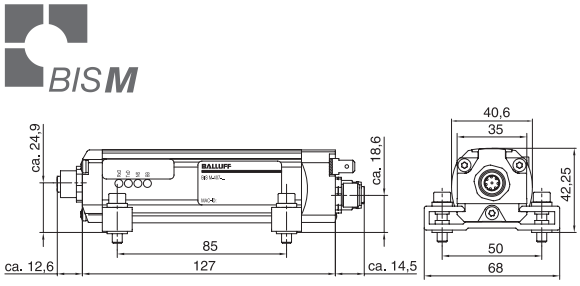
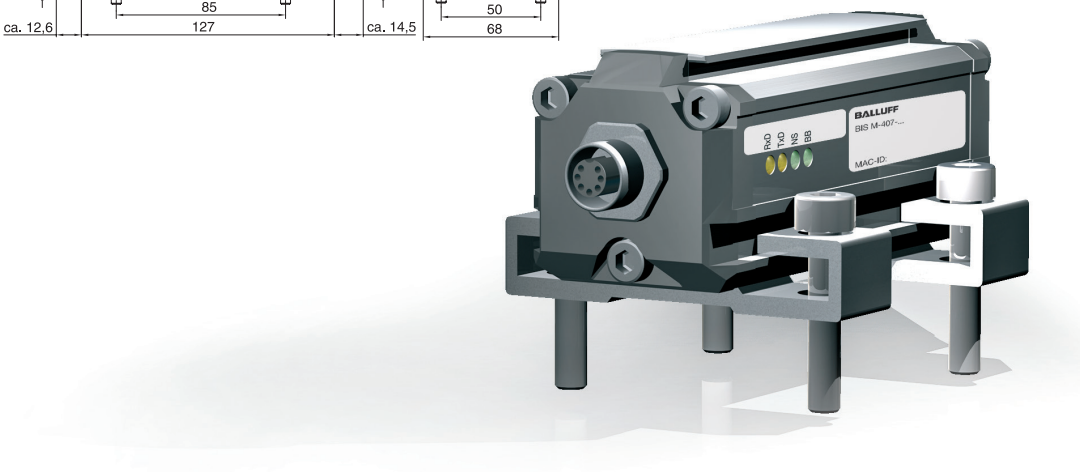
BALLUFF

BIS M-407 Ethernet with TCP/IP-Protocol

Technical Description, User‘s Manual





english

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1 User Notes

1.1 About this Manual

This manual describes the processor for the BIS M-407 identification system and guides you through startup for immediate operation.

1.2 Manual layout

The manual is designed so that each section builds on the previous sections.
Section 2: Basic information regarding safety.
Section 3: The main steps in installing the identification system.
Section 4: An introduction into the material.
Section 5: Technical data for the processor.
Section 6: Mechanical and electrical connections.
Section 7: Logging the processor on to the network.
Section 8: User-defined settings for the processor.
Section 9: How the processor and host system work.

1.3 Conventions

The following conventions are used in this manual.

Enumerations

Enumerations are represented as a list with bullet points.
– 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.
⇒ Result of action.
► Action instruction 2.

Notation

Numbers:
– Decimal numbers are represented without additional description (e.g. 123),
– hexadecimal numbers are represented by appending the abbreviation hex (e.g. 00hex).

Parameters:
Parameters are written in italics, (e.g. *CRC_16).*

Directory paths:
Paths in which data are or will be saved/stored are represented in small caps (e.g. Project:\Data Types\Userdefined).

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

ASCII code:
Characters to be sent in ASCII code are placed in apostrophes (e.g. 'L').

Cross-references

Cross-references indicate where additional information on the topic can be found (see "Technical Data" on page 11).

1.4 Symbols

Attention!
This symbol indicates a safety advisory which must be observed.

Note, tip
This symbol indicates general notes.

1 User Notes

1.5 Abbreviations

BIS	Balluff Identification System
CRC	Cyclic Redundancy Code
EEPROM	Electrical Erasable and Programmable ROM
EMC	Electromagnetic Compatibility
IP	Internet Protocol
MAC-ID	Media Access Control Identifier
PC	Personal Computer
PLC	Programmable Logic Controller
TCP	Transmission Control Protocol

2 Safety

2.1 Intended use

The BIS M-407 processor is a component of the BIS M identification system. Within the identification system it is used for linking to a host computer (PLC, PC).
It is intended only for use only in this way and in an industrial environment complying with Class A of the EMC Law.
This description applies to processors in series BIS M-407-039-….

2.2 General notes on device safety

Installation and startup
Installation and startup are to be carried out only by trained specialists. The manufacturer revokes the right to any warranty or liability claims resulting from unauthorized modifications or improper use. When connecting the processor to an external controller, be sure to observe proper polarity for all connections including the power supply (see "Installation"on page 12).
The processor must be operated only using approved power supplies (see "Technical Data"on page 11).

Operation and testing
It is the responsibility of the operator to ensure that the locally applicable safety regulations are maintained.
In case of defects and faults in the identification system which cannot be remedied, take it out of operation and protect against unauthorized use.

2.3 Meaning of safety instructions

⚠ **Attention!**
The pictogram used with the word "Attention" warns of a possibly hazardous situation for the health of persons or equipment damage.
Disregarding these warnings may result in personal injury or equipment damage.
► Always observe the instructions given for avoiding this hazard.

3 Getting Started

Mechanical connection

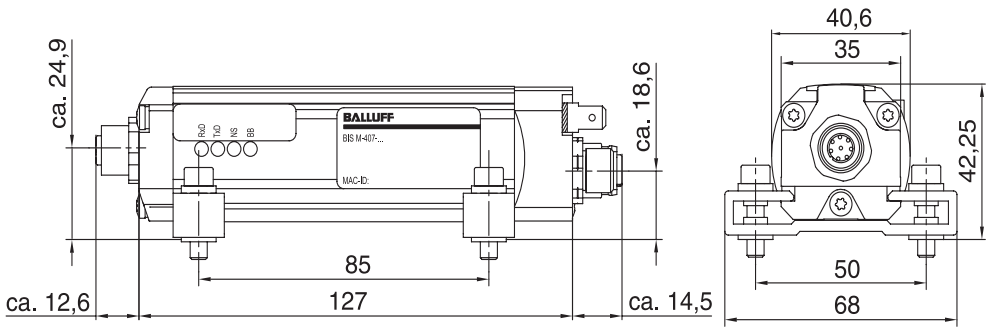


Fig. 1: Dimensions in mm

► Attach processor using (4) M4 screws.

Electrical connection

Note
Route the ground wire to ground either directly or through an RC combination, depending on the system.
When connecting to the Ethernet, be sure that the connector shield is perfectly connected to the connector body.

