EtherNet/IP for Grundfos boosters

CIM/CIU 500 Ethernet

Functional profile and user manual

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GRUNDFOS

Original functional profile and user manual

This functional profile describes Grundfos EtherNet/IP 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 CIM/CIU 500 Ethernet for EtherNet/IP for the Grundfos booster systems mentioned below:

- Grundfos Hydro/Control MPC (CU 352)
- Grundfos Demand Driven Distribution (CU 354)
- 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 the MGE motor model G and earlier models are referred to as Multi-E model G.

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

The data parameters for Hydro MPC and Control MPC are identical, so in the following, only Hydro MPC is mentioned. If not specifically mentioned, Hydro MPC, Hydro Multi-E model G, Hydro Multi-E model H, TPED model H and MAGNA3 D are referred to as "booster system".

2.2 EDS file

For this product, an associated Electronic Data Sheet file (Grundfos_EIP_Booster_Adapter_EDS.eds) can be downloaded from the Grundfos Product Center.

2.3 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming of EtherNet/IP devices.

2.4 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, 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. Often used as abbreviation for water head (pressure in metres).
HTTP	Hyper Text Transfer Protocol. The protocol commonly used to navigate the world wide web.
Hydro MPC	Multipump controller. Grundfos booster system.
Hydro Multi-E	Grundfos booster system.
IANA	Internet Assigned Numbers Authority.
LED	Light-Emitting Diode.
Local mode	The booster system uses the setpoint and operating mode set on CU 352 (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	Often used as abbreviation for water 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.
SMTP	Simple Mail Transfer Protocol.
SNTP	Simple Network Time Protocol. Used for clock synchronisation between computer systems.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol for Internet communication, and also used as middle-layer protocol for most Ethernet-based fieldbuses.
Transmission speed	Bits transferred per second, bit/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.

3. System description

The system diagrams give an overview for the different technologies of how to connect the CIM module or CIU unit to the Grundfos booster system that you connect to an EtherNet/IP network.

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

Note that Hydro MPC exists in two variants; one with the old CU 351 controller or one with the present CU 352 controller. They have different CIM/CIU connections as described below.

CIM solution

CIM 500 is an add-on communication module that you install into the back of CU 352 Hydro MPC or CU 354 DDD, using a 10-pin connection. In this setup, the booster system supplies power to the module. See fig. 1.

CIU solution

CIU 500 is a unit with a power supply and a CIM module. You can mount it either on a DIN rail or on a wall.

You use CIU 500 with products:

- Hydro MPC with old CU 351 controller
- Multi-E model G. See Fig. 2.

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

3.1 EtherNet/IP, CIM 500

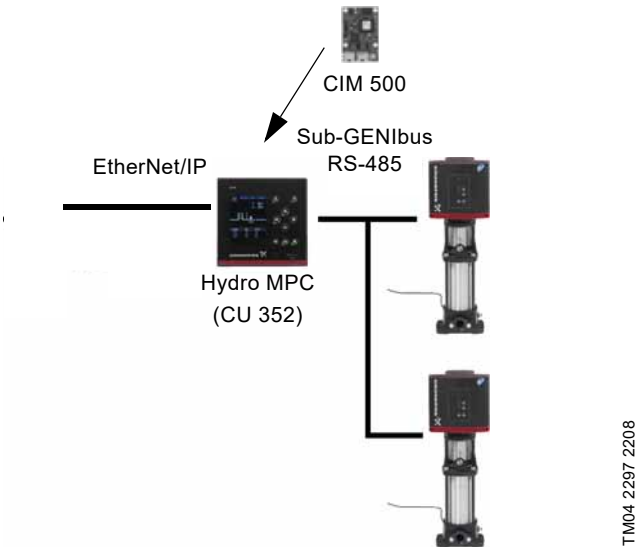

Fig. 1 Example of a CIM 500 EtherNet/IP solution. The module is installed inside the CU 352 controller, similarly to the setup for CU 354 DDD

