CL200

BM2-ASI
Module Description

Edition 101

BOSCH
Automation

CL200

BM2-ASI
Module Description

1070 072 194-101 (99.11) GB

Discretionary charge 10.00 DM

Contents

1 Safety Instructions

Before you start working with the BM2-ASI Bus Master Module, we recommend that you thoroughly familiarize yourself with the contents of this manual. Keep this manual in a place where it is always accessible to all users.

1.1 Proper use

This instruction manual presents a comprehensive set of instructions and information required for the standard operation of the described products. The products described hereunder are used for the purpose of setting up and configuring an AS-Interface bus installation for use with the CL200.

The products described hereunder

- were developed, manufactured, tested and documentd in accordance with the relevant safety standards. In standard operation, and provided that the specifications and safety instructions relating to the project phase, installation and proper operation of the product are followed, there should arise no risk of danger to personnel or property.
- are certified to be in full compliance
  - with the EMC Directives (89/336/EEC, 93/68/EEC, and 93/44/EEC)
  - EEC Directive on operation within certain voltage limits (73/23/EEC)
  - harmonized standards EN 50081-2 and EN 50082-2
- are designed for operation in an industrial environment (class A emissions), i. e.
  - not directly connected to the public low-voltage power supply,
  - connected via a transformer to the medium to high-voltage network.

  The following shall apply to the operation of the described products within a private residence, in business areas, on retail premises or in small-industry settings:
  - Installation in a control cabinet and/or an enclosure providing a high screening factor.
  - All cables exiting from the screened area must be protected by suitable filtering and screening measures.
  - The user will be required to obtain a single operating license issued by the appropriate national authority or approval body. In Germany, this is the Federal Institute for Posts and Telecommunications and/or its local branch offices.

☞ **This is a Class A device. In a residential area, this device may cause radio interference. If this is the case, the user or operator may be required to provide appropriate remedial measures at his own expense.**

The prerequisites for trouble-free service and safe operation of the product are proper transport, handling and storage, placement, installation, plus careful operation of the equipment.

1.2 Qualified personnel

The requirements pertaining to qualified personnel are based on the job specifications as outlined by the ZVEI (central association of the electrical industry) and VDMA (association of German machine and plant builders) professional associations in Germany. Please refer to the following German–language publication:
Weiterbildung in der Automatisierungstechnik
Hrsg.: ZVEI und VDMA
MaschinenbauVerlag
Postfach 71 08 64
60498 Frankfurt

This instruction manual is specifically designed for PLC technicians. They will require specific knowledge of the CL200 and the AS-Interface.

Interventions in the hardware and software of our products which are not described in this instruction manual may only be performed by specially trained Bosch personnel.

Unqualified interventions in the hardware or software or non-compliance with the warnings listed in this instruction manual or indicated on the product may result in serious personal injury or damage of property.

Installation and maintenance of the products described hereunder is the exclusive domain of trained electricians as per VDE 1000-10, who are familiar with the contents of this manual.

Trained electricians are persons of whom the following is true:

- they are capable, due to their professional training, skills and expertise, and based upon their knowledge of and familiarity with applicable technical standards, of assessing the work to be carried out, and of recognizing possible hazards.
- they possess, subsequent to several years' experience in a comparable field of endeavour, a level of knowledge and skills that may be deemed commensurate with that attainable in the course of a formal professional education in this area.

With regard to the foregoing, please read the information about our comprehensive training program. You'll find a listing of our seminars on the front inside cover of this manual. The professional staff at our training centre will be pleased to provide detailed information. You may contact the centre by telephone at (++49) (0)6062 78-258.

1.3 Safety markings on components

Danger: High voltage!

Danger: Battery acid!

Electrostatically sensitive components!

Warning of hazardous light radiation (optical waveguide transmitter)

Disconnect at mains before opening!

Pin for connecting PE conductor only!

Functional earthing/low noise earth

For screened conductor only!

1.4 Safety instructions in this manual

DANGEROUS ELECTRICAL VOLTAGE
This symbol is used to warn of the presence of a **dangerous electrical voltage**. Insufficient compliance with or failure to observe this warning may result in **personal injury**.

DANGER
This symbol is used wherever insufficient or lacking compliance with instructions may result in **personal injury**.

CAUTION
This symbol is used whenever insufficient or lacking compliance with instructions may result in **damage to equipment or data files**.

☞ This symbol is used to alert the user to an item of special interest.

1.5 Safety instructions concerning the described product

DANGER
Fatal injury hazard through ineffective Emergency-STOP devices!
Emergency-STOP devices must remain effective and accessible in all system operating modes. The release of functional locks imposed by Emergency-STOP devices must never be allowed to cause an uncontrolled system restart! Before restoring power to the system, test the Emergency-STOP circuit!

DANGER
Danger to Personnel and Equipment!
Test every new program prior to initial system startup!

DANGER
Retrofits or modifications may adversely affect the safety of the products described!

The consequences may include severe injuries, damage to equipment, or environmental hazards. Possible retrofits or modifications to the system using third-party equipment therefore have to be approved by Bosch.

DANGEROUS ELECTRICAL VOLTAGE
Unless otherwise indicated, maintenance procedures must always be carried out with the system switched OFF! The system must be protected and secured against inadvertent restart.

In the event that measuring or testing procedures must be carried out while the system is active, these shall be performed by trained electricians.

CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION
Only Bosch approved spare parts may be used!

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

Observe the following protective measures for electrostatically endangered modules (EEM)!

- The personnel responsible for storage, transport and handling must be trained in ESD protection.
- EEMs must be stored and transported in the dedicated protective packaging specified for this purpose.
- Out of principle, EEMs may only be handled at special ESD work stations equipped for this particular purpose.
- Personnel, work surfaces and all devices and tools that could come into contact with EEMs must be on the same potential (e. g. earthed).
- An approved earthing wrist strap shall be worn. It must be connected to the work surface via a cable with an integrated 1 MΩ resistor.
- EEMs may under no circumstances come into contact with objects susceptible to accumulating an electrostatic charge. Most items made of plastics belong to this category.
- When installing EEMs in or removing them from an electronic device, the power supply of the device must be switched OFF.

1.6 Documentation, version and trademark

Documentation

Overview of instruction manuals:

Instruction manuals	Language	Part no.
CL200, Controller Manual	D	1070 072 091
	GB	1070 072 145
	E	1070 072 336
	F	1070 072 213
CL200, Operations List	D	1070 072 090
	GB	1070 072 151
	E	1070 072 337
	F	1070 072 214

★ This asterisk symbol shows that the manual is describing an activity which you will be required to perform.

Trademarks

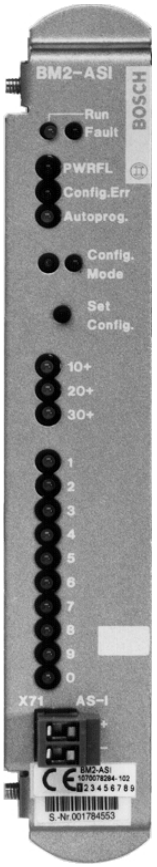
All trademarks referring to software that is installed on Bosch products when shipped from the factory represent the property of the respective manufacturers.

When shipped from the factory, all installed software is protected by copyright. It may therefore be duplicated only with prior permission by Bosch or in accordance with the licensing agreements with the respective manufacturer or copyright owner.

AS-I® is a registered trade mark of the AS-I International Association.

2 Features and Functions

2.1 Hardware Configuration



The BM2-ASI Bus master module acts as a mediation device in the exchange of I/O data and commands between the central processing unit of the CL200 and the bus stations of an AS-Interface installation.

The module is installed in a basic unit or in a centralized or decentralized expansion unit.

In a decentralized deployment of the BM2-ASI module, it may be combined with the RM2-DP12 module to implement a gateway between the PROFIBUS-DP und AS-I installation.

The BM2-ASI module supports the M0 and M1 profiles defined in the AS-I Specifications.

M0 Profile

The I/O address range of the BM2-ASI is located within the I/O address range of the CL200, and is serviced cyclically by this unit in the I/O state. The data exchange between the master and the bus stations is limited to I/O data. The bus stations are cyclically checked by the bus master. Errors are reported via the status bits.

