM for each key (A and B).

5.3 Access rights and memory organization

The tag is divided into 16 sectors of 4 blocks each. Each block contains 16 bytes. The 4th block in each sector contains the keys and access rights for the respective sector (sector trailer). Access rights can be assigned individually to each block. Each sector can be assigned one of two different keys (A or B).

These keys and access rights must be stored in a defined format (according to the MIFARE specification). To change these access rights, use the "write" command to write to the respective sector trailer in the proper format.

This documentation will not go into further detail with regard to memory organization and access right of tags. For more information, please see data sheet "MIFARE Standard Card IC MF1 IC S50 Functional Specification".

5.4 Value block

A block can be used as a value block. A value block is a signed 4-byte value. With each command (read, increment, decrement, restore), the tag automatically increments/decrements the value without requiring the value to be read. In order to use a block as a value block, it must adhere to a defined format.

This documentation will not go into further detail with regard to the value blocks of tags. For more information, please see the PDF file "MIFARE Standard Card IC MF1 IC S50 Functional Specification".

5.5 Access rights

There are various options for parameter 2 depending on the configuration.

MIFARE access rights (parameter 2)			
Config	Key_CMD	Key_EEPROM	Key_TEMP
Para2	6-byte key	Sector for key in reader's EEP-ROM	Uses the temporarily stored key: Dummy value (0-63)

Table 8: MIFARE access rights (parameter 2)

"A" = Authentication with key A, "B" = Authentication with key B

Sector = 0-63

Source and target block = 0-254 (depends on type: 0-63 for MIFARE 1K, 0-254 for MIFARE 4K;

for "Decrement", "Increment" and "Restore", the source block must be a value block)

Data and key = 00- FF (no leading "0x", bytes can optionally be separated by a space)

Value = 4 bytes including sign bit

All commands and parameters are in ASCII. Data is in 00h hex format.

Para1	Para2	Para3	Para4	Para5
Block (typically 3 - sector trailer)	Access rights for block 0 (data block)	Access rights for block 1 (data block)	Access rights for block 2 (data block)	Access rights for block 3 (sector trailer)

Table 9: MIFARE access rights (5-byte parameters)

Value	RD	WR	INCR	DECREMENT / TRANSFER / RESTORE	Comment
0x00	A / B	A / B	A / B	A / B	Full access with every key (default factory setting)
0x01	A / B	B	-	-	
0x02	A / B	-	-	-	
0x03	A / B	B	B	A / B	Value block
0x04	A / B	-	-	A / B	Value block
0x05	B	-	-	-	
0x06	B	B	-	-	
0x07	-	-	-	-	No access

Table 10: MIFARE access rights - Parameters 2, 3 and 4 (data blocks)

If key B is read in the corresponding sector trailer, it cannot be used for authentication (all of the yellow rows in the table above).

Consequences: When the reader attempts to authenticate a block in a sector with Key B (access conditions marked in gray), then the card will refuse all subsequent memory access following the authentication.

Value	Key A		Access bits		Key B		Comment
	RD	WR	RD	WR	RD	WR	
0x00	-	A	A	-	A	A	Key B can be read.
0x01	-	B	A / B	-	-	B	
0x02	-	-	A	-	A	-	Key B can be read.
0x03	-	-	A / B	-	-	-	No access
0x04	-	A	A	A	A	A	Key B can be read (factory default).
0x05	-	-	A / B	B	-	-	
0x06	-	B	A / B	B	-	B	
0x07	-	-	A / B	-	-	-	No access

Table 11: MIFARE access rights - Parameter 5 (sector trailer)

The rows marked in yellow are access conditions where key B can be read and used for data.

5.6 MIFARE commands - Examples

```
write,a,0,5,0123456789ABCDEF0123456789ABCDEF
```

Response:

```
Command write ->
Data in sector 1 Block 5 written=0123456789ABCDEF0123456789ABCDEF
read,a,0,5
```

Response:

```
Command read ->
Data in block 5 in HEX=0123456789ABCDEF0123456789ABCDEF
Initzero,a,0,8
```

Response:

```
Command initzero ->
Data in sector 2 Block 8 written=00000000FFFFFFFF0000000000FF00FF
Incr,a,0,8,8,2
```

Response:

```
Command incr ->
Block 008 successful by 0000000002 incremented and written to block 008
read,a,ff ff ff ff ff ff,5
```

