

BACnet for Grundfos Level Control LC 2X1 and LC 2X2

CIM/CIU 300 BACnet MS/TP

CIM/CIU 500 Ethernet for BACnet IP

Functional profile and user manual



Original functional profile and user manual

This functional profile describes Grundfos BACnet for Level Control LC 2X1 and LC 2X2.

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1. General information**1.1 Hazard statements**

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

**DANGER**

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

**WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

**CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

**SIGNAL WORD****Description of hazard**

Consequence of ignoring the warning.

- Action to avoid the hazard.

1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.



Observe these instructions for explosion-proof products.



A blue or grey circle with a white graphical symbol indicates that an action must be taken.



A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.



If these instructions are not observed, it may result in malfunction or damage to the equipment.



Tips and advice that make the work easier.



Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1.3 About this functional profile

This functional profile describes the following modules and units:

- CIM/CIU 300 BACnet MS/TP
- CIM/CIU 500 Ethernet for BACnet IP.

For the following Grundfos products:

- Grundfos Level Control System LC 231
- Grundfos Level Control System LC 241
- Grundfos Level Control System LC 232
- Grundfos Level Control System LC 242

Note that the supported controllers are referred to as LC 2X1 and LC 2X2 in this document.

Grundfos cannot be held responsible for any problems caused directly or indirectly by using information in this functional profile.

1.4 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming BACnet devices. The reader should have some basic knowledge of the BACnet protocol and technical specifications. It is also assumed that an existing BACnet MS/TP or BACnet IP network is present.

1.5 Definitions and abbreviations

APDU	Application Protocol Data Unit.
ARP	Address Resolution Protocol. Translates IP addresses into MAC addresses.
Auto-MDIX	Ensures that both crossover cable types and non-crossover cable types can be used.
CAT5	Ethernet cable with four twisted pairs of wires.
CAT5e	Enhanced CAT5 cable with better performance.
CAT6	High performance Ethernet cable compatible with CAT5 and CAT5e.
CIM	Communication Interface Module. A Grundfos add-on module.
CIU	Communication Interface Unit. Grundfos box for CIM modules.
CRC	Cyclic Redundancy Check. A data error detection method.
Device	A node on the BACnet MS/TP network.
DHCP	Dynamic Host Configuration Protocol. Used to configure network devices so that they can communicate on an IP network.
DNS	Domain Name System. Used to resolve host names to IP addresses.
GENIbus	Proprietary Grundfos fieldbus standard.
GENIpro	Proprietary Grundfos fieldbus protocol.
Grundfos GO Remote	A Grundfos application designed to control Grundfos products via infrared or radio communication. Available for iOS and Android devices.
HTTP	Hyper Text Transfer Protocol. The protocol commonly used to navigate the world wide web.
IANA	Internet Assigned Numbers Authority.
Inter-network	A set of two or more BACnet networks interconnected by routers.
IP	Internet Protocol.
LED	Light-Emitting Diode.
MAC	Unique network address for a piece of hardware.
MS/TP	Master-Slave / Token-Passing. A data protocol used for BACnet RS-485.
Ping	Packet Internet Groper. A software utility that tests the connectivity between two TCP/IP hosts.
Router	A device that connects two or more networks at the network layer.
SELV	Separated or Safety Extra-Low Voltage.
SELV-E	Separated or Safety Extra-Low Voltage with earth connection.

SMTP	Simple Mail Transfer Protocol.
SNTP	Simple Network Time Protocol. Used for clock synchronisation between computer systems.
TCP	Transmission Control Protocol. Protocol for Internet communication and Industrial Ethernet communication.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol for Internet communication.
Transmission speed	Bits transferred per second, bits/s.
Trunk cable	Main RS-485 cable on a BACnet MS/TP network.
URL	Uniform Resource Locator. The IP address used to connect to a server.
UTC	Coordinated Universal Time. The primary time standard by which the world regulates clocks and time.
UTF-8	Unicode Transformation Format. Character encoding.
VPN	Virtual Private Network. A network using the Internet to connect nodes. These systems use encryption and other security mechanisms to ensure that only authorised users can access the network and that the data cannot be intercepted.

1.6 BACnet

A Grundfos Level Control LC 2X1 can be connected to two wastewater pumps, while a Grundfos Level Control LC 2X2 can be connected to two submersible pumps. LC units provide status information, as well as control and monitoring for a wastewater pit or submersible pump via an operating panel.

1.6.1 BACnet MS/TP, CIM 300

CIM 300 is an add-on communication module that can be installed in an LC 2XX using a 10-pin connector. This enables communication with a PLC, SCADA system, etc.

Via the BACnet MS/TP connection, it is possible to control the system and read status, measured values, etc.

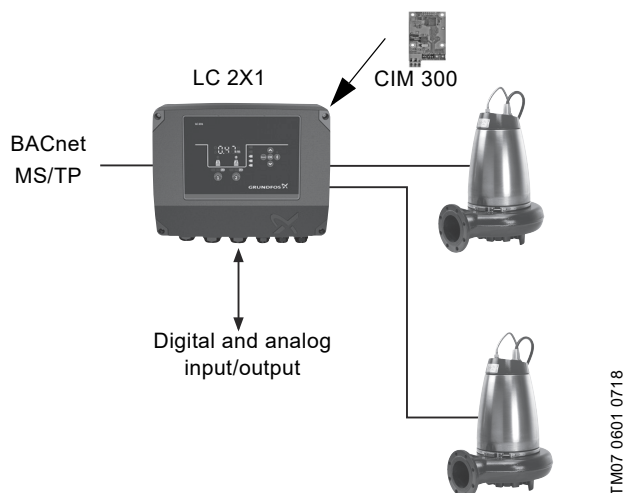


Fig. 1 CIM 300 solution for LC 2X1. One or two pumps can be connected

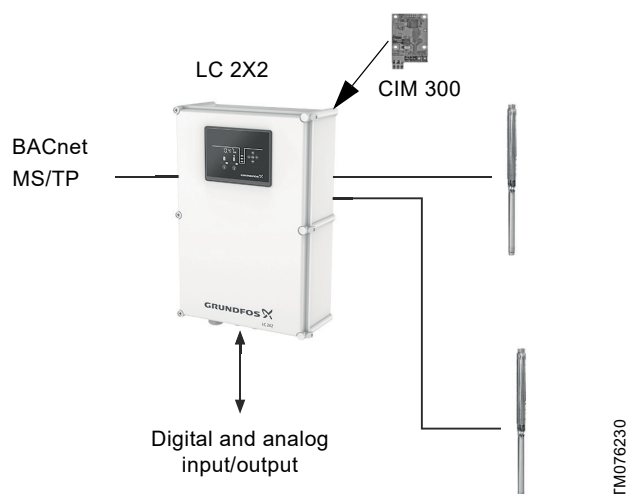


Fig. 2 CIM 300 solution for LC 2X2. One or two pumps can be connected

1.6.2 BACnet IP, CIM 500

CIM 500 is an add-on communication module that can be installed in an LC 2XX using a 10-pin connector. This enables communication with a PLC, SCADA system, etc.

It is possible to control the system over the BACnet IP connection and read status, measured values, etc.

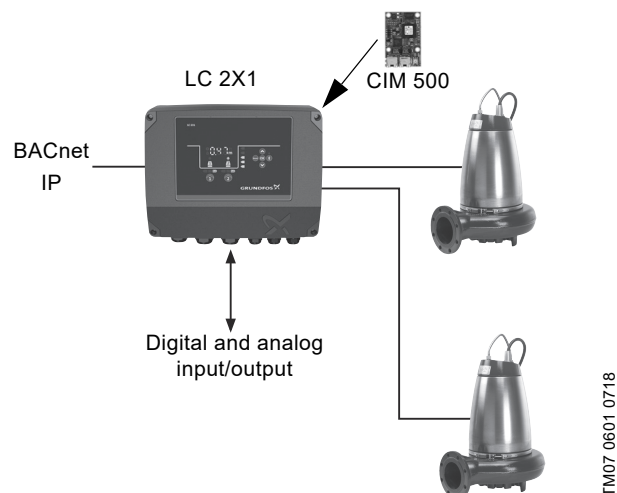


Fig. 3 CIM 500 solution for LC 2X1. One or two pumps can be connected.

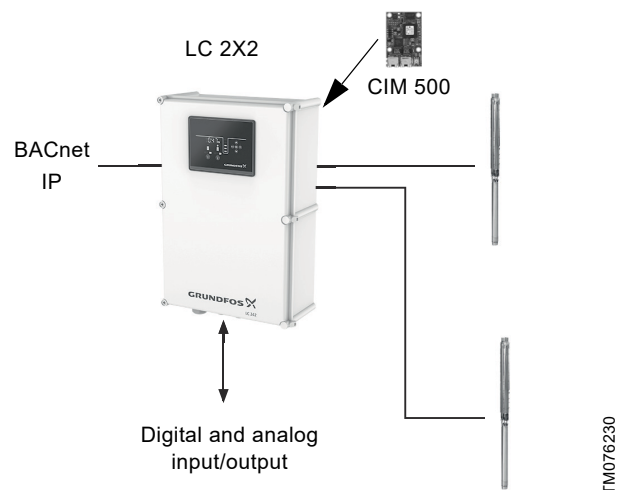


Fig. 4 CIM 500 solution for LC 2X2. One or two pumps can be connected.