This operating mode can be enabled via the front panel control elements, without requiring the use of a programming unit.

M1 Profile

The BM2-ASI executes additional tasks (commands). These are used, for example, to handle parameterization, diagnostics, configuration, etc.

2.2 Module Features

The BM2-ASI module functions as a bus master in a linear and/or tree-shaped topology.

The connection between the BM2-ASI module and the bus stations consists of an unscreened two-wire cable.

A maximum of 31 bus stations are permitted on each branch of the bus. The bus cycle time required to address 31 bus stations is 5 ms.

For each bus station, up to 8 peripheral connections are provided, i. e., 4 actuator and 4 sensor ports. With each bus station addressing event, a net count of 4 input bits and 4 output bits are transferred.

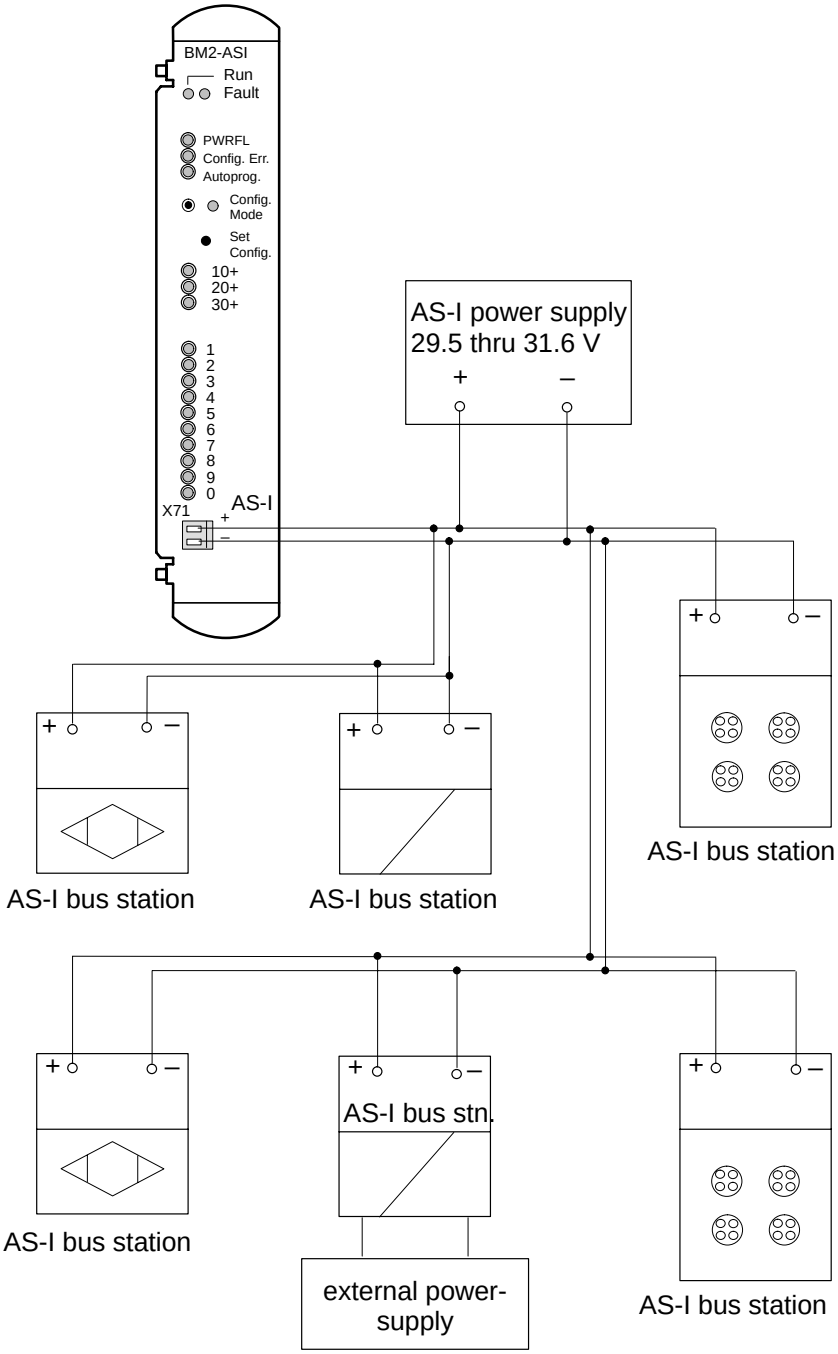
Messages containing errors are repeated automatically.

The BM2-ASI module provides the following services:

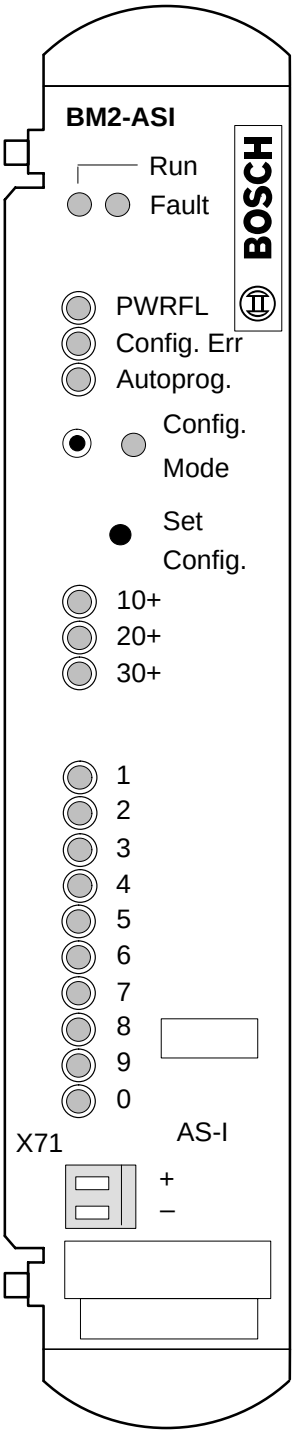
- Cyclical data exchange between central processing unit and bus stations.
- Initialization of the AS-I installation.
- Transfer of parameter values to the bus stations.
- Diagnostics of data transfer to the bus stations.
- Addressing of substituted bus stations.

2.3 AS-I Bus Topology

Example of an AS-I bus topology



2.4 Front Panel



RUN LED, power indicator

Fault LED, hardware fault

PWRFL LED, faulty voltage from AS-I power supply

Config. Err LED, AS-I bus station configuration error

Autoprog. LED, autoprogramming of AS-I bus station

Config. Mode button, switching operating modes

Config. Mode LED ON, Configuration Mode enabled

Config. Mode LED OFF, Protected Mode enabled

Set Config. button, adopts current bus station assignment

LED's labelled 10+, 20+, 30+, and LED's labelled 1 through 0 provide time-controlled display of bus station addresses in groups of ten.

Labelling field

AS-I bus connector

Version ID

Serial number

2.4.1 Control and Display Elements

Run LED

Indicates that the BM2-ASI module has started without problems, and that is is ready for operation. Following the successful verification of the AS–I bus or in the presence of an error (after about 1 minute), the startup of the central processing unit with the bus master will occur.

Fault LED

During the startup, a hardware fault is detected in the BM2-ASI module (Fault LED flashes, LED ”1” shows steady ON). The module must be replaced.

PWRFL LED

The voltage in the AS-I branch is too low or has failed, possibly due to excessive power consumption, i.e., greater than 2 A. The power supply must be checked.

During startup, the BM2-ASI performs a voltage check within the AS-I installation which lasts approx. 1 minute. If the voltage is within tolerances, both the PLC and BM2-ASI module will start.

In the event that the voltage is outsuide of tolerances, the fault condition will be reported to the central processing unit via the status flags. The central processing unit will start regardless.

In the event that the voltage fails during ongoing operation, the outputs of the bus stations will be reset. When the power returns, the servicing of bus stations will restart automatically.

Config. Err. LED (steady ON)

A configuration error was detected. The bus stations recognized in the AS-I installation, and/or their I/O or ID code, fail to match the bus stations that were configured. None of the faulty bus stations will be serviced.

