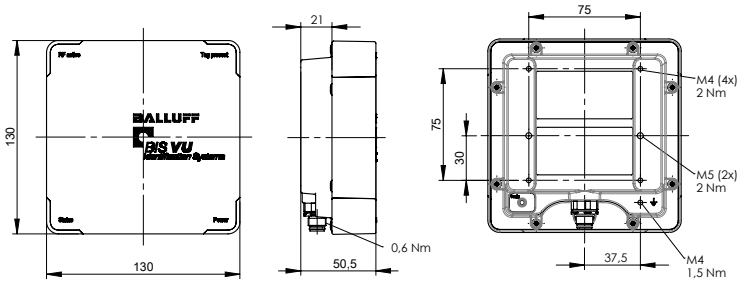
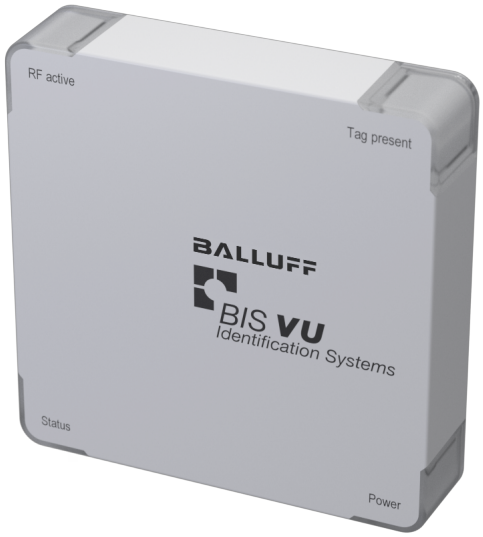
BALLUFF

BIS VU-320 Series

Technical Description, Operating Manual





english

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Quick-Start

Status indicators

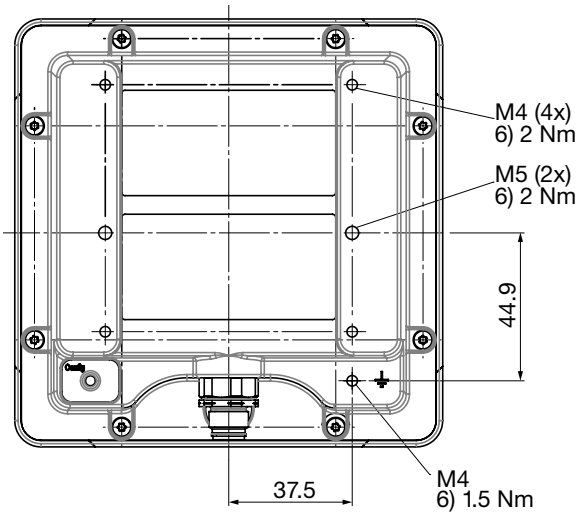
LED	Meaning
Power (green)	Ready
Tag present (yellow)	Data carrier detected, being processed
RF active (blue)	Antenna active (sending)
Status (red)	Device status

Assembly

Note

► For permanent mounting of the processor, refer to Section 6.1 „Installation location considerations“.

The read/write head can be mounted in various ways to provide optimal orientation with respect to the data carriers. The rear-side mounting holes (4x M4 and 2x M5) can be used to directly attach the device to a carrier or using a three-dimension rotating mounting bracket.



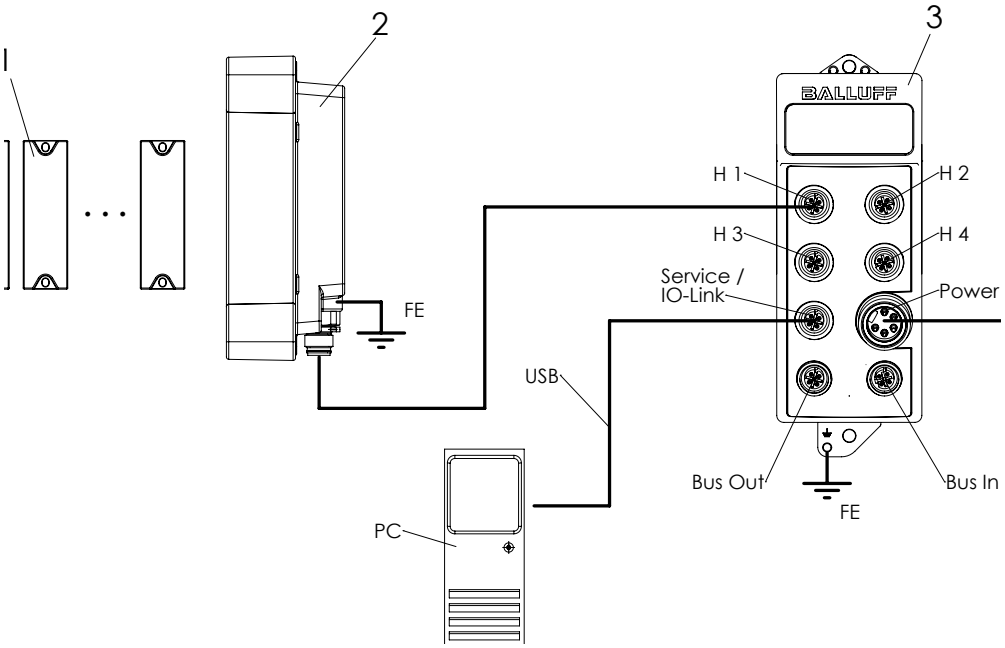
Note
For information on wiring and accessories, visit our website at www.balluff.de.

Quick-Start

Connecting the RFID system

For quick startup of the read/write head, carry out these steps:

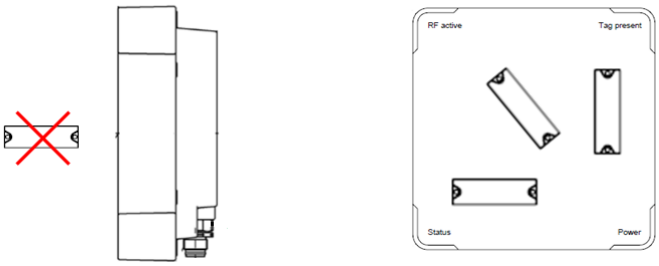
- ► Connect the BIS VU read/write head using a shielded, 4-conductor M12 cable (A-coded) to one of the four terminals H1…H4 on the BIS V processor.
- ► Connect the service interface of the BIS V processor to a free USB port of the PC using a USB M12 connection cable.
- ► Connect the processor and read/write head function grounds to ground. The connection can be made directly or via a suitable RC combination.
- ► Connect the power terminal of the BIS V processor to the power supply (+24 VDC, see Section 5 „Technical Data“ on page 16) .
  ⇒ If the device is ready, the Power LED on the BIS VU read/write head will be on (green).
- ► Position one or more data carriers (max. 50) at a distance of 0…100 cm in front or the read/write head.



1 UHF data carrier
2 BIS VU read/write head
3 BIS V processor

Aligning the data carriers

The built-in antenna of the BIS VU read/write head with its circular polarization allows it to interface with the data carrier in nearly any orientation. Simply be sure that data carriers which are linear or circular polarized are oriented parallel to the front of the antenna (illustration at right). A perpendicular orientation of the data carrier with respect to the front of the head has a negative effect on the read/write distance of the UHF-RFID system, which can mean in some circumstances that the data carrier is no longer detected (illustration at left).



Quick-Start

Auto-Setup for single-tag applications

The Config key on the rear of the device can be used to quickly and conveniently set parameters for a single-tag application.