1.7 Specifications

General data	Description	Comments
Ambient humidity	30-95 %	Relative, non-condensing.
Operating temperature	-20 to +45 °C	
Storage temperature	-25 to +70 °C	
GENIbus visual diagnostics	LED2	The LED will be in one of these states: Off, permanently green, flashing red, permanently red. See section 2.10 LEDs.
BACnet MS/TP	Description	Comments
BACnet connector	Screw-type terminal	3 pins. See section 2.2 CIM 300 BACnet module.
BACnet connection type	RS-485	
BACnet wire configuration	Two-wire + ground	Conductors: Plus, Minus and Ground. See section 2.3 Connecting to the BACnet network.
Maximum cable length	1200 m	Equals 4000 ft
Recommended cross-section of BACnet cable	0.20 - 0.25 mm ²	AWG24 or AWG23
MAC address	0-127	Set via rotary switches SW6 and SW7. See section 2.7 Selecting the BACnet MAC address.
Line termination	On or Off	Set via DIP switches SW1 and SW2. See section 2.8 Termination resistor.
Supported transmission speeds [bits/s]	9600, 19200, 38400, 76800	Set via DIP switches SW4 and SW5. See section 2.4 Setting the BACnet transmission speed.
Data bits	8	Fixed value
Stop bits	1	Fixed value
Parity	None	Fixed value
BACnet visual diagnostics	LED1	Red and green status LED. See section 2.10.1 LED1, BACnet MS/TP communication.
Maximum number of BACnet devices	32	Using repeaters, this number can be increased.
Grundfos BACnet vendor ID	227	
BACnet segmentation support	No	
Character set support	ANSI X3.4	Base definition for the widely used character code known as ASCII.
BACnet device profile	B-ASC	BACnet Application-Specific controller
BACnet MS/TP master	Yes	CIM/CIU 300 and 500 are BACnet MS/TP master devices.
Manual slave address binding	No	
BACnet protocol revision	For hardware version R4: 4 For hardware version R8: 9	

BACnet IP	Description	Comments
Application layer	DHCP, HTTP, Ping, FTP, SMTP, SNTP, BACnet IP	Rotary switch in position 2.
Transport layer	UDP	
Internet layer	Internet protocol V4 (IPv4)	
Link layer	ARP, media access control (Ethernet)	
Ethernet cable	CAT5, CAT5e or CAT6	Supports auto cable-crossover detecting (Auto-MDIX).
Maximum cable length	100 metres at 10/100 Mbits/s	Corresponds to 328 feet.
Transmission speed	10 Mbits/s, 100 Mbits/s	Auto-detected
Industrial Ethernet protocols	PROFINET IO, BACnet IP etc.	Selected with rotary switch, section 3.2 <i>Setting the Industrial Ethernet protocol</i> .
BACnet protocol revision	9	
CIM 300 and 500		
Dimensions [w x h x d] [mm]	50 x 19 x 80	
Power supply		Supplied by the LC 2XX controller.
Connection to booster system	10-pin connection	

2. BACnet MS/TP, CIM 300 setup

2.1 BACnet bus topology

The Grundfos CIM/CIU 300 unit is connected as a BACnet MS/TP master directly to the BACnet MS/TP network.

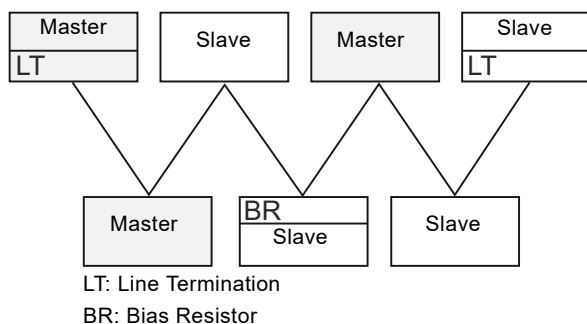


Fig. 5 Example of BACnet MS/TP network

BACnet MS/TP is a multi-master system, meaning that there can be more than one master on the network. It uses a token to control access to the bus network. A master node may initiate the transmission of a data telegram when it holds the token. Both master and slave nodes may transmit data telegrams in response to requests from master nodes, but slaves never hold the token. Master nodes pass the token between them.

A BACnet MS/TP segment is a single contiguous medium to which BACnet nodes are attached. Segments can be connected by use of repeaters or bridges, thus forming networks.

Multiple networks may be interconnected by BACnet routers to form a BACnet inter-network.

2.1.1 Line termination resistors

Line termination must be connected at each of the two ends of the segment medium. CIM/CIU 300 has optional line termination resistor on board.

2.1.2 Bias resistors

At least one set, and no more than two sets, of network bias resistors must exist for each segment so that an undriven communications line will be held in a guaranteed logical one state. The bias provides a reliable way for stations to detect the presence or absence of signals on the line. An unbiased line will take an indeterminate state in the absence of any driving node. CIM/CIU 300 has no bias resistors.

2.2 CIM 300 BACnet module

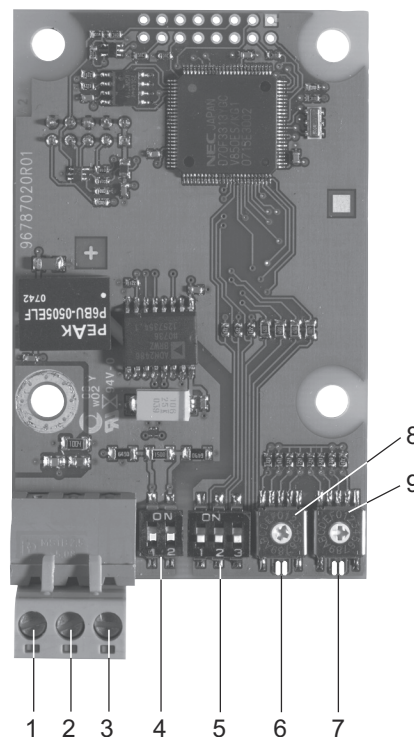


Fig. 6 CIM 300 BACnet module

Pos.	Designation	Description
1	Plus	BACnet plus terminal (RS-485 positive data signal)
2	Minus	BACnet minus terminal (RS-485 negative data signal)
3	Ground	BACnet ground terminal
4	SW1/SW2	On and off switches for termination resistor
5	SW3/SW4/SW5	Switches for selecting the BACnet transmission speed and the default or custom Device Object Instance Number.
6	LED1	Red and green status LED for BACnet communication
7	LED2	Red and green status LED for internal communication between CIM 300 and the Grundfos pump
8	SW6	Hexadecimal rotary switch for setting the BACnet MAC address (four most significant bits)
9	SW7	Hexadecimal rotary switch for setting the BACnet MAC address (four least significant bits)

2.3 Connecting to the BACnet network

Use a screened, twisted-pair cable.

BACnet terminal	Recommended colour	Data signal
Plus	Red	Positive
Minus	Green	Negative
Ground	Grey	Ground

The ANSI/ASHRAE BACnet standard states that the cable screen must only be earthed at one end of the segment to prevent earth fault currents.

2.4 Setting the BACnet transmission speed

Set the transmission speed correctly before CIM 300 is ready to communicate on the BACnet MS/TP network. Use DIP switches SW4 and SW5 to set the transmission speed. The default transmission speed is 9600 bits/s, but we recommend higher speeds for better data throughput. All devices on the BACnet MS/TP network must communicate at the same transmission speed.

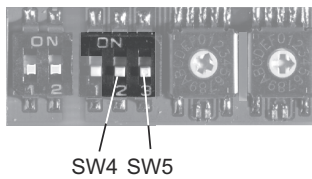


Fig. 7 BACnet transmission speed settings

2.4.1 DIP switch settings

Available transmission speeds in bits/s: 9600, 19200, 38400, 76800.

Use DIP switches SW4 and SW5 to select the desired speed.

Transmission speed [bits/s]	SW4	SW5
9600	OFF	OFF
19200	OFF	ON
38400	ON	OFF
76800	ON	ON

The default transmission speed is 9600 bit/s, as per the BACnet MS/TP standard. The transmission speed will be effective immediately after setting the values of the DIP switch.

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2.5 Selecting the Device Object Instance Number

The Device Object Identifier value consists of two components:

- a 10-bit Object Type (bits 22 to 31)
- a 22-bit Instance Number (bits 0 to 21).



Fig. 8 Bit numbers

The Object Type is fixed and determines that it is a Device Object. The Instance Number is a numeric code that is used to identify the device. It must be unique inter-network-wide, i.e. on all interconnected networks.

