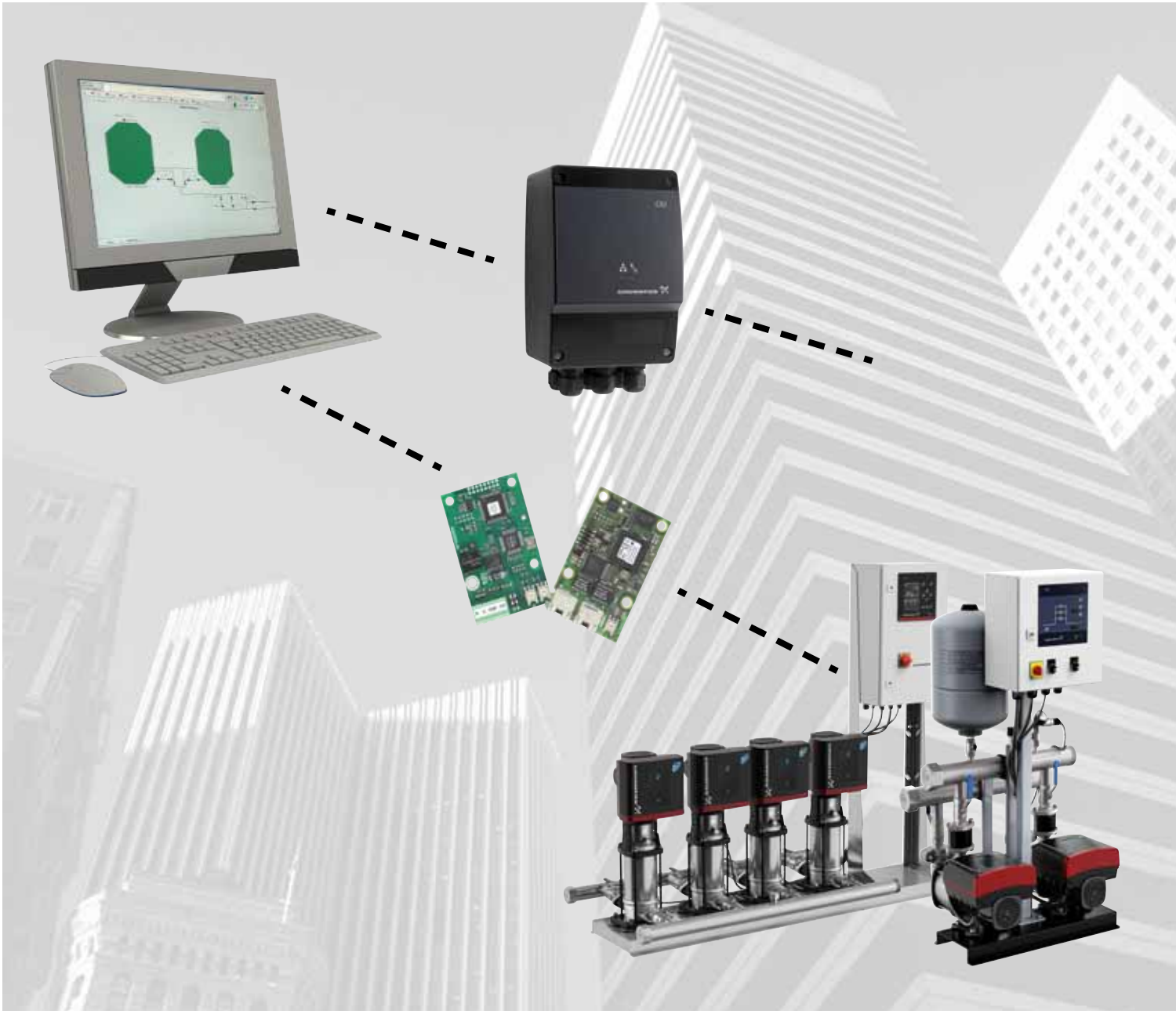
PROFIBUS and PROFINET for Grundfos boosters

CIM/CIU 150 PROFIBUS DP
CIM/CIU 500 Ethernet for PROFINET IO

Functional profile and user manual



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GRUNDFOS

Original functional profile and user manual.

This functional profile describes Grundfos PROFINET and PROFIBUS for boosters.

CONTENTS

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

1. General information

1.1 Hazard statements

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

DANGER

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

WARNING

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

CAUTION

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

The hazard statements are structured in the following way:

SIGNAL WORD

Description of hazard

Consequence of ignoring the warning.

- Action to avoid the hazard.

1.2 Notes

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

Observe these instructions for explosion-proof products.

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

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

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

Tips and advice that make the work easier.

2. Introduction

2.1 About this functional profile

This functional profile describes these protocols for the Grundfos booster systems mentioned below:

- CIM/CIU 150 PROFIBUS DP
- CIM/CIU 500 ethernet for PROFINET IO.

Grundfos booster systems:

- Grundfos Hydro MPC (CU 35X)
- Grundfos Control MPC (CU 35X)
- Grundfos Hydro Multi-E model G
- Grundfos Hydro Multi-E model H and later
- Grundfos TPED model H and later, twin-head pump
- Grundfos MAGNA3-D, twin-head pump.

All Multi-E systems that are based on MGE model G and earlier models will be referred to as Multi-E model G.

All Multi-E systems that are based on MGE model H and later models will be referred to as Multi-E model H.

The data modules for 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, Hydro Multi-E model G and Hydro Multi-E model H are referred to as "booster system".

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

2.2 PROFIBUS DP-V0

The PROFIBUS DP interface conforms to the PROFIBUS DP-V0 standard for cyclic data transmission.

The option of setting the PROFIBUS DP address via bus is not supported as CIM 150 has two switches for setting the address.

2.3 PROFIBUS DP-V1

Only the diagnostic part and the extra three bytes of parameterisation data are supported. Acyclic data transmission is not supported.

2.4 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming of PROFIBUS and PROFINET devices.

2.5 Definitions and abbreviations

ARP	Address Resolution Protocol. Translates IP addresses into MAC addresses.
Auto-MDIX	Ensures that both crossover cable types and non-crossover cable types can be used.
CAT5	Ethernet cable type with four twisted pairs of wires.
CAT5e	Enhanced CAT5 cable with better performance.
CAT6	Ethernet cable compatible with CAT5 and CAT5e and with very high performance.
CIM	Communication Interface Module.
CIU	Communication Interface Unit.
Control MPC	Grundfos pump controller and booster system.
CRC	Cyclic Redundancy Check. A data error detection method.
DHCP	Dynamic Host Configuration Protocol. Used to configure network devices so that they can communicate on an IP network.
DNS	Domain Name System. Used to resolve host names to IP addresses.
Enumeration	List of values.
GENIbus	Proprietary Grundfos fieldbus standard.
GENIpro	Proprietary Grundfos fieldbus protocol.
Grundfos GO Remote	A Grundfos application designed to control Grundfos products via infrared or radio communication. Available for iOS and Android devices.
H	Head (pressure).
HTTP	Hyper Text Transfer Protocol. The protocol commonly used to navigate the world wide web.
Hydro MPC	Grundfos booster system.
Hydro Multi-E	Grundfos booster system.
IANA	Internet Assigned Numbers Authority.
IP	Internet Protocol.
LED	Light-Emitting Diode.
Local mode	The booster system uses the setpoint and operating mode set on CU 35X (MPC) or with Grundfos GO Remote (Hydro Multi-E).
MAC	Media Access Control. Unique network address for a piece of hardware.
Ping	Packet InterNet Groper. A software utility that tests connectivity between two TCP/IP hosts.
Q	Flow rate.
Remote mode	The booster system uses the setpoint and operating mode set from the bus.
SELV	Separated or Safety Extra-Low Voltage.
SELV-E	Separated or Safety Extra-Low Voltage with earth connection.
SMA	SubMiniature version A. Coaxial radio signal cable connection standard.
SMTP	Simple Mail Transfer Protocol.
SNTP	Simple Network Time Protocol. Used for clocks synchronisation between computer systems.
TCP	Transmission Control Protocol. Protocol suitable for Internet communication and Industrial Ethernet communication.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol for Internet communication.
Transmission speed	Bits transferred per second, bits/s.
URL	Uniform Resource Locator. The 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.

3. System description

The system diagrams give an overview for the different technologies of how to connect the module or unit to the Grundfos booster system that you connect to a PROFIBUS/ PROFINET network.

The booster system controls and monitors a number of pumps, all connected with RS-485 cables (Sub-GENIbus).

Note that the Hydro MPC and Control MPC are available in two variants, with a CU 351 or a CU 352 control unit. They have different CIM/CIU connections as described below.

CIM solution

CIM 150 is an add-on communication module that you install into the back of CU 352 Hydro MPC or CU 323 Hydro Multi-B, using a 10-pin connection. In this setup, the booster system supplies power to the module. See fig. 1 and fig. 4.

CIU solution

CIU 150 is a unit with a power supply module and a CIM module. You can mount it either on a DIN rail or on a wall. See fig. 2 and fig. 5.

You use CIU 150 with earlier products:

- CU 351 MPC
- Multi-E model G

Further, you must fit CU 351 MPC with an add-on module for the external GENIbus connection to connect to the unit.