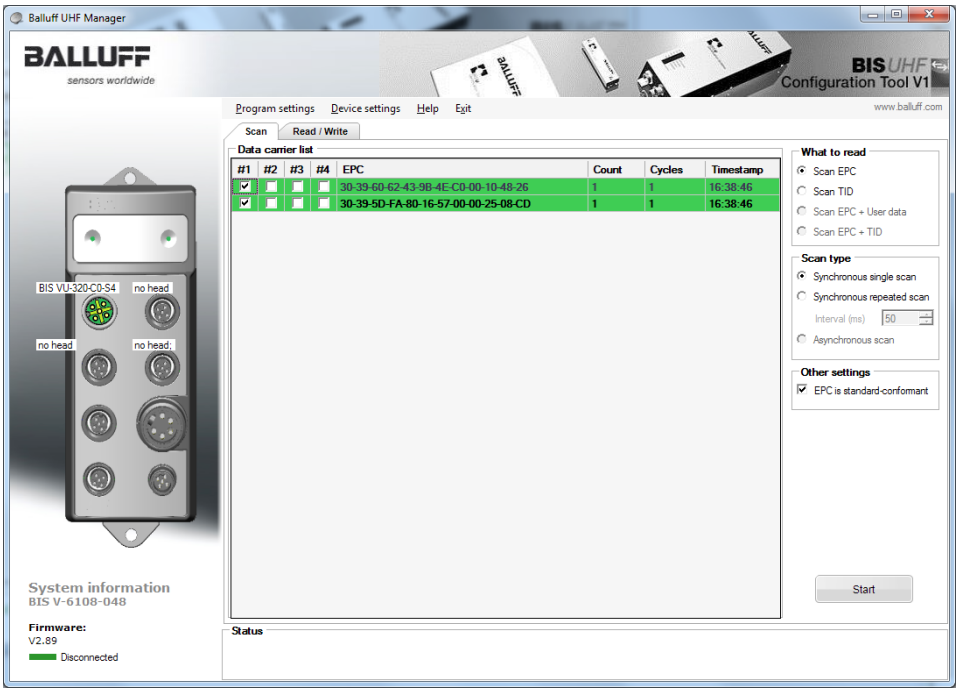
- ► Position a single data carrier at the expected read/write distance from the antenna.
- ► Hold down the Config key for 3 sec.
  - ⇒ All LEDs will flash.
- ► Press the Auto-Setup key briefly within 10 seconds.
  - ⇒ Auto-Setup is performed.
  - ⇒ All LEDs will stay on, and Auto-Setup will begin in a few seconds.
  - ⇒ During setup the green Power LED will flash, and the blue LED *RF active* will flicker.
  - ⇒ If the green Power LED flashes alone, the procedure has been successfully completed.
  - ⇒ If the green Power LED flashes together with the yellow LED *Tag Present*, additional tags were found in the vicinity. Automatic distinguishing of a single data carrier was not possible.
  - ⇒ If the yellow LED *Tag Present* comes on together with the green Power LED, the tag was read but could not be written to. The tag may be write-protected, have no user memory or be too distant.
  - ⇒ If the red Status LED flashes, no tag was detected or read.
  - ⇒ After a few seconds the device resumes the base state (green Power LED continuous on).

Note
For more information about Auto-Setup see Section 6.3 „Config key (Auto-Setup)“ on page 19.

Startup using the UHF Manager configuration software

Use the UHF Manager configuration software (for details see Section 8 „UHF Manager Configuration Software“) to change device-specific parameters which describe the behavior of the read/write head in the application and to test various basic functions.

Note
A USB connection to a PC is required for operating the processor using the UHF Manager. This is provided by the USB port on the BIS V processor.



Making a serial connection
Connect the processor to the UHF Manager as follows:
► Menu: Program settings -> Interface…
⇒ The "Interface Settings" window opens.
► Select COM port.
► Click on Search.
⇒ The correct connection parameters are determined.
⇒ Connection to the BIS V processor is opened.
⇒ Interface Settings window closes automatically.

Detecting data carriers
In the simplified representation of the BIS V processor on the left side of the window the connected read/write heads are shown. After selecting a read/write head it can be used to process data carriers.

Selecting a read/write head
► Click on the connector representing the desired read/write head
⇒ The connector icon turns green

Detecting all data carriers in the field (inventory)
► In the *Data* field select the type of data to be acquired.
► Clicking on *Search Tags...* detects all the data carriers in the field and enters them in the data carrier list.

Note
For additional information, see Section 8 „UHF Manager Configuration Software“

1 User Instructions

1.1 About this Manual

This manual describes read/write heads Series BIS VU-320 and their startup.

1.2 Typographical conventions

The following conventions are used in this manual.

Enumerations

Enumerations are shown as a list with an en-dash.
– Entry 1,
– Entry 2.

Actions

Action instructions are indicated by a preceding triangle. The result of an action is indicated by an arrow.
► Action instruction 1.
⇒ Action result.
► Action instruction 2.

Syntax

Numbers:
– Decimal numbers are shown without additional indicators (e.g. 123).
– Hexadecimal numbers are shown with the additional indicator $_{hex}$ (e.g. 00_{hex}).

Parameters:
Parameters are shown in italics (e.g. *Dynamic).*

Directory paths:
References to paths in which data are stored or are to be saved to are shown in small caps (e.g. Project:\Data Types\User Defined).

Control characters:
Control characters for sending are set in angle brackets (e.g. <ACK>)

ASCII code:
Characters transmitted in ASCII code are set in apostrophes (e.g. 'L').

1.3 Symbols

⚠ This symbol indicates a security notice which must be observed.

Note, tip
This symbol indicates general notes.

1.4 Meaning of Warning Notes

⚠ **ATTENTION!**
The pictogram together with the word "ATTENTION" warns of possible equipment damage. Failure to observe these warning notes may result in injury or damage to equipment.
► Always observe the described measures for preventing this danger.

⚠ **CAUTION!**
The pictogram used with the word "CAUTION" warns of a possible hazardous situation affecting the health of persons. Failure to observe these warning notes may result in injury.
► Always observe the described measures for preventing this danger.

1 User Instructions

1.5 Abbreviations

BIS	Balluff Identification System
CRC	Cyclic Redundancy Check
DC	Direct current
EEPROM	Electrical Erasable and Programmable ROM
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic compatibility
EPC™	Electronic Product Code
ERP	Effective Radiated Power
FCC	Federal Communications Commission
FE	Function ground
IC	Industry Canada
ISO	International Organization for Standardization
n. c.	not connected
PC	Personal Computer
RFID	Radio Frequency Identification
RFU	Reserved for Future Use
PLC	Programmable Logic Controller
Tag	Data carrier with antenna
TID	Tag identifier
UHF	Ultra-high frequency

2 Safety

2.1 Proper use

The BIS VU-320 read/write head is a component for the BIS V processor. Within the identification system it is used for communication with the data carriers and may be used only for this purpose.

2.2 General safety notes

► **Before starting up the device, read the safety instructions included with the product.**

Installation and Startup
Installation and startup must be carried out by trained technicians. Any damage resulting from unauthorized manipulation or improper use voids warranty and liability claims against the manufacturer.

When connecting the read/write head to a processor, observe proper selection and polarity of the connection (see „Installing the read/write head“ on page 14).
The read/write head may be connected only to a Series BIS V processor.

CAUTION!
Ultra-high frequency electromagnetic waves
The antenna of the BIS VU read/write head emits ultra-high frequency electromagnetic waves.
► IEC 62369 stipulates that personnel must not remain within close range of the UHF antenna for long periods (several hours).
► When installing the read/write head, ensure that a safety distance of at least 20 cm is maintained between the read/write head and stations where persons work.

2.3 Conformity

Note
The BIS VU RFID read/write head may be used only in approved countries with observance of the respective national legal requirements.
► Please note the information sheet on conformity and approval which is included with the product.

All approvals and certifications are no longer valid if:
– Components are used that are not part of the BIS V Identification System.
– Components are used that have not been explicitly approved by Balluff.

