

IPT-*-R4-V1

**RFID Read/Write Devices,
RS-485, 125 kHz**

Manual



Your automation, our passion.

 **PEPPERL+FUCHS**

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1	Introduction	5
1.1	Content of this Document	5
1.2	Target Group, Personnel	5
1.3	Intended Use	5
1.4	Symbols Used	6
1.5	Terms and Abbreviations	7
2	Certificates and approvals.....	8
2.1	General	8
2.2	CE Marking	8
3	Product Description	9
3.1	Product Description	9
3.2	Dimensions.....	11
3.3	Indicators.....	12
3.4	Electrical Connection	12
3.5	Accessories.....	13
3.5.1	RFID Tags	13
3.5.2	Connection Cable	13
4	Installation.....	14
4.1	Storage and Transportation	14
4.2	Unpacking	14
4.3	Mounting.....	14
4.4	Minimum Distances	15
5	Commissioning and Operation	16
5.1	Definitions	16
5.1.1	Display	16
5.1.2	Legend	16
5.2	125 kHz ISO/IEC 18000-2 Tags.....	17
5.3	Command Overview	18
5.4	System Commands.....	19
5.5	Read/Write Commands	21
5.6	IPC03 Configuration Commands.....	22
5.6.1	IPC03 Password Mode	24
5.7	Write Fixcode	25

6 **Appendix.....26**

6.1 **Error and Status Messages26**

6.2 **ASCII table27**

1 Introduction

1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.



Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com/device-information.

The documentation consists of the following parts:

- Present document
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Functional safety manual
- Cybersecurity documentation
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Intended Use

Always operate the device as described in these instructions. Only in this way, the safe function of the device and the connected systems is guaranteed.

The protection of operating personnel and plant is only given if the device is used in accordance with its intended use.

1.4 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note

This symbol brings important information to your attention.



Tip

This symbol brings an useful tip to your attention.



Example

This symbol provides an example of the issue described.



Action

1. This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

1.5 Terms and Abbreviations

Terms

Tag	Mobile data carrier containing user data and a unique number
Fixed code	Unique and unalterable number of a tag
IPC	Pepperl+Fuchs-specific designation of tags with 125 kHz
ISO/IEC 18000-2	Standard for data transmission for a 125 kHz RFID system
Tag	Read/write tag; tag

Abbreviations

FCC	F ederal C ommunications C ommission
LF	L ow F requency
IC	I ndustry C anada
ISO	I nternational S tandardisation O rganisation
RFID	R adio F requency I dentification
PLC	P rogrammable L ogic C ontroller
UID	U nique I tem I dentifier

2 Certificates and approvals

2.1 General

This manual applies to several types and variants of the device. The applicable approvals can be found in the relevant data sheet for your device. Further approvals are available on request.

2.2 CE Marking

This product was developed and manufactured in line with the applicable European standards and directives.



Note

A Declaration of Conformity can be requested from the manufacturer or downloaded from www.pepperl-fuchs.com.

3 Product Description

3.1 Product Description

Use and Application

The read/write devices are designed for reading and writing passive tags in the 125 kHz frequency range in accordance with the ISO/IEC18000-2 standard. The read/write devices have a serial RS-485 interface.