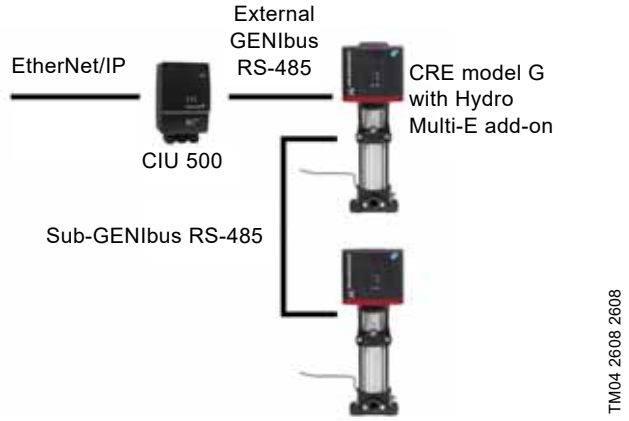

Fig. 2 Example of a CIU 500 EtherNet/IP solution for Hydro Multi-E, model G

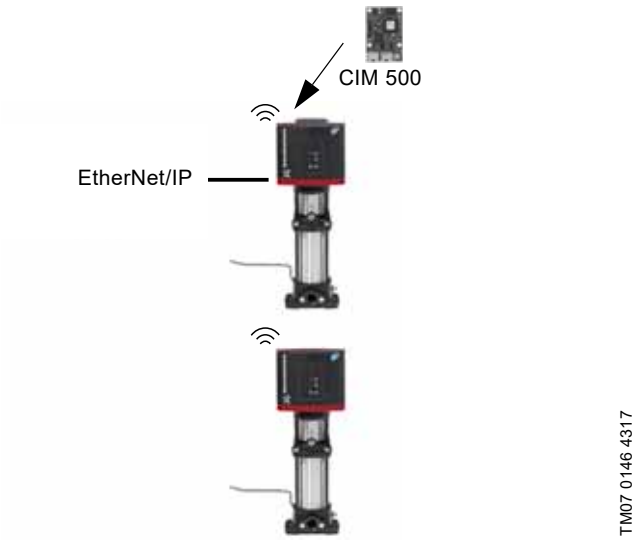

Fig. 3 Example of a CIM 500 EtherNet/IP solution for Hydro Multi-E model H and later. CIM 500 is mounted in the master pump. The other pumps in the Multi-E booster connects to the master pump via built-in radio communication (Grundfos Glowpan)

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 EtherNet/IP 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	The LED will be in one of these states: Off, permanently green, flashing red, permanently red. See section *5.5 Status LEDs*.
Power supply (CIU)	24-240 V	Integrated in the unit.
GENIbus connection type (CIU)	RS-485, 3-wire + screen	Conductors: A, B and Y.
CIU box enclosure class	IP54	
CIU box dimensions (H × W × D)	182 × 108 × 82 mm	

4.2 CIM 500 Ethernet

CIM 500 Ethernet specifications	Description	Comments
Application layer	DHCP, HTTP, Ping, FTP, fieldbus protocols	
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 Mbit/s	Corresponds to 328 feet.
Transmission speed	10 Mbit/s, 100 Mbit/s	Auto-detected.
Industrial Ethernet fieldbus protocols	PROFINET IO, Modbus TCP, BACnet IP, EtherNet/IP, GRM IP, Grundfos iSolutions Cloud	Selected with rotary switch. See section *5.2 Selection of Industrial Ethernet protocol*.

4.3 EtherNet/IP

EtherNet/IP specifications	Description
Minimum requested packet interval	15 ms
I/O data	505 bytes output 509 bytes input Maximum 255 bytes I/O data per assembly.
Number of IO connections	10 Default; configurable depending on available socket resources.
Number of encapsulation sessions	10 Default; configurable depending on available socket resources.
Number of explicit messaging connections	2 explicit messaging connections per encapsulation session 20 explicit messaging connections in total, configurable.
User-specific objects	Object 100. Depending on the connected product. • Grundfos pump • Grundfos booster • Grundfos dosing.
Maximum number of connections	2 explicit messaging connections × 10 encapsulation sessions Additional 10 I/O connections Total: 30 connections.
Standard objects	• Identity object (class 0x01) • Message Router object (class 0x02) • Assembly object (class 0x04). Assembly: up to 32 • Connection Manager object (class 0x06) • Device Level Ring (DLR) object (0x47) • Quality of Service (QoS) object (0x48) • TCP/IP Interface object (0xF5) • Ethernet Link object (0xF6)
DHCP	Supported
Functional scope	• Adapter • Support of 2 Ethernet Link objects for implementing ring and daisy chain topologies • Device Level Ring (DLR) protocol (announce-based ring node) • Quality of Service (QoS) • IPv4 Address Conflict Detection (ACD)
Watchdog	Communication watchdog with fixed 5 seconds time-out. It can be enabled via the CIM 500 web page.
Certificate	Plugfest December 2018, Conformance July 2019.

5. EtherNet/IP, CIM 500 setup

WARNING

Electric shock

Death or serious personal injury

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

5.1 Connecting the Ethernet cable

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

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.

