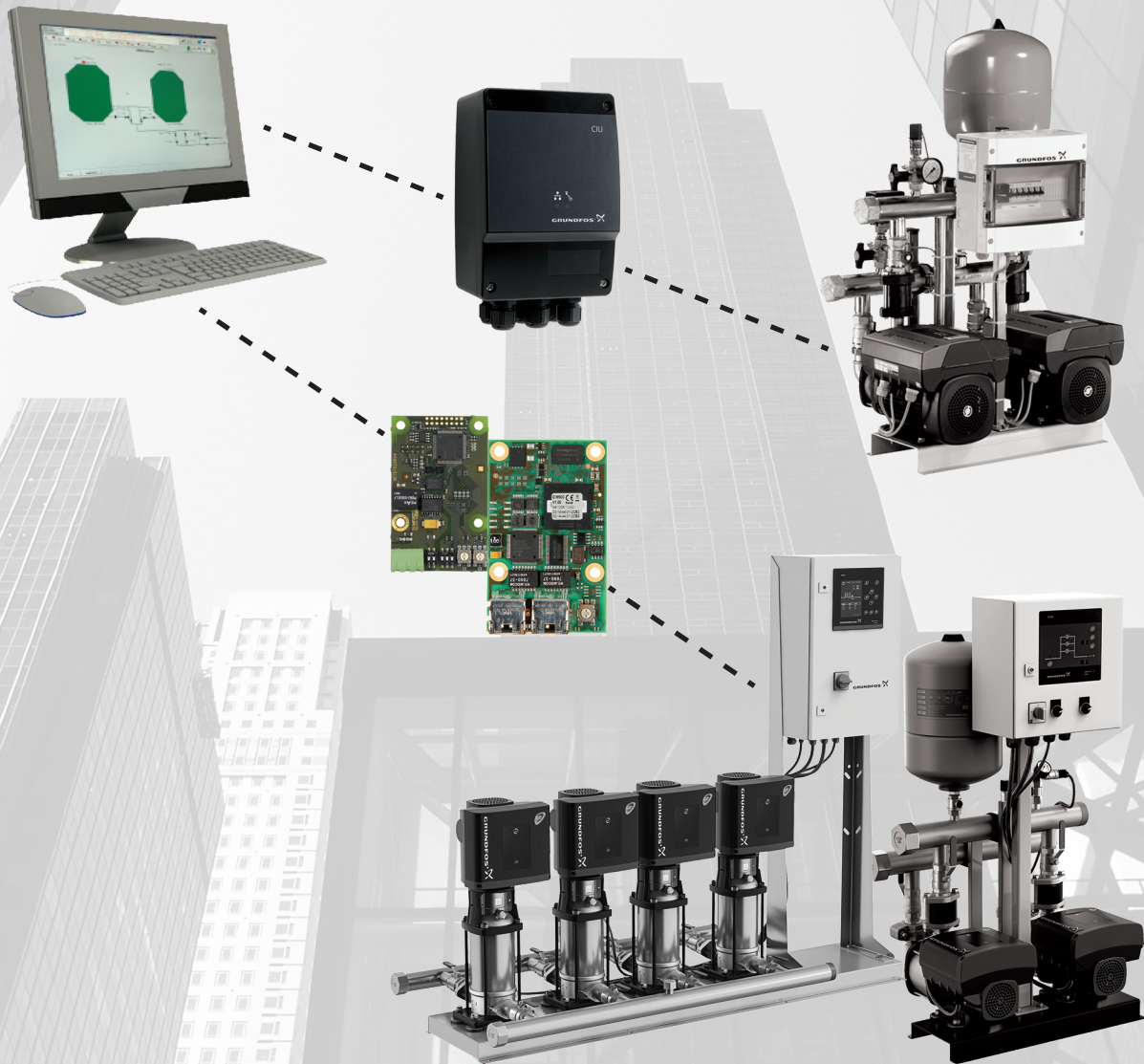# BACnet for Grundfos boosters

CIM/CIU 300 BACnet MS/TP
CIM/CIU 500 BACnet IP

Functional profile and user manual

GRUNDFOS

BACnet for Grundfos boosters

Table of contents

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English (GB) Functional profile and user manual

Original functional profile and user manual

Table of contents

1. General information

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

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 the 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.

2. Introduction

2.1 About this functional profile

This functional profile describes the CIM/CIU 300 for BACnet MS/TP and the CIM/CIU 500 for BACnet Ethernet IP as part of a communication interface with the following Grundfos booster systems:

- Grundfos Hydro Multi-B (CU 323)
- Grundfos Hydro MPC (CU 35X)
- Grundfos Control MPC (CU 35X)
- Grundfos Hydro Multi-E.

TPED twin-head pump with MGE motors model H or later in multipump mode and MAGNA3 Twin-head pump in multipump mode, requires a CIM module installed in the master pump.

The object lists for the Hydro MPC and Control MPC are identical, so in the following, only Hydro MPC is mentioned. If not specifically mentioned, Hydro Multi-B, Hydro MPC and Hydro Multi-E are referred to as "booster system".

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

2.2 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming BACnet devices. The reader should also have some basic knowledge of the BACnet protocol and technical specifications.

It is also assumed that an existing BACnet MS/TP or IP network is present.

2.3 Definitions and abbreviations

ARP	Address Resolution Protocol translating IP addresses into MAC addresses
Auto-MDIX	Port ensuring 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 300	Communication Interface Module 300
CIU 300	Communication Interface Unit 300
CRC	Cyclic Redundancy Check: data error-detection method
CU 323	Grundfos Control Unit 323
CU 35X	Grundfos Control Units 351 and 352
Device	Node on the BACnet MS/TP network
DHCP	Dynamic Host Configuration Protocol for configuring network devices so that they can communicate on an IP network
DNS	Domain Name System for resolving host names to IP addresses
GENIbus	Proprietary Grundfos fieldbus standard based on RS-485
GENIpro	Proprietary Grundfos fieldbus protocol
Grundfos GO	Grundfos application designed to control Grundfos products via infrared or radio communication (available for iOS and Android devices)
HTTP	Hyper Text Transfer Protocol (commonly used for navigating the world wide web)
IANA	Internet Assigned Numbers Authority
Inter-network	Set of two or more BACnet networks interconnected by routers
IP	Internet Protocol
LED	Light-Emitting Diode
MAC	Media Access Control: unique network address for a piece of hardware
MPC	Multi-Pump Controller
MS/TP	Master-Slave/Token-Passing (data protocol used for BACnet RS-485)

Ping	Packet Internet Groper: software utility testing the connectivity between two TCP/IP hosts
Router	Device connecting two or more networks at the network layer
SELV	Separated or Safety Extra-Low Voltage
SMTP	Simple Mail Transfer Protocol
SNTP	Simple Network Time Protocol for clock synchronisation between computer systems
TCP	Transmission Control Protocol for internet communication and industrial Ethernet communication
TCP/IP	Transmission Control Protocol/Internet Protocol for internet communication
Transmission speed	Bits transferred per second (bit/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: 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.

2.4 System diagram

Figures CIM solution for Hydro Multi-B and Solution with CIM 300 and 500 for CU 352 and CIU for Hydro Multi-E (CU 351) give an overview of how to connect the module or unit to the Grundfos booster system that is to be connected to a BACnet network.

The Hydro MPC, Control MPC and Multi-E boosters are available in two variants. They have different CIM/CIU connections as described below.

CIM solution

A Communication Interface Module (CIM) is an add-on communication module that you fit into the following products:

- CU 352 MPC
- CU 323 Multi-B
- Multi-E based on MGE motors model H or later
- TPED twin-head pump in multipump mode
- MAGNA3-D twin-head pump in multipump mode.

In this setup, the booster system supplies power to the module. See figure CIM solution for Hydro Multi-B below.

CIU solution

A Communication Interface Unit (CUI) is a box incorporating a power supply module and a CIM 300 BACnet module. It can either be mounted on a DIN rail or on a wall. See figure Solution with CIM 300 and 500 for CU 352 and CIU for Hydro Multi-E (CU 351).

The unit is used with the following products:

- CU 351 MPC
- Multi-E based on MGE motors before model H.

The Hydro MPC with the CU 351 or the Hydro Multi-E controls and monitors a number of pumps (2 to 6), all connected with RS-485 cables. If fitted with an extra GENIbus module, the Hydro MPC with the CU 351 can be connected to the unit via an RS-485 cable.

The CU 351 must have an external GENIbus module installed in order to communicate with the CIU BACnet unit.
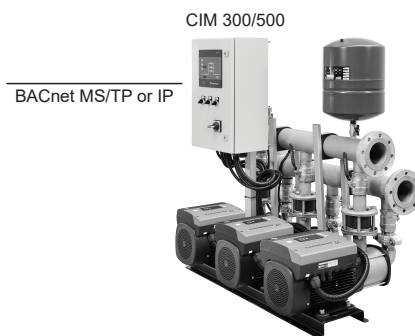
CIM solution for Hydro Multi-B
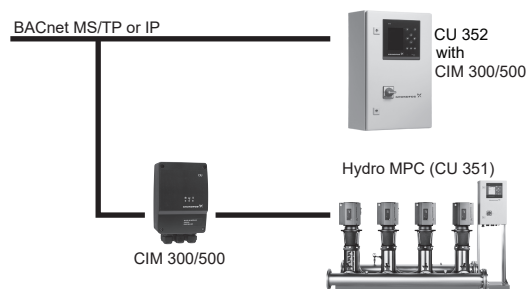
Solution with CIM 300 and 500 for CU 352 and CIU for Hydro Multi-E (CU 351)

2.5 Specifications

The table below provides an overview of the specifications for the Grundfos CIM/CIU 300 for BACnet MS/TP and the CIM/CIU 500 for BACnet IP. For further details, refer to the specific sections of this functional profile.

General data	Description	Comments
Ambient humidity	30-95 %	It is considered relative, non-condensing.
Operating temperature	-20 to +45 °C	
Storage temperature	-25 to +70 °C	
GENIbus visual diagnostics	LED2	The LED is in one of the following states: Off, permanently green, flashing red, permanently red.

BACnet MS/TP	Description	Comments
BACnet connector	Screw-type terminal	3 pins
BACnet connection type	RS-485	
BACnet wire configuration	2-wire + ground	Conductors: Plus, Minus and Ground
Maximum cable length [m]	1200	Equals 4000 ft
Recommended cross-section of BACnet cable	0.20 - 0.25 mm^2	AWG24 or AWG23
MAC address	0-127	To be set via rotary switches SW6 and SW7
Line termination	On or Off	To be set via DIP switches SW1 and SW2
Supported transmission speeds [bit/s]	9600, 19200, 38400, 76800	To be set via DIP switches SW4 and SW5
Data bits	8	Fixed value
Stop bits	1	Fixed value
Parity	None	Fixed value
BACnet visual diagnostics	LED1	Red and green status LED
Maximum number of BACnet devices	32	Number can be increased by using repeaters
Grundfos BACnet vendor ID	227	
BACnet segmentation support	No	
Character set support	ANSI X3.4 and UTF8	Supported character sets
BACnet device profile	B-ASC	BACnet Application-Specific Controller
BACnet MS/TP master	Yes	CIM/CIU 300 is a BACnet MS/TP master device
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 Mbit/s	Corresponds to 328 feet
Transmission speed	10 Mbit/s, 100 Mbit/s	Auto-detected
Industrial Ethernet protocols	PROFINET IO, Modbus TCP, BACnet IP etc.	Selected with rotary switch
BACnet protocol revision	9	

CIM 300 and 500	Description	Comments
Dimensions [w x h x d] [mm]	50 x 19 x 80	
Power supply		Supplied by the booster system
Connection to booster system	10-pin connection	

CIU 300 and 500	Description	Comments
CIU box dimensions (H x W x D)	182 x 108 x 82 mm	
Power supply	24-240 V AC/DC	Located in the unit
GENIbus connection type	RS-485, 3-wire + screen	Conductors: A, B and Y
Enclosure class	IP54	
Recommended cross-section of GENIbus cable	0.20 - 0.25 mm^2	AWG24 or AWG23

Related information

3. BACnet MS/TP, CIM 300 setup

3.1 BACnet bus topology

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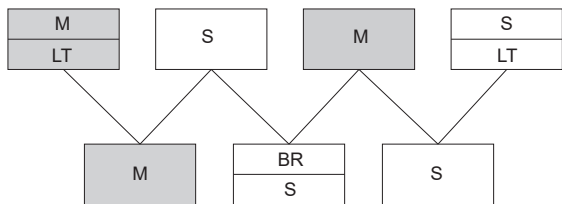
Example of BACnet MS/TP network

Pos.	Description
M	Master
S	Slave
LT	Line Termination
BR	Bias Resistors

The BACnet MS/TP is a multi-master system which means 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.

