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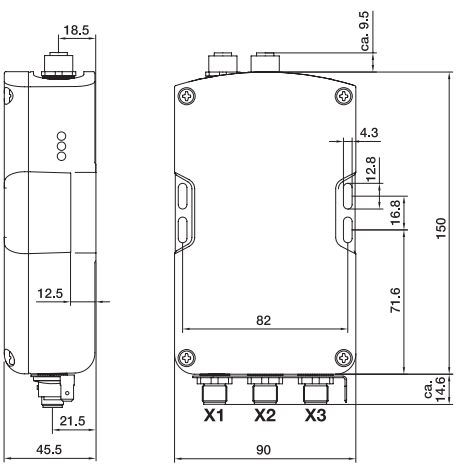
BIS M-6000 RS232

Technical Description, User's Guide



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1 Notes to the user

1.1 CE Declaration of Conformity and user safety

Declaration of Conformity

This product was developed and produced in compliance with applicable European standards and directives.

Process Control Equipment
Control No 3TLJ
File No E227256

Note
You can request a Declaration of Conformity separately.
For additional safety instructions, refer to the "Safety" section on page 6

1.2 About this manual

This manual describes processors in the series BIS M-6000-... identification system as well as startup instructions for immediate operation.

1.3 Manual organization

The manual is organized so that the sections build on each other.
Section 2: Basic safety information.
Section 3: The key steps for installing the Identification System.
Section 4: Introduction to the material.
Section 5: Technical data for the processor.
Section 6: Mechanical and electrical connection.
Section 7: User-defined processor settings.
Section 8: Processor and host system interaction.

1.4 Conventions

The following conventions are used in this manual:

Enumerations

Enumerations are shown as a list with em-dashes.
– 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. 00hex).

ASCII characters:
– The control characters in ASCII code are set in pointed brackets (e.g. <CR>),
– the other ASCII characters are set in apostrophes (e.g. 'L').

Parameters:
Parameters are shown in italics (e.g. CRC_*16*).

Cross-references

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

1.5 Symbols

	**Attention!** This symbol indicates a safety instruction that must be followed.
	**Note, tip** This symbol indicates general notes.
	DC current
	Function ground
	ESD symbol

1.6 Abbreviations

BCC	Block Check Character
BIS	Balluff Identification System
CRC	Cyclic Redundancy Check
EEPROM	Electrically Erasable and Programmable Read Only Memory
EMC	Electromagnetic Compatibility
PC	Personal Computer
PLC	Programmable Logic Controller
LPS	Limited Power Source Class 2

2 Safety

2.1 Intended use

The BIS M-6000 processor is a component of the BIS M Identification System. Within the Identification System it is used to for connecting to a host computer (PLC, PC). It may be used only for this purpose in an industrial environment corresponding to Class A of the EMC Law.
This description is valid for processors in series BIS M-6000-007-….

2.2 General safety notes

Installation and startup
Installation and startup are to be performed only by trained specialists. Any damage resulting from unauthorized manipulation or improper use voids the manufacturer's guarantee and warranty.
When connecting the processor to an external controller, observe proper selection and polarity of the connection as well as the power supply (see "Installation" section on page 13).
The processor may be operated only using an approved power supply (see "Technical Data" on page 11).

Operation and testing
The operator is responsible for ensuring that local safety regulations are observed.
When defects and non-clearable faults in the Identification System occur, take the system out of service and secure it against unauthorized use.

2.3 Meaning of the warning notes

⚠ **Attention!**
The pictogram used with the word "Caution" warns of a possible hazardous situation affecting the health of persons or equipment damage. Ignoring these warnings may result in personal injury or equipment damage.
► Always observe the described measures for preventing this danger.

3 Getting Started

3.1 Mechanical connection

BIS M-6000-007-050-00-ST15

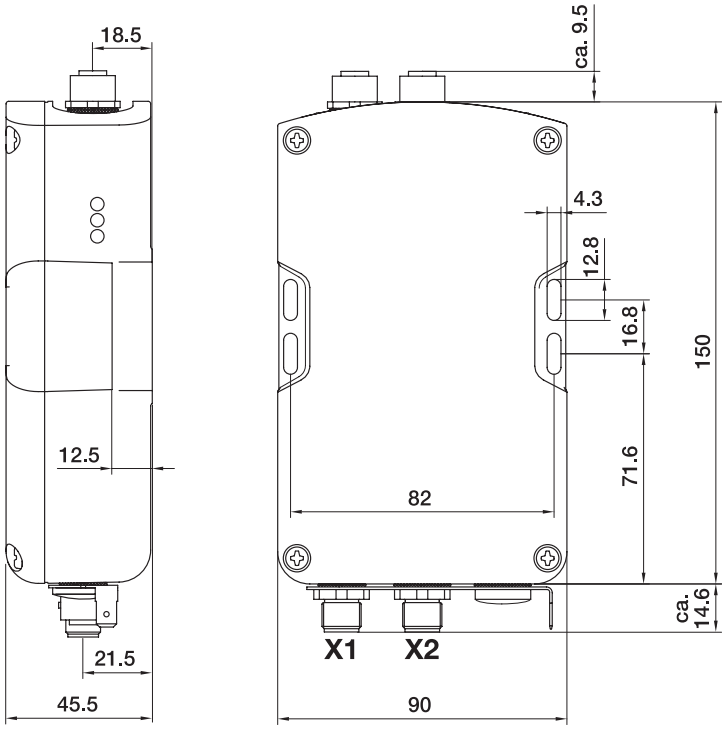


Fig. 1: Mechanical connection BIS M-6000-007-050-00-ST15 (dimensions (in mm)

BIS M-6000-007-050-00-ST24

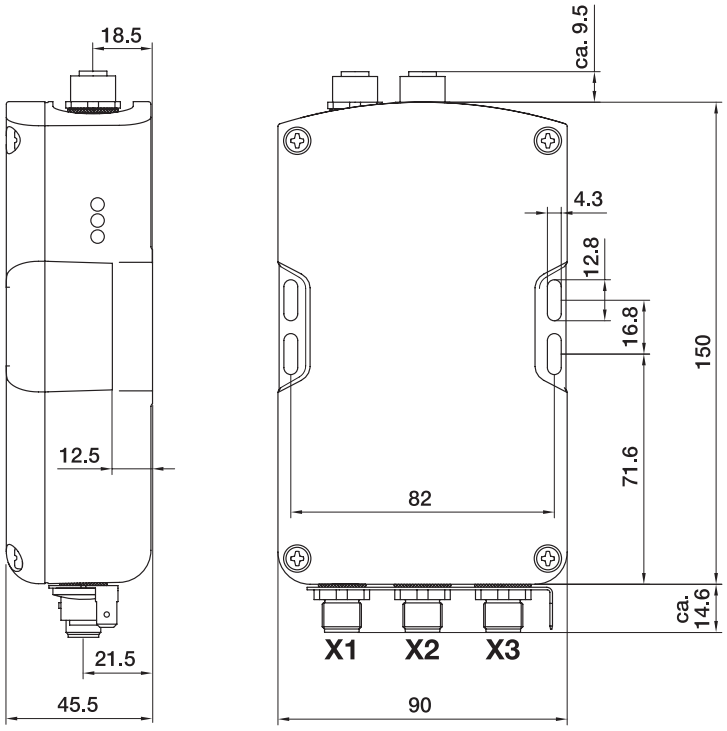


Fig. 2: Mechanical connection BIS M-6000-007-050-00-ST24 (dimensions (in mm)

► Attach processor using 4 M4 screws.
Maximum tightening torque: 9 Nm.

3 Getting Started

3.2 Electrical connection

Note
Make the ground connection either directly or using an RC combination to ground. The DIL switch settings must not be changed (factory default setting: all DIL switches in OFF position).