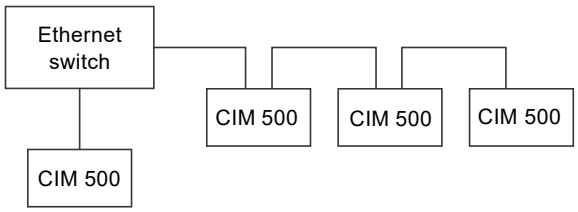

Fig. 4 Example of an Industrial Ethernet network with CIM 500

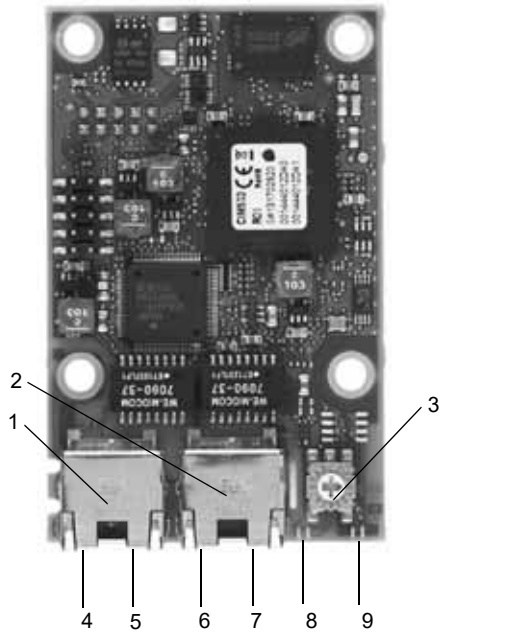

Fig. 5 CIM 500 Ethernet module

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 module and pump	LED2

5.2 Selection of Industrial Ethernet protocol

The module has a rotary switch for selection of the Industrial Ethernet protocol. See fig. 6.

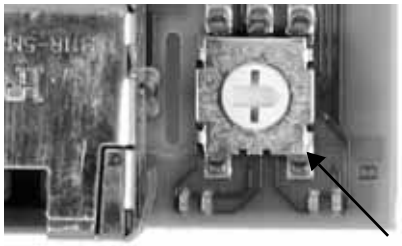

Fig. 6 Selecting the Industrial Ethernet protocol

Pos.	Description
0	PROFINET IO, default
1	Modbus TCP
2	BACnet IP
3	EtherNet/IP
4	GRM IP for Grundfos Remote Management, requires a contract with Grundfos.
5	Grundfos iSOLUTIONS Cloud (GiC)
6...E	Reserved. LED1 is permanently red to indicate an invalid configuration.
F	Resetting to factory settings. 1. Set the rotary switch to this position. 2. LED1 starts to flash red and green for 20 seconds to indicate that factory resetting is about to take place. 3. After 20 seconds, LED1 stops to flash and factory resetting is initiated. 4. When both LED1 and LED2 switch off, the resetting is completed. The rotary switch can be moved to another position.

If the rotary switch position is changed when the module is powered on, the module will restart and use the protocol associated with the new position.

5.3 Setting the IP addresses

The CIM 500 Ethernet module is by 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: Subnet mask: Gateway:	192.168.1.100 255.255.255.0 192.168.1.1
IP settings for EtherNet/IP	Make the settings via the webserver	

5.4 Establishing a connection to the webserver

You can configure CIM 500 using the built-in webserver. To establish a connection from a PC to CIM 500, 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 *Webserver configuration*.
- 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)

The first time you log in, you will be asked to change the password.

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

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Fig. 7 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.

5.5 Status LEDs

The CIM 500 Ethernet module has two Status LEDs, LED1 and LED2. See fig. 5.

- 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	Ethernet Link is not active.
Permanently green	Ethernet Link is active, connection is established.
Flashing green	Ethernet Link is active, no connection is established.
Permanently red	Ethernet Link is active, IP address conflict is detected.
Flashing red	Ethernet Link is active, any connection is timed out.

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.

5.6 DATA and LINK LEDs

The CIM 500 Ethernet module has two connectivity LEDs related to each RJ45 connector. See fig. 5.

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 is ongoing on the RJ45 connector.
Permanently yellow	Heavy network traffic on the RJ45 connector.