Figure 3.1 IPT-18GM-R4-V1



Figure 3.2 IPT-30GM-R4-V1



Figure 3.3 IPT-F61-R4-V1



Figure 3.4 IPT-FP-R4-V1

3.2 Dimensions

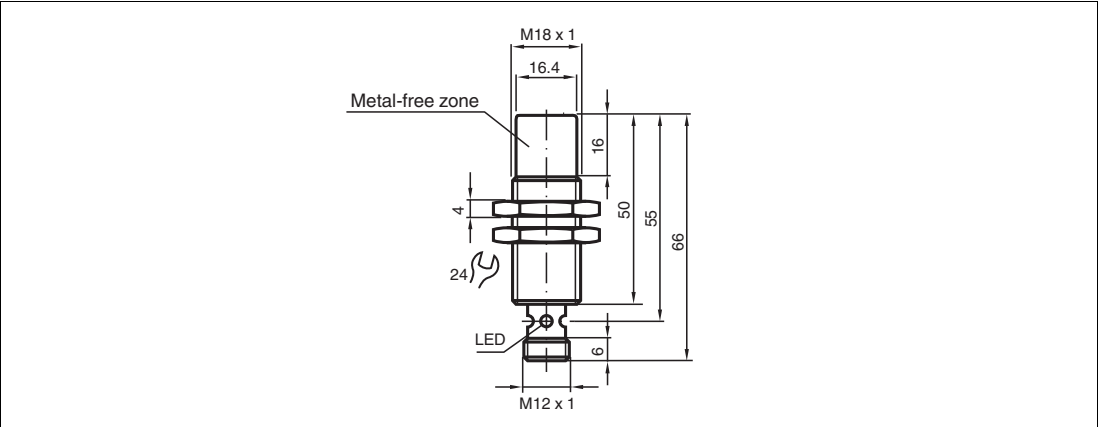


Figure 3.5 IPT-18GM-R4-V1

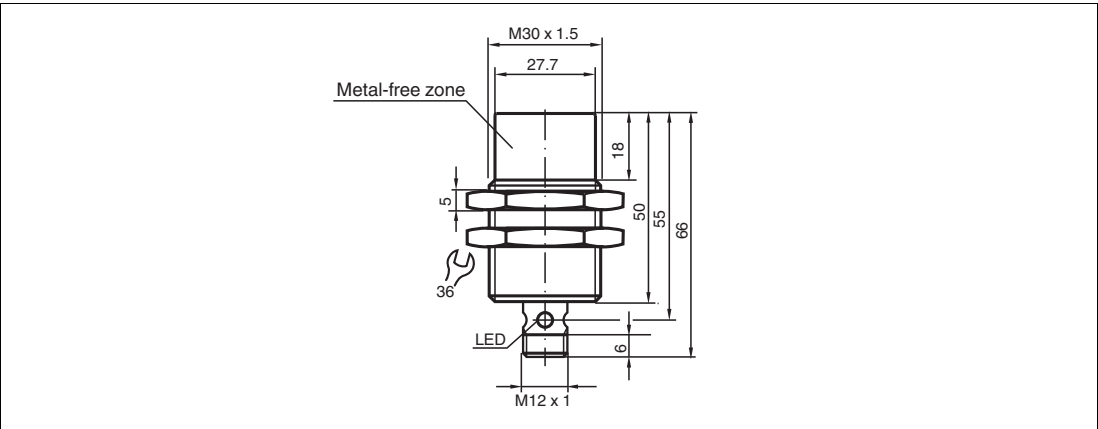


Figure 3.6 IPT-30GM-R4-V1

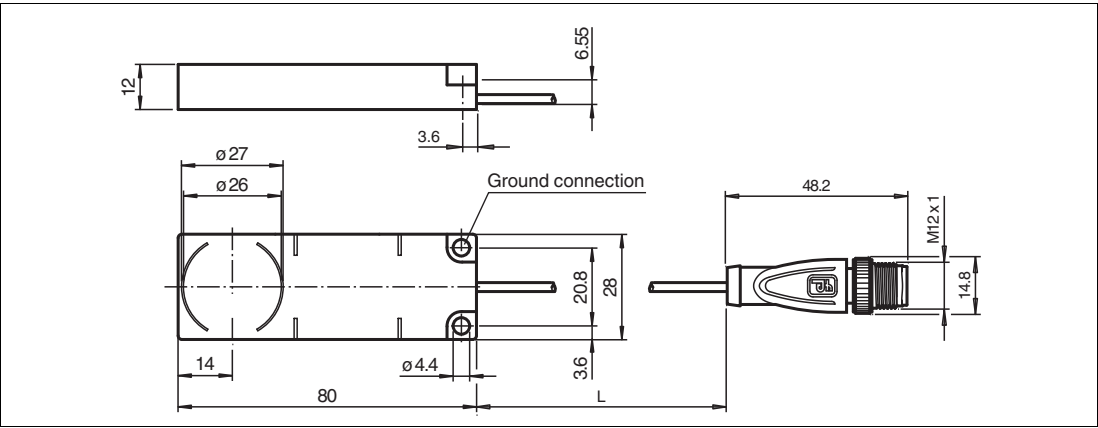


Figure 3.7 IPT-F61-R4-V1

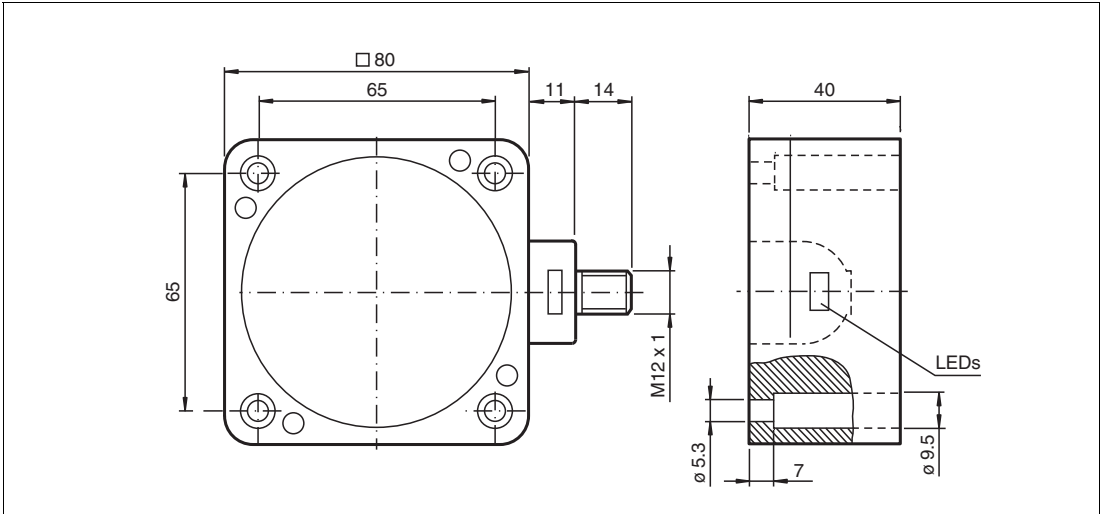


Figure 3.8 IPT-FP-R4-V1

3.3 Indicators

The RFID read/write devices IPT-18GM-R4-V1, IPT-30GM-R4-V1 and IPT-FP-R4-V1 have a dual LED for displaying operating and status information. The various indicators denote:

LED	Description
Green	On: power on Flashing: Read/write attempt performed
Yellow	On: data carrier detected

3.4 Electrical Connection

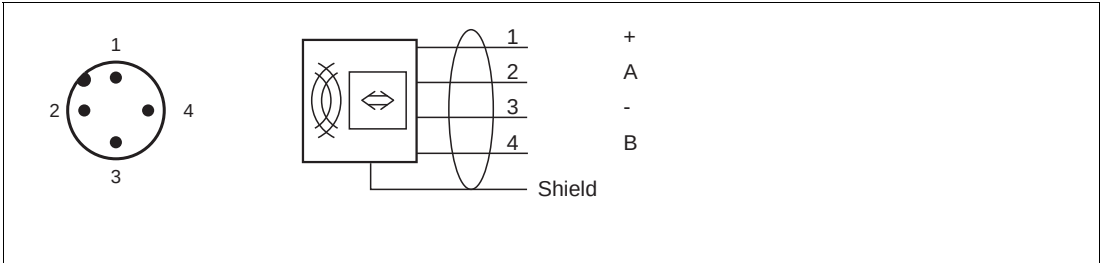


Figure 3.9

The read/write devices are connected via an M12 x 1 connector.

After connecting the supply voltage, the green LED on the device lights up. If the LED does not light up on the device, the voltage supply is not connected correctly.

3.5 Accessories

3.5.1 RFID Tags

The read/write devices can access any RFID tag that is compliant with the ISO/IEC 18000-2 standard. For an overview of possible RFID tags, see chapter 5.2. A selection of available RFID tags from Pepperl+Fuchs can be found online at www.pepperl-fuchs.com on the product page for the respective read/write device.

3.5.2 Connection Cable

Compatible shielded connection cables are available for connecting the read/write devices. A selection of available connection cables from Pepperl+Fuchs can be found online at www.pepperl-fuchs.com on the product page for the respective read/write device.

4 Installation

4.1 Storage and Transportation

Keep the original packaging. Always store and transport the device in the original packaging.

Store the device in a clean and dry environment. The permitted ambient conditions must be considered, see datasheet.

4.2 Unpacking

Check the product for damage while unpacking. In the event of damage to the product, inform the post office or parcel service and notify the supplier.

Check the package contents against your purchase order and the shipping documents for:

- Delivery quantity
- Device type and version in accordance with the type label
- Any accessories ordered

Retain the original packaging in case you have to store or ship the device again at a later date.