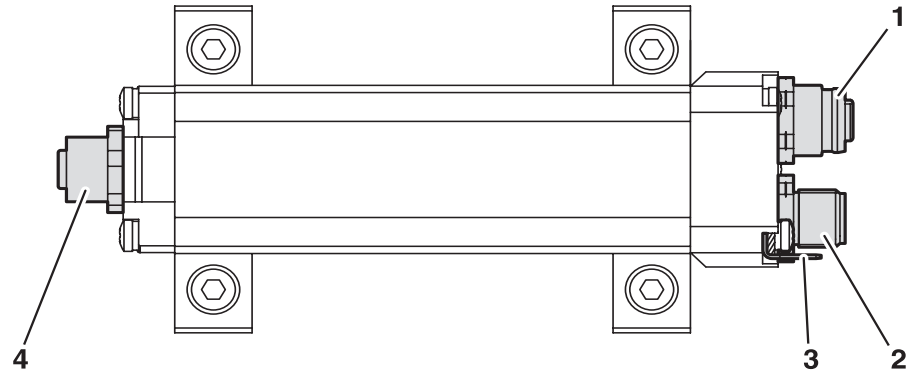
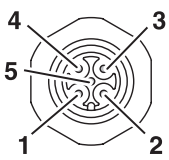


Fig. 2: Electrical connection

1 X3 - Ethernet
2 X1 - Power supply
3 Function Ground - FE
4 Head - Read/write head

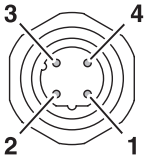
3 Getting Started

X1 - 5-pin terminal



PIN	Function
1	+Vs
2	
3	-Vs
4	
5	

X3 - 4-pin socket

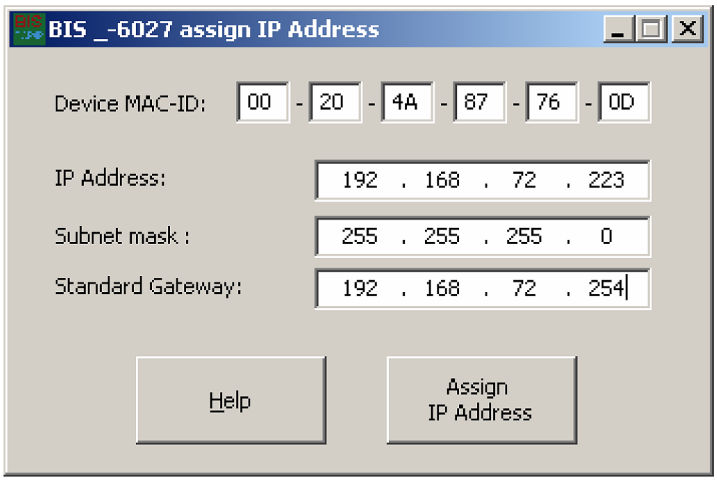


PIN	Function
1	TD+
2	RD+
3	TD-
4	RD-

Bus connection

The bus connection is established using the "BIS SetIP" program running on a Windows PC having an Ethernet connection. The "BIS SetIP" application is included on the BIS-CD supplied.

► Start "BIS SetIP".
⇒ The "BIS_-6027 assign IP Address" window is opened.



► Enter the MAC-ID for the device.

Note
The MAC-ID for the device can be found on the sticker on the housing cover.

► Assign IP address, subnet mask and gateway address.
► Confirm your setting by clicking on "Assign IP Address".

4 Basic Knowledge

4.1 Identification system principles of operation

The BIS M identification system belongs to the category of non-contact systems having a read and write function. This enables you to not only read data contained in the data carriers, but also to write new data to them at any point in the process.

The main components of the BIS M identification system are:
– Processor,
– Read/write heads,
– Data carriers.

The main areas of application are:
– In production for controlling material flow (e.g. for variant-specific processes, workpiece transport using conveying systems, for collecting safety-related data),
– In inventory systems for monitoring inventory movements,
– In transport and conveying technology.

4.2 Product description

BIS M-407 processor:
– Metal enclosure,
– Round connectors for making plug connections,
– Capacity for one read/write head,
– Read/write heads are suitable for both dynamic and static operation,
– Processor provides power for system components,
– Carrier signal from the read/write heads provides power for the data carrier.

4.3 Control function

The processor represents the link between the data carrier and the host control system. It manages two-way data transfer between the data carrier and read/write head and provides a buffer storage function.
The processor writes data from the host signal to the data carrier through the read/write head, or reads data from the data carrier and makes the data available to the host system.

Host systems may be:
– A control computer (e.g. industrial PC),
– a PLC.

4.4 Data integrity

To ensure data integrity the data transfer between data carrier and processor must be monitored using a check procedure.
The factory default setting in the processor is for double read with compare. A CRC_16 check may however be selected as an alternative.
In CRC_16 checking a check code is written to the data carrier, which enables checking the data for validity at any time.
Which procedure is used depends on how you are using the identification system.

Note
Mixed operation of the two check procedures is not possible!

4 Basic Knowledge

The following table provides an overview of the advantages of each respective check procedure.

CRC_16 data check	Double read
Data integrity even during the non-active phase (data carrier outside the read/write head).	No user data bytes are lost for storing a check code.
Shorter read time – page is read just once.	Shorter read time – no check code is written.

4.5 Communication module

The communication module is used for implementing data exchange between the processor and the host system. The LED on the communication module indicates the status of the Ethernet connection.

LED Indicator

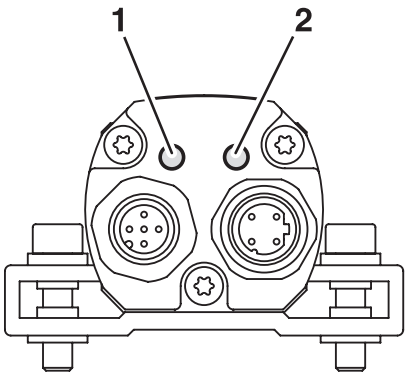


Fig. 3: LED indicator on communication module

1 LED 1
2 LED 2

LED 1 (10 BASE-T connection)	LED 2 (100 BASE-T connection)	Connection type
Off	Off	No connection
Off	Yellow	100 BASE-T half-duplex
Off	Flashing yellow	100 BASE-T half-duplex; activity
Off	Green	100 BASE-T full-duplex
Off	Flashing green	100 BASE-T full-duplex; activity
Yellow	Off	10 BASE-T half-duplex
Flashing yellow	Off	10 BASE-T half-duplex; activity
Green	Off	10 BASE-T full-duplex
Flashing green	Off	10 BASE-T full-duplex; activity

4.6 Bus connection

The processor and host system communicate using the physical Ethernet network.
The device uses Internet Protocol (IP) for network communication.
Transmission Control Protocol (TCP) is used to ensure complete, errorless and properly sequenced data transmission.

5 Technical Data

Dimensions

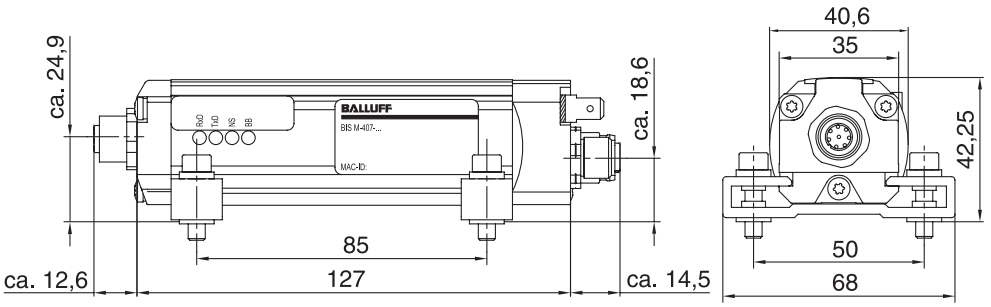


Fig. 4: Dimensions in mm

Mechanical data

Housing material	EN AC-AlSi12 (a), DIN EN 1706
X1 – Input	V_S 24 V DC - 5-pin terminal
X3 – Ethernet	4-pin socket, D-coded
Head (Read/Write head connections)	8-pin socket
Enclosure rating	IP65 (with plugs connected)
Weight	950 g