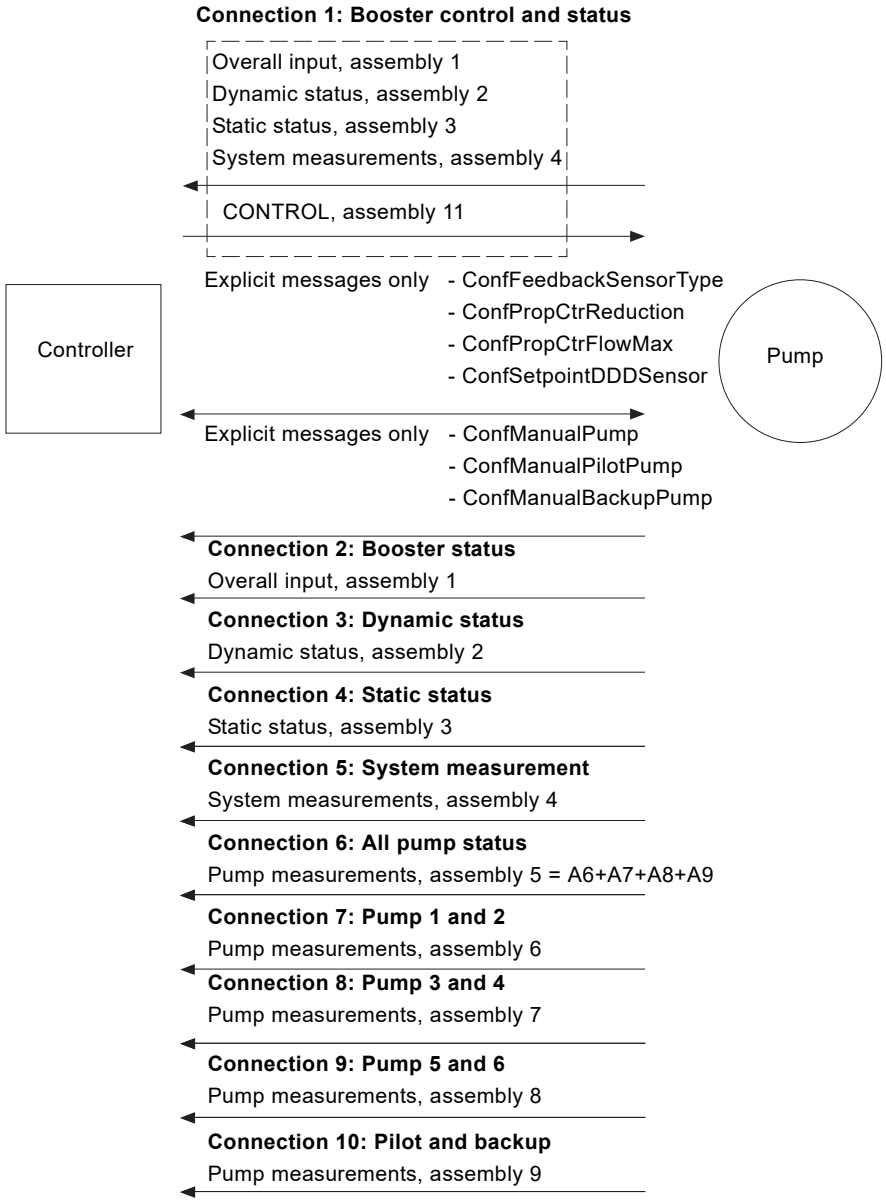
LINK1 and LINK2

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.

6. Detailed description of data parameters

6.1 Connection and assembly overview



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6.2 Booster input/output assembly details

Connection No	Connection type	Connection name	Input assembly instance	Input assembly size	Output assembly instance	Output assembly size
1	Exclusive owner	Booster control and status	1	156	11	24
2	Input only	Booster status	1	156	197	0
3	Input only	Booster dynamic status	2	28	197	0
4	Input only	Booster static status	3	8	197	0
5	Input only	Booster measurements	4	120	197	0
6	Input only	Pumps status and measurements	5	192	197	0
7	Input only	Pump 1 and 2 parameters	6	48	197	0
8	Input only	Pump 3 and 4 parameters	7	48	197	0
9	Input only	Pump 5 and 6 parameters	8	48	197	0
10	Input only	Pilot and backup pump parameters	9	48	197	0

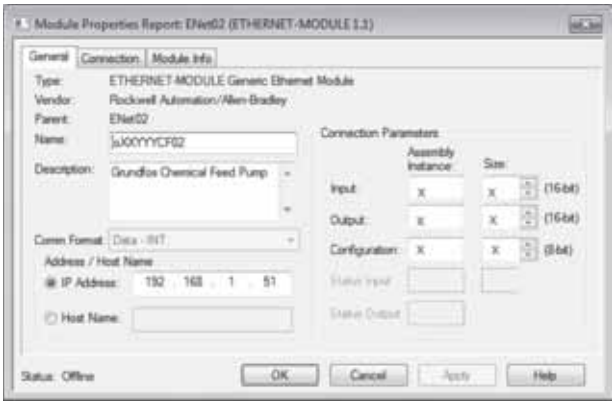

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Fig. 8 Rockwell PLC dialogue box for manual entering of information