BIS M-6000-007-050-00-ST15

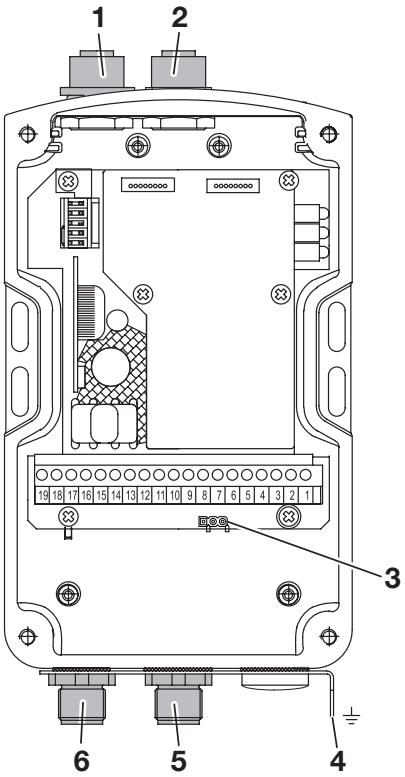
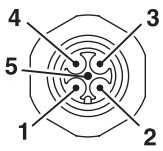


Fig. 3: Electrical connectionn BIS M-6000-007-050-00-ST15

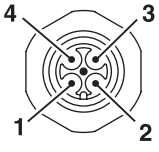
1 Head 2 – Read/write head 2
2 Head 1 – Read/write head 1
3 Shunt connector (see next page)
4 Function ground FE
5 X2 – Serial port RS232
6 X1 – Supply voltage, digital input

X1 - Male panel connector, 5-pin



PIN	Function
1	+Vs
2	–IN
3	–Vs
4	+IN
5	n.c.

X2 - Male panel connector, 4-pin



PIN	Function
1	n.c.
2	TxD
3	COM
4	RxD

- ► Connect power supply and digital input to port X1 (6).
- ► Connect data line for host system to port X2 (5).

BIS M-6000-007-050-00-ST24

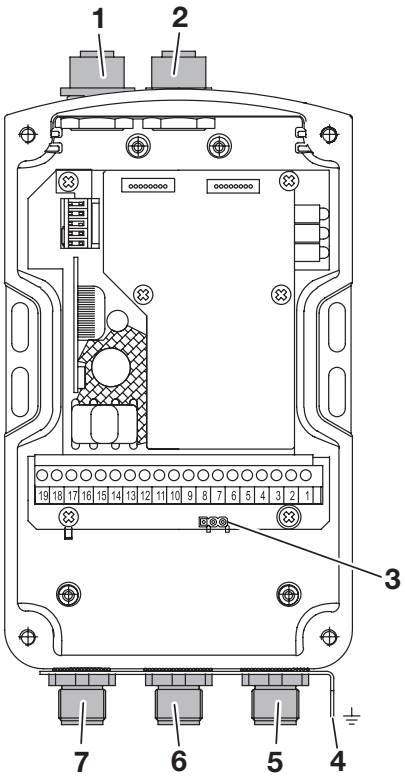
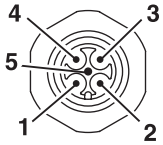


Fig. 4: Electrical connection BIS M-6000-007-050-00-ST24

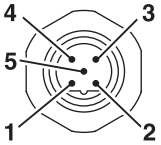
1 Head 2 – Read/write head 2
2 Head 1 – Read/write head 1
3 Shunt connector (see next page)
4 Function ground FE
5 X3 – Serial port RS232
6 X2 – For BIS M-6000-... no function
7 X1 – Supply voltage

X1 - Male panel connector, 5-pin



PIN	Function
1	+Vs
2	n.c.
3	–Vs
4	n.c.
5	n.c.

X3 - Male panel connector, 5-pin, B-coded



PIN	Function
1	RTS
2	TxD
3	COM
4	RxD
5	CTS

- ► Connect power supply to port X1 (7).
- ► Connect data line for host system to port X3 (5).

3.3 Configuration

The configuration is made using a computer and the Balluff application “BIS Configuration Software” and stored in the processor. It can be overwritten at any time. The configuration can be saved in a file so that it can be used whenever needed. The application can be found on the included BIS-CD.

4 Basic knowledge

4.1 Function principle of Identification Systems

The BIS M Identification System is classified as a non-contacting system with read and write function. This allows it to not only transport information which is fixed programmed in the data carrier, but also to collect and pass on current information.

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. in model-specific processes), in workpiece transport with conveying systems, for acquiring safety-relevant data.
– warehousing for monitoring material movement,
– transporting and conveying..

4.2 Product description

Processor BIS M-6000:
– Plastic housing,
– Connections made using round connectors,
– Two read/write heads can be connected,
– Read/write heads are suitable for dynamic and static operation,
– Power for the system components provided by the processor,
– Power for the data carrier provided by the read/write heads via carrier signal.

4.3 Control function

The processor is the link between data carrier and controlling system. It manages two-way data transfer between data carrier and read/write head and provides buffer storage.
The processor uses 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 controlling system.

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

4.4 Data integrity

In order to ensure data integrity, data transfer between the data carrier and processor can be monitored using a CRC_16 data check.
In CRC_16 data checking a checksum is written to the data carrier which enables the data to be checked for validity at any time.

Advantages of CRC_16 data checking:
– Very high data integrity, even during the non-active phase (data carrier outside the read/write zone)

Disadvantages of CRC_16 data checking:
– Longer read write times
– User data capacity is sacrificed.

Use of the CRC_16 can be parameterized by the user (see “Parameter Setting” starting page 20).

4.5 Connection

The processor is connected to the controlling system (PC/PLC) through the serial RS232 port. Bus connection is possible using an external gateway.

5 Technical Data

5.1 Electrical Data (valid for all device versions)

Operating voltage VS	24 V DC ±10 % LPS Class 2
Ripple	≤ 10 %
Current draw	≤ 400 mA
Device interface	RS232

5.2 Operating Conditions (valid for all device versions)

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

5.3 Function Indicators (valid for all device versions)

CT2 Present/operating	LED green/yellow
CT1 Present/operating	LED green/yellow
Ready	LED green

5.4 BIS M-6000-007-050-00-ST15

Dimensions

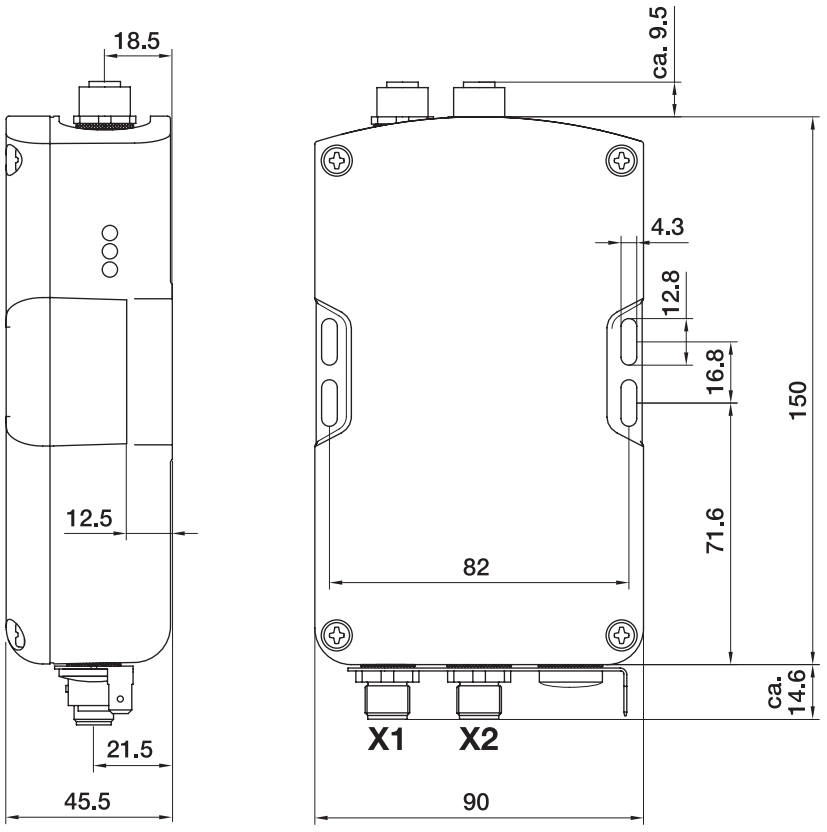


Fig. 5: BIS M-6000-007-050-00-ST15 – dimensions in mm

5 Technical Data

Mechanical data

Housing material	Plastic, ABS
X1 – Supply voltage input	V_S 24 V DC, 5-pin male panel connector, A-coded
X2 – RS232 interface	4-pin male panel connector, A-coded)
Head 1, 2 (read/write head connections)	fixed socket 8-pin
Enclosure rating	IP65 (with connectors)
Weight	approx. 500 g