Electrical data

Operating voltage V_S	24 V DC ±10 %
Ripple	≤ 10 %
Current consumption	≤ 400 mA
Device interface	Ethernet

Operating conditions

Ambient temperature	0 °C … 60 °C
EMV – EN 61000-4-2/3/4/5/6 – EN 55011	 – Severity level 4A/3A/3A/1B/3A – Gr. 1, Cl. A
Shock/Vibration	EN 60068 Part 2-6/27/29/64/32

Function indicators

Status Ethernet TCP/IP connection	Receive Data (RxD) Transwith Data (TxD) Network Status (NS) Ready (BB)	Yellow LED Yellow LED Green LED Green LED
Physical Ethernet status (displays on communication module)	No connection Half-duplex connection Half-duplex; activity Full-duplex connection Full-duplex; activity	Off LED Yellow LED Yellow flashing LED Green LED Green flashing LED

6 Installation

6.1 Processor installation

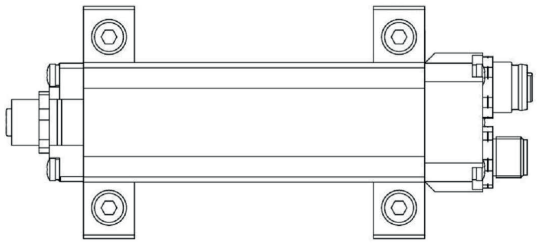


Fig. 5: Installation

► Attach processor using (4) M5 screws.

6.2 Interface information/ Connection diagrams

Note
Route the ground wire to ground either directly or through an RC combination, depending on the system.
When connecting to the Ethernet, be sure that the connector shield is perfectly connected to the connector body.

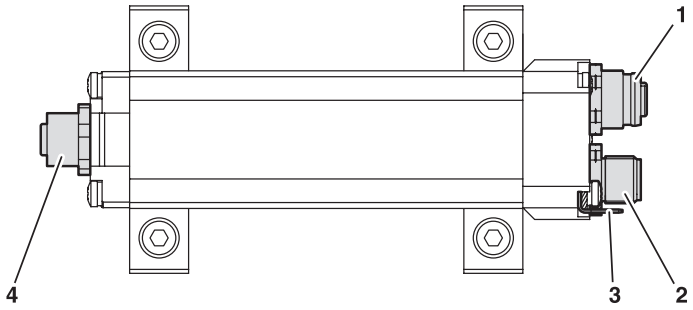
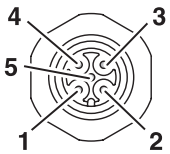


Fig. 6: Processor connections

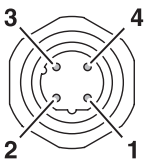
1 X3 - Ethernet
2 X1 - Power supply
3 Function Ground - FE
4 Head - Read/write head

X1 - 5-pin terminal



PIN	Function
1	+Vs
2	
3	-Vs
4	
5	

X3 - 4-pin socket



PIN	Function
1	TD+
2	RD+
3	TD-
4	RD-

7 Bus Connection

7.1 IP address

The processor and host system communicate over the Ethernet. Assigning a unique IP address associates the processor with a network.

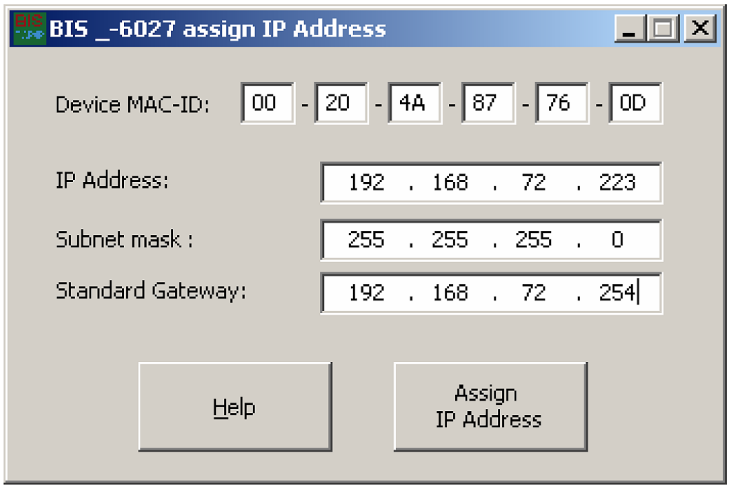
The MAC address is used as the basis for incorporating into the network. This hardware address is used only one time and uniquely identifies network devices such as the processor.

7.2 BIS SetIP

"BIS SetIP" is a software program that allows you to address the hardware for the corresponding subnet before installing it.

The "BIS SetIP" application is included on the BIS CD which comes with the processor.

► Start "BIS SetIP".
⇒ The "BIS_-6027 assign IP Address" window is opened.



► Enter the MAC address for the device.

Note
The MAC-ID for the device can be found on the sticker on the housing.

► Assign the IP address, subnet mask and gateway address.
► Confirm your settings by clicking on "Assign IP Address".

8 Parameterizing the Processor

8.1 Basic knowledge

Data carrier types

For the BIS M-6026 processor the following data carrier types are available.

Mifare:

Balluff data carrier type	Manufacturer	Name	Memory capacity	Memory type
BIS M-1_ _-**01**	Philips	Mifare Classic	752 Byte	EEPROM

ISO15693:

Hinweis
ISO15693 data carriers are usable only with read/write heads having hardware version 2.0 or higher.

Balluff data carrier type	Manufacturer	Name	Memory capacity	Memory type
BIS M-1_ _-**02**	Fujitsu	MB89R118	2000 Byte	FRAM
BIS M-1_ _-**03***	Philips	SL2ICS20	112 Byte	EEPROM
BIS M-1_ _-**04***	Texas Instruments	TAG-IT Plus	256 Byte	EEPROM
BIS M-1_ _-**05***	Infineon	SRF55V02P	224 Byte	EEPROM
BIS M-1_ _-**06***	EM	EM4135	288 Byte	EEPROM
BIS M-1_ _-**07***	Infineon	SRF55V10P	992 Byte	EEPROM

* on request

CRC check

The CRC check is a procedure for determining a test value for data so as to detect errors in transferring data. If CRC check is activated, an error message is output when a CRC error is detected.

Initializing
To be able to use the CRC check, the data carriers must be initialized. The data carriers are initialized using the command ID 'Z'. If the data carrier does not contain the correct CRC when reading or writing, the processor sends the error message 'CRC-Error'.
As shipped from the factory, data carriers may be immediately written a checksum, since all the data are set to 0.

Error message
- If an error message is the result of a failed write job, then the data carrier must be reinitialized before it can be used again.
- If an error message is not the result of a failed write job, then one or more of the memory cells in the data carrier are defective. This means the data carrier must be replaced.

Checksum
The checksum is written to the data carrier as a 2-byte information per block. 2 bytes per block are lost for the data transmission. This leaves 14 bytes remaining per block. The usable number of bytes can be determined from the following table.