Operation and testing
The operator is responsible for ensuring that local safety regulations are observed. If defects and persistent faults occur in the identification system, take it out of service and secure it to prevent unauthorized use.

3 Basic Knowledge

3.1 Function Principle of Identification Systems

The BIS VU read/write head belongs to the category of non-contact systems having a read and write function. This not only allows it to detect information programmed permanently in the data carrier, but also to collect and pass on current information.

Main components of the BIS U identification are:
– BIS-V processor unit
– BIS VU read/write head
– Data carriers

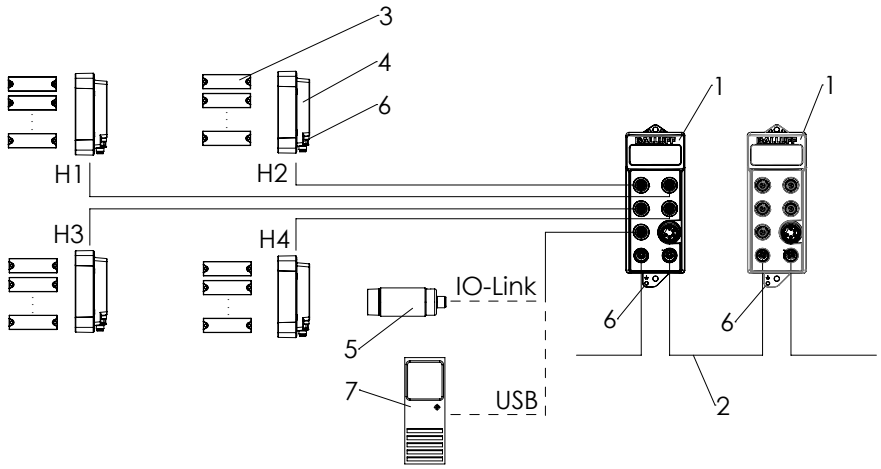


Figure 1: System overview

1 BIS V processor
2 BUS connection (e.g. PROFIBUS, ...)
3 Data carrier
4 BIS VU read/write head
5 IO-Link component
6 Function ground (FE)
7 PC

The main areas of application are:
– In the production and control of material flow (e.g. in model-specific processes, workpiece transport in conveying systems, for acquiring safety-related data)
– In tool coding and monitoring
– In organization of tools and equipment
– In warehousing for monitoring material movements
– In transporting and conveyor technology
– in waste disposal for quantity-based fee assessment
– Controlling assembly lines
– Intralogistics (e.g. kanban)

Note
See the "Basic UHF manual" for more information on UHF identification systems.

3 Basic Knowledge

3.2 Product description

- UHF RFID read/write head for connecting to BIS V processors
- UHF operating frequencies 860...960 MHz depending on the country version
- Read/write distance typically up to 1 m depending on the ambient conditions and data carriers.
- Auto-Setup function for quick setup of the read/write head
- Rugged metal housing
- Control displays for communication and status
- Supports data carriers conforming to ISO 18000-63 and EPCglobal™ Class-1 Generation-2

Note
The beam power and operating frequencies will vary depending on the country version of the read/write head. For detailed information, refer to the information sheet on conformity and approvals (included in the scope of delivery).

3.3 Control function

The read/write head is the link between the data carrier and the processor. It manages two-way data transfer between data carrier and processor and provides buffer storage.
The processor uses the antenna built into the read/write head to write data from the controlling system to the data carrier or reads the data from the carrier and makes it available to the processor.

3.4 Data integrity

In order to ensure data integrity, data transfer between the data carrier and processor must be monitored using a CRC16 check procedure.

3.5 Interaction of read/write head and data carrier

Critical to errorless data exchange between the read/write head and the data carrier is that a sufficient dwell time for the data carrier in active read/write range of the read/write head be maintained.

3 Basic Knowledge

3.6 Features of UHF data carriers

The memory organization of UHF data carriers provides for various memory areas (memory banks) depending on the version.
– Reserved
– EPC
– TID
– USER

Note
The organization and size of the respective memory banks can be found in the data sheet for the respective data carrier.

The memory banks EPC and USER (if present) can be freely edited.
The TID memory bank is write-protected and can be read only. The reserved memory bank is intended for passwords. It can be used to store an *access password* and a kill password (see commands *Lock* and *Kill*).
The *access password* allows reading and writing of memory banks whose protection status requires a password.

The security status for the reserved *memory bank* can be specified as follows:

Reserved memory	Unlock	Lock	Unlock Permanent	Lock Permanent
Read	Allowed	Password	Allowed	Password
Write	Allowed	Password	Allowed	Password
Status reversible	Yes	Yes	No	No

The security status for the memory banks EPC, TID and USER can be specified as follows:

EPC TID USER	Unlock	Lock	Unlock Permanent	Lock Permanent
Read (EPC, TID, USER)	Allowed	Allowed	Allowed	Allowed
Write (EPC, USER)	Allowed	Password	Allowed	Blocked
Status reversible	Yes	Yes	No	No

Note
Details on the various memory banks as well as the functions *Lock* and *Kill* can be found in the UHF RFID standards ISO/IEC 18000-63 and EPCglobal™ Class -1 Generation -2.

4 Assembly

4.1 Scope of delivery read/write head

Included in the scope of delivery:
– BIS VU-320
– Safety notes
– Information sheet regarding conformity and approvals

Note
For corresponding technical documents as well as additional information on available software and accessories, see www.balluff.com.

4.2 Installing the read/write head

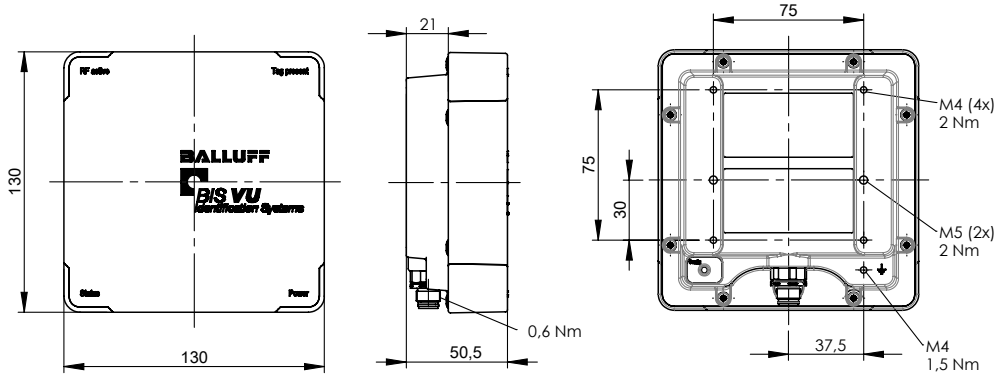


Figure 2: Installation

CAUTION!
Ultra-high frequency electromagnetic waves
The antenna of the BIS VU read/write head emits ultra-high frequency electromagnetic waves.
► To select the mounting position refer to the notes in Section 2 „Safety“ on page 10 and Section 6„Commissioning“ on page 18 .

The read/write distance can typically be as great as 1 m depending on the ambient conditions and installed system components. See the "Basic UHF manual" for more information on minimum/maximum distances.

► Select a suitable installation position.
► Secure the processor unit using two M5 or four M4 screws (strength category 5.6, lightly oiled, tightening torque 2 Nm).

Note
Optional mounting plates are available for installing the processor unit (see „Accessories“on page 37).

4 Installation

4.3 Interface information/ wiring diagrams

Note
Make the ground connection either directly or using an RC combination to ground.