3.1 PROFIBUS DP, CIM 150

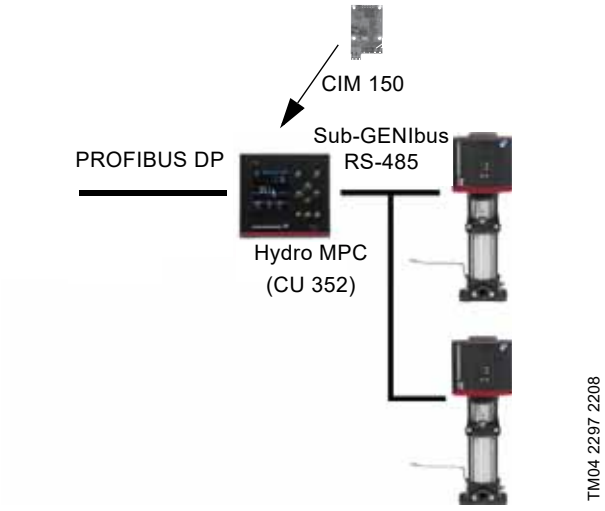

Fig. 1 Example of a CIM 150 solution. The module is installed inside the CU352 controller

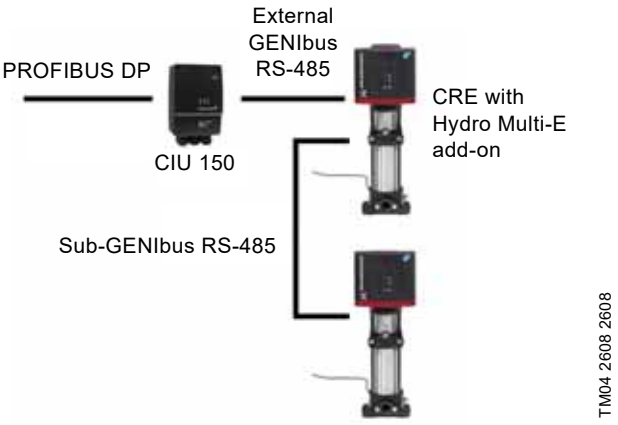

Fig. 2 Example of a CIU 150 solution for Hydro Multi-E, model G

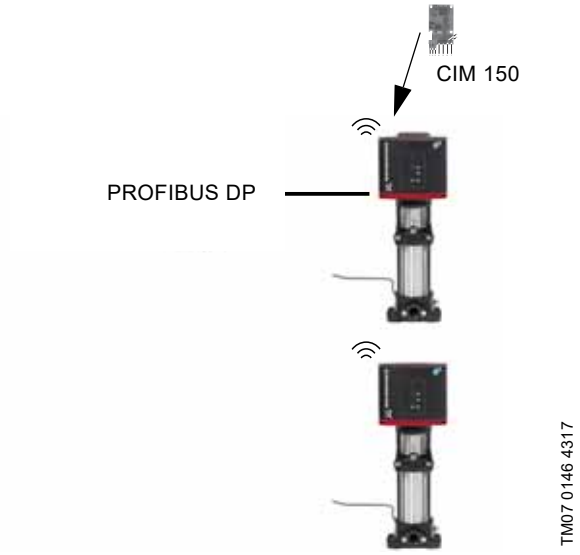

Fig. 3 Example of a CIM 150 solution for Hydro Multi-E model H and later. Pumps connected via built-in radio communication (Grundfos Glowpan)

The example for Multi-E model H and later is identical for TPED model H and later and MAGNA3-D. In all cases, mount the CIM module in the master pump placed to the left.

For the purpose of redundancy, you can mount a second CIM module in pump 2 for TPED and Multi-E (not MAGNA3-D). In that case, all writings from the PROFIBUS master must be send to both CIM modules.

3.2 PROFINET IO, CIM 500

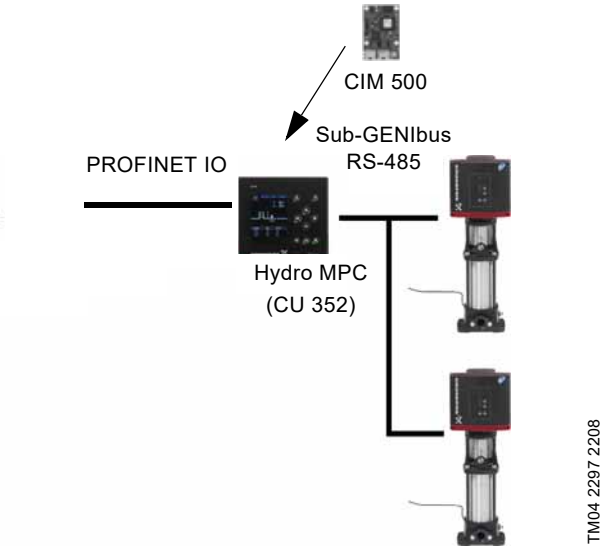

Fig. 4 Example of a CIM 500 solution. The module is installed inside the CU352 controller

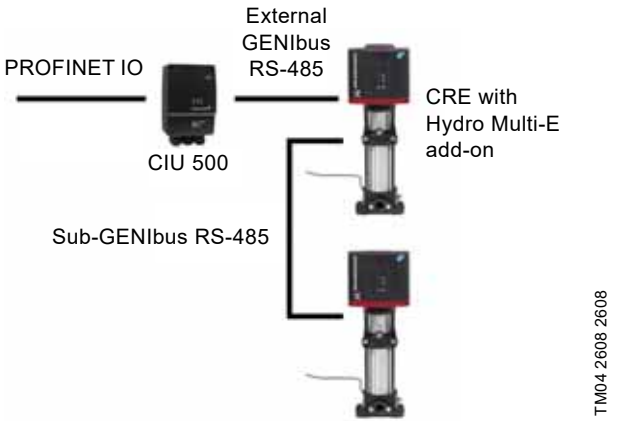

Fig. 5 Example of a CIU 500 solution for Hydro Multi-E, model G

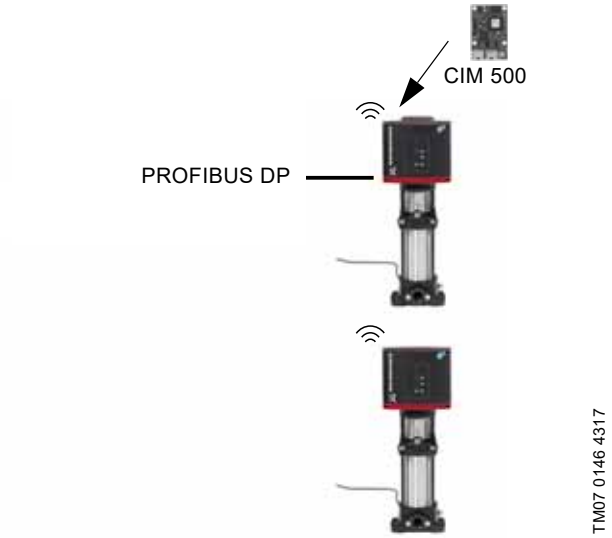

Fig. 6 Example of a CIM 500 solution for Hydro Multi-E model H and later. Pumps connected via built-in radio communication (Grundfos Glowpan)

The example for Multi-E model H and later is identical for TPED model H and later and MAGNA3-D. In all cases, mount the CIM module in the master pump placed to the left.

For the purpose of redundancy, you can mount a second CIM module in pump 2 for TPED and Multi-E (not MAGNA3-D). In that case, all writings from the PROFIBUS master must be sent to both CIM modules.

4. Specifications

4.1 CIM module

General data	Description	Comments
Ambient humidity	30-95 %	Relative, non-condensing.
Operating temperature	-20 to +45 °C	
Storage temperature	-25 to +70 °C	
GENIbus visual diagnostics	LED2	Will be in one of these states: Off, permanently green, flashing red, permanently red. See section *5.6 Status LEDs* for PROFIBUS DP and section *6.5 Status LEDs* for PROFINET IO.
Power supply (CIU)	24-240 V	Located in the CIU.
GENIbus connection type (CIU)	RS-485, 3-wire + screen	Conductors: A, B and Y.
CIU box enclosure class	IP54	
CIU box dimensions (H x W x D)	182 x 108 x 82 mm	

4.2 CIM 150 PROFIBUS DP

The table below provides an overview of the specifications for Grundfos CIM 150 and CIU 150. For further details, please refer to the specific sections of this functional profile.

PROFIBUS DP specifications	Description	Comments
PROFIBUS implementation class	DP-V0	Intelligent pump profile.
PROFIBUS connector	Screw-type terminal	A, B, DGND, VP (+5 V).
PROFIBUS connection type	RS-485, two-wire	Conductors: A, B.
Maximum cable length	100 metres at 12 Mbits/s	Corresponds to 328 feet. See section *5.3.1 Data transmission rates and cable length*.
Slave address	1-126	Set via rotary switches SW3 and SW4. See section *5.4 Setting the PROFIBUS address*.
Line termination	On or off	Set via DIP switches SW1 and SW2. See section *5.5 Termination resistors*. Auto detected
Recommended cable cross-section	0.20 - 0.25 mm^2	AWG24 or AWG23
Supported transmission speed	9.6 Kbits/s to 12 Mbits/s	Auto detected.
PROFIBUS visual diagnostics	LED1	Off, permanently green, flashing red, permanently red. See section *5.6 Status LEDs*.
Maximum number of PROFIBUS devices at a physical network segment	32	Up to 125 devices if repeaters are used (physically segmented network).

4.3 CIM 500 PROFINET IO

The table below provides an overview of the specifications for Grundfos CIM/CIU 500 ethernet for PROFINET IO. For further details, please refer to the specific sections of this functional profile.

PROFINET IO specifications	Description	Comments
Application layer	DHCP, HTTP, Ping, FTP, SMTP, SNTP, PROFINET IO	Rotary switch in position 0.
Transport layer	TCP	
Internet layer	Internet protocol V4 (IPv4)	
Link layer	ARP, Media Access Control (ethernet)	
Ethernet cable	CAT5, CAT5e or CAT6	Supports auto cable-crossover detecting (Auto-MDIX)
Maximum cable length	100 metres at 10/100 Mbits/s	Corresponds to 328 feet.
Transmission speed	10 Mbits/s, 100 Mbits/s	Auto-detected.
Industrial Ethernet protocols	PROFINET IO, Modbus TCP	Selected with rotary switch, section *6.2 Setting the Industrial Ethernet protocol*.

5. PROFIBUS DP, CIM 150 setup

5.1 PROFIBUS bus topology

The PROFIBUS-preferred bus topology is daisy chaining as illustrated in fig. 7. The end devices of a physical bus segment must be terminated (LT = Line Termination). Each device must have a unique physical address [1-126]. Up to 32 PROFIBUS devices can be connected to a bus segment, and by using a repeater another 32 devices can be connected. This can be repeated until the maximum number of addresses are used. Make sure that each device is connected to a proper earth potential.

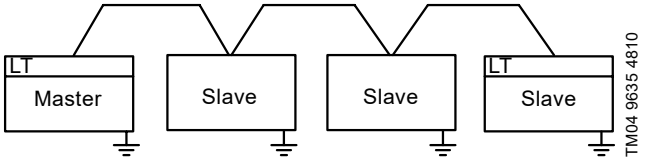

Fig. 7 Example of PROFIBUS bus segment with line termination

5.2 CIM 150 PROFIBUS module

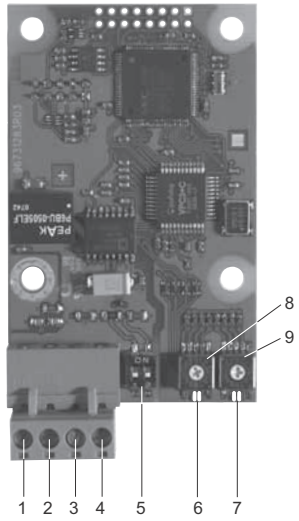

Fig. 8 CIM 150 PROFIBUS module

Pos.	Designation	Description
1	B (RxD/TxD-P)	PROFIBUS terminal B, positive data signal
2	A (RxD/TxD-N)	PROFIBUS terminal A, negative data signal
3	DGND	PROFIBUS terminal DGND, only for external termination
4	VP	+5 VDC, only for external termination
5	SW1/SW2	On and off switches for termination resistors
6	LED1	Red and green status LED for PROFIBUS communication
7	LED2	Red and green status LED for GENIbus communication between CIM/CIU 150 and the Grundfos product
8	SW3	Hexadecimal rotary switch for setting the PROFIBUS address, four most significant bits
9	SW4	Hexadecimal rotary switch for setting the PROFIBUS address, four least significant bits

The power supply (pos. 4, fig. 8) must only be used for external termination.

