BALLUFF

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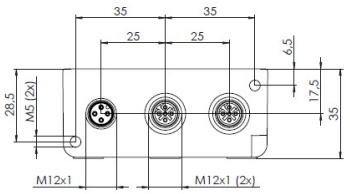
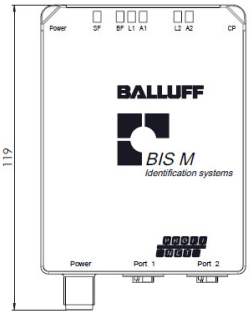
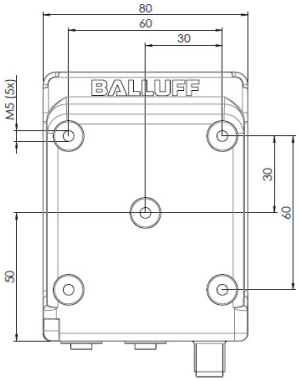
BIS M-4008-048-0xx-ST4
PROFINET

Technical Description, Operating Manual







english

www.balluff.com

1 User Instructions

1.1 About this Manual

This manual describes the compact processor of the identification system BIS M-4008 as well as its startup for immediate use..

1.2 Typographical Conventions

The following conventions are used in this manual:

Enumerations

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

Actions

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

Syntax

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

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

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

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

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

1.3 Symbols

Caution!
This symbol indicates a security notice which must be observed.

Note, tip
This symbol indicates general notes.

1 User Instructions

1.4 Abbreviations

BIS	Balluff Identification System
CP	Code Present
CRC	Cyclic Redundancy Check
DCP	Discovery and basic Configuration Protocol
DID	Device ID
DP	Decentralized peripherals
I/O port	Digital input and output port
EEPROM	Electrical Erasable and Programmable ROM
EMC	Electromagnetic compatibility
FCC	Federal Communications Commission
FE	Function ground
GSD	General Station Description
GSDML	GSD Markup Language
HTML	Hypertext Markup Language
IP	Internet Protocol
I/O	Port Digital Input and Output
IRT	Isynchronous Real Time
LF CR	Line Feed with Carriage Return
LSB	Least Significant Byte
MAC	Media Access Control
MSB	Most Significant Byte
n. c.	not connected
PC	Personal Computer
PLC	Programmable Logic Controller
PROFINET	Process Field Network
RT	Real Time
PLC	Programmable Logic Controller
Tag	Data carrier
TCP	Transmission Control Protocol
UID	Unique Identifier
UDP	User Datagram Protocol
URL	Uniform Resource Locator
VID	Vendor ID

2 Safety

2.1 Intended use

The BIS M-4008 compact processor is a component of the BIDS M identification system. Within this system it is used for linking to a higher level 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 applies to compact processor units of the following series:
– BIS M-4008-048-001-ST4
– BIS M-4008-048-002-ST4

2.2 General Safety Notes

Installation and Startup
Installation and startup are to be performed by trained technical personnel only. Any damage resulting from unauthorized manipulation or improper use voids warranty and liability claims against the manufacturer.
When connecting the processor unit to an external controller, observe proper selection and polarity of the connection as well as the power supply (see “Assembly” on page 9).
The processor unit may only be used with an approved power supply (see “Technical Data” on page 11).

Caution!
This is a Class A device. This device may cause RF disturbances in residential areas; in such a case the operator may be required to take appropriate countermeasures.

Conformity

CE This product was developed and manufactured in accordance with the applicable European directives. CE conformity has been verified.

All approvals and certifications are no longer valid if:
– Components are used that are not part of the identification system BIS M,
– Components are used that have not been explicitly approved by Balluff.

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

2.3 Meaning of Warning Notes

Caution!
The pictogram used with the word “Caution” warns of a situation that could harm someone's health or damage equipment. Failure to observe these warning notes may result in injury or damage to equipment.
► Always observe the described measures for preventing this danger.

3 Basic Knowledge

3.1 Function Principle of Identification Systems

The BIS V Identification System is classified as a non-contacting system with read and write function. This allows it to convey information programmed permanently in the data carrier, but also to collect and pass on current information.

The main components of the BIS M identification system are:
– Compact processor,
– Data carrier.

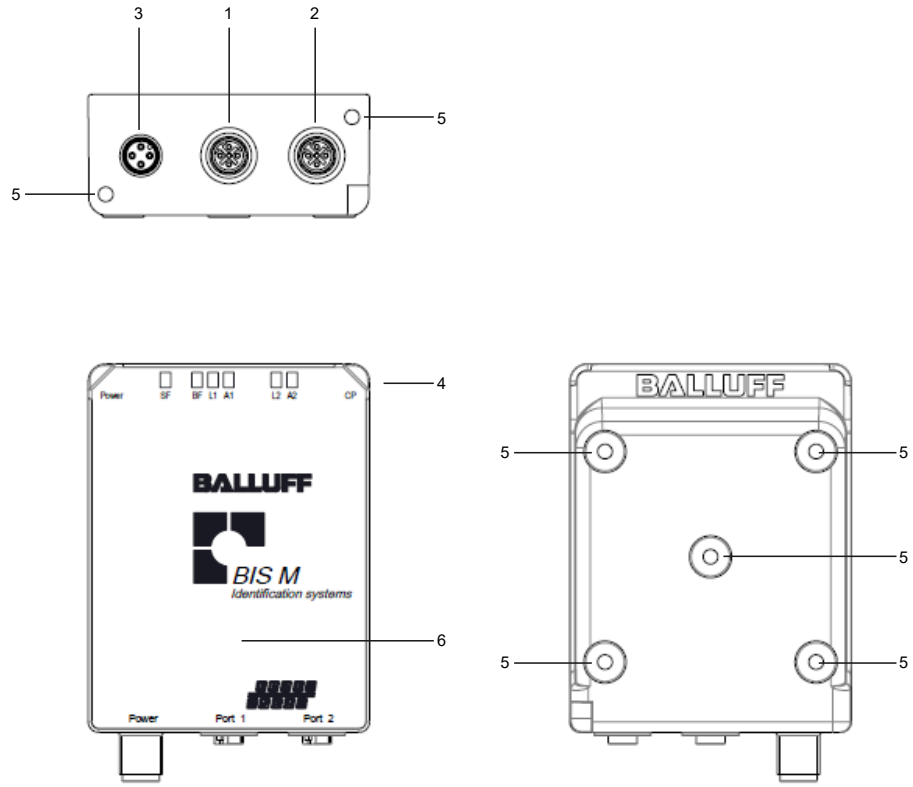


Figure 1: System overview

1 PROFINET Port 1
2 PROFINET Port 2
3 Power IN
4 Status LEDs
5 Mounting hole
6 Sensing surface

The main areas of application are:
– In production for controlling material flow (e.g. for model-specific processes, conveying systems that transport workpieces, acquisition of safety-related data),
– transporting and conveying.

3.2 Product description

Compact processor BIS M-4008:
– Metal housing
– Round connector terminations
– Power for the data carrier provided by the compact processor via carrier signal
– 2 × PROFINET IO port
– Control displays
– Webserver for diagnostics and service functions

3 Basic Knowledge

3.3 Control function

The compact processor unit is the link between data carrier and host system. It manages two-way data transfer between data carrier and compact processor and provides buffer storage. The compact processor unit writes data from the controlling system to the data carrier or reads the data from the data carrier and makes it available to the controlling system.

Controlling systems may be the following:
– A PLC.

Double bit string:
In order to ensure complete transmission of all data in the data buffer, the control bits in the data buffer's first and last byte (bit header) are transmitted and compared. If both bit headers are the same, then the data is updated completely and can be taken over. This means that the data for each R/W head is only valid if both bit headers are the same. Thus, the host system also has to compare the bits in the bit strings.

3.4 Data integrity

In order to increase data integrity, data transfer between the data carrier and compact processor as well as the storage device can be monitored using a check procedure. A CRC_16 data check can be enabled for this via parameter configuration.
With the CRC_16 data check, a check code that allows the validity to be checked at any time is written to the data carrier.

A CRC_16 data check provides the following advantages:
– Data integrity even during the non-active phase (data carrier outside the R/W head).
– Shorter read time – page is read once.

3.5 PROFINET

Open bus system for process and field communication in cell networks with few nodes and for data communication in accordance with IEC 61158/EN 50173. Automation devices, such as PLCs, PCs, operating and observation devices, sensors or actuators, can communicate using this bus system. PROFINET IO is used in the BIS M-4008.

3.6 Communication Mode

Process data (cyclical):
The GSDML file provides combined input/output modules (8 bytes…254 bytes) to map the sensor image:
– Combined input/output modules (8 bytes…254 bytes)

Service data (diagnostics, parameters):
– Parallel and non-reactive to process data

4 Assembly

4.1 Processor Unit Scope of Delivery

Included in the scope of delivery:
- BIS M-4008
- Security notice
- 1 × closure cap
- Grounding set

Note
Visit www.balluff.com for more information on available software and accessories.