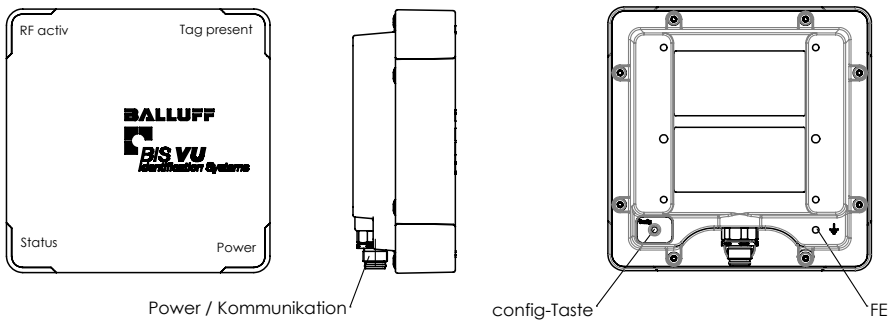
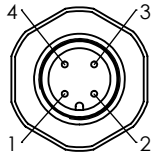


Figure 3: Electrical connection

X1 – Power/Communication



PIN	Function
1	+24 V DC
2	RS485 A
3	GND
4	RS485 B

5 Technical Data

Dimensions

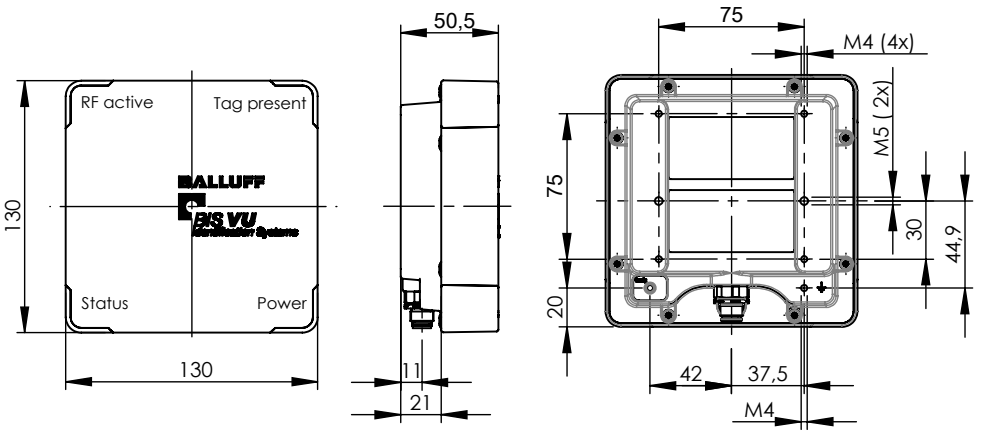


Figure 4: Dimensions

Mechanical data

Housing material	Die-cast zinc, PC, ABS
X1 – Power/Communication	M12, 4-pin, A-coded
Weight	870 g

Electrical Data

Power supply	+24 V DC (supply provided by BIS V processor)
Current consumption	≤ 200 mA
Communication	RS485
Adjustable beam power	ERP: 5…25 dBm (3…320 mW) ERIP: 7…27 dBm (5…500 mW)

Note
The maximum beam power that can be set depends on the country-specific device version. Details on RF frequencies and beam power can be found in the information sheet on conformity (included with the product).

Antenna

Antenna	865…870 MHz	902...928 MHz
3 dB dispersion angle (typ.)	83°	83°
Axis ratio (typ.)	2 dB	1 dB
Front-to-back ratio (typ.)	–10 dB	–10 dB

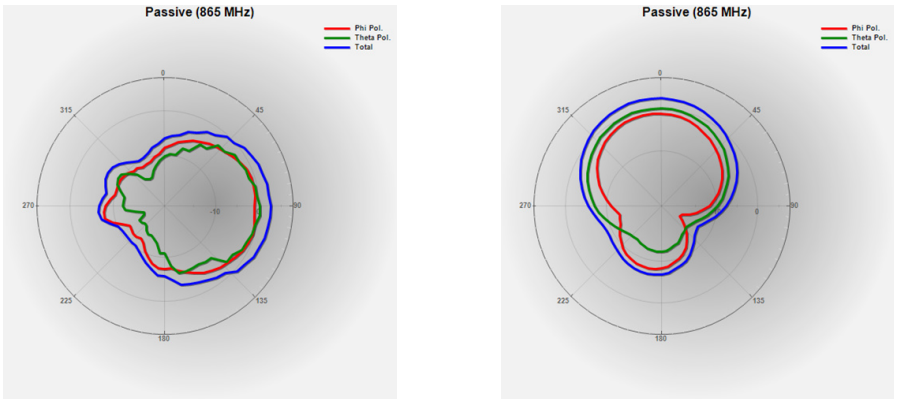


Figure 5a: Antenna alignment diagrams (horizontal 865 MHz and vertical 865 MHz)

5 Technical Data

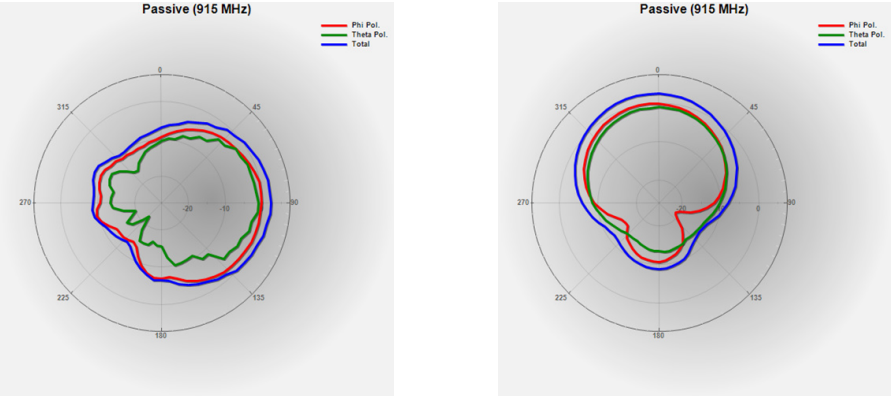


Figure 5b: Antenna alignment diagrams (horizontal 915 MHz and vertical 915 MHz)

Ambient conditions

Ambient temperature	–20 °C…+55 °C
Storage temperature	–20 °C…+70 °C
EMC (Europe only) – EN 301 489-1 – EN 301 489-3 – EN 61000-4-2/4/6 – EN 61000-4-3 – 80 MHz – 1000 MHz – 1400 MHz – 2000 MHz – 2000 MHz – 2700 MHz – Emission as per EN 301489-1/-3	 – Severity level 2B/2A/3A – Severity level 3A – Severity level 3A – Severity level 2A – EN 55022 (class A)
Vibration/shock	EN 60068 Part 2-2-6/27
Degree of protection as per IEC 60529	IP67

Data carriers

ISO	18000-63
EPCglobal™	Class 1 Generation 2

Multi-tagging

Maximum number of data carriers in field	50

Display elements

Power Status Tag Present RF active	Green LED Red LED Yellow LED Blue LED

6 Commissioning

BIS VU-3xx read/write heads belong to the category of UHF read/write heads that communicate with the data carrier by sending and receiving electromagnetic waves. This principle enables great read/write distances (typically several meters), but for technological reasons requires some forethought with respect to the installation location and ongoing operation.

Note
More information about the physical principle of UHF identification systems and read/write distances can be found in the "Basic UHF Manual" (available at www.balluff.com).

6.1 Installation location considerations

When selecting the installation location, ensure sufficient distances from workstations where persons are occupied for longer periods of time. See Section 2 „Safety“.
In addition, ensure that the read/write head is attached so the main beam direction of the antenna is aligned optimally with the actual identification location and that the line of sight between the read/write head and data carrier is free from metals or other electromagnetically active materials. If this cannot be ensured, optimal function of the read/write head may be affected.