CIM 300 offers two different approaches to setting the BACnet Device Object Instance Number: default and custom, both described in the following subsections.

2.5.1 Default Instance Number

By default, CIM 300 uses a predefined Device Object Instance Number, which is 227XXX where XXX is the BACnet MAC address. This gives an Instance Number range of 227000 to 227127. See section 2.7 *Selecting the BACnet MAC address* for more information on MAC addresses.

Example

The BACnet MAC address is set to 20 via the hexadecimal rotary switches, so the Device Object Instance Number is 227020.

2.5.2 Custom Instance Number

To use the complete Instance Number range, set the new Instance Number with the BACnet object Custom Device Object Instance Number (AV, 0), and set SW3 to ON. This will immediately set the new Device Object Instance Number. See fig. 9 for DIP switch location.

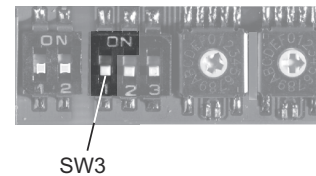


Fig. 9 Device Object Instance Number

Device Object Instance Number	SW3
Default (227000 + BACnet MAC address)	OFF
Custom, set with object (AV, 0)	ON

The default Present_Value of the Custom Device Object Instance Number is 231.

Example

The Present_Value of the Custom Device Object Instance Number (AV, 0) is 231, so the Device Object Instance Number is 231.



The Present_Value of the Custom Device Object Instance Number cannot be 4194303, as this is a reserved value.

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2.6 Selecting the Device Object Name

The property Device_Name is a character string that must be unique inter-network-wide. By default, the name is constructed as "Grundfos - XXXXXX" where XXXXXX is the current Device Object Instance Number as described in section 2.5 *Selecting the Device Object Instance Number*.

Example

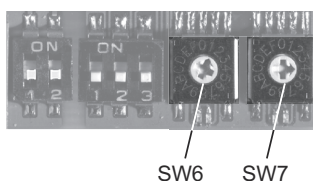
The Device Object Instance Number is 227001, so the Device Object Name is "Grundfos - 227001".

If a new name is selected, it is stored in the device, and replaces the default naming scheme.

2.7 Selecting the BACnet MAC address

To set the BACnet MAC address, use the two hexadecimal rotary switches, SW6 and SW7.

The value must be within the range of 0 to 127. An illegal value results in a MAC address of 0.



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Fig. 10 Setting the BACnet MAC address

For a complete overview of BACnet addresses, see section 10. *BACnet MAC address (CIM 300)*.



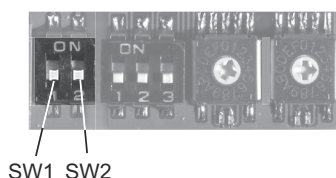
The BACnet MAC address can be set using a decimal value from 0 to 127, and it needs to be unique on the BACnet MS/TP segment.

A power cycle is required to load the selected value.

2.8 Termination resistor

A 120 Ω impedance termination resistor is fitted on CIM 300 for line termination. The resistor has to be cut in if CIM 300 is set as the last station on the network.

CIM 300 has two DIP switches, SW1 and SW2, for cutting the termination resistor in and out. Figure 9 shows the DIP switches in cut-out state.



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Fig. 11 Cutting the termination resistor in and out

Status	SW1	SW2
Cut in	ON	ON
	OFF	OFF
Cut out	ON	OFF
	OFF	ON

Default setting: Termination resistor cut out.

2.9 Cable length

The maximum recommended cable length within a BACnet MS/TP segment is 1200 metres (4000 ft) with 0.82 mm² (AWG 18) cable.

The connection between the BACnet modules must be made by use of a screened, twisted-pair cable with a characteristic impedance between 100 and 130 Ω .

2.10 LEDs

CIM 300 BACnet has two LEDs:

- red and green status LED (LED1) for BACnet MS/TP communication
- red and green status LED (LED2) for internal communication between CIM 300 and the Grundfos pump.

2.10.1 LED1, BACnet MS/TP communication

Status	Description
Off	No communication.
Flashing green	Communication active.
Flashing red	Fault in the BACnet communication.
Permanently red	Fault in the CIM 300 BACnet configuration.

2.10.2 LED2, internal communication

Status	Description
Off	CIM 300 has been switched off or is starting up.
Flashing red	No internal communication between CIM 300 and the pump.
Permanently red	CIM 300 does not support the specific pump version.
Permanently green	Internal communication between CIM 300 and the pump is OK.



During startup, there may be a delay of up to 5 seconds before the LED status is updated.

3. BACnet IP, CIM 500 setup



WARNING

Electric shock

Death or serious personal injury

- Connect CIM 500 only to SELV or SELV-E circuits.

3.1 Connecting the Ethernet cable

Use RJ45 plugs and an Ethernet cable. Connect the cable shield to protective earth at both ends.



It is important to connect the cable shield to earth through an earth clamp or to connect the cable shield to earth in the connector.

CIM 500 is designed for flexible network installation; the built-in two-port switch makes it possible to daisy chain from product to product without the need of additional Ethernet switches. The last product in the chain is only connected to one of the Ethernet ports. Each Ethernet port has its own MAC address.

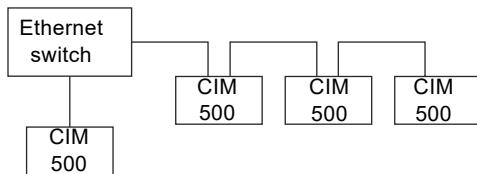


Fig. 12 Example of Industrial Ethernet network

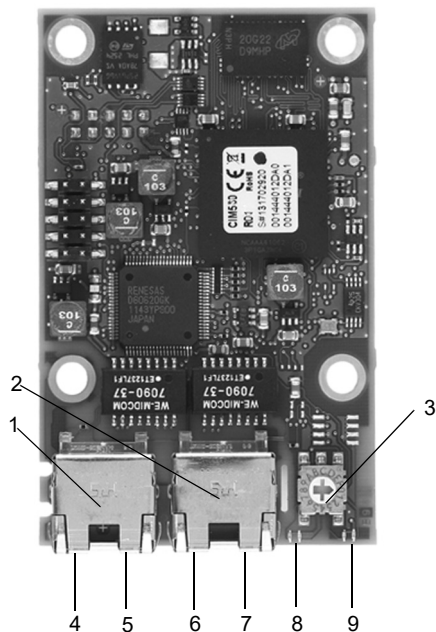


Fig. 13 Example of Ethernet connection

Pos.	Description	Designation
1	Industrial Ethernet RJ45 connector 1	ETH1
2	Industrial Ethernet RJ45 connector 2	ETH2
3	Rotary switch for protocol selection	SW1
4	Data activity LED for connector 1	DATA1
5	Link LED for connector 1	LINK1
6	Data activity LED for connector 2	DATA2
7	Link LED for connector 2	LINK2
8	Green and red status LED for Ethernet communication	LED1
9	Green and red status LED for internal communication between the module and the pump.	LED2

3.2 Setting the Industrial Ethernet protocol

The CIM 500 Ethernet module has a rotary switch for selection of the Industrial Ethernet protocol. See fig. 14.

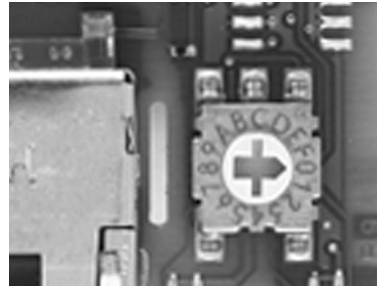


Fig. 14 Selecting the Industrial Ethernet protocol

Pos.	Description
0	PROFINET IO (default)
1	Modbus TCP
2	BACnet IP
3	EtherNet/IP
4	GRM IP (requires a contract with Grundfos)
5	Grundfos iSOLUTIONS Cloud (GiC)
6.E	Reserved, LED1 will be permanently red to indicate an invalid configuration
F	Reset to factory default Note that the rotary switch must be set in this position for 20 seconds to reset to factory default. During this period, LED1 flashes red and green at the same time to indicate that a reset will occur.



Every change of the rotary switch while the module is powered on will cause the module to restart.

3.3 Setting the IP addresses

The CIM 500 Ethernet module is default set to a fixed IP address. You can change the IP address settings from the built-in webserver.

Default IP settings used by the webserver	IP address: 192.168.1.100 Subnet mask: 255.255.255.0 Gateway: 192.168.1.1
IP settings for BACnet IP	Make the settings via the webserver

3.4 Establishing a connection to the webserver

You can configure CIM 500 using the built-in webserver. To establish a connection from a PC to CIM 500, follow these steps:

- Connect the PC and CIM 500 using an Ethernet cable.
- Configure the PC Ethernet port to the same subnetwork as CIM 500, for example 192.168.1.101, and the subnet mask to 255.255.255.0. See section A.2 *How to configure an IP address on your Windows 7 PC* on page 28.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log in to the webserver using:

Username	admin (default)
Password	Grundfos (default)



Username and password may have been changed from their default values.