8 Parameterizing the Processor

Data carrier	Balluff data carrier type	Memory capacity	Usable bytes for CRC_16
Mifare	BIS M-1_ _-**01**	752 Byte	658 Byte
ISO15693	BIS M-1_ _-**02**	2000 Byte	1750 Byte
	BIS M-1_ _-**03**	112 Byte	98 Byte
	BIS M-1_ _-**04**	256 Byte	224 Byte
	BIS M-1_ _-**05**	224 Byte	196 Byte
	BIS M-1_ _-**06**	288 Byte	252 Byte
	BIS M-1_ _-**07**	992 Byte	868 Byte

Send CT data immediately

Each time a data carrier is recognized, it is read depending on the setting. The data are output over the interface.
This setting allows you to eliminate a read command in dialog mode.
The prescribed amount of data (start addresses and number of bytes) can be set (see "Configuration" on page 18).

Dynamic mode

As soon as the Dynamic mode function is activated, the processor accepts the read/write job from the host system and stores it regardless of whether there is a data carrier in the active zone of the read/write head. When a data carrier enters the active zone of the read/write head, the stored job is executed.

Protocol type

The factory setting is for block check BCC. The BCC is formed as an EXOR operation from the serially sent binary characters of the telegram block.

If needed the termination using BCC block check can be replaced by the ASCII character "Carriage Return" (CR).

For controllers that always require a termination character, this must always be inserted into the telegrams. The following are available:
– "Carriage Return" (CR) or
– "Line Feed with Carriage Return" (LF CR).

Examples for terminating the telegrams:

Protocol type	Telegram with command, address, no. of bytes, head-no., block size	Terminator	Acknowl-edgement	Termination identifier
Block check BCC	L 0000 0001 10	BCC	<ACK> 0	
CR	L 0000 0001 10	CR	<ACK> 0	
Termination identifier CR	L 0000 0001 10	CR	<ACK> 0	CR
Termination identifier LF CR	L 0000 0001 10	LF CR	<ACK> 0	CR

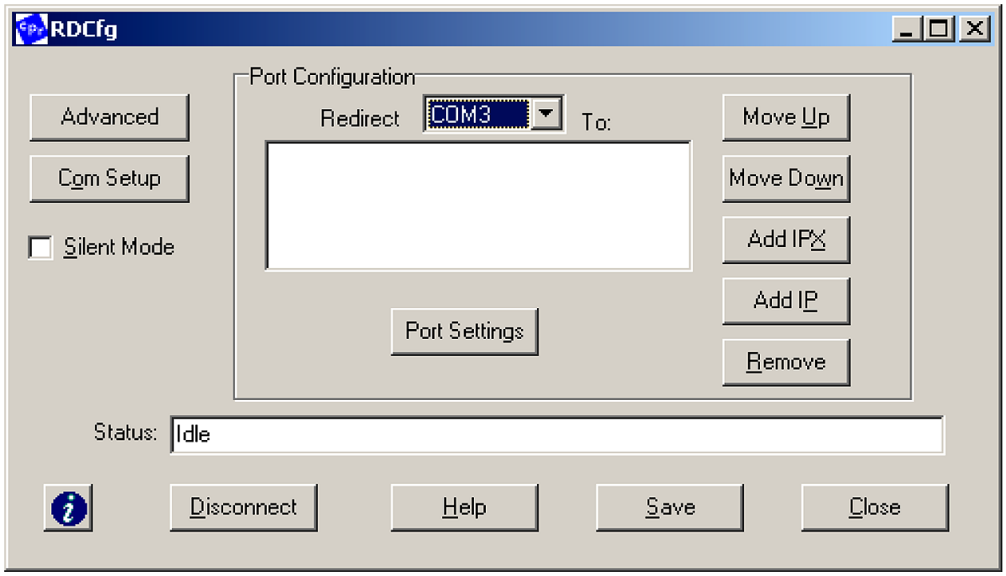
8 Parameterizing the Processor

8.2 Software COM Port Redirector

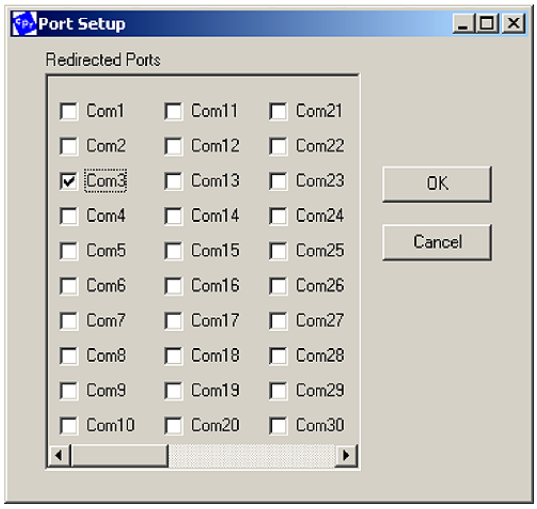
The Com Port Redirector allows a software program with COM port support to send TCP/IP sockets on the Ethernet.
The COM Port Redirector installs virtual Windows Communication (or COM) Ports for this purpose. Data which are sent through these virtual COM Ports (e.g. COM3) are passed along to the network station over the network as TCP/IP sockets.
The "Com Port Redirector" software program is included on the BIS-CD provided.

Set up virtual COM Port

► Start "Lantronix Redirector --> Configuration" software,
⇒ Configuration window "RDCfdg" opens.

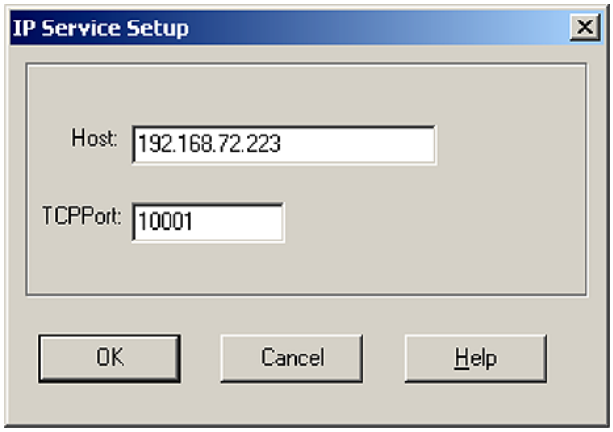


► Click on "Com Setup" button.
► Select number of COM port you want to set up as a virtual prot.
► Confirm selection by clicking on "OK".

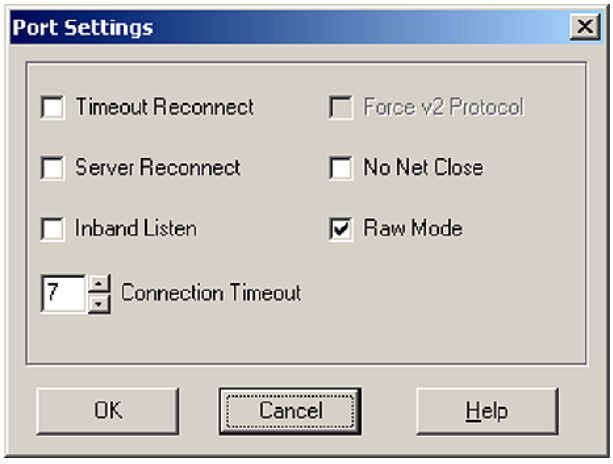


8 Parameterizing the Processor

- ► Click on "Add IP" button in "RCDfg" window.
- ► Enter IP address of the processor in the "Host" field.
- ► Enter 10001 in the "TCPPort" field.
- ► Confirm entries by clicking on "OK".



