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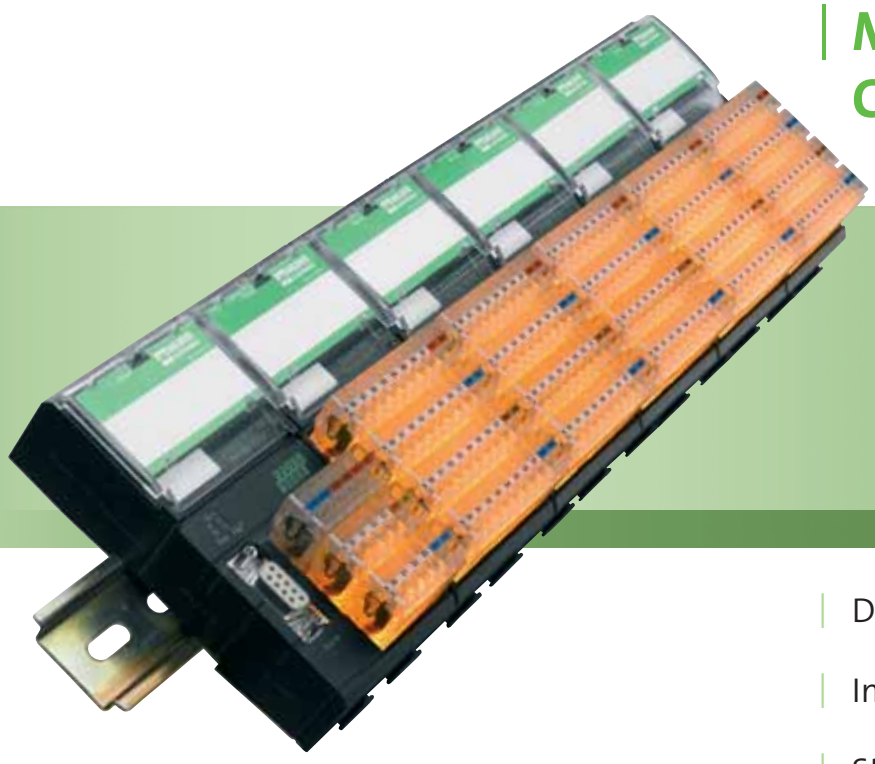
stay connected



Manual
Cube20 BN-P

- Description
- Installation
- Startup
- Diagnostics
- Technical Data

Publisher's Note

Instruction manual for Cube20 BN-P DP-V1 DI8 (Article Number: 56001)

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In addition, our Customer Service Center (CSC) will be glad to assist you:

Our Customer Service Center can support you throughout your project in the planning and conception of customer applications, configuration, installation, and startup. We also offer competent consulting or – in more complex cases – we even provide direct onsite support.

The Customer Service Center provides support tools. It performs measurements for fieldbus systems, such as PROFIBUS DP, DeviceNet, CANopen, and AS interface, as well as energy, heat, and EMC measurements.

Our coworkers at the Customer Service Center provide their competence, know-how, and years of experience. They are knowledgeable about hardware and software, and compatibility with products made by various manufacturers.

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About the User Manual and its Structure

Bus Manual:
General explanations and functions for each bus.

On this subject, please click on the links to the next page.

System Manuals:
Describe the system in general and give an overview about the products, accessories and documentation.

Art. No.	Designation
56030	Cube 20 System

www.murrelektronik.com

Product Manuals:
Describe product-specific features.

Art. No.	Designation
56001	Cube20 BN-P DI8
56005	Cube20 BN-E DI8
56006	Cube20 BN-PNIO DI8
56035	Cube20 Expansions

www.murrelektronik.com

The following link will provide you with more information on the bus system, as well as the standards and specifications on which it is based:

>>> PROFIBUS (www.PROFIBUS.com)

Important Information

Minimum Basic Knowledge Requirements

This manual contains general information on the system and the product. For more details, refer to the bus manuals (see page **Fehler! Textmarke nicht definiert.**).

To understand this manual, you need to know about automation systems.

Symbols and Icons

This manual contains information and instructions you must comply with in order to maintain safety and avoid personal injury or damage to property. They are identified as follows:

Notes indicate important information.

Warnings contain information that, if you ignore this information, may cause damage to equipment or other assets or, if you fail to comply with safety precautions, may constitute a danger to the user's health and life.

These instructions are recommendations issued by Murrelektronik.

Table of Contents

1 Description of the Cube20 BN-P DP-V1 DI8 Art. No. 56001

The Cube20 system is a modular I/O system with IP20 protection for decentralized collection and control of digital and analog process variables. It consists of a fieldbus specific bus node and I/O modules that are independent of the fieldbus and are connected to the bus node via an internal system connection. Galvanic separation between the supply of the system supply and the sensor supply has to be provided.

In order to maximize electromagnetic compatibility, we advise you to ensure galvanic separation.

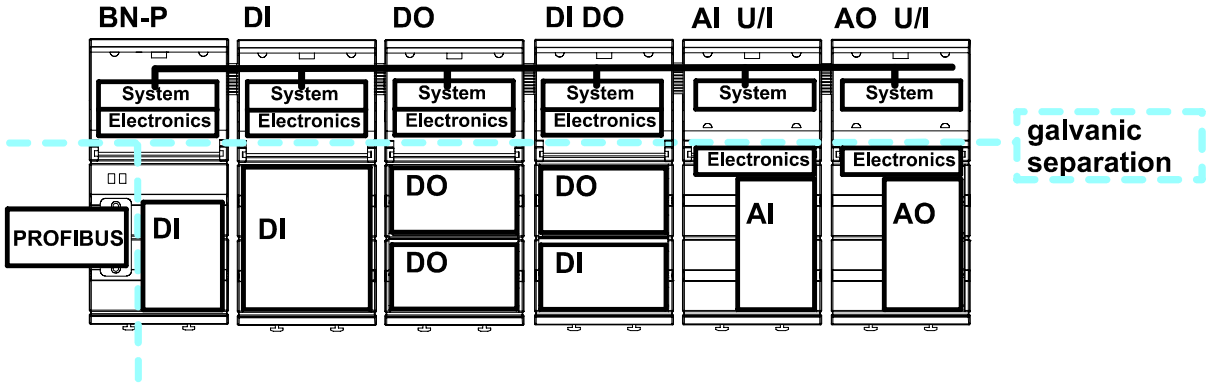


Fig. 1: Typical system structure with galvanic separation

The illustration above shows a typical Cube20 system structure with digital inputs and outputs (DI/DO) and analog inputs and outputs (AI/AO).

Furthermore, it shows PROFIBUS, I/O area, and I/O supply as well as the supply of the system electronics are galvanically separated. The internal electronics of the digital input/output modules are supplied by the system cable. The internal electronics of the analog input/output modules are supplied via the input/output supply voltage.

Information on the analog I/O modules.

The I/O supply voltage must always be connected, otherwise communication via the internal system connection is interrupted, starting from the analog module that is not supplied.

Application Notes

The bus node "Cube20 BN-P DP-V1 DI8" described here is the successor to the "Cube20 BN-P DI8" that also bears Article Number 56001. Install the GDS file MUR20B3D.* in order to obtain full functionality. The file can also be used in existing systems as a substitute for the "Cube20 BN-P DI8" with GSD file MURR0B3D.*. In this case, the extended functions of the Cube20 BN-P DP-V1 DI8 are not available.

2 Installation

2.1 Mounting

For general information on mounting, please see the Cube20 system manual Art. No. 56030.

2.2 Overview of Connections Cube20 BN-P DI8 Art. No. 56001

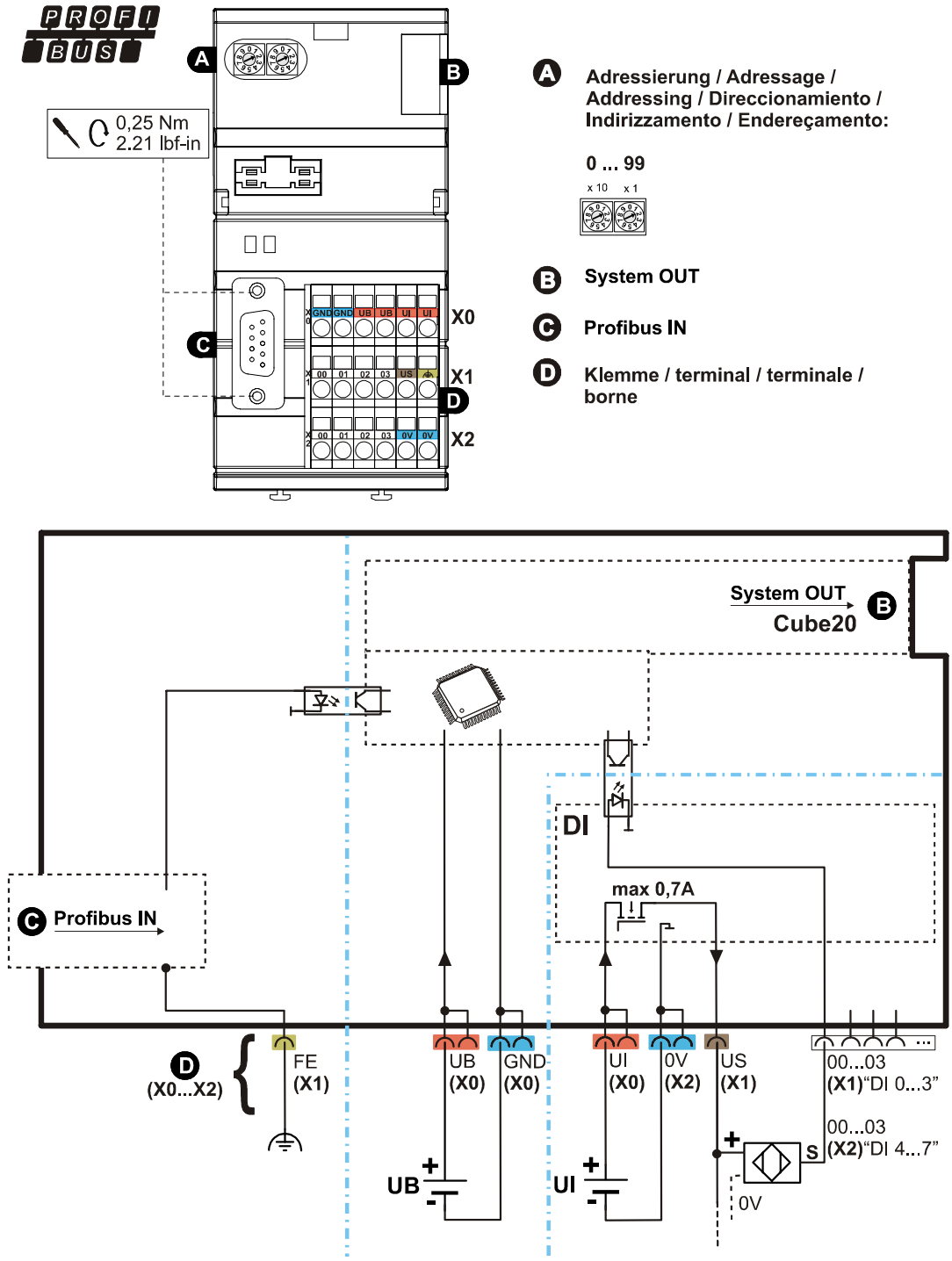


Fig. 2: Overview of Connections Cube20 BN-P DP-V1 DI8 Art. No. 56001

We recommend use of our common terminal block Art. No. 56109.

For further information, please refer to the common terminal block instruction manual.

3 Startup

3.1 Terminating PROFIBUS Segments

A terminating resistor is required at the beginning and at the end of the PROFIBUS segment. The terminating resistors must be powered in order to guarantee a physically clean signal level. A maximum of 16 users may be connected to the PROFIBUS segment.

3.2 Assigning and Setting the PROFIBUS Address

The PROFIBUS address is set by means of two rotary switches directly on the Cube20. Values are permitted between 0 and 99. Usually, a DP Master assigns the addresses 0 to 2. Therefore, we recommend setting the addresses for Cube20 starting with address 3.

The address setting is read in once after the power supply is connected. A change of address only becomes effective, therefore, when the module power supply is reset. When the address is assigned, make sure you provide each PROFIBUS device with a unique individual address.

3.3 GSD File

The equipment described in this manual requires a GSD file

MURR20B3D.* or MURR0B3D.* in order to be operable.

The file suffix indicates the language version. GSD files are available in six different languages.

Language	File Suffix
Default = English	***.gsd**
English	***.gse**
German	***.gsg**
Spanish	***.gss**

Language	File Suffix
French	***.gsf**
Italian	***.gsi**
Portuguese	***.gsp**

Tab. 1: GSD File Suffixes

The GSD file is downloadable from the Murrelektronik website:
http://www.murrelektronik.com/

The software features described in this manual can only be activated by installing GDS (DDB) file MUR20B3D.* Version 2.0 or higher.

Compatibility Data

If the bus node "Cube20 BN-P DP-V1 DI8" is operated with GDS file MUR20B3D.*, it is not replaceable by predecessor model "Cube20 BN-P DI8".

The predecessor model "Cube20 BN-P DI8" is replaceable by bus node "Cube20 BN-P DP-V1 DI8", provided GDS file MURR0B3D.* is used.

3.4 Baud Rates

All devices in a PROFIBUS network operate at a standard baud rate that is defaulted by the bus master. The Cube20 bus node automatically identifies the preset baud rate. Comply with the maximum permissible line lengths dependent on the baud rate used as shown in the table below. The values refer to one segment in each case. Larger network topologies are implementable across several segments by means of repeaters.

Maximum Permissible Line Lengths in a PROFIBUS Segment

Transmission speed in Kbps	9,6	19,2	45,45	93,75	187,5	500	1500	3000	6000	12000
Cable length in m	1200	1200	1200	1200	1000	400	200	100	100	100

Tab. 2: Cable lengths in a PROFIBUS segment

3.5 Configuration and Parameterization

The Cube20 system is usually configured with the help of a configuration tool provided by the master device manufacturer. The master sends the configuration telegram to the slave during system startup and defines the number of input and output bytes. Cube20 uses the special identifier format according to IED 61158. Cube20 can only be operated with DP masters that support the special identifier format.