Possible causes:

- The I/O or index ID codes do not correspond to the codes that were configured, e. g., when a bus station of a given type has been replaced with a bus station of another type. A new configuration is required.
- Referenced against the configured bus stations, a shortfall or an excess of one or more bus stations was recognized.
- One or several of the configured bus stations are no longer addressable due to a cable break or a defective bus station. The Autoprog. LED fails to illuminate. The defective bus stations and/or cable must be replaced. When replacing bus stations, the replacements must be assigned the correct address by means of the configuration device.
- A signal cable within the AS-I installation is interrupted. All cables and connectors must be checked.

In Configuration Mode, the bus station addresses deviating from the configuration settings flash in the display.

Config. Err. LED (flashing)

Indicates a spontaneous error. Individual AS-I messages are impeded by interference. As a remedy, AS-I cables should be installed at larger distances of interference sources, such as strong magnetic fields.

Autoprog. LED

Automatic address programming of a bus station in Protected Mode is possible. A configured bus station is missing or has failed. If a bus station of the same type is installed with address 0, it will automatically be assigned the address of the missing or defective bus station.

Config. Mode button

Used to toggle between the Configuration Mode and Protected Mode operating modes.

Config. Mode LED

- LED ON indicates that Configuration Mode is enabled.
- LED OFF indicates that Protected Mode is enabled.

Set Config. button

Adopts the detected actual assignment into the configuration (nominal assignment), provided that Configuration Mode is enabled. Subsequent to the adoption, automatic switchover into Protected Mode will occur.

LED’s labelled 10+, 20+, 30+, and 1 through 0

Time-controlled display of active bus stations in groups of ten. The LED’s 1 through 0 indicate the units digits, and the LED’s labelled 10+, 20+ and 30+ indicate the tens-digits.

When the LED’s labelled 10+, 20+ and 30+ illuminate simultaneously, this indicates that the BM2-ASI module has not recognized any bus stations.

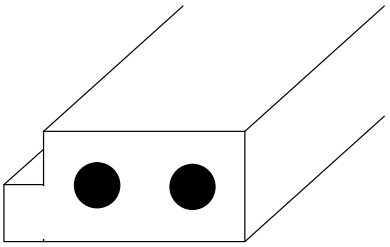
In Configuration Mode: Cyclical display of all bus stations. Any bus stations deviating from the configuration (more bus stations or fewer bus stations that provided for in the configuration) are indicated by a blinking display. A bus station with address 0 is always indicated.

No active bus stations are indicated in Protected Mode.

2.4.2 Connection

The AS-I connector plug comprises a two–pin screw terminal. The connector accommodates the standard AS-I flat cable or round cable.

AS-Interface Flat Cable



AS-I +, brown
AS-I –, blue

2.5 Addressing

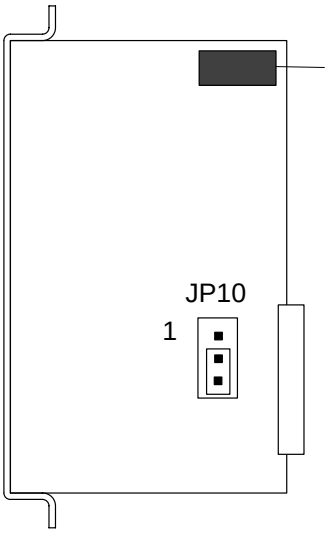
CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

When setting the addressing range and start address, a differentiation is made between centralized and decentralized applications.

- Module is centrally located in basic unit or expansion unit
- Module is operated decentrally via the PROFIBUS-DP.

The jumper labelled JP10 is used to select centralized or decentralized module operation.



The module addressing is accomplished with DIP switch S1.

Switch	8	7	6	5	4	3	2	1
Weight	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Value	128	64	32	16	8	4	2	1

2.6 I/O Address Range

The I/O address range interface performs the following tasks:

- Data exchange with bus stations.
- Monitoring the BM2-ASI via the status bits.

The addresses for input and output data are located in the respective opposite bytes, i. e., if the right-hand bit in output byte 0 represents output O0.0, the right–hand bit in input byte 0 will represent input I0.0.

I/O address functions:

Structure of output addresses (16 bytes) (EO correspondingly):

Byte 0	Output 7 through 4, bus station 1	Output 3 through 0, control bits
Byte 1	Output 7 through 4, bus station 3	Output 3 through 0, bus station 2
Byte 2	Output 7 through 4, bus station 5	Output 3 through 0, bus station 4
Byte 3	Output 7 through 4, bus station 7	Output 3 through 0, bus station 6
Byte 4	Output 7 through 4, bus station 9	Output 3 through 0, bus station 8
Byte 5	Output 7 through 4, bus station 11	Output 3 through 0, bus station 10
Byte 6	Output 7 through 4, bus station 13	Output 3 through 0, bus station 12
Byte 7	Output 7 through 4, bus station 15	Output 3 through 0, bus station 14
Byte 8	Output 7 through 4, bus station 17	Output 3 through 0, bus station 16
Byte 9	Output 7 through 4, bus station 19	Output 3 through 0, bus station 18
Byte 10	Output 7 through 4, bus station 21	Output 3 through 0, bus station 20
Byte 11	Output 7 through 4, bus station 23	Output 3 through 0, bus station 22
Byte 12	Output 7 through 4, bus station 25	Output 3 through 0, bus station 24
Byte 13	Output 7 through 4, bus station 27	Output 3 through 0, bus station 26
Byte 14	Output 7 through 4, bus station 29	Output 3 through 0, bus station 28
Byte 15	Output 7 through 4, bus station 31	Output 3 through 0, bus station 30

☞ **The control bits (bits 0 through 3, byte 0) are not being used at this time. Their address always remains the same, even in the event that there is no bus station with address 1.**

Structure of input addresses (16 bytes) (EI correspondingly):

Byte 0	Input 7 through 4, bus station 1	Input 3 through 0, status bits
Byte 1	Input 7 through 4, bus station 3	Input 3 through 0, bus station 2
Byte 2	Input 7 through 4, bus station 5	Input 3 through 0, bus station 4
Byte 3	Input 7 through 4, bus station 7	Input 3 through 0, bus station 6
Byte 4	Input 7 through 4, bus station 9	Input 3 through 0, bus station 8
Byte 5	Input 7 through 4, bus station 11	Input 3 through 0, bus station 10
Byte 6	Input 7 through 4, bus station 13	Input 3 through 0, bus station 12
Byte 7	Input 7 through 4, bus station 15	Input 3 through 0, bus station 14
Byte 8	Input 7 through 4, bus station 17	Input 3 through 0, bus station 16
Byte 9	Input 7 through 4, bus station 19	Input 3 through 0, bus station 18
Byte 10	Input 7 through 4, bus station 21	Input 3 through 0, bus station 20
Byte 11	Input 7 through 4, bus station 23	Input 3 through 0, bus station 22
Byte 12	Input 7 through 4, bus station 25	Input 3 through 0, bus station 24
Byte 13	Input 7 through 4, bus station 27	Input 3 through 0, bus station 26
Byte 14	Input 7 through 4, bus station 29	Input 3 through 0, bus station 28
Byte 15	Input 7 through 4, bus station 31	Input 3 through 0, bus station 30

The status bits (bits 0 through 3, byte 0) are used to query the following information:

- Bit 0
  - 0, configuration error, the bus stations from the original configuration do not match the bus stations detected during actual operation
  - 1, no configuration error
- Bit 1
  - 0, Protected Mode is enabled
  - 1, Configuration Mode is enabled
- Bit 2
  - 0, Correct voltage in AS-I installation
  - 1, Faulty voltage in AS-I installation
- Bit 3
  - 0, BM2-ASI module is in starting up
  - 1, BM2-ASI is operating

☞ **The address of the status bits always remains the same, even if there is no bus station with address 1.**

2.6.1 Centralized

Jumper JP10, when bridging pins 2 and 3, selects centralized operation.