5.5 BIS M-6000-007-050-00-ST24

Dimensions

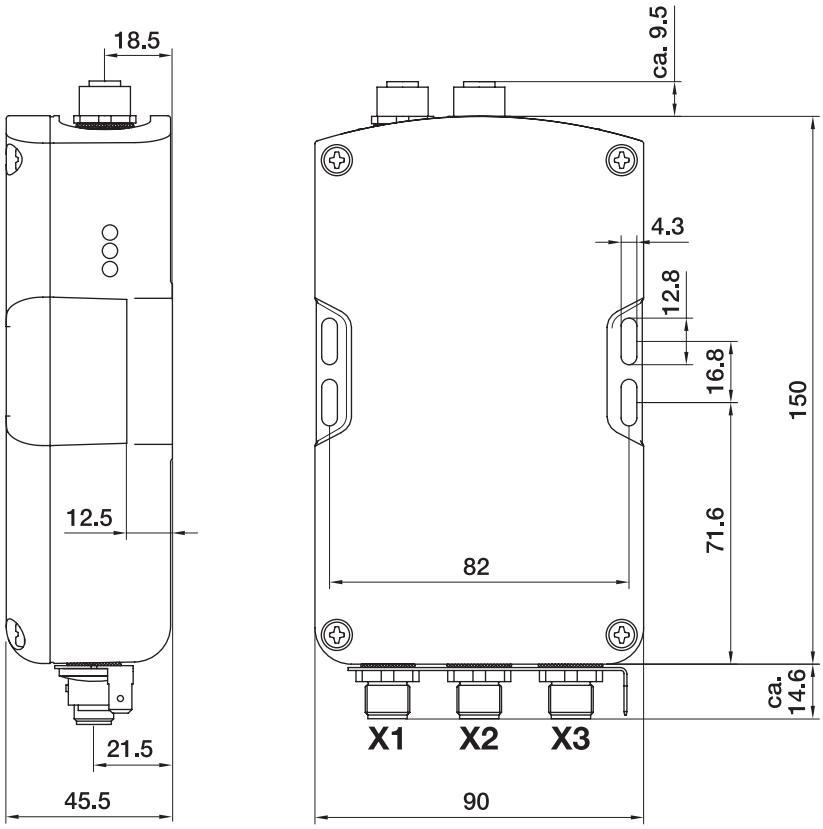


Fig. 6: BIS M-6000-007-050-00-ST24 – dimensions in mm

Mechanical data

Housing material	Plastic, ABS
X1 – Supply voltage input	V_S 24 V DC, 5-pin male panel connector, A-coded
X2 – no function	8-pin male panel connector
X3 – RS232 interface	5-pin male panel connector, B-coded
Head 1, 2 (read/write head connections)	fixed socket 8-pin
Enclosure rating	IP65 (with connectors)
Weight	approx. 500 g

6 Installation

6.1 Processor installation (valid for all device versions)

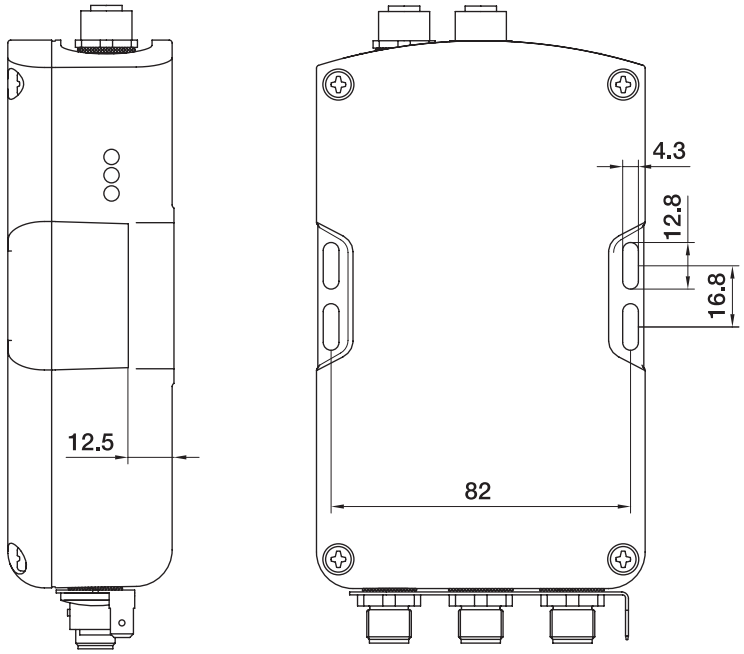


Fig. 7: Installation (dimensions (in mm)

► Attach processor using 4 M4 screws.
Maximum tightening torque: 9 Nm.

Mounting using rail holder (accessory)

Installation examples using mounting bracket and rail holder BIS Z-HW-001 (accessory).

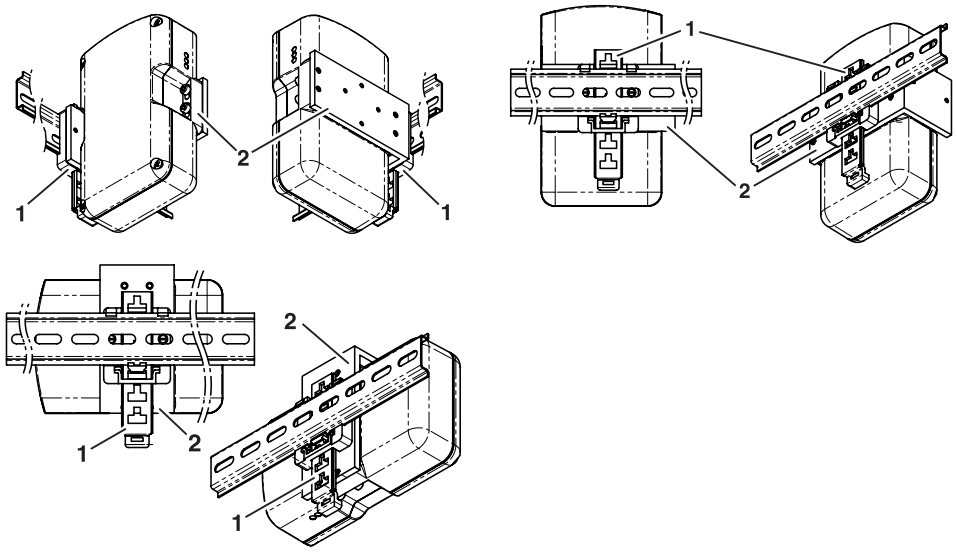


Fig. 5: Mounting using rail holder

1 Rail holder
2 Mounting brackets

6 Installation

6.2 Interface information/ Wiring diagrams

Note
Make the ground connection either directly or using an RC combination to ground.
The factory default setting of the DIL switches must not be changed.

BIS M-6000-007-050-00-ST15

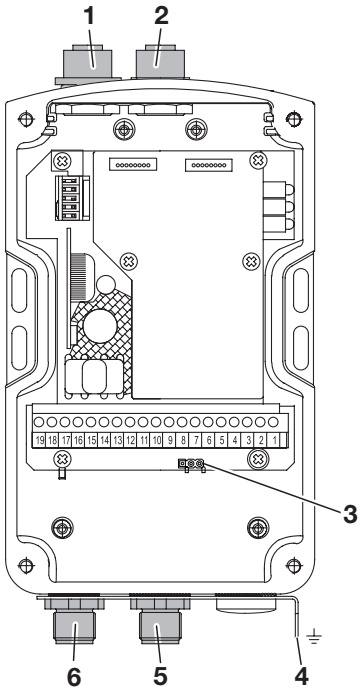
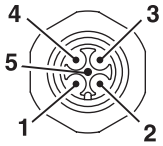


Fig. 8: Processor BIS M-6000-007-050-00-ST15 connections

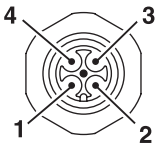
1 Head 2 – Read/write head 2
2 Head 1 – Read/write head 1
3 Shunt connector (see next page)
4 Function ground FE
5 X2 – Serial port RS232
6 X1 – Supply voltage, digital Input

X1 - Male panel connector, 5-pin



PIN	Function
1	+Vs
2	–IN
3	–Vs
4	+IN
5	n.c.

X3 - Male panel connector, 5-pin



PIN	Function
1	n.c.
2	TxD
3	COM
4	RxD

- ► Connect power supply and digital input to port X1 (6).
- ► Connect data line for host system to port X3 (4).