Change username and password at first login.



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Fig. 15 CIM 500 connected to PC via Ethernet cable

For further information on how to use the webserver, see section A.3 *How to configure an IP address on your Windows 10 PC* on page 28.



You can use both ETH1 and ETH2 to establish a connection to the webserver.



You can access the webserver while the selected Industrial Ethernet protocol is active.

3.5 Status LEDs

The CIM 500 Ethernet module has two status LEDs, LED1 and LED2. See fig. 13.

- Red and green status LED (LED1) for Ethernet communication
- red and green status LED (LED2) for internal communication between CIM 500 and the Grundfos product.

LED1

Status	Description
Off	No BACnet IP communication, or switched off.
Flashing green	BACnet IP communication active.
Permanently red	CIM 500 module configuration fault. See section 8.2.1 <i>LED status</i> .
Permanently red and green	Error in firmware download. See section 8.2.1 <i>LED status</i> .
Flashing red and green	Resetting to factory default. After 20 seconds, CIM 500 restarts.

LED2

Status	Description
Off	CIM 500 is switched off.
Flashing red	No internal communication between CIM 500 and the Grundfos product.
Permanently red	CIM 500 does not support the Grundfos product connected.
Permanently green	Internal communication between CIM 500 and the Grundfos product is OK.
Permanently red and green	Memory fault.



During startup, there is a delay of up to 5 seconds before LED1 and LED2 status is updated.

3.6 DATA and LINK LEDs

The CIM 500 Ethernet module has two connectivity LEDs related to each RJ45 connector. See fig. 13.

DATA1 and DATA2

These yellow LEDs indicate data traffic activity.

Status	Description
Yellow off	No data communication on the RJ45 connector.
Yellow flashing	Data communication ongoing on the RJ45 connector.
Permanently yellow	Heavy network traffic on the RJ45 connector.

LNK1 and LNK2

These green LEDs show whether the Ethernet cable is properly connected.

Status	Description
Green off	No Ethernet link on the RJ45 connector.
Green on	Ethernet link on the RJ45 connector is OK.

4. Supported services

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are described in terms of an "A" and a "B" device. Both devices are nodes on a BACnet inter-network. In most cases, the "A" device will act as the user of data (client), and the "B" device will be the provider of this data (server).

CIM/CIU 300 and 500 are BACnet Application-Specific Controllers (B-ASC) with a few additional services.

4.1 Data-sharing services

Name	BACnet BIBB code	Notes	Initiate	Execute
ReadProperty	DS-RP-B	CIM/CIU 300 and 500 can be providers of data.	-	•
ReadPropertyMultiple	DS-RPM-B	CIM/CIU 300 and 500 can be providers of data and return multiple values at one time.	-	•
WriteProperty	DS-WP-B	CIM/CIU 300 and 500 allow a value to be changed over the network.	-	•
WritePropertyMultiple	DS-WPM-B	CIM/CIU 300 and 500 allow multiple values to be changed over the network.	-	•
SubscribeCOV	DS-COV-B	CIM/CIU modules can be providers of "Change Of Value" data. The modules support up to 10 simultaneous COV subscriptions. Subscription lifetime can be limited or unlimited.	-	•
ConfirmedCOVNotification			•	-
UnconfirmedCOVNotification			•	-

4.2 Device management services

Name	BACnet BIBB code	Notes	Initiate	Execute
Who-Is	DM-DDB-A	CIM/CIU 300 and 500 can seek information about device attributes of other devices and interpret device announcements.	•	-
I-Am			-	•
Who-Is	DM-DDB-B	CIM/CIU 300 and 500 can provide information about their device attributes and respond to requests to identify themselves.	-	•
I-Am			•	-
Who-Has	DM-DOB-B	CIM/CIU 300 and 500 can provide address information about their objects upon request.	-	•
I-Have			•	-
DeviceCommunicationControl	DM-DCC-B	CIM/CIU 300 and 500 can respond to communication control requests. The modules support both limited and unlimited duration. The password, if required, is "Grundfos".	-	•

5. Object overview

5.1 Device Object

The following properties are supported in the Device Object (available for all pump types).

Property identifier	Data type	Description	Access
Object_Identifier	BACnetObjectIdentifier	See section 2.5 <i>Selecting the Device Object Instance Number</i> .	R
Object_Name	CharacterString	See section 2.6 <i>Selecting the Device Object Name</i> for details on object name.	W
Object_Type	BACnetObjectType	DEVICE.	R
System_Status	BACnetDeviceStatus	OPERATIONAL.	R
Vendor_Name	CharacterString	Grundfos.	R
Vendor_Identifier	Unsigned16	227.	R
Model_Name	CharacterString	Shows the Grundfos pump model to which the CIM/CIU module is connected.	R
Firmware_Revision	CharacterString	Revision of the firmware in the CIM/CIU module.	R
Application_Software_Version	CharacterString	Software build date, DD-MM-YYYY.	R
Location	CharacterString	The user can enter a location here (maximum 200 characters).	W
Description	CharacterString	The user can enter a description here (maximum 200 characters).	W
Protocol_Version	Unsigned	Actual version of the BACnet protocol.	R
Protocol_Revision	Unsigned	Actual revision of the BACnet protocol.	R
Protocol_Services_Supported	BACnetServicesSupported	Indicates which standardised protocol services are supported.	R
Protocol_Object_Types_Supported	BACnetObjectTypesSupported	Indicates which standardised protocol object types are supported.	R
Object_List	BACnetARRAY[N]of BACnetObjectIdentifier	An array of objects available.	R
Max_APDU_Length_Accepted	Unsigned	CIM 300: The maximum number of bytes that may be contained in a single APDU. Fixed to 480. CIM 500: The maximum is 1476.	R
Segmentation_Supported	BACnetSegmentation	Indicates if segmentation of messages is possible. Will always read NO_SEGMENTATION to indicate that segmentation is not possible.	R
APDU_Timeout	Unsigned	Indicates the amount of time in ms before time-out.	R
Number_Of_APDU_Retries	Unsigned	Maximum number of times an APDU is to be retransmitted.	R
Max_Master	Unsigned	Specifies the highest possible address for master nodes and must be between 1 and 127. The default value is 127, but this value can be lowered by the user to reduce transmission overhead.	W
Max_Info_Frames	Unsigned	Specifies the maximum number of information frames that are sent before the token is passed on. Fixed to 1.	R
Device_Address_Binding	List of BACnetAddressBindings	Holds address bindings to other devices, if any.	R
Database_Revision	Unsigned	Logical revision number for the device database.	R

5.2 Binary inputs

Binary objects that provide information from a Grundfos pump.

ID	Object name	R/W	Description	LC 2X1	LC 2X2
BI, 0	AcknowledgeAlarm	R	0: Not acknowledged 1: Acknowledged	•	•
BI, 1	FloatSwitch1Status	R	0: Off (Float switch down) 1: On (Float switch up)	•	•
BI, 2	FloatSwitch2Status	R	0: Off (Float switch down) 1: On (Float switch up)	•	•
BI, 3	FloatSwitch3Status	R	0: Off (Float switch down) 1: On (Float switch up)	•	•
BI, 4	FloatSwitch4Status	R	0: Off (Float switch down) 1: On (Float switch up)	•	•
BI, 5	FloatSwitch5Status	R	0: Off (Float switch down) 1: On (Float switch up)	•	•
BI, 6	Pump1Present	R	0: Not present 1: Present	•	•
BI, 7	Pump2Present	R	0: Not present 1: Present	•	•
BI, 8	Pump1Running	R	0: Not running 1: Running	•	•
BI, 9	Pump2Running	R	0: Not running 1: Running	•	•
BI, 10	Pump1CommFault	R	0: No communication fault 1: Pump or auxiliary device communication fault	•	•
BI, 11	Pump2CommFault	R	0: No communication fault 1: Pump or auxiliary device communication fault	•	•
BI, 12	Pump1Alarm	R	0: No Alarm 1: Alarm	•	•
BI, 13	Pump2Alarm	R	0: No Alarm 1: Alarm	•	•
BI, 14	Pump1Warning	R	0: No warning 1: Warning	•	•
BI, 15	Pump2Warning	R	0: No warning 1: Warning	•	•
BI, 16	Pump1Disabled	R	0: Enabled 1: Disabled (Out of operation)	•	•
BI, 17	Pump2Disabled	R	0: Enabled 1: Disabled (Out of operation)	•	•
BI, 18	UserDigitalInBlock, DI 1	R	0: Inactive 1: Active	•	-
BI, 19	UserDigitalInBlock, DI 2	R	0: Inactive 1: Active	•	-
BI, 20	UserDigitalInBlock, DI 3	R	0: Inactive 1: Active	•	-
BI, 21	UserDigitalInBlock, DI 4	R	0: Inactive 1: Active	•	-
BI, 22	UserDigitalInBlock, DI 5	R	0: Inactive 1: Active	•	-
BI, 23	UserDigitalInBlock, DI 6	R	0: Inactive 1: Active	•	-
BI, 24	UserDigitalInBlock, DI 7	R	0: Inactive 1: Active	•	-
BI, 25	UserDigitalInBlock, DI 8	R	0: Inactive 1: Active	•	-
BI, 26	UserDigitalInBlock, DI 9	R	0: Inactive 1: Active	•	-
BI, 27	UserDigitalInBlock, DI 10	R	0: Inactive 1: Active	•	-
BI, 28	UserDigitalInBlock, DI 11	R	0: Inactive 1: Active	•	-