Switch segment 8 on the DIP switch determines whether the start address of the I/O data shall be located in the I/O address range or in the EI/EO address range.

Switch 8 in OFF position: Start address in I/O address range

Switch 8 in ON position: Start address in EI/EO address range

E/A Interface

The settings (positions) of switches 5 through 7 determine the I/O start address within the I/O address range. Starting at the selected start address, one setting occupies 16 bytes in the I/O field. Within the addressed 16 bytes only those bytes are assigned that are actually assigned in the connected AS-I installation.

☞ **The start address of the I/O data in the I/O address range must always be a multiple integer of 16. Only even-numbered addresses are permitted.**

Switch segment 4 always remains in the OFF position.

Command Interface

The settings (positions) of switches 1 through 3 determine the start address for the command range within the EI/EO address range. Starting at the selected start address, one setting occupies 8 bytes of output addresses and 8 bytes of input addresses in the EI/EO address range.

☞ **The command range is always located in the extended input/output field.**

☞ **The start address for the command range must always be a multiple integer of 16. Only even-numbered addresses are permitted.**

Functions performed within the command range:

- Setting up the configuration of the AS-I installation
- Querying status information
- Setting parameter values for AS-I bus stations

I/O Data Start Address in the I/O Address Range and Command Range Start Address in the EI/EO address range

The table below lists the settings for I/O start addresses in the I/O address range, and those for the command range start addresses in the EI/EO address range.

☞ **Both address settings are independent of each other.**

Start addresses in I/O address range						**Start addresses in EI/EO address range**			
Address	**Switch**					**Address**	**Switch**		
	8	**7**	**6**	**5**	**4**		**3**	**2**	**1**
0	OFF	OFF	OFF	OFF	OFF	0	OFF	OFF	OFF
16	OFF	OFF	OFF	ON	OFF	16	OFF	OFF	ON
						32	OFF	ON	OFF
						48	OFF	ON	ON
						64	ON	OFF	OFF
						80	ON	OFF	ON
						96	ON	ON	OFF
						112	ON	ON	ON

Start Address in EI/EO Address Range and resulting Command Range Start Address

The table below lists the available settings for the start addresses for I/O data in the EI/EO address range, and the resulting start address for the command range in the EI/EO address range.

☞ **The command range start address comprises the next even–numbered address following the 16 byte wide EI/EO field. The command range occupies 8 bytes.**

Command range start address = EI/EO start address + 16

Address	Switch settings		
	8	**7**	**6**
0	ON	OFF	OFF
32	ON	OFF	ON
64	ON	ON	OFF
96	ON	ON	ON

☞ **The settings of switches 1 through 5 are nonfunctional.**

The settings (positions) of switches 6 through 7 determine the I/O data start address within the EI/EO address range. Starting at the selected start address, one setting occupies 24 bytes in the EI/EO field. The settings must be made in increments of 32, and only even-numbered start addresses are permitted. Within the 16 bytes thus addressed in the EI/EO address range, only those bytes are assigned that are actually assigned in the connected AS-I installation.

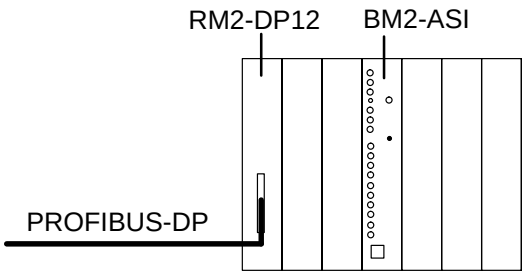
2.6.2 Decentralized Operation via PROFIBUS-DP

Jumper JP10, when bridging pins 1 and 2, selects decentralized operation.

In decentralized operation of the BM2-ASI module via the PROFIBUS-DP field bus, the selected address represents the module number of a given module within the respective bus station (RM2-DP12 bus station address). The modules are consecutively numbered with 0, 1, 2, and so forth.

The module number is selected on switch S1.

The module is addressed by the RM2-DP12. The data always remains range-consistent, i. e., the data will be renewed as a whole message only.



☞ **In decentralized operation, 24 bytes of inputs and 24 bytes of outputs are assigned. The lower 16 bytes are occupied by the I/O data, while the upper command range occupies the upper 8 bytes. The assignment of address ranges is handled by the Win-DP configuration software.**

The device specification file contains the data for the module. By clicking and dragging (Drag & Drop action) the BM2-ASI module below the RM2-DP12 icon, 24 bytes of input and 24 bytes of output addresses are assigned automatically.

Each data range occupied by a bus station is assigned a PLC byte via Drag & Drop action.

☞ **The assignment of AS-I addresses to the PLC addresses occurs in a word-by-word fashion.**

The addresses 16 through 23 correspond to the command range. Although these may be assigned, this is by not means mandatory.

In the event that commads are used, these addresses should be assigned in the free EI/EO range.

☞ **When configuring the AS-I installation, it is good practice to start by removing the DP bus connector from the RM2-DP module. This causes the signal state of all outputs in the expansion unit to be set LOW. In this condition the configuration of the AS-I installation can be accomplished without outputs assuming the HIGH signal state or the PLC entering STOP mode.**

The address assignment can occur in a linear fashion, and without gaps.

In order to prevent the occurrence of gaps in the address assignment, the AS-I modules, starting with bus station number 1, should be assigned in a word-by-word (word-wise) fashion. Addressing gaps that leave insufficient space for complete word addresses are wasted and cannot be used at a later time.

Example: Recommended address assignment (4E: existing bus stations)

Words 0 and 4 are occupied by AS-I bus stations; words 2 and 6 are free, and available for another assignment.

Word address	**0**				**2**				**4**				**6**				**etc.**	
Byte address	**0**		**1**		**2**		**3**		**4**		**5**		**6**		**7**		**etc.**	
existing AS-I bus stations		1	2	3	–	–	–	–	4	5	6	7	–	–	–	–	–	–
bytes occ'd by AS-I	St.	4E	4E	4E	–	–	–	–	4E	4E	4E	4E	–	–	–	–	–	–

☞ **The switchover between operating modes (Protected Mode/Configuration Mode) does not depend on the STOP status of the central processing unit.**

☞ **Upon switching to Protected Mode, a complete startup is executed. While the startup routine is in progress, the outputs assume the LOW signal state.**

2.6.3 Mixed Population of Conventional and AS-I Inputs/Outputs

The module occupies only those bits that are actually contained in the AS-I installation. Bits 0 through 3 in byte 0 of the address range are always assigned to status and control information.

The bits that are not used by the BM2-ASI module can be assigned to centralized I/O modules.

☞ **In the case of a mixed population, the CL200 will not detect an address violation.**

☞ **As a first step, the interconnections of the AS–I installation are completed, with the exception of the centralized modules, and an assignment list is created. The remaining free bytes can then be assigned to centralized I/O modules.**

Example: Mixed population of AS-I inputs and outputs with centralized inputs and outputs.

Word address	**0**				**2**				**4**				**6**				**etc.**	
Byte address	**0**		**1**		**2**		**3**		**4**		**5**		**6**		**7**		**etc.**	
existing AS-I bus stations		1	2	3	–	–	–	–	4	5	6	7	–	–	–	–	–	–
assigned AS-I bus stations	St.	4E	4E	4E	–	–	–	–	4E	4E	4E	4E	–	–	–	–	–	–
centrally assigned bytes	–	–	–	–	16-way inputs				–	–	–	–	16-way outputs				–	–

2.7 Module Slot

In the diagram below, the available – and permitted – module slots are shaded for better identification.

CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

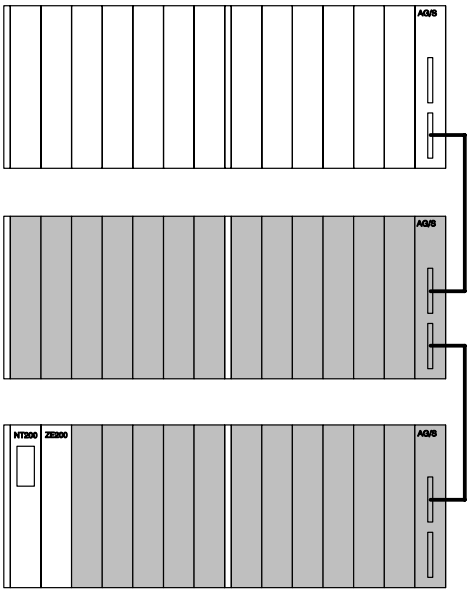
CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

Module Slot, centralized operation

not permitted

max. ambient temperature, 45 °C

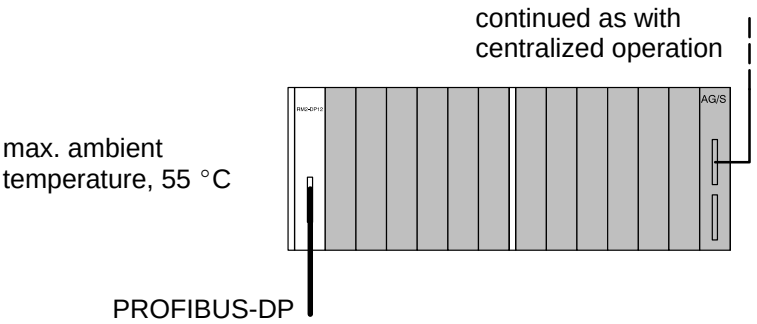
max. ambient temperature, 55 °C



At an ambient temperature between 0 and 55 °C, the module may be operated in the basic unit (without fan assisted ventilation) only as long as the adjacent module slots do not contain any heat-generatuing modules (e. g., output modules).

At an ambient temperature between 0 and 40 °C, the module may also be operated with fan-assisted ventilation in the second expansion tier inside a control cabinet.

Module Slot, decentralized operation



2.8 Specifications

Specifications	BM2-ASI
Part no.	1070 078 283
Supported AS-I profiles	• M0 I/O operation • M1 I/O operation and command operation
Current draw • Back plane bus • AS-I installation	 • 170 mA typical • 200 mA maximum • 80 mA typical • 100 mA maximum
Maximum AS-I bus cycle time	5 ms with max. 31 bus stations
Configuration	via front panel controls or application program
Connectors	AS-I bus connector via screw terminals at the front panel, max. 1.5 mm^2
Line length	max. 100 metres; with repeaters, multiple extensions are possible.
I/O assignment	• 16 bytes in I/O range, plus • 8 bytes in EI/EO range or • 24 bytes in EI/EO range
Temperature range • Storage • Operating	 –27 through +70 °C 0 through 40/55 °C
AS-I analog connection	AMAS 21/A-01, Dimensions (mm): 75 x 40
Supply voltage range	from AS-I power supply, 29.5 V through 31.6 V
Protection type, installed	IP 20
Shock and vibration resistance	Installation in stationary devices that are not vibration-free
Width	1 slot width
Weight	250 g

☞ **In addition, the CL200 Specifications shall apply.**

3 Operating Modes

The BM2-ASI module features two operating modes:

- Protected Mode.
- Configuration Mode.

Subsequent to Power-ON, the selected operating mode is the mode that was last used prior to shutdown.

☞ **In centralized operation, each change of operating modes must be preceded by switching the PLC to STOP status. If this is not done, a modus change will not be possible; no error message will be returned, however.**

☞ **In decentralized operation, the change of operating mode is independent of the PLC STOP status, the operating mode can be changed at any time. When changing into Protected Mode, a complete startup is performed. During the startup routine, the outputs assume the LOW signal state.**

3.1 Protected Mode

The Protected Mode comprises the standard operating mode of the BM2-ASI module in which the I/O data exchange with the bus stations is effected.

The BM2-ASI module transfers the output data to a bus station. The bus station responds by sending the input data. The bus stations are addressed sequentially.

For a fully populated AS-I installion with 31 bus stations, the bus addressing cycle has a maximumlength of 5 ms.

During bus station servicing, a constant check is run to verify that all bus stations are present. In the event that this process reports a deviation from the original configuration, a Config. Error message will be returned.

In this operating mode, no bus stations will be displayed by the LED's labelled 10+, 20+, 30+ and 1 through 0.

Error upon switchover into Configuration Mode

In centralized operation, each changeover to Protected Mode must be preceded by switching the PLC into STOP status. If this is not done, a change in operating mode will not be possible; however, an error message is not returned.

3.2 Configuration Mode

The Configuration Mode is used to change the configuration of the AS-I installation. This mode is enabled by pressing the Config. Mode button on the front panel while the PLC is in STOP status.

In decentralized operation, Configuration Mode can be enabled at any time.

To leave Configuration Mode, the Config. Mode button on the font panel is pressed again.

In this operating mode, all active bus stations are cyclically displayed by the front panel LED's labelled 10+, 20+, 30+, and 1, 2 through 9, 0. Any bus stations deviating from the configuration (either too fesw or too many bus stations) are indicated by the blinking display.

Error upon Switchover to Protected Mode

In centralized operation, the switchover to Protected Mode is not possible as long as the central processing unit is in RUN status, or in the event that a bus station with the address 0 is present.

Automatic Addressing is not possible

If the Config. Err. is not cleared once the new bus station has been inserted, the new bus station does not have address 0 or a bus station of the wrong type (different I/O and ID code) was installed, or the new bus station is connected improperly, and/or the cable is defective.

Autoprog. LED fails to illuminate upon Failure of a Bus Station

The BM2-ASI is in Configuration Mode, or the Autoprogramming control bit has not been set.

More than one bus station has failed.

Notes:

4 System Startup

A new BM2-ASI module is set up for centralized operation in a CL200, and programmed with a defined configuration for a specific AS-I installation, which must be changed.

Prio to the system startup, the address settings on the S1 DIP switch, and the position of jumper JP10 must be corrected.

The BM2-ASI must be inserted in a CL200 basic unit or expansion unit, or in an expansion unit connected via the PROFIBUS-DP field bus.

In preparation for startup, the following procedures are required:

- AS-I branch is installed in accordanxce with the AS-I specifications.
- The addressing device is used to assign an address to each AS-I bus station.
- The AS-I power supply is connected.
- The CL200 is switched to STOP status.
- The AS-I installation is connected with the BM2-ASI module.

Once this has been done, the configuration is performed as follows:

- The BM2-ASI is switched to Configuration Mode by pressing the Config. Mode button on the front panel; the Config. Mode LED on the front panel illuminates.
- All recognized and active bus stations of the AS-I installation are displayed by means of the front panel LED's labelled 10+, 20+, 30+, and 1 through 0.
- In the event of a match between the display of recognized bus stations and installed bus stations, the Set Config. button on the front panel is pressed to adopt the actual assignment thus determined into the nominal assignment list.

This is followed by an automatic switchover to Protected Mode, making the AS-I installation ready for operation.

Notes:

5 Operating Behaviour

Power-On

The BM2-ASI keeps the CL200 central processing unit in STOP mode until it has completed its own start-up procedure.

During the startup procedure, the following actions are carried out:

- Checking local hardware and voltage for AS-I installation.
- Clearing local output mapping.
- Exchanging data with all configured bus stations.
- Comparing the nominal assignments with the actual bus station assignments.
- Updating control bit and status bit states.

If the startup was accomplished without fault, the CL200 central processing unit will be enabled.

Upon the first startup attempt, the nominal assignment does not correspond with the actual assignment of bus stations. The Config. Err. LED on the fron panel illuminates, and the central processing unit remains in STOP status.

A switchover to Configuration Mode (Config. Mode button) is required to effect a configuration of the AS-I installation.

Active Operating Mode

Subsequent to a Power-On, the BM2-ASI module will continue working in the operating mode that was active at the time of shutoff.

Power Failure in the AS-I Installation

During startup, the BM2-ASI performs a voltage check within the AS-I installation which lasts approx. 1 minute. If the voltage is within tolerances, both the PLC and BM2-ASI module will start.

In the event that the voltage is outsuide of tolerances, the fault condition will be reported to the central processing unit via the status flags and status tetrade (nibble). The PWRFL LED illuminates. The central processing unit will start regardless.