Assignments for the terminal strip:

Terminal	19	18	17	16	15	14	13	12	11	10	9	8
configu-ration	+VS	-VS	n.c.	TxD	RxD	COM	+VS	-VS	1	2	3	4
	Power			Service interface			Output					

Terminal	7	6	5	4	3	2	1
configu-ration	+In	–In	COM	RxD	CTS	TxD	RTS
	Input		RS232 port				

6 Installation

BIS M-6000-007-050-00-ST24

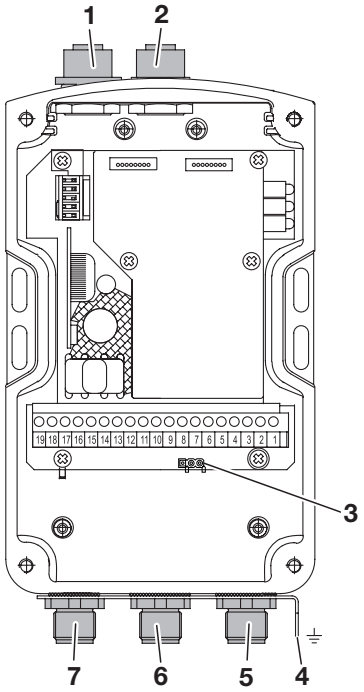
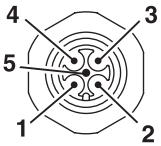


Fig. 9: Processor BIS M-6000-007-050-00-ST24 connections

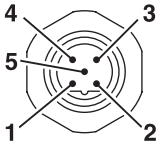
1 Head 2 – Read/write head 2
2 Head 1 – Read/write head 1
3 Shunt connector (see next page)
4 Function ground FE
5 X3 – Serial port RS232
6 X2 – For BIS M-6000-... no function
7 X1 – Supply voltage

X1 - Male panel connector, 5-pin



PIN	Function
1	+Vs
2	n.c.
3	–Vs
4	n.c.
5	n.c.

X3 - Male panel connector, 5-pin, B-coded



PIN	Function
1	RTS
2	TxD
3	COM
4	RxD
5	CTS

- ► Connect power supply to port X1 (6).
- ► Connect data line for host system to port X3 (4).

Assignments for the terminal strip:

Terminal	19	18	17	16	15	14	13	12	11	10	9	8
configu-ration	+VS	-VS	n.c.	TxD	RxD	COM	+VS	-VS	1	2	3	4
	Power			Service interface			Output					

Terminal	7	6	5	4	3	2	1
configu-ration	+In	–In	COM	RxD	CTS	TxD	RTS
	Input		RS232 port				

6 Installation

Shunt connector Hardware handshake

Data transmission may take place using hardware handshake or software handshake.
If the control signal CTS is not used, the shunt plug remains in the SHORT position (factory default setting).

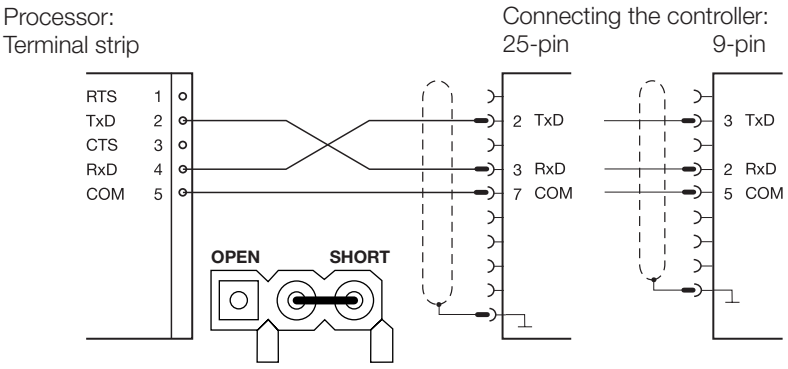


Fig. 10: Software handshake – Jumper position SHORT (no CTS/RTS signal, factory default setting)

If the control signals CTS is used, the shut plug is placed in the OPEN position.

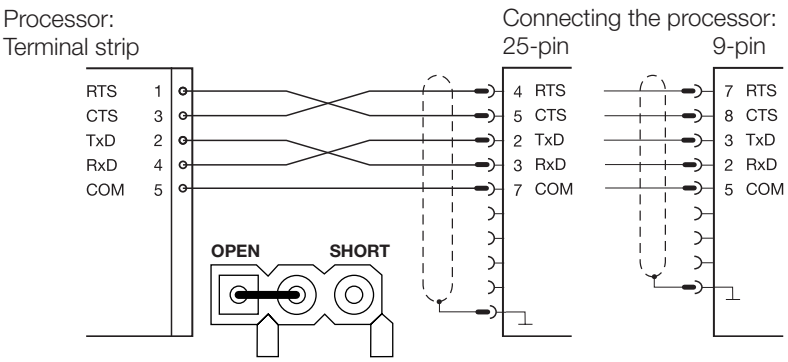


Fig. 11: Hardware handshake – Jumper position OPEN (with CTS/RTS signal)

6 Installation

6.3 Replacing the EEPROM

Attention!
Components may be damaged by electrostatic discharge.
- ► Turn device off before opening.
- ► Observe rules for handling electrostatic discharge sensitive components.

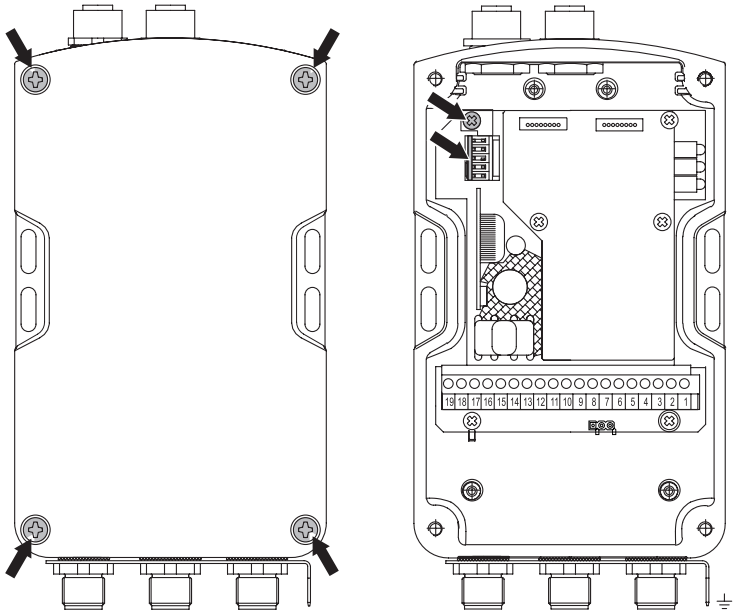


Fig. 11: Replacing the EEPROM

- ► Unscrew 4 screws on housing cover and remove cover.
- ► Remove EEPROM holder.
- ► Remove EEPROM from holder.
- ► Plug new EEPROM into socket.
- ► Reattach EEPROM holder.
- ► Replace cover and tighten down 4 screws (max. tightening torque 0.15 Nm).

7 Setting the processor parameters

7.1 Basic knowledge

The following data carriers may be used with the BIS M-6000 processor:

Data carrier types

Mifare data carriers:

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

ISO15693 data carriers:

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

* On request

Note
The data carriers contain additional memory ranges for configuration and protected data. These ranges cannot be processed using the BIS M-6000 processor.

CRC check

The CRC check is a procedure for determining a check value for data in order to be able to recognize transmission errors. If the CRC check is activated, an error message is sent when a CRC error is detected.

Initializing
To use the CRC data 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 checksum when reading or writing, the processor sends the error message 'CRC-Error'.
Data carriers as shipped from the factory can be written immediately with a checksum, since all data are set to 0.

Error message
- If an error message is the result of a failed write job, the data carrier must be reinitialized to make it usable again.
- If an error message is not the result of a failed write job, the one or more memory cells in the data carrier is likely defective. The data carrier must be replaced.

Checksum
The checksum is written to the data carrier as 2 bytes of information. 2 bytes per block are sacrificed. This leaves 14 bytes per block available. The usable number of bytes can be found in the following table.

7 Setting the processor parameters

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

Send CT data immediately

Each time a data carrier is detected, it is read depending on the setting. The data are output to the port.
This setting eliminates the need for a read command in dialog mode.
The prescribed data quantity (start addresses and number of bytes) can be set (see Parameter Setting on page 22).

Dynamic mode

As soon as the dynamic mode function (*Dynamic*) is activated, the processor accepts the read/write job from the controlling system and stores it, regardless of whether a data carrier is in the active zone of the read/write head or not. As soon as a data carrier enters the active zone of the read/write head, the stored job is run.

Type and serial number

If the parameter *TypSN* (*type and serial number for CT Present*) is activated, instead of the user data the data carrier type and unique serial number (UID = unique ID) of the data carrier is output.
For data carrier type BIS M-1_ _-01 the serial number is 4 bytes in size. For all other data carrier types the serial number is 8 bytes.

Protocol type

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

If required the termination can be replaced using Block check BCC by the ASCII character “Carriage Return” (<CR>).

For controllers that always require a termination character, this must always be inserted into the telegrams. Available are:
– “Carriage Return” (<CR>) or
– “Line Feed with Carriage Return” (<LF> <CR>).