Should you have any questions, please contact Pepperl+Fuchs.

4.3 Mounting



Note

The RFID read/write devices are designed for wall mounting and mounting on brackets indoors.

Mount the read/write device on a flat surface and secure it using only the holes provided on the housing.



Caution!

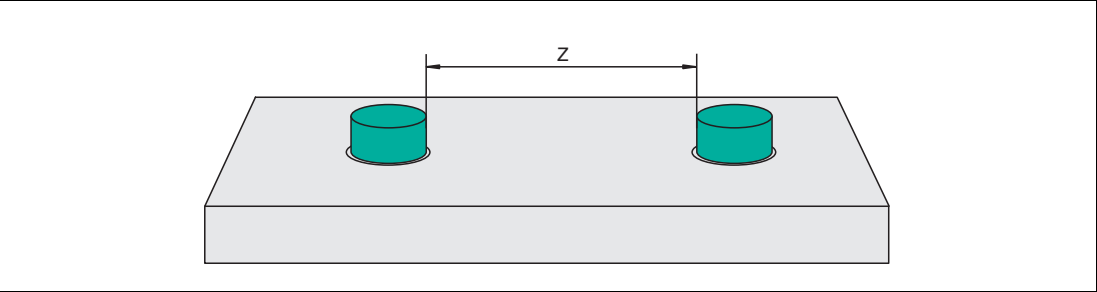
Hot surfaces

Risk of burns when handling the read/write device! After switching off the device, allow it to cool down for at least half an hour before touching it.

Attach the IPT-F61-R4-V1 read/write device with two screws and the IPT-FP-R4-V1 with four screws, inserting them into the housing via the mounting holes provided. Attach the IPT-18GM-R4-V1 and IPT-30GM-R4-V1 read/write devices using suitable mounting material, e.g., nuts or mounting aids.

4.4 Minimum Distances

When mounting several RFID read/write devices next to each other, a minimum distance Z must be observed. This distance prevents the RFID read/write devices from interfering with each other.



Read/write device	Z
IPT-18GM-R4-V1	180
IPT-30GM-R4-V1	270
IPT-F61-R4-V1	290
IPT-FP-R4-V1	550

5 Commissioning and Operation

5.1 Definitions

5.1.1 Display

Angle brackets contain the abbreviated meaning of a command structure, e.g., <Data>

The index _{hex} or .xx denotes a hexadecimal number.

hex_{ASCII} denotes a value in the hexadecimal system, specified in ASCII characters.

Example: 10_{dec} corresponds to A_{hex}; A_{ASCII} corresponds to 41_{hex}. see chapter 6.2

5.1.2 Legend

Name	Meaning
<CHCK>:	1 ASCII character, 8 bit checksum with the addition of all preceding characters, without overrun.
<CR>:	1 ASCII character 13
<Data>:	<WordNum> times 4 octets.
<DeviceNo>:	2 ASCII characters
<ExecCounter>:	'-': No command active 'Ø': Command active, no new read/write tags read or written since last polling. '1': Read/write tag successfully read or written '≥2': Several tags detected in read/write range since last polling. There is a risk that data read has not been transferred!
<ETX>:	1 ASCII character 03
<Status>:	1 ASCII character: '0': Command executed successfully '2': Switch-on message '4': Syntax error in command '5': No read/write tag in detection range '6': Hardware error
<SW-No>:	Application software number
<TagType>:	2 ASCII characters
<Timeout>:	Interface timeout: An error message is sent after this time runs out. 1–3 ASCII characters, in ms.
<WordAddr>:	Word start address in the read/write tag, 4 ASCII characters, range from "0000" to "FFFF" depending on tag type.
<WordNum>:	Number of data blocks to be read or written (each 4 octets), 2 ASCII characters. Range from "01" to "20" depending on tag type (see chapter 5.2).
<ConfAddr>:	1 ASCII character, word startin adress in configuration range of data carrier. The following applies for IPC03: 01h = Protection Word 02h = Control Word

2026-07

Name	Meaning
<FixLen>:	4 bits, length of the read only code in bytes
<FixType>:	2 ASCII characters, for example: '02' for IPC02
<Mode>:	Password mode, 1 ASCII character, 0 = PW-Mode off, 1 = PW-Mode on
<Password>:	4 ASCII characters

5.2 125 kHz ISO/IEC 18000-2 Tags

Parameterization of the associated tag type is recommended to set the RFID read/write device to the tag being used.