5.3 Connecting the PROFIBUS

5.3.1 Data transmission rates and cable length

We recommend using a cable according to IEC 61158.

Example

Siemens, 6XV1 830-0EH10.

kbits/s	Maximum cable length [m/ft]
9.6	1200/4000
19.2	1200/4000
45.45	1200/4000
93.75	1000/3300
187.5	1000/3300
500	400/1300
1500	200/660
3000	100/330
6000	100/330
12000	100/330

Fitting the cable

See fig. 9.

1. Connect the red conductor(s) to terminal B (pos. 1).
2. Connect the green conductor(s) to terminal A (pos. 2).
3. Connect the cable screens to earth via the earth clamp (pos. 3).

For maximum safety and reliability, connect the cable screen to earth via the earth clamp, and make sure that all CIU 150 units are properly earthed via the mains supply earth-wire.

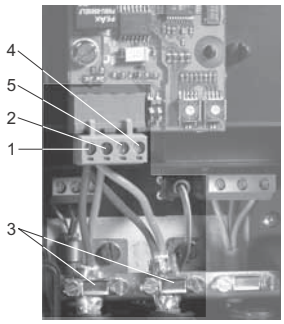

Fig. 9 Connecting the PROFIBUS

Pos.	Description
1	PROFIBUS terminal B
2	PROFIBUS terminal A
3	Earth clamp
4	+5 VDC
5	DGND

5.4 Setting the PROFIBUS address

The CIM 150 PROFIBUS module has two hexadecimal rotary switches for setting the PROFIBUS address. The two switches are used for setting the four most significant bits, SW3, and the four least significant bits, SW4, respectively. See fig. 10.

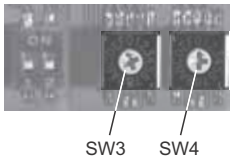

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Fig. 10 Setting the PROFIBUS address

The table below shows examples of PROFIBUS address settings.

You must set the PROFIBUS address decimally from 1 to 126. The address 126 is normally used for special purposes and should not be used.

PROFIBUS address	SW3	SW4
8	0	8
20	1	4
31	1	F
126	7	E

A restart of CIM/CIU 150 has to be performed for a PROFIBUS address change to take effect.

For a complete overview of the PROFIBUS addresses, see section *10. PROFIBUS address*.

5.5 Termination resistors

The termination resistors are fitted on the CIM 150 PROFIBUS module. See fig. 11.

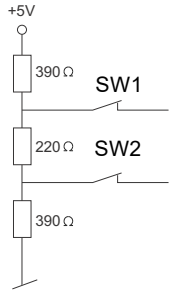

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Fig. 11 Internal termination resistors

CIM 150 has a DIP switch with two switches, SW1 and SW2, for cutting the termination resistors in and out. Fig. 12 shows the DIP switches in cut-out state.

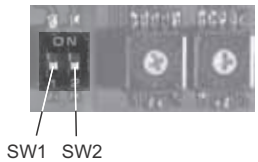

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Fig. 12 Cutting termination resistors in and out

DIP switch settings

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

To ensure a stable and reliable communication, it is important that only the termination resistors of the first and last units in the PROFIBUS network are cut in.

5.6 Status LEDs

CIM 150 PROFIBUS has two LEDs. See fig. 8.

- Red and green status LED, LED1, for PROFIBUS communication.
- Red and green status LED, LED2, for GENIbus communication between CIM/CIU 150 and the connected Grundfos product.

LED1

Status	Description
Off.	CIM 150 has been switched off.
Permanently green.	CIM 150 is ready for PROFIBUS data transmission (Data Exchange State).
Permanently red.	CIM 150 does not support the connected Grundfos product.
Flashing red.	Wrong or missing PROFIBUS configuration or no contact to the PROFIBUS master.

LED2

Status	Description
Off.	CIM 150 is switched off.
Permanently green.	GENIbus communication between CIM 150 and the Grundfos product is OK.
Permanently red.	CIM 150 does not support the connected Grundfos product.
Flashing red.	No GENIbus communication between CIM 150 and the Grundfos product.

During startup, there may be a delay of up to 5 seconds before the LED2 status is updated.

5.7 Communication watchdog

The state of the PROFIBUS communication watchdog can be changed with a PROFIBUS commissioning tool, for example Siemens Simatic Manager. If the watchdog is enabled, all bits in the ControlModule are automatically set to "0" if the PROFIBUS communication is broken. See section *7.2 Control module (ControlModule, module 2)*.

As a result, the booster system will be set to local mode and then be operating according to the local operating mode, local setpoint and local control mode.

5.8 Reaction to PLC "Stop button"

If the PLC is stopped by the operator, all output registers will be set to "0".

As a result, the control bit RemoteAccessReq will be cleared, and the booster system will be set to local mode and then be operating according to the local operating mode, local setpoint and local control mode.

6. PROFINET IO, CIM 500 setup

6.1 Connecting the ethernet cable

WARNING

Electric shock

Death or serious personal injury

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

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.

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

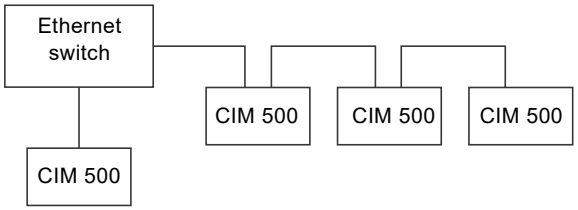

Fig. 13 Example of Industrial Ethernet network

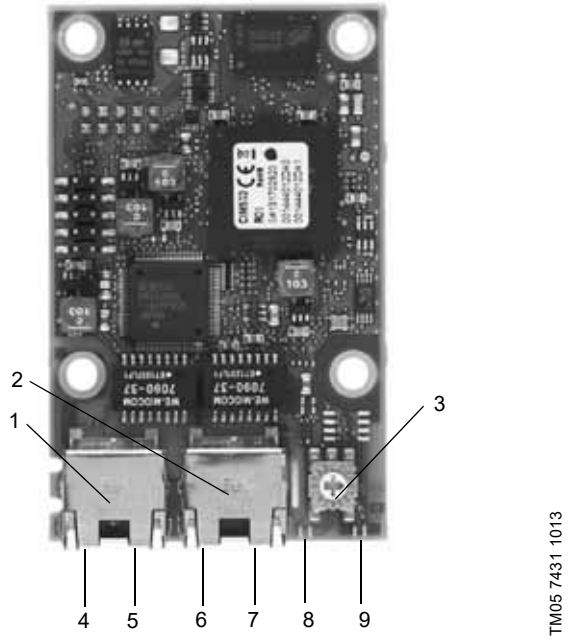

Fig. 14 Example of an ethernet connection, CIM 500

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	LED 1
9	Green and red status LED for internal communication between the module and the pump.	LED 2

6.2 Setting the Industrial Ethernet protocol

The CIM 500 ethernet module has a rotary switch for selection of the Industrial Ethernet protocol. See fig. 15.

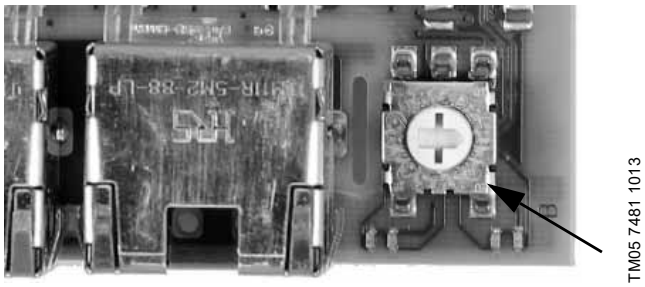

Fig. 15 Selecting the Industrial Ethernet protocol

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 will be permanently red to indicate an invalid configuration
F	Reset to factory default Note: The rotary switch must be set in this position for 20 seconds before CIM 500 resets to factory default. During this period LED1 flashes red and green at the same time to indicate that a reset will occur.

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

6.3 Setting the IP addresses

The CIM 500 ethernet module is default set to a fixed IP address. It is possible to 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 Modbus TCP	Make the settings via the webserver
Device name and IP settings for PROFINET IO	Static configuration from the webserver or configuration from the PROFINET IO configuration tool.

6.4 Establish a connection to the webserver

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

- Connect the PC and CIM 500 using an ethernet cable.
- Configure the PC ethernet port to the same subnetwork as CIM 500, for example 192.168.1.101, and the subnet mask to 255.255.255.0. See section *A.2 Webserver configuration* on page 32.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log in to the webserver using the following:

Username	admin (default)
Password	Grundfos (default)

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

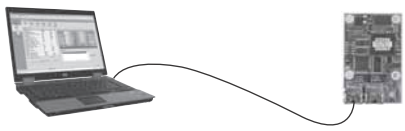

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Fig. 16 CIM 500 connected to a PC

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.

6.5 Status LEDs

The CIM 500 ethernet module has two status LEDs, LED1 and LED2. See fig. 14.

- Red and green status LED, LED1, for ethernet communication
- Red and green status LED, LED2, for internal communication between CIM 500 and the Grundfos product.

LED1

Status	Description
Off	CIM 500 is switched off.
Flashing green	Wink function. LED flashes 10 times when activated from the master.
Permanently green	CIM 500 is ready for data transmission (data exchange state).
Flashing red (3 Hz, duty cycle 50 %)	Wrong or missing PROFINET IO configuration. See section *9.2.1 LED status*.
Pulsing red (0.3 Hz, duty cycle 10 %)	Configured, but the connection to the master is lost. See section *9.2.1 LED status*.
Permanently red	Product not supported. See section *9.2.1 LED status*.
Permanently red and green	Error in the firmware download. See section *9.2.1 LED status*.
Flashing red and green	After 20 seconds in this state, CIM 500 factory settings are restored and the device is restarted.

LED2

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

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

6.6 DATA and LINK LEDs

The CIM 500 ethernet module has two connectivity LEDs related to each RJ45 connector. See fig. 14.

DATA1 and DATA2

These yellow LEDs indicate data traffic activity.