ID	Object name	R/W	Description	LC 2X1	LC 2X2
BI, 29	UserDigitalInBlock, DI 12	R	0: Inactive 1: Active	•	-
BI, 30	UserDigitalInBlock, DI 13	R	0: Inactive 1: Active	•	-
BI, 31	UserDigitalInBlock, DI 14	R	0: Inactive 1: Active	•	-
BI, 32	UserDigitalInBlock, DI 15	R	0: Inactive 1: Active	•	-
BI, 33	UserDigitalInBlock, DI 16	R	0: Inactive 1: Active	•	-
BI, 34	Acknowledge ResetEventLogAlarm	R	0: Not Acknowledged 1: Acknowledged	-	•
BI, 35	Control Status	R	0: Auto control 1: Manual control	-	•

5.3 Binary outputs

Binary objects used for controlling a Grundfos pump.

ID	Object name	R/W	Description	LC 2X1	LC 2X2
BO, 0	Reset alarms	W	0: No resetting 1: Resetting alarms	•	•
BO, 1	Reset EventLog	W	0: No resetting 1: Resetting alarms	-	•

5.4 Multistate inputs

Binary objects that provide information from a Grundfos pump.

ID	Object name	R/W	Description	LC 2X1	LC 2X2
MI, 0	System Operating Mode	R	0: Standby 1: Start-up delay 2: Pumping 3: Stop delay 4: Pumping max 5: Stopped 6: Foam draining 7: Daily emptying 8: Pump antiseizing 9: Manual control 10: Interlock control 11: Mains failure 12: Level sensor error 13: All pumps in alarm 14: All pumps out of operation 15: Service mode, alarms suppressed	•	•
MI, 1	CIM status	R	1: OK 2: EEPROM fault 3: Memory fault 4: Unknown	•	•
MI, 2	System status	R	STATUS_MAIN_STATUS reported by bits 0-2. Possible values: • 1: System OK • 2: Warnings present • 3: Alarms Present • 4: Unknown	-	•
MI, 3	System control sensor type	R	Reports the type of sensor controlling the system. Possible values: • 1: Analog level sensor • 2: Float switch • 3: Unknown	•	•

5.5 Multistate outputs

Objects that contain an enumeration value from the pump.

ID	Object name	R/W	Description	LC 2X1	LC 2X2
MO, 0	Control Pump 1	W	1: Auto 2: Forced start 3: Forced stop	•	•
MO, 1	Control Pump 2	W	1: Auto 2: Forced start 3: Forced stop	•	•

5.6 Analog inputs

Objects with measured values and status information from the pump

ID	Object name	R/W	Description	Unit	LC 2X1	LC 2X2
AI, 0	Fault code	R	Grundfos fault code.	-	•	•
AI, 1	Warning code	R	Grundfos warning code.	-	•	•
AI, 2	HighLevel	R	High level in centimetres.	cm	•	•
AI, 3	StartLevelPump1	R	Start level for pump 1 in centimetres.	cm	•	•
AI, 4	StopLevelPump1	R	Stop level for pump 1 in centimetres.	cm	•	•
AI, 5	StartLevelPump2	R	Start level for pump 2 in centimetres.	cm	•	•
AI, 6	Pit water level	R	Pit water level in centimetres.	cm	•	•
AI, 7	Pit power consumption	R	Pit power consumption in watts.	W	•	•
AI, 8	Pit energy consumption	R	Pit energy consumption in kilowatt hours.	kWh	•	•
AI, 9	Pit running time	R	Pit running time in minutes.	min	•	•
AI, 10	Analog Input 1 (AI1)	R	Analog Input 1	%	•	•
AI, 11	Analog Input 2 (AI2)	R	Analog Input 2	%	•	•
AI, 12	Analog Input 3 (AI3)	R	Analog Input 3	%	•	•
AI, 13	Pump1 time to service	R	Pump 1 time to service in minutes.	min	•	•
AI, 14	Pump2 time to service	R	Pump 2 time to service in minutes.	min	•	•
AI, 15	Pump1 start counter	R	Pump 1 start counter.	-	•	•
AI, 16	Pump2 start counter	R	Pump 2 start counter.	-	•	•
AI, 17	Pump1 current	R	Pump 1 current in amperes.	A	•	•
AI, 18	Pump2 current	R	Pump 2 current in amperes.	A	•	•
AI, 19	Pump1 operating time	R	Pump 1 overall operating time in minutes.	min	•	•
AI, 20	Pump2 operating time	R	Pump 2 overall operating time in minutes.	min	•	•
AI, 21	UserAnalogInput1	R	User-defined measurement, analog input 1.	%	•	•
AI, 22	UserAnalogInput2	R	User-defined measurement, analog input 2.	%	•	•
AI, 23	UserAnalogInput3	R	User-defined measurement, analog input 3.	%	•	•
AI, 24	UserAnalogInput4	R	User-defined measurement, analog input 4.	%	•	•
AI, 25	UserAnalogInput5	R	User-defined measurement, analog input 5.	%	•	•
AI, 26	Last operating time pump1	R	Last operating time for Pump 1.	s	•	•
AI, 27	Last operating time pump2	R	Last operating time for Pump 2.	s	•	•
AI, 28	Energy consumption pump1	R	Energy consumption Pump 1.	kWh	•	•
AI, 29	Energy consumption pump2	R	Energy consumption Pump 2.	kWh	•	•
AI, 30	System Energy today	R	DATA_ENERGY_TODAY reported with 0.1 kWh resolution.	kWh	-	•
AI, 31	PulseFlowMeter	R	DATA_PULSE_FLOW_METER	l/s	-	•
AI, 32	Turbidity	R	DATA_TURBIDITY reported with 0.1 NTU resolution.	NTU	-	•
AI, 33	PhMeasure	R	DATA_PH_MEASURE reported with 0.1 pH resolution.	pH	-	•
AI, 34	Conductivity	R	DATA_CONDUCTIVITY reported with 1 S/m resolution.	S/m	-	•
AI, 35	Pump1OprTimeToday	R	DATA_PUMP1_RUNTIME_TODAY	min	-	•
AI, 36	Pump2OprTimeToday	R	DATA_PUMP2_RUNTIME_TODAY	min	-	•
AI, 37	Pump1StartCounterToday	R	DATA_PUMP1_RUNTIME_TODAY	min	-	•
AI, 38	Pump2StartCounterToday	R	DATA_PUMP2_RUNTIME_TODAY	min	-	•
			Values are transmitted in the following order:			
			<ul style="list-style-type: none"> • bit 0: Status warnings1 • bit 1: Status warnings2 • bit 2: Status warnings3 • bit 3: Status warnings4 • bit 4: Status warnings5 • bit 8: Status alarms1 			
AI, 39	Alarms 1-5 and warnings 1-5	R	<ul style="list-style-type: none"> • bit 9: Status alarms2 • bit 10: Status alarms3 • bit 11: Status alarms4 • bit 12: Status alarms5 	-	•	•
			Bit values indicate the following:			
			<ul style="list-style-type: none"> • bit value 0: Alarm or warning not present • bit value 1: Alarm or warning present 			

ID	Object name	R/W	Description	Unit	LC 2X1	LC 2X2
AI, 40	Sensor present status	R	<p>Values are transmitted in the following order:</p> <ul style="list-style-type: none"> • bit 0: Flow sensor present • bit 1: Power/energy sensor present • bit 2: AI sensor 1 present • bit 3: AI sensor 2 present • bit 4: AI sensor 3 present • bit 5: AI sensor 4 present • bit 6: AI sensor 5 present • bit 7: Turbidity sensor present • bit 8: pH sensor present • bit 9: Conductivity sensor present • bit 10: Pulse flow meter present • bit 11: Pressure sensor present • bit 12: Level sensor present <p>Bit values indicate the following:</p> <ul style="list-style-type: none"> • bit value 0: Sensor not present • bit value 1: Sensor present 	-	•	•

5.7 Analog outputs

Object for setting a new setpoint in the pump.