Examples for terminating the telegrams:

Protocol type	Telegram with command, address, number of bytes, head ho., block size	Termination	Acknowledgment	Termination character
Block check BCC	L 0000 0001 1 0	BCC	<ACK> 0	
CR	L 0000 0001 1 0	<CR>	<ACK> 0	
Termination character CR	L 0000 0001 1 0	<CR>	<ACK> 0	<CR>
Termination character LF CR	L 0000 0001 1 0	<LF><CR>	<ACK> 0	<LF><CR>

7 Setting the processor parameters

7.2 Setting parameters

Parameters are set using the Windows application “BIS Configuration Software”. This is done online and can be overwritten at any time.
The parameter settings can be saved in a file so that they can be used whenever needed.

The application “BIS Configuration Software” can be found on the included BIS-CD.

Prerequisites

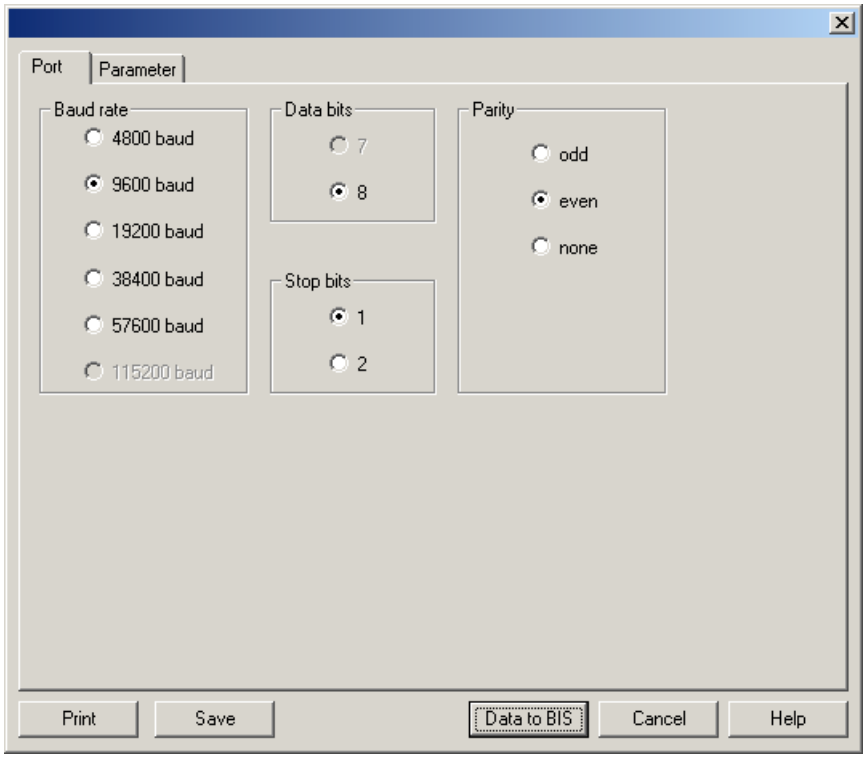
– The device is online (connected to the PC through the serial port).

Starting the configuration software

- ► Start Configuration software BIS.
- ► Menu “Configuration --> Port” Select COM port
- ► Select device “**BIS M-6000-007-...**”.

7 Setting the processor parameters

► Select “Online --> Initialize” menu.
⇒ “Port” dialog window opens.



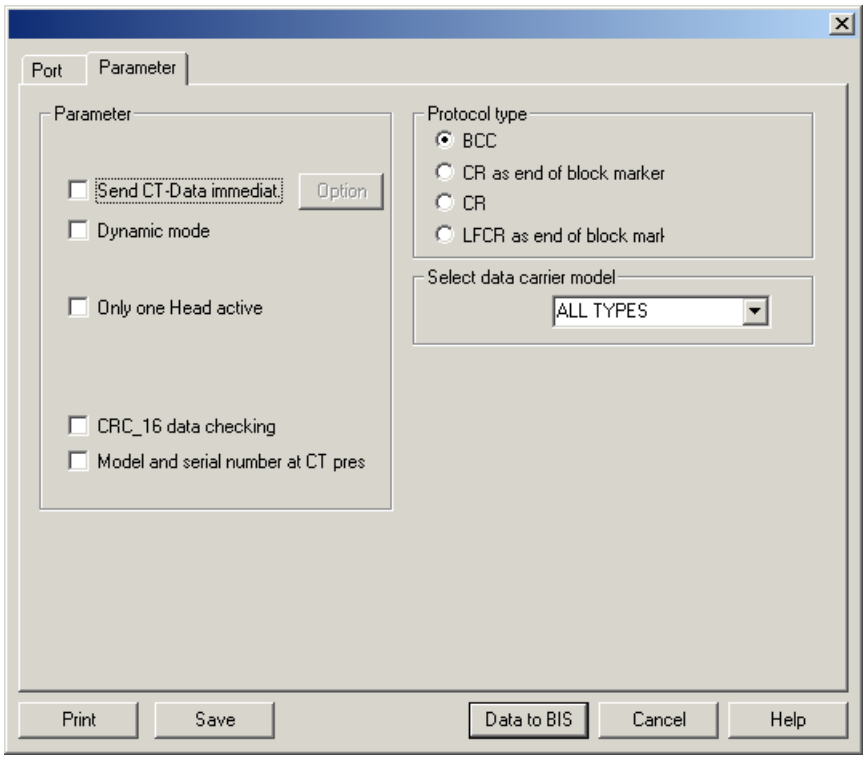
Parameter Port

Default settings:
Baud rate: 9600 Data bits: 8 Parity: Even Stop bits: 1

Set the parameters Baud rate, number of data and stop bits as well as the parity type for the serial interface.

7 Setting the processor parameters

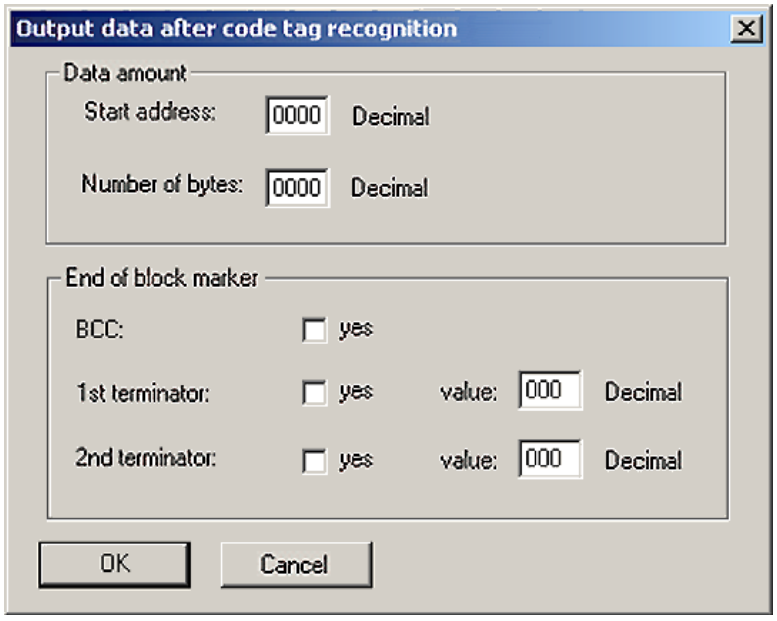
► Select dialog window “Parameter".



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

Parameter Send CT data immediately

Send CT Data immediately --> Option
Other configurations of the parameter if *Send CT Data immediately* is active.



7 Setting the processor parameters

Data amount
Prescribed data amount which is read from the newly recognized data carrier (number of bytes starting with the start address).

Termination character
Optionally a BCC and/or 1 or 2 freely definable termination characters can be sent in addition.

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

Dynamic mode parameter

Dynamic mode-activated:
A read/write command is stored until a data carrier enters the working range of the read/write head.
This function turns off the error message “No data carrier present”.

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

Factory default setting: *Dynamic mode* not active.

Parameter Only one head active

Only on head active activated:
If this parameter is turned on, whichever head is not selected is electrically deactivated (see also “Selecting the read/write head” on page 33).
Use this parameter when the two heads are located physically close together.

Only one head active not activated:
Both heads are electrically active.

Parameter CRC_16 data check

CRC_16 data check activated:
The validity of the data is assured using a CRC checksum (see also section “Data integrity” on page 10 and “Basic knowledge” on page 18).

CRC_16 data check not activated:
The validity of the data is checked using double reading.

Factory default setting: *CRC_16 data check* not active.

Parameter Type and serial number for CT present

Type and serial number for CT present activated:
For CT Present the data carrier type and serial number of the data carrier are output and then the user data.