Response:

```
Command read ->
Data in Block 5 in HEX=FFFF0000000000000000000000000000
connect,0b a1 78 98
```

Response:

```
Command connect ->
***************INFO***************
Key_mode = Key_eeprom
Info_text = Info_on
Tag_connected = Manual_mode
Tag_sn = 0BA17898
***********END_OF_INFO************
read_blocks,a,0,0,3
```

Response:

```
Command read_blocks ->
Data in block 0 in HEX=3B7CF4E05388040046B9949745302809
Data in block 1 in HEX=00000000000000000000000000000000
Data in block 2 in HEX=00000000000000000000000000000000
Data in block 3 in HEX=000000000000FF078069FFFFFFFFFFFF
```

6 ISO15693

6.1 ISO 15693 commands

Command	Description	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Read	Reads a 4-byte block from PICC	Flags (flag)	Source block	--	--	--
Read_Blocks	Reads the specified range of blocks from PICC	Flags (flag)	Starting block	Ending block	--	--
Write	Writes a 4-byte block to PICC	Flags (flag)	Destination block	4-byte data in hex 00h	--	--
Sys_Info	Reads the AFI, DSFID, number of bytes and bytes/block	Flags (flag)	--	--	--	--
Security	Displays the write protection status of individual blocks	Flags (flag)	Starting block	Ending block	--	--
Set_AFI	Writes the AFI value	Flags (flag)	1-byte value	--	--	--
Set_DSFID	Writes the DSFID value	Flags (flag)	1-byte value	--	--	--
Lock_Block	Enables write protection for a block	Flags (flag)	Target block	--	--	--
Lock_AFI	Sets AFI write protection	Flags (flag)	--	--	--	--
Lock_DSFID	Sets DSFID write protection	Flags (flag)	--	--	--	--
Connect	Connects manually to a specific tag	8-byte SNr	--	--	--	--
Disconnect	Automatically restores a connection to the best tag	--	--	--	--	--
Inventory	Reads the UID and DSFID from the PICC	Flags (flag)	AFI (afi)	Bit length (bitlength)	Mask (mask)	
Stay_Quiet	PICC enters quite mode	Flags (flag)	Serial number (sn)	--	--	--
Reset_To_Ready	PICC exits quiet mode	Flags (flag)	Serial number (sn)	--	--	--
Reset_Quiet	All PICCs exit quiet mode	--	--	--	--	--

Table 12: ISO 15693 commands

Information:

For more information about flags, see "Flag definitions".

6.2 Memory organization

Source and destination block = 0 to 254 (depends on the tag)

Data and key = 00 to FF (no leading "0x", bytes can optionally be separated by a space)

Value = 1 bytes including sign bit

All commands and parameters are in ASCII. Data is in 00h hex format.

6.3 Flag definitions

Request flag bits 1 to 4			
Bit	**Flag name**	**Value**	**Description**
b1	Subcarrier flag	0	A single subcarrier is used by the flag.
		1	Two subcarriers are used by the flag.
b2	Data rate flag	0	Low data rate
		1	High data rate
b3	Inventory flag	0	The function of flags 5 to 8 is listed in the following tables ("Request flag bits 5 to 8 when inventory flag is NOT set").
		1	The function of flags 5 to 8 is listed in the following tables (Request flag bits 5 to 8 when inventory flag IS set).
b4	Protocol extension flag	0	No protocol format extension
		1	Extended protocol format. Reserved for future use.

Table 13: Request flag bits 1 to 4

Request flag bits 5 to 8 when inventory flag is NOT set			
Bit	**Flag name**	**Value**	**Description**
b5	Select flag	0	Request executed by any tag according to the *Address flag* setting
		1	Request executed only by tag in selected state. *Address flag* is set to 0, and the UID field is not included in the request.
b6	Address flag	0	Request not addressed. The UID field is not included. It can be executed by any tag.
		1	Request addressed. The UID field is included. It is executed only by the tag whose UID matches the UID specified in the request.
b7	Option flag	0	Function defined by the command description. Set to 0 if not otherwise defined by the command.
		1	Function defined by the command description
b8	RFU	0	Reserved for future use