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

LINK1 and LINK2

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

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

7. Detailed description of data modules

7.1 Data types

Grundfos CIU 150 and CIU 500 support the following data types.

All data types, except for data type 10, comply with specification IEC 61158-6 standard data types for use in PROFIBUS/ PROFINET profiles.

Data type	Description
1	Boolean
2	Integer 8
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
8	Floating point
9	Visible string
10	Non-standard

All multi-byte data types are transmitted with MSB (Most Significant Byte) first.

7.2 Control module (ControlModule, module 2)

The control module is a PROFIBUS/PROFINET output module used for the control of the booster system from bus. Its data type is 10, non-standard. If pump 2 in a Multi-E or TPED pump also has a CIM module mounted, for redundancy, any writings to the control module must be done for both pump heads.

To control the Hydro MPC or Control MPC from bus, you must select the control source "From bus" on the CU 35X: "Settings" > "Secondary functions" > "Control source".

Byte	Bit	Name	Event trigger
Byte 1 (data type 5)	0	RemoteAccessReq	State
	1	OnOff	State
	2	ResetFault	Rising edge
	3	-	-
	4	CopyToLocal	State
	5-7	-	-
Byte 2 (data type 5)		ControlMode [enumeration]	
		0: ConstSpeed*	
		1: ConstFreq*	
		2: -	
		3: ConstHead	
		4: ConstPressure	
		5: ConstDiffPress	
		6: VarDiffPress	
		7: ConstFlow	
		8: ConstTemp	
		9: ConstTempDiff	
		10: ConstLev	
Byte 3 (data type 5)		OperatingMode [enumeration]	
		0: AutoControl	
		1-3: -	
		4: OpenLoopMin*	
		5: -	
		6: OpenLoopMax	
Bytes 4 and 5 (data type 6)		Setpoint [0.01 %]**	

* Not supported by Hydro Multi-E.

** Closed loop:

MPC, Multi-E: Percentage of closed-loop feedback sensor maximum value.

TPED, MAGNA3-D: Percentage of the setpoint range.

Open loop:

MPC, Multi-E: Percentage of the maximum performance.

TPED, MAGNA3-D: Percentage of the nominal pump frequency.

7.2.1 Explanation to event trigger

Rising edge

Control bits with a rising-edge event trigger behave like a command that is executed when a bit transition from "0" to "1" occurs. Each of them has a corresponding acknowledge bit in the StatusModule which is set when the command is executed and cleared when the control bit is written back to "0".

State

Control bits with a state event trigger behave like a "state" that is forced upon the booster system. In CIU 150 and 500, the "actual state" of the booster system as read from StatusModule is continuously compared with the "requested" state in ControlModule, and CIU 150 and 500 write the appropriate GENIbus command to the booster system to make the two states correspond to each other. Due to state restrictions or priorities, this might not always be possible, see the explanation to the bit in question.

Value change

Control bits/bytes with a change event trigger behave like a command that is executed when the bit/byte changes its value. CIM 150 andv500 will attempt to make the system operate according to the requested value. The change will be reflected in a bit/byte value in a corresponding input module.

7.2.2 Explanation to control bits

RemoteAccessReq

Control bit for setting the booster system in remote mode, controlled from bus, or local mode, controlled from the operating panel or Grundfos GO Remote:

0:	The booster system is set to local mode and operates according to its local operating mode and setpoint. With this setting, the other control bits in ControlModule will have no influence.
1:	The booster system is set to remote mode and operates according to the operating mode and setpoint set in ControlModule. The other control bits in ControlModule will also be active.

However, certain commands from other control sources, for example Stop or Max. from a local source or external Stop from a digital input, have a higher priority and overrule the control from the bus.

OnOff

Control bit used to start and stop the booster system:

0:	For stopping the booster system remotely.
1:	For starting the booster system remotely.

ResetFault

Control bit that resets alarms and warnings.

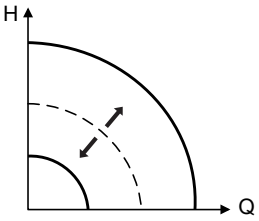
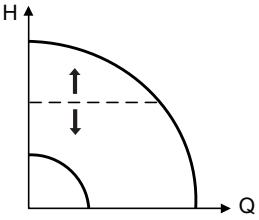
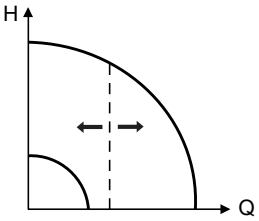
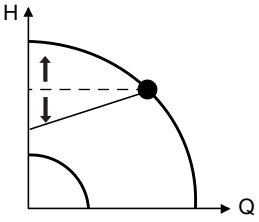
CopyToLocal

If this bit is set, the remote setting of Control mode, Operating mode and the setpoint will be copied to the local setting during a remote to local transition. This bit is not supported by MPC, Multi-E model G and earlier models.

0:	Copy to local settings inactive
1:	Copy to local settings active. Switching the booster from remote to local will not influence the behaviour of the booster.

7.2.3 Explanation to control mode

Control enumeration for selection of the remote control mode.

Control modes	Description	Illustration
> ConstSpeed (0) > ConstFreq (1)	The setpoint of the booster system is a percentage of the maximum performance. No sensor is required, and in these modes the booster system is operating in open-loop control. **Note:** Not supported by Hydro Multi-E.	 TM04 2289 2208
> ConstHead (3) > ConstPressure (4) > ConstDiffPressure (5)	The setpoint of the booster system is interpreted as the setpoint for the pressure. In these modes, the booster system operates in closed-loop control and adapts its speed so that the pressure is constant, regardless of the flow. A pressure sensor is required.	 TM04 2290 2208
> ConstFlow (7) > ConstTemp (8) > ConstLev (10)	The setpoint of the booster system is interpreted as the setpoint for the flow, temperature or level. ConstFlow is indicated in the figure. In these modes, the booster system operates in closed-loop control, and a relevant sensor is required: • a temperature sensor for temperature control • a level sensor for level control • a flow sensor for flow control.	 TM04 2288 2208
> VarDiffPress (6)	The setpoint of the booster system is interpreted as a proportional-pressure setpoint as shown in the figure. This is a closed-loop control mode, and a pressure sensor is required.	 TM04 2291 2208

H: Pressure (head)

Q: Flow

Important:

When using CIM 150 and 500 or CIU 150 and 500 with Hydro/ Control MPC, the following limitations in the setup of the primary sensor, feedback sensor, apply:

- Only sensor 1 (AI1) can be used as primary sensor.
- The primary sensor must have a minimum value of 0 for the Setpoint and FeedBack scaling to be correct.

7.2.4 Explanation to operating mode

Control enumeration for selection of the remote operating mode.

0:	AutoControl This is the normal mode. The booster system is controlled according to the selected control mode and setpoint. See section *7.2.3 Explanation to control mode*.
4:	OpenLoopMin The booster system operates at a fixed minimum performance. **Note:** Not supported by Hydro Multi-E.
6:	OpenLoopMax The booster system operates at a fixed maximum performance.

7.2.5 Setpoint in closed-loop control

Hydro MPC and Multi-E

The setpoint is written to module 2 bytes 4 and 5 Setpoint as a percentage value scaled in 0.01 % of the sensor maximum value, module 46 FeedbackSensorMax. The sensor minimum value is always 0. The selected setpoint is reflected in module 41 UserSetpoint with the same scaling.

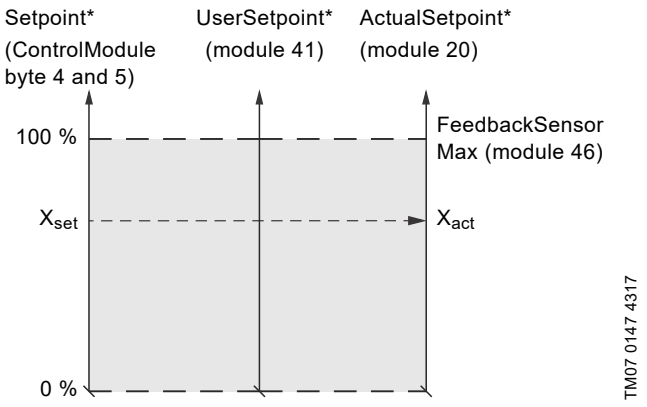
The actual setpoint, whether it has been set via Grundfos GO Remote, the pump display, the pump buttons or the fieldbus, can be read from module 20 ActualSetpoint. It is a percentage value scaled in 0.01 % of module 46 FeedbackSensorMax.

Generally, the actual setpoint value represents head, pressure, flow, temperature and so on depending on what the feedback sensor has been set to measure. The unit of measure can be read from module 44 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



* Percentage of sensor maximum.

Fig. 17 Setpoint in closed-loop control for Hydro MPC and Multi-E

TPED and MAGNA3-D

The setpoint is written to module 2 bytes 4 and 5 Setpoint as a percentage value scaled in 0.01 % of the setpoint range [r_{min}; r_{max}]. The selected setpoint is reflected in module 41 UserSetpoint with the same scaling.

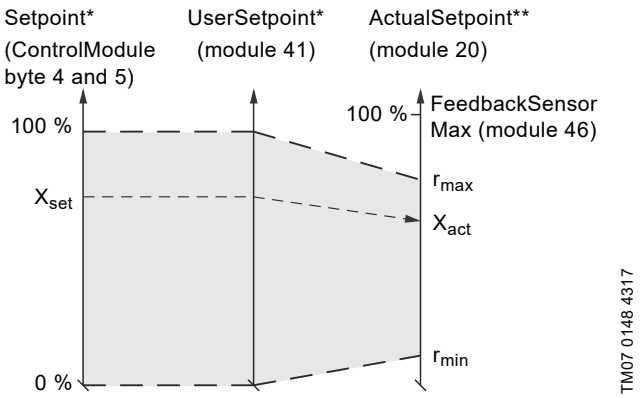
The actual setpoint, whether it has been set via Grundfos GO Remote, the pump display, the pump buttons or the fieldbus, can be read from module 20 ActualSetpoint. It is a percentage value scaled in 0.01 % of module 46 FeedbackSensorMax.

Generally, the actual setpoint value represents head, pressure, flow, temperature and so on depending on what the feedback sensor has been set to measure. The unit of measure can be read from module 44 FeedbackSensorUnit.

It is possible to calculate back and forth between 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 they can be seen in the Grundfos GO Remote "Setpoint" menu.



* Percentage of setpoint range.