- ► Click on "Port Settings" button in "RCDfg" window.
- ► Activate "Raw Mode" option.
- ► Confirm selecting by clicking on "OK".



- ► Click on "Save" button in "RCDfg" window.
  ⇒ The settings are saved.
- ► Quit program and restart PC.
  ⇒ The virtual Windows Port is ready to use.

8 Parameterizing the Processor

8.3 Parameterizing

Basics

Parameterizing is done using the "Configuration Software BIS" software.
Configuration is done online. The parameters may be overwritten at any time. The configuration may be saved in a file so that it is always available.

The "Configuration Software BIS" software is included in the BIS-CD provided.

Requirements

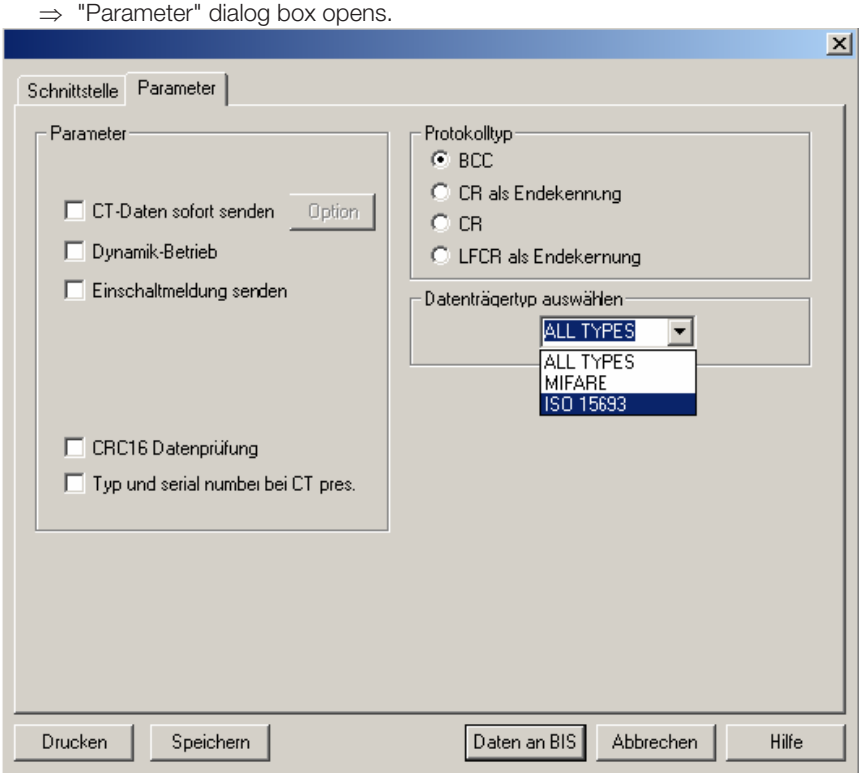
- Software "Com Port Redirector" is installed and a virtual port is set up (see "Software COM Port Redirector" on page 16).
- The device is online (available on the Ethernet).

Start configuration software

► Start BIS configuration software.
► Select COM Port in "Configuration --> Port" menu
► Select "**BIS M-407-039...**".

8 Parameterizing the Processor

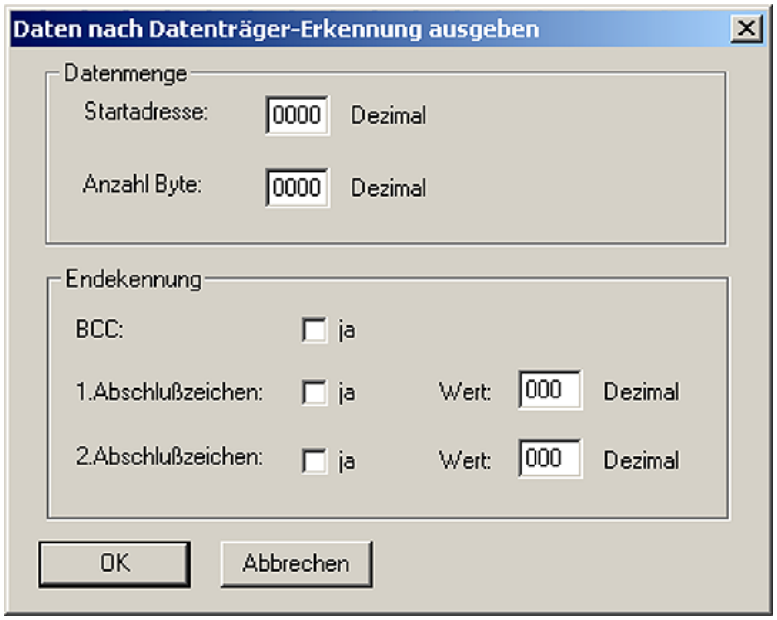
► Select "Online --> Initialize" menu.
⇒ "Parameter" dialog box opens.



Each time a data carrier is recognized, it is read depending on the configuration. The data are output to the port.

Send CT Data immediately parameter

Send CT Data immediately --> Option
Further configuration of the parameter if *Send CT Data immediately* is active.



Data amount
Specified amount of data to be read from a newly recognized data carrier (number of bytes beginning with the start address).

8 Parameterizing the Processor

End of block marker
As an option a BCC and/or 1 or 2 freely definable termination characters may be sent as a terminator.

Factory setting: *Send CT Data immediately* not active.

Parameter Dynamic mode

Dynamic-mode activated:
A read/write command is stored until a data carrier enters the working range of the read/write head.

Dynamic-mode not activated:
A read/write command is carried out only if there is a data carrier in the range of the read/write head.
If there is no data carrier in the range of the read/write head, a read/write command is rejected with the error message <NAK>'1'. The processor goes into the base state.

Factory setting: *Dynamic-mode* not active.

Parameter CRC_16 data checking

CRC_16 data checking activated:
The validity of the data is verified using a CRC check (see "Data Integrity" on page 9).

CRC_16 data checking not activated:
The validity of the data is verified by a double read.

Factory setting: *CRC_16 data checking* not active.

Parameter Model and serial number at CT Present

Model and serial number at CT Present activated:
At CT Present the data carrier type and the serial number of the data carrier are output.

Factory setting: *Model and serial number at CT Present* not activated.

Protocol type

For selecting the protocol type (protocol variant).

BCC	Blockcheck	Factory setting
CR as end identifier	Carriage Return as end identifier	Also possible for controllers always requiring a termination character.
CR	Carriage Return	If needed, terminator using BCC can be replaced with *CR*.
LFCR as end identifier	Line Feed with Carrige Return	Also possible for controllers always requiring a termination character.

Select data carrier type

For selecting the data carrier type.

ALL TYPES	All Mifare data carriers and ISO15693 data carriers **supported by Balluff** are processed.
MIFARE	All Mifare data carriers **supported by Balluff** are processed.
ISO15693	All ISO15693 data carriers **supported by Balluff** are processed (read/write head hardware version **HW 2.0** or higher).