Table 14: Request flag bits 5 to 8 when inventory flag is NOT set

Request flag bits 5 to 8 when inventory flag IS set			
Bit	Flag name	Value	Description
b5	AFI flag	0	AFI field not present
		1	AFI field present
b6	Nb_slots_flag	0	16 slots
		1	1 slot
b7	Option flag	0	Function defined by the request description. Set to 0 if not otherwise defined by the request.
		1	Function defined by the request description.
b8	RFU	0	Reserved for future use

Table 15: Request flag bits 5 to 8 when inventory flag IS set

6.4 ISO 15693 commands - Examples

6.4.1 Inventory

flags [hex]:

0x02 = High data rate

0x04 = Inventory

0x10 = AFI value is set

0x20 = Single slot

afi [dec]:

AFI value if 0x10 set in the flags

bitlength [dec]:

Bit length of the subsequent UID mask. A maximum bit length of 60 is permitted for 16 slots; a bit length of 64 is permitted for one slot. The length of the subsequent mask is derived from this parameter.

mask [hex]:

UID mask for the inventory command - 1 to 8 bytes. If the bit length is "0", then a byte ("00") must be transmitted.

INFORMATION:

The UID of an ISO 15693 transponder is output in reverse byte order.

Inventory examples:

```
Inventory,06,0,0,0  \\ Inventory with high data rate, 16 slots, no AFI value
Inventory,16,3,0,0  \\ Inventory with high data rate, 16 slots, AFI value "3"
Inventory,26,0,0,0  \\ Inventory with high data rate, 1 slot, no AFI value
```

Inventory - Response:

```
1-byte DSFID value, 8-byte UID - slot 1
1-byte DSFID value, 8-byte UID - slot 2
...
...
1-byte DSFID value, 8-byte UID - slot 16
```

If 0x20 is set as a flag, then only the entry from slot 1 is valid. All other slots return "0".

6.4.2 Reset_To_Ready

Reset_To_Ready

flags (hex), sn [hex]: 8-byte UID of tag

The filter for the tag is set, and the tag is disconnected.

6.4.3 Stay_Quiet

Stay_Quiet

flags (hex), sn [hex]: 8-byte UID of tag

The filter of the tag is reset and reappears with the inventory command.

6.4.4 Reset_Quiet

Reset_Quiet

This command resets ALL filters that were set previously with Stay_Quiet.

7 Error codes

7.1 Error messages and error numbers

Operating errors		
Value	Name	Description
0	ERR_NONE	No errors (OK)
1	ERR_OTHER	Miscellaneous operating error, unrecognized command
2	ERR_PARAMETER	Incorrect number of parameters
3	ERR_AUTH	Authentication error (A or B)
4	ERR_SECTOR	Invalid range for sector (0-63)
5	ERR_BLOCK_SRC	Invalid range for source block (0-255)
6	ERR_WRITE	No data found for writing
7	ERR_KEY_EE	No key found for writing
8	ERR_KEY_STORE	Could not save key
9	ERR_BLOCK_DST	Invalid range for destination block (0-255)
10	ERR_NO_TAG	No tag in range
11	ERR_BLOCK_NUM	Incorrect values for source/destination blocks
12	ERR_TAG_NUM	Invalid tag number
13	ERR_KEY	Invalid key
14	ERR_REMOTE	X-modem firmware update canceled (not used)
15	ERR_SYNC	X-modem firmware update packet start not found (not used)
16	ERR_RETRY	X-modem firmware update number of retry attempts (not used)
17	ERR_READ	Could not read data
18	ERR_INCDECRES	Error accessing value block
19	ERR_LOCK	Could not lock block
20	ERR_AFI	Error writing AFI value
21	ERR_DSFID	Error writing DSFID value
22	ERR_SYSINFO	Could not read system information
23	ERR_INVENTORY	Could not execute inventory command due to incorrect parameter (value) or internal RFID stack error
24	ERR_STAY_QUIET	Could not set specified ISO tag to STAY_QUIET (no longer accessible)
25	ERR_RESET2READY	Could not set specified ISO tag to READY (after a preceding STAY_QUIET)

Table 16: Operating errors

Error codes

RFID stack errors can be queried using the "show_status" command. Each error number consists of a high byte (stack components) and a low byte (errors). The "show_error" command allows the error to be evaluated in detail. (For example: ISO 15693 error codes, see "Response flags and error codes".)