** Percentage of sensor maximum.

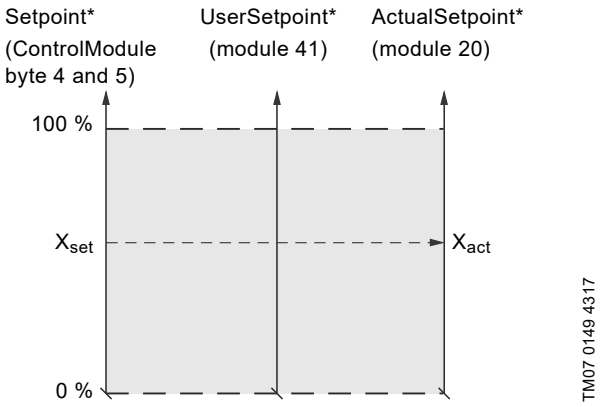
Fig. 18 Setpoint in closed-loop control for TPED and MAGNA3-D

7.2.6 Setpoint in open-loop control

Hydro MPC and Multi-E

The setpoint is written to module 2 bytes 4 and 5 Setpoint as a percentage value scaled in 0.01 % of the maximum performance. The selected setpoint is reflected in module 41 UserSetpoint with the same scaling.

The actual setpoint, whether it has been set via Grundfos GO Remote, the pump or controller display or buttons, or the fieldbus, can be read from module 20 ActualSetpoint, and it reflects whatever limitations, for example power or frequency limits, that might be active in the system. It equals the value that the booster system actually uses.



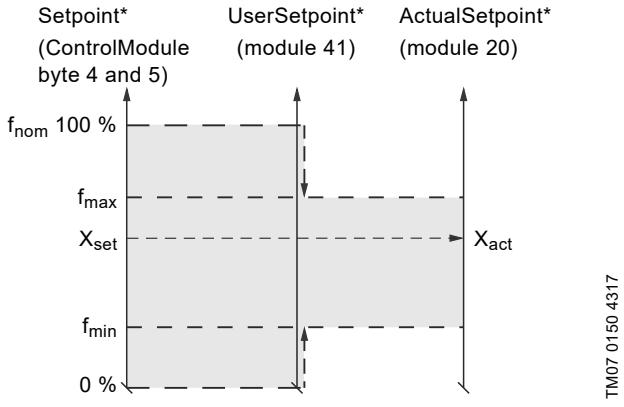
* Percentage of system performance.

Fig. 19 Setpoint in open-loop control for Hydro MPC and Multi-E

TPED and MAGNA3-D

The setpoint is written to module 2 bytes 4 and 5 Setpoint as a percentage value scaled in 0.01 % of the nominal pump frequency f_{nom}. The selected setpoint is reflected in module 41 UserSetpoint with the same scaling. From the fieldbus, it will get whatever value written to Setpoint but from the display and Grundfos GO Remote, it is truncated to the internal pump frequency limits [f_{min}; f_{max}].

The actual setpoint, whether it has been set via Grundfos GO Remote, the pump display, the pump buttons or the fieldbus, can be read from module 20 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 via Grundfos GO Remote.



* Percentage of *fnom*.

Fig. 20 Setpoint in open-loop control for TPED and MAGNA3-D

7.2.7 Multi-E model H and twin-head pump TPED model H control

- For Multi-E with a CIM module in the master pump only, set CopyToLocal (Module 2, byte 1, bit 4) to value "1" in the master pump.
- For Multi-E with a CIM module in two pumps, always set CopyToLocal (Module 2, byte 1, bit 4) to value '1' in both pumps. Any writings to the control module (module 2) must be written to each pump.
- A TPED model H is essentially a Multi-E model H with two pumps. Mount a CIM module in each pump head. Always set CopyToLocal (Module 2, byte 1, bit 4) to value '1' in both pump heads. Any writings to the control module (Module 2) must be written to each pump head.

7.3 Status module (StatusModule, module 1)

The status module is a PROFIBUS/PROFINET input module used for reading status from booster systems. Its data type is 10, non-standard.

Byte	Bit	Name
Byte 1 (data type 5)	0	AccessMode
	1	OnOff
	2	Fault
	3	Warning
	4	-
	5	AtMaxSpeed
	6	-
	7	AtMinSpeed
Byte 2 (data type 5)	0-1	-
	2	CopyToLocal
	3	ResetFaultAck
	4	SetPointInfluence
	5	-
	6	Rotation
	7	-
Bytes 3 and 4 (data type 6)		ProcessFeedback [0.01 %]
Byte 5 (data type 5)		**ControlMode** [enumeration] 0: ConstSpeed* 1: ConstFreq* 2: - 3: ConstHead 4: ConstPressure 5: ConstDiffPress 6: VarDiffPress 7: ConstFlow 8: ConstTemp 9: ConstTempDiff 10: ConstLevel
Byte 6 (data type 5)		**OperatingMode** [enumeration] 0: AutoControl 1-3: - 4: OpenLoopMin* 5: - 6: OpenLoopMax

* Not supported by Hydro Multi-E.

7.3.1 Explanation to status module

AccessMode

Status bit indicating whether the booster system is controlled from the bus or from some other control source.

0:	The booster system is controlled from a local source, display or Grundfos GO Remote, or from an external digital input.
1:	The booster system is controlled from the bus, remotely.

To allow the booster system to be controlled from PROFIBUS/PROFINET, the RemoteAccessReq control bit in the ControlModule must be set to "1". However, certain commands from other control sources, for example Stop or Max. from a local source or external Stop from a digital input, have a higher priority and sets the AccessMode to "0", indicating that the actual control source is not PROFIBUS/PROFINET.

OnOff

Status bit indicating whether the booster system is started or stopped.

0:	The booster system is stopped (off).
1:	The booster system is started (on).

The booster system can be started and stopped from the bus by using the OnOff control bit in ControlModule.

"Started" does not necessarily indicate that the booster system is pumping as it might be in a "low-flow stop" condition.

Fault

Status bit indicating that the booster system has been stopped due to an alarm.

0:	No alarm.
1:	Alarm. Booster system stopped, red booster LED on, FaultCode (module 4) shows the alarm code.

Warning

Status bit indicating that the booster system has a warning.

0:	No warning.
1:	Warning. WarningCode (module 3) shows the warning code.

AtMaxSpeed

Status bit indicating that the booster system is running at maximum performance.

0:	The booster system is not running at maximum performance.
1:	The booster system is running at maximum performance.

AtMinSpeed

Status bit indicating that the booster system is running at minimum performance.

0:	The booster system is not running at minimum performance.
1:	The booster system is running at minimum performance.

CopyToLocal

Status bit indicating that the booster will copy remote settings to local settings when it is switched from Access mode Remote to Access mode Local. The involved settings are the control mode, Operating mode and setpoint. This bit is not supported by Multi-E model G and earlier models.

0:	Copy of remote settings to local settings is not active.
1:	Copy of remote settings to local settings is active.

ResetFaultAck

Acknowledge bit belonging to the ResetFault control bit. It will be set when the control bit is set and the command has been executed. It will be cleared when the control bit is cleared.

SetPointInfluence

Status bit indicating if the setpoint is influenced, for example by analog input. If influenced, the ActualSetpoint (module 29) will differ from the UserSetpoint (module 37).

0:	No setpoint influence.
1:	The setpoint is influenced.

Rotation

Status bit indicating that the booster system is pumping.

0:	No rotation (not pumping).
1:	Rotation (pumping).

ProcessFeedback

In closed-loop control, this is the value of the controlled process variable (feedback/primary sensor). The process variable can always be compared directly with the ActualSetpoint variable. If no setpoint influence is active, it can also be compared with the setpoint variable in the ControlModule.

In open-loop control, setpoint is mapped to ProcessFeedback. The value of the feedback sensor can be read in the corresponding measurement module.

See section *7.8 Measurement modules*.

ControlMode

Status enumeration showing the actual booster system control mode.

See section *7.2.3 Explanation to control mode* for detailed explanation to the various control modes.

OperatingMode

Status enumeration showing the actual booster system operating mode.

See section *7.2.4 Explanation to operating mode* for detailed explanation to the various operating modes.

7.4 Illustration of closed-loop control

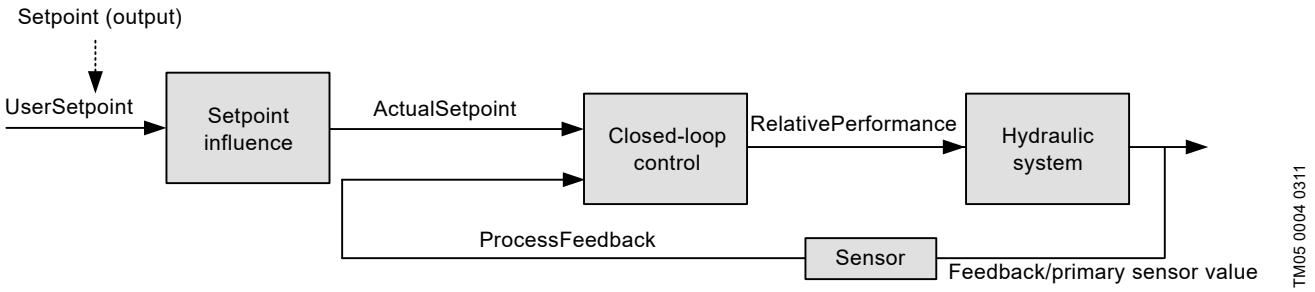


Fig. 21 Illustration of closed-loop control, see also page 21

7.5 Direct bus control of pumps (ControlPumps, module 50)

This module is only available for CU 352.

With this module it is possible to individually force each of the six zone pumps, the pilot pump and the backup pump to stop. Its data type is 5, unsigned 8 bit.

Bit	Name	Event trigger	Description
0	ControlZonePump1	Value change	0: Zone pump 1 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 1 is in auto mode, controlled from CU 352.
1	ControlZonePump2	Value change	0: Zone pump 2 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 2 is in auto mode, controlled from CU 352.
2	ControlZonePump3	Value change	0: Zone pump 3 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 3 is in auto mode, controlled from CU 352.
3	ControlZonePump4	Value change	0: Zone pump 4 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 4 is in auto mode, controlled from CU 352.
4	ControlZonePump5	Value change	0: Zone pump 5 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 5 is in auto mode, controlled from CU 352.
5	ControlZonePump6	Value change	0: Zone pump 6 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 6 is in auto mode, controlled from CU 352.
6	ControlPilotPump	Value change	0: Pilot pump is forced to stop from PROFIBUS/PROFINET. 1: Pilot pump is in auto mode, controlled from CU 352.
7	ControlBackupPump	Value change	0: Backup pump is forced to stop from PROFIBUS/PROFINET. 1: Backup pump is in auto mode, controlled from CU 352.

The present auto mode status of each pump can be read from AutoModePumps (module 51).