ID	Object name	R/W	Notes	Unit	LC 2X1	LC 2X2
AO, 0	SetHighLevel	W	Set high level in centimetres.	cm	•	•
AO, 1	SetDryRunningLevel	W	Set dry running level in centimetres.	cm	•	•
AO, 2	SetStartLevelPump1	W	Set start level for pump 1 in centimetres.	cm	•	•
AO, 3	SetStopLevelPump1	W	Set stop level for pump 1 in centimetres.	cm	•	•
AO, 4	SetStartLevelPump2	W	Set start level for pump 2 in centimetres.	cm	•	•

5.8 Analog values

Objects for configuration of the module, the unit and the pump.

ID	Object name	R/W	Notes	Unit	LC 2X1	LC 2X2
AV, 0	Custom device object instance number	R/W	Present_Value range: 0-0x3FFFFE. Default Present_Value: 0xE7. [RD = 0]	-	•	•
AV, 1	Product time and date	R/W	Set clock in UNIX format.	s	•	•
AV, 2	CIMSoftwareVersionNumber	R	Decimal value	-	-	•

6. Detailed description

6.1 Fault monitoring and resetting

This example shows how to monitor faults or warnings in the Grundfos pump and how to manually reset a fault.

The Fault code object (AI, 0) and the Warning code object (AI, 1) can both hold a Grundfos-specific fault code. See section 10. *BACnet MAC address (CIM 300)* for code interpretation.

Warnings are notifications only and will not stop the pump, whereas faults will stop the pump. Most pumps can be configured to either automatically reset the fault when the fault condition disappears, or to require manual resetting.

If a fault is to be manually reset, use the Reset fault object (BO, 0). When the Present_Value of this object is set to 1, a Reset fault command is sent to the device.

7. Commissioning

7.1 Step-by-step guide to hardware setup, CIM 300

Step	Action
1	Complete the pump configuration, for example sensor configuration.
2	Select the BACnet MAC address (0-127) on CIM 300. See section 2.7 <i>Selecting the BACnet MAC address</i> .
3	Select the transmission speed of CIM 300. See section 2.4 <i>Setting the BACnet transmission speed</i> .
4	Select the Device Object Instance Number. See section 2.5 <i>Selecting the Device Object Instance Number</i> .
5	If necessary, set line termination. See section 2.8 <i>Termination resistor</i> .
6	Connect the necessary cables from CIM 300 to the BACnet network. See section 2.3 <i>Connecting to the BACnet network</i> .
7	Confirm that the GENibus LED is permanently green and that the BACnet LED is either off or flashing green, indicating communication. See section 2.10 <i>LEDs</i> .
CIM 300 is now configured and ready.	

7.2 BACnet IP communication setup, CIM 500

Step	Action
1	Install CIM 500 in the Grundfos product according to the product documentation.
2	Select position 2 at the protocol rotary switch. See section 3.2 <i>Setting the Industrial Ethernet protocol</i> .
3	Power on the product, and observe that LED2 turns permanently green and LED1 remains off.
4	Complete the pump configuration, for example sensor configuration, and selection of local Operating mode, local Control mode and local Setpoint, for example with Grundfos GO Remote.
5	Connect one of the CIM 500 Ethernet ports (RJ45) to a PC using an Ethernet cable.
6	Configure the PC Ethernet port to the same subnetwork as CIM 500, for example 192.168.1.1, and the subnet mask to 255.255.255.0. See section A.2 <i>How to configure an IP address on your Windows 7 PC</i> on page 28.
7	Open your Internet browser and make contact to the CIM 500 webserver. Default: 192.168.1.100
8	Log in to the webserver. Default: Username: admin Password: Grundfos.
9	In the menu column to the left select: Configuration > Real time Ethernet protocol
10	Type in the required settings for BACnet IP. See section A.3 <i>How to configure an IP address on your Windows 10 PC</i> on page 28.
11	Click [Submit] to transfer the new settings, and close the web browser.

CIM 500 is now ready to be accessed from a BACnet IP master via one of its Ethernet ports. Use the IP address selected under step 9.

- The CIM 500 LED1 will be flashing green when BACnet IP communication takes place.
- You can use the two Ethernet ports for daisy chaining of CIM 500 modules.
- It is possible to have connection to the webserver simultaneously with a connection to a BACnet IP master.
- It is possible to have connection to more BACnet IP masters simultaneously, for example to have connection to PC Tool CIM/CIU while connected to another BACnet IP master.

8. Fault finding the product

8.1 CIM 300 BACnet MS/TP

8.1.1 LED status

Faults in a CIM 300 can be detected by observing the status of the two communication LEDs. See the table below.

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected, and 5 seconds have passed.	a) CIM 300 is defective.	Replace CIM 300.
2. LED2 for internal communication is flashing red.	a) No internal communication between CIM 300 and the Grundfos pump.	<ul style="list-style-type: none"> Check that the individual conductors are fitted correctly. Check the power supply to the pump.
3. LED2 for internal communication is permanently red.	a) CIM 300 does not support the connected pump.	Contact the nearest Grundfos company.
4. BACnet LED1 is permanently red.	a) Fault in the CIM 300 BACnet configuration.	<ul style="list-style-type: none"> Ensure that the BACnet MAC address has a valid setting. See section 2.7 <i>Selecting the BACnet MAC address</i>. Ensure that the Device Object Instance Number is within the allowed range. See section 2.5 <i>Selecting the Device Object Instance Number</i>.
5. BACnet LED1 is flashing red.	a) Fault in the BACnet communication (cyclic redundancy check).	<ul style="list-style-type: none"> Check the transmission speed, switches SW4 and SW5. See section 2.4 <i>Setting the BACnet transmission speed</i>. Check the cable connection between CIM 300 and the BACnet network. Check the termination resistor settings, switches SW1 and SW2. See section 2.8 <i>Termination resistor</i>.

8.1.2 BACnet faults

Fault	Possible cause	Remedy
1. CIM 300 does not communicate on the BACnet MS/TP network.	a) Configuration or wiring fault.	<p>Ensure that the cable between the BACnet MS/TP devices is connected correctly. See section 2.3 <i>Connecting to the BACnet network</i> for wiring recommendations.</p> <p>Ensure that the BACnet MAC address and Device Object Instance Number are configured correctly and are unique on the network. See section 2.7 <i>Selecting the BACnet MAC address</i> and 2.5 <i>Selecting the Device Object Instance Number</i> for address selections.</p> <p>Ensure that the transmission speed is configured correctly. See section 2.4 <i>Setting the BACnet transmission speed</i>.</p> <p>Ensure that each end of the BACnet MS/TP trunk cable is terminated, if necessary. See section 2.8 <i>Termination resistor</i> for line termination of Grundfos CIM/CIU 300.</p> <p>Ensure that the bus topology for a BACnet MS/TP network is correct.</p>
	b) CIM 300 is instructed to not communicate on the BACnet network via the DeviceCommunicationControl service.	Use the DeviceCommunicationControl service to enable communication from the device.

8.2 CIM 500 BACnet IP

You can detect faults in CIM 500 by observing the status of the two communication LEDs. See the table below.

8.2.1 LED status

CIM 500 connected to an LC 2XX.

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected.	a) CIM 500 is fitted incorrectly in the Grundfos product. b) CIM 500 is defective.	Check that CIM 500 is fitted and connected correctly. Replace CIM 500.
2. LED2 for internal communication is flashing red.	a) No internal communication between CIM 500 and the Grundfos product.	Check that CIM 500 is fitted correctly in the Grundfos product.
3. LED2 for internal communication is permanently red.	a) CIM 500 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
4. BACnet LED1 is permanently red.	a) Fault in the CIM 500 BACnet IP configuration.	Check that the rotary switch SW1 is set to 2. Check that BACnet IP address configuration is correct. See section A.3 <i>How to configure an IP address on your Windows 10 PC</i> on page 28.
5. LED1 is permanently red and green at the same time.	a) Error in firmware download.	Use the webserver to download the firmware again.
6. LED2 is permanently red and green at the same time.	a) Memory fault.	Replace CIM 500.

8.2.2 CIM 500 BACnet IP communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams.	a) Configuration or wiring error.	<ul style="list-style-type: none"> Check the visual diagnostics on the BACnet slave. Normal conditions are that the Grundfos GENibus LED (LED2) is permanently green and that the BACnet IP LED (LED1) is off or flashing green. If not, see section 8.2.1 <i>LED status</i>. Make sure that the cable between the BACnet IP master and the BACnet slave is connected correctly. See section 3.1 <i>Connecting the Ethernet cable</i>. Ensure that the slave IP address is configured correctly, and that the correct slave IP address is used in the BACnet master poll. See section 3.3 <i>Setting the IP addresses</i>.
2. The slave returns data value 0xFFFF (65535).	a) The value is unavailable. A data value of 0xFFFF does not necessarily indicate an error condition. It means that the value is unavailable from the controller. b) The product is not configured to show the value or lacks a sensor to read the value.	See section 5. <i>Object overview</i> for available data. See section 5.6 <i>Analog inputs</i> for data values that require a sensor.