6.3 Control parameters, output assembly 1

The control parameters are output parameters for controlling the booster. 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 setpoint and operating mode of the Hydro MPC and DDD from bus, you must select the control source "From bus" on the CU 352: "Settings" > "Secondary functions" > "Control source". The control mode however can be changed from bus without making this selection.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
1	SetRemoteLocal	SINT8, 0xC2	Bool (state)	0, 1	Setting of Remote/Local state	●	●		●	●
2	SetOnOff				Setting of On/Off state	●	●	●	●	●
3	SetCopyToLocal				Setting of Copy to local state				●	●
4	SetRelayOutput1				Setting of Relay output 1				●	
5	SetRelayOutput2				Setting of Relay output 2				●	
6	SetRelayOutput3				Setting of Relay output 3				●	
7	SetRelayOutput4				Setting of Relay output 4				●	
8	TrigResetAlarm		Bool (event)	↑ 1 (edge)	Command: Triggers alarms reset	●	●	●	●	●
9	TrigResetAccCnt			↑ 1 (edge)	Command: Triggers counter reset	●	●		●	
10	SetReserved1		Bool (state)	0, 1	Reserved for future use					
20	SetControlMode	SINT16, 0xC3	Enum	0-255	Select Control mode					
					0: Constant Speed	●			●	●
					1: Constant Frequency	●			●	●
					3: Constant Head	●	●		●	●
					4: Constant Pressure	●	●	●	●	●
					5: Constant Differential Pressure				●	
					6: Proportional Pressure	●	●		●	●
					7: Constant Flow				●	●
					8: Constant Temperature				●	●
					9: Constant Temp. Difference				●	●
					10: Constant Level				●	
					128: Auto-Adaption		●		●	●
					129: Flow Adaption				●	●
					130: Closed Loop Sensor Control				●	
21	SetOperatingMode	SINT16, 0xC3	Enum	0-255	Select Operating mode					
					0: AutoControl	●	●	●	●	●
					4: Minimum	●			●	●
					6: Maximum	●		●	●	●
30	SetSetpoint	SINT16, 0xC3	0.01 %	0 - 327.67 %	Setting of Setpoint	●	●	●	●	●
31	SetReserved2	SINT16, 0xC3	-	-	Reserved for future use					
32	SetReserved3	SINT16, 0xC3	-	-	Reserved for future use					
40	SetRTCValue	SINT32, 0xC4	Unix time	$0-(2^{31}-1)$	Setting of Real Time Clock in seconds elapsed since 01-01-1970.				●	●

6.3.1 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 500, the "actual state" of the booster system as read from StatusModule is continuously compared with the "requested" state in ControlModule, and CIU 500 writes 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 parameters behave like a command that is executed when the value changes. CIM 500 attempts to make the system operate according to the requested value. The change will be reflected in a parameter value in a corresponding input module.

6.3.2 Explanation to control bits

SetRemoteLocal

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 parameters will have no influence.
1:	The booster system is set to remote mode and operates according to the operating mode and setpoint written from the bus. The other control bits 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.

SetOnOff

Control bit used to start and stop the booster system:

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

SetCopyToLocal

If this bit is set, the remote settings for the control mode, operating mode and setpoint are copied to the local settings 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 thus not influence the behaviour of the booster.

- For Multi-E model H with a CIM module in the master pump only, set CopyToLocal (parameter 3) to value "1" in the master pump.
- For Multi-E model H with a CIM module in two pumps, always set CopyToLocal (parameter 3) to value "1" in both pumps. Any writings to a control parameter 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 (parameter 3 to value "1" in both pump heads. Any writings to a control parameter must be written to each pump head.

SetRelayOutput 1-4

These parameters can control the electromechanical relays in the booster if they are configured via a Grundfos PC Tool to be bus-controlled.

Only available for Multi-E and TPED pumps.

Bit	Name	Event trigger	Description
0	OutputRelay1Control	State	0: Relay inactive. 1: Relay active.
1	OutputRelay2Control	State	
2	OutputRelay3Control	State	
3	OutputRelay4Control	State	

Relay 3 and 4 are only available for Multi-E model H and later and TPED model H and later.

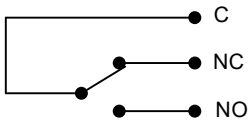

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Fig. 9 Relay output shown in inactive state

TrigResetAlarm

Control bit that resets alarms and warnings during transitions from "0" to "1" (positive edge triggered).