In the event that the voltage fails during ongoing operation, the BM2-ASI will curtail the servicing of all bus stations, and the outputs of the bus stations will be set LOW. The fault condition is reported to the central processing unit via the status flags and status nibble. The BM2-ASI will not automatically place the central processing unit into STOP status, however. When the power returns, the servicing of bus stations will restart automatically.

STOP/Outputs Disabled modes

The STOP and Outputs Disabled modes are recognized by the BM2-ASI module. The outputs within the AS-I installation are set LOW within 5 ms. The remaining data exchange with the bus stations continues.

5.1 Automatic Address Programming

The automatic address programming facilitates, in Protected Mode and in the case of a fault occurrence, the exchange of a defective bus station without the need to place the CL200 into STOP status, and/or without requiring a change to Configuration Mode.

Prequisites for automatic address programming:

- The automatic address programming feature must have been enabled. It will be enabled if no errored automatic address programming has occurred since the last Power–On; it can also be enabled with the use of the Auto_Adress_Enable command in the PLC program.
- No genral configuration error has been reported.
- The AS-I installation shows the correct voltage.
- Auto_Adress_Enable has HIGH state.
- Protected Mode is enabled.

The enabled automatic address programming is reported by three bits having HIGH state.

Provided that all prerequisites have been met, the enable status of the automatic addressing can be queried via the following bits:

- Auto_Adress_Enable (bit 0, status flag 2)
- Auto_Adress_Assign (bit 2, status flag 1)
- Auto_Adress_Available (bit 3, status flag 1)

The Config. Err. and Autoprog. LED's illuminate. The address of the defective bus station is indicated by the LED's labelled 10+ through 30+, and 1 through 0.

The defective bus station must be replaced by a bus station of the same type having an address setting of 0. The new bus station will automatically receive the address assignment of the failed bus station.

The Automatic Address programming function is again enabled.

If the Config. Err. LED fails to extinguish after the bus stion replacement, this may be due to the following reasons:

- Automatic address programming has not been enabled or is no longer enabled.
- A general configuration error has been detected.
- Faulty voltage in the AS-I installation.
- Protected Mode had not been enabled.
- The new bus station does not have address setting 0.
- The new bus station is not of the same type as the bus station that was replaced.
- The new bus station was connected improperly or the cable is defective.

A faulty automatic address programming procedure always causes the Auto_Adress_Assign status flag to be reset, making the execution of the function no longer possible. As a consequence, the automatic address programming function must again be enabled.

Autoprog. LED fails to illuminate subsequent to the failure of a bus station:

- The BM2-ASI module is in Configuration Mode; automatic address programming is possible only in Protected Mode.
- Automatic address programming is disabled.
- More than one bus station has failed.

5.2 Operating Behaviour in Case of Malfunctions

The PLC detects a programming fault and switches to STOP status

The STOP status is recognized. In response, the BM2-ASO module sets the outputs on all active bus stations LOW. The required interval is no more than 5 ms.

PLC Failure

A failure of the PLC is not detected by the BM2-ASI module. It will continue with its cyclical transmission of the last output data to the bus stations.

Cable Break in AS-I data line

The cable break will be detected because the bus stations situated on the other side of the break can no longer be addressed. The location of the break can be spotted by means of the display indicating the missing bus stations.

Short-circuit in AS-I installation

A short-circuit in the AS-I installation will be detected and reported. A short-circuit normally trips the fuse in the AS-I power supply, shutting off the AS-I system power.

Excessive Power Consumption or Short-circuit in an AS-I Sensor

A short-circuit in an AS-I sensor will trip the fuse on the respective AS-I bus station. The bus station is thus no longer addressable, and its number will be reported on the front panel.

Bus Master Failure

Through its interpretation of the status flags, the central processing unit recognizes the failure of the BM2-ASI module. An appropriate response must be provided in the application program.

6 Command Interface

The command interface always occupies 8 input and 8 output bytes in the extended input/output field. The start address is selected on the S1 DIP switch.

The command data traffic is handled via this address range. A command that is written into the EO range of the control unit is read and subsequently processed by the BM2-ASI module. The response to a command is written into the EI field on the control unit.

The command interface provides the following functions:

- Setting up the configuration of the AS-I installation
- Querying status information via the status nibble (bit 0 through 3, byte 0)
- Setting parameter values for AS-I bus stations

6.1 Forwarding PLC commands to the BM2-ASI module

Structure of the command interface, for PLC commands sent to the BM2-ASI module in the form of EO output data (8 bytes):

Byte 0	Command
Byte 1	Parameter 1
Byte 2	Parameter 2
Byte 3	Parameter 3
Byte 4	Parameter 4
Byte 5	Identifier
Byte 6	Control flags
Byte 7	Spare

Command

The command represents a task request issued by the PLC control unit to the BM2-ASI module. Each command features its own code, refer to section 6.3.1.

Parameter

Parameters contain specific additional information (attributes) for a given command.

Identifier

The identifier is used to assign an acknowledgement to a command. A new identifier within the command range will be recognized by the BM2-ASI module, starting the command processing routine.

To ensure unambiguous assignment, a freely selectable identifier must be assigned to each command by the application program.

In the event that one and the same command is to be executed in cyclical repetition, it must also be sent with a new identifier in each cycle.

Control Flags

The control flags can be written independently of the command operations.

Control flag functions:

Bit	Explanation	Explanation
0	Data exchange enabled	• 0: The I/O data exchange between the bus master and the bus stations is enabled, and bus station communications are active. • 1: The I/O data exchange between the bus master and the bus stations is disabled, and bus station communications are active.
1	AS-I message interchange	• 0: Online, message interchange on AS-I bus activated. • 1: Offline, message interchange on AS-I bus deactivated.
2 through 7	free	

☞ **Control flag addressing: Extended output field, start address +6.**

6.2 BM2-ASI Module Acknowledgements sent to the PLC

Command interface structure for acknowledgements sent by the BM2-ASI module to the PLC in the form of EI input data (8 bytes):

Byte 0	Acknowledgement
Byte 1	Parameter 1
Byte 2	Parameter 2
Byte 3	Parameter 3
Byte 4	Parameter 4
Byte 5	Identifier
Byte 6	Status flag 1
Byte 7	Status flag 2

Acknowledgement

The acknowledgement represents the response by the BM2-ASI module to a processed command.

Parameters

Parameters contain specific information additional to the respective acknowledgement.

Identifier

The identifier in the EI address range indicates whether or not a command was completely processed by the BM2-ASI module.

The identifier in the acknowledgement range is identical to that in the command range, and is freely defined by the user.

Status Flags

Status flags 1 and 2 can be read independently of the command operations.

Status flag 1 functions:

Bit	Explanation	Explanation
0	Config_OK	• 0: Configured and actual bus station assignment on AS-I bus are not identical. • 1: Configured and actual bus station assignment on AS-I bus are identical, corresponds to Config. Err. LED.
1	LES0	• 0: Bus station with address 0 not found. • 1: Bus station with address 0 was found.
2	Auto_Adress_Assign	• 0: Automatic address programming disabled. • 1: Automatic address programming enabled, refer to section 5.1
3	Auto_Adress_Available	• 0: Automatic address programming not possible. • 1: Automatic address programming possible, refer to section 5.1
4	Configuration Mode	• 0: Protected Mode enabled. • 1: Configuration Mode enabled, corresponds to Config. Mode LED.
5	Standard operation	• 0: Module in startup process. • 1: Module in standard operation, AS-I bus is being serviced.
6	APF	• 0: AS-I voltage within tolerances. • 1: AS-I power failure, corresponds to PWRFL LED.
7	Offline_Ready	• 0: Online operation, communications on AS-I bus are active. • 1: Offline operation, no communications on AS-I bus, indication by/on Config. Err. LED and LED's labelled 10+, 20+, 30+.