3.1.1 Line termination resistors

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

3.1.2 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 is 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 takes an indeterminate state in the absence of any driving node.

The CIM/CIU 300 has no bias resistors.

3.2 CIM 300 BACnet module
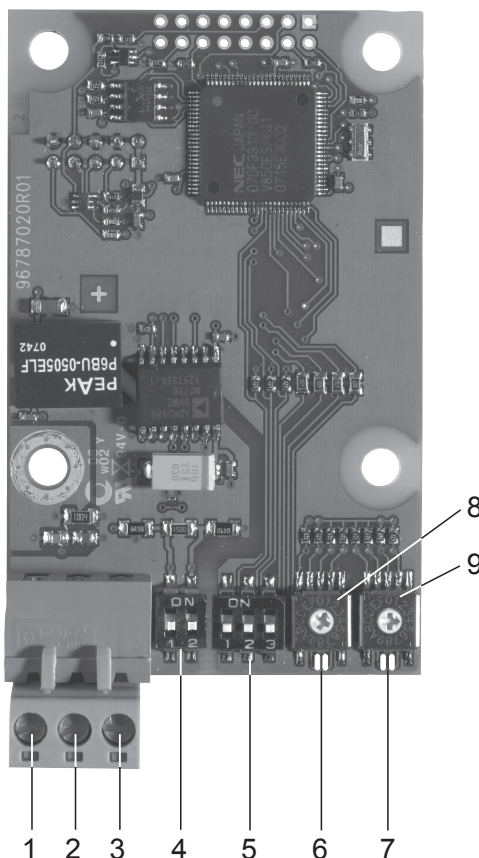
CIM 300 BACnet module

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 booster system
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)

3.3 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.

3.4 Setting the BACnet transmission speed

Set the transmission speed correctly before the CIM 300 is ready to communicate on the BACnet MS/TP network. Use the DIP switches SW4 and SW5 to set the transmission speed.

The default transmission speed is 9600 bit/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.

BACnet transmission speed settings

3.4.1 DIP switch settings

Available transmission speeds in bit/s: 9600, 19200, 38400 and 76800.
Use the DIP switches SW4 and SW5 to select the desired speed.

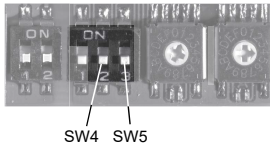| Transmission speed [bit/s]	SW4	SW5
9600	OFF	OFF
19200	OFF	ON
38400	ON	OFF
76800	ON	ON

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

3.5 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).

31 22	21 ... 0
Object type 10 bits	**Instance Number** 22 bits

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, that is, on all interconnected networks.

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

3.5.1 Default Instance Number

By default, the CIM 300 uses a pre-defined Device Object Instance Number which is 227XXX where XXX is the BACnet MAC address. This gives an Instance Number range of 227000 to 227127.

Example

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

Related information

3.5.2 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 immediately sets the new Device Object Instance Number.
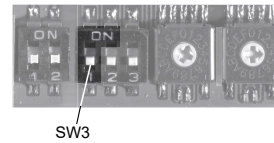
Device Object Instance Number

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.

3.6 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 the section 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.

Related information

3.5 Selecting the Device Object Instance Number

3.7 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.

SW6   SW7
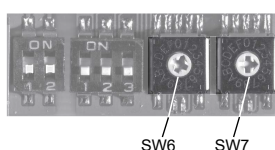
Setting the BACnet MAC address

For a complete overview of BACnet addresses, see section BACnet MAC address, CIM 300.

! You must set the BACnet MAC address decimally from 0 to 127 and it must be unique on the BACnet MS/TP segment.

Related information

11. BACnet MAC address, CIM 300

3.8 Termination resistor

A termination resistor for line termination is fitted on the CIM 300 and has a value of 120 Ω. It is to be cut in if the CIM 300 is set as the last station on the network.

The CIM 300 has two DIP switches, SW1 and SW2, for cutting the termination resistor in and out.
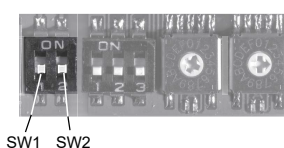
SW1 SW2

Cutting the termination resistor in and out

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

Default setting: The termination resistor is cut out.

3.9 Cable length

The recommended maximum cable length within a BACnet MS/TP segment is 1200 metres (4000 ft) with 0.82 mm^2 (AWG 18) cable.

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

3.10 LEDs

The 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 the CIM 300 and the Grundfos pump.

3.10.1 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

3.10.2 LED2, internal communication

Status	Description
Off	The CIM/CIU 300 has been switched off or is starting up.
Flashing red	There is no internal communication between the CIM/CIU 300 and the booster system.
Permanently red	The CIM/CIU 300 does not support the connected booster system.
Permanently green	Internal communication between the CIM/CIU 300 and the booster system is OK.

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

4. BACnet IP, CIM 500 setup

WARNING
Electric shock
Death or serious personal injury

- Connect the CIM 500 only to SELV circuit.

4.1 Connecting the Ethernet cable

Use RJ45 plugs and 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.

Maximum cable length

Speed [Mbit/s]	Cable type	Maximum cable length [m/ft]
10	CAT5	100/328
100	CAT5e, CAT6	100/328

The 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 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.
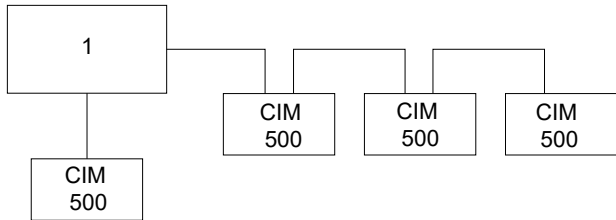
Example of Industrial Ethernet network

Pos.	Description
1	Ethernet switch
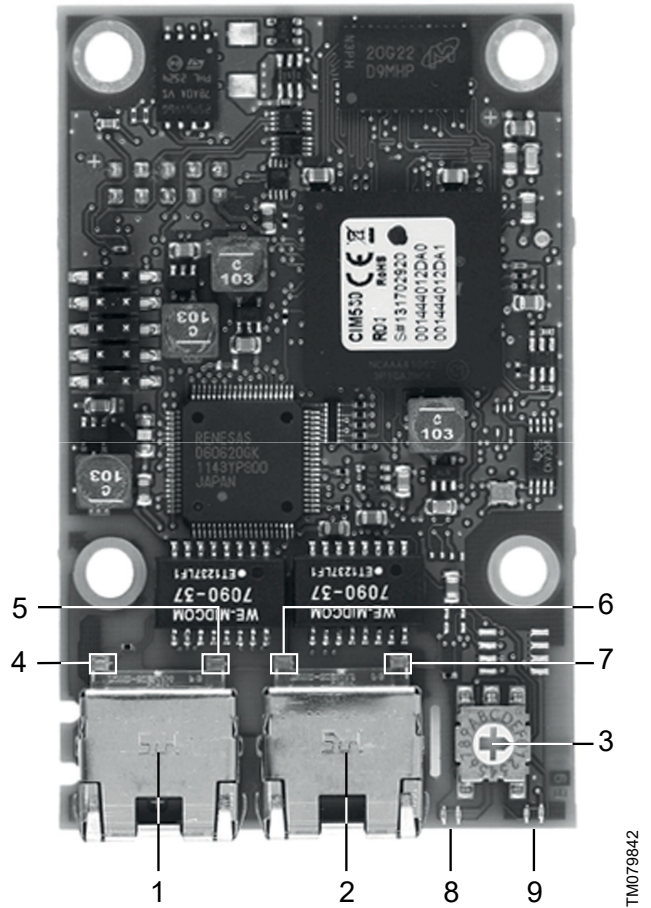
Example of Ethernet connection

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 booster system	LED2

4.2 Setting the industrial Ethernet protocol

The CIM 500 Ethernet module has a rotary switch for selecting industrial Ethernet protocol.
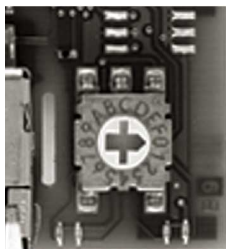
TM079751

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.E	Reserved - LED1 being permanently red: invalid configuration
F	Reset to factory default Note: 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 a reset.

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

Related information

3.7 Selecting the BACnet MAC address

4.3 Setting the IP addresses

By default, the CIM 500 Ethernet module is 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	To be set via the webserver	

4.4 Establishing connection to the webserver

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

- Connect the PC and the CIM 500 using an Ethernet cable.
- Configure the PC Ethernet port to the same subnetwork as that of the CIM 500, for example, 192.168.1.101, and the subnet mask to 255.255.255.0.
- Open a standard internet browser and type 192.168.1.100 in the URL field.
- Log in to the webserver:

User	admin (default)
Password	Grundfos (default)

The user name and password may have been changed from their default values.

Change the username and password at the first login.

TM056436

CIM 500 connected to PC via Ethernet cable

For further information on how to use the webserver, see section Webserver configuration.

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.

Related information

A.1.2. How to configure an IP address on your PC using Windows 10

A.1.1. Webserver configuration

4.5 Status LEDs

The CIM 500 Ethernet module has two status LEDs:

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

LED1

Status	Description
Off	There is no BACnet IP communication or it is switched off.
Flashing green	The BACnet IP communication is active.
Permanently red	There is a fault in the CIM 500 configuration.
Permanently red and green	There is an error in firmware download.
Flashing red and green	The module is resetting to factory default. After 20 seconds, the CIM 500 restarts.

LED2

Status	Description
Off	The CIM 500 is switched off.
Flashing red	There is no internal communication between the CIM 500 and the Grundfos product.
Permanently red	The CIM 500 does not support the Grundfos product connected.
Permanently green	Internal communication between the CIM 500 and the Grundfos product is OK.
Permanently red and green	A memory fault occurred.

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

Related information

4.6 DATA and LINK LEDs

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

DATA1 and DATA2

These yellow LEDs indicate data traffic activity.

Status	Description
Yellow off	There is no data communication on the RJ45 connector.
Yellow flashing	There is data communication ongoing on the RJ45 connector.
Permanently yellow	There is heavy network traffic.

LINK1 and LINK2

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

Status	Description
Green off	There is no Ethernet link on the RJ45 connector.
Green on	The Ethernet link on the RJ45 connector is OK.

Related information

5. 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 acts as the user of data (client), and the "B" device is the provider of this data (server).