Factory setting: *ALL TYPES*

9 Device Function

9.1 Function principle of BIS M-407

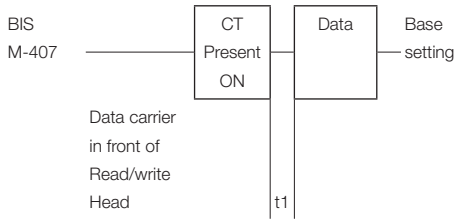
The processor and host system communicate over the physical Ethernet of BIS M-407 network. The device uses Internet Protocol (IP) for network communication.
Transmission Control Protocol (TCP) is used for ensuring complete, errorless and properly sequenced data transmission.

The host system and BIS M-407 communicate via TCP/IP sockets. Communication is done in raw mode (only user data is exchanged, no configuration or status information).

Possibilities for opening a connection:
1. Socket connection to the IP address of the device, Port 10001. How the connection is established depends on the (PC operating) system used and the programming language.
2. Use of the "Com Port Redirector" software (see "Software Com Port Redirector" on page 16) and a software program with access to a COM port (e.g. "Hyperterminal").
   For simple read/write access, the "BISCOMRW" program (included on the supplied BIS Software CD) can be used.

9.2 Protocol sequence

Read mode



t1 Depends on number of bytes to read

Prerequisite for validity of these figures:

- The processor is in the base setting.
- There is a data carrier in front of the read/write head.

9 Device Function

9.3 Communication

The host system and processor communicate with each other using telegrams. There are specific telegrams for each task. These always begin with the command which is associated with the telegram type.

Telegram types with associated command (ASCII character)

'L'	Read the data carrier and select the read/write head
'P'	Write to the data carrier and select the read/write head
'C'	Write a constant value to the data carrier and select the read/write head
'Q'	Restart the processor - Quit
'U'	Read data carrier type, data carrier ID and output with Status byte.
'Z'	Initialize CRC_16 data check

Note
Continuous querying on the interface is not allowed. The wait time between two commands must be at least 300 ms.

Explanations of telegram contents

Start address and number of bytes	The start address (A3, A2, A1, A0) and the number of bytes for sending (L3, L2, L1, L0) are sent in decimal as ASCII characters. For the start address the range 0000 to (n-1) and for the number of bytes 0001 to n may be used. A3 ... L0 stand for one ASCII character each, n stand for the memory capacity of the used data carrier.
Note	The start address + number of bytes may not exceed the data carrier capacity. A maximum of 1024 bytes can be read or written. Data carriers with a larger memory capacity must be read/written twice.
Head number and block size	In the case of the commands 'L' (read with head select) and 'P' (write with head select) the number of the read/write head K (constant '1') is sent first and then the block size B ('0' or '1').
Note	Parameter B and K have no meaning for communication with a BIS M-407 processor. It is sent to ensure uniform read/write telegrams for the entire BIS series.
Acknowl-edgement	The acknowledgement <ACK> '0' is sent by the identification system if the serially transwithted characters were recognized as correct and there is a data carrier in the working range of a read/write head. <NAK> + 'ErrorNo.' is acknowledged if an error was detected or if there is no data carrier in the working range of the read/write head.
Start	<STX> is used to start data transmission.
Sent bytes	The data are sent code-transparent (no data conversion).

9 Device Function

Telegram for read/write data carrier with R/W head select

Read from the data carrier.
Write to the data carrier.

Note
The start address of the first byte to send and the number of bytes sent in the telegram shown refer to data carrier type BIS M-1_ _-01.
In general the following applies:
Start address = memory capacity of the data carrier - 1;
Number of bytes to send = memory capacity of the data carrier (but not more than 1024 bytes).

Task	Data flow	Com-mand	Start address of the first byte to send	Number of bytes to send	Head no.	Block size	Ter. 2)	Acknow. 3)	EI 4)	Start for sending	EI 4)	Data 5)	Ter. 2)	Acknow. 3)	EI 4)
Read	To BIS 6)	'L'	A3 A2 A1 A0 '0 0 0 0' to '0 7 5 1'	L3 L2 L1 L0 '0 0 0 1' to '0 7 5 2'	K '1'	B '0' or '1'	BCC or 2)			<STX>	'CR' or 'LF CR'				
	From BIS 7)							<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'			D1 D2 D3...Dn	BCC or 2)		
			1)								1)				
Write	To BIS 6)	'P'	A3 A2 A1 A0 '0 0 0 0' to '0 7 5 1'	L3 L2 L1 L0 '0 0 0 1' to '0 7 5 2'	K '1'	B '0' or '1'	BCC or 2)			<STX>		D1 D2 D3...Dn	BCC or 2)		
	From BIS 7)							<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'					<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'
			1)									1)			

1) The commands Status and/or Quit are not perwithted at this point.
2) Terminator; Instead of BCC block check either Carriage Return 'CR' or Line Feed with Carriage Return 'LF CR' may be used depending on the protocol variant.
3) As an acknowledgement <ACK> '0', is used if there was no error, or <NAK> + 'Error no.', if an error occured.
4) End identifier; for protocol variants which always require an end identifier, one of the termination characters 'CR' or 'LF CR' must be inserted here.
5) Data from start address to start address + number of bytes.
6) From host system to BIS.
7) From BIS to host system.

Note
Telegram examples can be found in Section 9.7 starting page 31.

9 Device Function

Telegram for writing a constant value to the data carrier with R/W head select

For writing a constant value to the data carrier.
This command can be used for erasing a data carrier. This saves time in transwithting the bytes for writing.

Note
The start address of the first byte to send and the number of bytes sent in the telegram shown refer to data carrier type BIS M-1_ _-01.
In general the following applies:
Start address = memory capacity of the data carrier - 1;
Number of bytes to send = memory capacity of the data carrier (but not more than 1024 bytes).

Task	Data flow	Com-mand	Start address of the first byte to send	Number of bytes to send	Head no.	Block size	Ter. 2)	Acknow. 3)	EI 4)	Start for sending	EI 4)	Data 5)	Ter. 2)	Acknow. 3)	EI 4)
Write	To BIS 6)	'C'	A3 A2 A1 A0 '0 0 0 0' to '0 7 5 1'	L3 L2 L1 L0 '0 0 0 1' to '0 7 5 2'	K '1'	B '0' or '1'	BCC or 2)			<STX>		D	BCC or 2)		
	From BIS 7)							<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'					<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'
			1)									1)			

1) The commands Status and/or Quit are not perwithted at this point.
2) Terminator; Instead of BCC block check either Carriage Return 'CR' or Line Feed with Carriage Return 'LF CR' may be used depending on the protocol variant.
3) As an acknowledgement <ACK> '0', is used if there was no error, or <NAK> + 'Error no.', if an error occured.
4) End identifier; for protocol variants which always require an end identifier, one of the termination characters 'CR' or 'LF CR' must be inserted here.
5) Data from start address to start address + number of bytes.
6) From host system to BIS.
7) From BIS to host system.

Note
Telegram examples can be found in Section 9.7 starting page 31.

9 Device Function

Telegram for restarting the processor (Quit)

Sending the Restart (Quit) telegram breaks off any telegram currently in process. The processor is placed in the base state.

Attention!
The Restart (Quit) telegram is not allowed while the processor is waiting for a termination character (BCC, 'CR' or 'LF CR').
In this situation Quit is misinterpreted as a terminator or data character.

Note
After acknowledgement of this telegram allow a pause of **at least 1600 ms** before starting a new telegram.