On delivery of the RFID read/write device, tag type 02 is preset. The following table shows the tag types specified and recommended for the RFID read/write device

125 kHz ISO/IEC 18000-2 Tag Types

Tag type		P+F designation	Chip type	Access	Writable memory [bits]	Fixcode / UID [bytes]
High byte	Low byte					
'0'	'2'	IPC02	Unique, EM4102 (EM Microelectronic)	Fixcode	-	5
'0'	'3'	IPC03	EM4450 (EM Microelectronic), Titan	R/W, Fixcode	928	4
'1'	'1'	IPC11	Q5 (Sokymat)	R/W	5	-
'1'	'3'	IPC13	NXP Hitag S	R/W, Fixcode	256 / 2048	4

Table 5.1 125 kHz tag types in accordance with ISO/IEC 18000-2



Note

IPC13 tags are not part of the Pepperl+Fuchs product portfolio. As a result, read/write performance data for specific tag geometries is not available.

5.3 Command Overview

The commands in the list are described in detail on the following pages.

System commands

Command name	Command abbreviation	Command description
Version	VE	Reads out the firmware version
Change Tag	CT	Selects the tag type
Quit	QU	Cancels an active enhanced command
Configure Interface	CI	Sets the timeout and the baud rate
Reset	RS	Restarts the device
Command Store	CS	The next command is stored in the nonvolatile memory
Get State	GS	Reads the settings stored in the nonvolatile memory of the read/write device

Read/Write Commands

Reading Data

Command name	Command abbreviation	Command description
Single Read Words	SR	One-time read access to the user memory
Enhanced Buffered Read Words	ER	Permanent read access to the user memory

Writing Data

Command name	Command abbreviation	Command description
Single Write Words	SW	One-time write access to the user memory
Enhanced Buffered Write Words	EW	Permanent write access to the user memory

Read-Only Code

Command name	Command abbreviation	Command description
Single Read Fixcode	SF	One-time read access to the Fixcode (UID)
Enhanced Buffered Read Fixcode	EF	Permanent read access to the Fixcode (UID)

IPC03 Configuration Commands

Command name	Command abbreviation	Command description
Single Write Configuration	SC	One-time write access to the tag configuration
Enhanced Buffered Configuration	EC	Permanent write access to the tag configuration
Single Get Configuration	SG	One-time read access to the tag configuration
Enhanced Buffered Get Configuration	EG	Permanent read access to the tag configuration

2026-07

IPC03 Password Mode

Command name	Command abbreviation	Command description
Password Mode	PM	Activates and deactivates the password mode
Password Set	PS	Sets the password
Password Change	PC	Changes the password

Write fixcode

Commands for the IPC11

Command name	Command abbreviation	Command description
Single Write Fixcode	SX	One-time write access to the Fixcode (UID)
Enhanced Buffered Write Fixcode	EX	Permanent write access to the Fixcode (UID)

5.4

System Commands



Note

Command Syntax

IPT*-R4-V1 RFID read/write devices are set to single-drop mode at the factory. In this mode, the RFID read/write device first executes the respective command and then sends the response. This can take a few seconds, depending on the command.

If your RFID read/write device is not operating in multidrop mode, omit the device address (= <DeviceNo>) from the command.

Example:

Command: <CommandCode><CommandParameters><CHCK><ETX>

Response <Status><Data><CHCK><ETX>

You also have the option of replacing <CHCK><ETX> with #<CR>.

A new command can be sent only after a response to the previous command has been received.

Version (VE)

This command transfers the software version.

Command: VE <CHCK> <ETX>

Response: <Status> (c) P+F IDENT-I
<Type code>
<Part no.>
<SW no.>
<Date> <CHCK> <ETX>

Change Tag (CT)

This command configures the tag type with which the read/write device is communicating. Type "02" is active by default.

Command: CT <TagType> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

For supported read/write tags, see chapter 5.2.

Quit (QU)

All active enhanced-buffered read or write commands are canceled.

Command: QU <CHCK> <ETX>
 Response: <Status> <CHCK> <ETX>

Configure Interface (CI)

This command configures the timeout and the baud rate. The values are stored in the nonvolatile memory. Any modifications become active only after a reset has been performed.