☞ **Adressing status flag 1: Extended input field, start address +6.**

Status flag 2 functions:

Bit	Explanation	Explanation
0	Auto_Adress_Enable	• 0: Automatic address programming not possible. • 1: Automatic address programming not possible. The flag is actuated via the "set Auto_Adress_Enable" command, and can also be read via the "read Auto_Adress_Enable" command, refer to section 5.1.
2 through 7	free	

☞ **Adressing status flag 2: Extended input field, start address +7.**

6.3 Commands

In command operations, all master functions are supported in accordance with the AS-I Specifications. An exception are those functions that can be processed directly via the control and/or status flags.

Data formats being used:

Format	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Symbols*
Parameter	–	–	–	–	P3	P2	P1	P0	P
I/O data	–	–	–	–	D3	D2	D1	D0	D
Configuration data	E3	E2	E1	E0	I3	I2	I1	I0	EI
Error counters	F7	F6	F5	F4	F3	F2	F1	F0	F
Bus station no's. 1 through 31	–	–	–	A4	O3	O2	O1	O0	A
Bit	B7	B6	B5	B4	B3	B2	B1	B0	B**
Master request	–	–	–	M4	M3	M2	M1	M0	M
Bus station response	–	–	–	S4	S3	S2	S1	S0	S

* The symbols are used in the command table, refer to section 6.3.1.

** Each bit in a bit array represents a bus station: B1 for bus stations 7 through 0, B2 for bus stations 15 through 8, B3 for bus stations 23 through 16, and B4 for bus stations 31 through 24.

6.3.1 Command Table

For the symbols, refer to section 6.3

Command	Code	P1	P2	P3	P4	Acknowl-edgement	P1	P2	P3	P4
Configure Parameter Value	01_{Hex}	A	P			OK				
Read Configured Parameter Value	02_{Hex}	A				OK	P			
Write Parameter Value	03_{Hex}	A	P			OK, NOK, SNA, MOFF	P			
Read Parameter Value	04_{Hex}	A				OK	P			
Configure ACTUAL Parameter Value	05_{Hex}					OK				
Set Configuration Data	06_{Hex}	A	EI			OK, MNOP				
Read Configuration Data	07_{Hex}	A				OK	EI			
Store ACTUAL Configuration	08_{Hex}					OK, NOK				
Read ACTUAL Configuration Data	09_{Hex}					OK	EI			
Configure LPS	$0A_{Hex}$	B1	B2	B3	B4	OK, MNOP				
Read LPS	$0B_{Hex}$					OK	B1	B2	B3	B4
Read LAS	$0C_{Hex}$					OK	B1	B2	B3	B4
Read LES	$0D_{Hex}$					OK	B1	B2	B3	B4
Read Status	$0E_{Hex}$*									
Set Configuration Mode	OF_{Hex}	0/1				OK, MAUTO, LES0				
Set Offline Mode	10_{Hex}*									
Data exchange enabled	11_{Hex}*									
Change Operating Address	12_{Hex}	Oold	Onew			OK, NOKSND, DE, SD0, AT, SD2, SE				
Invoke Command	13_{Hex}	A	M			OK, NOK, MOFF, CNI	S			
Read Input Data Image	14_{Hex}	A				OK	D			
Write Output Data Image	15_{Hex}	A	D			OK				
Read Error Counter	16_{Hex}	A				OK	F			
Read / Clear Error Counter	17_{Hex}	A				OK	F			
Set Auto_Adress_Enable	18_{Hex}	0/1				OK				
Read Auto_Adress_Enable	19_{Hex}*									
Read Bus Station Data	$1B_{Hex}$	A				OK	D inp.	EI act.	P act.	F

* These commands are not supported because they can be executed by processing the flags.

6.3.2 Configure Parameter Value

Command: Set_Permanent_Parameters

Writes the permanent parameters for a specific bus station.

Command structure		
Command code	Byte 0	01_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	Parameter

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.

6.3.3 Read Configured Parameter Value

Command: Get_Permanent_Parameters

Reads the (permanently configured) parameters for a specific bus station.

Command structure		
Command code	Byte 0	02_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.
Parameter 1	Byte 1	Configuration data

6.3.4 Write Parameter Value

Command: Write_Parameters

Writes the parameters for a bus station. The parameter value will be transferred to the bus station during the next free processing phase.

Command structure		
Command code	Byte 0	03_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	Parameter

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed. • 01_{Hex}: NOK, not successfully completed. • 02_{Hex}: SNA, bus station not in LAS. • $0C_{Hex}$: MOFF, Master is in Offline phase.
Parameter 1	Byte 1	Configuration data echo, optional

6.3.5 Read Parameter Value

Reads current parameters of a specific bus station.

Command structure		
Command code	Byte 0	04_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.
Parameter 1	Byte 1	Parameter

6.3.6 Configure ACTUAL Parameter Value

Command: Store_Actual_Parameters

Permanently stores the current parameter values.

Command structure		
Command code	Byte 0	05_{Hex}

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed

6.3.7 Set Configuration Data

Command: Set_Permanent_Configurations

Permanently stores the ID and I/O code for a bus station.

Command structure		
Command code	Byte 0	06_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	• Bits 0 through 3: I/O configuration • Bits 4 through 7: ID code

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • 09_{Hex}: MNOP, Master is not in Configuration Mode

6.3.8 Read Configuration Data

Command: Get_Permanent_Configurations

Reads the permanent configuration data for a bus station from the EEPROM.

Command structure		
Command code	Byte 0	07_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	• Bits 0 through 3: I/O configuration data • Bits 4 through 7: I/O code

6.3.9 Storing ACTUAL Configuration

Command: Store_Actual_Configuration

Writes the obtained ACTUAL configuration data and I/O codes into the EEPROM, writes the active LAS bus stations into the configured list.

Command structure		
Command code	Byte 0	08_{Hex}

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • 09_{Hex}: MNOP, Master is not in Configuration Mode

6.3.10 Read ACTUAL Configuration Data

Command: Read_Actual_Configuration

Reads the obtained configuration data and I/O codes for a bus station.

Command structure		
Command code	Byte 0	09_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	
Parameter 3	Byte 3	
Parameter 4	Byte 4	

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	• Bits 0 through 3: I/O configuration data • Bits 4 through 7: I/O code

6.3.11 Write List of Configured Slaves/Bus Stations (LPS)

Command: Set_LPS

Writes the LPS (List of Configured Slaves/bus stations) into the EEPROM.

- 0 = Bus station not found.
- 1 = Bus station found.

Command structure		
Command code	Byte 0	$0A_{Hex}$
Parameter 1	Byte 1	LPS bus stations 7 through 0
Parameter 2	Byte 2	LPS bus stations 15 through 8
Parameter 3	Byte 3	LPS bus stations 23 through 16
Parameter 4	Byte 4	LPS bus stations 31 through 24

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • 09_{Hex}: MNOP, Master is not in Configuration Mode

6.3.12 Read List of Configured Slaves/Bus Stations (LPS)

Command: Get_LPS

Reads the LPS (List of Configured Slaves/bus stations) from the EEPROM.

- 0 = Bus station not found.
- 1 = Bus station found.

Command structure		
Command code	Byte 0	$0B_{Hex}$

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.
Parameter 1	Byte 1	LPS bus stations 7 through 0
Parameter 2	Byte 2	LPS bus stations 15 through 8
Parameter 3	Byte 3	LPS bus stations 23 through 16
Parameter 4	Byte 4	LPS bus stations 31 through 24

6.3.13 Read List of Configured Slaves/Bus Stations (LAS)

Command: Get_LAS

Reads the LAS (List of Activated Slaves/bus stations).

- 0 = Bus station not found.
- 1 = Bus station found.

Command structure		
Command code	Byte 0	$0C_{Hex}$

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	LAS bus stations 7 through 0
Parameter 2	Byte 2	LAS bus stations 15 through 8
Parameter 3	Byte 3	LAS bus stations 23 through 16
Parameter 4	Byte 4	LAS bus stations 31 through 24

6.3.14 Read List of Effective Slaves/Bus Stations (LES)

Command: Get_LES

Reads the LES (List of Effective Slaves/bus stations).

- 0: Bus station not found.
- 1: Bus station found.