9. BACnet telegrams

9.1 BACnet MS/TP telegram overview

All BACnet MS/TP telegrams have the following format:

Preamble	Telegram type	Destination	Source	Length	Header CRC	Data	Data CRC	Pad
2 bytes: 0x55 0xFF	1 byte	1 byte	1 byte	2 bytes, MSB first	1 byte	Variable, [0-501] bytes	2 bytes, LSB first	At most 1 byte 0xFF

For BACnet MS/TP, the destination address and source address are MAC addresses. See section 2.7 *Selecting the BACnet MAC address*. A destination address of 255 (0xFF) denotes broadcast. The length field specifies the length in bytes of the data field, which must be between 0 and 501 bytes long.

9.2 Telegram types

The available telegram types are listed below.

Type	Name	Description
00	Token	Used to pass network mastership to the destination device.
01	Poll for master	Discovers the presence of other master devices on the network.
02	Reply to poll for master	Used by a master to indicate a wish to enter the token ring.
03	Test request	Used to initiate a loopback test.
04	Test response	A reply to a test request telegram.
05	BACnet data, expecting reply	Used for data transmission where a reply is expected.
06	BACnet data, not expecting reply	Used for data transmission where no reply is expected.
07	Reply postponed	Used by master devices to defer sending a BACnet data reply.

10. BACnet MAC address (CIM 300)

BACnet address	SW6	SW7
0	0	0
1	0	1
2	0	2
3	0	3
4	0	4
5	0	5
6	0	6
7	0	7
8	0	8
9	0	9
10	0	A
11	0	B
12	0	C
13	0	D
14	0	E
15	0	F
16	1	0
17	1	1
18	1	2
19	1	3
20	1	4
21	1	5
22	1	6
23	1	7
24	1	8
25	1	9
26	1	A
27	1	B
28	1	C
29	1	D
30	1	E
31	1	F
32	2	0
33	2	1
34	2	2
35	2	3
36	2	4
37	2	5
38	2	6
39	2	7
40	2	8
41	2	9
42	2	A
43	2	B
44	2	C
45	2	D
46	2	E
47	2	F
48	3	0
49	3	1
50	3	2

BACnet address	SW6	SW7
51	3	3
52	3	4
53	3	5
54	3	6
55	3	7
56	3	8
57	3	9
58	3	A
59	3	B
60	3	C
61	3	D
62	3	E
63	3	F
64	4	0
65	4	1
66	4	2
67	4	3
68	4	4
69	4	5
70	4	6
71	4	7
72	4	8
73	4	9
74	4	A
75	4	B
76	4	C
77	4	D
78	4	E
79	4	F
80	5	0
81	5	1
82	5	2
83	5	3
84	5	4
85	5	5
86	5	6
87	5	7
88	5	8
89	5	9
90	5	A
91	5	B
92	5	C
93	5	D
94	5	E
95	5	F
96	6	0
97	6	1
98	6	2
99	6	3
100	6	4
101	6	5

BACnet address	SW6	SW7
102	6	6
103	6	7
104	6	8
105	6	9
106	6	A
107	6	B
108	6	C
109	6	D
110	6	E
111	6	F
112	7	0
113	7	1
114	7	2
115	7	3
116	7	4
117	7	5
118	7	6
119	7	7
120	7	8
121	7	9
122	7	A
123	7	B
124	7	C
125	7	D
126	7	E
127	7	F

If the MAC address switches are set to an invalid MAC address value, a MAC address of 0 will be used.

11. Grundfos alarm and warning codes

This is a complete list of alarm and warning codes for Grundfos products. For the codes supported by this product, see the alarms and warnings section.

Code	Description	Code	Description	Code	Description
1	Leakage current	36	Outlet valve leakage	71	Motor temperature 2 (Pt100, t_mo2)
2	Missing phase	37	Inlet valve leakage	72	Hardware fault, type 1
3	External fault signal	38	Vent valve defective	73	Hardware shutdown (HSD)
4	Too many restarts	39	Valve stuck or defective	74	Internal supply voltage too high
5	Regenerative braking	40	Undervoltage	75	Internal supply voltage too low
6	Mains fault	41	Undervoltage transient	76	Internal communication fault
7	Too many hardware shutdowns	42	Cut-in fault (dV/dt)	77	Communication fault, twin-head pump
8	PWM switching frequency reduced	43	-	78	Fault, speed plug
9	Phase sequence reversal	44	-	79	Functional fault, add-on module
10	Communication fault, pump	45	Voltage asymmetry	80	Hardware fault, type 2
11	Water-in-oil fault (motor oil)	46	-	81	Verification error, data area (RAM)
12	Time for service (general service information)	47	-	82	Verification error, code area (ROM, FLASH)
13	Moisture alarm, analog	48	Overload	83	Verification error, FE parameter area (EEPROM)
14	Electronic DC-link protection activated (ERP)	49	Overcurrent (i_line, i_dc, i_mo)	84	Memory access error
15	Communication fault, main system (SCADA)	50	Motor-protection function, general shutdown (MPF)	85	Verification error, BE parameter area (EEPROM)
16	Other	51	Blocked motor or pump	86	Fault (add-on) I/O module
17	Performance requirement cannot be met	52	Motor slip high	87	-
18	Commanded alarm standby (trip)	53	Stalled motor	88	Sensor fault
19	Diaphragm break (dosing pump)	54	Motor-protection function, 3 sec. limit	89	Signal fault, (feedback) sensor 1
20	Insulation resistance low	55	Motor current protection activated (MCP)	90	Signal fault, speed sensor
21	Too many starts per hour	56	Underload	91	Signal fault, temperature sensor 1
22	Moisture switch alarm, digital	57	Dry running	92	Calibration fault, (feedback) sensor
23	Smart trim gap alarm	58	Low flow	93	Signal fault, sensor 2
24	Vibration	59	No flow	94	Limit exceeded, sensor 1
25	Setup conflict	60	Low input power	95	Limit exceeded, sensor 2
26	Load continues even if the motor has been switched off	61	-	96	Setpoint signal outside range
27	External motor protector activated (for example MP 204)	62	-	97	Signal fault, setpoint input
28	Battery low	63	-	98	Signal fault, input for setpoint influence
29	Turbine operation (impellers forced backwards)	64	-	99	Signal fault, input for analog setpoint
30	Change bearings (specific service information)	65	Motor temperature 1 (t_m or t_mo or t_mo1)	100	RTC time synchronisation with cellular network occurred
31	Change varistor(s) (specific service information)	66	Temperature, control electronics (t_e)	101	-
32	Overvoltage	67	Temperature too high, internal frequency converter module (t_m)	102	Dosing pump not ready
33	Soon time for service (general service information)	68	External temperature or water temperature (t_w)	103	Emergency stop
34	No priming water	69	Thermal relay 1 in motor, for example Klixon	104	Software shutdown
35	Gas in pump head, de-aerating problem	70	Thermal relay 2 in motor, for example thermistor	105	Electronic rectifier protection activated (ERP)