On the basis of this information, the Cube20 bus node checks the installation for compliance with the projected configuration. If the bus node detects a difference between the nominal configuration transferred by the DP Master and the physical configuration, the bus node reports a configuration error message (parameter error message) and does not exchange data with the DP Master. A configuration or parameter error is displayed at the bus node by the LED "CFg F". If there is a failure, the LED "Cfg F" lights up red.

The Cube20 system is configured as a modular system. If supported by your DP master, the bus node "56001 BN-P DP-V1" is automatically added when the Cube20 bus node is entered. The bus node "56001 BN-P DP-V1" is always the 1st module in the configuration. It is capable of running without any expansion modules.

3.5.1 Example :Configuration of a Cube20 system with Simatic Step7®

❶

When GSD file MUR20B3D.* is used, the hardware catalog of the Simatic Manager lists Cube20 BN-P DP-V1 DI8 Art. No.: 56001 under "Other Field Devices" and under "I/O" with the name "Cube20 BN-P DP-V1".

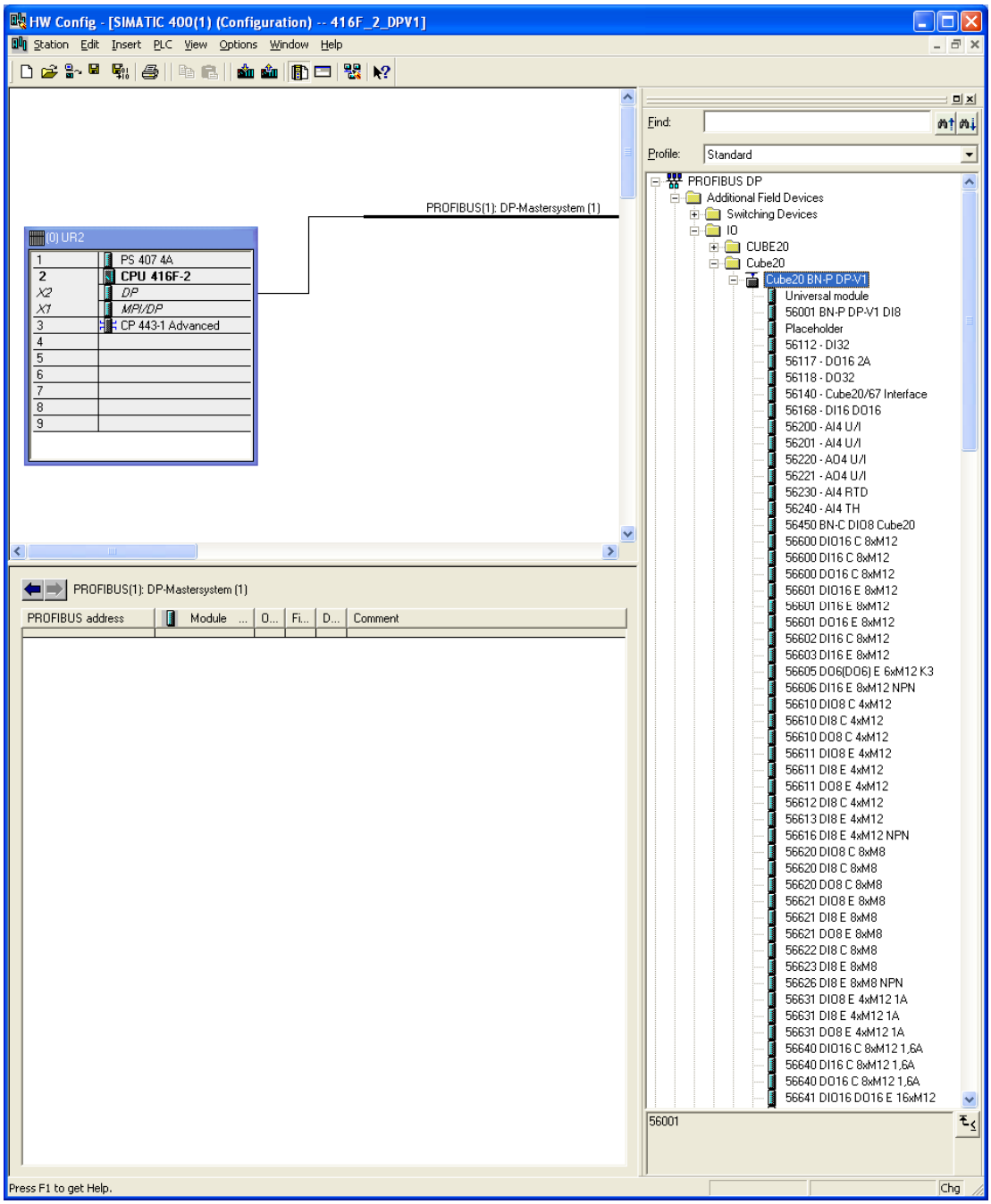


Fig. 3: Cube20 BN-P DP-V1 DI8 Art.No.: 56001 in the Simatic Manager

❷

Mark "Cube20 BN-P DP-V1 DI8 Art. No. 56001" and drag the entry to the PROFIBUS string while keeping the left mouse button depressed, or double-click on the PROFIBUS string. This automatically adds the module "Cube20 BN-P DP-V1 DI8 Art. No.: 56001". In order to add additional modules to the configuration (max. 15), double-click on the corresponding entry in the hardware catalog.

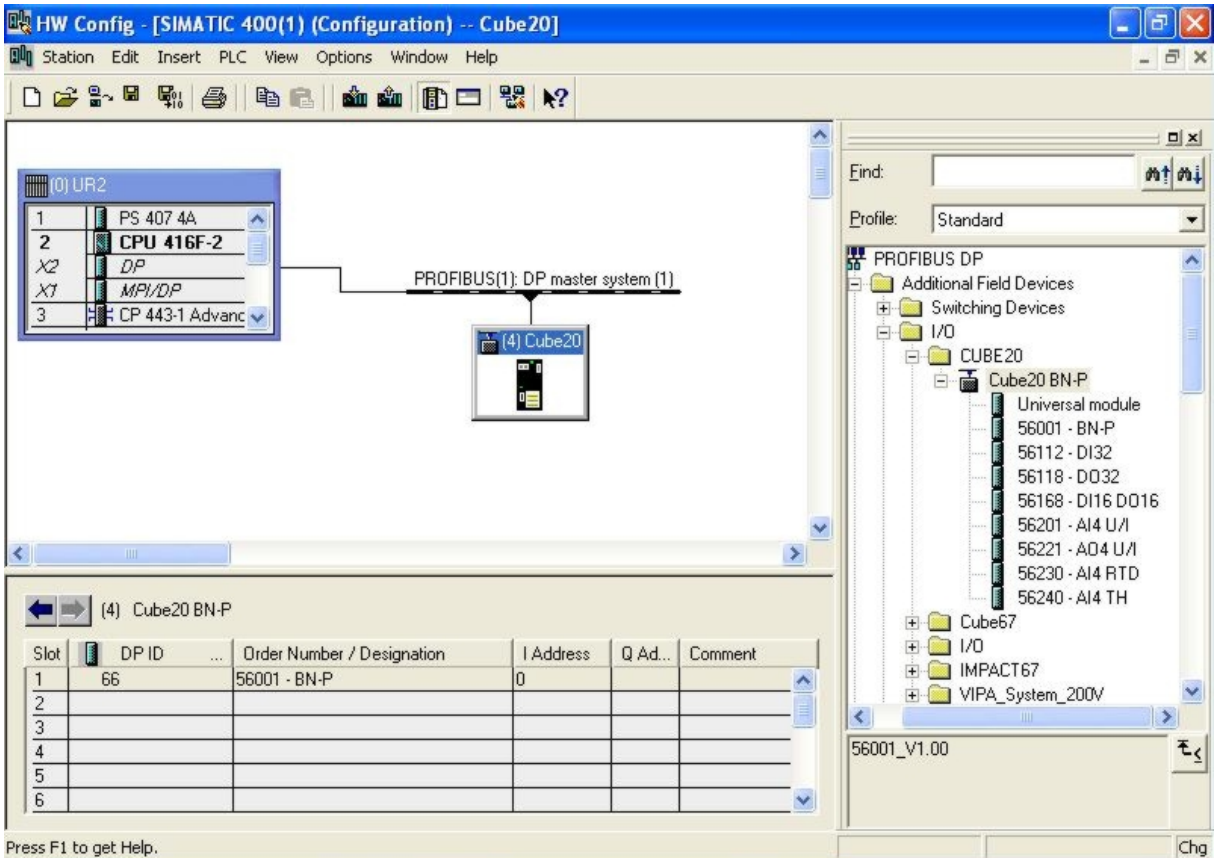


Fig. 4: Adding Cube20 field units to the Simatic Manager

❸

Double-click on any module to open a list box containing the parameter settings for this module.

Select the settings you require.

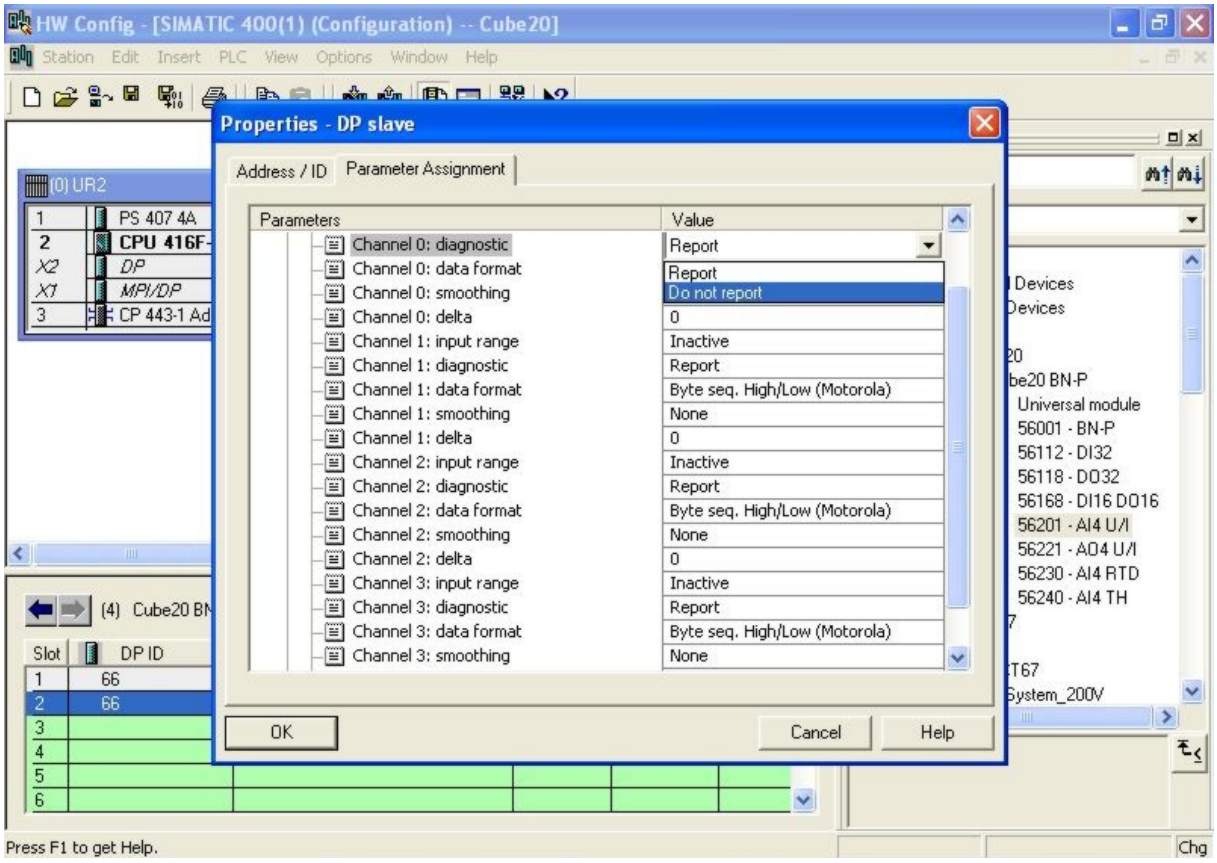


Fig. 5: Settings of Cube20 field units in the Simatic Manager

3.5.2 Cube20 BN-P DP-V1 DI8 Art. No. 56001

3.5.2.1 Identification

Description	Art. No.	Process data		Identification
		Input	Output	
Cube20 BN-P DP-V1 DI8	56001	1 byte	0 byte	0x43, 0x00, 0xDA,0xC1, 0x08