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

5.1 Data-sharing services

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

5.2 Device management services

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

6. Object overview

6.1 Device Object

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

Property identifier	Data type	Notes	Access
Object_Identifier	BACnetObjectIdentifier	See section Selecting the Device Object Instance Number.	R
Object_Name	CharacterString	See section Selecting the Device Object Name 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	It shows the Grundfos pump model to which the CIM/CIU is connected.	R
Firmware_Revision	CharacterString	It shows the revision of the firmware in the CIM/CIU.	R
Application_Software_Version	CharacterString	It displays the 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	It is the actual version of the BACnet protocol.	R
Protocol_Revision	Unsigned	It is the actual revision of the BACnet protocol.	R
Protocol_Services_Supported	BACnetServicesSupported	It shows the supported standardised protocol services.	R
Protocol_Object_Types_Supported	BACnetObjectTypesSupported	It shows the supported standardised protocol object types.	R
Object_List	BACnetARRAY[N]of BACnetObjectIdentifier	It shows the 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 is fixed to 480. CIM 500: The maximum number is 1476.	R
Segmentation_Supported	BACnetSegmentation	It indicates if segmentation of messages is possible. It always reads NO_SEGMENTATION to indicate that segmentation is not possible.	R
APDU_Timeout	Unsigned	It shows the amount of time in ms before time-out.	R
Number_Of_APDU_Retries	Unsigned	It is the maximum number of times an APDU is to be retransmitted.	R
Max_Master	Unsigned	The default value is 127, but this value can be lowered by the user to reduce transmission overhead. The Max_Master value must be higher than or equal to the highest MAC address used by a master node in an MS/TP network.	W
Max_Info_Frames	Unsigned	It shows the maximum number of information frames sent before the token is passed on (fixed to 1).	R
Device_Address_Binding	List of BACnetAddressBindings	It holds address bindings to other devices, if any.	R
Database_Revision	Unsigned	Logical revision number for the device database.	R

Related information

6.2 Binary inputs

Binary objects provide information from the Grundfos booster system.

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
BI, 0	Control source status	R	Status of the actual control source 0: Local control 1: Bus control	●	●	●	●
BI, 2	Rotation status	R	Rotation status 0: No rotation 1: Rotation (one or more pumps running)	●	●	●	●
BI, 3	At minimum speed	R	0: Not running at minimum speed 1: Running at minimum speed	●	-	●	●
BI, 4	At maximum speed	R	0: Not running at maximum speed 1: Running at maximum speed	●	-	●	●
BI, 5	Standby pumps active	R	0: Standby pumps not active 1: Standby pumps active	-	-	●	-
BI, 6	Pressure relief active	R	0: Pressure relief not active 1: Pressure relief active	-	-	●	-
BI, 7	Soft pressure active	R	0: Soft pressure not active 1: Soft pressure active	-	-	●	-
BI, 8	Low-flow boost active	R	0: Low-flow boost not active 1: Low-flow boost active	-	-	●	-
BI, 9	Low-flow stop active	R	0: Low-flow stop not active 1: Low-flow stop active	H	●	●	-
BI, 10	Alternative setpoint active	R	0: Alternative setpoint not active 1: Alternative setpoint active	-	-	●	-
BI, 11	Digital input 1 status	R	0: Not active 1: Active	●	●	●	●
BI, 12	Digital input 2 status	R	0: Not active 1: Active	●	●	●	●
BI, 13	Digital input 3 status	R	0: Not active 1: Active	H	●	●	●
BI, 14	Digital output 1 status	R	0: Not active 1: Active	●	●	●	●
BI, 15	Digital output 2 status	R	0: Not active 1: Active	●	●	●	●
BI, 16	Subpump 1 presence	R	0: Subpump not present 1: Subpump present	H	●	●	●
BI, 17	Subpump 1 communication status	R	0: Communication OK 1: Communication fault	H	●	●	●
BI, 18	Subpump 2 presence	R	0: Subpump not present 1: Subpump present	H	●	●	●
BI, 19	Subpump 2 communication status	R	0: Communication OK 1: Communication fault	H	●	●	●
BI, 20	Subpump 3 presence	R	0: Subpump not present 1: Subpump present	-	●	●	●
BI, 21	Subpump 3 communication status	R	0: Communication OK 1: Communication fault	-	●	●	●
BI, 22	Subpump 4 presence	R	0: Subpump not present 1: Subpump present	-	●	●	●
BI, 23	Subpump 4 communication status	R	0: Communication OK 1: Communication fault	-	●	●	●
BI, 24	Subpump 5 presence	R	0: Subpump not present 1: Subpump present	-	-	●	●

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
BI, 25	Subpump 5 communication status	R	0: Communication OK 1: Communication fault	-	-	●	●
BI, 26	Subpump 6 presence	R	0: Subpump not present 1: Subpump present	-	-	●	●
BI, 27	Subpump 6 communication status	R	0: Communication OK 1: Communication fault	-	-	●	●
BI, 28	Fault simulation status	R	Fault simulation status 0: Fault simulation disabled 1: Fault simulation enabled	-	●	●	H
BI, 31	At power limit	R	At power limit status 0: Not at power limit 1: At power limit		-	-	-
BI, 32	Subpump 1 auto mode	R	0: Manual control 1: Auto-control	-	●	●	-
BI, 33	Subpump 2 auto mode	R	0: Manual control 1: Auto-control	-	●	●	-
BI, 34	Subpump 3 auto mode	R	0: Manual control 1: Auto-control	-	●	●	-
BI, 35	Subpump 4 auto mode	R	0: Manual control 1: Auto-control	-	●	●	-
BI, 36	Subpump 5 auto mode	R	0: Manual control 1: Auto-control	-	-	●	-
BI, 37	Subpump 6 auto mode	R	0: Manual control 1: Auto-control	-	-	●	-
BI, 38	Setpoint influence active	R	0: No influence on setpoint 1: Setpoint influence active	●	-	●	H
BI, 39	Max flow limit enabled	R	0: Max flow limit disabled 1: Max flow limit enabled	M	-	-	H
BI, 40	Pilot pump auto mode	R	0: Manual control 1: Auto-control	-	-	●	-
BI, 41	Pilot pump presence	R	0: Pilot pump not present 1: Pilot pump present	-	-	●	-
BI, 42	Pilot pump communication status	R	0: Communication OK 1: Communication fault	-	-	●	-
BI, 43	Backup pump auto mode	R	0: Manual control 1: Auto-control	-	-	●	-
BI, 44	Backup pump presence	R	0: Backup pump not present 1: Backup pump present	-	-	●	-
BI, 45	Backup pump communication status	R	0: Communication OK 1: Communication fault	-	-	●	-
BI, 46	Subpump 1 running	R	0: Not running, 1: Running	H	-	●	●
BI, 47	Subpump 2 running	R	0: Not running, 1: Running	H	-	●	●
BI, 48	Subpump 3 running	R	0: Not running, 1: Running	-	-	●	●
BI, 49	Subpump 4 running	R	0: Not running, 1: Running	-	-	●	●
BI, 50	Subpump 5 running	R	0: Not running, 1: Running	-	-	●	●
BI, 51	Subpump 6 running	R	0: Not running, 1: Running	-	-	●	●
BI, 52	Pilot pump running	R	0: Not running, 1: Running	-	-	●	●
BI, 53	Backup pump running	R	0: Not running, 1: Running	-	-	●	●
BI, 54	Subpump 1 fault	R	1: Fault	H	-	●	●
BI, 55	Subpump 2 fault	R	1: Fault	H	-	●	●
BI, 56	Subpump 3 fault	R	1: Fault	-	-	●	●
BI, 57	Subpump 4 fault	R	1: Fault	-	-	●	●

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
BI, 58	Subpump 5 fault	R	1: Fault	-	-	●	●
BI, 59	Subpump 6 fault	R	1: Fault	-	-	●	●
BI, 60	Pilot pump fault	R	1: Fault	-	-	●	●
BI, 61	Backup pump fault	R	1: Fault	-	-	●	●
BI, 62	Flow estimation below range	R	0: Flow estimation not below range 1: Flow estimation below range	-	-	-	-
BI, 63	Flow estimation ABOVE range	R	0: Flow estimation not above range 1: Flow estimation above range	-	-	-	-
BI, 64	Forced to local	R	0: Not forced to local 1: Forced to local	-	-	-	-
BI, 65	Digital Input 3 status	R	0: Not active 1: Active	-	-	●	-
BI, 66	Digital Input 4 status	R	0: Not active 1: Active	-	-	●	-
BI, 67	Digital Input 5 status	R	0: Not active 1: Active	-	-	●	-
BI, 68	Digital Input 6 status	R	0: Not active 1: Active	-	-	●	-
BI, 69	Digital Input 7 status	R	0: Not active 1: Active	-	-	●	-
BI, 70	Digital Input 8 status	R	0: Not active 1: Active	-	-	●	-

H: For MGE model H and later only

M: For MAGNA3 only

6.3 Binary outputs

Binary objects are used for controlling the Grundfos booster system.

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
BO, 0	Set control source	W	It sets the control source. Set to 1 to enable control via BACnet. 0: Local control (default) 1: Bus control	●	●	●	●
BO, 1	Relay 1 control	W	It controls relay 1 if bus control is enabled and relay 1 is set to be controlled via bus. 0: Closed (default) 1: Open	H	-	-	H
BO, 2	Relay 2 control	W	It controls relay 2 if bus control is enabled and relay 2 is set to be controlled via bus. 0: Closed (default) 1: Open	H	-	-	H
BO, 4	Reset fault	W	It resets alarm if bus control is enabled. (It is triggered on rising edge.) 0: No resetting (default) 1: Resetting	●	●	●	●
BO, 5	Fault simulation	W	It enables fault simulation. 0: Disabled (default) 1: Enabled	-	●	●	H
BO, 6	Copy settings to local	W	It copies remote settings to local pump settings. 0: Disabled 1: Enabled If enabled, change BO from 0 to "1: Bus control".	●	-	-	H
BO, 7	Relay 3 control	W	It controls relay 3 if bus control is enabled and relay 3 is set to be controlled via bus. 0: Closed (default) 1: Open	H	-	-	H
BO, 8	Relay 4 control	W	It controls relay 4 if bus control is enabled and relay 4 is set to be controlled via bus. 0: Closed (default) 1: Open	H	-	-	H
BO, 9	Enable max flow limit	W	It is used to limit the flow. 0: No flow limitation 1: Flow limit active	●	-	-	H

H: For MGE model H or newer

For Multi-E with CIM in each pump: always send all commands (writings) to all pumps.

A TPED model H is essentially a Multi-E model H with two pumps.

6.4 Multistate inputs

They are objects that contain an enumeration value from the booster system.

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
MI, 0	Actual control mode	R	It reads the current control mode. 1: Constant speed 2: Constant pressure 3: Proportional pressure 4: AUTOADAPT 5: Constant flow 6: Constant temperature 7: Constant level 8: Constant percentage (not for MAGNA and MGE) 9: FLOWADAPT 10: Closed-loop sensor control (not for MAGNA and MGE) 11: Constant diff. pressure 12: Constant diff. temperature See section Control modes for details on the control modes.	●	●	●	●
MI, 1	Actual operating mode	R	It reads the current operating mode. 1: Start (normal) 2: Stop 3: Minimum 4: Maximum	●	●	●	●
MI, 3	CIM status	R	It reads the status of the CIM module, thus is useful for fault finding. 1: OK 2: EEPROM fault 3: Memory fault	●	●	●	●
MI, 4	Subpump 1 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	●	●	H
MI, 5	Subpump 2 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	●	●	H
MI, 6	Subpump 3 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	●	●	H
MI, 7	Subpump 4 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	●	●	H
MI, 8	Subpump 5 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	-	●	H
MI, 9	Subpump 6 control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	-	●	H

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
MI, 10	Application type	R	1: Pressure boosting 2: Heating pumps on hot side 3: Heating pumps on cold side 4: AirCon pumps on hot side 5: AirCon pumps on cold side 6: MPC S2000 heating pumps on hot side 7: MPC S2000 heating pumps on cold side 8: MPC S2000 AirCon pumps on hot side 9: MPC S2000 AirCon pumps on cold side 10: Tank filling 11: Tank filling (float switches) 12: Undefined	-	●	●	-
MI, 11	Feedback sensor unit	R	1: Unknown 2: bar 3: mbar 4: m 5: kPa 6: psi 7: ft 8: m^3/h 9: m^3/s 10: l/s 11: gpm 12: °C 13: °F 14: % 15: K 16: l/h	●	●	●	H
MI, 12	Pilot pump control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	-	●	-
MI, 13	Backup pump control source	R	1: Buttons 2: GENIbus 3: GENIlink 4: External control	-	-	●	-

Related information

6.5 Multistate outputs

They are objects that set an enumeration value in the booster system.