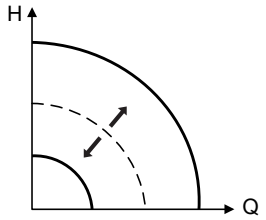
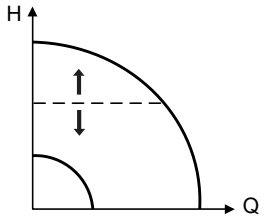
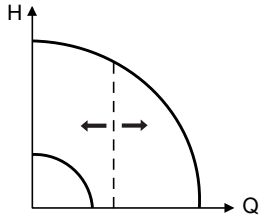
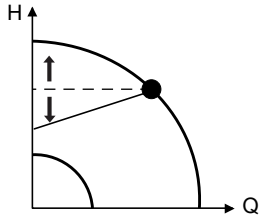
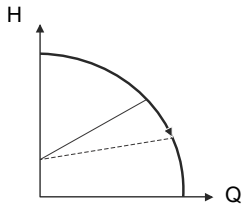
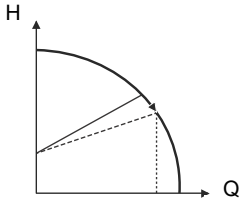
TrigResetAccCnt

Control bit used to reset operating hours and energy counter.

6.3.3 Explanation to control mode

Control enumeration for selection of the remote control mode via SetControlMode (parameter 20).

For Hydro MPC and DDD the control mode can be changed from bus without selecting "Controlled from bus" in the Settings menu.

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.	 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) > ConstTemDiff (9) > 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
> PropPress (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
> AUTO$_{ADAPT}$ (128)	In this control mode, the setpoint curve is a proportional-pressure curve where the setpoint has been set from factory. The AUTO$_{ADAPT}$ algorithm in the pump will over time optimise the setpoint value according to the pipe characteristics of the system. The setpoint curve will always be adjusted in a downward direction. A pressure sensor is required for all system types, except MAGNA3 D.	 TM05 3241 1012
> FLOW$_{ADAPT}$ (129)	This control mode works similar to AUTO$_{ADAPT}$, except that the flow-limiting function, FLOW$_{LIMIT}$, is always active and limits the flow to the value of SetMaxFlowLimit (parameter 50). A pressure sensor is required for all system types, except MAGNA3 D.	 TM05 3242 1012
> ClosedLoopSensor (130)	This is a general purpose closed-loop control mode that you can use in cases where the system is used for a type of control not covered by one of the other control modes.	

H: Pressure (head)

Q: Flow

Important:

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

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

6.3.4 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 *6.3.3 Explanation to control mode*.
4:	Minimum The booster system operates at a fixed minimum performance. Not supported by Hydro Multi-E model G and DDD.
6:	Maximum The booster system operates at a fixed maximum performance. Not supported by DDD.

6.3.5 Setpoint in closed-loop control

Hydro MPC, DDD and Multi-E model G

The setpoint is written to SetSetpoint (parameter 30) as a percentage value scaled in 0.01 % of the sensor maximum value, FeedbackSensorMax (parameter 110). The sensor minimum value is always 0. The selected setpoint is reflected in UserSetpoint (parameter 300) with the same scaling.

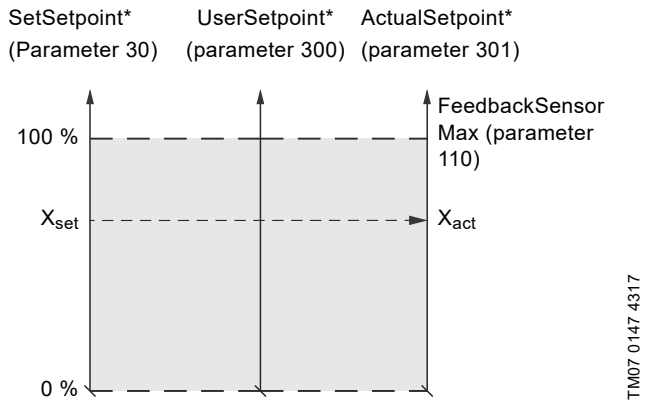
The actual setpoint, whether it has been set via Grundfos GO Remote, the pump display, the pump buttons or the fieldbus, can be read from ActualSetpoint (parameter 301). It is a percentage value scaled in 0.01 % of FeedbackSensorMax (parameter 110).

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 FeedbackSensorUnit (parameter 108).

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 percentage and its scaled value:

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



* Percentage of sensor maximum.

Fig. 10 Setpoint in closed-loop control for Hydro MPC, DDD and Multi-E model G

TPED, MAGNA3 D, Multi-E model H

The setpoint is written to SetSetpoint (Parameter 30) as a percentage value scaled in 0.01 % of the setpoint range [r_{min}; r_{max}]. The selected setpoint is reflected in UserSetpoint (parameter 300) with the same scaling.