Tab. 3: Identification of Cube20 BN-P DP-V1 DI8 Art. No. 56001

3.5.2.2 Parameters

Number of parameter bytes: 6

Bit assignment of parameter Byte 0

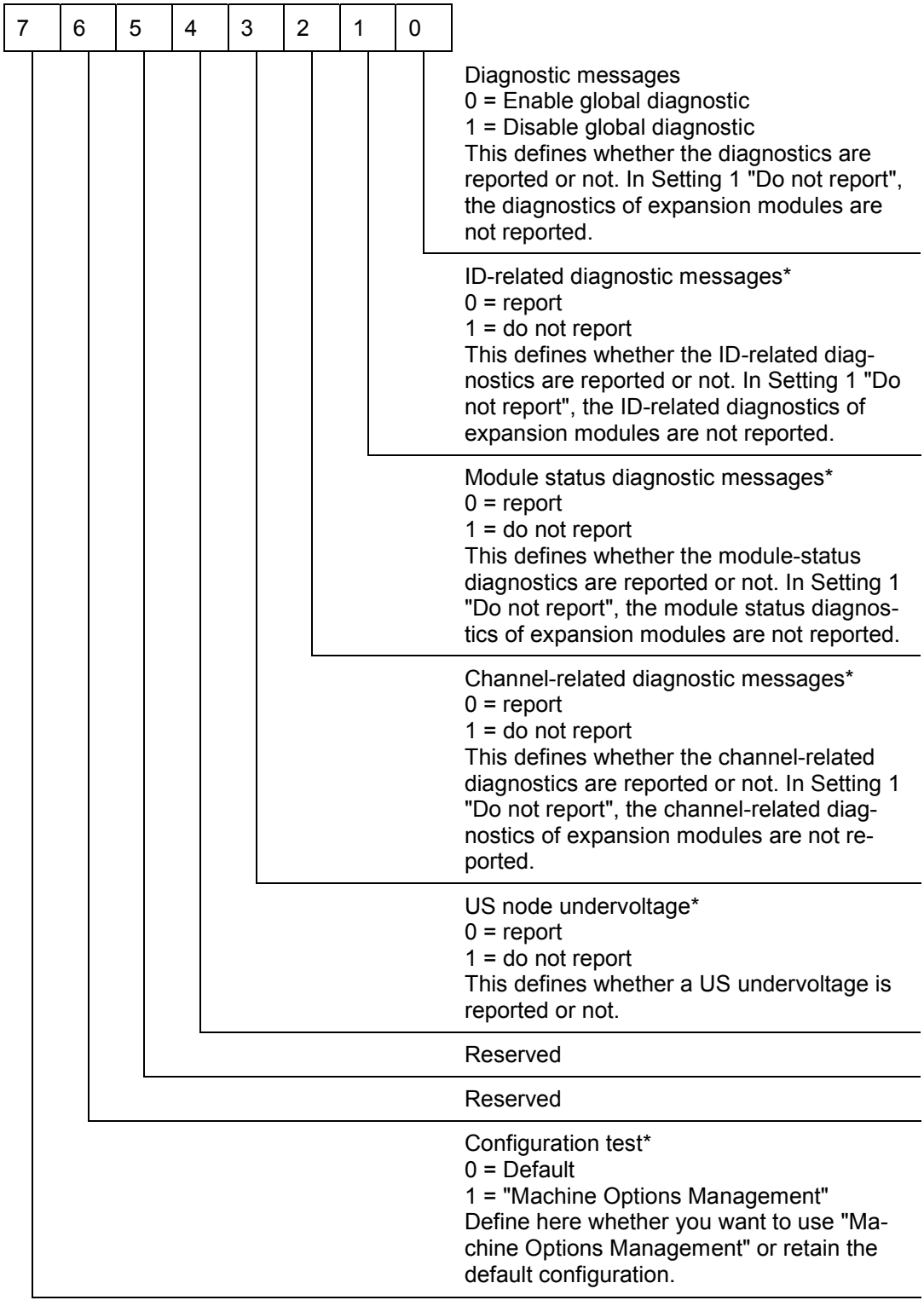


Fig. 6: Parameter Byte 0 of Cube20 BN-P DP-V1 DI8 Art. No. 56001

Bit assignment of parameter Byte 1

Reserved

Bit assignment of parameter Byte 2

This defines whether actuator power supply diagnostics, such as undervoltage, or no voltage, are reported for the assigned slot or not.

0 = report
1 = do not report

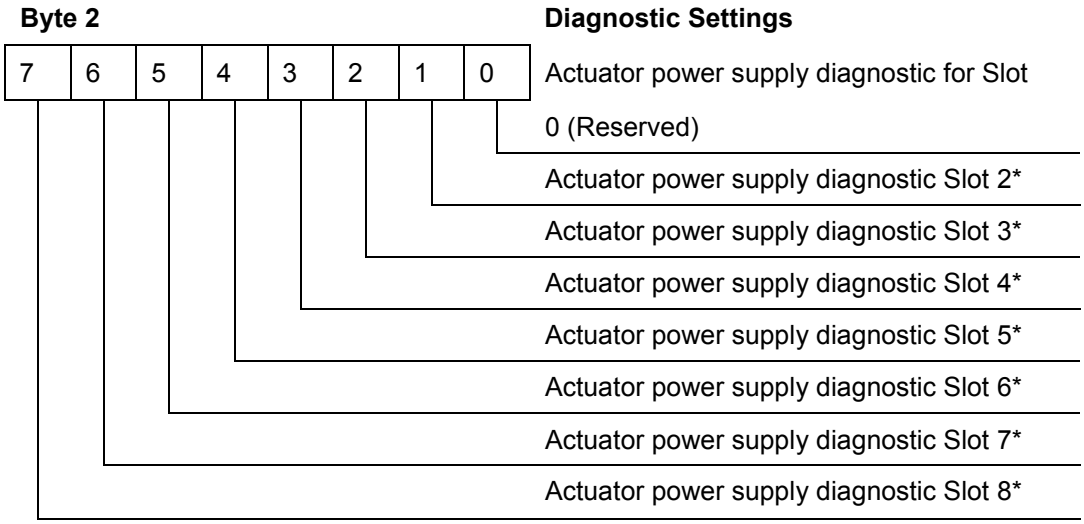


Fig. 7: Parameter Byte 2 of Cube20 BN-P DP-V1 DI8 Art. No. 56001

Bit assignment of parameter bytes 3 to 5

This defines whether actuator power supply diagnostics, such as undervoltage, or no voltage, are reported for the assigned slot or not.

0 = report
1 = do not report

Byte 3: Actuator power supply diagnostic for Slots 9 to 16

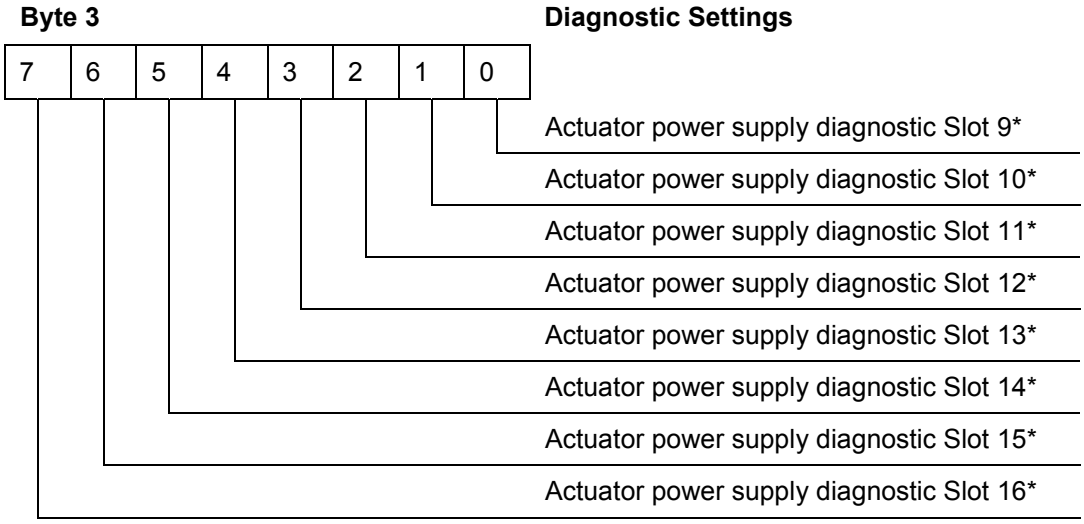


Fig. 8: Parameter Byte 3 of Cube20 BN-P DP-V1 DI8 Art. No. 56001

Corresponding assignment of Bytes 4 and 5:

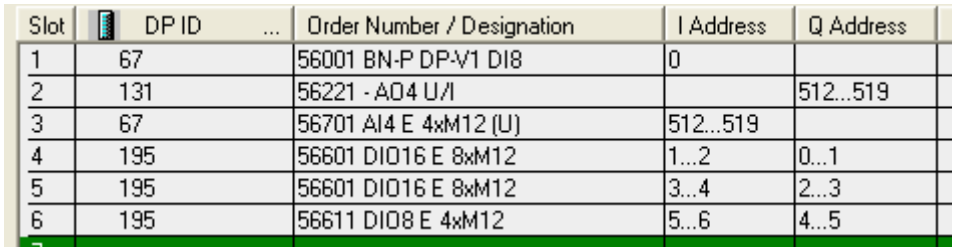
Byte 4: Actuator power supply diagnostic for Slots 17 to 24*

Byte 5: Actuator power supply diagnostic for Slots 25 to 32*

* only when GSD file MUR20B3D.* is used

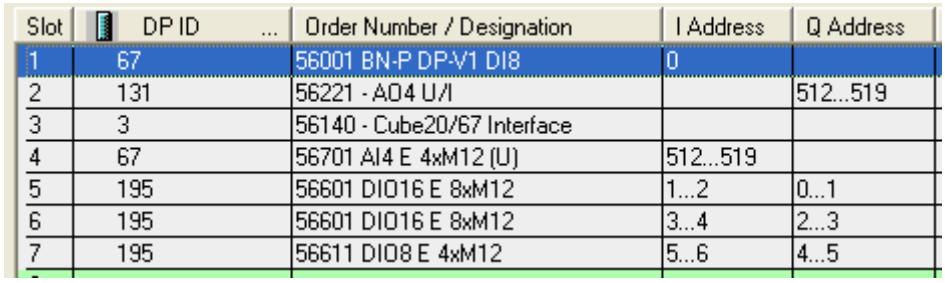
3.5.3 Cube20/67 Interface, Art. No. 56140

When the GDS file MUR20B3D.* is used, you also have the interface module "56140 Cube20/67 Interface" and several Cube67 modules at your disposal, besides the previous Cube20 modules available. Use of the interface module "56140 Cube20/67 Interface" before replacing a Cube20 module by a Cube67 module is optional, i.e. you are free to change directly from Cube20 to Cube67 (as in Fig. 9: 56221 after 56701), or to configure the interface module "56140 Cube20/67 Interface" (Fig. 10:). The two configurations are valid.



Slot	DP ID	...	Order Number / Designation	I Address	Q Address
1	67		56001 BN-P DP-V1 DI8	0	
2	131		56221 - AO4 U/I		512...519
3	67		56701 AI4 E 4xM12 (U)	512...519	
4	195		56601 DIO16 E 8xM12	1...2	0...1
5	195		56601 DIO16 E 8xM12	3...4	2...3
6	195		56611 DIO8 E 4xM12	5...6	4...5

Fig. 9: Configuration with Cube20 and Cube67 modules without interface module



Slot	DP ID	...	Order Number / Designation	I Address	Q Address
1	67		56001 BN-P DP-V1 DI8	0	
2	131		56221 - AO4 U/I		512...519
3	3		56140 - Cube20/67 Interface		
4	67		56701 AI4 E 4xM12 (U)	512...519	
5	195		56601 DIO16 E 8xM12	1...2	0...1
6	195		56601 DIO16 E 8xM12	3...4	2...3
7	195		56611 DIO8 E 4xM12	5...6	4...5

Fig. 10: Configuration with Cube20 and Cube67 modules with interface module

The configuration of a Cube20/Cube67 System may only include one interface module "56140 Cube20/67 Interface".

3.5.4 Modules and Slots

Number of available slots	32*
Max. number of usable modules	16 (including bus nodes Cube20 BN-P DP-V1 DI8 Art. No. 56001, including interface module "56140 Cube20/67 Interface")*

* only when GSD file MUR20B3D.* is used

Too many modules are configured in the configuration in Fig. 11: . Since module 56140 "Cube20/67 Interface" is not considered in the calculation of the maximum number of modules, the error message "Slot 18: False Module" is issued, even if this configuration physically exists.

Slot	DP ID ...	Order Number / Designation	I Address	Q Address
1	67	56001 BN-P DP-V1 DI8	0	
2	131	56221 - AO4 U/I		512...519
3	67	56201 - AI4 U/I	512...519	
4	67	56240 - AI4 TH	520...527	
5	131	56117 - DO16 2A		0...1
6	3	56140 - Cube20/67 Interface		
7	67	56701 AI4 E 4xM12 (U)	528...535	
8	195	56611 DIO8 E 4xM12	1...2	2...3
9	131	56601 DO16 E 8xM12		4...5
10	131	56611 DO8 E 4xM12		6...7
11	67	56621 DI8 E 8xM8	3	
12	67	56631 DI8 E 4xM12 1A	4...5	
13	67	56603 DI16 E 8xM12	6...7	
14	67	56613 DI8 E 4xM12	8...9	
15	67	56623 DI8 E 8xM8	10	
16	131	56651xx DO16 E Valve		10...11
17	131	56655xx DO8 E Valve		12
18	131	56656xx DO32 E Valve 0,5A		13...16
19	131	56661 DO8 E Cable		17
20	195	56662 DIO16 E Cable	11...12	18...19
21	195	56663 DIO8 E M16 0,5A	13	20
22	195	56760 DIO4 RS485 E 3xM12	14...21	21...28

Fig. 11: Example of an incorrect configuration

Please note that the number of modules to be configured may be reduced if you deploy Cube67+ modules. For example, it is not possible to use more than six modules of type Cube67+ DIO12 IOL4 E 8xM12 Art. No. 56752, as they require five slots each: one slot for the module itself and four slots for virtual modules.