7.6 Change feedback sensor type (SelectFeedbackSensor module 57)

This module is only available for CU 352.

With this module it is possible to dynamically change the feedback sensor type between a flow sensor and a pressure sensor. For the setting to work, CU 352 must in advance be configured to use a pressure sensor on one of its analogue inputs and a flow sensor on another one.

The data type is 5, unsigned 8 bit.

Module	Name	Description
57	SelectFeedbackSensor	Can be used to dynamically switch between flow control and pressure control. MPC must have both sensors connected and configured. 3: Flow control 6: Pressure control

7.7 Alarms and warnings

Module	Name	Description
3	WarningCode	Code for booster system warning.
4	FaultCode	Code for booster system alarm.

In the WarningCode module, the cause of a booster system warning can be read. A warning has no influence on the booster system operation.

In the FaultCode module, the cause of a booster system alarm can be read. A booster system alarm always leads to a reaction in the booster system operation, usually all pumps are stopped, but some Hydro MPC or Control MPC alarms have programmable alarm action types.

The complete list of possible alarm and warning codes is shown below.

Code	Alarm/warning description	Reset type[1)]	Action type[2)]
3	External fault signal	A/M	Prog.
10	Communication fault, pump	A	None
80	Hardware fault, IO 351 pump module	A	None
80	Hardware fault, IO 351 I/O module	A	None
83	Verification error, EEPROM parameter area	A	None
88	Sensor fault, general measuring sensor	A	None
89	Signal fault, closed-loop feedback sensor	A/M	Prog.
91	Temperature sensor 1 signal fault	A/M	Prog.
157	Real Time Clock error	A	None
161	Sensor supply fault, 5 V	A	None
162	Sensor supply fault, 24 V	A	None
165	Signal fault, analog input A1	A/M	Prog.
166	Signal fault, analog input A2	A/M	Prog.
167	Signal fault, analog input A3	A/M	Prog.
175	Temperature sensor 2 signal fault	A/M	Prog.
190	Limit exceeded, supervised item 1	A/M	Prog.
191	Limit exceeded, supervised item 2	A/M	Prog.
203	Alarm on all pumps	A/M	Prog.
204	Inconsistency between sensors	A	None
208	Operation outside performance range	A/M	Prog.
210	High pressure	A/M	Prog.
211	Low pressure	A/M	Prog.
213	VFD not ready	A	None
214	Water shortage	A/M	Prog.
215	Soft pressure buildup timeout	A/M	Prog.
216	Pilot pump alarm	A	None
219	Pressure relief not adequate	A	None
231	Ethernet: No IP address from DHCP server	A	None
232	Ethernet: Auto-disabled due to misuse	A	None
248	Fault, battery/UPS	A	None
From device	Pump alarms. See section *7.9 Zone pump modules (ZonePumpModule, modules 29 to 34)*.	-	None

1) For Hydro/Control MPC and Multi-E model H and later, it can be automatic (A) or selectable Automatic/Manual (A/M).

2) For Hydro/Control MPC and Multi-E model H and later, it can be none or programmable (Prog.).
Event action programmable are Stop, Stop with delay, Min., UserDef, Max., Pumps in local, Emergency run.
The Hydro Multi-E model G is always stopped in case of an alarm.

7.8 Measurement modules

This is measurement data that can be read in Hydro MPC, Control MPC and Hydro Multi-E.

PROFIBUS/PROFINET direction: Inputs.

Module	Name	Data type	Unit	Description	MPC	Multi-E model G	Multi-E/TPED model H and later	MAGNA3-D
3	WarningCode	5	-	The Grundfos-specific warning code. For a list of warning codes. See section *7.7 Alarms and warnings*.	●	-	●	●
4	FaultCode	5	-	The Grundfos-specific alarm code. For a list of alarm codes. See section *7.7 Alarms and warnings*.	●	●	●	●
5	VolumeFlow	8	m^3/h	Provides the flow through the system as estimated or measured.	S	S	S	●
6	Head	8	bar	Provides the differential pressure between inlet and outlet as estimated, or measured, by the booster system.	S	S	S	●
7	RemotePressure	8	bar	Provides the measured pressure at an external pressure sensor. This pressure sensor must be installed for this value to be valid.	S	-	S	S
8	InletPressure	8	bar	Provides the inlet pressure if a pressure sensor is configured and installed at the inlet. It has an offset of -1.000 bar.	S	-	S	-
9	OutletPressure	8	bar	Provides the outlet pressure measured by a pressure sensor.	S	-	S	-
10	Level	8	m	Provides the tank level. Requires that a level sensor is installed. It has an offset of -100 metres.	S	S	S	-
11	FeedTankLevel	8	m	Provides the feed tank level. Requires that a level sensor is installed. It has an offset of -100 metres.	S	-	S	-
12	Power	8	W	Provides the actual power consumed by the booster system.	●**	●	●	●
13	Energy	8	Wh	Provides the accumulated electric energy consumption of the system.	●**	●	●	●
14	RemoteTemperature	8	°C	Provides the temperature measured by a remote temperature sensor.	S	S	S	-
15	AmbientTemperature	8	°C	Provides the ambient temperature measured by a temperature sensor.	S	-	S	-
16	InletTemp	8	°C	Provides the inlet temperature measured by a temperature sensor.	S	-	-	-
17	OutletTemp	8	°C	Provides the outlet temperature measured by a temperature sensor.	S	-	-	-
18	TemperatureDifference	8	°C	Provides the differential temperature.	S	-	-	-
19	OperationTime	8	h	Provides the total operating hours of the booster system.	●	●	●	●
20	ActualSetpoint	8	%	Selected system control-loop setpoint. See description of scaling for a setpoint in *7.2 Control module (ControlModule, module 2)*	●	●	●	●
21	RelativePerformance	8	%	Value of speed control signal to pumps that are not stopped or running at maximum speed.	●	●	●	●

Module	Name	Data type	Unit	Description	MPC	Multi-E model G	Multi-E/TPED model H and later	MAGNA3-D
22	SystemActiveFunctions	6	Bits	Indicates active system functions. 0: - 1: Emergency run function 2: Standby pumps 3: Pump test run 4: Alternative setpoint 5: Clock program 6: Remote VNC (Virtual Network Connection) 7: Remote bus 8: Remote service port 9: Pressure-relief function 10: Soft-pressure function 11: Low-flow boost 12: Low-flow stop 13: Proportional pressure.	•	-	-	-
23	DigitalInput	5	Bits	Provides the status of the external digital inputs. Logical "0": The input is 0 V. Logical "1": The input is 5 V. 0: Digital input 1 1: Digital input 2 2: Digital input 3 3: Digital input 4 4: Digital input 5 5: Digital input 6 6: Digital input 7 7: Digital input 8.	•	•	•	•
24	DigitalOutput	5	Bits	Provides the status of the external digital outputs. Logical "0": The output is 0 V. Logical "1": The output is 5 V. 0: Digital output 1 1: Digital output 2 2-7: Reserved.	•	•	•	•
25	PumpsPresent	5	Bits	One bit for each pump configured in the system. Logical "1": The pump is present. 0: Zone pump 1 present 1: Zone pump 2 present 2: Zone pump 3 present 3: Zone pump 4 present 4: Zone pump 5 present 5: Zone pump 6 present 6: Pilot pump present 7: Backup pump present.	•	•	•	•
26	PumpsRunning	5	Bits	One bit for each pump which is running. Logical "1": The pump is running. 0: Zone pump 1 running 1: Zone pump 2 running 2: Zone pump 3 running 3: Zone pump 4 running 4: Zone pump 5 running 5: Zone pump 6 running 6: Pilot pump running 7: Backup pump running.	•	•	•	•
27	PumpsFault	5	Bits	One bit for each pump indicating if the pump is faulty. Logical "1": The pump is faulty. 0: Zone pump 1 fault 1: Zone pump 2 fault 2: Zone pump 3 fault 3: Zone pump 4 fault 4: Zone pump 5 fault 5: Zone pump 6 fault 6: Pilot pump fault 7: Backup pump fault.	•	•	•	•

Module	Name	Data type	Unit	Description	MPC	Multi-E model G	Multi-E/TPED model H and later	MAGNA3-D
28	PumpsCommFault	5	Bits	One bit for each pump indicating that there is no communication with the pump. Logical "1": No communication with the pump. 0: Communication fault, zone pump 1 1: Communication fault, zone pump 2 2: Communication fault, zone pump 3 3: Communication fault, zone pump 4 4: Communication fault, zone pump 5 5: Communication fault, zone pump 6 6: Communication fault, pilot pump 7: Communication fault, backup pump.	●	●	●	●
41	UserSetpoint	8	%	User setpoint as written from the bus or selected on the booster. See description of scaling for a setpoint in *7.2 Control module (ControlModule, module 2)*.	●	-	●	●
42	AnalogueInfluence	8	%	Influence from analog input.	●	-	●	●
43	NoOfPowerOn	8	-	Number of power-on cycles.	●	-	-	-
44	FeedBackSensorUnit	5	Enum	Scaling unit for the closed-loop feedback sensor 0: bar 7: m^3/s 14: l/h 1: mbar 8: l/s 15: l/min 2: m 9: gpm 16: gal/h 3: kPa 10: °C 17: gal/s 4: psi 11: °F 18: ft^3/h 5: ft 12: % 19: ft^3/min 6: m^3/h 13: K 20: ft^3/s	●*	-	●	●
45	FeedbackSensorMin	6	Sensor unit	Minimum value for the closed-loop feedback sensor.	●	-	●	●
46	FeedbackSensorMax	6	Sensor unit	Maximum value for the closed-loop feedback sensor.	●	-	●	●
51	AutoModePumps	5	Bits	One bit for each pump indicating if the pump is commanded to stop from PROFIBUS/PROFINET or is in auto mode, controlled from CU 352. Logical "1": Pump in auto mode. 0: Zone pump 1 in auto mode 1: Zone pump 2 in auto mode 2: Zone pump 3 in auto mode 3: Zone pump 4 in auto mode 4: Zone pump 5 in auto mode 5: Zone pump 6 in auto mode 6: Pilot pump in auto mode 7: Backup pump in auto mode. The data module ControlPumps (module 50) is used to command the individual pumps.	●***	-	-	-
52	FlowMeasurement1	6	0.1 m^3/h	Flow measurement 1 from sensor.	S	-	-	-
53	FlowMeasurement2	6	0.1 m^3/h	Flow measurement 2 from sensor.	S	-	-	-
53	FlowMeasurement2	6	0.1 m^3/h	Flow measurement 3 from sensor.	S	-	-	-
58	SelectedFeedbackSensor	5	Enum	Read selected feedback sensor type 3: Flow sensor 6: Pressure sensor	●***	-	-	-

S: Sensor required.