Type and serial number for CT present not activated:
For CT Present the data carrier type and serial number are not sent.

Factory default setting: *Type and serial number for CT present* not active.

7 Setting the processor parameters

Protocol type

Selecting the protocol type (protocol version).

BCC	Block check	Factory preset.
CR	Carriage Return	If needed, termination using *BCC* can be replaced by termination using *CR*.
CR as termination character	Carriage Return as termination character	Also possible for controllers which always require a termination character.
LF CR as termination character	Line Feed with Carriage Return as termination character	Also possible for controllers which always require a termination character.

Select data carrier type

Selection of the data carrier type. All or one particular data carrier may be selected.

ALL TYPES	All **Balluff supported** data carrier types are processed (factory default setting).
Mifare	All **Balluff supported** Mifare data carriers are processed.
ISO15693	All **Balluff supported** ISO 15693 data carriers are processed.

8 Device Function

8.1 Function principle of the BIS M-6000

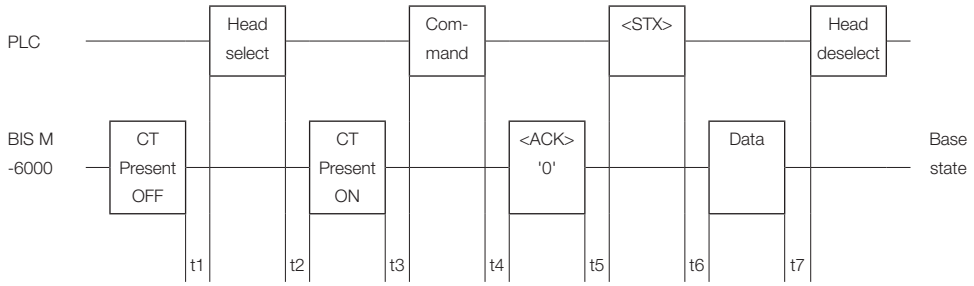
Data and commands are exchanged between the processor and controlling system through the serial port.

Communication between the controlling system and processor is defined by a sequence protocol.

Example: Dialog mode with head select

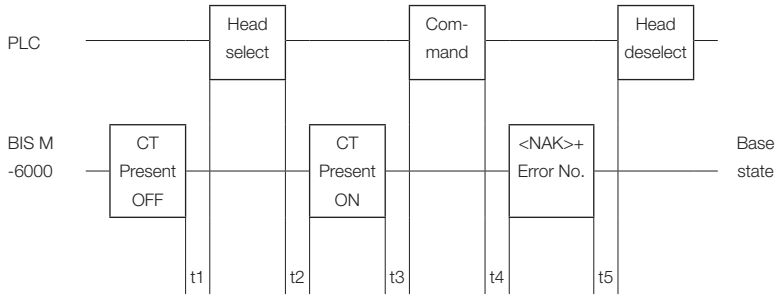
Read:

1. No error occurs:



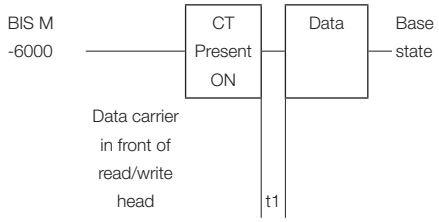
t1, t3, t7 ≥ 0	t5 ≥ 0 (not monitored by the processor)
t2 = **max. 500 ms**	t6 system-dependent
t4 Depends on number of bytes to be read	

2. An error occurs:



t1, t3, t5 ≥ 0	t4 Depending on number of bytes to read and error type (recommended monitoring time 15 s)
t2 = **max. 500 ms**	

Example: Direct read mode



t1 Depends on number of bytes to be read

Requirements for valid representations:

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

8 Device Function

8.2 Communication

There are specific telegrams for individual tasks in the BIS M-6000 Identification System. They always begin with the command associated with the telegram type:

Telegram types with associated command (ASCII character)

Command	Function
'L'	Read data carrier with read/write head select
'P'	Write to data carrier with read/write head select
'C'	Write a constant value to the data carrier with read/write head select
'R'	Read the data carrier
'W'	Write to the data carrier
'H' 'S'	Select the read/write head (command 'H'). With variant 'S': Find next data carrier (once)
'Q'	Restart processor (Quit)
'Z'	Initialize CRC-16 data check
'U'	Read data carrier ID and output with status byte

Note
Continual polling on the port is not permitted.
The minimum wait time between two commands is 300 ms.

Explanation of telegram contents

Start address and number of bytes	The start address (A3, A2, A1, A0) and the number of bytes to send (L3, L2, L1, L0) are transmitted in decimal as ASCII characters. A range of 0000 to 1999 can be used for the start address and 0001 to 2000 for the number of bytes. A3 ... L0 represent one ASCII character each.
Note	The start address + number of bytes may not exceed the data carrier capacity.
Head number and block size	For 'L' (Read with head select) and 'P' (Write with head select) first the number of the read/write head K ('1' or '2') and then the block size B (either '0' or '1') are sent.
Note	Parameter B has no meaning for communication with a BIS M-6000 processor. It is sent to ensure uniform read/write telegrams for the entire BIS series.
Acknowledgment	The acknowledgment <ACK> '0' is sent by the processor if the serial transmitted characters were recognized as correct and there is a data carrier within the range of a read/write head. <NAK> + 'Error No.' is used as an acknowledgment if an error was detected or if there is no data carrier in the range of the read/write head
Start	<STX> is used to start data transmission
Bytes sent	The data are sent code-transparent (no data conversion)

8 Device Function

Forming the BCC block check

The block check BCC is formed as an EXOR operation from the serially sent binary characters of the telegram block. Example: Read 128 bytes starting at Address 13.
The command line with no BCC reads: ‚L 0013 0128 20'. The BCC is formed as follows:

'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
2 = 0011 0010 EXOR
0' = 0011 0000 EXOR

Result: BCC = 0100 0111 = 'G'

Variant for termination with BCC, termination character

If needed the termination with block check BCC can be replaced by a special ASCII character. This is:
– Carriage Return <CR>
For controllers that always require a termination character, this must always be inserted into the telegrams. Available are:
– Carriage Return <CR> or
– Line Feed with Carriage Return <LF><CR>.
In the following the various protocol variants are shown (see also Parameter setting on page 24).

Summary of the various protocol variants

The example command line 'L 0013 0128 20 G' with 'G' as BCC is compared with the possible variants in the following table. The various forms of acknowledgment with and without termination character are shown:

Command line Controlling system	Acknowledgment from BIS Correct receipt	Acknowledgment from BIS Incorrect receipt
with BCC as terminator, no termination character 'L 0013 0128 20 G'	no termination character <ACK> '0'	no termination character <NAK> '1'
with <CR> instead of BCC, no termination character 'L 0013 0128 20 CR'	no termination character <ACK> '0'	no termination character <NAK> '1'
no BCC, with termination character <CR> 'L 0013 0128 20 CR'	with termination character <CR> <ACK> '0' <CR>	with termination character <CR> <NAK> '1' <CR>
no BCC, with termination character <LF><CR> 'L 0013 0128 20 LF CR'	with termination character <LF><CR> <ACK> '0' <LF><CR>	with termination character <LF><CR> <NAK> '1' <LF><CR>

Note
For <NAK> with error number '1' (no data carrier present) is given as an error example.

8 Device Function

Telegram: Read with read/ write head select

In a telegram with the command 'L' the parameters *K* and *B* must be specified.
It is also possible to read the data carrier using the command 'R', see “Read data carrier” on page 31.

1. Controller sends

Com-mand	Start address				No. of bytes				Head number	Block size	Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	K	B	
'L'	'0	0	0	0'	'0	0	0	1'	'1'	'0'	BCC (Hex value)
			to				to		or	or	or
	'1	9	9	9'	'2	0	0	0'	'2'	'1'	<CR> / <LF><CR>
	[2]										

2. Processor replies

Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends

Start transmission	Termination character[3]
<STX>	<CR> / <LF><CR>
	[2]

4. Processor replies

Data					Termination[1]
D3	D2	D1	…	D_n	BCC (Hex value) or <CR> / <LF><CR>

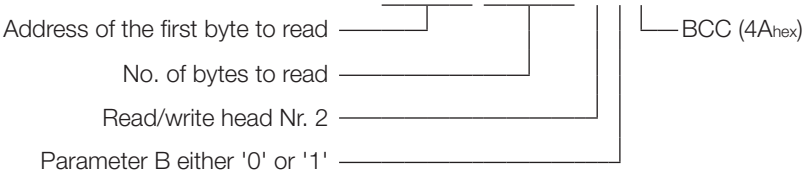
1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Read data carrier with read/write head select and with block check (BCC).