Slot	DP ID ...	Order Number / Designation	I Address	Q Address
1	67	56001 BN-P DP-V1 DI8	0	
2	3	56140 - Cube20/67 Interface		
3	195	56752 DIO12 E 8xM12 IO-Link	1...2	0...1
4	66	IOL_I_2 Byte	512...513	
5	2	IOL_DEACTIVATED		
6	2	IOL_DEACTIVATED		
7	2	IOL_DEACTIVATED		
8	195	56752 DIO12 E 8xM12 IO-Link	3...4	2...3
9	66	IOL_I_2 Byte	514...515	
10	2	IOL_DEACTIVATED		
11	2	IOL_DEACTIVATED		
12	2	IOL_DEACTIVATED		
13	195	56752 DIO12 E 8xM12 IO-Link	5...6	4...5
14	66	IOL_I_2 Byte	516...517	
15	2	IOL_DEACTIVATED		
16	2	IOL_DEACTIVATED		
17	2	IOL_DEACTIVATED		
18	195	56752 DIO12 E 8xM12 IO-Link	7...8	6...7
19	66	IOL_I_2 Byte	518...519	
20	2	IOL_DEACTIVATED		
21	2	IOL_DEACTIVATED		
22	2	IOL_DEACTIVATED		
23	195	56752 DIO12 E 8xM12 IO-Link	9...10	8...9
24	66	IOL_I_2 Byte	520...521	
25	2	IOL_DEACTIVATED		
26	2	IOL_DEACTIVATED		
27	2	IOL_DEACTIVATED		
28	195	56752 DIO12 E 8xM12 IO-Link	11...12	10...11
29	66	IOL_I_2 Byte	522...523	
30	2	IOL_DEACTIVATED		
31	2	IOL_DEACTIVATED		
32	2	IOL_DEACTIVATED		

Fig. 12: Example of a configuration using Cube67+ modules

3.6 I/O - Data Cube20 BN-P DP-V1 DI8 Art. No. 56001

Bit assignment I/O data - input data PAE

Byte 0								
Bit	7	6	5	4	3	2	1	0
Terminal	X2 03	X2 02	X2 01	X2 00	X1 03	X1 02	X1 01	X1 00

Tab. 4: Input Data Cube20 BN-P DP-V1 DI8 Art. No. 56001

4 Diagnostics

4.1 LED Indicators

For a detailed description, please see the Cube20 System Manual Art. No. 56030.

4.1.1 Significance of the States of the "Bus Run" LED

The "Bus Run" LED represents the state of PROFIBUS communication on the Cube20 BN-P DI8 Art. No. 56001.

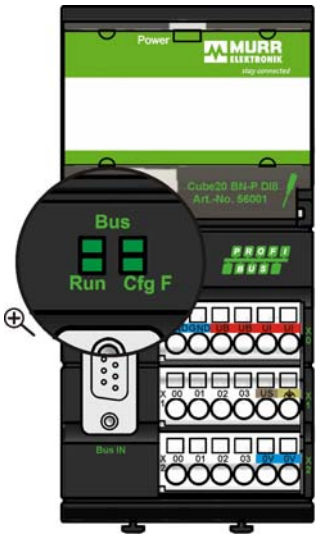


Fig. 13: Bus-Run LED of Cube20 BN-P DI8 Art. No. 56001

LED Display	Response	State
■	Lights up continuously	PROFIBUS-DP data exchange
▨	Flashing (green)	No PROFIBUS-DP data exchange
□	Off	- PROFIBUS firmware not yet initialized - Voltage at terminal UB too low (<13V)

Tab. 5: LED-Bus-Run on Cube20 BN-P DP-V1 DI8 Art. No.: 56001

4.1.2 Significance of the States of the "Cfg F" LED

The "Cfg F" LED represents the state of a correct/incorrect configuration on the Cube20+ BN-P DP-V1 DI8 Art. No. 56001.

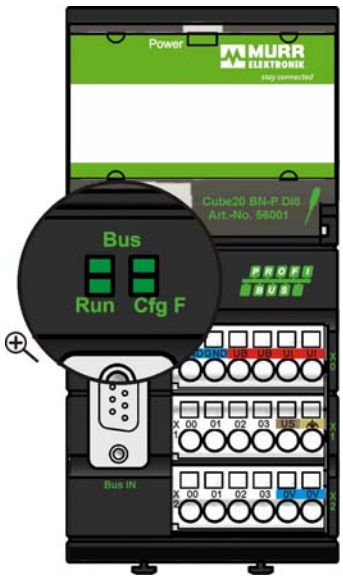


Fig. 14: Cfg F-LED on Cube20 BN-P DP-V1 DI8 Art. No. 56001

LED Display	Response	State
■	Lights up continuously (red)	Real configuration does not match the projected configuration
■	Off	Configuration correct

Tab. 6: Cfg F-LED on the Cube20 BN-P DP-V1 DI8 Art. No. 56001

4.1.3 Displays for the Supply Voltage at the Terminals

Please see the Cube20 System Manual Art. No. 56030.

4.1.4 Diagnostics Overview

Overview of the reported diagnostic messages Cube20 BN-P DP-V1 DI8 Art. No.: 56001

Designation of terminals	Description	Fieldbus Diagnostics	Related to:
UB	Undervoltage (< 18V)	Undervoltage	Modules
UI	Undervoltage (< 18V)	Undervoltage	Modules
US	Overload or short-circuit sensor supply	Short-circuit	Modules

Tab. 7: Overview of reported diagnostic messages

4.2 Diagnostics via the Fieldbus

There are a total of four levels of diagnostic information over PROFIBUS on the Cube20.

1. ProfiBus standard diagnostics

Bytes 0 to 5 of diagnostic telegram.

2. Identification-related diagnostic (information about what modules have a diagnostic function)

Bytes 6 to 10 Parameter Byte 0, Bit 1 = 0 (ID-related diagnostic is activated)

3. Module status diagnostic (information about what modules have a diagnostic function, or are missing, or are incorrect).

Bytes 11 to 22 Parameter Byte 0, Bit 2 = 0 (module status diagnostic is activated)

4. Channel-related diagnostic (short-circuits at outputs, etc.).

Byte 23…. Parameter Byte 0, Bit 1 = 0, Bit 2 = 0 (ID-related and module status diagnostics are switched on) 3 byte per channel, max. 64 channel diagnostics.

When you set the bus node parameter "Diagnostic Message" to "Disable global diagnostics", the blocks "ID-related diagnostic" and "Module status diagnostic" still exist, but the content of these diagnostic blocks always indicate an errorfree state.

Use of the Profibus DP-V1 functionality Alarms and Status Reports for the diagnostic is not supported by Cube20 BN-P DP-V1 DI8 Art. No. 56001. Select Mode DP-V0 for the DP Alarm Mode (diagnostic mode) if the Profibus Master configuration tool offers an option.

All diagnostic messages are reported slot-dependent. Note here that some configuration tools name the first slot as Slot 0; others name it Slot 1. The reported diagnostic messages refer to the numbering of the first slot with "Slot 1".

4.2.1 Standard Diagnostic Information Format

Standard diagnostic information Byte 0 to 5

Byte 0

7	6	5	4	3	2	1	0

Diag.station_non_existent

This bit is set by the DP master if this DP slave is not accessible (to generate a group diagnostic). The DP slave sets this bit to zero.

Diag.station_not_ready

This bit is set by the DP slave, if the SP slave is not ready for data exchange.

Diag.cfg_Fault

This bit is set by the DP slave when the configuration data previously received from the master does not match the configuration data detected by the DP slave..

Diag.ext_diag

This bit indicates that a diagnostic entry is present in the slave-specific diagnostic area (Ext_Diag_Data).

Diag.not supported

This bit is set by the DP slave as soon as a function not supported by the DP slave is requested.

Diag. Invalid slave response

This bit is set by the DP master when an implausible response is received from an addressed DP slave. The DP slave sets this bit to zero.

Diag.prm_fault

This bit is set by the DP slave if the previous parameter telegram was erroneous, e.g. incorrect length, incorrect ID number, invalid parameter.

Diag.master_lock

The DP slave was parameterized by another master. This bit is set by the master, if the address in Byte 3 is not equal to Ffhex and is not equal to the slave's own address. The DP slave sets this bit to zero.