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
MO, 0	Set control mode	W	It sets the control mode if bus control is enabled. 1: Constant speed (default) 2: Constant pressure 3: Proportional pressure 4: AUTOADAPT 5: Constant flow 6: Constant temperature 7: Constant level 8: Constant percentage (not for MAGNA and MGE) 9: FLOWADAPT 10: Closed-loop sensor control (not for MAGNA and MGE) 11: Constant diff. pressure 12: Constant diff. temperature See section Control modes for details on the control modes.	•	-	•	H
MO, 1	Set operating mode	W	It sets the operating mode if bus control is enabled. 1: Start (normal) 2: Stop (default) 3: Minimum 4: Maximum (Hydro MPC and Hydro Multi-E only)	•	•	•	•
MO, 2	Product simulation	W	It enables product simulation for commissioning and testing purposes It can only be enabled when no physical booster system is present. 1: Disabled 5: Hydro Multi-E (Model G and earlier) 6: Hydro MPC 7: Hydro Multi-B 10: Hydro Multi-E (MGE model H/I) See section Product simulation for details.	-	•	•	•
MO, 3	Control subpump 1	W	Manual control of subpump 1 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	•	•	-
MO, 4	Control subpump 2	W	Manual control of subpump 2 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	•	•	-
MO, 5	Control subpump 3	W	Manual control of subpump 3 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	•	•	-
MO, 6	Control subpump 4	W	Manual control of subpump 4 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	•	•	-

ID	Object name	R/W	Notes	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
MO, 7	Control subpump 5	W	Manual control of subpump 5 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	-	●	-
MO, 8	Control subpump 6	W	Manual control of subpump 6 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	-	●	-
MO, 9	Control pilot pump	W	Manual control of pilot pump 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	-	●	-
MO, 10	Control backup pump	W	Manual control of backup pump 1: Automatic control (default) 2: Forced start (MPC only) 3: Forced stop	-	-	●	-

H: For MGE model H or newer

For Multi-E with CIM in each pump, always send all commands (writings) to all pumps.

A TPED model H is essentially a Multi-E model H with two pumps.

Related information

6.6 Analog inputs

They are objects with measured values and status information from the booster system.

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AI, 0	Fault code	R	Grundfos fault code. See section Grundfos alarm and warning codes.	-	●	●	●	●
AI, 1	Warning code	R	Grundfos warning code. See section Grundfos alarm and warning codes.	-	●	●	●	●
AI, 3	Capacity	R	Actual capacity value (process feedback)	%	●	●	●	●
AI, 4	Head	R	Actual system head/pressure	bar	●	-	S	S
AI, 5	Flow	R	Actual system flow	m^3/h	●	-	S	S
AI, 6	Relative performance	R	Performance relative to maximum performance	%	●	●	●	●
AI, 9	Actual setpoint	R	Actual setpoint	%	M	●	●	●
AI, 13	Power	R	Total power consumption of the system	W	●	●	●	●
AI, 15	Inlet pressure	R	System inlet pressure	bar	H	S	S	H
AI, 16	Remote pressure	R	Measured pressure at external sensor	bar	●	-	S	H
AI, 20	Remote temperature	R	Temperature at external sensor	°C	H	-	S	S
AI, 22	Fluid temperature	R	Liquid temperature	°C	●	-	-	H
AI, 25	Auxiliary sensor input	R	Auxiliary sensor input	%	H	S	-	S
AI, 26	Specific energy	R	Specific energy of the system	kWh/m^3	H	-	S	H
AI, 27	Runtime	R	Total operating time of the system	h	●	●	●	●
AI, 30	Energy consumption	R	Total energy consumption of the system	kWh	●	●	●	●
AI, 33	Ambient temperature	R	Ambient temperature	°C	-	-	S	H
AI, 34	Forward temperature	R	Flow-pipe temperature	°C	-	-	S	H
AI, 35	Return temperature	R	Return-pipe temperature	°C	-	-	S	-
AI, 36	Differential temperature	R	Differential temperature	°C	-	-	S	-
AI, 37	Outlet pressure	R	System outlet pressure	bar	-	S	S	H
AI, 38	Feed tank level	R	Actual level in the feed tank	m	H	-	S	H
AI, 39	Subpump 1 fault code	R	Fault code, subpump 1	-	●	●	●	●
AI, 40	Subpump 1 runtime	R	Total operating time, subpump 1	h	●	●	●	●
AI, 41	Subpump 1 speed	R	Actual speed, subpump 1	%	●	●	●	H
AI, 42	Subpump 2 fault code	R	Fault code, subpump 2	-	●	●	●	●
AI, 43	Subpump 2 runtime	R	Total operating time, subpump 2	h	●	●	●	●
AI, 44	Subpump 2 speed	R	Actual speed, subpump 2	%	●	●	●	H
AI, 45	Subpump 3 fault code	R	Fault code, subpump 3	-	-	●	●	●
AI, 46	Subpump 3 runtime	R	Total operating time, subpump 3	h	-	●	●	●
AI, 47	Subpump 3 speed	R	Actual speed, subpump 3	%	-	●	●	H
AI, 48	Subpump 4 fault code	R	Fault code, subpump 4	-	-	●	●	●
AI, 49	Subpump 4 runtime	R	Total operating time, subpump 4	h	-	●	●	●
AI, 50	Subpump 4 speed	R	Actual speed, subpump 4	%	-	●	●	H
AI, 51	Subpump 5 fault code	R	Fault code, subpump 5	-	-	-	●	●
AI, 52	Subpump 5 runtime	R	Total operating time, subpump 5	h	-	-	●	●
AI, 53	Subpump 5 speed	R	Actual speed, subpump 5	%	-	-	●	H
AI, 54	Subpump 6 fault code	R	Fault code, subpump 6	-	-	-	●	●
AI, 55	Subpump 6 runtime	R	Total operating time, subpump 6	h	-	-	●	●
AI, 56	Subpump 6 speed	R	Actual speed, subpump 6	%	-	-	●	H
AI, 57	Remote temperature 2	R	Temperature at external temperature sensor 2	°C	●	-	-	H
AI, 58	User setpoint	R	User-defined setpoint	%	●	●	●	-
AI, 59	Analogue influence	R	Analog setpoint influence	%	H	●	●	H

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AI, 60	Power-on counter	R	Number of power-on cycles	-	-	-	●	●	-
AI, 61	Subpump 1 line current	R	Line current, subpump 1	A	●	●	●	H
AI, 62	Subpump 1 power consumption	R	Power consumption, subpump 1	W	●	●	●	H
AI, 63	Subpump 1 motor temperature	R	Motor temperature, subpump 1	°C	-	●	●	H
AI, 64	Subpump 1 No of starts	R	Number of starts, subpump 1	-	●	●	●	H
AI, 65	Subpump 2 line current	R	Line current, subpump 2	A	●	●	●	H
AI, 66	Subpump 2 power consumption	R	Power consumption, subpump 2	W	●	●	●	H
AI, 67	Subpump 2 motor temperature	R	Motor temperature, subpump 2	°C	-	●	●	H
AI, 68	Subpump 2 No of starts	R	Number of starts, subpump 2	-	●	●	●	H
AI, 69	Subpump 3 line current	R	Line current, subpump 3	A	-	●	●	H
AI, 70	Subpump 3 power consumption	R	Power consumption, subpump 3	W	-	●	●	H
AI, 71	Subpump 3 motor temperature	R	Motor temperature, subpump 3	°C	-	●	●	H
AI, 72	Subpump 3 No of starts	R	Number of starts, subpump 3	-	-	●	●	H
AI, 73	Subpump 4 line current	R	Line current, subpump 4	A	-	●	●	H
AI, 74	Subpump 4 power consumption	R	Power consumption, subpump 4	W	-	●	●	H
AI, 75	Subpump 4 motor temperature	R	Motor temperature, subpump 4	°C	-	●	●	H
AI, 76	Subpump 4 No of starts	R	Number of starts, subpump 4	-	-	●	●	H
AI, 77	Subpump 5 line current	R	Line current, subpump 5	A	-	-	●	H
AI, 78	Subpump 5 power consumption	R	Power consumption, subpump 5	W	-	-	●	H
AI, 79	Subpump 5 motor temperature	R	Motor temperature, subpump 5	°C	-	-	●	H
AI, 80	Subpump 5 No of starts	R	Number of starts, subpump 5	-	-	-	●	H
AI, 81	Subpump 6 line current	R	Line current, subpump 6	A	-	-	●	H
AI, 82	Subpump 6 power consumption	R	Power consumption, subpump 6	W	-	-	●	H
AI, 83	Subpump 6 motor temperature	R	Motor temperature, subpump 6	°C	-	-	●	H
AI, 84	Subpump 6 No of starts	R	Number of starts, subpump 6	-	-	-	●	H
AI, 85	Minimum of feedback sensor	R	Minimum of feedback sensor	(see MI, 11 for unit)	●	-	●	●
AI, 86	Maximum of feedback sensor	R	Maximum of feedback sensor	(see MI, 11 for unit)	●	-	●	●
AI, 87	Actual tank-filling tank height	R	Tank height in tank-filling mode See sectionTank-filling applications.	m	-	●	-	-
AI, 88	Actual tank-filling start limit	R	Start limit in percentage of tank height	%	-	●	-	-
AI, 89	Actual tank-filling stop limit	R	Stop limit in percentage of tank height	%	-	●	-	-
AI, 90	Actual tank-filling alarm high-limit	R	Alarm high-limit in percentage of tank height	%	-	●	-	-
AI, 91	Actual tank-filling warning low-limit	R	Warning low-limit in percentage of tank height	%	-	●	-	-
AI, 92	Load percent	R	Motor current in percentage of rated motor current	%	●	-	-	H
AI, 93	Differential pressure	R	Pressure between pump flanges	Bar	●	-	-	H
AI, 94	Remote pressure 2	R	Pressure measured at remote sensor 2	Bar	H	-	-	H
AI, 95	Actual flow limit	R	Actual maximum flow limit	m³/h	●	-	-	H
AI, 96	Specific energy average	R	Average specific energy	kWh/m³	-	-	S	-
AI, 97	Flow measurement 1	R	Flow measurement 1	m³/h	-	-	S	-
AI, 98	Flow measurement 2	R	Flow measurement 2	m³/h	-	-	S	-
AI, 99	Flow measurement 3	R	Flow measurement 3	m³/h	-	-	S	-
AI, 100	Pilot pump fault code	R	Fault code, pilot pump	-	-	-	●	-
AI, 101	Pilot pump runtime	R	Total operating time, pilot pump	h	-	-	●	-
AI, 102	Pilot pump speed	R	Actual speed, pilot pump	%	-	-	●	-
AI, 103	Pilot pump line current	R	Line current, pilot pump	A	-	-	●	-