6.2 Transmitting power considerations

Adjusting the beam power allows you to increase and decrease the desired read/write distance. Greater beam power generally also means a greater read/write distance. Too high a beam power can also however be disadvantageous.

CAUTION!
Electromagnetic radiation
Electromagnetic radiation can represent a health hazard.
- ► Always try to minimize the amount of electromagnetic radiation in the surroundings.
- ► Do not set the beam power higher than necessary for reliable identification of the desired data carrier population.

Selecting too high a beam power may result in the following undesirable side-effects:
– Data carriers located further away may be detected and unintentionally read or programmed.
– When using multiple, spatially close read/write heads, malfunctions may occur if they are too close to each other or lie in the active area of other read/write heads. The greater the beam power, the greater the required distance can be.

Note
Writing to a data carrier generally requires more power than reading one. Depending on the data carrier, the required power may vary.

Note
Automatically increasing the beam power of the read/write head for write operations is possible, see parameter „Automatic beam power increase (Writing)“ on page 22.

6.3 Config key (Auto-Setup)

Auto-Setup is used to set the optimal beam power in a single-tag application. The beam power is set so that only the data carrier positioned at the read/write head is detected and processed. During *Auto-Setup* the RF active LED (blue) is on to indicate that the UHF field is turned on. The Power LED (green) flashes during the search process.

Note
During *Auto-Setup* no other commands are accepted by the read/write head. After *Auto-Setup* is completed, the Power LED stays on (green).

Starting Auto-Setup

- ► Hold down the Config key for 3 sec.
  - ⇒ All LEDs will flash.
- ► Hold down Config key for 10 seconds.
  - ⇒ Auto-Setup is prepared..
  - ⇒ All LEDs come on for 2.5 seconds.
  - ⇒ Power LED flashes during Auto-Setup.
  - ⇒ RF active LED indicates antenna activity.

Result of Auto-Setup

LED	Status	Meaning
Power (green)	Flashing (yellow LED Tag present is off)	Parameters for Single-Tag operation were accepted.
	On	Auto-Setup finished.
Tag present (yellow)	Flashes (green Power LED flashing)	No Single-Tag operation possible. Parameters for read operations in Multi-Tag mode were accepted.
	On (green Power LED flashing)	Data carrier could not be programmed. Parameters for read operations were applied
Status (red)	Flashes	No tag found. Parameters remain unchanged.

Note
The *Auto-Setup* function can be started using the button on the rear of the housing or using the *Auto-Setup* parameter, see Section „Description of standard user parameters“ on page 21.

Note
The *Auto-Setup* key can be disabled using the parameter *Disable Auto-Setup key*, see „Overview of standard user parameters“ on page 20.

6.4 Setting read/ write head parameters

Both the standard user parameters and the expert user parameters can be used to adapt the read/write heads to the application and to the ambient conditions. The individual parameters and their effects are described in the following.

Note
Details on parameterizing the read/write heads through the BUS interface can be found in the manual for the respective BIS V processor (available at www.balluff.com).

Note
Parameters with an ID in the range 0001_{hex}…$0FFF_{hex}$) are continually stored in the read/write head so that they remain intact even after a restart or reset. Depending on the technology, the flash memory used may not be capable of unlimited write cycles (typically 1 million write/delete cycles). It is recommended that these parameters not be changed more often than necessary during operation.
Parameters with IDs higher than 1000_{hex} remain only temporarily, meaning until the device is restarted, and they may be changed as often as desired..

Overview of standard user parameters

Parameter ID	Parameters
0002_{hex}	Initial Q value
0003_{hex}	Max. EPC length
0004_{hex}	TID length
0008_{hex}	Standard beam power (Reading)
0009_{hex}	Automatic beam power increase (Writing)
$000A_{hex}$	Number of read/write attempts
$000B_{hex}$	Active channels
$000F_{hex}$	Automatic scanning
0010_{hex}	Config key (Auto-Setup)
1001_{hex}	Current beam power (Reading)
1002_{hex}	Access password
1003_{hex}	Auto-Setup
1004_{hex}	Memory bank

Overview of expert user parameters

Parameter ID	Parameters
0001_{hex}	RF profile
0005_{hex}	Session
0006_{hex}	Preamble (pilot signal)
0007_{hex}	Modulation
$000C_{hex}$	Use BlockWrite
$000D_{hex}$	Max. write length
$000E_{hex}$	Max. read length

Description of standard user parameters

Initial Q value

Parameter-ID: 0002_{hex}
The Q value is used as an indicator for the number of data carriers expected in the active zone of a read/write head. The Q value can be used for optimizing the time required for an inventory. The set Q value is used only initially during inventory and can be changed by the read/write head.

The following table shows recommended Q value settings depending on the expected number of data carriers.

Expected number of data carriers	Recommended Q value
1…2	2
3…6	3
7…12	4
13…25	5
26…50	6

Settable values: 1 – 9

Length [bits]	Permissible values	Factory setting	Meaning
8	1 – 9	4	Initial Q value

Max. EPC length

Parameter-ID: 0003_{hex}
The parameter *Max. EPC length* can be used to set the maximum number of bytes in the EPC memory range sent by the read/write head to the processor.
When data carriers are read whose EPC is larger than the set *Max. EPC length*, the read EPC limited to the set number of bytes.
When data carriers are read whose EPC is smaller than the set *Max. EPC length*, the sent EPC is filled with leading zeros to reach the set length.

When setting a length of 12 bytes the actual length of the EPC is not also sent.

Settable EPC lengths: 12 bytes or 62 bytes

Length [bits]	Permissible values	Factory setting	Meaning
8	1 or 2	1	1: 12 bytes 2: 62 bytes

Startup

TID length

Parameter-ID: 0004_{hex}
The *TID length* determines how many data words (16 bits) of the TID are sent from the read/write head to the processor.
When data carriers are read whose TID is larger than the set *TID length*, the read TID is limited to the set number of bytes.
When data carriers are read whose TID is less than the set *TID length*, the TID is not sent to the processor.

Settable TID lengths: 1 – 31 words, settable in 1-word increments

Length [bits]	Permissible values	Factory setting	Meaning
8	1 – 31	4 4 words (8 bytes)	*TID length* in number of words (16 bits)

Standard Beam power (Reading)

Parameter-ID: 0008_{hex}
Using this parameter you can set the radiated beam power (in dBm) of the read/write head after a reset or after powering up. The beam power refers to read operations.
The parameter value is the desired power in quarter dBm's

Parameter value = P(dBm) * 4

Settable power (ERP): 5…25 dBm (corresponds to 3...320 mW)
Settable power (EIRP): 7…27 dBm (corresponds to 5...500 mW)

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 108	96 ERP: 22 dBm (160 mW) EIRP: 24 dBm (250 mW)	*Standard beam power* in ¼ dBm (ERP or EIRP)

Note
The settings for beam power are understood to be (depending on the device version) ERP (Equivalent Radiated Power) or EIRP (Equivalent Isotropically Radiated Power) values. The respective valid setting can be found in the information sheet for conformity and approvals.

Automatic beam power increase (Writing)

Parameter-ID: 0009_{hex}
This parameter can be used to specify whether the same beam power is used for both read and write operations or whether the beam power is increased by an offset value for write operations.

Write power (dBm) = Read power (dBm) + Offset (dB)
corresponds to
Write power (mW) = Read power (mW) * Factor

The parameter value sent is the desired offset power in quarter dBm's.

Settable offset power: 0…20 dB (corresponds to Factor 1 – 100)

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 80	8 2 dB (~Factor 1.6)	Offset power in ¼ dB

Number of read/ write attempts

Parameter-ID: 000A$_{hex}$
The parameter *Number of read attempts* specifies how often the read/write head attempts to repeat a failed read operation on a data carrier before a negative status message is sent to the processor.