Fig. 15: Standard diagnostic information Byte 0

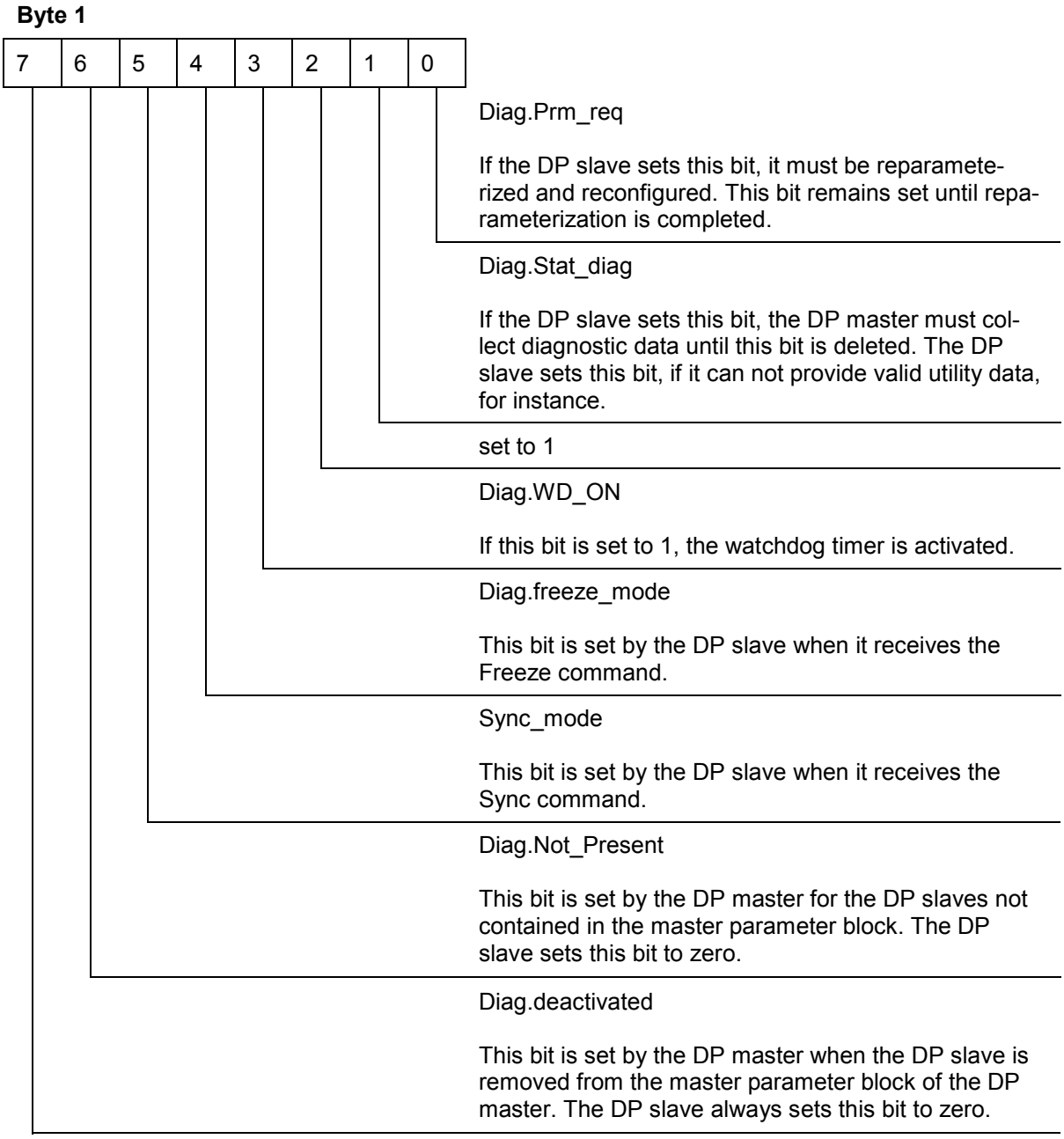


Fig. 16: Standard diagnostic information Byte 1

Byte 2

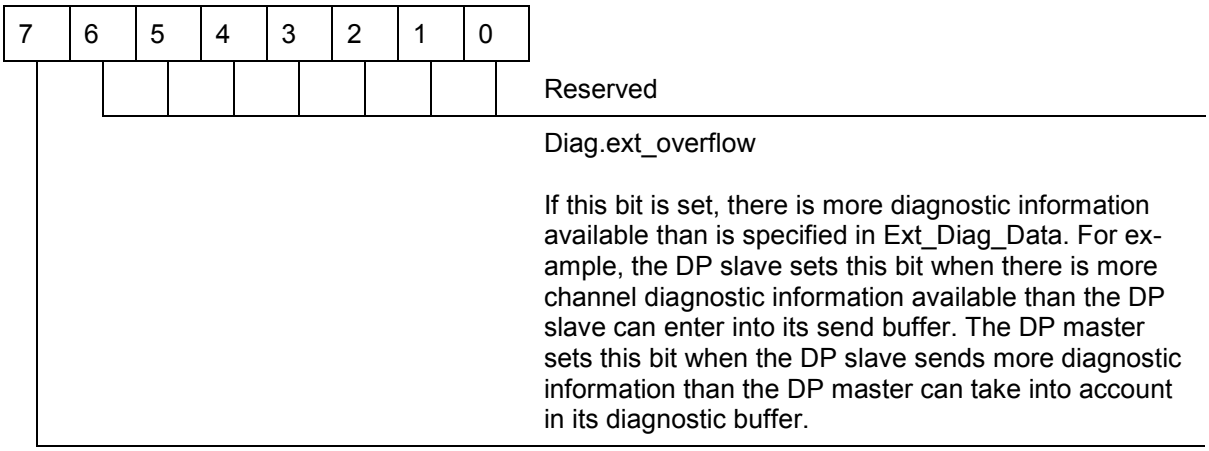


Fig. 17: Standard diagnostic information Byte 2

Byte 3

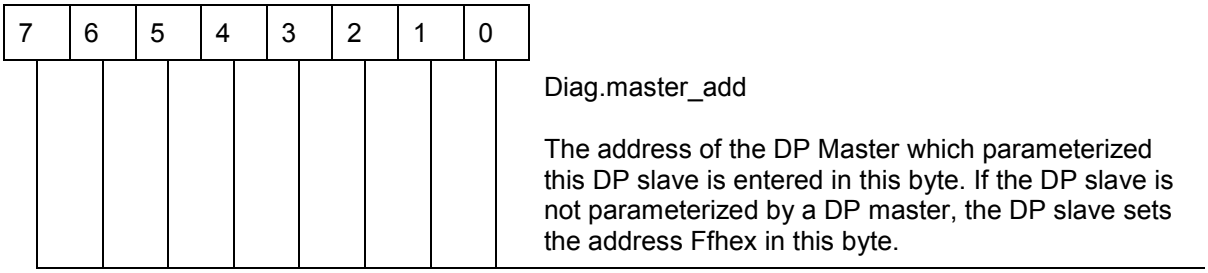


Fig. 18: Standard diagnostic information Byte 3

Byte 4

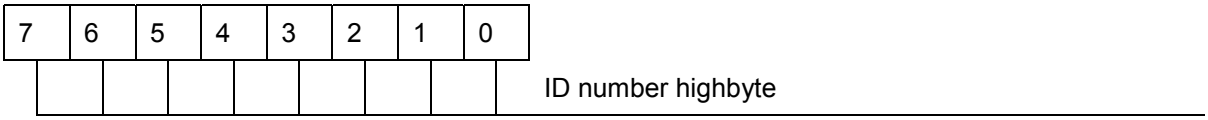


Fig. 19: Standard diagnostic information Byte 4

Byte 5

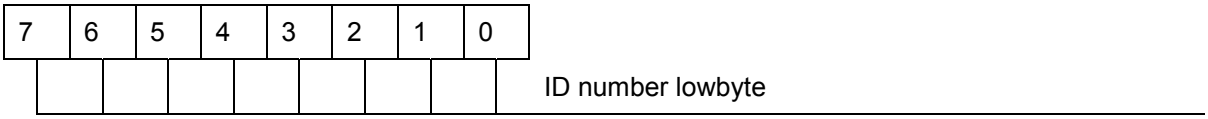


Fig. 20: Standard diagnostic information Byte 5

4.2.2 Identification-Related Diagnostic

Identification-related diagnostic bytes 6

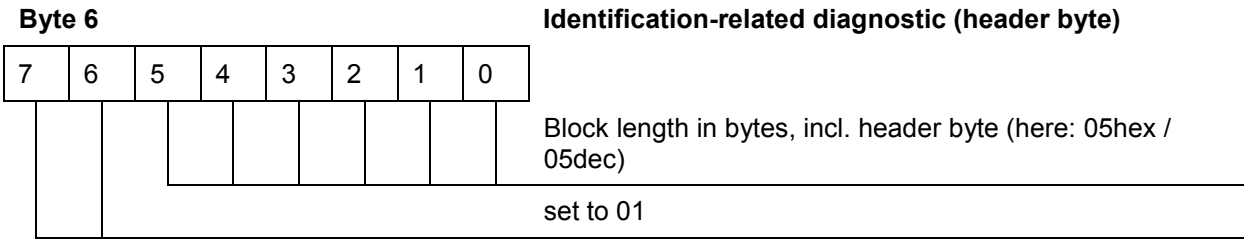


Fig. 21: Identification-related diagnostic Byte 6

Bit assignment of parameter bytes 7 to 10

Defines whether the assigned slot has an ID-related diagnostic.

Byte 7: Diagnostic of the ID for Slots 1 to 8:

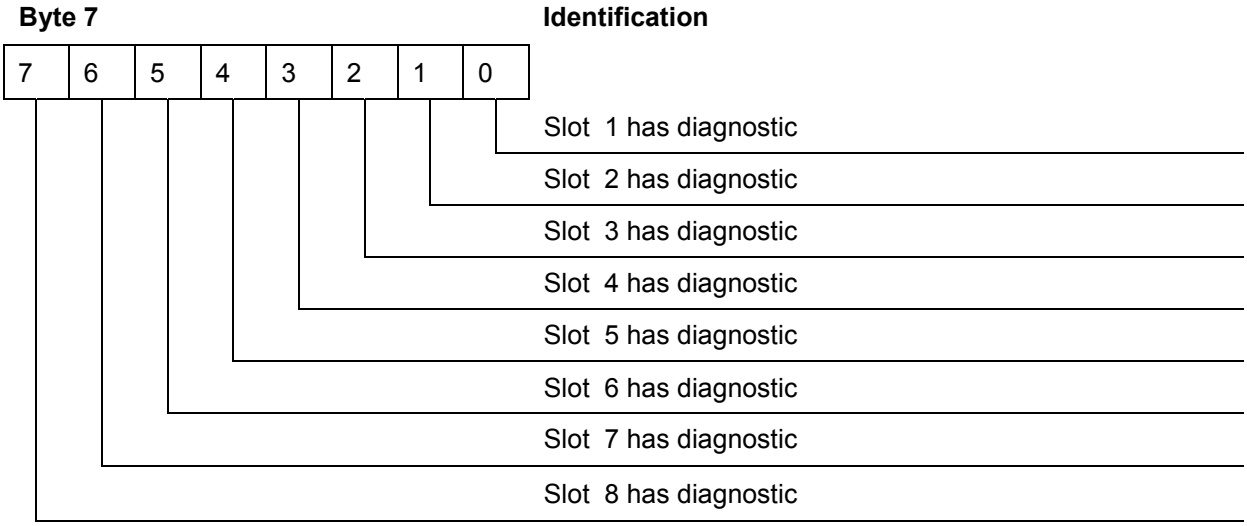


Fig. 22: Identification-related diagnostic Byte 7

Corresponding assignment of Bytes 8 to 10:

Byte 8 **Slots 9 to 16**

Byte 9 **Slots 17 to 24**

Byte 10 **Slots 25 to 32**

If you do not set the bus node parameter "ID-related diagnostic messages" to "Do not report", the block of ID-related diagnostics is no longer contained in the diagnostic telegram.

4.2.3 Module Status Diagnostic

Module status diagnostic Bytes 11 to 22

Byte 11 **Module Status Diagnostic (Header Byte)**

7	6	5	4	3	2	1	0

Block length in bytes, incl. header byte (here: 0Chex / 12dec)

Set to 00

Fig. 23: Module status diagnostic Byte 11

Byte 12 **Module Status Type**

7	6	5	4	3	2	1	0

Unused

Set to 1 for module status

Unused

Unused

Unused

Unused

Unused

Set to 1 for status block

Fig. 24: Module status diagnostic Byte 12

Byte 13 **Slot Number**

7	6	5	4	3	2	1	0

Set to 0 since all diagnostics are reported to the bus node slot.

Fig. 25: Module status diagnostic Byte 13

Byte 14 **Status Specification**

7	6	5	4	3	2	1	0

Set to 0 since it is not further differentiated.

Fig. 26: Module status diagnostic Byte 14

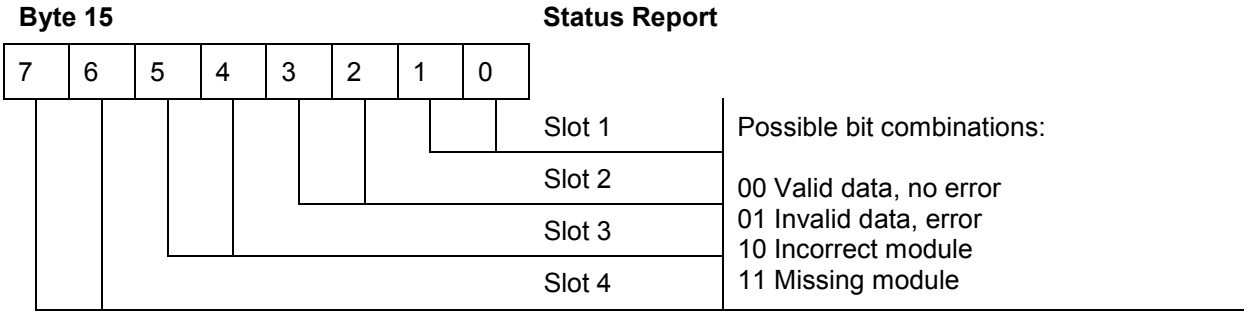


Fig. 27: Module status diagnostic Byte 15

Corresponding assignment of Bytes 16 to 22:

Byte 16: Diagnostic of module status for Slots 5 to 8

Byte 17: Diagnostic of module status for Slots 9 to 12

Byte 18: Diagnostic of module status for Slots 13 to 16

Byte 19: Diagnostic of module status for Slots 17 to 20

Byte 20: Diagnostic of module status for Slots 21 to 24

Byte 21: Diagnostic of module status for Slots 25 to 28

Byte 22: Diagnostic of module status for Slots 29 to 32

If you do not set the bus node parameter "Module status diagnostic messages" to "Do not report", the block of module status diagnostics is no longer contained in the diagnostic telegram.

4.2.4 Channel-Related Diagnostic

Channel-related diagnostic Bytes 23 to 25 and following

Three bytes are assigned in the diagnostic telegram for each channel-related diagnostic. If, for example, 5 channel-related diagnostics are available, a total of 5 times 3 bytes channel-related diagnostic information will follow from byte 23.

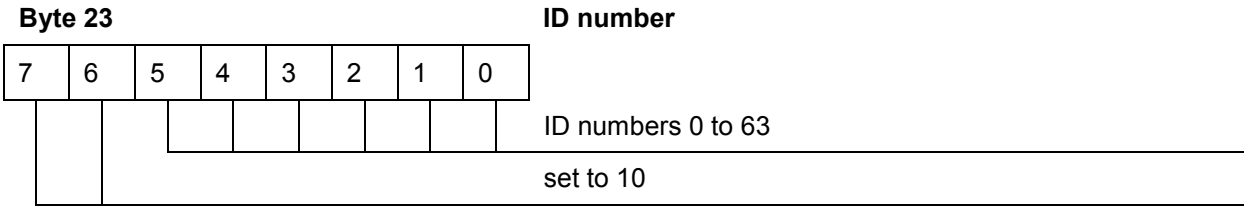


Fig. 28: Channel-related diagnostic Byte 23

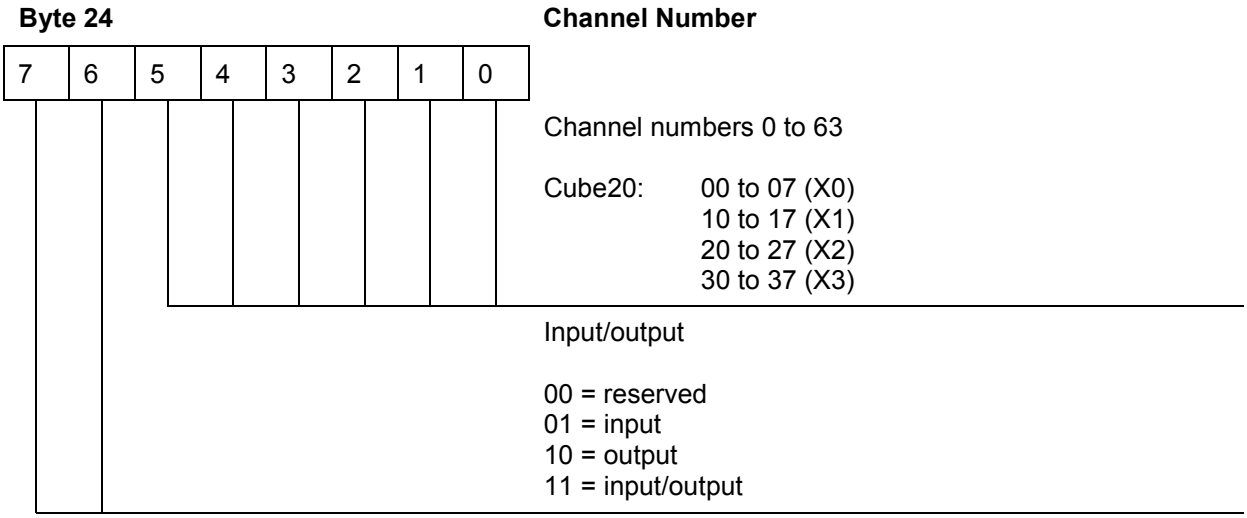


Fig. 29: Channel-related diagnostic Byte 24

Byte 25

7	6	5	4	3	2	1	0

Fault Type

Fault type

01hex (01dec)	Short circuit (in sensor supply)
02hex (02dec)	I/O link undervoltage
04hex (04dec)	Overload (sensor power supply)
06hex (06dec)	Line break
07hex (07dec)	Upper limit overshot
08hex (08dec)	Lower limit undershot
09hex (09dec)	Fault (e.g. I/O link)
10hex (16dec)	Parameterization error
11hex (17dec)	Actuator power supply undervoltage
13hex (19dec)	Actuator power supply overload
15hex (21dec)	Reference channel error
17hex (23dec)	Actuator warning
18hex (24dec)	Actuator disable
1Ahex (26dec)	External fault
1Bhex (27dec)	No actuator power supply
1Chex (28dec)	No sensor power supply
1Dhex (29dec)	No ext. actuator power supply
1Ehex (30dec)	Ext. actuator power supply undervoltage

Channel type

000 = reserved
001 = bit
010 = 2 bits
011 = 4 bits
100 = byte
101 = word
110 = 2 words
111 = reserved

Fig. 30: Channel-related diagnostic Byte 25

If you set the bus node parameter "channel-related diagnostic messages" to "Do not report", no channel-related diagnostics are contained in the diagnostic telegram.

4.3 Troubleshooting

Rectify errors or incorrect modules in ascending slot order.

Diagnostic Message		Possible Cause	Action
Chan-nel	Short-circuit (sensor supply)	Overload or short-circuit of sensor power supply to 0V.	Change cable to sensor or check sensor for short-circuit.
		Overload or short-circuit of internal system connection (channel type = 000)	Check cables on associated line.
	Undervoltage I/O link	I/O link undervoltage (events 0x5100 to x5119)	Check cable to sensor.
	Overload	Current load on a line greater than 4 A and less than 4.4 A (100 to 110%)	Check current load and possibly distribute to other lines.
	I/O link overload	I/O link overload (event 0x5410)	Check current load.
	Line break	Defective line. Only for analog inputs and outputs.	Check connection to sensor or sensor itself.
	Line break I/O link	I/O link device not plugged in or incorrect (invalid data length, cycle time too short, etc.)	Check connection to I/O link device. Check data length. Increase cycle time in parameters.
	Upper limit overshot	Analog input measuring range overshot.	Check connection to sensor or sensor itself.
	Upper limit overshot (I/O link)	IO link event 0x8C10, 0x8C20	Check parameterization or measuring range.
	Lower limit undershot	Analog input measuring range undershot	Check connection to sensor or sensor itself.
	Lower limit undershot (I/O link)	I/O link event 0x8C30	Check parameterization or measuring range.
	Fault	I/O link fault not assignable to another fault	Check I/O link devices or read out their event memories.
	Parameterization error	Parameterization incorrect.	Check parameterization.
	Actuator power supply undervoltage	Actuator power supply < 18 V	Check power supply unit and cable.
	Reference channel fault	TH module KTY not plugged in	Install KTY correctly.