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AI, 104	Pilot pump power consumption	R	Power consumption, pilot pump	W	-	-	●	-
AI, 105	Pilot pump motor temperature	R	Motor temperature, pilot pump	°C	-	-	●	-
AI, 106	Pilot pump number of starts	R	Number of starts, pilot pump	-	-	-	●	-
AI, 107	Backup pump fault code	R	Fault code, backup pump	-	-	-	●	-
AI, 108	Backup pump runtime	R	Total operating time, backup pump	h	-	-	●	-
AI, 109	Backup pump speed	R	Actual speed, backup pump	%	-	-	●	-
AI, 110	Backup pump line current	R	Line current, backup pump	A	-	-	●	-
AI, 111	Backup pump power consumption	R	Power consumption, backup pump	W	-	-	●	-
AI, 112	Backup pump motor temperature	R	Motor temperature, backup pump	°C	-	-	●	-
AI, 113	Backup pump number of starts	R	Number of starts, backup pump	-	-	-	●	-
AI, 114	Remote diff. temperature	R	Differential temperature at remote sensor	°C	-	-	-	H
AI, 115	Inlet diff. pressure	R	Differential pressure at the inlet pipe	Bar	H	-	-	H
AI, 116	Outlet diff. pressure	R	Differential pressure at the outlet pipe	Bar	H	-	-	H
AI, 117	Remote diff. pressure	R	Differential pressure at remote sensor	Bar	H	-	-	H
AI, 118	Storage tank Level	R	Water level in the storage tank	m	H	-	-	H
AI, 119	Heat energy counter	R	Life time accumulated heat energy External temperature sensor required	1 kWh	●	-	-	-
AI, 120	Heat power	R	Current heat power External temperature sensor required	0.1 W	●	-	-	-
AI, 121	Heat differential temperature	R	Differential temperature External temperature sensor required	0.01 °C	●	-	-	-
AI, 122	Subpump 1 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 123	Subpump 2 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 124	Subpump 3 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 125	Subpump 4 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 126	Subpump 5 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 127	Subpump 6 Energy consumption	R	Energy consumption	kWh	-	-	●	H
AI, 128	Pilot pump Energy consumption	R	Energy consumption	kWh	-	-	●	-
AI, 129	Backup pump Energy consumption	R	Energy consumption	kWh	-	-	●	-
AI, 135	Heat energy counter 2	R	Heat energy counter 2	kWh	●	-	-	-
AI, 136	Volume 2	R	Volume counter 2	m^3	●	-	-	-
AI, 138	Analog Input1	R	Analog Input 1 scaled	-	-	-	●	-
AI, 139	Analog Input2	R	Analog Input 2 scaled	-	-	-	●	-
AI, 140	Analog Input3	R	Analog Input 3 scaled	-	-	-	●	-
AI, 141	Analog Input4	R	Analog Input 4 scaled	-	-	-	●	-
AI, 142	Analog Input5	R	Analog Input 5 scaled	-	-	-	●	-
AI, 143	Analog Input6	R	Analog Input 6 scaled	-	-	-	●	-
AI, 144	Analog Input7	R	Analog Input 7 scaled	-	-	-	●	-

●: Always available

S: Sensor required

H: Only for MGE model H or newer

Related information

6.7 Analog outputs

Object for setting a new setpoint in the booster system.

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AO, 0	Set setpoint	W	Sets the booster system setpoint if bus control is enabled. A value of 0 does not imply a stop. See section Setpoint.	%	●	●	●	●
AO, 1	Tank-filling start limit	W	Sets the start limit in percentage of tank height.	%	-	●	-	-
AO, 2	Tank-filling stop limit	W	Sets the stop limit in percentage of tank height.	%	-	●	-	-
AO, 3	Tank-filling alarm high-limit	W	Sets the alarm high-limit in percentage of tank height.	%	-	●	-	-
AO, 4	Tank-filling warning low-limit	W	Sets the warning low-limit in percentage of tank height.	%	-	●	-	-
AO, 5	Set max. flow limit	W	Sets the maximum flow limit value.	m^3/h	●	-	-	H
AO, 6	Set speed setpoint Pump1	W	Sets the man speed setpoint pump1 if man start is enabled.	%	-	-	●	-
AO, 7	Set speed setpoint Pump2	W	Sets the man speed setpoint pump2 if man start is enabled.	%	-	-	●	-
AO, 8	Set speed setpoint Pump3	W	Sets the man speed setpoint pump3 if man start is enabled.	%	-	-	●	-
AO, 9	Set speed setpoint Pump4	W	Sets the man speed setpoint pump4 if man start is enabled.	%	-	-	●	-
AO, 10	Set speed setpoint Pump5	W	Sets the man speed setpoint pump5 if man start is enabled.	%	-	-	●	-
AO, 11	Set speed setpoint Pump6	W	Sets the man speed setpoint pump6 if man start is enabled.	%	-	-	●	-
AO, 12	Set speed setpoint Pilot Pump	W	Sets the man speed setpoint pump1 if man start is enabled.	%	-	-	●	-
AO, 13	Set speed setpoint Backup Pump	W	Sets the man speed setpoint pump1 if man start is enabled.	%	-	-	●	-

H: For MGE model H or newer

For Multi-E with CIM in each pump, always send all commands (writings) to all pumps.

A TPED model H is essentially a Multi-E model H with two pumps.

Related information

6.8 Analog values

They are objects for configuration of the CIM/CIU 300 and 500 and the booster system.

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AV, 0	Custom Device Object Instance Number	R/W	It is the value for Custom Device Object Instance Number, used in conjunction with DIP switch SW3. See sectionSelecting the Device Object Instance Number. Present_Value range: 0-0x3FFFFE Default Present_Value: 0xE7	-	•	•	•	•
AV, 1	BACnet watchdog	R/W	Is shows the time in seconds before BACnet communication watchdog times out, and sets the booster system to use its local settings. See section BACnet communication watchdog. 0: Disabled (default) Set to a value between 5 and 3600 to enable.	s	•	-	-	H
AV, 2	Simulation fault code	R/W	It is fault code to simulate. See section Grundfos alarms and warning codes. It can be cleared by writing a value of 0.	-	-	-	-	H
AV, 3	Simulation warning code	R/W	It is warning code to simulate. See section Grundfos alarms and warning codes. It can be cleared by writing a value of 0.	-	-	-	-	H
AV, 4	Simulation event code	R/W	It is event code to simulate. The following event code values are available for simulation of the CU 35X, among others: 000: No alarm 003: External fault 010: Booster system communication alarm 089: Closed-loop feedback sensor signal fault 088: General (measuring) sensor signal fault 203: All pumps in alarm 210: Pressure high 211: Pressure low 214: Water shortage 231: No Ethernet address from DHCP server	-	-	•	•	-
AV, 5	Simulation device type	R/W	It is the device type of a simulated event: 0: Controller 2: Pump 3: IO 351 4: Primary sensor 7: IO 351 8: System 9: Analog input 10: Pilot booster system 11: Limit-exceeded function	-	-	•	•	-
AV, 6	Simulation device number	R/W	It is the device number of a simulated event: If the device type is "Pump", the device number indicates the pump number [1-6]. If the device type is "Analog input", the device number indicates the sensor that generated the event [1-7].	-	-	•	•	-
AV, 7	Simulation event action type	R/W	It is the associated action to the event. 0: Go to operating mode "Stop" 1: Go to operating mode "Stop" (delay) 2: Go to operating mode "Minimum" 3: Go to operating mode "User-defined" 4: Go to operating mode "Maximum" 5: Set pumps in source mode to "Local control" 6: No action (warning only) 7: Go to operating mode "Emergency run"	-	-	-	•	-

ID	Object name	R/W	Notes	Unit	MGE model H and later Twin-head pump + MAGNA3 Twin-head pump	Hydro Multi-B	Hydro MPC	Hydro Multi-E
AV, 8	Simulation event reset type	R/W	It is the resetting type for simulated event. 0: Manual resetting 1: Automatic resetting	-	-	-	●	-
AV, 9	Product time and date	R/W	Pump time and date in UNIX format (seconds since 00:00 01-01-1970)	s	●	-	-	H
AV, 10	Proportional-control reduction	R/W	Reduction in % to be used in proportional-pressure control mode	%	H	-	●	H
AV, 11	Proportional-control flow max.	R/W	Max. flow in m^3/h to be used in proportional-pressure control mode	m^3/h	H	-	●	H
AV, 13	Remote Sensor 1	R/W	Remote Sensor 1 via BACnet (CU 352)	%	-	-	●	-
AV, 14	Remote Sensor 2	R/W	Remote Sensor 2 via BACnet (CU 352)	%	-	-	●	-
AV, 15	Remote Sensor 3	R/W	Remote Sensor 3 via BACnet (CU 352)	%	-	-	●	-
AV, 16	Remote Sensor 4	R/W	Remote Sensor 4 via BACnet (CU 352)	%	-	-	●	-
AV, 17	Remote Sensor 5	R/W	Remote Sensor 5 via BACnet (CU 352)	%	-	-	●	-
AV, 18	Remote Sensor 6	R/W	Remote Sensor 6 via BACnet (CU 352)	%	-	-	●	-
AV, 19	Set Kp	R/W	Set proportional gain	Kp 0.1	-	-	●	-
AV, 20	Set Ti	R/W	Set integral action time	Ti 0.1s	-	-	●	-

Related information

7. Detailed descriptions

7.1 Control modes

Control modes	Description	Illustration
Constant speed	**Open loop** The setpoint of the booster system is interpreted as the setpoint for the system performance. The setpoint value is a percentage of the maximum performance of the pumps. No sensor is required.	TM079755
Constant pressure Constant diff. pressure	**Closed loop** The setpoint of the booster system is interpreted as the setpoint for the pressure. The controller in the booster system adapts the pump speed so that the pressure is constant, regardless of the flow. A pressure sensor is required.	TM079756
Constant flow Constant level Constant temperature Constant diff. temperature Constant percentage Closed-loop sensor control	**Closed loop** You can obtain these control modes by replacing the main pressure sensor by another relevant sensor. For example, a flow sensor for flow control, a level sensor for level control, or a temperature sensor for temperature control. Constant flow is illustrated on the right.	TM079754
Proportional pressure	**Closed loop** The setpoint of the booster system is interpreted as the setpoint for proportional-pressure mode (the black dot in the illustration). A pressure sensor is required. In this control mode, the booster system automatically adjusts the setpoint according to changes in flow, in order to save energy.	TM079757
AUTOADAPT	**AUTOADAPT** For this control mode, the optimum setpoint is automatically estimated and used. This also means that any setpoint value is ignored. A pressure sensor is required. This control mode is not supported by all products.	TM079753
FLOWADAPT	**FLOWADAPT with flow limitation** For this control mode, the optimum setpoint is automatically estimated and used, but the flow is limited by the maximum flow-limit value set by the user. Set the value with AO, 5. This control mode is not supported by all products.	TM079758

H = Pressure (Head)

Q = Flow

For tank filling, see section Tank-filling applications.

Related information

7.2 Setpoint

This object accepts values ranging from 0 to 100 (0 % to 100 %).

The setpoint value can represent for example, speed, pressure, flow, depending on the selected control mode.

A setpoint of 0 does not imply a stop.

7.2.1 Setpoint in closed-loop control

Hydro MPC and Multi-E

The setpoint is written to AO, 0 Setpoint as a percentage value of the sensor maximum value, called FeedbackSensorMax.

The sensor minimum value is always 0. The selected setpoint is reflected in AI, 58 UserSetpoint with the same scaling.