4.2 Compact processor installation

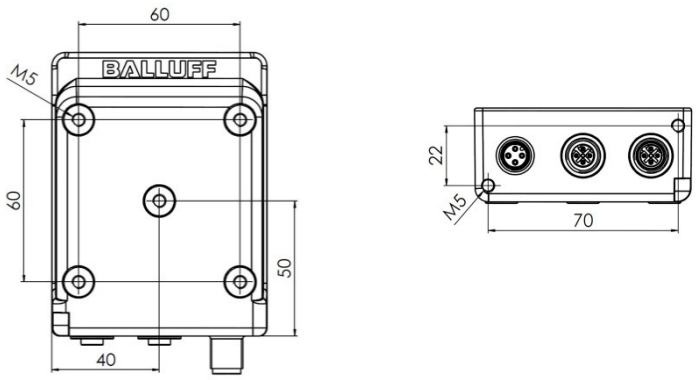


Figure 2: Mechanical connection (dimensions in mm)

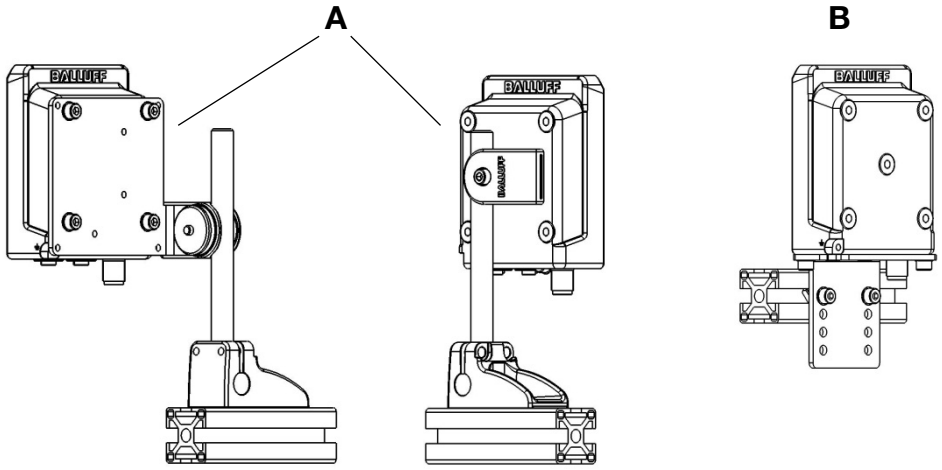


Figure 3: Mounting examples (**A**: Using Balluff Mounting System, **B**: Using mounting bracket on T-slot profile)

► Select a suitable installation position.
► Secure the processor unit using 4 or 2 M5 screws (strength category 8.8, lightly oiled, tightening torque M = 5.5 Nm).

4 Installation

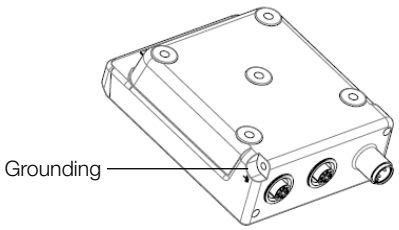


Figure 4: Grounding

Note
The function ground connection from the housing to the machine must have low-impedance and is made using the supplied ground strap.

4.3 Electrical connection

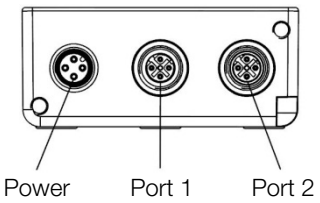
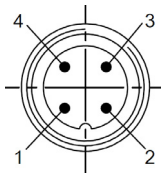


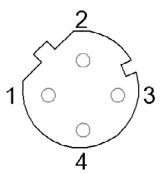
Figure 5: Electrical connection

Power
Male insert, 4-pin, A-coded



PIN	Function
1	+24 V DC
2	n.c.
3	0 V
4	n.c.

PROFINET IO port 1/2
Female M12, 4-pin, D-coded



PIN	Function
1	+Tx
2	+Rx
3	–Tx
4	–Rx

5 Technical Data

5.1 Dimensions

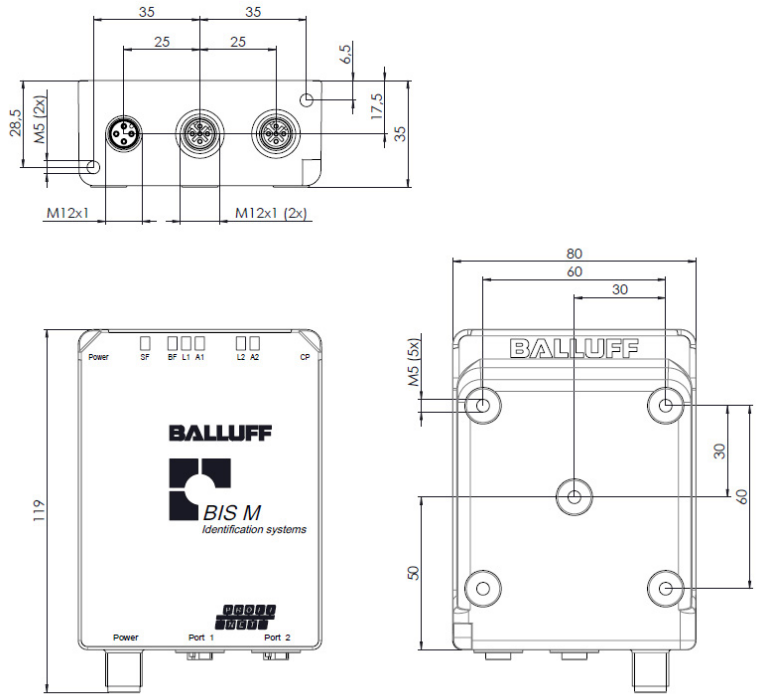


Figure 6: Dimensions in mm

Mechanical data

Housing material	Zinc die-cast housing
Power	4-pin M12 plug, A-coded
PROFINET IO port 1	Female M12, 4-pin, D-coded
PROFINET IO port 2	Female M12, 4-pin, D-coded
Degree of protection	IP67 (with connectors)
Weight	BIS M-4008-048-001-S4 = 410g BIS M-4008-048-002-S4 = 490g

Electrical data

Supply voltage V_S	24 V DC ±20% LPS Class 2
Residual ripple	≤ 10%
Current consumption	150 mA
Application interfaces	PROFINET IO

Operating conditions

Ambient temperature	0 °C…+70 °C
Storage temperature	–20 °C…+85 °C
EMC – EN 61000-4-2/4/5/6 – EN 61000-4-3 (80-1000 MHz) – EN 61000-4-3 (1000-2000 MHz) – EN 61000-4-3 (2000-2700 MHz) – EN 301489-1/-3	 – Severity level 2A/1A/1A/2A – Severity level 2A – Severity level 3A – Severity level 2A – EN 55022 (Cl.A)
Vibration/shock	EN 60068 Part 2-6/27/32

6 Commissioning

PROFINET IO

The BIS M-4008 processor unit and the controlling system communicate via PROFINET IO. The system PROFINET IO consists of the following components:
– IO controller
– IO device (here, the BIS M-4008 processor unit)

In a PROFINET network, IO controllers and IO devices can be connected to each other using all common network topologies: a radial, linear, ring or tree topology is possible.

Note
The BIS M-4008 has a built-in IRT switch with 2 ports for this purpose. This means that both RT and IRT can be used.

Device master data

In order to configure the parameters for the IO controller correctly based on type, the device master data for the BIS M-4008 compact processor unit are included in the form of a GSD file. These data can be found on the BALLUFF Web page or on the device Web server.

Input/output buffer

The data exchange takes place with the host system in the input and output buffer. The size of these buffers must be configured by the master.

Note
The possible buffer sizes are stored in the GSDML file. A minimum size of 8 and a maximum size of 254 bytes can be configured; the value must always be an even number.

Device name and IP address

The compact processor unit and the host system communicate via the PROFINET protocol. This means an IP address and a unique device name are required.
The device name and the IP address can be edited using the respective project planning software used, e.g. “Simatic Manager” and the IO device.

Note
The BIS M-4008 processor unit is shipped without a device name. The GSDML file has the prepared device name “bism4008”.

6 Startup

6.1 Configuration

When project planning a PROFINET device it is represented as a modular system which consists of a header module “BIS M-4008” and a data module.

GSDML file

The device data required for project planning is stored in GSDML files (General Station Description). Appropriate data modules are assigned to a specific slot for configuring the BIS M-4008.

The “BIS M-4008” header module always has to be plugged in at slot 0.

Slot	Module	Function
0	Header module BIS M-4008	no process data
1	Read/write head	Parameter configuration and process data

6.2 Parameter configuration

RFID port parameter

Slot 1, Subslot 1

Index	Byte	Bit	Length	Contents	Values	Default
1	0	0	1 bits	CRC	0/1	0
	0	1	1 bits	Dynamic mode	0/1	0
	0	2	1 bits	Type serial number	0/1	0
	0	3	1 bits	Slow tag detection	0/1	0

Description of individual parameters

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.