Diagnostic Message		Possible Cause	Action
	Actuator warning	External power supply to an output.	Check cable.
	Actuator disable	Overload or short-circuit of output signal to 0V.	Check wiring or actuator.
	External fault	Desina diagnostic	Check sensor or wiring.
	No actuator supply	Actuator power supply < 13 V	Check power supply unit and cable.
	No sensor voltage	Sensor power supply < 13 V	Check power supply unit and cable.
	No ext. actuator power supply	External actuator power supply < 13 V	Check power supply unit and cable.
	Ext. actuator power supply undervoltage	Ext. actuator power supply < 18 V	Check power supply unit and cable.

Tab. 8: Troubleshooting

5 DPV1 Support Cube20 BN-P DP-V1 DI8 Art. No. 56001

Cube20 BN-P DP-V1 DI8 Art. No. 56001 currently supports DP-V1 for each Master Class 1 and Master Class 2 access. Below is an overview of supported indices.

5.1 Supported DPV1 Indices

5.1.1 Index 10 "Machine Options Management"

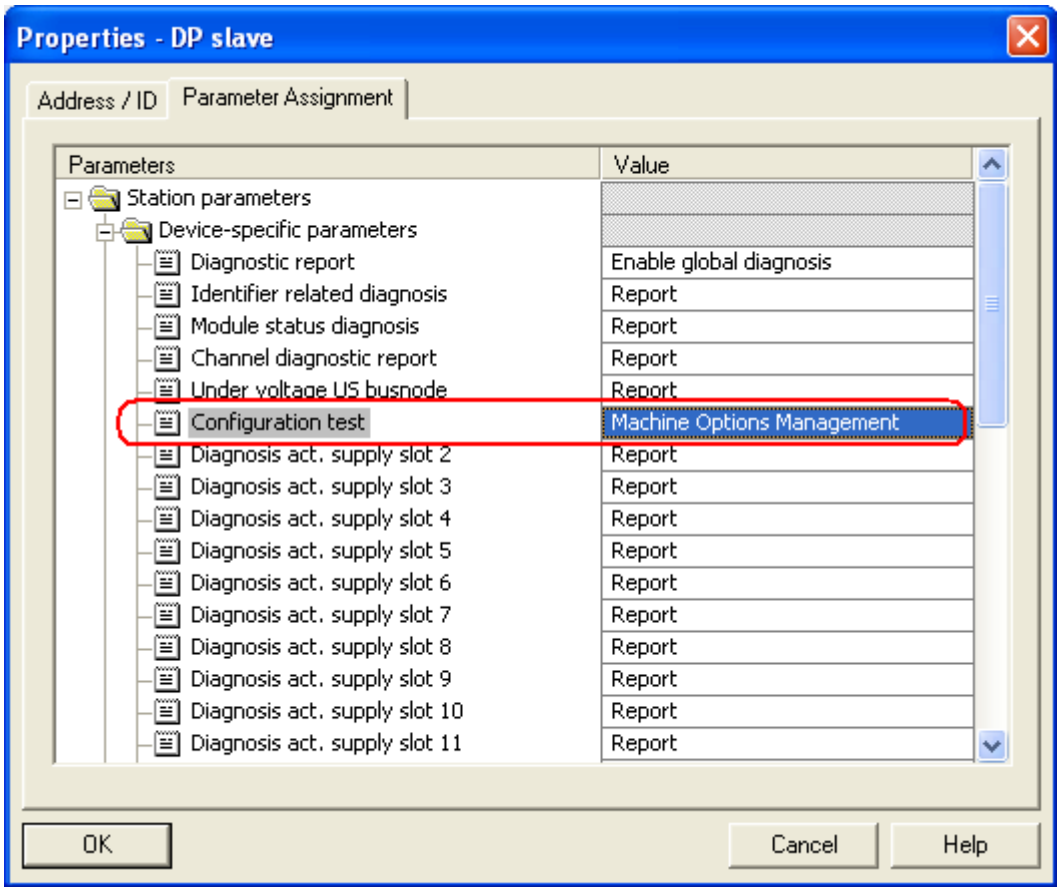


Fig. 31: Configuration test within the parameter list

Slots 2 to 32 can be enabled or disabled in 4 bytes, provided "Machine Options Management" is parameterized. Slot 1 (bus node) can not be disabled.

Byte0 to Byte3 must always be written

Byte 0 Disable Slots 1 to 8:

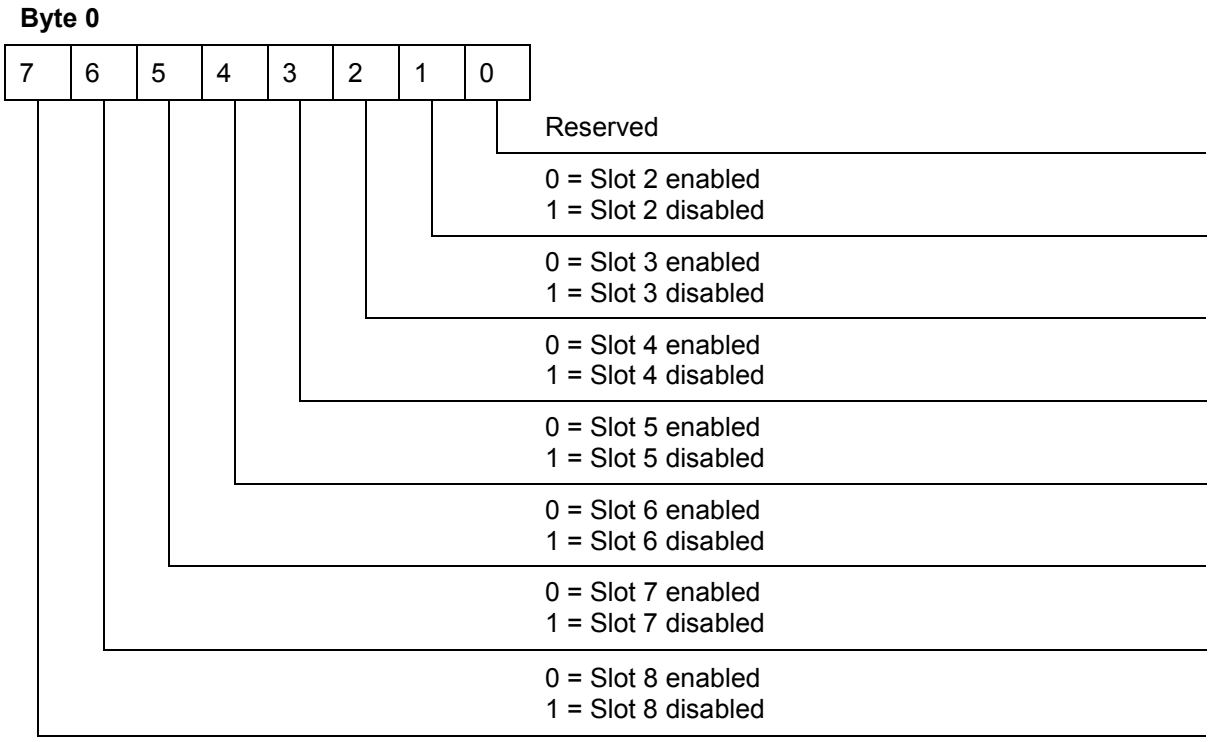


Fig. 32: Assignment of Byte 0

Corresponds to:

Byte 1: Disable Slots 9 to 16:

Byte 2: Disable Slots 17 to 24:

Byte 3: Disable Slots 25 to 32:

Placeholders may not be disabled If an attempt is made to do this, a configuration error is displayed.

Read/write requests in "Default Configuration" receive the negative reply "Feature not supported".

Read requests with "Machine Options Management" receive a positive reply. The response contains the parameters that were previously written with Index 10.

If the configuration is invalid, Index 10 write requests always receive a positive reply. If the configuration is valid after an Index 10 write request, every following Index 10 write request receives a negative reply with "State conflict".

If no valid configuration is set in "Machine Options Management", no "Static diagnostic" can be set in the system.

If "Machine Options Management" is set and there is still no valid configuration set, a diagnostic message "Missing module at Slot 1" is sent if the link to a module is lost. The system most be reset after the link problem is rectified.

If a further error occurs at Slot 1 in relation to the missing module, this error is NOT indicated in the default diagnostic but in the channel-specific diagnostic (see Fig. 33: Fig. 33:).

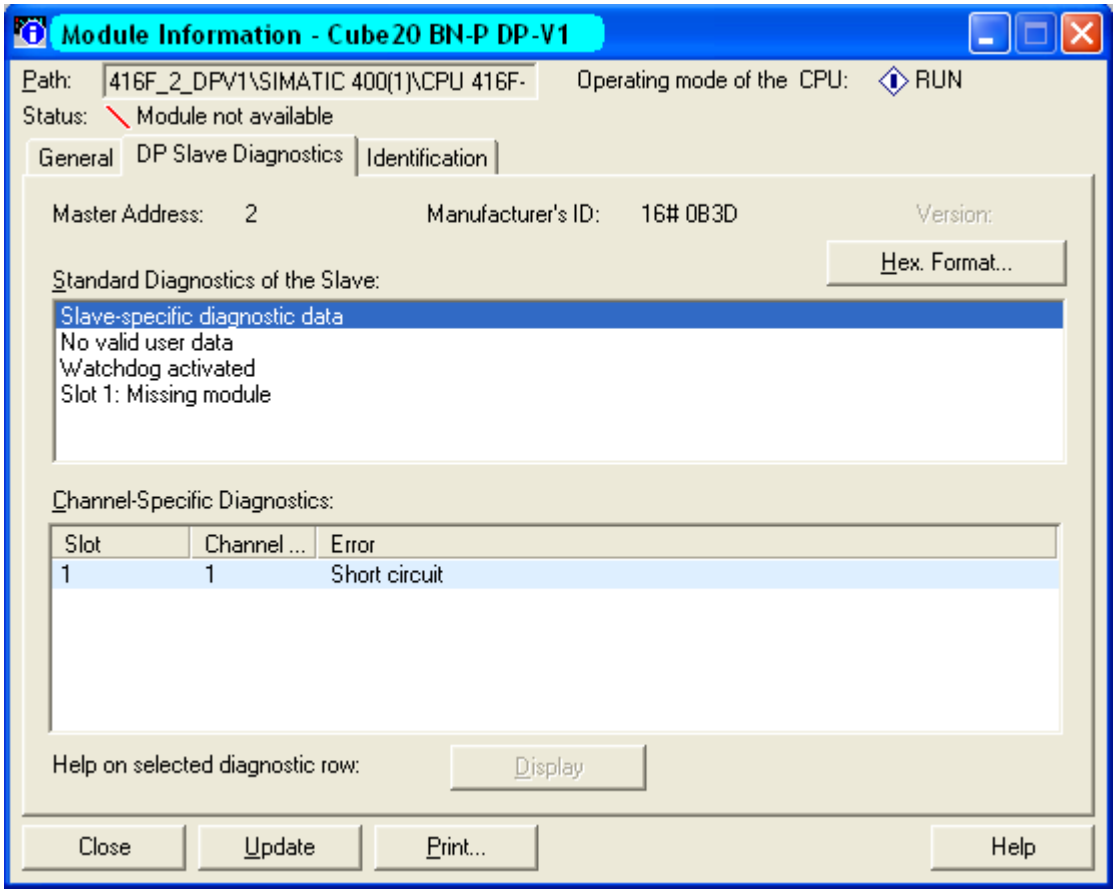


Fig. 33: Error display in default and channel-specific diagnostic

For more details on "Machine Options Management", please refer to Chapter 6.

5.1.2 Index 12 "BusControl"

Byte 0 "BusControl":

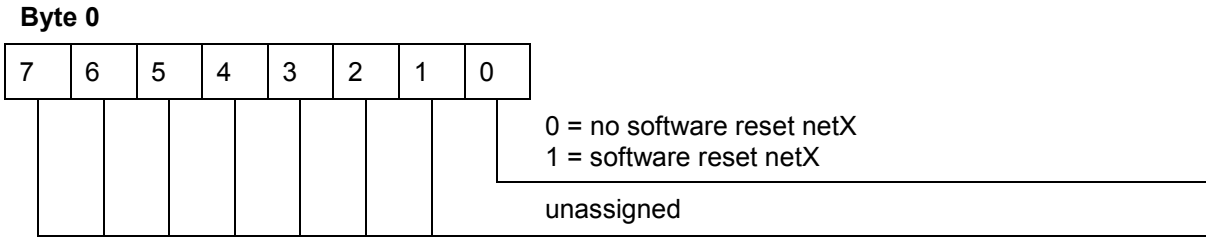


Fig. 34: BusControl byte DPV1 Index 12

Use the BusControl request to perform a bus node reset from the PLC.