The actual setpoint, whether it has been set with the Grundfos GO, the pump display, the pump buttons or the fieldbus, can be read from AI, 9 ActualSetpoint. It is a percentage value of FeedbackSensorMax.

The actual setpoint value represents head, pressure, flow, temperature and so on, depending on how the feedback sensor has been set to measure. The unit of measure can be read from MI, 11 FeedbackSensorUnit.

Unless a setpoint influencing function, like proportional influence, is active, ActualSetpoint equals UserSetpoint.

It is possible to calculate back and forth between the setpoint in percent and its scaled value:

X_{act}[unit] =

X_{set}[%] × FeedbackSensorMax × FeedbackSensorUnit
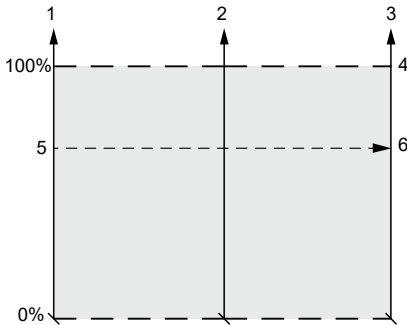
Setpoint in closed-loop control for the Hydro MPC and Multi-E

Pos.	Description
1	Setpoint [1] (AO, 0)
2	UserSetpoint [1] (AI, 58)
3	ActualSetpoint [1] (AI, 9)
4	FeedbackSensorMax
5	X_{set}
6	X_{act}

[1] Percentage of sensor maximum

TPED and MAGNA3-D

The setpoint is written to AO, 0 Setpoint as a percentage value of the setpoint range [r_{min}; r_{max}]. The selected setpoint is reflected in AI, 58 UserSetpoint with the same scaling.

The actual setpoint, whether it has been set with the Grundfos GO, the pump display, the pump buttons or the fieldbus, can be read from AI, 9 ActualSetpoint. It is a percentage value of FeedbackSensorMax.

The actual setpoint value represents head, pressure, flow, temperature and so on depending on how the feedback sensor has been set to measure. The unit of measure can be read from MI, 11 FeedbackSensorUnit.

It is possible to calculate back and forth between AI, 9 ActualSetpoint in percent and its scaled value:

X_{act}[unit] = X_{act}[%] × FeedbackSensorMax × FeedbackSensorUnit

The setpoint range limits r_{min} and r_{max} cannot be read from the fieldbus but can be found in the pump data sheet, or in the Grundfos GO "Setpoint" menu.
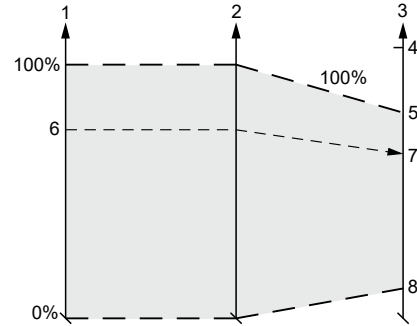
Setpoint in closed-loop control for the TPED and MAGNA3-D

Pos.	Description
1	Setpoint [2] (AO, 0)
2	UserSetpoint [2] (AI, 58)
3	ActualSetpoint [3] (AI, 9)
4	FeedbackSensorMax
5	r_{max}
6	X_{set}
7	X_{act}
8	r_{min}

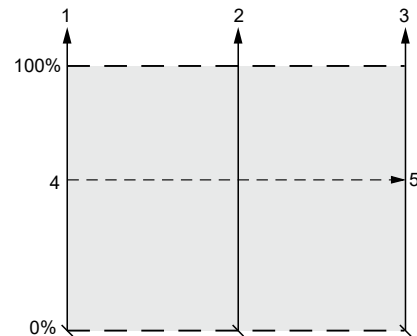[2] Percentage of setpoint range

[3] Percentage of sensor maximum

7.2.2 Setpoint in open-loop control

Hydro MPC and Multi-E

The setpoint is written to AO, 0 Setpoint as a percentage value of the maximum performance. The selected setpoint is reflected in AI, 58 UserSetpoint with the same scaling.

The actual setpoint, whether it has been set with the Grundfos GO, the pump or controller display or buttons, or the fieldbus, can be read from AI, 9 ActualSetpoint, and it reflects different limitations, for example power or frequency limits, that might be active in the system. It equals the value that the booster system actually uses.

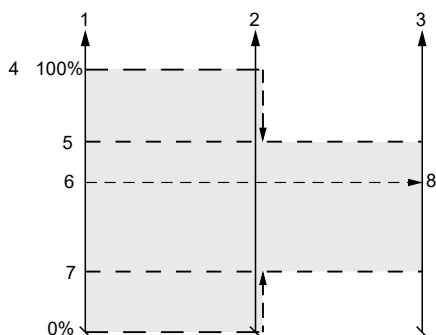*Setpoint in open-loop control for the Hydro MPC and Multi-E*

Pos.	Description
1	Setpoint [4] (AO, 0)
2	UserSetpoint [4] (AI, 58)
3	ActualSetpoint [4] (AI, 9)
4	X_{set}
5	X_{act}

[4] Percentage of system performance

TPED and MAGNA3-D

The setpoint is written to AO, 0 Setpoint as a percentage value of the nominal pump frequency, f_{nom}. The selected setpoint is reflected in AI, 58 UserSetpoint with the same scaling. From fieldbus, it gets whatever value is written to Setpoint, but from pump display and the Grundfos GO, it is truncated to the internal pump frequency limits $[f_{min}; f_{max}]$.

The actual setpoint, whether it has been set with the Grundfos GO, the pump display, the pump buttons or the fieldbus, can be read from AI, 9 ActualSetpoint, and it always reflects the frequency limitations. It equals the value that the pump actually uses. Values of f_{min}, f_{max} and f_{nom} can be read in the Grundfos GO.

Setpoint in open-loop control for the TPED and MAGNA3-D

Pos.	Description
1	Setpoint [5] (AO, 0)
2	UserSetpoint [5] (AI, 58)
3	ActualSetpoint [5] (AI, 9)
4	f_{nom}
5	f_{max}
6	X_{set}
7	f_{min}
8	X_{act}

[5] Percentage of f_{nom}

7.3 BACnet communication watchdog

A BACnet communication watchdog is implemented in the CIM/CIU 300 and the CIM/CIU 500. If no BACnet communication is detected for the time period defined by the BACnet watchdog object (AV, 1), and the control source of the booster system is set to Bus control (BO, 0), the CIM 300 makes the booster system run with the settings defined in local mode.

This functionality can be used for defining the booster system behaviour in case of a BACnet communication breakdown. Before enabling the watchdog, the local booster system settings must be made with either a Grundfos PC Tool or the Grundfos GO (for Hydro Multi-E only). This ensures that the booster system behaves as expected if the BACnet communication breaks down.

When the BACnet communication is re-established after a watchdog time-out, the booster system runs with the remote settings again.

When the Present_Value of the AV, 1 object is set to 0, the watchdog is disabled (default). To enable the watchdog, set the Present_Value to [5-3600] seconds.

7.4 Fault monitoring and resetting

The following example shows how to monitor faults or warnings in the booster system and how to manually reset a fault. This option is not available on the CIM/CIU 500.

The Fault code object (AV, 0) and the Warning code object (AV, 1) can both hold a Grundfos-specific fault code. See section Grundfos alarm and warning codes for code interpretation.

Warnings are notifications only, and a warning normally does not stop the booster system.

If a fault is to be manually reset, use the Reset fault object (BO, 4). When the Present_Value of this object is set to 1, a Reset fault command is sent to the device.

Example:

Fault simulation can be helpful for testing alarm behaviour for a Hydro MPC booster system. The system behaves exactly as if a real alarm was present.

This example shows how to simulate a "Pressure high" alarm on a Hydro MPC that results in a stop of all pumps, and requires manual resetting.

- Set "Simulation event code" (AV, 4) to 210 (Pressure high).
- Set "Simulation device type" (AV, 5) to 8 (System).
- Set "Simulation device number" (AV, 6) to 1 (System).
- Set "Simulation event action type" (AV, 7) to 0 (Stop).
- Set "Simulation event reset type" (AV, 8) to 0 (Manual resetting).
- Set "Fault simulation" (BO, 5) to 1 (Enabled).
- The CU 35X now enters into the system mode "Event action" and stops all pumps, with the red LED on the CU 35X being on. On the CU 35X display, the "Pressure high" alarm is indicated.
- Read "Fault simulation status" (BI, 28), and see that it is set to 1 (Fault simulation enabled).
- Remove the simulated alarm settings by setting "Fault simulation" (BO, 5) to 0 (Disabled).
- Reset the alarm via the CU 35X display or via the BACnet object "Reset fault" (BO, 4), and the CU 35X goes back to normal operation.

Related information

12. Grundfos alarm and warning codes

7.5 Control via BACnet

This example shows how to set a Hydro MPC to 50 % setpoint, constant-pressure mode and bus control.

Before enabling control via the BACnet, values for setpoint, control mode and operating mode must be set.

- Enable bus control via the CU 35X display. Select "Settings" > "Secondary functions" > "Control source", then select "Controlled from bus".
- Set the operating mode with Multistate output 1 (MO, 1). In this example, the value for operating mode must be 1 (Start).
- Set the control mode with Multistate output 0 (MO, 0). A value of 2 corresponds to Constant pressure.
- Set the setpoint to a value of 50 with Analog output 0 (AO, 0). See section Setpoint for details on setpoint.
- To enable bus control via the BACnet, set the Binary output 0 (BO 0) to a value of 1.

Now the Hydro MPC should be running at 50 % in constant-pressure mode with bus control.

Related information

7.2 Setpoint

7.6 Product simulation

Product profile simulation, or booster system simulation, can be useful for testing and pre-commissioning purposes. It is possible to simulate a booster system profile when using a CIM/CIU 300 that is not connected to any product. The CIM/CIU 300 behaves as if a booster system was connected on the GENIbus. The objects supported by the simulated product appear available, although the data are only dummy values that do not simulate real booster system behaviour.

Product simulation is enabled by setting the Multistate output object "Product simulation" (MO, 2):

Product to simulate	Value
Disabled (no simulation)	1
Hydro Multi-E before MGE model H	5
Hydro MPC (CU 352)	6
Hydro Multi-B (CU 323)	7
Hydro Multi-E (MGE model H and later)	10

Product simulation is always disabled on power-up.

If a physical booster system is detected on the GENIbus at power-up, it is not possible to enable product simulation.

7.7 Tank-filling applications

Normally, the Hydro Multi-B runs in pressure-boosting mode, but it can also be set to run in tank-filling mode.

Proceed as follows:

1. Set the application to tank-filling mode on the CU 323 via the Grundfos PC Tool E-Products. This cannot be set via the BACnet.

2. To enable bus control via the BACnet, set the Binary output 0 (BO, 0) to value 1.

3. Set the tank height with Analog output 0 (AO, 0), Setpoint.

4. Set start and stop levels as well as alarm and warning limits with (AO, 1), (AO, 2), (AO, 3) and (AO, 4). Note that these values are set in percentage of the total tank height.

7.8 Remote sensors (CU 352)

A PLC fieldbus master with 1-6 connected analogue sensors can send the sensor readings to the Grundfos Hydro MPC via a CIM fieldbus. The MPC can display the values and use them for different planned functions like setpoint influencing.