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

The number of usable bytes thus decreases when using the checksum.

6 Startup

Balluff data carrier type	Memory capacity	Usable bytes for CRC_16
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
BIS M-1_ _-**08**	160 bytes	140 bytes
BIS M-1_ _-**09**	32 bytes	28 bytes
BIS M-1_ _-**11**	8192 bytes	7168 bytes
BIS M-1_ _-**13**	32786 bytes	28672 bytes
BIS M-1_ _-**14**	65536 bytes	57344 bytes
BIS M-1_ _-**15**	131072 bytes	114688 bytes
BIS M-1_ _-17	208 bytes	182 bytes
BIS M-1_ _-**20**	8192 bytes	7168 bytes

Dynamic mode

As soon as the (*Dynamic mode*) function is enabled, the compact processor unit 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 R/W head or not. If a data carrier enters the active range of the R/W head, the stored job is run.

Type serial number

If this function is enabled, the type of the read/write head as well as the data carrier type and serial number (UID = Unique Identifier) for the data carrier are output when CP occurs.

Slow tag detection

For this option, the antenna on the read/write head is switched on for data carrier detection only every 200 ms. The parameters for this function are configured in the respective read/write head module.

6.3 Integration into Project Planning Software

The connection of a BIS V-4008 to a Siemens S7 controller is shown using “SIMATIC Manager”. The exact procedure depends on the project planning software used.

Installing the GSD file

To perform project planning on the PC, the GSD file for the module must be installed:

- ► Open a new project.
- ► Open hardware configurator.
- ► Select the “Tools | Install new GSD” menu command.
  - ⇒ An “Install new GSD file” dialog will appear.
- ► Select directory and GSD file.
  - ⇒ The [Install] button only becomes active if a GSD file is selected.
- ► Click on [Install].
  - ⇒ The GSD file is installed.
  - ⇒ A message appears once the process has finished.

6 Startup

► Confirm the message and close the window.
► Select the menu command “Tools | Update catalog”.
⇒ The devices are displayed in the product tree.

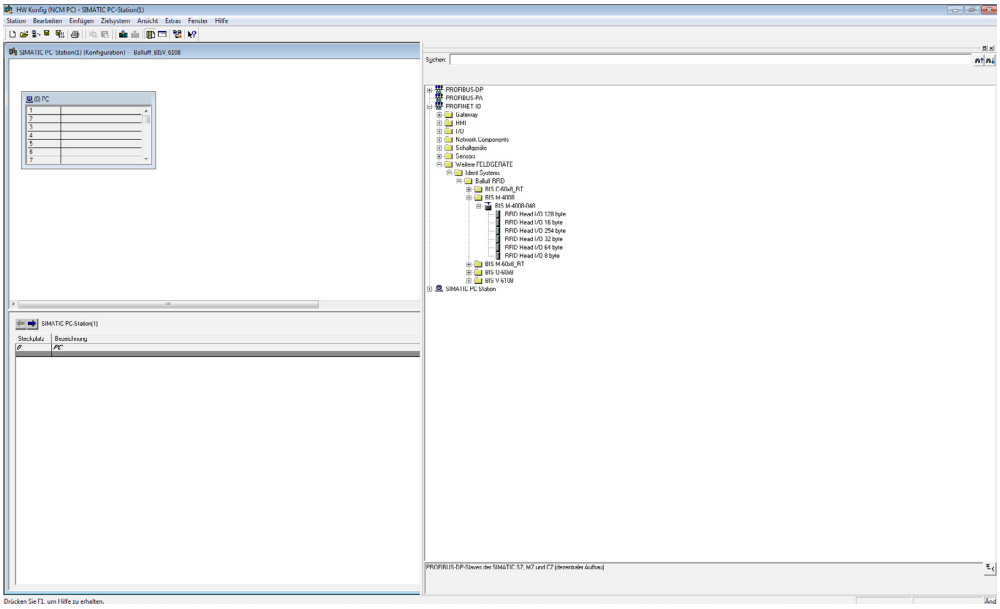


Figure 7: Parameter configuration with a GSDML file

Adding a DP slave

The devices are located in the hardware catalog under “Other field devices”, “Ident systems”, “Balluff”, “RFID”. The module is added as PROFINET IO.

► Select the PROFINET rail.
► Double-clicking adds the device as a PROFINET IO.
⇒ The slots are assigned the default settings.

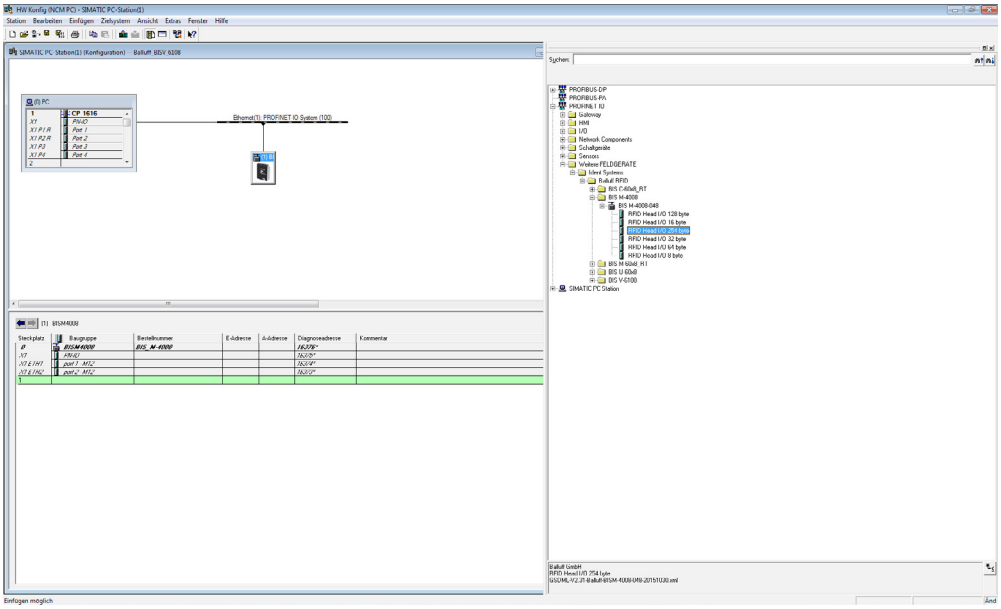


Figure 8: Adding the BIS M-4008 as a slave

6 Startup

Determining the station name

► Define the PROFINET station name of the device.