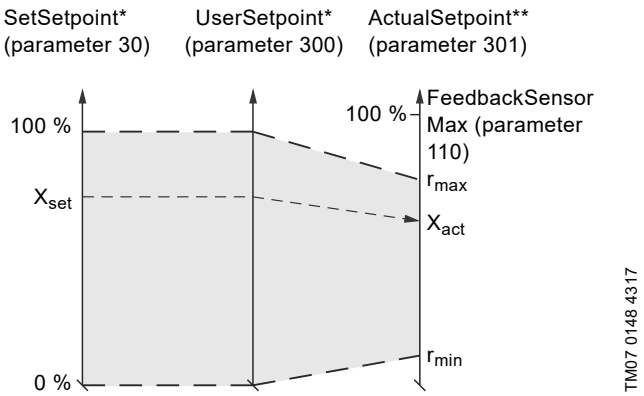
The actual setpoint, whether it has been set via Grundfos GO Remote, the pump display, the pump buttons or the fieldbus, can be read from ActualSetpoint (parameter 301). It is a percentage value scaled in 0.01 % of FeedbackSensorMax (parameter 110).

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 FeedbackSensorUnit (parameter 108).

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



* Percentage of setpoint range.

** Percentage of sensor maximum.

Fig. 11 Setpoint in closed-loop control for TPED, MAGNA3 D and Multi-E model H

6.4 Illustration of closed-loop control

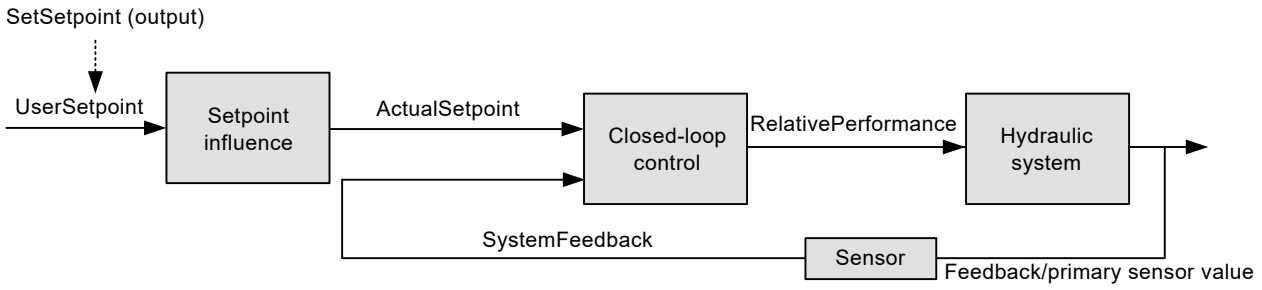


Fig. 12 Illustration of closed-loop control

The system feedback scaled according to SystemFeedbackUnit can be calculated from this formula:

Feedback (scaled) = SystemFeedback × (FeedbackSensorMax - FeedbackSensorMin) / 100 % + FeedbackSensorMin

See also section *6.3 Control parameters, output assembly 1*.

SystemFeedback

In closed-loop control, this is the value of the controlled process variable (feedback/primary sensor). SystemFeedback (parameter 302) can always be compared directly with the ActualSetpoint (parameter 301) variable. If no setpoint influence is active, it can also be compared with SetSetpoint parameter.

In open-loop control, SetSetpoint is mapped to SystemFeedback. The value of the feedback sensor can always be read in the corresponding measurement parameter.

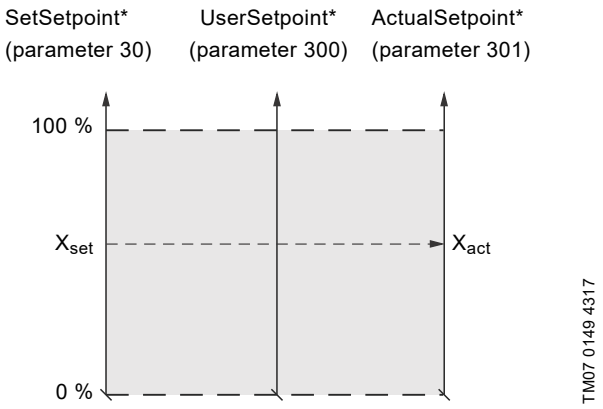
See section *6.9 Booster system measured parameters, input assembly 4*.

6.4.1 Setpoint in open-loop control

Hydro MPC, DDD and Multi-E model G

The setpoint is written to SetSetpoint (parameter 30) as a percentage value scaled in 0.01 % of the maximum performance. The selected setpoint is reflected in UserSetpoint (parameter 300) 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 ActualSetpoint (parameter 301), 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.