8. Commissioning of hardware: step-by-step setup

8.1 CIM 300

Step	Action
1	Fit the CIM 300 in the CU 352 of the Hydro MPC or in the CU 323 of the Hydro Multi-B booster system. With a Multi-E system, using MGE motors model H or later, the CIM 300 is installed in the master pump (typically where the system sensors are attached). Secure the module with screws.
2	Complete the booster configuration, for example, the sensor configuration, via the operating panel or the PC Tool.
3	Select the BACnet MAC address (0-127) on the CIM 300.
4	Select the transmission speed of the CIM 300.
5	Select the Device Object Instance Number.
6	If necessary, set the line termination.
7	Connect the necessary cables from the CIM 300 to the BACnet network.
8	Confirm that the GENIbus LED is permanently green and that the BACnet LED is either off or flashing green, indicating communication.

The CIM 300 is now configured and ready.

Related information

8.2 CIU 300

Step	Action
1	Complete the booster configuration, for example, the sensor configuration, via the operating panel or the PC Tool.
2	Select the BACnet MAC address (0-127) on the CIM 300.
3	Select the transmission speed of the CIM 300.
4	Select the Device Object Instance Number.
5	If necessary, set the line termination.
6	Connect the GENIbus cable from the CIU 300 to the booster system.
7	Connect the necessary cables from the CIU 300 to the BACnet network.
8	Connect the power cable to the CIU 300, and switch it on.
9	Confirm that the GENIbus LED is permanently green and that the BACnet LED is either off or flashing green, indicating communication.

The CIU 300 is now configured and ready.

Related information

8.3 CIM 500

Step	Action
1	Install the CIM 500 in the Grundfos booster system according to the booster system documentation.
2	Select position 2 at the protocol rotary switch. See section Setting the industrial Ethernet protocol.
3	Power on the booster system, and observe the LED2 turning permanently green and the LED1 remaining off.
4	Complete the booster system configuration, for example, the sensor configuration, and selection of local Operating mode, local Control mode and local Setpoint, for example, with the Grundfos GO.
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 that of the CIM 500, for example 192.168.1.1, and the subnet mask to 255.255.255.0. See section How to configure an IP address on your PC.
7	Open your internet browser, and make contact to the CIM 500 webserver. Factory default address: 192.168.1.100
8	Log in to the webserver. Default: User: admin Password: Grundfos

Step	Action
9	In the menu column to the left, select "Configuration" > "Real time Ethernet protocol".
10	Type in an IP address belonging to the same subnet as your PC, for example 192.168.1.2.
11	Type in the subnet mask 255.255.255.0, and leave the rest of the settings at their default values.
12	Click [Submit] to transfer the new settings, and close the web browser.

The 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 flashes green when the BACnet IP communication takes place.

You can use the two Ethernet ports for daisy chaining the 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 the PC Tool CIM/CIU while connected to another BACnet IP master.

Related information

A.1.2. How to configure an IP address on your PC using Windows 10

4.2 Setting the industrial Ethernet protocol

8.4 CIU 500

Step	Action
1	Make sure that both the CIU 500 unit and the booster system are powered off.
2	Remove the front cover of the CIU 500 unit.
3	Select position 2 at the CIM 500 module protocol rotary switch.
4	Connect the GENIbus cable from the CIU 500 to the booster system. See the CIU quick guide.
5	Power on the CIU 500 and the booster system, and observe the LED2 turning permanently green and the LED1 remaining off.
6	Connect one of the CIU 500 Ethernet ports (RJ45) to a PC using an Ethernet cable.
7	Configure the PC Ethernet port to the same subnetwork as that of the CIM 500, for example 192.168.1.1, and the subnet mask to 255.255.255.0. See section How to configure an IP address on your PC.
8	Open your internet browser, and make contact to the CIM 500 webserver. Factory default address: 192.168.1.100
9	Log in to the webserver. Default: User: admin Password: Grundfos
10	In the menu column to the left, select "Configuration" > "Real time Ethernet protocol".
11	Type in an IP address belonging to the same subnet as your PC, for example 192.168.1.2.
12	Type in the subnet mask 255.255.255.0, and leave the rest of the settings at their default values.
13	Click [Submit] to transfer the new settings and close the web browser.

The 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 10.

The CIU 500 LED1 flashes green when the BACnet IP communication takes place.

You can use the two Ethernet ports for daisy chaining the 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 the PC Tool CIM/CIU while connected to another BACnet IP master.

Related information

A.1.2. How to configure an IP address on your PC using Windows 10

4.2 Setting the industrial Ethernet protocol

9. Fault finding the product

9.1 CIM/CIU 300 BACnet MS/TP

9.1.1 LED status

You can detect faults in a CIM/CIU 300 by observing the status of the two communication LEDs.

9.1.1.1 Both LEDs remain off when the power supply is connected, and 5 seconds have passed.

Cause	Remedy
The CIM/CIU is defective.	• Replace the CIM/CIU.

9.1.1.2 The LED2 for internal communication is flashing red.

Cause	Remedy
There is no internal communication between the CIM/CIU and the connected Grundfos product.	• Check the cable connection between the CIM/CIU and the connected Grundfos product. • Check if the individual conductors are fitted correctly, for example, not reversed. • Check the power supply to the connected Grundfos product.

9.1.1.3 The LED2 for internal communication is permanently red.

Cause	Remedy
The CIM/CIU does not support the connected Grundfos product.	• Contact the nearest Grundfos company.

9.1.1.4 The LED1 for BACnet communication is permanently red.

Cause	Remedy
There is fault in the CIM/CIU BACnet configuration.	• Make sure that the BACnet MAC address has a valid setting. • Make sure that the Device Object Instance Number is within the allowed range.

9.1.1.5 The LED1 for BACnet communication is flashing red.

Cause	Remedy
There is a fault in the BACnet communication (cyclic redundancy check).	• Check the transmission speed via switches SW4 and SW5. • Check the cable connection between the CIM 300 and the BACnet network. • Check the termination resistor settings via switches SW1 and SW2.

Related information

9.1.2 BACnet faults

9.1.2.1 The CIM/CIU does not communicate on the BACnet MS/TP network.

Cause	Remedy
An error occurred in the configuration or wiring.	• Make sure that the cable between the BACnet MS/TP devices is connected correctly. • Make sure that the BACnet MAC address and Device Object Instance Number are configured correctly and are unique on the network. • Make sure that the transmission speed is configured correctly. • Make sure that each end of the BACnet MS/TP trunk cable is terminated, if necessary. • Make sure that the bus topology for the BACnet MS/TP network is correct.
The CIM/CIU is instructed not to communicate on the BACnet network via the DeviceCommunicationControl service.	• Use the DeviceCommunicationControl service to enable communication from the device.

9.1.2.2 The booster system does not react to control commands from the bus.

Cause	Remedy
The booster system is running in local mode.	• Set the booster system to bus control by setting the Present_Value of BO 0 to 1. • Set bus control on the CU 35X display. Select "Settings" > "Secondary functions" > "Control source", and select "Controlled from bus".

9.1.2.3 There are only a few BACnet objects available, and the GENIbus LED flashes red.

Cause	Remedy
There is no communication between the CIM/CIU and the booster system.	• Make sure that the GENIbus cable between the CIM/CIU 300 and the booster system is connected correctly. • Make sure that the booster system is switched on and able to communicate on the GENIbus.

Related information

9.2 CIM/CIU 500 BACnet IP

You can detect faults in CIM/CIU 500 by observing the status of the two communication LEDs.

9.2.1 LED status: The CIU 500 is fitted in a Grundfos booster system.

9.2.1.1 Both LEDs remain off when the power supply is connected.

Cause	Remedy
The CIM/CIU is fitted incorrectly in the connected Grundfos product.	• Ensure that the CIM/CIU is fitted and connected correctly.
The CIM/CIU is defective.	• Replace the CIM/CIU.

9.2.1.2 The LED2 for internal communication is flashing red.

Cause	Remedy
There is no internal communication between the CIM/CIU and the connected Grundfos product.	• Make sure that the CIM/CIU is fitted correctly in the Grundfos product.

9.2.1.3 The LED2 for internal communication is permanently red.

Cause	Remedy
The CIM/CIU does not support the connected Grundfos product.	• Contact the nearest Grundfos company.

9.2.1.4 The LED1 for BACnet communication is permanently red.

Cause	Remedy
There is fault in the CIM 500 BACnet IP configuration.	• Make sure that the rotary switch SW1 is set to 2. • Make sure that BACnet IP address configuration is correct.

9.2.1.5 The LED1 is permanently red and green at the same time.

Cause	Remedy
There is error in the firmware download.	• Use the webserver to download the firmware again.

9.2.1.6 The LED2 is permanently red and green at the same time.

Cause	Remedy
There is a memory fault.	• Replace the CIM/CIU.

Related information

9.2.2 LED status: The CIM 500 is fitted in the CIU 500.

9.2.2.1 Both LEDs remain off when the power supply is connected.

Cause	Remedy
The CIM/CIU is defective.	• Replace the CIM/CIU.

9.2.2.2 The LED2 for internal communication is flashing red.

Cause	Remedy
There is no internal communication between the CIM/CIU and the connected Grundfos product.	• Check the cable connection between the CIM/CIU and the connected Grundfos product. • Check if the individual conductors are fitted correctly, for example, not reversed. • Check the power supply to the connected Grundfos product.

9.2.2.3 The LED2 for internal communication is permanently red.

Cause	Remedy
The CIM/CIU does not support the connected Grundfos product.	• Contact the nearest Grundfos company.

9.2.2.4 The LED1 for BACnet communication is permanently red.

Cause	Remedy
There is fault in the CIM/CIU BACnet configuration.	• Make sure that the BACnet MAC address has a valid setting. • Make sure that the Device Object Instance Number is within the allowed range.

9.2.2.5 The LED1 is permanently red and green at the same time.

Cause	Remedy
There is error in the firmware download.	• Use the webserver to download the firmware again.

9.2.2.6 The LED2 is permanently red and green at the same time.

Cause	Remedy
There is a memory fault.	• Replace the CIM/CIU.

Related information

9.2.3 CIM/CIU 500 BACnet IP communication faults

9.2.3.1 The slave does not respond to telegrams.

Cause	Remedy
There is error in the configuration or wiring.	• 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. • Make sure that the cable between the BACnet IP master and the BACnet slave is connected correctly. See section Connecting the Ethernet cable.

9.2.3.2 The slave returns data value 0xFFFF (65535).

Cause	Remedy
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 connected Grundfos product.	• See section Object overview for available data.
The connected Grundfos product is not configured to show the value, or it lacks a sensor to read the value.	• See section Analog values for data values that require a sensor.

9.2.3.3 The slave does not react to control actions or to writing of settings.

Cause	Remedy
The Grundfos product might be in "Local" mode, in which case Operating mode, Control mode and Setpoint cannot be changed from the bus. Register 00201 bit 8 AccessMode must be "1" (=Remote) for bus control to be active.	• Set the Grundfos product in "Remote mode" by setting register . • The Grundfos product should show "Controlled from bus" on the booster display. Select "Settings" > "Secondary functions" > "Control source", and select "Controlled from bus".

Related information

10. BACnet telegrams

10.1 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. 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.

Related information

3.7 Selecting the BACnet MAC address

10.2 Telegram types

The available telegram types are listed below.