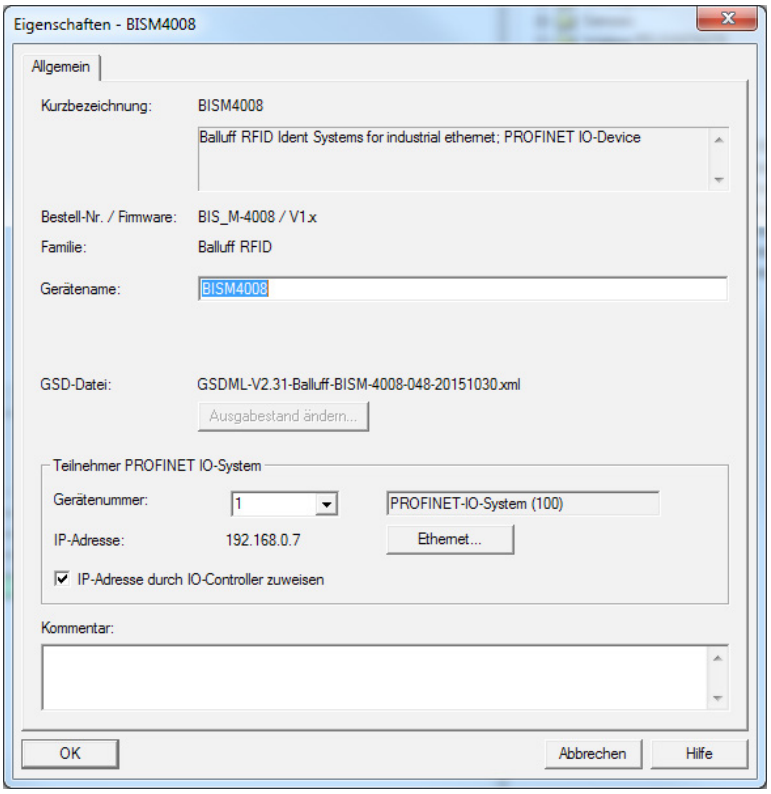


Figure 9: Determining the station name

Changing the device's IP address

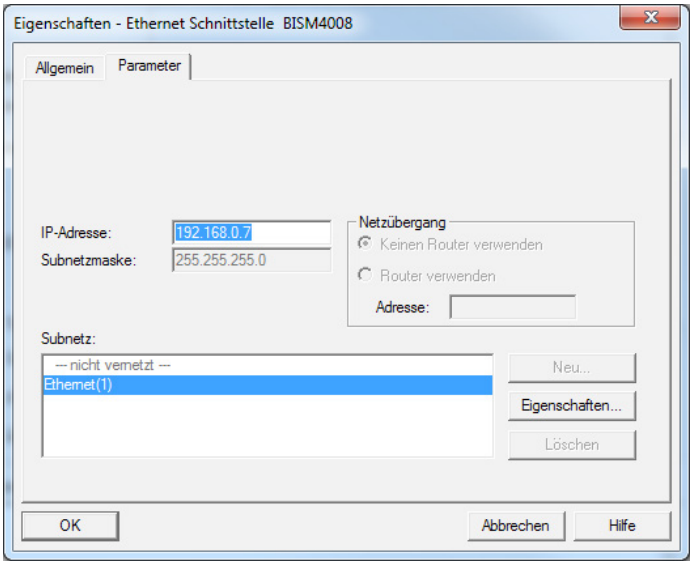


Figure 10: Changing the IP address

7 Device function

7.1 Function principle of the BIS M-4008

Two buffers are needed to exchange data and commands between the processor unit and the controlling system (input buffer and output buffer). The buffer contents are exchanged using cyclical polling. The buffer content depends on the cycle in which it is written (e.g. control commands at the beginning of a job).
When writing to the buffer, the transmitted data from the preceding cycle is overwritten. Unwritten bytes are not deleted and retain their data content.

7.2 Process Data Buffer

Output buffer

The control commands are carried over to the identification system and those on the data carrier are carried over to written data through the output buffer.

Bit-No. / Subaddress	7	6	5	4	3	2	1	0
00_{hex} = bit string		TI	KA			GR		AV
01_{hex}	Command identifier					or	Data	
02_{hex}	Start address (Low Byte) or program No.					or	Data	
03_{hex}	Start address (high byte)					or	Data	
04_{hex}	Number of bytes (low byte)					or	Data	
05_{hex}	Number of bytes (high byte)					or	Data	
06_{hex}	Data							
…	Data							
Last byte = bit string		TI	KA			GR		AV

Assignment and explanation

Subaddress	Bit name	Meaning	Function description
00_{hex}/last byte	TI	Toggle bit in	Controller is ready to receive additional data (read job).
	KA	Head shutoff	Shuts off the R/W head's antenna. Tag detection no longer takes place. CP and MT are 0.
	GR	Basic state	Cancels the current job for this R/W head and puts the channel into a basic state. The R/W head can then be used again once GR = 0 and the controller has acknowledged this with BB = 1. CP and MT are 0.
	AV	Job	A job is present.

Note
After a R/W error the GR bit does not need to be set in order to place the R/W in the basic state. Each time a command (successful or with error) is carried out, the R/W head is in the basic state.

7 Device Functions

Command structure

Command designator 00_{hex}: No command present

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
00_{hex}	Command identifier	00_{hex}: No command present.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 01_{hex}: Read from data carrier

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	01_{hex}: Read from data carrier.
02_{hex}	Start address (low byte)	Start address for reading.
03_{hex}	Start address (high byte)	Start address for reading.
04_{hex}	Number of bytes (low byte)	Number of bytes to be read starting from the start address.
05_{hex}	Number of bytes (high byte)	Number of bytes to be read starting from the start address.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 02_{hex}: Write to data carrier

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	02_{hex}: Write to data carrier.
02_{hex}	Start address (low byte)	Start address to be written from.
03_{hex}	Start address (high byte)	Start address to be written from.
04_{hex}	Number of bytes (low byte)	Number of bytes to be written starting from the start address.
05_{hex}	Number of bytes (high byte)	Number of bytes to be written starting from the start address.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Command structure

Data is accepted from the compact processor unit only after the command has been accepted by the processor unit and acknowledged.

00_{hex}	1st bit string	
01_{hex}	Data	Transmission of the data that is to be written to the data carrier.
…	Data	Transmission of the data that is to be written to the data carrier.
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 07_{hex}: Store the start address for the “Auto Read” function

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	07_{hex}: Store the start address for the “Auto Read” function in EEPROM.
02_{hex}	Start address (low byte)	Address for the “Auto Read” function starting from which the data carrier is read. The value is stored in the EEPROM.
03_{hex}	Start address (high byte)	Address for the “Auto Read” function starting from which the data carrier is read. The value is stored in the EEPROM.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 09_{hex}: Type and serial number

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	09_{hex}: Read the read/write head type, data carrier type and UID (unique identifier) of a data carrier in the field (for data format, see page 14).
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Command structure

Command designator 12_{hex}: Initialize CRC_16 data check

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	12_{hex}: Initialize data carrier.
02_{hex}	Start address (low byte)	Start address from which the CRC_16 data check is to be carried out.
03_{hex}	Start address (high byte)	Start address from which the CRC_16 data check is to be carried out.
04_{hex}	Number of bytes (low byte)	Start address from which the CRC_16 data check is to be carried out.
05_{hex}	Number of bytes (high byte)	Start address from which the CRC_16 data check is to be carried out.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 32_{hex}: Write constant value to data carrier

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	32_{hex}: Write a data carrier with a constant value.
02_{hex}	Start address (low byte)	Start address to be written from.
03_{hex}	Start address (high byte)	Start address to be written from.
04_{hex}	Number of bytes (low byte)	Number of bytes to be written starting from the start address.
05_{hex}	Number of bytes (high byte)	Number of bytes to be written starting from the start address.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Data is accepted from the compact processor unit only after the command has been accepted by the processor unit and acknowledged.

00_{hex}	1st bit string	
01_{hex}	Data	Value that is to be written to the data carrier.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Command structure

Command designator 81_{hex}: Read data carrier with 24-bit address assignment

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	81_{hex}: Read from data carrier.
02_{hex}	Start address (low byte)	Start address for reading.
03_{hex}	Start address (middle byte)	Start address for reading.
04_{hex}	Start address (high byte)	Start address for reading.
05_{hex}	Number of bytes (low byte)	Number of bytes to be read starting from the start address.
06_{hex}	Number of bytes (middle byte)	Number of bytes to be read starting from the start address.
07_{hex}	Number of bytes (high byte)	Number of bytes to be read starting from the start address.
...	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 82_{hex}: Write data carrier with 24-bit address assignment

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	82_{hex}: Write to data carriers.
02_{hex}	Start address (low byte)	Start address to be written from.
03_{hex}	Start address (middle byte)	Start address to be written from.
04_{hex}	Start address (high byte)	Start address to be written from.
05_{hex}	Number of bytes (low byte)	Number of bytes to be written starting from the start address.
06_{hex}	Number of bytes (middle byte)	Number of bytes to be written starting from the start address.
07_{hex}	Number of bytes (high byte)	Number of bytes to be written starting from the start address.
...	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Command structure

Command designator 87_{hex}: Saving the start address for the Auto Read function with 24-bit address assignment

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	87_{hex}: Store the start address for the “Auto Read” function in EEPROM.
02_{hex}	Start address (low byte)	Address for the “Auto Read” function starting from which the data carrier is read. The value is stored in the EEPROM.
03_{hex}	Start address (middle byte)	Address for the “Auto Read” function starting from which the data carrier is read. The value is stored in the EEPROM.
04_{hex}	Start address (high byte)	Address for the “Auto Read” function starting from which the data carrier is read. The value is stored in the EEPROM.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

Command designator 92_{hex}: Initialize CRC_16 data check with 24-bit address assignment

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	92_{hex}: Initialize CRC_16 data check.
02_{hex}	Start address (low byte)	Start address from which the CRC_16 data check is to be carried out.
03_{hex}	Start address (middle byte)	Start address from which the CRC_16 data check is to be carried out.
04_{hex}	Start address (high byte)	Start address from which the CRC_16 data check is to be carried out.
05_{hex}	Number of bytes (low byte)	Number of bytes for which the CRC_16 data check is to be carried out starting from the start address.
06_{hex}	Number of bytes (middle byte)	Number of bytes for which the CRC_16 data check is to be carried out starting from the start address.
07_{hex}	Number of bytes (high byte)	Number of bytes for which the CRC_16 data check is to be carried out starting from the start address.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Command structure

Command designator $B2_{hex}$: Write constant value to data carrier with 24-bit address assignment

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Command identifier	$B2_{hex}$: Write constant value to data carrier with 24-bit address assignment.
02_{hex}	Start address (low byte)	Start address to be written from.
03_{hex}	Start address (middle byte)	Start address to be written from.
04_{hex}	Start address (high byte)	Start address to be written from.
05_{hex}	Number of bytes (low byte)	Number of bytes to be written starting from the start address.
06_{hex}	Number of bytes (middle byte)	Number of bytes to be written starting from the start address.
07_{hex}	Number of bytes (high byte)	Number of bytes to be written starting from the start address.
…	None	No meaning
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Input buffer

The input buffer is used to send the data read from the identification system, the designations and the status codes to the host system.