Command structure		
Command code	Byte 0	$0D_{Hex}$

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	LDS bus stations 7 through 0
Parameter 2	Byte 2	LDS bus stations 15 through 8
Parameter 3	Byte 3	LDS bus stations 23 through 16
Parameter 4	Byte 4	LDS bus stations 31 through 24

6.3.15 Read Status

Command: Get_Flags

Reads the status flags via the CL200 central processing unit.

As the flags are available for constant access in the extended EI field at start address +5, this function is implemented via direct access to the status flags, refer to section 6.2.

6.3.16 Set Configuration Mode

Command: Mode switchover, Configuration Mode/Protected Mode.

- 0: Protected Mode.
- 1: Configuration Mode.

Command structure		
Command code	Byte 0	$0F_{Hex}$
Parameter 1	Byte 1	• 00_{Hex}: Protected Mode • 01_{Hex}: Configuration Mode

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • $0B_{Hex}$: MAUTO, automatic address programming enabled • $0A_{Hex}$: LES0 bus station 0 in LES

☞ **This command switches the BM2-ASI module into Configuration Mode while the CL200 is in RUN mode. All bus stations that are present in the AS-I installation at this time will be enabled and serviced.**

6.3.17 Set Offline Mode

Command: Set_Offline_Mode

Sets the Offline mode via the CL200 central processing unit.

This function is implemented via direct access to the status flags, refer to section 6.1.

6.3.18 Set Data Exchange Active

Command: Set_Data_Exchange_Aktive

Activates the data exchange with bus stations via the CL200 central processing unit.

This function is implemented via direct access to the status flags, refer to section 6.1.

6.3.19 Change Operating Address

Command: Change_Slave/Busteilnehmer_Adress

C hanges the address of a specific bus station.

Command structure		
Command code	Byte 0	12_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31, old address
Parameter 2	Byte 2	Bus station no's. 1 through 31, new address

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • 01_{Hex}: NOK, not successfully completed • 03_{Hex}: SND, bus station with old address not recognized • 04_{Hex}: SD0, bus station with address 0 recognized • 05_{Hex}: SD2, new address already exists • 06_{Hex}: DE, unable to delete/clear old address • 08_{Hex}: AT, new address is in volatile (nonpermanent) storage • $0x_{Hex}$: SE, unable to assign new address

6.3.20 Master Request

Command: Execute_Command

Bus master sends a request/command to a specific bus station.

Command structure		
Command code	Byte 0	13_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	Command

Acknowledgement structure		
Acknowl. code	Byte 0	• 00_{Hex}: OK, successfully completed • 01_{Hex}: NOK, not successfully completed • $0C_{Hex}$: MOFF, Master is in Offline phase • $0D_{Hex}$: CNI, unknown command
Parameter 1	Byte 1	Data from bus station

6.3.21 Read Bus Station Input Data Image

Command: Read_IDI (Read Input Data Image)

Command structure		
Command code	Byte 0	14_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.
Parameter 1	Byte 1	Data

6.3.22 Write Bus Station Output Data Image

Command: Write_ODI (Write Output Data Image)

Command structure		
Command code	Byte 0	15_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31
Parameter 2	Byte 2	Data

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed

6.3.23 Read Error Counter

Reads the error counter of a specific bus station. An error counter counts all errored messages sent by a bus station.

Command structure		
Command code	Byte 0	16_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31, new address

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	Error counters

6.3.24 Read/Clear Error Counter

Reads and then clears the error counter of a specific bus station.

Command structure		
Command code	Byte 0	17_{Hex}
Parameter 1	Byte 1	Bus station no's. 1 through 31, new address

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed
Parameter 1	Byte 1	Error counters

6.3.25 Set Auto_Adress_Enable

Command: Set_Auto_Adress_Enable

Enabling or disbaling automatic address programming, refer to section 5.1.

Command structure		
Command code	Byte 0	18_{Hex}
Parameter 1	Byte 1	• 00_{Hex}: Reset Auto_Adress_Enable flag • 01_{Hex}: Set Auto_Adress_Enable flag

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed

6.3.26 Read Auto_Adress_Enable

Command: Get_Auto_Adress_Enable

Reads the status of automatic address programming via the CL200 central processing unit.

The function is implemented via direct access to the Status_Flag 2, bit 0, refer to section 5.1.

6.3.27 Read Bus Station Data

Reads all bus station data.

Command structure		
Command code	Byte 0	$1B_{Hex}$
Parameter 1	Byte 1	Bus station no's. 1 through 31, new address

Acknowledgement structure		
Acknowl. code	Byte 0	00_{Hex}: OK, successfully completed.
Parameter 1	Byte 1	Input data
Parameter 2	Byte 2	Configuration data and ID code
Parameter 3	Byte 3	Parameter
Parameter 4	Byte 4	Error counters

Notes:

7 Programming Example

Only a single command is sent at a time. The execution is then awaited and, if a positive acknowledgement is recieved, the next command is sent.

The objective is to write Parameter 1 to Bus Station 1.

The command is sent by the PLC application program and, at that point, the program is halted to wait for the acknowledgement. Program processing will continue only after the positive acknowledgement indicates the successful execution of the command.

The command can be used in any organization module or program module. This command addresses the 4 parameter outputs of an intelligent bus station, e. g., switching over the operating frequency or reversing the switching signal.

The bus station thus addressed includes the desired setting in the acknowledgement that it is sending in this bus station reponse.

In decentralized operation, the BM2-ASI module has start address 0 for the I/O data in the I/O address range, and start address 0 for the command range in the EI/EO address range.

```
;Activate the command, the parameter, then the command, and then the identifier
;are written in that order.
L       K03H,A              ;Load parameter code
T       A,EO0               ;Send parameter code
L       K1H,A               ;Load bus station number
T       A,EO1               ;Send bus station number
L       K5H,A               ;Load parameter number
T       A,EO2               ;Send parameter number
L       K1H,A               ;Load identifier
T       A,EO5               ;Send identifier, set unequal zero

;The command is processed once. Although the PLC keeps sending it repeatedly, it
;is no longer executed because the identifier remains unchanged.

;Subsequent to command processing, the bus station sends the acknowledgement
;containing the identifier. If the identifier sent with the command is part of the
;acknowledgement (EI + 5), the acknowledgement data is valid, and the command is
;processed.

     -loop1
L       EI5,A               ;Read identifier in acknowledgement
L       K1H,B               ;Load associated identifier
CPLA    B,A                 ;Compare for congruence, is acknowledgmement valid?
JPN     -loop1              ;Invalid acknowledgement, waiting for avalidity
```

```
;Reading and interpreting acknowledgement

L       EI0,A               ;Read status
T       A,M60               ;Write status into M60 marker byte
L       EI1,A               ;Read response parameter 1
T       A,M61               ;Write status of response parameter 1 into M61 marker
                            ;byte
L       EI2,A               ;Read response parameter 2
T       A,M62               ;Write status of response parameter 2 into M62 marker
                            ;byte
L       EI3,A               ;Read response parameter 3
T       A,M63               ;Write status of response parameter 3 into M63 marker
                            ;byte
L       EI4,A               ;Read response parameter 4
T       A,M64               ;Write status of response parameter 4 into M64 marker
                            ;byte

;The marker bytes used here are examples only. The parameter interpretation can
;occur directly or can be written into data bytes.
;The parameters can be loaded also via indirect addressing.
```

A Appendix

A.1 Suggested Reading

ASI, Das Aktuator-Sensor-Interface für die Automation

W. Kriesel, W. Madelung,

Carl Haanser Verlag München, Wien

A.2 Abbreviations

O	Output
AS-I	Actuator Sensor Interface
EO	Extended output field
BM	Bus Master
BY	Byte
I	Input
EI	Extended input field
JP	Jumper
High byte	Left-hand byte in word
L	Operator Load
LAS	List of current slaves/bus stations
LES	List of effective slaves/bus stations
LPS	List of configured slaves/bus stations
Low byte	Right-hand byte in word
M	Markers
MO	Profile, as per AS-I Specification
M1	Profile, as per AS-I Specification
NT	Power supply
PWRFL	Power Failure, faulty voltage detected in AS-I installation
Slave	Bus stations

A.3 Index

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