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

11. BACnet MAC address, CIM 300

BACnet address	SW6	SW7	BACnet address	SW6	SW7	BACnet address	SW6	SW7
0	0	0	45	2	D	90	5	A
1	0	1	46	2	E	91	5	B
2	0	2	47	2	F	92	5	C
3	0	3	48	3	0	93	5	D
4	0	4	49	3	1	94	5	E
5	0	5	50	3	2	95	5	F
6	0	6	51	3	3	96	6	0
7	0	7	52	3	4	97	6	1
8	0	8	53	3	5	98	6	2
9	0	9	54	3	6	99	6	3
10	0	A	55	3	7	100	6	4
11	0	B	56	3	8	101	6	5
12	0	C	57	3	9	102	6	6
13	0	D	58	3	A	103	6	7
14	0	E	59	3	B	104	6	8
15	0	F	60	3	C	105	6	9
16	1	0	61	3	D	106	6	A
17	1	1	62	3	E	107	6	B
18	1	2	63	3	F	108	6	C
19	1	3	64	4	0	109	6	D
20	1	4	65	4	1	110	6	E
21	1	5	66	4	2	111	6	F
22	1	6	67	4	3	112	7	0
23	1	7	68	4	4	113	7	1
24	1	8	69	4	5	114	7	2
25	1	9	70	4	6	115	7	3
26	1	A	71	4	7	116	7	4
27	1	B	72	4	8	117	7	5
28	1	C	73	4	9	118	7	6
29	1	D	74	4	A	119	7	7
30	1	E	75	4	B	120	7	8
31	1	F	76	4	C	121	7	9
32	2	0	77	4	D	122	7	A
33	2	1	78	4	E	123	7	B
34	2	2	79	4	F	124	7	C
35	2	3	80	5	0	125	7	D
36	2	4	81	5	1	126	7	E
37	2	5	82	5	2	127	7	F
38	2	6	83	5	3			
39	2	7	84	5	4			
40	2	8	85	5	5			
41	2	9	86	5	6			
42	2	A	87	5	7			
43	2	B	88	5	8			
44	2	C	89	5	9			

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

12. 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	2	Missing phase	3	External fault signal
4	Too many restarts	5	Regenerative braking	6	Mains fault
7	Too many hardware shutdowns	8	PWM switching frequency reduced	9	Phase sequence reversal
10	Communication fault, pump	11	Water-in-oil fault (motor oil)	12	Time for service (general service information)
13	Moisture alarm, analog	14	Electronic DC-link protection activated (ERP)	15	Communication fault, main system (SCADA)
16	Other	17	Performance requirement cannot be met	18	Commanded alarm standby (trip)
19	Diaphragm break (dosing pump)	20	Insulation resistance low	21	Too many starts per hour
22	Moisture switch alarm, digital	23	Smart trim gap alarm	24	Vibration
25	Setup conflict	26	Load continues even when motor switched off	27	External motor protector activated (for example MP 204)
28	Battery low	29	Turbine operation (impellers forced backwards)	30	Change bearings (specific service information)
31	Change varistor(s) (specific service information)	32	Overvoltage	33	Soon time for service (general service information)
34	No priming water	35	Gas in pump head, de-aerating problem	36	Outlet valve leakage
37	Inlet valve leakage	38	Vent valve defective	39	Valve stuck or defective
40	Undervoltage	41	Undervoltage transient	42	Cut-in fault (dV/dt)
43	-	44	-	45	Voltage asymmetry
46	-	47	-	48	Overload
49	Overcurrent (i_line, i_dc, i_mo)	50	Motor-protection function, general shutdown (MPF)	51	Blocked motor or pump
52	Motor slip high	53	Stalled motor	54	Motor-protection function, 3-second limit
55	Motor current protection activated (MCP)	56	Underload	57	Dry running
58	Low flow	59	No flow	60	Low input power
61	-	62	-	63	-
64	-	65	Motor temperature 1 (t_m or t_mo or t_mo1)	66	Temperature, control electronics (t_e)
67	Temperature too high, internal frequency converter module (t_m)	68	External temperature or water temperature (t_w)	69	Thermal relay 1 in motor, for example, Klixon
70	Thermal relay 2 in motor, for example, thermistor	71	Motor temperature 2 (Pt100, t_mo2)	72	Hardware fault, type 1
73	Hardware shutdown (HSD)	74	Internal supply voltage too high	75	Internal supply voltage too low
76	Internal communication fault	77	Communication fault, twin-head pump	78	Fault, speed plug
79	Functional fault, add-on module	80	Hardware fault, type 2	81	Verification error, data area (RAM)
82	Verification error, code area (ROM, FLASH)	83	Verification error, FE parameter area (EEPROM)	84	Memory access error
85	Verification error, BE parameter area (EEPROM)	86	Fault (add-on) I/O module	87	-
88	Sensor fault	89	Signal fault, (feedback) sensor 1	90	Signal fault, speed sensor
91	Signal fault, temperature sensor 1	92	Calibration fault, (feedback) sensor	93	Signal fault, sensor 2
94	Limit exceeded, sensor 1	95	Limit exceeded, sensor 2	96	Setpoint signal outside range
97	Signal fault, setpoint input	98	Signal fault, input for setpoint influence	99	Signal fault, input for analog setpoint
100	RTC time synchronisation with cellular network occurred	101	-	102	Dosing pump not ready
103	Emergency stop	104	Software shutdown	105	Electronic rectifier protection activated (ERP)
106	Electronic inverter protection activated (EIP)	107	-	108	-
109	-	110	Skew load, electrical asymmetry	111	Current asymmetry
112	Cosφ too high	113	Cosφ too low	114	Motor heater function activated (frost protection)
115	Too many grinder reversals or grinder reversal attempt failed	116	Grinder motor overtemperature	117	Intrusion (door opened)
118	Signal fault, hydrogen sulfide H2S sensor	119	Signal fault, analog input AI4	120	Auxiliary winding fault (single phase motors)
121	Auxiliary winding current too high (single-phase motors)	122	Auxiliary winding current too low (single-phase motors)	123	Start capacitor, low (single-phase motors)

Code	Description	Code	Description	Code	Description
124	Run capacitor, low (single-phase motors)	125	Signal fault, outdoor temperature sensor	126	Signal fault, air temperature sensor
127	Signal fault, shunt relative pressure sensor	128	Strainer clogged	129	-
130	-	131	-	132	-
133	-	134	-	135	-
136	-	137	-	138	-
139	-	140	-	141	-
142	-	143	-	144	Motor temperature 3 (Pt100, t_mo3)
145	Bearing temperature high (Pt100), in general or top bearing	146	Bearing temperature high (Pt100), middle bearing	147	Bearing temperature high (Pt100), bottom bearing
148	Motor bearing temperature high (Pt100) in drive end (DE)	149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	150	Fault (add-on) pump module
151	Fault, display (HMI)	152	Communication fault, add-on module	153	Fault, analog output
154	Communication fault, display	155	Inrush fault	156	Communication fault, internal frequency converter module
157	Real-time clock out of order	158	Hardware circuit measurement fault	159	CIM (Communication Interface Module) fault
160	Cellular modem, SIM card fault	161	Sensor supply fault, 5 V	162	Sensor supply fault, 24 V
163	Measurement fault, motor protection	164	Signal fault, LiqTec sensor	165	Signal fault, analog input 1
166	Signal fault, analog input 2	167	Signal fault, analog input 3	168	Signal fault, pressure sensor
169	Signal fault, flow sensor	170	Signal fault, water-in-oil (WIO) sensor	171	Signal fault, moisture sensor
172	Signal fault, atmospheric pressure sensor	173	Signal fault, rotor position sensor (Hall sensor)	174	Signal fault, rotor origo sensor
175	Signal fault, temperature sensor 2 (t_mo2)	176	Signal fault, temperature sensor 3 (t_mo3)	177	Signal fault, Smart trim gap sensor
178	Signal fault, vibration sensor	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing	180	Signal fault, bearing temperature sensor (Pt100), middle bearing
181	Signal fault, PTC sensor (short-circuited)	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing	183	Signal fault, extra temperature sensor
184	Signal fault, general-purpose sensor	185	Unknown sensor type	186	Signal fault, power meter sensor
187	Signal fault, energy meter	188	Signal fault, user-defined sensor	189	Signal fault, level sensor
190	Limit exceeded, sensor 1 (for example, alarm level in WW application)	191	Limit exceeded, sensor 2 (for example, high level in WW application)	192	Limit exceeded, sensor 3 (for example, overflow level in WW application)
193	Limit exceeded, sensor 4 (for example, low level in WW/tank filling application)	194	Limit exceeded, sensor 5	195	Limit exceeded, sensor 6
196	Operation with reduced efficiency	197	Operation with reduced pressure	198	Operation with increased power consumption
199	Process out of range (monitoring, estimation, calculation, control)	200	Application alarm	201	External sensor input high
202	External sensor input low	203	Alarm on all pumps	204	Inconsistency between sensors
205	Level float switch sequence inconsistency	206	Water shortage, level 1	207	Water leakage
208	Cavitation	209	Non-return valve fault	210	High pressure
211	Low pressure	212	Diaphragm tank precharge pressure out of range	213	VFD not ready
214	Water shortage, level 2	215	Soft pressure buildup time-out	216	Pilot pump alarm
217	Alarm, general-purpose sensor high	218	Alarm, general-purpose sensor low	219	Pressure relief not adequate
220	Fault, motor contactor feedback	221	Fault, mixer contactor feedback	222	Time for service, mixer
223	Time for service, mixer	224	Pump fault due to auxiliary component or general fault	225	Communication fault, pump module
226	Communication fault, I/O module	227	Combi event	228	Night flow max. limit exceeded
229	Water on floor	230	Network alarm	231	Ethernet: no IP address from the DHCP server
232	Ethernet: auto-disabled due to misuse	233	Ethernet: IP address conflict	234	Backup pump alarm
235	Gas detected	236	Pump 1 fault	237	Pump 2 fault
238	Pump 3 fault	239	Pump 4 fault	240	Lubricate bearings (specific service information)
241	Motor phase failure	242	Automatic motor model recognition failed	243	Motor relay is forced (manually operated or commanded)
244	Fault, On/Off/Auto switch	245	Pump continuous runtime too long	246	User-defined relay is forced (manually operated or commanded)

Code	Description	Code	Description	Code	Description
247	Power-on notice (device or system is switched off)	248	Fault, battery/UPS	249	User-defined event 1
250	User-defined event 2	251	User-defined event 3	252	User-defined event 4
253	SMS data from DDD sensor not received within time limit	254	Inconsistent data model		

A.1. 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 the CIM 500.

A.1.1. Webserver configuration

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

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

Before configuration

- Make sure that the PC and the CIM 500 are connected via an Ethernet cable.
- Make sure that the PC Ethernet port is set to the same network as the CIM 500. For network configuration, see section How to configure an IP address on your PC using Windows 10.

To establish a connection from a PC to the CIM 500 for the first time, the following steps are required:
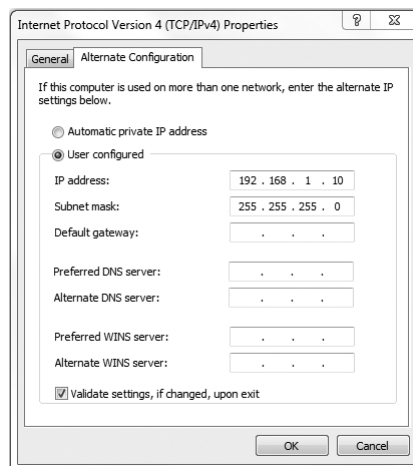
1. Open a standard internet browser and type 192.168.1.100 in the URL address field.

2. Log in to the webserver.

Related information

A.1.2. How to configure an IP address on your PC using Windows 10

A.1.2. How to configure an IP address on your PC using Windows 10

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.

Example from windows 10

TM057422

A.1.3. Login

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: • 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 the CIM 500 resets the back-off algorithm.

The username and password can be changed on the webserver under "User Management".

Change the username and password at first login.

A.1.4. BACnet IP configuration

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 the BACnet IP.
Device Instance	Select the Device Instance. The default number is 227000. The Device Instance must be unique in the BACnet network. 227 denotes Grundfos and it is fixed. The lasts 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, the CIM 500 is configured to use a BACnet custom device instance number.
Foreign Device	If ticked, the 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".

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