Settable values: 0 – 255

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 255	05_{hex} 5	*Number of read/write attempts*

Active channels

Parameter-ID: 000B$_{hex}$
This parameter is used to specify what frequencies resp. channels are used for communicating with the data carrier.

Note
The setting for active channels is only available for devices which are approved for operation within the European Community.
Additional information can be found in the European standard ETSI EN 302 208.

The channels are turned on and off by setting or resetting the corresponding bit position in the data byte of the parameter value. Only the lower 4 bits of the data byte are filled.

Data type	Permissible values	Factory setting	Meaning
Byte value	Bit mask $0F_{hex}$ – 01_{hex}	$0F_{hex}$ All channels on	0: Channel off 1: Channel on Bit 0: Channel 4 Bit 1: Channel 7 Bit 2: Channel 10 Bit 3: Channel 13

When using 2...4 channels, these are selected one after the other using a frequency-hopping procedure.
In applications where multiple read/write heads are operated simultaneously in a small area, we recommend parameterizing them using a channel assignment plan. Preferably such that adjacent read/write heads have the greatest possible channel separation. This minimizes mutual interference between adjacent read/write heads.

Automatic scanning

Parameter-ID: 000F$_{hex}$
The parameter *Automatic scanning* places the read/write head in a mode in which the active zone of the antenna is continually monitored. As soon as one or more data carriers is present in the active zone of the antenna, this is reported to the processor. The processor indicates this to the controller in the form of a *Tag present*-message if there is only one data carrier in front of the antenna, or with a *Multi-Tag* message if two or more data carriers are located in front of the antenna. As soon as a tag is reported as present (Tag present), it can be processed.
The advantage of this mode is that the antenna field does not have to be continually polled manually. This reduces the bus load.
If just a single tag is detected in the antenna field, its EPC or TID (depending on the *Memory bank* parameter, see following page) can be read on the processor display.

Note
More information about display messages can be found in the manual for the respective processor (available at www.balluff.com).

The parameter is set as a time value which specifies after how much time the antenna field is again searched for tags.
The desired repetition time is set as a multiple of 0.5 s.

Time = parameter value * 0.5 s

Length [bits]	Permissible values	Factory setting	Meaning
8	0 1 – 255	00$_{hex}$ 0	0: *Automatic scanning* off 1 – 255: Parameter value * 0.5 s = (0.5 s – 127.5 s)

Disable Config key (Auto-Setup)

Parameter-ID: 1000$_{hex}$
Enables or disables the *Config key (Auto-Setup)*.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 255	255	0: Key deactivated 1 – 255: Key enabled

Startup

Current beam power (Reading)

Parameter-ID: 1001_{hex}
After a reset or power up, the *Current beam power corresponds* to the *Standard beam power.*
After changing the *Current beam power* it remains set until changed again or until a reset.
The set beam power is used for read operations.
The parameter value is the desired power in quarter dBm's.

Parameter value = P(dBm) * 4

Settable power (ERP): 5…24 dBm (corresponds to 3...250 mW)
Settable power (EIRP): 7…26 dBm (corresponds to 5...400 mW)

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 108	94 ERP: 22 dBm (160 mW) EIRP: 24 dBm (250 mW)	*Current beam power* in ¼ dBm (ERP or EIRP)

Note
The settings for beam power are understood to be (depending on the device version) ERP (Equivalent Radiated Power) or EIRP (Equivalent Isotropically Radiated Power) values. The respective valid setting can be found in the information sheet for conformity and approvals.

Access password

Parameter-ID: 1002_{hex}
If a password protected data carrier needs to be accessed, the parameter *Access password* can tell the read/write head the password for the corresponding data carrier.
If there are no data carriers with different passwords in use, the parameter only needs to be sent once to the read/write head.
The password remains saved in the read/write head until power is disconnected or a reset is performed.

Settable values: 4-byte password (Standard 00 00 00 00_{hex})

Length [bits]	Permissible values	Factory setting MSB…LSB	Meaning
32	4-byte password	00 00 00 00_{hex}	*Access password*

Note
Details on password protection, locking and unlocking ("Lock") or UHF RFID data carriers can be found in the UHF RFID standards EPCglobal Radio Frequency Identity Protocols Class-1 Generation-2 UHF RFID and ISO IEC 18000-63.

Startup

Auto-Setup

Parameter-ID: 1003_{hex}
The read/write head begins with *Auto-Setup* as soon as the *Auto-Setup* parameter is received. During *Auto-Setup* no other commands are accepted by the read/write head.

Note
For details on *Auto-Setup*, see Section 6.3 „Config key (Auto-Setup)“.

If the procedure was successful, the Power LED (green) will be continuously on.
If two or more data carriers are detected during *Auto-Setup*, the read/write head is unable to perform proper optimizing. This is indicated by the Tag present (yellow) LED flashing. The parameters set by Auto-Setup are applied.
If no data carrier can be detected during *Auto-Setup*, the Status LED (red) flashes briefly. All parameters remain unchanged.

Settable values: 1 (automatically reverts back to 0 after finishing)

Length [bits]	Permissible values	Factory setting	Meaning
32	1	00_{hex} 0	1: Auto-Setup 0: Off, automatic

Note
The *Auto-Setup* function can be started using the button on the rear of the housing or using the *Auto-Setup*parameter, see Section „Disable Config key (Auto-Setup)“ on page 24and Section „Description of standard user parameters“ on page 21.

Memory bank

Parameter-ID: 1004_{hex}
The *Memory bank* parameter is used to control on which memory area of the data carrier the read/write operation should be performed.
Depending on the data carrier, memory areas RFU, EPC, TID and USER are available.
Once the memory area is changed, the setting remains until it is changed again or a reset is performed on the read/write head.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 3	3	Data carrier *memory bank* 0: RFU 1: EPC 2: TID 3: USER

Note
More information about the various memory areas of the data carriers can be found in the standard for UHF RFID systems (www.epcglobal.de).

Description of expert parameters

The Expert parameters can be used to adapt the read/write heads to the application and to the ambient conditions. The individual parameters and their effects are described in the following.

Note
Detailed information on the expert parameters are available at www.epcglobal.com.

Note
Due to the differing international RF regulations the available *RF profiles* will depend on the country version being used. The available *RF profiles* can be found in the information sheet on conformity and approvals included with the product.

RF profile

Parameter-ID: 0001_{hex}
Selecting the *RF profile* allows various connection parameters for the air gap between data carrier and read/write head to be set:

- Tx: Bitrate forward, i.e. from read/write head to data carrier
- Rx: Bitrate backward, i.e. from data carrier to read/write head
- Coding: Specifies the coding the data carrier uses to reply.
  - FM0: Single-bit transmission
  - Miller-2: Each bit is sent as a double-bit.
  - Miller-4: Each bit is sent as a quadruple bit.
  - …

The forward resp. backward bitrate allows the communication speed of the read/write head and data carrier to be affected. In fast dynamic processes it may be necessary to increase the data rate. Note that processes of this kind can reduce process reliability. For electromagnetically noisy areas it can be advantageous to use profiles which employ a higher Miller encoding, e.g. Miller-4.

Note
We only recommend changing the *RF profile* if the standard RF profile does not provide satisfactory performance or if it is not supported by the data carrier.