Requirements: Head 1 is selected. Read 10 bytes starting at Address 50 on the data carrier at read/write head 2.

Control system: 'L 0 0 5 0 0 0 1 0 2 0 J'



Processor: Acknowledgment <ACK> '0'

Control system: Start command <STX>

Processor: Data from data carrier '1 2 3 4 5 6 7 8 9 0 1'

BCC (31_{hex})

After telegram traffic has finished Head 2 remains selected.

8 Device Function

Telegram: Write with read/ write head select

In a telegram with the command 'P' the parameters *K* and *B* must be specified.
Writing to the data carrier is also possible using the 'W' command, see “Writing to data carrier” on page 32.

1. Controller sends										
Com-mand	Start address				No. of bytes				Head number	Block size	Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	K	B	
'P'	'0	0	0	0'	'0	0	0	1'	'1'	'0'	BCC (Hex value)
			to				to		or	or	or
	'1	9	9	9'	'2	0	0	0'	'2'	'1'	<CR> / <LF><CR>
	[2]										

2. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends						
Start transmission	Data					Termination[1]
<STX>	D3	D2	D1	…	D_n	BCC (Hex value) or <CR> / <LF><CR>
	[2]					

4. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> or <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Write to data carrier with read/write head select and with block check (BCC).

Requirements: Head 1 is selected. Write 5 bytes starting at Address 50 on the data carrier at read/write head 2.

Control system: 'L 0 0 5 0 0 0 0 5 2 0 R'

- Address of the first byte to read
- No. of bytes to read
- Read/write head Nr. 2
- Parameter B either '0' or '1'
- BCC (52_{hex})

Processor: Acknowledgment <ACK> '0'

Control system: Start command and data <STX>'1 2 3 4 5 3'

- BCC (33_{hex})

Processor: Acknowledgment <ACK> '0'

After telegram traffic has finished Head 2 remains selected.

8 Device Function

Telegram: Write a constant value to the data carrier with read/ write head select

The telegram with the 'C' command can be used to clear a data carrier. The transmission time of the bytes to be written is saved.

1. Controller sends

Com-mand	Start address				No. of bytes				Head number	Block size	Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	K	B	
'C'	'0	0	0	0'	'0	0	0	1'	'1'	'0'	(Hex value)
			to				to		or	or	or
	'1	9	9	9'	'2	0	0	0'	'2'	'1'	<CR> / <LF><CR>
	[2]										

2. Processor replies

Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends

Start transmission	Data	Termination[1]
<STX>	D	BCC (Hex value) or <CR> / <LF><CR>
	[2]	

4. Processor replies

Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Requirements: Head 1 is selected.
Write 100 bytes of ASCII data value '0' starting with Address 20 to the data carrier at read/write head 2 (30_{hex}).

Control system: 'L 0020 0100 20B'

- Address of the first byte to read
- No. of bytes to read
- Read/write head Nr. 2
- Parameter B either '0' or '1'
- BCC (42_{hex})

Processor: Acknowledgment <ACK> '0'

Control system: Start command and data <STX> '0 2'

- BCC (32_{hex})

Processor: Acknowledgment <ACK> '0'

After telegram traffic has finished Head 2 remains selected.

8 Device Function

Telegram: Read

Read a data carrier at the active read/write head.

1. Controller sends									
Com-mand	Start address				No. of bytes				Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	
'R'	'0	0	0	0'	'0	0	0	1'	BCC (Hex value) or <CR> / <LF><CR>
	to				to				
	'1	9	9	9'	'2	0	0	0'	
	[2]								

2. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends	
Start transmission	Termination character[3]
<STX>	<CR> / <LF><CR>

4. Processor replies	
Data	Termination[1]
D3 D2 D1 … D_n	BCC (Hex value) or <CR> / <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Read 10 bytes starting at Address 50:

Control system: 'R 0 0 5 0 0 0 1 0 V'
- Address of the first byte to read: 0 0 5 0
- No. of bytes to read: 0 0 1 0
- BCC (56_{hex}): V

Processor: Acknowledgment <ACK> '0'

Control system: Start command <STX>

Processor: Data from data carrier '1 2 3 4 5 6 7 8 9 0 <SOH> '
- BCC (01_{hex}): <SOH>

8 Device Function

Telegram: Write

Write to the data carrier at the active read/write head.

1. Controller sends									
Com-mand	Start address				No. of bytes				Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	
'W'	'0	0	0	0'	'0	0	0	0'	BCC (Hex value) or <CR> / <LF><CR>
	to				to				
	'1	9	9	9'	'2	0	0	0'	
	[2]								

2. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends					
Start transmission	Data				Termination[1]
<STX>	D3	D2	D1	… Dn	BCC (Hex value) or <CR> / <LF><CR>
	[2]				

4. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Write 5 bytes starting at Address 100:

Control system: 'W 0 1 0 0 0 0 0 5 S'
- Address of the first byte to write: 0 1 0 0
- No. of bytes to write: 0 0 0 5
- BCC (53hex): S

Processor: Acknowledgment <ACK> '0'

Control system: Start command and data <STX>'1 2 3 4 5 3'
- BCC (33hex): 3

The processor acknowledges with <ACK> '0'

8 Device Function

Telegram: Read/write head select

Using the command 'H' you can select Read/write head 1 and use 'H' to select Read/write head 2.

1. Controller sends		
Command	Head number	Termination[1]
'H'	'1' or '2'	BCC (Hex value) or <CR> / <LF><CR>
	[2]	

2. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

[1] Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
[2] The command “Quit” is not permitted at this point.
[3] Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

Telegram example

Requirements: Head 2 is selected. Switch to Head 1.

Control system: 'H 1 Y'
Command and head number — BCC (79_{hex})
Processor: Acknowledgment <ACK> '0'

Note
It may take approx. 1.5 seconds until the selected read/write head is active.

Telegram: Find next data carrier (once)

The following telegram is used to find the next data carrier. The next following read/write head is selected and checked to see whether a data carrier is in front of this read/write head:

- **Data carrier in front of read/write head**: The telegram reply contains the number of the read/write head and the first 4 bytes (BIS M-1_ _-01) resp. 8 bytes (other data carrier types) of the data carrier.
- **No data carrier in front of the read/write head**: The original read/write head is reselected and checked. If no data carrier is found here either, the telegram reply is 'H S 000000 <ESC>'.

1. Controller sends		
Command	ID	Termination[1]
'H'	'S'	BCC (Hex value) or <CR> / <LF><CR>
	[2]	

2. Processor replies					
Acknowledgment	Reply	Head no.	Data carrier	Data carrier ID	Termination[1]
<ACK> '0' or <NAK>+'Error No.'	'H'	'1', '2' or 'S'	t1	D1 … D8	BCC (Hex value) or <CR>/<LF><CR>

[1] Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
[2] The command “Quit” is not permitted at this point.
T1 = 01_{hex}: Data carrier type BIS M-1_ _-01
T1 = 02_{hex}: Data carrier type BIS M-1_ _-02
Additional types on request

8 Device Function

Telegram example

Requirements: Head 1 is selected.
There is a data carrier only in front of read/write head 2 whose data carrier ID is 9876.

Control system: 'H S' <ESC>
Command and head number — BCC (1B$_{hex}$)

Processor: Acknowledgment <ACK> '0'

Processor: Data <ACK> '0 H 2' 01$_{hex}$ '9 8 7 6' {
Reply, head number, data carrier type — BCC (7B$_{hex}$)
Data carrier ID

Telegram: Restart

By sending the Restart telegram, any telegram still in process is canceled and the processor is placed in the base state.
After acknowledging this telegram a **min. 1600 ms pause** must be provided before a new telegram is started.

Note
The command “Quit” is not permitted while the processor is waiting for a termination character (BCC, <CR> or <LF><CR>). In this situation “Quit” would be interpreted as a terminator or user data character.

1. Controller sends		2. Processor replies	
Command	Termination[1)]	Acknowledgment	Termination[1)]
'Q'	BCC (Hex value) or <CR> / <LF><CR>	'Q'	BCC (Hex value) or <CR> / <LF><CR>
	[2)]		

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.

Telegram example

Restart the processor (Quit) with block check (BCC):

Control system: 'Q Q'
Command — BCC (51$_{hex}$)

Processor: Acknowledgment 'Q Q'
BCC (51$_{hex}$)

8 Device Function

Telegram: Initialize CRC_16 data check

This telegram is used to initialize a data carrier located in front of a read/write head for use with the CRC_16 data check. This telegram must be sent again if a CRC error has occurred as a consequence of a failed write job. The data carrier must then be reinitialized before it can be used again.