Bit-No. / Subaddress	7	6	5	4	3	2	1	0
00_{hex} = bit string	BB	HF	TO	MT	AF	AE	AA	CP
01_{hex}	Status code or Data							
02_{hex}	Data							
…	Data							
Last byte = bit string	BB	HF	TO	MT	AF	AE	AA	CP

Assignment and explanation

Subaddress	Bit name	Meaning	Function description
00_{hex}/last byte	BB	Ready	After powering up or after a reset via the GR bit, the BB bit indicates that the corresponding channel is ready.
	HF	Head error	Cable break to the R/W head.
	TO	Toggle bit out	**Read:** Additional data is being provided by the identification system. **Write operation:** Identification system can accept additional data.
	MT	Multiple Tag	More than 1 data carrier is in the R/W head's field.
	AF	Job error	A job was processed incorrectly or was canceled.
	AE	Job end	A job was completed without errors.
	AA	Job start	A job was detected and started.
	CP	Code Present	A data carrier has been detected.

Structure of the input buffer

The structure of the process data buffer is identical for all commands.

Subaddress	Meaning	Function description
00_{hex}	1st bit string	
01_{hex}	Status code	Provides information on the status of a query.
02_{hex}	Data	Transmission of data that was read from the data carrier.
…	Data	Transmission of data that was read from the data carrier.
Last byte	2nd bit string	Valid data is present if the 1st and 2nd bit strings match.

7 Device Functions

Status codes

Note
Status codes are only valid in connection with the AF bit!

Status code	Function description
00_{hex}	Everything OK
01_{hex}	Job cannot be run because there is no data carrier in range of the read/write head.
02_{hex}	Cannot read the data carrier.
04_{hex}	Cannot write to the data carrier.
05_{hex}	Data carrier was removed from the R/W head's range during writing.
07_{hex}	No or invalid command designator with set AV bit or the number of bytes is 00_{hex}.
09_{hex}	R/W head cable break or no R/W head connected.
$0D_{hex}$	Communication to the R/W head disrupted.
$0E_{hex}$	CRC for the read data and CRC for the data carrier do not agree.
$0F_{hex}$	1st and 2nd bit string are unequal. The 2nd bit string must be used.
20_{hex}	Address assignment of the read/write job is outside the memory range of the data carrier.
21_{hex}	This function is not possible for this data carrier.

Description of the Code Present (CP) and Multiple Tag (MT) bits

CP	MT	Meaning
0	0	No tag in the field
1	0	Exactly one tag in the field. Automatic reading is OK (if configured).
0	1	More than one data carrier is in the field. They cannot be processed.
1	1	Does not occur.

7 Device Functions

Communication

The communication between the controlling system and processor unit is defined by a sequence protocol. Communication between controlling system and processor unit is implemented using a control bit in the output and input buffer.

Basic sequence

1. The controller sends a command designator to the processor unit in the output buffer with the AV bit set.
   The AV bit tells the compact processor unit that a job is beginning and the transmitted data is valid.
2. The compact processor unit accepts the job and confirms the job by setting the AA bit in the input buffer.
3. If additional data needs to be exchanged for the job, readiness for additional data exchange is indicated by inverting the TI and TO toggle bits.
4. The compact processor unit has correctly executed the job and sets the AE bit in the input buffer.
5. The controller has accepted all data. The AV bit in the output buffer is reset.
6. The compact processor unit resets all control bits set in the input buffer during the job (AA bit, AE bit). The processor unit is ready for the next job.

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

Read/write times

ISO 15693:

Read times Data carrier with 16 bytes per block	
Data carrier detection	~ 20 ms
Read bytes 0 to 15	~ 25 ms
For each additional 16-byte block started	~ 10 ms

Write times Data carrier with 16 bytes per block		
	FRAM (BIS M-1_ _-02/20)	EEPROM (BIS M-1_ _-03/07/08)
Data carrier detection	~ 20 ms	~ 20 ms
Write bytes 0 to 15	~ 60 ms	~ 80 ms
For each additional 16-byte block started	~ 25 ms	~ 80 ms

High speed*:

Read times Data carrier with 64 bytes per block	
Data carrier detection	~ 20 ms
Read bytes 0 to 63	~ 14 ms
For each additional 64-byte block started	~ 6 ms

Write times Data carrier with 64 bytes per block	
Data carrier detection	~ 20 ms
Write bytes 0 to 63	~ 30 ms
For each additional 64-byte block started	~ 15 ms

*These times apply only to data carriers BIS M-1_ _-**11**/A, BIS M-1_ _-**13**/A, BIS M-1_ _-**14**/A and BIS M-1_ _-**15**/A.

7 Device Functions

Distance between the data carriers

Data carrier	Distance BIS M					
	106-… 107-… 108-… 110-… 111-… 115-… 128-…	112-… 134-… 135-…	140-… 142-… 143-… 144-…	150-… 151-… 152-… 154-… 155-… 156-…	153-…	191-…
BIS M-4008-…-001	> 20 cm	> 20 cm	> 20 cm			
BIS M-4008-…-002				> 25 cm	> 30 cm	> 25 cm

Distance between the compact processor units

Compact processor,	Minimum distance
BIS M-4008-…-001	20 cm
BIS M-4008-…-002	20 cm

When installing two BIS M-4_ _-... on metal, there is normally no mutual interference. Unfavorable use of a metal frame can result in problems when reading a data carrier. In this case, the read distance is reduced to 80% of the maximum value. In critical applications, a pre-test is recommended.

7 Device Functions

7.3 Function indicator

The operating states of the identification system and the PROFINET interface are indicated by LEDs.

Overview of display elements

Figure 11: Function indicators

LED	Status	Function
POWER	Off	Device is not ready for operation
	Green	Supply voltage OK
	Green, flashing	Cable break
CP	Off	No data carrier detected
	Yellow	Data carrier detected
	yellow flashing	Data carrier is being processed
SF	Off	No error
	Red	Diagnostics message; system error
	Red, flashing	DCP activated via bus
BF	Off	No error
	Red	No connection or no configuration
	Red, flashing	No data exchange
L1 / L2	Off	No connection
	Green	Connection
A1 / A2	Off	No data transfer
	Green	Data transfer

7 Device Functions

7.4 Examples

1. Read 30 bytes at read/write head, start address 10

Once enough data has been read to fill the input buffer of R/W head1, the data will be carried over to the input buffer.
The AE bit is not set until the compact processor unit has finished the “Read” operation.
The reply “Job end” (AE bit) is reliably set no later than before the last data has been sent.
This time point depends on the requested volume of data and the time response of the controller. In the example, the use of italics for “*Set AE bit*” calls your attention to this fact.

Controller — **Identification system**

1. Process output buffer (note sequence):

01_{hex}	Command designator 01_{hex}
02_{hex}	Start address $0A_{hex}$
03_{hex}	Start address 00_{hex}
04_{hex}	No. of bytes $1E_{hex}$
05_{hex}	No. of bytes 00_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

2. Process input buffer (note sequence):

$00_{hex}/0F_{hex}$	Set AA bit
$01…0E_{hex}$	Enter first 14 bytes
$00_{hex}/0F_{hex}$	Invert TO bit
$00_{hex}/0F_{hex}$	*Set AE bit*

3. Process input buffer:

$01…0E_{hex}$	Copy first 14 bytes

Process output buffer:

$00_{hex}/0F_{hex}$	Invert TI bit

4. Process input buffer:

$01…0E_{hex}$	Enter second 14 bytes
$00_{hex}/0F_{hex}$	Invert TO bit
$00_{hex}/0F_{hex}$	*Set AE bit*

5. Process input buffer:

$01…0E_{hex}$	Copy second 14 bytes

Process output buffer:

$00_{hex}/0F_{hex}$	Invert TI bit

6. Process input buffer:

$01…02_{hex}$	Enter last bytes
$00_{hex}/0F_{hex}$	Invert TO bit
$00_{hex}/0F_{hex}$	*Set AE bit*

7. Process input buffer:

$01…02_{hex}$	Copy last bytes

Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

8. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AE bits

7 Device Functions

2. Read 30 bytes at read/write head, start address 10, problem with reading

> **Note**
> If a problem occurs, the AF bit is set with the corresponding status number instead of the AE bit. Setting the AF bit cancels the job and declares it as finished.

Controller

1. Process output buffer (note sequence):

01_{hex}	Command designator 01_{hex}
02_{hex}	Start address $0A_{hex}$
03_{hex}	Start address 00_{hex}
04_{hex}	No. of bytes $1E_{hex}$
05_{hex}	No. of bytes 00_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

3. Process input buffer:

01_{hex}	Copy status number

Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

Identification system

2. Process input buffer (note sequence):
If problem occurs immediately!

$00_{hex}/0F_{hex}$	Set AA bit
01_{hex}	Enter status number
$00_{hex}/0F_{hex}$	Set AF bit

4. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AF bits

7 Device Functions

3. Read 30 bytes at read/write head, start address 10, problem with reading

Note
If a problem occurs after transmission of the data has started, the AF bit is provided instead of the AE bit together with a corresponding status number. The AF status message is dominant. Which data is incorrect cannot be specified. Setting the AF bit cancels the job and declares it as finished.