5.1.3 Index 13 "Machine Options Management Configuration Test"

Byte 0 Configuration test:

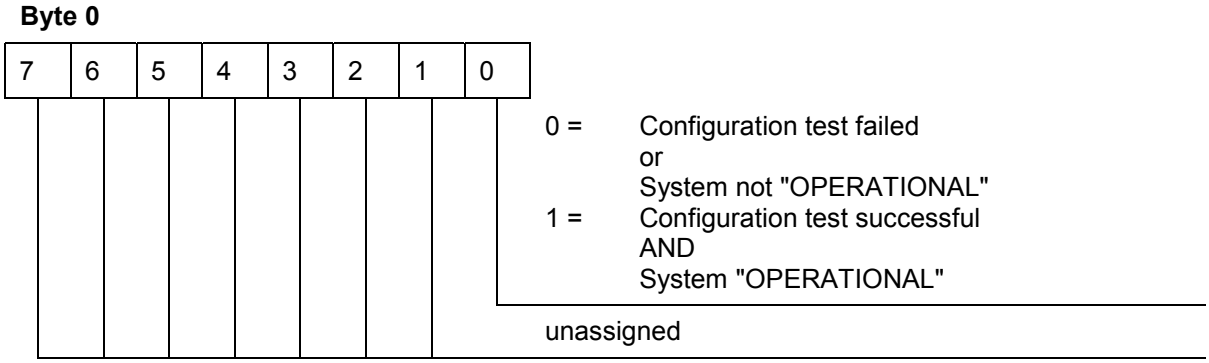


Fig. 35: Assignment of configuration test

Read request must be set with Index 13 to know whether a valid configuration was set in "Machine Options Management". Here, 1 is returned if the configuration is valid and the system is "OPERATIONAL", otherwise 0.

If the bus node is parameterized with "Default configuration"; the negative reply "Feature not supported" is sent.

Write requests receive a negative reply "Feature not supported".

5.1.4 Index 255 "Identification and Maintenance" (I&M)

The bus node itself supports a read request to I&M Index 65000 (IM0) and the manufacturer-specific Index 65100. If other Cube67+ modules are connected to the bus nodes, the Cube67+ modules can then support additional I&M indices. For more details, please refer to the related module documentation.

The bus node supports the following read/write requests:

Read bus node	IM0
Read bus node	IM100
Write Not-IOL module	IM100
Read Not-IOL module	IM100
Write IOL module	IM98
Read IOL module	IM98

5.1.4.1 IM0 (65000)

Content	Size	Content
Header		
Manufacturer-specific	10 bytes	Manufacturer-specific
I&M data		
MANUFACTURER_ID	2 bytes	012Fhex, 303dec
ORDER_ID	20 bytes	'56001 '
SERIAL_NUMBER	16 bytes	' '
HARDWARE_REVISION	2 bytes	Manufacturer-specific
SOFTWARE_REVISION	4 bytes	Manufacturer-specific
REVISION_COUNTER	2 bytes	Manufacturer-specific
PROFILE_ID	2 bytes	F600hex
PROFILE_SPECIFIC_TYPE	2 bytes	0003hex
IM_VERSION	2 bytes	0101hex for V1.1
IM_SUPPORTED	2 bytes	0hex

Tab. 9: IM0

5.1.4.2 IM100 (65100)

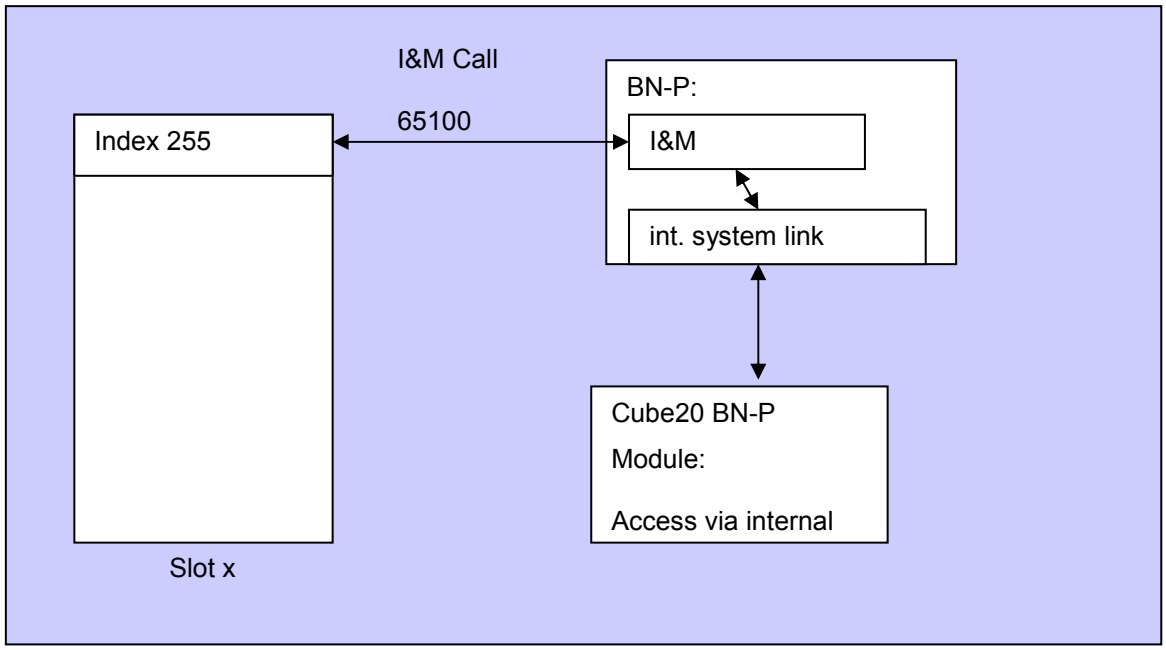


Fig. 36: IM100 request to Cube20 BN-P DP-V1 DI8 Art. No. 56001 or Cube67 modules

Using the manufacturer-specific I&M Index 65100 (IM100), you can send read or write requests to module parameter bytes.

If the outputs of an analog module are enabled or reparameterized by means of DP-V1 IM100 requests, the output data must be reset to 0 during the request. On completion of reparameterization, the output data are re-updated.

Example:

In the simple example below, we will show you how to disable a channel of an analog output module using two IM100 requests and enable another channel of the same module to switch a sensor off and switch another sensor on. The example was carried out using a Siemens controller. DP-V1 requests were handled using module that are available in the download section of the Murrelektronik website.

The configuration:

Slot	DP ID ...	Order Number / Designation	I Address	Q Address
1	67	56001 BN-P DP-V1 DI8	0	
2	131	56220 - AO4 U/I		512...519

Fig. 37: Configuration example

Channel 0 of Cube20 module AO4 U/I Art. No. 56220 is enabled for the range 4 to 20 mA; here are the parameters in detail:

Station parameters	
Device-specific parameters	
Channel 0: output range	4..20mA
Channel 0: diagnostic	Report
Channel 0: data format	Byte seq. High/Low (Motorola)
Channel 1: output range	Inactive
Channel 1: diagnostic	Report
Channel 1: data format	Byte seq. High/Low (Motorola)
Channel 2: output range	Inactive
Channel 2: diagnostic	Report
Channel 2: data format	Byte seq. High/Low (Motorola)
Channel 3: output range	Inactive
Channel 3: diagnostic	Report
Channel 3: data format	Byte seq. High/Low (Motorola)
Hex parameter assignment	
User_Prm_Data (0 to 7)	03,00,00,00,00,00,00,00
User_Prm_Data (8 to 11)	00,00,00,00

Fig. 38: Example of parameters

The current he parameter string of the module is 03 00 00 00 00 00 00 00 00 00 00 00; this can also be found in the parameter assignment of Cube20 AO4 U/I Art. No. 56220 (extract from the Cube20 Expansion Manual (Art. No. 56035):

Number of parameter bytes: 12

Bit assignment of parameter bytes 0 (Channel 0), 3 (Channel 1), 6 (Channel 2), 9 (Channel 3)

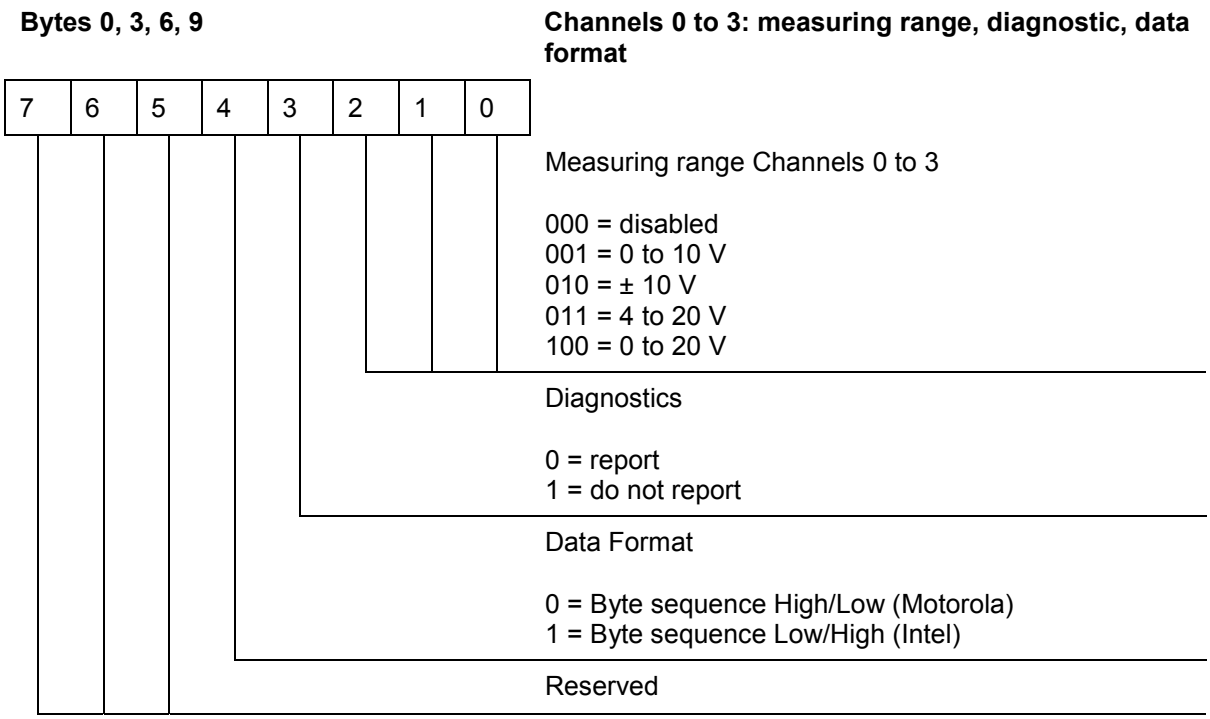


Fig. 39: Bit assignment of parameter bytes 0, 3, 6, 9

Bit assignment of parameter bytes 1, 2, 4, 5. 7, 8, 10, 11:

reserved

Disabling Channel 0 of Cube20 AO4 U/I Art. No. 56220

In order to change the module parameters using DP-V1, the DP-V1 Write Request is sent:

5F 02 FF 08 08 00 FE 4C A0 01 01 00

Meaning of the characters in detail (all hexadecimal):

5F	Write Request
02	Slot Number
FF	Number of index used (255dec = IM)
08	Number of useful data in bytes
08	Call Function
00	Reserved
FE 4C	(65100 dec) = IM100
A0 01	Index 20 01, here the highest bit is set (2+8 = A), it means write request
01	The 1st parameter byte (parameter byte 0) is handled
00	Write parameter for the selected byte

Read Request

After the write request, a reply telegram is sent containing the written data length. According to the IM standard, this must be followed by a read request (without parameters).

5E 02 FF F0

Meaning of the numerals in detail (all hexadecimal):

5E	Read Request
02	Slot Number
FF	Number of index used (255dec = IM)
F0	Number of useful data in bytes

The parameter change was successful, Channel 0 is now set to "disabled".

Enabling Channel 1 for the range 4 to 20 mA

The value 3 (binary 0000 0011) must be set for parameter byte 3. Here are the telegram data in detail:

5F 02 FF 08 08 00 FE 4C A0 01 04 03

Meaning of the numerals in detail (all hexadecimal):

5F	Write Request
02	Slot Number
FF	Number of index used (255dec = IM)
08	Number of useful data in bytes
08	Call Function
00	Reserved
FE 4C	(65100 dec) = IM100
A0 01	Index 20 01, here the highest bit is set (2+8 = A), it means write request
04	The 4th parameter byte (parameter byte 3) is handled
03	Write parameter for the selected byte

According to the IM standard, this must be followed by a read request (without parameters).

The parameter change was successful; Channel 1 is not enabled for the range 4 to 20 mA.

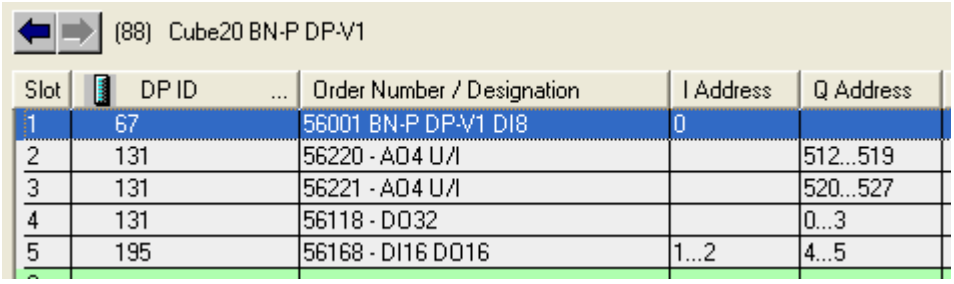
STEP7 libraries that contain modules for IM accesses are available in the download section of the Murrelektronik website:
www.murrelektronik.com

6 Machine Options Management (MOM)

Using the Machine Options Management ("MOM"), you can perform a module configuration on machines. If the machine comprises a Basic Module A and an optional Machine Module B, for example, you can disable modules belonging to the – nonexistent – Machine Module B using Machine Options Management.

For this reason, the configuration tool configures all the optional modules of the Machine Module B modules. This configuration is then the "Maximum configuration". In addition, you can parameterize the "Configuration test" parameter of the bus node with "Machine Options Management". The system reports no error after runup and this is totally independent of the received configuration or parameterization. The bus node then reverts to data exchange, but the data are not yet updated.