The following *RF profiles* can be set:

Profile no.	Parameter value	Tx [kBit/s]	Rx [kBit/s]	Coding
0	00000000_{hex}	40	40	FM0
1	00000002_{hex}	40	40	Miller-4
2	00000600_{hex}	40	160	FM0
3	00000602_{hex}	40	160	Miller-4
4	00030600_{hex}	80	160	FM0
5	00030602_{hex}	80	160	Miller-4
6	00000902_{hex}	40	256	Miller-4
7	00030902_{hex}	80	256	Miller-4
8	$00030C01_{hex}$	80	320	Miller-2
9	$00030C02_{hex}$	80	320	Miller-4
10	$00030C03_{hex}$	80	320	Miller-8
11	$00060F02_{hex}$	160	640	Miller-4

Settable values: See parameter value in table

Length [bits]	Permissible values	Factory setting	Meaning
32	Parameter values in table	00000602_{hex} RF profile no. 3	RF profile

Session

Parameter-ID: 0005_{hex}
Sets the *session* for an inventory.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 3	0	Session 0: Session 0 1: Session 1 2: Session 2 3: Session 3

Preamble (pilot signal)

Parameter-ID: 0006_{hex}
Turning the pilot tone on and off

Length [bits]	Permissible values	Factory setting	Meaning
8	0 or 1	0	Preamble (pilot signal) 0: Pilot signal off 1: Pilot signal on

Note
The pilot signal can only be turned off for *RF profiles* which use Miller-4 or Miller-8 encoding.

Modulation

Parameter-ID: 0007_{hex}
Switches the modulation procedure used to modulate the data on the air gap from the read/write head to the data carrier.

Length [bits]	Permissible values	Factory setting	Meaning
8	1	1	Modulation procedure 1: PR-ASK (Phase Reversal – Amplitude Shift Keying)

Note
Detailed information about the Expert parameters *Session*, *Preamble* and *Modulation* can be found in the UHF RFID standards ISO/IEC 18000-63 and EPCglobal™ Class-1 Generation-2.

Use BlockWrite

Parameter-ID: 000C$_{hex}$
For normal write accesses to a data carrier the data are written sequentially (word-serially) via several write operations.
If the parameter *Use BlockWrite* is enabled, multiple data words can be written to the data carrier in a single write operation.

Note
The *BlockWrite command* is optional and may not be supported by all data carriers.

If the *BlockWrite* command cannot be successfully carried out on the data carrier because for example it doesn't support the command, the write operation is repeated using the usual write command.

Note
As a consequence, use of this command can, when using mixed data carriers which do and do not support it, result in longer read/write times.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 or 1	0 BlockWrite off	Use BlockWrite 0: *BlockWrite* off (not used) 1: *BlockWrite* on (is used)

Max. write length

Parameter-ID: 000D$_{hex}$
The parameter *Max. write length* specifies what number of data words can be sent with a BlockWrite command.
From 1 to 256 (parameter value 0 - 255) words can be sent, whereby a setting of 1 corresponds to a normal write command.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 255	16 16 words (32 bytes)	Number of data words to write to the data carrier 0 – 255 data words

Note
In noisy EMC environments where strong interference can be expected, a short *Max. write length* may yield better results.

Max. read length

Parameter-ID: 000E
The parameter *Max. read length* specifies what number of data words can be sent from the data carrier to the read/write head with a read command.
From 1 to 256 (parameter value 0 - 255) words can be sent.

Length [bits]	Permissible values	Factory setting	Meaning
8	0 – 255	16 16 words (32 bytes)	Number of data words for reading from the data carrier 0 – 255 data words

Note
In noisy EMC environments where strong interference can be expected, a short *Max. read length* may yield better results.

7 Function Indicators and Diagnostics

7.1 Function indicators

The operating states of the read/write head are indicated by LEDs.

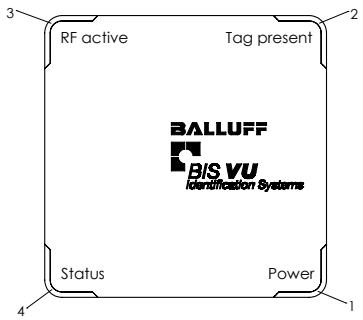


Figure 6: Function indicators

7.2 Diagnostics

LED Power	Meaning
Off	Device is not ready for operation
Flashing green	Auto-Setup is being performed
Green, solid on	Device is ready for operation

RF active (Radio Field active)	
Off	Device is not ready for operation
Blue, flashing	Antenna field is turned on or off depending on job
Blue, solid on	Antenna field is continuous on

Tag Present	
Off	Device is not ready for operation
Yellow, flashing	Data carrier is being programmed
Yellow, lit	Data carrier detected in the active range of the antenna

Status	
Off	Normal operation
Flashing red	No data carrier found (only during Auto-Setup) or configuration faulty
Red, solid on	Error (e.g. device error, cable break or excessive temperature)

Note
If the Config key is pressed and held to prepare the Auto-Setup function, then all 4 LEDs will flash. For details on the Auto-Setup function, see Section 6 „Commissioning“ on page 26.

8 UHF Manager Configuration Software

8.1 General

The UHF Manager configuration software is used to set parameters for the BIS VU read/write head and initiate the basic functions.

Note
For startup, connect the RFID system, consisting of the BIS V processor and BIS VU read/write head, as described in the Quick-Start section.

8.2 Installing and starting the configuration software

To install the configuration software, start the Installation Wizard by double-clicking on the installation file (file extension .msi) and follow the instructions.

Note
The configuration software is available online at www.balluff.com.
Administrator rights may be required for installing the software.
Unless otherwise specified by the user, the software is installed in the default installation path C:\Program Files (x86)\Balluff\UHF Manager.

Double-clicking on the file Balluff.Uhf.UhfManager.exe in the installation directory starts the configuration software.

After the software is started the main window is shown.

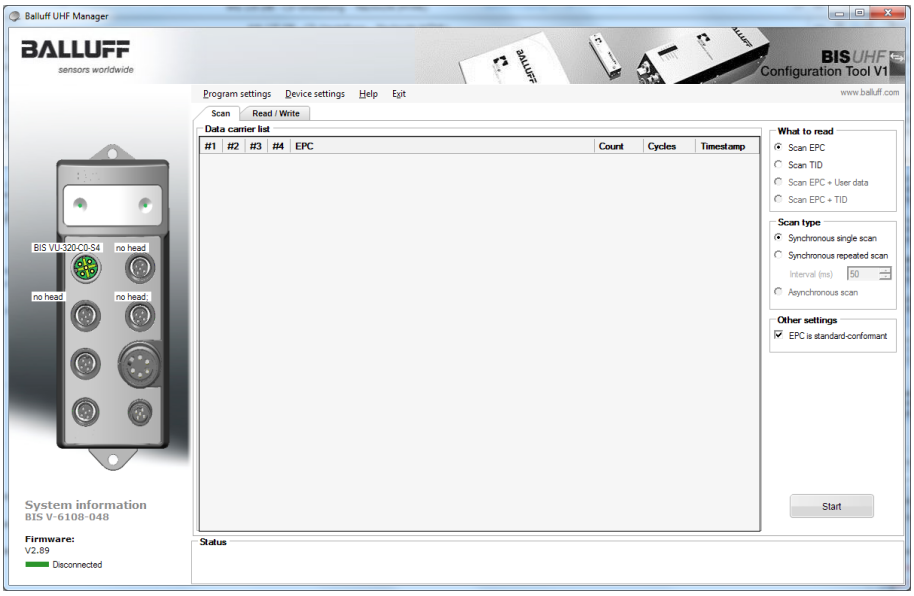


Figure 7: Main window

8 UHF Manager configuration software

RFID System information
RFID system information is shown in the left area of the window. This is in the form of a schematic representation of the BIS V processor and provides the following information:
– Model of the connected BIS V processor
– Processor firmware version
– Connection status of the serial port
– Model of the connected read/write heads
– Currently selected read/write head (port of the currently selected read/write head is highlighted in green, see „Figure 7: Main window“)

Action area
The Action area in the center of the window shows the data for the data carriers found in the active field of the antenna and provides the operating elements needed for interacting with a data carrier.

Status line
The status line below the Action area shows the result of the action that was last carried out.

Note
Detailed information on using the UHF Manager can be found by invoking the Help function. This is opened from the menu or by pressing the F1 key.