The timeout is the time after which the read/write device no longer waits for characters in a command. After the timeout expires, the user receives an error message. To deactivate the timeout, the time must be set to "0".

The number of data bits is always eight. A parity bit is not used.

Command: CI <Timeout>, <Baud> <CHCK> <ETX>
 Response: <Status> <CHCK> <ETX>

The following settings are possible:

<Timeout>: "0" ... "100" (x 100 ms, timeout in 100-ms steps)
 <Baud>: "1200", "2400", "4800", "9600", "19,200", "38,400"

The default values are a timeout of "0" and a baud rate of "38,400".

Reset (RS)

This command is used to revert modified system settings, e.g., the timeout and baud rate settings, back to the values stored in the nonvolatile memory.

Command: RS <CHCK> <ETX>
 Response: "2" <CHCK> <ETX>

Command Store (CS)

<Param> = "1" stores the next command in this setting in the nonvolatile memory. This command is executed. Following a reset, this command is automatically reactivated.

If <Param> = "0", the stored command is deleted.

Command: CS <Param> <CHCK> <ETX>
 Response: <Status> <CHCK> <ETX>

Get State (GS)

This command is used to read the settings stored in the nonvolatile memory of the read/write device. These settings become active after the next system reset.

Command: GS <CHCK> <ETX>
 Response: <Status> TO:<Timeout> BD:<Baud> HD1:<Status><Tag-
 Type><CHCK><ETX>

5.5 Read/Write Commands

Single Read Words (SR)

The read/write device makes only one attempt to read <WordNum> 32-bit words from the address <WordAddr>.

Command: SR <WordAddr> <WordNum> <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

Enhanced Buffered Read Words (ER)

The read/write device continuously attempts to read <WordNum> 32-bit words from the address <WordAddr>. Variable data is transferred via the interface.

When a tag leaves the detection range, the status '05h' (read command) is output.

Command: ER <WordAddr> <WordNum> <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

Single Write Words (SW)

The read/write device makes only one attempt to write <WordNum> 32-bit words from the address <WordAddr>.

Command: SW <WordAddr> <WordNum> <Data> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

Enhanced Buffered Write Words (EW)

The read/write device repeatedly attempts to write <WordNum> 32-bit words from the address <WordAddr> until successful. Once it has successfully read a code, the status '00h' is output.

The status '05h' is only output when a tag leaves the detection range or is not yet within the detection range. The command remains active.

Command: EW <WordAddr> <WordNum> <Data> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

Single Read Fixcode (SF)

The read/write device makes only one attempt to read a fixcode.

Command: SF <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

Enhanced Buffered Read Fixcode (EF)

The read/write device makes attempts until successful to read a fixcode. Once it has successfully read a code, the status '00h' is output.

The status '05h' (read command) is output whenever a tag leaves the detection range. The command remains active.

Command: EF <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

5.6 IPC03 Configuration Commands



Note

In order to be able to use these commands, the data carrier type IPC03 must be set. The configuration commands cannot be used in the autodetect mode (mixed operation, data carrier type 00)!

The storage of a type IPC03 data carrier is organized by word. Every "word" is made up of 32 bits. For the normal data range, 29 words from addresses 3 through 31 (<WordAddr> = 00_h ... 1C_h) are available.

The storage of the data carrier IPC03 is constructed in the following way:

Address	Meaning	<WordAddr>	<ConfAddr>	Note
Word 0	Password	-	-	Write only
Word 1	Protection word	-	"1"	Read/write
Word 3	Control word	-	"2"	Read/write
Word 3...31	Data range	"00"... "1C"	-	Read/write
Word 32	Device Serial Number	"1D"	-	Read only
Word 33	Device identification	"1E"	-	Read only

The IPC03 has one "protection word" and one "control word". With the "protection word", a read-protected and a write-protected range can be defined. For this, each start and end of a read-protected and a write-protected range can be defined. With the "control word", various operating modes and the read range for the "default read" operating mode are set. Both words can only be accessed with the correct password.