In order to illustrate MOM, here is an example of maximum configuration:



Slot	DP ID ...	Order Number / Designation	I Address	Q Address
1	67	56001 BN-P DP-V1 DI8	0	
2	131	56220 - AO4 U/I		512...519
3	131	56221 - AO4 U/I		520...527
4	131	56118 - DO32		0...3
5	195	56168 - DI16 DO16	1...2	4...5

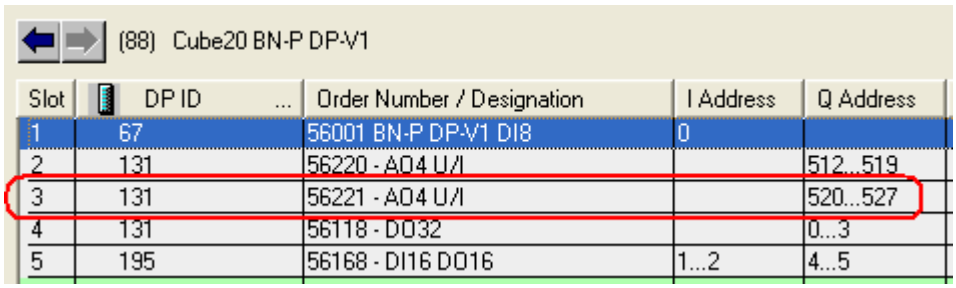
Fig. 40: Maximal configuration

6.1 Module Selection and Setting a Configuration

If the system is in data exchange mode, set the configuration you require by disabling the slots of the unused modules by means of DP-V1 Index 10 ("Machine Options Management"). You will find a detailed description of this in Section 5.1.1. A configuration text then takes place in the system, i.e. the configuration set using MOM is compared to the actual setup. If this test is OK, the configuration is valid and the system reverts to data exchange mode. If the test fails, the configuration is invalid and a diagnostic is generated (missing or false module). The system is then no longer in data exchange mode - the static diagnostic bit is set.

The test result can be requested using DP-V1 Index 13 ("Machine Options Management Configuration Test"). A detailed description of this is in Section 5.1.3. If the configuration is invalid, you can continue to try using MOM to set a valid configuration.

In our example, only the modules in Slots 1, 2, 4 and 5 are physically present. The module in Slot 3 is not present. It is then disabled by a DP-V1 write request using Index 10.



Slot	DP ID ...	Order Number / Designation	I Address	Q Address
1	67	56001 BN-P DP-V1 DI8	0	
2	131	56220 - AO4 U/I		512...519
3	131	56221 - AO4 U/I		520...527
4	131	56118 - DO32		0...3
5	195	56168 - DI16 DO16	1...2	4...5

Fig. 41: Example of an invalid configuration

The physical setup does not comprise the module highlighted by the red border (Slot 3).

Telegram parameters in detail:

5F 00 0A 04 04 00 00 00

Meaning of the numerals in detail (all hexadecimal):

5F	Write Request
00	Slot number (Slot 1)
0 A	Number of index used (10dec)
04	Number of useful data in bytes
04	1st parameter byte (parameter byte 0)
00	2nd parameter byte (parameter byte 1)
00	3rd parameter byte (parameter byte 2)
00	4th parameter byte (parameter byte 3)

Bit pattern of parameter bytes:

Byte 1:

Bit value:	0	0	0	0	0	1	0	0	→ Hex: 04
Slot number:	8	7	6	5	4	3	2	1	

Byte 2:

Bit value:	0	0	0	0	0	0	0	0	→ Hex: 00
Slot number:	16	15	14	13	12	11	10	9	

Byte 3 and Byte 4 are also 0, as is Byte 2.

A write request receives a positive reply telegram if it was successful, irrespective of the fact whether the configuration is valid or not.

6.2 Configuration Test

A DP-V1 read request with Index13 can test whether the configuration is valid.

Telegram parameters in detail:

5E 00 0D 01

Meaning of the numerals in detail (all hexadecimal):

5E	Read Request
00	Slot Number
0D	Number of index used (13dec)
01	Number of useful data in bytes

If "Machine Options Management" is a default configuration, this results in a positive reply telegram that looks like this:

5E 00 0D 01 01 (configuration is valid and system is OPERATIONAL) or 5E 00 0D 01 00 (otherwise).

If the configuration is valid, the system reverts to data exchange mode. If there are diagnostics present, they are displayed, provided they were not disabled by bus node parameters.

If the configuration is invalid, the system does not revert to data exchange mode. Instead, the static diagnostic is set and a slot error is displayed.

Our example shows a valid configuration. The system is in data exchange mode.

If a valid configuration is set, it is not possible to set another configuration using MOM. If you attempt to do this, it results in a negative reply telegram.

In order to know which parameters were sent by Index 10, a read request can be made to Index 10 which returns the written parameters. If nothing was written, then zeros are returned.

If the bit is set for a slot that does not exist (example: Slots 1 to 9 are assigned and Mask 00 00 02 00 was set (= Slot 18 is disabled), then this bit is ignored.

6.3 Module Change

If you want to change modules, i.e. change the physical setup, this is the procedure:

1. **Switch off all power supplies of the bus node and all modules.**
2. **Replace the modules.**
3. **Switch on all power supplies of the bus node and all modules.**
4. **Set a valid configuration using Index 10.**
5. **Check whether the configuration is valid.**

Example: Module Change

1. **Switch off power supplies of the bus node and all modules.**
2. **Replace the modules.**

Module 56220 is removed, Module 56221 is set at the same location.

3. **Switch on all power supplies of the bus node and all modules.**
4. **Set a valid configuration using Index 10.**

Now the modules of Slots 1, 3, 4, and 5 are connected; the module at Slot 2 is missing. It is disabled using DP-V1 Index 10 write request.

(88) Cube20 BN-P DP-V1

Slot	DP ID	...	Order Number / Designation	I Address	Q Address
1	67		56001 BN-P DP-V1 DI8	0	
2	131		56220 - AO4 U/I		512...519
3	131		56221 - AO4 U/I		520...527
4	131		56118 - DO32		0...3
5	195		56168 - DI16 DO16	1...2	4...5

Fig. 42: Example of module change

Telegram parameters in detail:

5F 00 0A 04 02 00 00 00

Meaning of the numerals in detail (all hexadecimal):

5F	Write Request
00	Slot number (Slot 1)
0A	Number of index used (10dec)
04	Number of useful data in bytes
02	1st parameter byte (parameter byte 0)
00	2nd parameter byte (parameter byte 1)
00	3rd parameter byte (parameter byte 2)
00	4th parameter byte (parameter byte 3)

Bit pattern of 1st parameter byte:

Byte 1:

Bit value:	0	0	0	0	0	1	0	0	→ Hex: 02
Slot number:	8	7	6	5	4	3	2	1	

5. Check whether the configuration is valid.

Now a test can be made using DP-V1 V1 read request by Index13 whether the configuration is valid. If this is the case, the system is in data exchange mode. The module change was successful.

7 Usable Modules

7.1 Cube20 Modules

All Cube20 modules are operable on the Cube20 BN-P DP-V1 DI8.

Please refer to the Cube20 System Manual for lists of the various Cube20 modules.

You will find a list of manuals in the section "List of Manuals and Layout" in this manual.

7.2 Cube67 Modules

All Cube67 modules are operable on the Cube20 BN-P DP-V1 DI8.

Please refer to the Cube67 System Manual for lists of the various Cube20 modules.

You will find a list of manuals in the section "List of Manuals and Layout" in this manual.

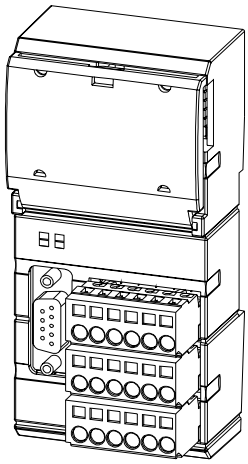
7.3 Cube67+ Modules

All Cube67+ modules are operable on the Cube20 BN-P DP-V1 DI8. The "+" of the Cube67+ stands for the expanded functionality of these modules.

Please refer to the Cube67+ Manual for the lists and information on the various Cube67+ modules.

You will find a list of manuals in the section "List of Manuals and Layout" in this manual.

8 Technical Data Cube20 BN-P DP-V1 DI8 Art. No. 56001



PROFIBUS Slave IP20 with 8 inputs

[Terminal X1] → 4 inputs

[Terminal X2] → 4 inputs

EMC

EN 61131-2 Product standard

EN 61000-4-2 ESD	Contact ± 4 kV, air ± 8 kV
EN 61000-4-3 RF-Field & GSM	10 V/m
EN 61000-4-4 Burst	± 2 kV DC inputs, ± 1 kV signal lines
EN 61000-4-5 Surge	Asym./symm. ± 500 V
	Asym. ± 1 kV
EN 61000-4-6 HF-asymmetric	10 V
EN 61000-4-8 Magnetic field 50 Hz	30 A/m
EN 55011 Emission	QP 40 dBµV/m (30 - 230 MHz)
	QP 47 dBµV/m (230 - 1000 MHz) Class A

Ambient Conditions

Operating temperature	0°C... +55°C
Storage temperature	-20°C to +85°C
Enclosure type according to EN 60529	IP 20

Mechanical Ambient Conditions

Oscillation according to EN 60068 Part 2-6	5 g
Shock according to EN 60068 Part 2-27	15 g / 11 ms

Miscellaneous

Dimensions (LxWxH) in mm	117 x 56 x 47 mm
Mounting dimension (L xW)in mm	117 x 56 mm
Weight	Approx. 170 g

Bus Data

Transfer protocol	PROFIBUS-DP according to IEC 61158 / 61784
Acyclic services	DP-V1 Master Class 1 and 2
Transfer rate	9,6 - 12000 kBaud
Baud rate identification	Automatically
Operating mode	Sync-Mode, Freeze-Mode are supported
Addressing	0 till 99 with BCD-rotary switch
Identity number	0B3D hex
Galvanic isolation	500 V between Bus and internal Logic

System connection

Transfer protocol	Internal system
Addressing	Automatic

Connection Possibilities

Internal system connection Out	10-pin male connector
Sensor and actuator supply	Cage clamp 2.5 mm²
Bus connection	Sub-D 9-pin
Sensor	2x4 terminal block connectors

Power Supply

Operating voltage range logic U_B	18 ... 30.2 V DC
Current consumption (only, U_B)	110 mA
Sensor supply U_I	18 ... 30.2 V DC

Reverse voltage protection module electronics	Yes
Reverse voltage protection sensor power supply	yes
Overvoltage protection	yes (suppressor diode)

Inputs

Delay time for signal change	2 ms
Input characteristics	EN 61131-2, Type 3
Galvanic separation	500 V

Sensor power supply

Max. current	0.7 A
Short circuit protection for sensors with automatic restart	Yes
Reverse polarity protection	Yes

This is a class A product. The product may cause broadcast interferences in a residential environment. In this case the applicant may have to take appropriate measures.

Accessories

A list of Cube20 accessories is contained in the Cube20 System Manual.

Information on accessories is available in our catalog and our online shop at:

onlineshop.murrelektronik.com

Glossary

Actuator shutdown	Short circuit or overload at an output leads to the shutdown
AI	Analog input
AO	Analog output
BN-P	Bus Node - PROFIBUS
Bus Run LED	LED that signals bus status
Bus segment	due to the electrical specification of the RS-485 interface, the number of users in an RS485 network is limited to 32. If there are more than 32 PROFIBUS users, the network must be divided into segments by means of repeaters.
1 byte	corresponds to 8 bits
Cfg F-LED	LED to signal a correct/incorrect configuration
DI	Digital input
DIN TH35	Standardized DIN rail (35x15mm, 35x7.5mm)
DO	Digital output
DP	Decentral Periphery. PROFIBUS protocol for rapid cyclical data exchange
E/A (I/O)	Input/output
EC Directive 2004/108/EEC	EMC Directive
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
FE	Function ground
Freeze Command	The input data of the slave are "frozen".
DDBF	The Device Master Data describes the technical features of a PROFIBUS product. This file is required to configure a PROFIBUS system and is provided by the device manufacturer.
I	Current
I/O	Input/ Output
ID number	A 16-bit number that identifies a PROFIBUS product uniquely. It represents a reference for the GSD file. Several devices have the same ID number, provided they are described in a common GSD file. This number is awarded by the PROFIBUS User Organization.
IEC 61158	Worldwide standard for PROFIBUS DP and FMS. Successor of international standard EN 50170, Volume 2

IP20	Ingress Protection, 20 = Device protection against the ingress of solid foreign bodies measuring a diameter of more than 12.5 mm (finger protection), the device is not protected against ingress of water with deleterious impacts.
LSB	Least Significant Bit.
FO	Optical fiber
MSB	Most Significant Bit.
Ni	Nickel
PAA	Process map of outputs
PAE	Process map of inputs
PELV	Protective Extra Low Voltage
PNO	Profibus Nutzerorganisation e.V. (German Profibus User Organization)
Power-LED	LED to signal the operating status
Pt 100	Temperature sensor on platinum base (0° is equivalent to 100Ω)
+R	High potential sensor connection
-R	Low potential sensor connection
Repeater	Coupling element to process signals between PROFIBUS segments
RL	Sensor power supply in three-wire mode
RTD	Resistance Temperature Device
S	Reference potential
SELV	Safety Extra Low Voltage.
Simatic Manager	Programming software for program-logic controllers made by Siemens
PLC	Program-logic controller
TH	Thermocouple
TH+	High potential sensor connection
TH	Low potential sensor connection
Type E, Type J, Type K, Type N, Type R	Thermocouples as per DIN EN 60584 standard
U	Voltage
U/I	Voltage / current
UA (brown terminal)	Actuator power supply
UA (red terminal)	Module power supply
UB	Operating voltage
UI (red terminal)	Module and sensor power supply
US (brown terminal)	Sensor power supply

VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V. (Association of German Machinery and Industrial Equipment Manufacturers)
VZ	Sign
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie e.V. (German Electrical and Electronic Manufacturers' Association)

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