●: Always available.

●*: Hydro Multi-E model G only.
For Hydro/Control MPC, see the table below.

●**: MPC-E only.

●***: CU 352 only.

All the data items ControlModule. Setpoint, StatusModule. ProcessFeedback, ActualSetpoint and UserSetpoint have a scaling relative to the feedback sensor. By using the scaling information of the feedback sensor (FeedbackSensorUnit, FeedbackSensorMin, FeedbackSensorMax) these data items can be expressed in absolute units.

Many of the booster system measurement modules require a particular sensor to be present. As a limited number of sensors are available, only a few of the measurement modules can be available simultaneously.

The table below shows the relation between the PROFIBUS/ PROFINET measurement modules and the sensor value selected on CU 35X.

Hydro/Control MPC and Multi-E/TPED model H			
PROFIBUS/PROFINET module	**FeedBackSensorUnit**	**Measuring sensor, options**	**Primary sensor, options**
VolumeFlow (5)	3: 0.1 m^3/h	Flow rate	Flow rate Flow rate, Series 2000
Head (6)	16: 0.01 m	Differential pressure, pump (zero is equal to -100 m)	Differential pressure, pump Differential pressure, Series 2000
RemotePressure (7)	5: 0.001 bar	Differential pressure, external External pressure It has an offset of -1.000 bar.	Differential pressure, external External pressure
InletPressure (8)	7: 0.001 bar	Differential pressure, inlet	Differential pressure, inlet
OutletPressure (9)	6: 0.001 bar	Outlet pressure Differential pressure, outlet	Outlet pressure Differential pressure, outlet
RemoteTemperature (14)	18: 0.01 K	Return-pipe temperature, external	Return-pipe temperature, external
AmbientTemperature (15)	22: 0.01 K	Ambient temperature	Ambient temperature
InletTemp (16)	20: 0.01 K	Return-pipe temperature	Return-pipe temperature
OutletTemp (17)	19: 0.01 K	Flow-pipe temperature	Flow-pipe temperature
TemperatureDifference (18)	21: 0.01 K	Differential temperature	Differential temperature
-	-	0-100 % signal	0-100 % signal

The table below shows the relation between the Hydro Multi-E PROFIBUS/PROFINET measurement modules and the measurement unit selected with Grundfos GO Remote for the feedback sensor. Only one of the measurement module groups in the table below is available at a time.

Hydro Multi-E model G	
Sensor unit configuration with the Grundfos GO Remote	**PROFIBUS/PROFINET data module generated from feedback sensor measurement**
bar	Head (6) OutletPressure (9)
mbar	
m	
kPa	
psi	
ft	
m^3/h	VolumeFlow (5)
m^3/s	
l/s	
gpm	
°C	RemoteTemperature (14)
°F	
%	-

You can calculate, the process feedback scaled according to ProcessFeedBackUnit from this formula:

Feedback (scaled) = ProcessFeedBack * (FeedBackSensorMax - FeedBackSensorMin) / 100 % + FeedBackSensorMin

See also page 16.

7.9 Zone pump modules (ZonePumpModule, modules 29 to 34)

A zone pump module is available for each of the six possible zone pumps. Its data type is 10, non-standard.

Byte	Bit	Name	Description
Byte 1 (data type 5)	0	AccessMode*	Zone pump control: 0:Local (buttons on pump, Grundfos GO Remote or external digital input). 1:Controlled from booster system.
	1	OnOff**	Zone pump on or off: 0:Off (stopped). 1:On (started).
	2	Fault	Zone pump fault condition: 0:No fault condition. 1:Fault, alarm on pump.
	3-7	-	-
Byte 2 (data type 5)		FaultCode*** [enum]	Alarm code from zone pump, see list of possible codes below.
Bytes 3 to 6 (data type 8)		OperationTime*** [h]	Operating time of zone pump.
Bytes 7 and 8 (data type 6)		Speed* [0.01 %]	Zone pump speed.

* Hydro/Control MPC-E, Multi-E/TPED model H and MAGNA3-D.

** For Hydro Multi-E this indicates the state commanded by the Hydro Multi-E control. A local override command, for example stop, is not indicated by this bit.

*** Hydro/Control MPC-E, Multi-E, TPED and MAGNA3-D.

Code	Alarm/warning description
1	Leakage current
2	Missing phase
3	External fault signal
4	Too many restarts
4	Too many restarts per 24 hours
7	Too many hardware shutdowns
10	Communication fault, pump
14	Electronic DC-link protection activated (ERP)
16	Other
29	Turbine operation, impellers forced backwards
30	Change bearings (specific service information)
31	Change varistor(s) (specific service information)
32	Overvoltage
40	Undervoltage
41	Undervoltage transient
42	Cut-in fault (dV/dt)
45	Voltage asymmetry
48	Overload
49	Overcurrent (i_line, i_dc, i_mo)
50	Motor protection function, general shutdown (MPF)
51	Blocked motor or pump
54	Motor protection function, 3 sec. limit
55	Motor current protection activated (MCP)
56	Underload
57	Dry running
64	Overtemperature
65	Motor temperature 1 (t_m or t_mo or t_mo1)
66	Temperature, control electronics
67	Temperature too high, internal frequency converter module (t_m)
70	Thermal relay 2 in motor, for example thermistor
72	Hardware fault, type 1
73	Hardware shutdown (HSD)
76	Internal communication fault
77	Communication fault, twin-head pump
80	Hardware fault, type 2
83	Verification error, FE parameter area (EEPROM)
84	Memory access error
85	Verification error, BE parameter area (EEPROM)
88	Sensor fault
89	Signal fault, (feedback) sensor 1
91	Signal fault, temperature 1 sensor
91	Temperature sensor 1 signal fault
93	Signal fault, sensor 2
96	Setpoint signal outside range
105	Electronic rectifier protection activated (ERP)
106	Electronic inverter protection activated (EIP)
148	Motor bearing temperature high (Pt100) in drive end (DE)
149	Motor bearing temperature high (Pt100) in non-drive end (NDE)
155	Inrush fault
156	Communication fault, internal frequency converter module
157	Real-time clock error
161	Sensor supply fault, 5 V
162	Sensor supply fault, 24 V
163	Motor drive protection function measurement fault
164	Signal fault, LiqTec sensor
165	Signal fault, analog input A1
166	Signal fault, analog input A2
167	Signal fault, analog input A3
175	Signal fault, temperature 2 sensor (t_mo2)
175	Temperature sensor 2 signal fault
176	Signal fault, temperature 3 sensor (t_mo3)
190	Limit exceeded, sensor 1
191	Limit exceeded, sensor 2
240	Lubricate bearings (specific service information)
241	Motor phase failure
242	Automatic motor model recognition failed

7.10 Zone pump extension modules (ZonePump#ExtModule, modules 35 to 40)

A zone pump extension module is only available for Hydro/ Control MPC-E, Multi-E/TPED model H and MAGNA3-D. Its data type is 10, non-standard.

Byte	Name	Description
Bytes 1 to 4 (data type 8)	Current [A]	Zone pump motor current.
Bytes 5 to 8 (data type 8)	Power [W]	Zone pump motor power.
Byte 9 (data type 5)	MotorTemperature [°C]	Zone pump motor temperature.
Byte 10 (data type 5)	ControlSource [enum]	Zone pump control source: 1: Buttons on pump 2: GENIbus (booster system) 3: GENIlink (Grundfos GO Remote) 4: External digital control. 5: Start/stop button

7.11 Pilot pump module (PilotPumpModule, module 55)

This module is available for CU 352 only.

A pilot pump module is only available for Hydro MPC-E and only if the pilot pump is an E-pump.

Byte	Name	Description
1	FaultCode [enum]	Fault code, pilot pump.
2-3	Speed [0.01 %]	Relative speed, pilot pump.
4-5	Power [1 W]	Power consumption, pilot pump.

7.12 Backup pump module (BackupPumpModule, module 56)

This module is available for CU 352 only.

A backup pump module is only available for Hydro MPC-E and only if the backup pump is an E-pump.

Byte	Name	Description
1	FaultCode [enum]	Fault code, backup pump.
2-3	Speed [0.01 %]	Relative speed, backup pump.
4-5	Power [1 W]	Power consumption, backup pump.

7.13 Device identification (DeviceIdentification, module 47)

The data type is 10, non-standard.

Byte	Name/description	
1	**UnitFamily [enumeration]**	**UnitType [enumeration]**
	1: UPE/MAGNA/MAGNA3 circulator pump	5: UPE, 3-phase 7: MAGNA, 1-phase 9: MAGNA, 1-phase, small 10: MAGNA3
	2: E-pump, 1-phase/3-phase, based on MGE motor or CUE frequency converter	2: MGE, 1-phase 3: MGE, 3-phase 4: MGE, 3-phase, large 5: CUE frequency converter 6: MGE, 3-phase, model G 7: MGE, 3-phase, model H and later
	7: MP 204 motor protector	1: MP 204
	17: Hydro Multi-E model G	1: With 3-phase pumps 2: With 1-phase pumps
	21: Hydro MPC/Control MPC, Hydro Multi-B	1: Hydro MPC/Control MPC, CU 351/CU 352 2: Hydro Multi-B, CU 323
	25: CR Monitor	1: CR Monitor, CU 351
	26: Dedicated Controls	1: Dedicated Controls, CU 362
	30: Smart Digital Dosing, DDA	1: Smart Digital Dosing, DDA
	39: Hydro Multi-E model H and later	1: With 3-phase pumps 2: With 1-phase pumps
2	UnitType [enumeration] According to description above.	
3	UnitVersion [enumeration] Used by Grundfos.	
4	CIMSoftwareVersion [number]	
5	CIMSoftwareRevision [number]	
6	CIMModel [enumeration]	

8. Product simulation

The CIM module can be put in product simulation mode in which case it will generate life-like simulated values of all the PROFIBUS/PROFINET input data modules.

It will thus be possible to connect a PROFIBUS/PROFINET master to CIU 150 or CIU 500 without this device being connected to a real pump in a real-life system. In an office environment, it can then be verified that communication works and data is being received and handled correctly by the PROFIBUS/PROFINET master application program, for example PLC program, before the equipment is installed under real-life conditions.

8.1 CIM 150 product simulation

Product simulation mode is entered when the hexadecimal address switch has one of the values shown in the table below:

Address setting (section *5.4 Setting the PROFIBUS address*)		**Simulated product**
SW3	**SW4**	
F	0	Pump profile
F	1	Booster system profile
F	2	CR Monitor profile
F	3	MP 204 motor protector profile
F	4	Digital Dosing DDA profile
F	5	Wastewater system profile

The effective address will be 15 (0x0F).