Menu

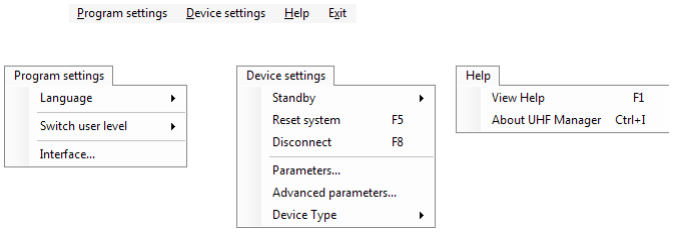


Figure 8: Menu

Program settings

Language
Switching between German and English

Change user level
Toggles the user levels *Normal/Service.* The Service level is accessed in *Device settings* , *Extended parameters…* .

Note
The area for configuring advanced device parameters is password-protected and can only be accessed by a Balluff service technician.

Port…
Opens the window for the *port settings*.

Rest mode
Not available with the BIS V processor.

Reset System (function key F5)
Not available with the BIS V processor.

8 UHF Manager configuration software

Connect/Disconnect (function key F8)
Opens a connection to the processor using the last used port settings.

Parameters…
Opens the parameter window.

Expanded parameters…
Opens the window for Expanded Parameters (area is password protected, see menu item *Changing user level* on page 33).

Device type
Shows a list of the processors supported by the software.

Help
View help (function key F1)
Opens the Help function for the configuration software

Use UHF-Manager (Ctrl + I)
Opens the window for the user information
- Software version of the configuration software
- Contact data for Balluff GmbH

Quit
Quits the configuration software

8.3 Interface settings

The serial connection between the configuration software and the processor is opened as follows:

Open port settings in the following menu:
► Program Settings - Port…

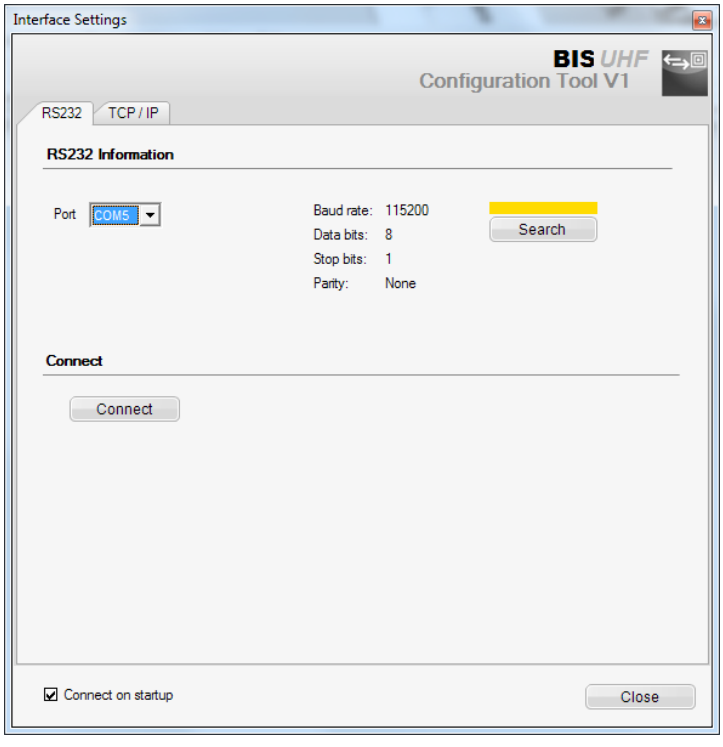


Figure 9: Port settings

8 UHF Manager configuration software

8.4 Detecting data carriers

Clicking on the button *Search tags…* in the *Detect* tab of the Action area shows a data carrier list containing those which are located in the active field of the antenna.

Selecting the read/write head in the Info area
Clicking on the connector image of the desired read/write head (H1…H4) in the schematic representation of the processor selects the read/write head.

Data
When using the BIS VU read/write head the data carrier list can be shown either as an EPC list or a TID list.

> **Note**
> The length of the EPC or TID data fields can be parameterized, see Section 6.4 „Setting read/write head parameters“.

Detection
Detect synchronous once carries out the function *Search tats…* one time. The data carrier population in the active field of the antenna is detected and entered in the *Data carrier list* in the selected format.
Detect synchronous repeated carries out the function *Search tags…* cyclically using the specified time interval. The data carrier list is refreshed each time the command is carried out. Detected data carriers are displayed in green. If an already detected data carrier is removed from the field, it will then be shown in red.

Additional settings
If the *EPC is standard conformal* box is checked, only data carriers which are intended for a EPCglobal™ application are detected whose EPC structure corresponds to the EPCglobal™ Tag Data Standard.

8.5 Reading/writing data carriers

The *Read/Write* tab provides the functions for reading as well as writing to data carriers. The *Read* and *Write* buttons are used to start the respective action.

Before an individual data carrier can be processed, it must be unambiguously identified in the field. Furthermore, it must be specified which memory range is to be written or read.

Memory range to be used for identifying the tag
To select an individual data carrier either EPC or TID can be used. Select an individual data carrier from the drop-down list. First the *Detect* tab must be used to carry out the *Search tags…* function.

> **Note**
> In the *Data carrier list* of the *Detect* tab you can right-click on the listed data carrier to switch directly to the *Read/Write* tab. The data carrier is automatically selected in the *Read/Write* tab, so that the selection described above is not necessary.

Access password
By checking the *Access password* box an input field appears in which an *access password* can be entered.

8 UHF Manager configuration software

Note
The *Access password* is only needed for password protected data carriers. Detailed information about password protection of data carriers can be found in the UHF RFID Standards EPCglobal™ Class-1 Generation-2 and ISO 18000-63.

Which memory area should be processed?
Selecting the memory area for reading or writing.
The areas *EPC, TID* and *User data* are available.

For the memory areas *EPC* and *TID* the *start address* and *length* (number of bytes) are specified using a parameter, see Parameterizing.

For the memory area *User data* the *start address* and *length* (number of bytes) can be specified using the fields *Start address* and Length.

Memory area	Read	Write	Start address	Length
EPC	Yes	Yes	Fixed	Parameters
TID	Yes	No	Fixed	Parameters
User data	Yes	Yes	Field *Start address*	Field *Length*

Data
The data that were read are shown in the data field. The left side of the data field shows the start addresses of the individual lines. The middle area shows the data in hex format. The right side shows the data in ASCII.
The data to be written can be edited directly in the data field from the keyboard. Entries can be in hex or ASCII.

Manipulating data
For simple data values the buttons *Increment, Decrement, Continuous* and *Fixed value* can be used. In the *Start value/Value* field you can specify a *start value* for the *Continuous* function or a *value* for the *Fixed value* function.

Saving/loading files
The buttons *Open* and *Save* can be used to export the hex data from the data field to a file (file extension .dat) or import them from a file.

Appendix

Type code

BIS VU– 3 20–C0–S4

Balluff Identification System

Series VU read/write system

Read/write head

Series
20 = Housing 130 mm x 130 mm x 50 mm
with integrated patch antenna

Antenna polarization
C = circular
L = linear

Country designation / frequency
0 = 865 -868 MHz Europe
1 = 902-928 MHz USA / Canada / Mexico
2 = 920.5-924.5 MHz China
4 = 917-920.8 MHz Rep. Korea
5 = 916.7-923.5 MHz Japan
7 = 918-926 MHz Australia

Connector type
S4 = 4-pin M12 plug, A-coded

Accessories (optional, not included in the scope of delivery)

Type	Order code
Mounting plates	BAM02YW

Note
More accessories for the BIS VU-320 can be found in the Balluff BIS catalog and at www.balluff.com.

Appendix

ASCII table

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

Index

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