The bits of the individual words have the following meaning:

Control word

Bit	Meaning	Byte
0...7	Read range start	0
8 ... 15	Read range end	1
16	Password protection on/off	2
17	"Read after write" operating mode on/off	
18 ... 23	Open	
24 ... 31	Open	3

Protection word

Bit	Meaning	Byte
0 ... 7	First read-protected word	0
8 ... 15	Last read-protected word	1
16 ... 23	First write-protected word	2
24 ... 31	Last write-protected word	3

With the control and protection word, it should be noted that when communicating a word, the highest value byte is transferred first and the lowest value byte last. With the entry of the read and write-protected words, the words are counted as follows:

00	Password
01	Protection word
02	Control word
03	1. Data word
04	2. Data word
...	...
1F	29. Data word

IPC03 password mode

It is possible to protect the control word and the protection word from being overwritten. Then the configuration can no longer be changed. The password mode serves this purpose.

With password mode active in the data carrier, the data range of a data carrier can only be read or written after the correct password is sent to the data carrier from the read/write head. The following must apply for this:

- The correct password is set once with the command **PS** "set password" and
- the password mode is activated with the command **PM** "set password mode".

The password in the read/write head and on the data carrier can be changed with the command **PC**.

If the password mode is deactivated, every word on the data carrier can be read and written as necessary.

In the factory default condition of the read heads and the data carrier IPC03, the password is 00000000_h. In the read head, the password is stored in a volatile manner and in the data carrier IPC03 in a non-volatile manner.

"Default read"

In the "default read" operating mode 1 or 2, words can be read very quickly, because the memory to be read is already defined on the data carrier and does not need to be communicated to the data carrier from the read/write head first.

The start and end of the read range are stored in the bytes 0 and 1 of the "control word". As soon as the data carrier is supplied with energy the data carrier sends out the data from the data range, which is defined by the read range start and end. The data range between read range start and end can be read with the read commands **SR** (single read words) and **ER** (enhanced buffered read words) when <WordAddr> is set to 0000h and <WordNum> is set to 00h.

The advantages of the "default read" operating mode lie in the readout speed. The readout of one data word (4 bytes) is twice as fast in this mode. The readout of 2 words takes approx. 1/3 less time. Starting at 3 data words there is no more time advantage since this mode is only intended for the reading of a maximum of 2 words (=8 bytes). Reading larger data ranges can lead to error messages when the read head does not respond within the planned reaction time.

Single Write Configuration (SC)

One attempt is made to write a word in the configuration range from the address <ConfAddr>. In order to write in the configuration range, the password mode must be active.

Command: SC <ConfAddr> <Data> <CHCK> <ETX>
 Response: <Status> <CHCK> <ETX>

Enhanced Buffered Configuration (EC)

One attempt is made to write a word in the configuration range from the address <ConfAddr> until successful. After each write, the status is evaluated and the system waits until a new data carrier is within the detection range. The command then starts again from the beginning. In order to write in the configuration range, the password mode must be active.

The status '5' is only output when a data carrier leaves the detection range or is not yet within the detection range when the command is executed.

Command: EC <ConfAddr> <Data> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

Single Get Configuration (SG)

One attempt is made to read a word in the configuration range ("protection word" or "control word") from the address <ConfAddr>.

Command: SG <ConfAddr> <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

Enhanced Buffered Get Configuration (EG)

An attempt is made to read a word in the configuration range ("protection word" or "control word") from the address <ConfAddr> until successful. Only data that changes is transferred via the interface, i.e. the read/write device transfers data whenever it reads a new data carrier or whenever it reads a data carrier which was previously not within the detection range.

The status '5' is output when the data carrier leaves the detection range or if the data carrier is not yet within the detection range when the command is executed.

Command: EG <ConfAddr> <CHCK> <ETX>

Response: <Status> <Data> <CHCK> <ETX>

5.6.1

IPC03 Password Mode

Note

The password is a 32-bit word that is set to "0" before a new IPC03 data carrier leaves the factory. The password cannot be read. Writing the passwords for the "control word" and the "protection word" must always be done in password mode.

Password Mode (PM)

This command activates (mode = "1") and deactivates (mode = "0") the password mode of the read/write device. In the password mode, the password is transferred to the data carrier before each read/write access. If a data carrier is addressed with the wrong password, then even the data range, for which no password protection is set, cannot be accessed.

Command: PM <Mode> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

Password Set (PS)

This command sets the password, which the read/write device communicates to the data carrier in the password mode.

Command: PS <Password> <CHCK> <ETX>

Response: <Status> <CHCK> <ETX>

Password Change (PC)

This command changes the password in a data carrier. Here, first the old and then the new password has to be entered. If the password has been successfully written, then the password in the read/write device is also changed. The command password set is no longer necessary. The password of the IPC03 can also be changed with password mode inactive.