Controller

1. Process output buffer (note sequence):

01_{hex}	Command designator 01_{hex}
02_{hex}	Start address $0A_{hex}$
03_{hex}	Start address 00_{hex}
04_{hex}	No. of bytes $1E_{hex}$
05_{hex}	No. of bytes 00_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

3. Process input buffer:

$01…0E_{hex}$	Copy first 14 bytes

Process output buffer:

$00_{hex}/0F_{hex}$	Invert TI bit

5. Process input buffer:

$01…0E_{hex}$	Copy status number

Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

Identification system

2. Process input buffer (note sequence):

$00_{hex}/0F_{hex}$	Set AA bit
$01…0E_{hex}$	Enter first 14 bytes
$00_{hex}/0F_{hex}$	Invert TO bit

4. Process input buffer:
If a problem has occurred!

01_{hex}	Enter status number
$00_{hex}/0F_{hex}$	Set AF bit

6. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AF bits

7 Device Functions

4. Write 30 bytes at read/write head, start address 20

Controller

1. Process output buffer (note sequence):

01_{hex}	Command designator 02_{hex}
02_{hex}	Start address 14_{hex}
03_{hex}	Start address 00_{hex}
04_{hex}	No. of bytes $1E_{hex}$
05_{hex}	No. of bytes 00_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

3. Process output buffer:

$01…0E_{hex}$	Enter first 14 bytes
$00_{hex}/0F_{hex}$	Invert TI bit

5. Process output buffer:

$01…0E_{hex}$	Enter second 14 bytes
$00_{hex}/0F_{hex}$	Invert TI bit

7. Process output buffer:

$01…02_{hex}$	Enter last 2 bytes
$00_{hex}/0F_{hex}$	Invert TI bit

9. Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

Identification system

2. Process input buffer (note sequence):

$00_{hex}/0F_{hex}$	Set AA bit, invert TO bit

4. Process output buffer:

$01…0E_{hex}$	Copy first 14 bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Invert TO bit

6. Process output buffer:

$01…0E_{hex}$	Copy second 14 bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Invert TO bit

8. Process output buffer:

$01…02_{hex}$	Copy last 2 bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Set AE bit

10. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AE bits

7 Device Functions

5. Writing a constant value to a data carrier

A data carrier is to be written with 1000 bytes (constant value) starting from start address 80.

Controller **Identification system**

1. Process output buffer (note sequence):

01_{hex}	Command designator 32_{hex}
02_{hex}	Start address 50_{hex}
03_{hex}	Start address 00_{hex}
04_{hex}	Number of bytes $E8_{hex}$
05_{hex}	No. of bytes 03_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

2. Process input buffer (note sequence):

$00_{hex}/0F_{hex}$	Set AA bit, invert TO bit

3. Process output buffer:

01	Enter constant value
$00_{hex}/0F_{hex}$	Invert TI bit

4. Process output buffer:

01	Copy constant value

Process input buffer:

$00_{hex}/0F_{hex}$	Set AE bit

5. Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

6. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AE bits

7 Device Functions

6. Initializing a data carrier for CRC

The sequence for CRC initialization is similar to a write command. The start address and number of bytes must correspond to the maximum volume of data used.
In the example the complete memory area of a data carrier (752 bytes) is used. 658 bytes on the data carrier are available as data bytes, since 94 bytes are required for the CRC.

Controller | **Identification system**

1. Process output buffer (note sequence):

01_{hex}	Command designator 12_{hex}
02_{hex}	Start address 00_{hex}
03_{hex}	Start address 00_{hex}
04_{hex}	No. of bytes 92_{hex}
05_{hex}	No. of bytes 02_{hex}
$00_{hex}/0F_{hex}$	Set AV bit

2. Process input buffer (note sequence):

$00_{hex}/0F_{hex}$	Set AA bit, invert TO bit

3. Process output buffer:

$01…0E_{hex}$	Enter first 14 bytes
$00_{hex}/0F_{hex}$	Invert TI bit

4. Process output buffer:

$01…0E_{hex}$	Copy first 14 bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Invert TO bit

5. Process output buffer:

$01…0E_{hex}$	Enter second 14 bytes
$00_{hex}/0F_{hex}$	Invert TI bit

6. Process output buffer:

$01…0E_{hex}$	Copy second 14 bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Invert TO bit

95. Process output buffer:

$01…08_{hex}$	Enter last bytes
$00_{hex}/0F_{hex}$	Invert TI bit

96. Process output buffer:

$01…08_{hex}$	Copy last bytes

Process input buffer:

$00_{hex}/0F_{hex}$	Set AE bit

97. Process output buffer:

$00_{hex}/0F_{hex}$	Reset AV bit

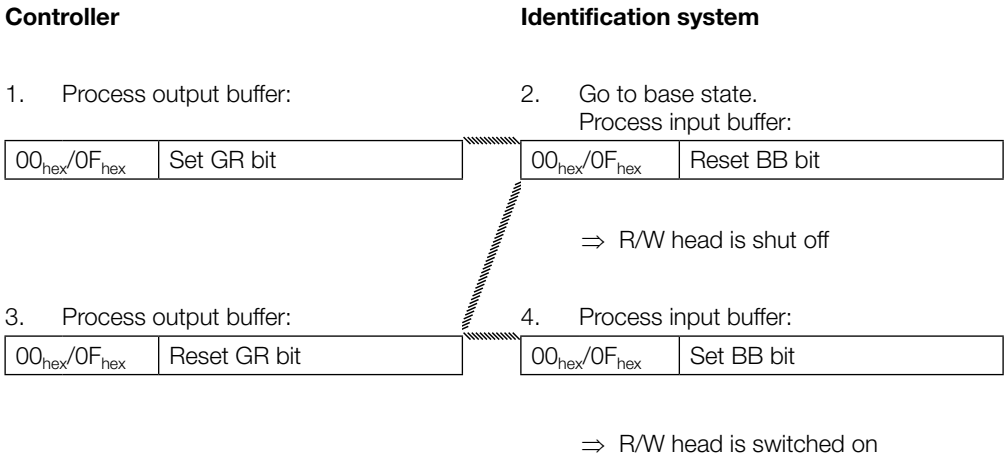
98. Process input buffer:

$00_{hex}/0F_{hex}$	Reset AA and AE bits

7 Device Functions

7. Set read-write unit to base state or turn off read-write unit

The read/write head of the identification system can be set to the base state or turned off.



8. Switching off a read/write head antenna

In normal operation the read/write head antenna is turned on. Setting the KA bit turns the antenna off.

Controller

1. Process output buffer:

$00_{hex}/0F_{hex}$	Set KA bit

The antennas are switched back on by resetting the KA bit.

7 Device Functions

7.5 Webserver

The BIS M-4008 includes an integrated webserver for retrieving detailed information on the current status. This can also be used to reset the device settings (Factory Reset).
For connection setup with the webserver, enter the IP address of the module in the address line of the browser. Please use Internet Explorer 10 or higher.

Navigation

To go to the various pages of the webserver. A navigation bar is shown in the upper area of the webserver. Clicking on the various icons takes you to the corresponding pages.

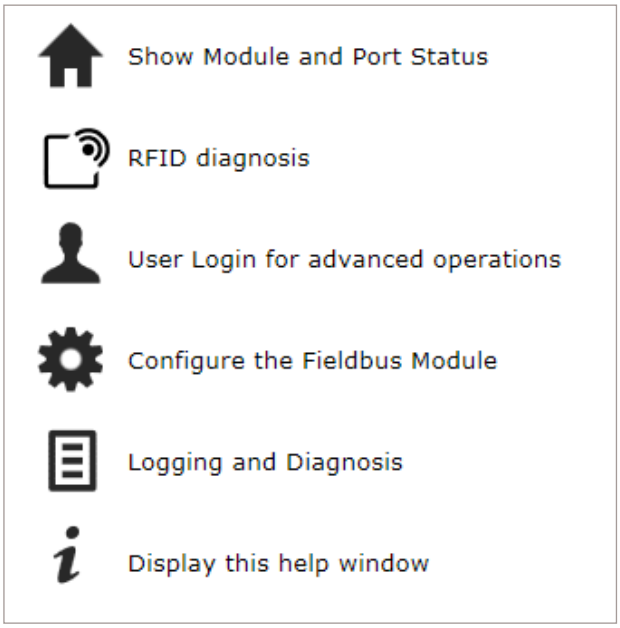


Figure 12: Webserver navigation bar

Note
The highlighted logo text shows the user which page he is on. In addition the logo text is positioned slightly below the other logo texts.