Only input modules are simulated. The data read has dummy values and no real product functionality is simulated.

8.2 CIM 500 Product Simulation

Product simulation mode is entered via the webserver. See section *A.4 PROFINET IO configuration* on page 33.

9. Fault finding the product

9.1 CIM/CIU 150

You can detect faults in a CIM 150 PROFIBUS module by observing the status of the two communication LEDs. See the table below.

9.1.1 LED status

CIM 150 fitted in a Grundfos booster system

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected.	a) CIM 150 is fitted incorrectly in the Grundfos product.	Check that CIM 150 is fitted and connected correctly.
	b) CIM 150 is defective.	Replace the CIM 150.
2. LED2 for internal communication is flashing red.	a) No internal communication between CIM 150 and the Grundfos product.	Check that CIM 150 is fitted correctly in the Grundfos product.
3. LED2 for internal communication is permanently red.	a) CIM 150 does not support the connected Grundfos product.	Contact the nearest Grundfos company.
4. PROFIBUS LED1 is permanently red.	a) Fault in CIM 150.	Contact the nearest Grundfos company.
5. PROFIBUS LED1 is flashing red.	a) Fault in the CIM 150 PROFIBUS configuration.	• Check that the PROFIBUS address, switches SW3 and SW4, has a valid value [1-126]. See section *5.4 Setting the PROFIBUS address*. • Check that the GSD file used is correct. • Check that the PROFIBUS cable has been fitted correctly. See section *5.3 Connecting the PROFIBUS*. • Check that the PROFIBUS termination is correct. See section *5.5 Termination resistors*.

CIM 150 fitted in CIU 150

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected.	a) CIU 150 is defective.	Replace CIU 150.
2. LED2 for internal communication is flashing red.	a) No internal communication between CIU 150 and the Grundfos product.	• Check the cable connection between CIU 150 and the Grundfos product. • Check that the individual conductors have been fitted correctly. • Check the power supply to the Grundfos product.
3. LED2 for internal communication is permanently red.	a) CIM 150 does not support the connected Grundfos product.	Contact the nearest Grundfos company.
4. PROFIBUS LED1 is permanently red.	a) Fault in CIM 150.	Contact the nearest Grundfos company.
5. PROFIBUS LED1 is flashing red.	a) Fault in the CIM 150 PROFIBUS configuration.	• Check that the PROFIBUS address, switches SW3 and SW4, has a valid value [1-126]. See section *5.4 Setting the PROFIBUS address*. • Check that the GSD file used is correct. • Check that the PROFIBUS cable has been fitted correctly. • Check that the PROFIBUS termination is correct. See section *5.5 Termination resistors*.

9.2 CIM/CIU 500

You can detect faults in CIU 500 by observing the status of the two communication LEDs. See the table below and section *4.3 CIM 500 PROFINET IO*.

9.2.1 LED status

CIM 500 fitted in a Grundfos booster system

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected.	a) CIM 500 is fitted incorrectly in the Grundfos product.	Check that CIM 500 is fittedand connected correctly.
	b) CIM 500 is defective.	Replace CIM 500.
2. PROFINET IO LED1 remains off.	a) The protocol selection switch, SW1 has been set in Modbus TCP position	Set the switch to "0".
3. LED2 for internal communication is flashing red.	a) No internal communication between CIM 500 and the Grundfos product.	Check that CIM 500 is fitted correctly in the Grundfos product.
4. LED2 for internal communication is permanently red.	a) CIM 500 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
5. PROFINET IO LED1 is permanently red.	a) Connected Grundfos product is not supported.	Contact the nearest Grundfos company.
	b) Illegal position of protocol switch, SW1	Check that the rotary switch SW1 is set to "0".
6. PROFINET IO LED1 is flashing red.	a) Fault in the CIM 500 PROFINET IO configuration.	• Check that the right GSDML file is used. Check that PROFINET IO IP address configuration is correct. See section *A.4 PROFINET IO configuration* on page 33. • Check the device name in CIM 500 and PROFINET IO master.
7. PROFINET IO LED1 is pulsing red.	a) Connection to the master is lost.	• Check that the cables are fitted and connected correctly. • Checkthat the master is running.
8. LED1 is permanently red and green at the same time.	a) Error in firmware download.	Use the webserver to download the firmware again.
9. LED2 is permanently red and green at the same time.	a) Memory fault.	Replace CIM 500.

CIM 500 fitted in CIU 500

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected	a) CIU 500 is defective.	Replace CIU 500.
2. PROFINET IO LED1 remains off.	a) The protocol selection switch, SW1 has been set in Modbus TCP position	Set the switch in position "0".
3. LED2 for internal communication is flashing red.	a) No internal communication between CIU 500 and the Grundfos product.	• Check the cable connection between the Grundfos product and CIU 500. • Check that the individual conductors have been fitted correctly. • Check the power supply to the Grundfos product.
4. LED2 for internal communication is permanently red.	a) CIM 500 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
5. PROFINET IO LED1 is permanently red.	a) Connected Grundfos product is not supported.	Contact the nearest Grundfos company.
	b) Illegal position of protocol switch, SW1	Check that the rotary switch SW1 is set to "0".
6. PROFINET IO LED1 is flashing red.	a) Fault in the CIM 500 PROFINET IO configuration.	• Check that the right GSDML file is used. • Check that PROFINET IO IP address configuration is correct. See section *6. PROFINET IO, CIM 500 setup*. • Check the device name in CIM 500 and PROFINET IO master.
7. PROFINET IO LED1 is pulsing red.	a) Connection to the master is lost.	• Check that the cables.are fitted and connected correctly • Check that the master is running.
8. LED1 is permanently red and green at the same time	a) Error in firmware download.	Use the webserver to download the firmware again.
9. LED2 is permanently red and green at the same time	a) Memory fault.	Replace CIM 500.

10. PROFIBUS address

Decimal to hexadecimal conversion table for setting of the PROFIBUS address switches. See section *5.4 Setting the PROFIBUS address*.

PROFIBUS address	SW3	SW4	PROFIBUS address	SW3	SW4	PROFIBUS address	SW3	SW4
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			
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			
45	2	D	90	5	A			

11. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

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

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

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

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

A.1 How to configure an IP address on your PC

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

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

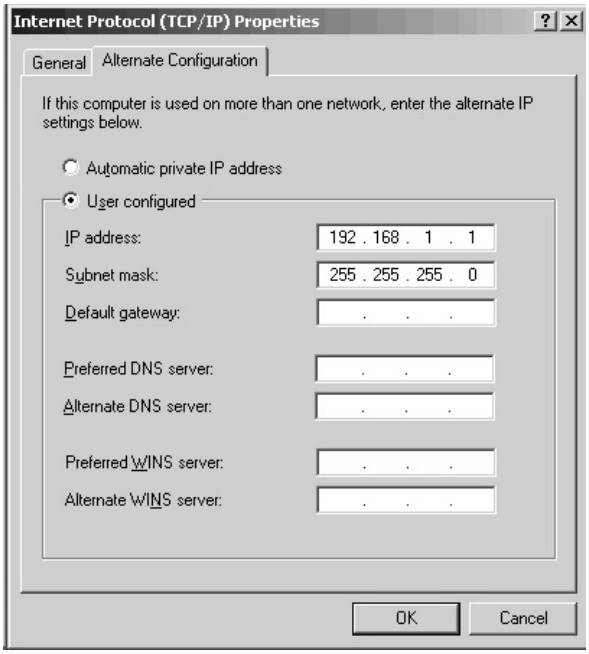


Fig. 1 Example from Windows

A.2 Webserver configuration

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

Before configuration

- Check that the PC and CIM 500 are connected via an ethernet cable.
- Check that the PC ethernet port is set to the same network as CIM 500. For network configuration, see section *A.1 How to configure an IP address on your PC*.

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

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

A.3 Login

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Fig. 2 Login

User name	Enter user name. Default: admin.
Password	Enter password. Default: Grundfos.

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

A.4 PROFINET IO configuration

This web page is used to configure all the parameters relevant to the PROFINET IO protocol standard. All settings can also be configured from a standard PROFINET IO configuration tool, for instance Siemens Primary Setup Tool (PST). It is available on the internet.

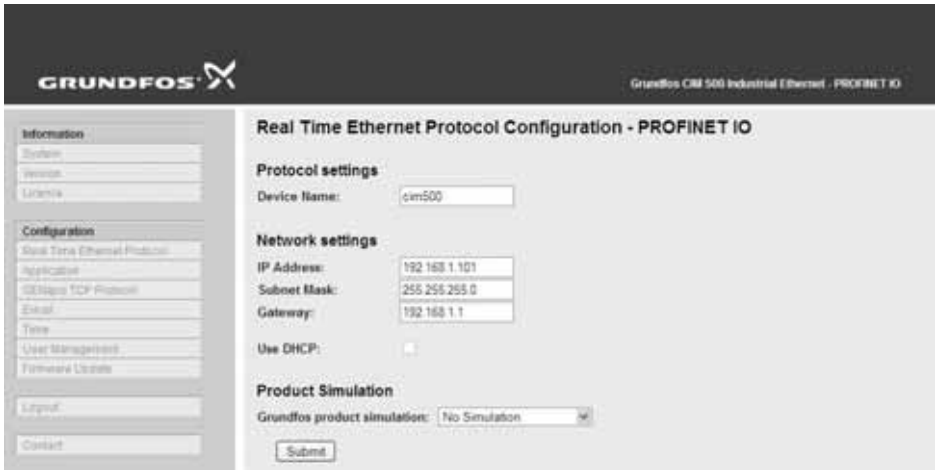

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Fig. 3 Real Time Ethernet Protocol Configuration - PROFINET IO

Object	Description
Device Name	The PROFINET IO device name. It must be unique.
IP Address	The static IP address for CIM 500 on the PROFINET IO network. It must be unique.
Subnet Mask	Configure the subnet mask for CIM 500 on the PROFINET IO network.
Gateway	Configure the default gateway for the PROFINET IO network.
Use DHCP	CIM 500 can be configured to automatically obtain the IP address from a DHCP server on the network.
Grundfos product simulation	CIM 500 can be put in product simulation mode to generate realistic simulated values of all the PROFINET IO input data modules. It will thus be possible to connect a PROFINET IO master to a CIM 500 fitted in a CIU unit or E-box without installing this device in a real industrial process system. In an office environment, it can then be verified that communication works and data are received and handled correctly by the PROFINET IO master application program, e.g. PLC program, before installing the device. To enable product simulation, select a product type from the drop down list. Product simulation is terminated by a module power cycle.

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