Task	Data flow	Command	Termination 2)	Acknow.	Termination 2)
Restart (Quit)	From host to BIS	'Q'	BCC or 2)		
	From BIS to host			'Q'	BCC or 2)
			1)		

1) The commands Status and/or Quit are not perwithted at this point.
2) Terminator; Instead of BCC block check either Carriage Return ‘CR’ or Line Feed with Carriage Return 'LF CR' may be used depending on the protocol variant.

Telegram Query status byte, data carrier type and data carrier ID

With the telegram the status byte the data carrier type and the data carrier ID of data carriers are read. In contrast to the standard command, here the reply is not an <ACK> or <NAK>, but rather a fixed data telegram.

Task	Data flow	Command	Termination 2)	Acknow. 3)	Termination 2)
Check status Message	From host to BIS	'U'	BCC or 2)		
	From BIS to host			S1 Type1 ID1	BCC or 2)
			1)		

1) The command Quit are not perwithted at this point.
2) Terminator; Instead of BCC block check either Carriage Return ‘CR’ or Line Feed with Carriage Return 'LF CR' may be used depending on the protocol variant.
3) Data telegram of the acknowledge:
S1: status byte ('1' = no data carrier; '0' = data carrier)
Type1: Data carrier type (01hex = BIS M-1_ _-01/_)
Data carrier type (02hex = BIS M-1_ _-02)
Data carrier type (03hex = BIS M-1_ _-03)
Data carrier type (04hex = BIS M-1_ _-04)
Data carrier type (05hex = BIS M-1_ _-05)
Data carrier type (06hex = BIS M-1_ _-06)
Data carrier type (07hex = BIS M-1_ _-07)
ID1 Data carrier ID of the data carrier

Note
Telegram examples can be found in Section 9.7 starting page 31.

9 Device Function

Telegram for initializing CRC_16 data check

This telegram is used to initialize a data carrier in front of a read/write head for using CRC_16 data checking.
The telegram must also be resent if a CRC error has occurred as a consequence of a failed write job.

> **Attention!**
> The start address of the first byte to send and the number of bytes sent in the telegram shown refer to data carrier type BIS M-1_ _-01.
> To determine the number of usable bytes for the other allowed data carrier types when using a CRC_16, see "CRC check" on page 14).

Task	Data flow	Com-mand	Start address of the first byte to send	Number of bytes to send	Head num-ber	Block size	Ter. 2)	Acknow. 3)	EI 4)	Start for sending	Data 5)	Ter. 2)	Acknow. 3)	EI 4)
CRC_16 Initialize range	To BIS 6)	'Z' or 'z'	A3 A2 A1 A0 '0 0 0 0' to '0 6 5 7'	L3 L2 L1 L0 '0 0 0 1' to '0 6 5 8'	K '1'	B '0' or '1'	BCC or 2)			<STX>	D1 D2 D3...Dn	BCC or 2)		
	From BIS 7)							<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'				<ACK> '0' or <NAK> + Error no.	'CR' or 'LF CR'
			1)								1)			

1) The commands Status and/or Quit are not perwithted at this point.
2) Terminator; Instead of BCC block check either Carriage Return 'CR' or Line Feed with Carriage Return 'LF CR' may be used depending on the protocol variant.
3) As an acknowledgement <ACK> '0', is used if there was no error, or <NAK> + 'Error no.', if an error occured.
4) End identifier; for protocol variants which always require an end identifier, one of the termination characters 'CR' or 'LF CR' must be inserted here.
5) Data from start address to start address + number of bytes.
6) From host system to BIS.
7) From BIS to host system.

9 Device Function

9.4 Error numbers

BIS M-407 always outputs an error number. Their meanings are listed in the following table.

No.	Error	Effect	
1	No data carrier present.	Telegram broken off. Processor goes into base state.	
2	Read error.	Read telegram broken off. Processor goes into base state.	
3	Read broken off because data carrier was removed.	Processor goes into base state.	
4	Write error.	Write telegram broken off. Processor goes into base state.	⚠ Attention! When the write process is broken off, incomplete data may be written to the data carrier. 1)
5	Write broken off because data carrier was removed.	Processor goes into base state.	
6	Interface error.	Processor goes into base state (parity or stop bit error).	
7	Telegram format error.	Processor goes into base state. Possible format errors: – Command is not 'L', 'P', 'C', 'Q', 'U' or 'Z'. – Start address or number of bytes outside the permissible range.	
8	BCC error. The sent BCC is wrong.	Telegram broken off. Processor goes into the base state.	

1) If you are using a CRC data check, the error message E may occur at the next read command if error 4 or 5 was not cleared.

9 Device Function

Error number (continued)

No.	Error	Effect
A	New command not possible because a read command is already in process.	After the error message the read command is quit internally but no longer acknowledged. Processor goes into base state.
B	New command not possible because a write command is already in process.	After the error message the write command is quit internally but no longer acknowledged. Processor goes into base state.
C	New command not possible because a head select command is already in process.	After the error message there is no longer a positive acknowledgement, even though the head select was carried out. Processor goes into base state.
E	CRC error. The CRC on the data carrier is wrong. 1)	Telegram broken off. Processor goes into base state.
F	Addressing error.	Job outside the address range of the data carrier.
G	Job not supported by the data carrier.	Read/write jobs are not supported by the data carrier.
I	EEPROM error.	Telegram broken off. Processor goes into base state.

1) If you are using a CRC data check, the error message E may occur if error 4, 5 or B was reported for the preceding command.

9 Device Function

9.5 Read/write times

Note
The times indicated below commence as soon as the data carrier is recognized. Otherwise 45 ms must be added to allow for energy to be generated before the data carrier is recognized.

Read times in static mode (double reading for data integrity, no CRC_16 data check):

	BIS M-01 _ _ -01	BIS M-01 _ _ -02
Data carrier recognition	≤ 20 ms	≤ 30 ms
Read bytes 0 to 15	≤ 20 ms	≤ 35 ms
for each additional start of 16 bytes	≤ 10 ms	≤ 20 ms

Write times in static mode (double reading for data integrity, no CRC_16 data check):

	BIS M-01 _ _ -01	BIS M-01 _ _ -02
Data carrier recognition	≤ 20 ms	≤ 30 ms
Read bytes 0 to 15	≤ 40 ms	≤ 75 ms
for each additional start of 16 bytes	≤ 30 ms	≤ 60 ms

9 Device Function

9.6 Function indicators

Overview of indicators

The operating states of the identification system, the Ethernet connection and the TCP/IP connection are indicated by means of LED's.

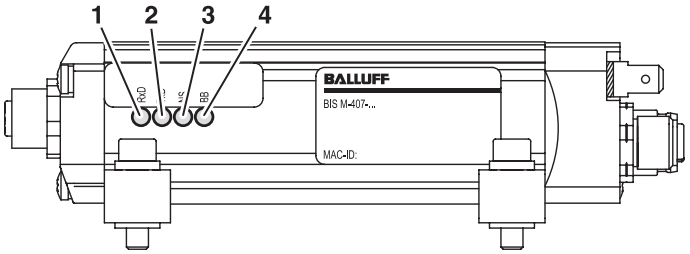


Fig. 7: Function indicators

1 Receive Data (RxD)
2 Transmit Data (TxD)
3 Network Status (NS)
4 Ready (BB)

Power-up

During power-up all LED's for the Ethernet connection are tested as described in the following table.