Code	Description	Code	Description	Code	Description
106	Electronic inverter protection activated (EIP)	141	-	176	Signal fault, temperature sensor 3 (t_mo3)
107	-	142	-	177	Signal fault, Smart trim gap sensor
108	-	143	-	178	Signal fault, vibration sensor
109	-	144	Motor temperature 3 (Pt100, t_mo3)	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing
110	Skew load, electrical asymmetry	145	Bearing temperature high (Pt100), in general or top bearing	180	Signal fault, bearing temperature sensor (Pt100), middle bearing
111	Current asymmetry	146	Bearing temperature high (Pt100), middle bearing	181	Signal fault, PTC sensor (short-circuited)
112	Cosφ too high	147	Bearing temperature high (Pt100), bottom bearing	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing
113	Cosφ too low	148	Motor bearing temperature high (Pt100) in drive end (DE)	183	Signal fault, extra temperature sensor
114	Motor heater function activated (frost protection)	149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	184	Signal fault, general-purpose sensor
115	Too many grinder reversals or grinder reversal attempt failed	150	Fault (add-on) pump module	185	Unknown sensor type
116	Grinder motor overtemperature	151	Fault, display (HMI)	186	Signal fault, power meter sensor
117	Intrusion (door opened)	152	Communication fault, add-on module	187	Signal fault, energy meter
118	Signal fault, hydrogen sulfide H2S sensor	153	Fault, analog output	188	Signal fault, user-defined sensor
119	Signal fault, analog input AI4	154	Communication fault, display	189	Signal fault, level sensor
120	Auxiliary winding fault (single phase motors)	155	Inrush fault	190	Limit exceeded, sensor 1 (for example alarm level in WW application)
121	Auxiliary winding current too high (single-phase motors)	156	Communication fault, internal frequency converter module	191	Limit exceeded, sensor 2 (for example high level in WW application)
122	Auxiliary winding current too low (single-phase motors)	157	Real-time clock out of order	192	Limit exceeded, sensor 3 (for example overflow level in WW application)
123	Start capacitor, low (single-phase motors)	158	Hardware circuit measurement fault	193	Limit exceeded, sensor 4 (for example low level in WW/tank filling application)
124	Run capacitor, low (single-phase motors)	159	CIM fault (Communication Interface Module)	194	Limit exceeded, sensor 5
125	Signal fault, outdoor temperature sensor	160	Cellular modem, SIM card fault	195	Limit exceeded, sensor 6
126	Signal fault, air temperature sensor	161	Sensor supply fault, 5 V	196	Operation with reduced efficiency
127	Signal fault, shunt relative pressure sensor	162	Sensor supply fault, 24 V	197	Operation with reduced pressure
128	Strainer clogged	163	Measurement fault, motor protection	198	Operation with increased power consumption
129	-	164	Signal fault, LiqTec sensor	199	Process out of range (monitoring, estimation, calculation, control)
130	-	165	Signal fault, analog input 1	200	Application alarm
131	-	166	Signal fault, analog input 2	201	External sensor input high
132	-	167	Signal fault, analog input 3	202	External sensor input low
133	-	168	Signal fault, pressure sensor	203	Alarm on all pumps
134	-	169	Signal fault, flow sensor	204	Inconsistency between sensors
135	-	170	Signal fault, water-in-oil (WIO) sensor	205	Level float switch sequence inconsistency
136	-	171	Signal fault, moisture sensor	206	Water shortage, level 1
137	-	172	Signal fault, atmospheric pressure sensor	207	Water leakage
138	-	173	Signal fault, rotor position sensor (Hall sensor)	208	Cavitation
139	-	174	Signal fault, rotor origo sensor	209	Non-return valve fault
140	-	175	Signal fault, temperature sensor 2 (t_mo2)	210	High pressure

Code	Description	Code	Description	Code	Description
211	Low pressure	226	Communication fault, I/O module	241	Motor phase failure
212	Diaphragm tank precharge pressure out of range	227	Combi event	242	Automatic motor model recognition failed
213	VFD not ready	228	Night flow max. limit exceeded	243	Motor relay has been forced (manually operated or commanded)
214	Water shortage, level 2	229	Water on floor	244	Fault, On/Off/Auto switch
215	Soft pressure buildup time-out	230	Network alarm	245	Pump continuous runtime too long
216	Pilot pump alarm	231	Ethernet: No IP address from DHCP server	246	User-defined relay has been forced (manually operated or commanded)
217	Alarm, general-purpose sensor high	232	Ethernet: Auto-disabled due to misuse	247	Power-on notice, (device or system has been switched off)
218	Alarm, general-purpose sensor low	233	Ethernet: IP address conflict	248	Fault, battery/UPS
219	Pressure relief not adequate	234	Backup pump alarm	249	User-defined event 1
220	Fault, motor contactor feedback	235	Gas detected	250	User-defined event 2
221	Fault, mixer contactor feedback	236	Pump 1 fault	251	User-defined event 3
222	Time for service, mixer	237	Pump 2 fault	252	User-defined event 4
223	Time for service, mixer	238	Pump 3 fault	253	SMS data from DDD sensor not received within time limit
224	Pump fault, due to auxiliary component or general fault	239	Pump 4 fault	254	Inconsistent data model
225	Communication fault, pump module	240	Lubricate bearings (specific service information)		

Appendix

The appendix describes the parts of the CIM 500 webserver needed for the configuration of a BACnet IP Ethernet connection. For other CIM 500 webserver features, not specifically related to BACnet IP, see the installation and operating instructions for CIM 500.

A.1 Webserver configuration

The built-in webserver is an easy and effective way to monitor the status of CIM 500 and configure the available functions and Industrial Ethernet protocols. The webserver also makes it possible to update the firmware of CIM 500, and store or restore settings.

To establish a connection from a PC to CIM 500, proceed as follows:

Before configuration

- Check that the PC and CIM 500 are connected via an Ethernet cable.
- Check that the PC Ethernet port is set to the same network as CIM 500. For network configuration, see section A.2 *How to configure an IP address on your Windows 7 PC*.

To establish a connection from a PC to CIM 500 for the first time, the following steps are required:

1. Open a standard Internet browser and type 192.168.1.100 in the URL address field.
2. Log in to the webserver.

A.2 How to configure an IP address on your Windows 7 PC

For connecting a PC to CIM 500 via Ethernet, the PC must be set to use a fixed (static) IP address belonging to the same subnetwork as CIM 500.

1. Open "Control Panel".
2. Enter "Network and Sharing Center".
3. Click "Change adapter settings".
4. Right-click and select "Properties" for Ethernet adapter. Typically "Local Area Connection".
5. Select properties for "Internet Protocol Version 4(TCP/IPv4)".
6. Select the "Alternate Configuration" tab.
7. Configure an IP address and subnet mask to be used by your PC. See fig. 1.

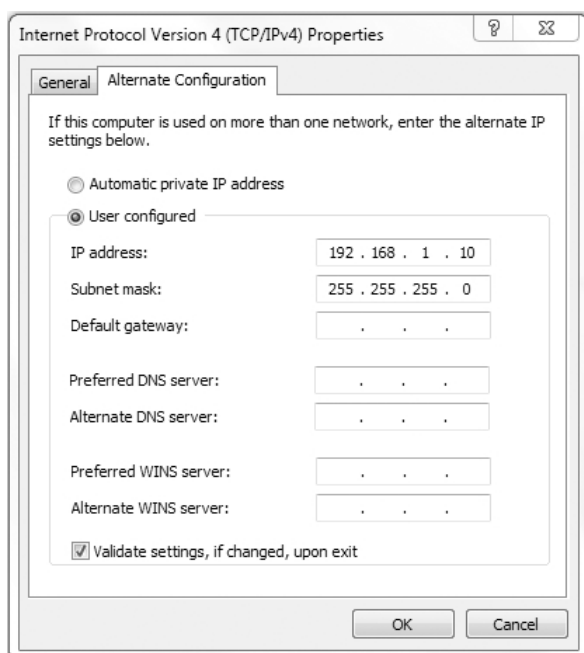


Fig. 1 Example from Windows 7

A.3 How to configure an IP address on your Windows 10 PC

1. Search for "Ethernet" in Windows.
2. Select "Change Ethernet setting".
3. Select "Change adapter options".
4. Right-click "Ethernet" and select "Properties".
5. Select properties for "Internet Protocol Version 4 (TCP/IPv4)".
6. Select the "Alternate Configuration" tab and enter the user-configured IP address and subnet mask you would like to assign to your PC.

A.4 Login

Fig. 2 Login

Object	Description
Username	Enter username. Default: admin.
Password	Enter password. Default: Grundfos. After the first log in, you are forced to change the password. The password must contain: <ul style="list-style-type: none"> • at least 8 and maximum 20 characters • at least one lower case letter • at least one upper case letter • at least one numeric or special character. When logging in, you have four attempts before a back-off algorithm starts an exponentially increasing time delay between each attempt. Power cycling CIM 500 resets the back-off algorithm.



Username and password can be changed on the webserver under "User Management"



Change username and password at first login.

A.5 BACnet IP configuration

GRUNDFOS

Information

- System
- Version
- Licence

Configuration

- Real Time Ethernet Protocol**
- Network Settings
- GENlpro TCP Protocol
- Email
- Time
- User Management
- Firmware Update

Logout

Contact

Real Time Ethernet Protocol Configuration - BACnet IP

Protocol Settings

UDP Port Number: 47808

Device Instance: 227000

Device Name:

Device Location:

Max APDU: 1476

Custom device instance enable: ☐

Foreign Device settings

Foreign Device: ☐

IP Address: 0.0.0.0

UDP Port : 47808

Re Register Time: 30

Submit

Fig. 3 Real Time Ethernet Protocol Configuration - BACnet IP

Object	Description
UDP Port Number	Select the UDP port number. The default number is 47808, the standard UDP port number for BACnet IP.
Device Instance	Select the Device Instance. The default number is 227000. The Device Instance must be unique in the BACnet network. Grundfos is 227 and it is fixed. The last three digits can be changed.
Device Name	You can name the device. The device name must be unique in the BACnet network (optional).
Device Location	You can name the device location for local identification (optional).
Max APDU	Select the maximum Application Protocol Data Unit, between 50 and 1476. By default it is 1476 bytes.
Custom device instance enable	If ticked, CIM 500 is configured to use a BACnet custom device instance number.
Foreign Device	If ticked, CIM 500 is configured as a foreign device.
IP Address	Enter the foreign IP address.
UDP Port	Select the UDP port number. The default number is 47808.
Re Register Time	Select the time period during which the foreign device must re-register on the BACnet network.



The IP address and subnet mask can be defined under "Network Settings".

TM06 08/17 1014

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