Note
Please note the table on page 16. The specified number of usable bytes may not be exceeded. This means the total consisting of start address plus number of bytes may not exceed the usable data carrier capacity.

Initialize CRC_16 range:

1. Controller sends											
Com-mand	Start address				No. of bytes				Head number	Block size	Termination[1]
	A3	A2	A1	A0	L3	L2	L1	L0	K	B	
'Z'	'0	0	0	0'	'0	0	0	1'	'1'	'0'	BCC (Hex value)
			to				to		or	or	or
	'1	9	9	9'	'2	0	0	0'	'2'	'1'	<CR> / <LF><CR>
	[2]										

2. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'Error No.'	<CR> / <LF><CR>

3. Controller sends						
Start transmission	Data					Termination[1]
<STX>	D3	D2	D1	…	D_n	BCC (Hex value) or <CR> / <LF><CR>
	[2]					

4. Processor replies	
Acknowledgment	Termination character[3]
<ACK> '0' or <NAK>+'*Error No.*'	<CR> / <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.
3) Depending on protocol variant: No termination character or <CR> resp. <LF><CR>.

8 Device Function

Telegram: Read data carrier ID and output with status byte

This telegram is used to read and send the status byte (cable break and Tag Present), data carrier type and data carrier ID for data carriers in front of both read/write heads. In contrast to the standard command, the reply here does not use <ACK> or <NAK>, but rather always a fixed data telegram.

Query Status, Tag Type and Tag-ID:

1. Controller sends	
Command	Termination[1)]
'U'	BCC (Hex value) or <CR> / <LF><CR>
	[2)]

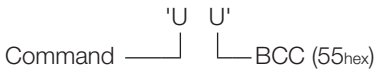
2. Processor replies	
Acknowledgment	Termination[1)]
S1 Type1 ID1 S2 Type2 ID2	BCC (Hex value) or <CR> / <LF><CR>

1) Depending on protocol variant: Block check BCC or <CR> resp. <LF><CR>.
2) The command “Quit” is not permitted at this point.

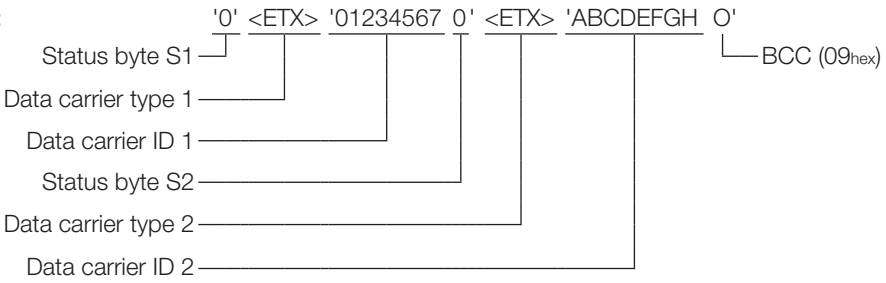
Acknowl-edgment	**Meaning**
S1	Status byte ('1' no data carrier; '9' cable break) for read/write head 1
Type1	Data carrier type for the data carrier in front of read/write head 1 (01_{hex} = BIS M-1_ _-**01**; 02_{hex} = BIS M-1_ _-**02**; 03_{hex} = BIS M-1_ _-**03; …)**
ID1	Data carrier ID of the data carrier in front of read/write head 1
S2	Status byte of read/write head 2
Type2	Data carrier type of the data carrier in front of read/write head 2
ID2	Data carrier ID of the data carrier in front of read/write head 2

Telegram example

Control system:



Processor:



8 Device Function

Error numbers

The BIS M-6000 processor always outputs an error number. The error numbers are explained in the following table.

No.	Error	Result	
1	No data carrier present.	Telegram canceled. The processor goes into base state.	
2	Read error.	Read telegram canceled. The processor goes into base state.	
3	Read canceled because the data carrier was removed.	The processor goes into base state.	
4	Write error.	Write telegram canceled. The processor goes into base state.	⚠ **Attention!** When a write job is canceled, incomplete data may have been written to the data carrier.[1]
5	Write canceled because the data carrier was removed.	The processor goes into base state.	
6	Error on the interface.	The processor goes into base state. (parity or stop bit error).	
7	Telegram format error.	The processor goes into base state. Possible format errors: – Command is not 'L', 'P', 'C', 'H', 'R', 'W', 'Q', 'U' or 'Z'. – Start address or number of bytes outside the permissible range.	
8	BCC error. The transmitted BCC is wrong.	Telegram canceled. The processor goes into base state.	
9	Cable break to selected read/write head or read/write head not connected. LED CT Present/Operating flashes.	Telegram canceled. The processor goes into base state. If both read/write heads were selected using the 'HT' command, one head may not be connected If both read/write heads are selected, the cable break message is only sent if there is no data carrier in front of the connected, non-defective head.	
D	Communication fault with the read/write head.	Telegram canceled. The processor goes into base state.	
E	CRC error The CRC checksum on the data carrier is incorrect[2].	Telegram canceled. The 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 BIS M-_ _-… type data carriers.	
I	EEPROM error.	Telegram canceled. The processor goes into base state.	

1) If CRC checking is used, the error message E may appear with the next read command if error 4 or 5 was not cleared.
2) If CRC checking is used, the error message E may appear if with the preceding command error 4, 5 or B was reported.

8 Device Function

8.3 Read/write times

Note
All specifications are typical values. Deviations are possible depending on the application and combination of read/write head and data carrier.
The specifications apply to static operation, no CRC_16 data checking.

Read times:

Data carrier with 16 byte block size[1)]	BIS M-1_ _-01	BIS M-1_ _-02
Data carrier recognition	≤ 20 ms	≤ 20 ms
Read bytes 0 to 15	≤ 20 ms	≤ 30 ms
For all additional started 16 bytes	≤ 10 ms	≤ 15 ms

Write times:

Data carrier with 16 byte block size[1)]	BIS M-1_ _-01	BIS M-1_ _-02
Data carrier recognition	≤ 20 ms	≤ 20 ms
Write bytes 0 to 15	≤ 40 ms	≤ 60 ms
For all additional started 16 bytes	≤ 30 ms	≤ 40 ms

1) Values for data carriers BIS M-1_ _-03 to BIS M-1_ _-07 on request

8 Device Function

8.4 Function indicators

The operating states of the Identification System are indicated using LEDs.

Overview of indicator elements

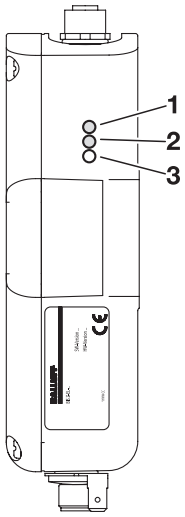


Fig. 12: Function indicators

1 CT2 Present/Operating
2 CT1 Present/Operating
3 Ready

Diagnostics

Status LED	Meaning
Ready	
green	Supply voltage OK; no hardware error
CT1 Present/operating	
green	Data carrier ready for reading or writing at read/write head 1
yellow	Read/write job at read/write head 1 in process
flashing yellow	Cable break read/write head 1 or read/write head 1 not connected
rapidly flashing yellow	Communication with read/write head 1 disturbed or read/write head 1 is defective.
off	No data carrier in range of read/write head 1
CT2 Present/operating	
green	Data carrier ready for reading or writing at read/write head 2
yellow	Read/write job at read/write head 2 in process
flashing yellow	Cable break read/write head 2 or read/write head 2 not connected
rapidly flashing yellow	Communication with read/write head 2 disturbed or read/write head 2 is defective.
off	No data carrier in range of read/write head 2

If all three LEDs flash together, this indicates a hardware errorThe unit must be returned for repair.

Appendix

Ordering code

BIS M – 6000 – 007 – 050 – 00 – ST__

Balluff Identification System

Series M Read/Write System

Hardware type
6000 = Plastic housing, RS232

Software type
007 = Serial interface RS232

Version
050 = with two ports for external read/write heads type BIS M-3_ _

Interface
00 = RS232

Customer connection
ST15 = Connector types
X1 = Round connector for supply voltage (5-pin male)
X2 = Round connector for RS232 interface (4-pin male)
ST24 Connector types
X1 = Round connector for supply voltage (5-pin male)
X3 = Round connector for RS232 interface (5-pin male, B-coded)

Accessories (optional, not included)

Accessories for the BIS M-6000-... can be found in the Balluff BIS catalog.

The catalog can be downloaded on the Internet at "www.balluff.de".

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			

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