Error messages - RFID stack LOW byte		
Value	**Name**	**Description**
0xXX00	PH_ERR_SUCCESS	Returned if no error
0xXX71	PH_ERR_SUCCESS_CHAINING	Rx chaining not complete, further action needed
0xXX72	PH_ERR_SUCCESS_INCOMPLETE_BYTE	Incomplete byte received
0xXX01	PH_ERR_IO_TIMEOUT	No reply received, e.g. PICC removal
0xXX02	PH_ERR_INTEGRITY_ERROR	Wrong CRC or parity detected
0xXX03	PH_ERR_COLLISION_ERROR	Collision occurred
0xXX04	PH_ERR_BUFFER_OVERFLOW	Attempt to write beyond buffer size
0xXX05	PH_ERR_FRAMING_ERROR	Invalid frame format
0xXX06	PH_ERR_PROTOCOL_ERROR	Received response violates protocol
0xXX07	PH_ERR_AUTH_ERROR	Authentication error
0xXX08	PH_ERR_READ_WRITE_ERROR	Read or write error in RAM/ROM or flash memory
0xXX09	PH_ERR_TEMPERATURE_ERROR	RC sensors signaling overheating
0xXX0A	PH_ERR_RF_ERROR	Error on RF interface
0xXX0B	PH_ERR_INTERFACE_ERROR	RC communication error
0xXX0C	PH_ERR_LENGTH_ERROR	Length error
0xXX7F	PH_ERR_INTERNAL_ERROR	Internal error
0xXX20	PH_ERR_INVALID_DATA_PARAMS	Invalid data parameters supplied (layer ID check failed)
0xXX21	PH_ERR_INVALID_PARAMETER	Invalid parameter supplied
0xXX22	PH_ERR_PARAMETER_OVERFLOW	Reading/Writing a parameter would produce an overflow
0xXX23	PH_ERR_UNSUPPORTED_PARAMETER	Parameter not supported
0xXX24	PH_ERR_UNSUPPORTED_COMMAND	Command not supported
0xXX25	PH_ERR_USE_CONDITION	Condition of use not satisfied
0xXX26	PH_ERR_KEY	Key error
0xXX80	ISO15693_ERROR	See "Response flags and error codes".
0xXX80	MIFARE	NAK 0
0xXX81	MIFARE	NAK 1
0xXX82	MIFARE	NAK 4
0xXX83	MIFARE	NAK 5

Table 17: Error messages - RFID stack LOW byte

Value	Name	Description
Error messages - RFID stack HIGH byte		
0x00XX	PH_COMP_GENERIC	Generic component code
0x01XX	PH_COMP_BAL	BAL component code
0x02XX	PH_COMP_HAL	HAL component code
0x03XX	PH_COMP_PAL_ISO14443P3A	ISO 14443-3A PAL component code
0x04XX	PH_COMP_PAL_ISO14443P3B	ISO14443-3A PAL component code
0x05XX	PH_COMP_PAL_ISO14443P4A	ISO 14443-4A PAL component code
0x06XX	PH_COMP_PAL_ISO14443P4	ISO 14443-4 PAL component code
0x07XX	PH_COMP_PAL_MIFARE	MIFARE(R) PAL component code
0x08XX	PH_COMP_PAL_FELICA	Open FeliCa PAL component code
0x09XX	PH_COMP_PAL_EPCUID	ICode EPC/UID PAL component code
0x0AXX	PH_COMP_PAL_SLI15693	ICode SLI/ISO 15693 PAL component code
0x0BXX	PH_COMP_PAL_I18000P3M3	ISO 18000-3 Mode3 PAL component code
0x0CXX	PH_COMP_PAL_I18092MPI	ISO18092 passive initiator mode PAL component code
0x10XX	PH_COMP_AL_MFC	MIFARE(R) Classic AL component code
0x11XX	PH_COMP_AL_MFUL	MIFARE(R) Ultralight AL component code
0x12XX	PH_COMP_AL_MFP	MIFARE(R) Plus AL component code
0x13XX	PH_COMP_AL_VCA	Virtual Card Architecture AL component code
0x14XX	PH_COMP_AL_FELICA	Open FeliCa AL component code
0x15XX	PH_COMP_AL_I15693	ISO 15693 AL component code
0x16XX	PH_COMP_AL_SLI	ICode SLI AL component code
0x18XX	PH_COMP_AL_I18000P3M3	ISO 18000-3 Mode3 AL component code
0x19XX	PH_COMP_AL_MFDF	MIFARE DESFIRE EV1 AL component code
0x1AXX	PH_COMP_AL_P40CMDPRIV	P40 command libraryAL component code
0x1BXX	PH_COMP_AL_P40CMDPUB	P40 command libraryAL component code
0x30XX	PH_COMP_DL_AMP	Amplifier DL component code
0x31XX	PH_COMP_DL_THSTRM	Thermostream DL component code
0x32XX	PH_COMP_DL_OSCI	Oscilloscope DL component code
0x33XX	PH_COMP_DL_RDFPGA	Reader FPGA Box DL component code
0x34XX	PH_COMP_DL_MSTAMPOSC	Master Amplifier Oscilloscope DL component code
0x35XX	PH_COMP_DL_STEPPER	Stepper DL component code
0xE0XX	PH_COMP_CIDMANAGER	Cid Manager component code
0xE1XX	PH_COMP_CRYPTOSYM	CryptoSym component code
0xE2XX	PH_COMP_KEYSTORE	KeyStore component code
0xE3XX	PH_COMP_TOOLS	Tools component code
0xE4XX	PH_COMP_CRYPTORNG	CryptoRng component code
0xEFXX	PH_COMP_LOG	Log component code