7 Device Functions

Home

Information on the configuration and network activity of the module can be found on this page. The status of the device can be determined from the image of the device. Here the current LED status is shown. The “Get GSDML” button allows you to download the needed GSDML file from the device for project planning.

Figure 13: Webserver homepage

LED Legend

Click on the “LED_Legend” link to see an explanation of the device status. Here a smaller box is shown in which the status of the individual LEDs is explained.

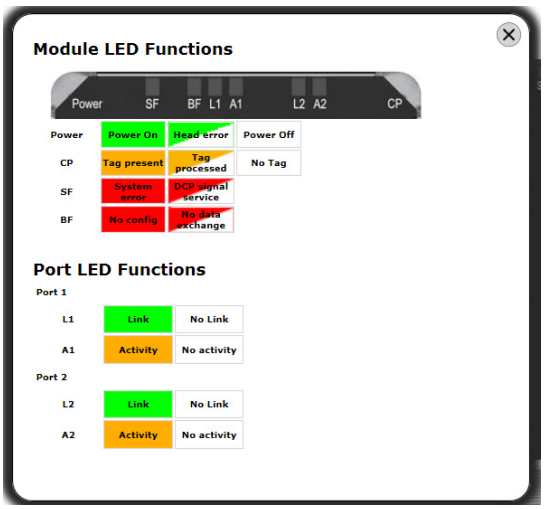


Figure 14: Webserver LED legend

7 Device Functions

RFID

This page shows information about the current process data and the parameter settings. These are the parameters set for the RFID unit during project planning. Use the checkbox to turn display of the process data exchange on and off. If there is no process data exchange with a master currently taking place, “No Data transfer with PLC” is shown.

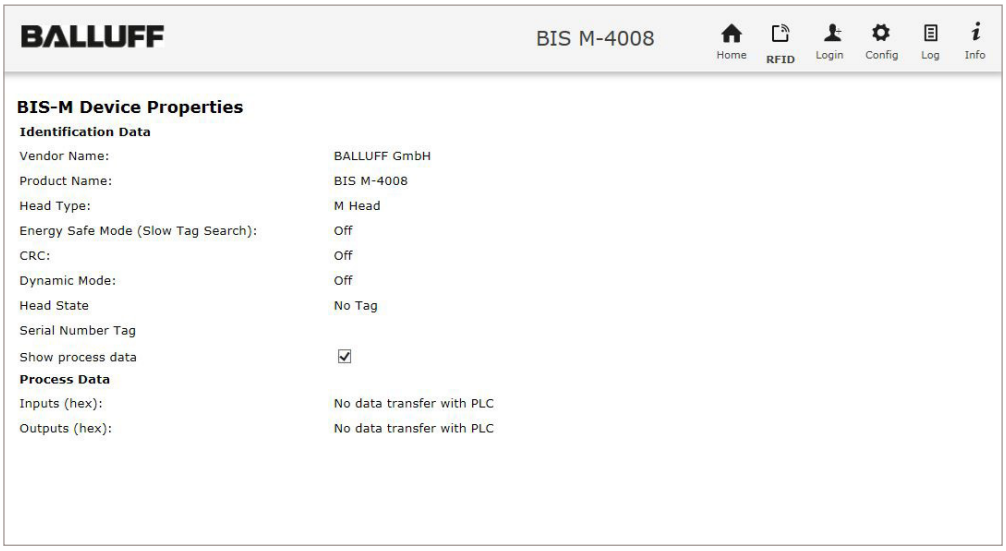


Figure 15: Webserver RFID page

Note
The process data display is refreshed every second. The displayed process data may therefore differ from the actual process data for the controller.
Furthermore, the system is slowed down since the process data are obtained from the firmware. This function should therefore only be used for diagnostics purposes or for startup.

7 Device Functions

Configurations

The module description and module position of the BIS M-4008 can be edited on this page. The device settings can also be reset (Factory Reset). This function can only be used after entering a username and password. The user is therefore automatically taken to the user login page:

Username: Balluff
Password: BISMPNT

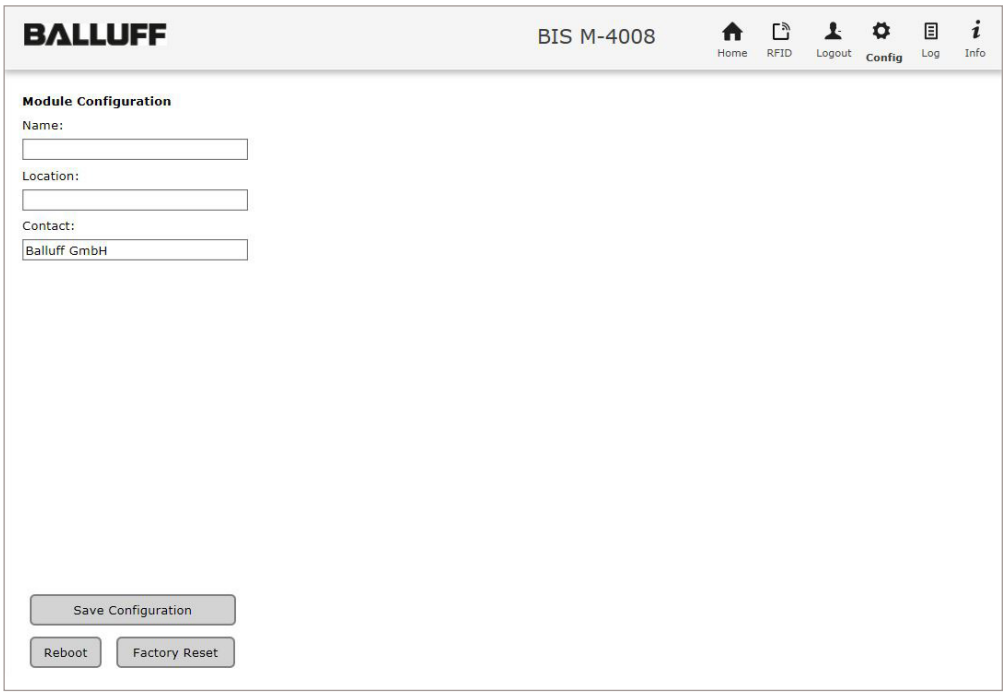


Figure 16: Webserver module configuration

Configurations

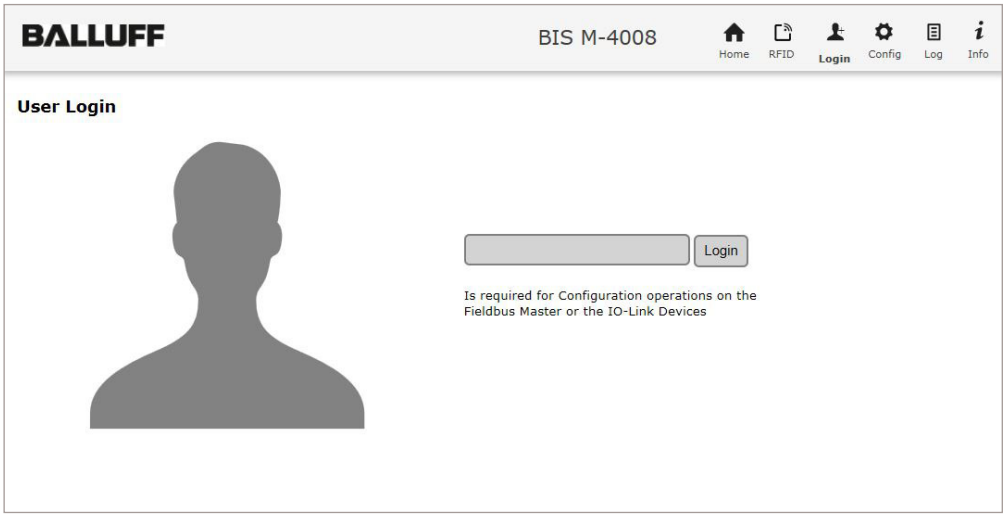


Figure 17: Webserver user login

7 Device Functions

Log

This page can be used by service or by the customer for performing diagnostics on the unit. The diagnostics messages are summarized in a list. Shown for the errors are severity, origin, time stamp and error description. Some diagnostics messages are also stored in a file in flash memory. This file can be exported to the connected PC using the “Export Web Log” button. The “Clear Log” button clears the temporary Web log entries. This function has no effect on the entries stored in the file and can only be performed after a user login. The “Set Module Time” button sends the current browser time to the device. The “Update Log” button updates the page and the associated entries.