Command: PC <Password old> <Password new> <CHCK> <ETX>
Response: <Status> <CHCK> <ETX>

5.7

Write Fixcode

Commands for the IPC11

The data carrier IPC11 is formatted during the first write process. It can therefore only be read when it has already been written.

The word start address is set to '0' for the read and write commands. The word count can be 1 or 3. For read commands, the word count is set to '0' since exactly the same amount of words are read as were previously written.

An IPC11 can also be programmed such that it behaves like an IPC02. To do this, the commands **SX** and **EX** are used. This programming takes place once, i.e. it can not be reversed (once the code is written it cannot be overwritten). The code is read when tag type '02' or '11' is set with the commands **SF** and **EF**.

Single Write Fixcode (SX)

One attempt is made to write a fixcode.

Command: SX <FixType> <FixLen> <Data> <CHCK> <ETX>
Response: <Status> <CHCK> <ETX>

Enhanced Buffered Write Fixcode (EX)

The read/write device continuously attempts to write a fixcode. After each successful write, the response is sent and the system waits until a new tag is within the detection range. The command then starts again from the beginning.

The status '5' is output when the data carrier leaves the detection range or if the data carrier is not yet within the detection range when the command is executed.

Command: EX <FixType> <FixLen> <Data> <CHCK> <ETX>
Response: <Status> <CHCK> <ETX>

<FixLen>: 5
<FixType>: '02' ASCII (30h 32h), the read-only code cannot be changed
'11' ASCII (31h 31h), the read-only code can be overwritten

6 Appendix

6.1 Error and Status Messages

Status/ error	Description
0	The command has been executed without error.
1	Reserved
2	Switch-on message, reset has been executed.
3	Reserved
4	The command is incorrect or incomplete. The parameter is not in the valid area.
5	No read/write tag in the sensing range.
6	Hardware error, e.g., error during self-test or read/write device defective
7	Reserved
8	Reserved
9	Reserved
A	Reserved
B	Reserved
C	Reserved
D	Reserved
E	Reserved
F	Reserved

6.2 ASCII table

hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII
00	0	NUL	20	32	Space	40	64	@	60	96	'
01	1	SOH	21	33	!	41	65	A	61	97	a
02	2	STX	22	34	"	42	66	B	62	98	b
03	3	ETX	23	35	#	43	67	C	63	99	c
04	4	EOT	24	36	\$	44	68	D	64	100	d
05	5	ENQ	25	37	%	45	69	E	65	101	e
06	6	ACK	26	38	&	46	70	F	66	102	f
07	7	BEL	27	39	'	47	71	G	67	103	g
08	8	BS	28	40	(	48	72	H	68	104	h
09	9	HT	29	41	)	49	73	I	69	105	i
0A	10	LF	2A	42	*	4A	74	J	6A	106	j
0B	11	VT	2B	43	+	4B	75	K	6B	107	k
0C	12	FF	2C	44	,	4C	76	L	6C	108	l
0D	13	CR	2D	45	-	4D	77	M	6D	109	m
0E	14	SO	2E	46	.	4E	78	N	6E	110	n
0F	15	SI	2F	47	/	4F	79	O	6F	111	o
10	16	DLE	30	48	0	50	80	P	70	112	p
11	17	DC1	31	49	1	51	81	Q	71	113	q
12	18	DC2	32	50	2	52	82	R	72	114	r
13	19	DC3	33	51	3	53	83	S	73	115	s
14	20	DC4	34	52	4	54	84	T	74	116	t
15	21	NAK	35	53	5	55	85	U	75	117	u
16	22	SYN	36	54	6	56	86	V	76	118	v
17	23	ETB	37	55	7	57	87	W	77	119	w
18	24	CAN	38	56	8	58	88	X	78	120	x
19	25	EM	39	57	9	59	89	Y	79	121	y
1A	26	SUB	3A	58	:	5A	90	Z	7A	122	z
1B	27	ESC	3B	59	;	5B	91	[	7B	123	{
1C	28	FS	3C	60	<	5C	92	\	7C	124	
1D	29	GS	3D	61	=	5D	93	]	7D	125	}
1E	30	RS	3E	62	>	5E	94	^	7E	126	~
1F	31	US	3F	63	?	5F	95	_	7F	127	DEL

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