Table 18: Error messages - RFID stack HIGH byte

Bit	Flag name	Value	Description
Response flags			
b1	Error flag	0	No error
		1	Error detected. The error code is in the error field response.
b2	RFU	0	Reserved for future use
b3	RFU	0	Reserved for future use
b4	Extension flag	0	High data rate
		1	Extended protocol format. Reserved for future use
b5	RFU	0	Reserved for future use
b6	RFU	0	Reserved for future use
b7	RFU	0	Reserved for future use
b8	RFU	0	Reserved for future use

Value	Description
Error codes	
01	Request not supported, i.e. request code not recognized
02	Request code not recognized, e.g. format error
03	Request option not supported
0F	Error with no information given or specific error code not supported
10	Specified block not available (does not exist)
11	Specified block already locked, cannot be locked again
12	Specified block locked, content cannot be changed
13	Specified block not programmed successfully
14	Specified block not locked successfully
A0 - DF	Custom request error codes
All others	Reserved for future use

Table 19: Response flags and error codes

8 Standards and certifications

8.1 Standards and guidelines

8.1.1 CE mark

Product complies with all applicable directives and their harmonized EN standards.

8.1.2 EMC directive

These devices meet the requirements of EC directive "2004/108/EC Electromagnetic compatibility" and are designed for the following areas:

EN 61131-2:2007	Programmable logic controllers - Part 2: Equipment requirements and tests
EN 61000-6 -2:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6 -4:2007	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

8.1.3 Low voltage directive

These devices satisfy the requirements of EC directive "2006/95/EC Low voltage directive" and are designed for the following areas:

EN 61131-2:2007	Programmable logic controllers - Part 2: Equipment requirements and tests
EN 60204-1:2006 + A1:2009	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

The low voltage directive applies to equipment that can be used with a nominal voltage between 50 and 1000 VAC and between 75 and 1500 VDC.

8.2 Certifications

> **Danger!**
>
> **A complete system can only receive certification if ALL of the individual components it includes have the applicable certifications. If an individual component is being used that DOES NOT have an applicable certification, then the complete system WILL NOT receive certification.**

B&R products and services comply with applicable standards. This includes international standards from organizations such as ISO, IEC and CENELEC, as well as national standards from organizations such as UL, CSA, FCC, VDE, ÖVE, etc. We are committed to ensuring the reliability of our products in an industrial environment.

Unless otherwise specified, the following certifications apply:

> **Information:**
>
> **Currently applicable certifications are listed on the device's serial number label.**

8.2.1 FCC and IC

B&R products satisfy EMC requirements for operation in the USA and Canada and are compliant with FCC and IC regulations. Corresponding "Radio Frequency Interference Statements" for the USA and Canada:

USA:
Federal Communications Commission (FCC)

This device complies with Part 15 of the FCC Rules and with Industry Canada licenseexempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canada:
Industry Canada (IC)

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

If products are also equipped with an RFID read/write unit, it must be approved for operation in the USA and Canada. These types of products are identified by a sticker with "Contains FCC ID:" and "Contains IC ID:" on the RFID read/write unit. In addition to the additional sticker for products with an RFID read/write unit, the requirements below also apply.

Information:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Information:

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

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

Figure index