LED name	LED sequence							
Receive Data (RxD)	off							
Transwith Data (TxD)	off							
Network Status (NS)	on		off	1 x flash	off			
Ready (BB)	on	off	4 x flash		off	1 x flash	off	on

Diagnostics Ethernet and TCP/IP-connections

Status LED	Meaning
Receive Data	
off	No data transmission
yellow	Device receiving data

Transwith Data	
off	No data transmission
yellow	Device sending data

Network Status	
off	Device has no TCP/IP connection
green flashing	Device has a TCP/IP connection

Ready	
off	Network module defective. Inform service department
green	Network module is ready

9 Device Function

9.7 Telegram examples

Forming the block check BCC

The BCC is formed as an EXOR operation from the serially sent binary characters of the telegram block.

Example: Read starting at address 13, 128 Byte are to be read.

The command line without BCC is: 'L 0013 0128 10'. BCC is formed:

	'L	=	0100	1100	EXOR
	0	=	0011	0000	EXOR
	0	=	0011	0000	EXOR
	1	=	0011	0001	EXOR
	3	=	0011	0011	EXOR
	0	=	0011	0000	EXOR
	1	=	0011	0001	EXOR
	2	=	0011	0010	EXOR
	8	=	0011	1000	EXOR
	1	=	0011	0001	EXOR
	0'	=	0011	0000	EXOR
Result of block check:	BCC	=	0100	0100	= 'D'

Protocol variants

If needed, the terminator using BCC block check can be replaced by Carriage Return ('CR') or Line Feed with Carriage Return ('LF CR').

The command line 'L 0013 0128 10 D' with 'D' as BCC results from the preceding example. This command line is compared here in the possible variants. The various forms of acknowledgement with and without end identifier are shown.

Command line from host system to BIS	Acknowledgement from BIS for correct reception	Acknowledgement from BIS for incorrect reception
With BCC as Termination, without end identifier 'L 0013 0128 10 D'	without end identifier <ACK> '0'	without end identifier <NAK> '1'
With 'CR' instead of BCC without end identifier 'L 0013 0128 10 CR'	without end identifier <ACK> '0'	without end identifier <NAK> '1'
Without BCC with end identifier 'CR' 'L 0013 0128 10 CR'	with end identifier 'CR' <ACK> '0 CR'	with end identifier 'CR' <NAK> '1 CR'
Without BCC with end identifier 'LF CR' 'L 0013 0128 10 LF CR'	with end identifier 'LF CR' <ACK> '0 LF CR'	with end identifier 'LF CR' <NAK> '1 LF CR'

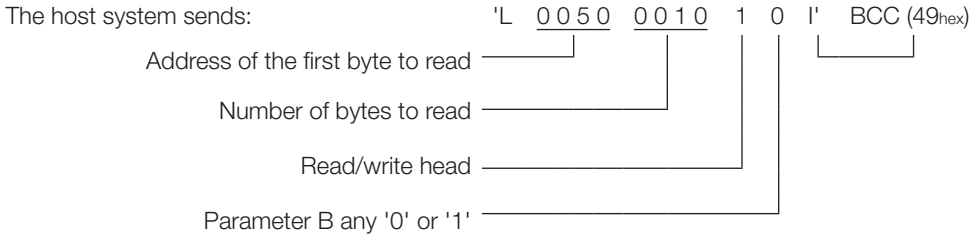
In the table <NAK> '1' (= no data carrier present) is given as an error example.

9 Device Function

Read the data carrier

Telegram example: Read data carrier with BCC block check.

Task: Read 10 bytes from the data carrier at read/write head starting at address 50.

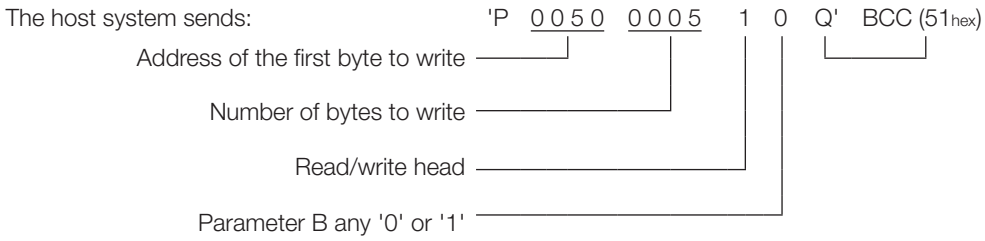


The processor acknowledges with:	<ACK> '0'
The host system gives the start command:	<STX>
The processor provides the data from the data carrier:	'1 2 3 4 5 6 7 8 9 F' BCC (70hex)

Write to the data carrier

Telegram example: Write to the data carrier with BCC block check.

Task: Write 5 bytes to the data carrier at read/write head starting at address 50.



The processor acknowledges with:	<ACK> '0'
The host system gives the start command and the Data:	<STX> '1 2 3 4 5 3' BCC (33hex)
The processor acknowledges with:	<ACK> '0'

9 Device Function

Restart the processor (Quit)

Telegram example: Restart the processor (Quit) with BCC block check.

Task: Bring the BIS system to the base state.

The host system sends 'Q Q' BCC (51_{hex})

The processor acknowledges with 'Q Q' BCC (51_{hex})

Query status byte, data carrier type and data carrier ID

Telegram example: Query status byte and data carrier ID with BCC block check.

The host system sends 'U U' BCC (55_{hex})

If **a data carrier** was **recognized**:

The processor acknowledges with '0<SOH>1234 0000 5' BCC (35_{hex})

If **no data carrier** was **recognized**:

The processor acknowledges with '1xxxxxxxxx 1' BCC (31_{hex})
(with x = <NUL>)

Appendix

Ordering code

BIS M – 407 – 039 – 003 – 06 – S115

Balluff Identification system

Series M Read/Write system

Hardware-Type
407 = Metal enclosure, Ethernet

Software-Type
039 = Ethernet with TCP/IP protocol

Version
003 = external Read/write head BIS M-3_ _

Interface
06 = Ethernet

Customer connection
M12 = 8-pin socket

Accessories (optional, not included in scope of delivery)

Type		Ordering code
Read/write head (from Hardware status HW 2.0)		BIS M-30x-003-S115
Connector: no cable	for Head 1	BKS-S117-00
Connection cable: one end with a straight, molded-in connector (female), one end for user-assembled connector, lenght as desired	for Head 1; 5 m	BIS S-501-PU1-05
	for Head 1; 10 m	BIS S-501-PU1-10
	for Head 1; 25 m	BIS S-501-PU1-25
	for Head 1; 50 m	BIS S-501-PU1-50
Connection cable: one end with a right-angle format, molded-in connector (female), one end for user-assembled connector, lenght as desired	for Head 1; 5 m	BIS S-502-PU1-05
	for Head 1; 10 m	BIS S-502-PU1-10
	for Head 1; 25 m	BIS S-502-PU1-25
Connector	for X1	BKS-S 79-00
	for X3	BKS-S 182-00
Cover cap	for Head 1	Cover cap M12 female (121 671)
Adapter cable M12 D coded to RJ45		BIS C-526-PVC-00,5

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	5A	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	0A	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	3A	:	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	6A	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	1A	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	4A	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	7A	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	2A		*	85	55	U			

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