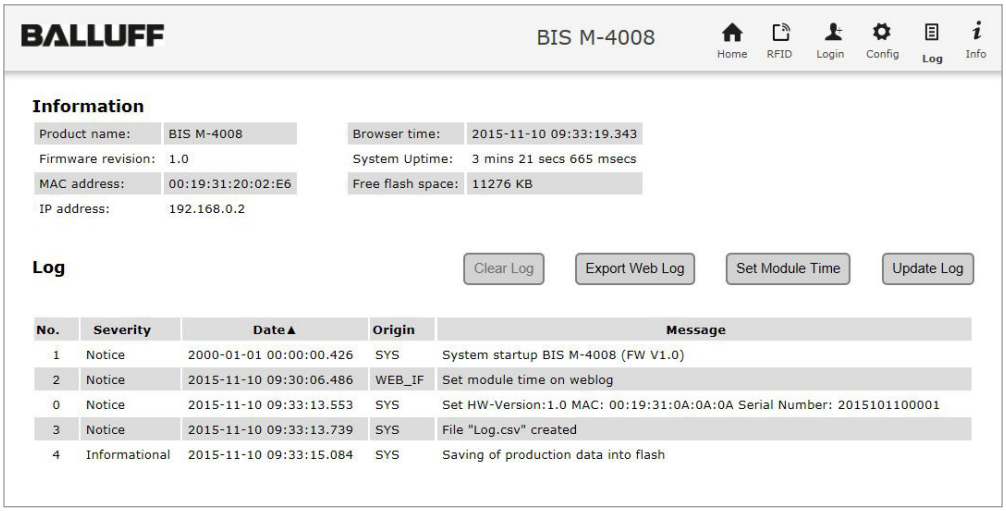


Figure 18: Webserver log page

Note
If a more precise time stamp is needed for the diagnostics, when restarting the device the time must be sent to the device using the “Set Module Time” button. This time indication is based on the “browser” time. Sending takes several seconds, so that a slight time offset results. If no time is sent to the device, the time is incremented starting at 2000 -01 -01…….

7 Device Functions

Logout

If the expanded functions are no longer needed for the webserver, the user can log out again using the “Logout” icon.

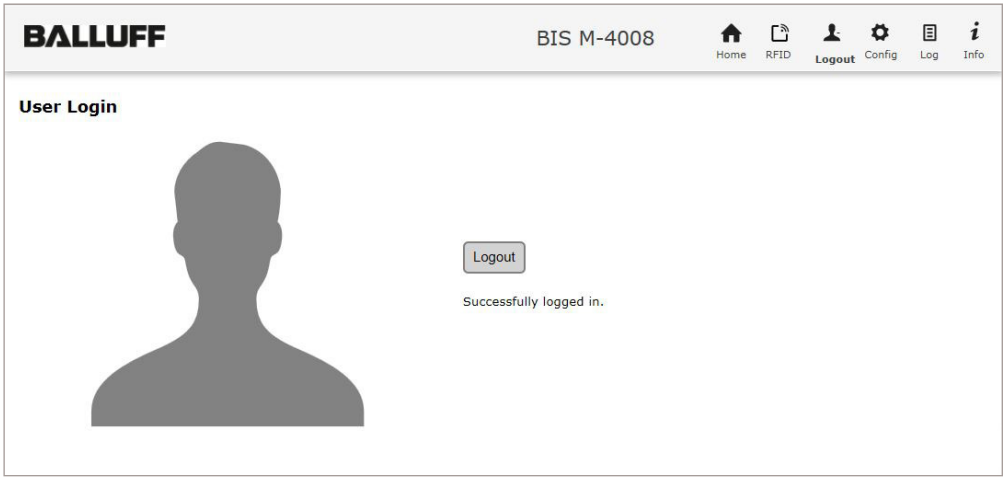


Figure 19: Webserver logout

Info

Contact information and the navigation elements are explained on this page.

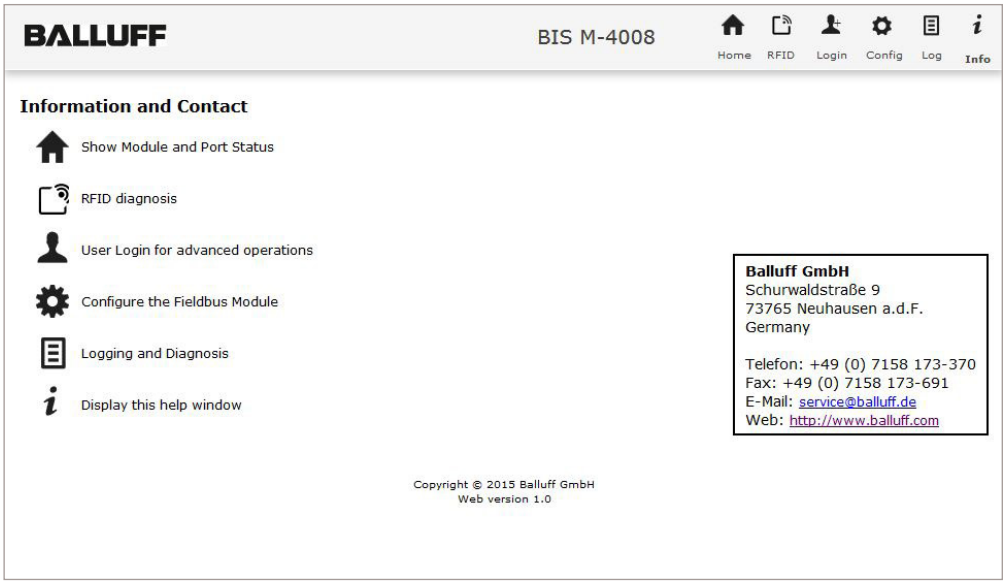


Figure 20: Webserver information and contact

Appendix

Type code

BIS M – 4 0 08 – 048 – 00x – ST4

Balluff Identification System

Series M

System component
4 = Compact processor

Generation (design/material)
0 = Generation 1, metal

Interface
08 = PROFINET

Software type
048 = PROFINET IO

Antenna type
001 = Round antenna
002 = Ferrite antenna

Connection system
ST4 = *Power supply:* 4-pin male connector with M12 external thread, A-coded
PROFINET input: 4-pin male connector with M12 internal thread, D-coded
PROFINET output: 4-pin female connector with M12 internal thread, D-coded

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

Note
Other accessories for the BIS M-4008-… can be found in the Balluff catalog and at www.balluff.com.

Appendix

ASCII table

Decimal	Hex	Control code	ASCII	Decimal	Hex	ASCII	Decimal	Hex	ASCII
0	00	Ctrl @	NUL	43	2B	+	86	56	V
1	01	Ctrl A	SOH	44	2C	,	87	57	W
2	02	Ctrl B	STX	45	2D	-	88	58	X
3	03	Ctrl C	ETX	46	2E	.	89	59	Y
4	04	Ctrl D	EOT	47	2F	/	90	5 A	Z
5	05	Ctrl E	ENQ	48	30	0	91	5B	[
6	06	Ctrl F	ACK	49	31	1	92	5C	\
7	07	Ctrl G	BEL	50	32	2	93	5D	[
8	08	Ctrl H	BS	51	33	3	94	5E	^
9	09	Ctrl I	HT	52	34	4	95	5F	_
10	0 A	Ctrl J	LF	53	35	5	96	60	`
11	0B	Ctrl K	VT	54	36	6	97	61	a
12	0C	Ctrl L	FF	55	37	7	98	62	b
13	0D	Ctrl M	CR	56	38	8	99	63	c
14	0E	Ctrl N	SO	57	39	9	100	64	d
15	0F	Ctrl O	SI	58	3 A	:	101	65	e
16	10	Ctrl P	DLE	59	3B	;	102	66	f
17	11	Ctrl Q	DC1	60	3C	<	103	67	g
18	12	Ctrl R	DC2	61	3D	=	104	68	h
19	13	Ctrl S	DC3	62	3E	>	105	69	i
20	14	Ctrl T	DC4	63	3F	?	106	6 A	j
21	15	Ctrl U	NAK	64	40	@	107	6B	k
22	16	Ctrl V	SYN	65	41	A	108	6C	L
23	17	Ctrl W	ETB	66	42	B	109	6D	m
24	18	Ctrl X	CAN	67	43	C	110	6E	n
25	19	Ctrl Y	EM	68	44	D	111	6F	o
26	1 A	Ctrl Z	SUB	69	45	E	112	70	p
27	1B	Ctrl [	ESC	70	46	F	113	71	q
28	1C	Ctrl \	FS	71	47	G	114	72	r
29	1D	Ctrl]	GS	72	48	H	115	73	s
30	1E	Ctrl ^	RS	73	49	I	116	74	t
31	1F	Ctrl _	US	74	4 A	J	117	75	u
32	20		SP	75	4B	K	118	76	v
33	21		!	76	4C	L	119	77	w
34	22		„	77	4D	M	120	78	x
35	23		#	78	4E	N	121	79	y
36	24		$	79	4F	O	122	7 A	z
37	25		%	80	50	P	123	7B	{
38	26		&	81	51	Q	124	7C	|
39	27		‘	82	52	R	125	7D	}
40	28		(	83	53	S	126	7E	~
41	29		)	84	54	T	127	7F	DEL
42	2 A		*	85	55	U			

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