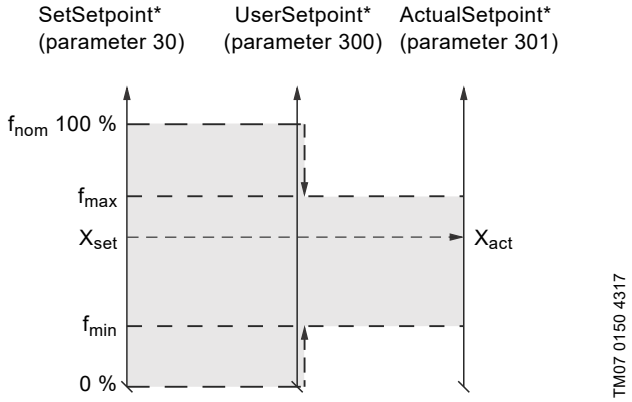
* Percentage of system performance.

Fig. 13 Setpoint in open-loop control for Hydro MPC, DDD and Multi-E model G

TPED, MAGNA3 D and Multi-E model H

The setpoint is written to SetSetpoint (parameter 30) as a percentage value scaled in 0.01 % of the nominal pump frequency f_{nom}. The selected setpoint is reflected in UserSetpoint (parameter 300) with the same scaling. From the fieldbus, it gets whatever value written to SetSetpoint, 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 ActualSetpoint (parameter 301), 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 f_{nom}

Fig. 14 Setpoint in open-loop control for TPED, MAGNA3 D and Multi-E model H

6.4.2 Set RTC value

Use this output to set the internal real-time clock of the pump. The format of the clock value is Unix Time format. It is not possible to read the actual value of the real-time clock.

Only Multi-E and TPED having a graphical display and MAGNA3 D support a built-in real-time clock. The real-time clock is used for time stamping of alarms, warnings and internal data logging. It has a built-in battery backup. If the power supply to the system is switched off, the real-time clock will keep running and a new setting is not required.

6.5 Configuration parameters, Input/Output explicit messaging

Configuration parameters are parameters that can be used to program selected settings in the booster.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
50	ConfFeedbackSensorType	SINT8, 0xC2	Enum	0-127	Select feedback sensor: 3: Flow 6: Press.	•				
51	ConfPropCtrReduction	SINT16, 0xC3	0.01 %	0 - 327.67 %	Configure reduction percentage in Proportional Pressure mode	•	•		•	
52	ConfPropCtrFlowMax		0.1 m^3/h	0 - 3276.7 m^3/h	Configure maximum flow in Proportional Pressure mode	•	•		•	
60	ConfManualPump1	SINT8, 0xC2	Bool (state)	0, 1	Pump1: 0: Forced to Stop 1: Auto	•	•			
61	ConfManualPump2				Pump2: 0: Forced to Stop 1: Auto	•	•			
62	ConfManualPump3				Pump3: 0: Forced to Stop 1: Auto	•	•			
63	ConfManualPump4				Pump4: 0: Forced to Stop 1: Auto	•	•			
64	ConfManualPump5				Pump5: 0: Forced to Stop 1: Auto	•	•			
65	ConfManualPump6				Pump6: 0: Forced to Stop 1: Auto	•	•			
66	ConfManualPilotPump				Pilot pump: 0: Forced to Stop 1: Auto	•				
67	ConfManualBackupPump				Backup pump: 0: Forced to Stop 1: Auto	•				
70	ConfReserved1	SINT16, 0xC3	-	-	Reserved for future use					
71	ConfReserved2		-	-	Reserved for future use					
72	ConfReserved3		-	-	Reserved for future use					
73	ConfReserved4		-	-	Reserved for future use					
80	ConfSetpointDDDSensor1		0.001 bar	0 - 32.767 bar	Configure the DDD remote sensor 1 setpoint		•			
81	ConfSetpointDDDSensor2				Configure the DDD remote sensor 2 setpoint		•			
82	ConfSetpointDDDSensor3				Configure the DDD remote sensor 3 setpoint		•			
83	ConfSetpointDDDSensor4				Configure the DDD remote sensor 4 setpoint		•			
84	ConfSetpointDDDSensor5				Configure the DDD remote sensor 5 setpoint		•			
85	ConfSetpointDDDSensor6				Configure the DDD remote sensor 6 setpoint		•			
86	ConfSetpointDDDSensor7				Configure the DDD remote sensor 7 setpoint		•			
87	ConfSetpointDDDSensor8				Configure the DDD remote sensor 8 setpoint		•			
88	ConfSetpointDDDSensor9				Configure the DDD remote sensor 9 setpoint		•			
89	ConfSetpointDDDSensor10	SINT16, 0xC3	0.001 bar	0 - 32.767 bar	Configure the DDD remote sensor 10 setpoint		•			

ConfFeedbackSensorType (parameter 50)

This parameter is only available for CU 352.

With this parameter 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.

6.6 Dynamic status parameters, input assembly 2

Dynamic status parameters are parameters that describe the actual modes and states of the booster. They are thus variables that can often change during operation of the booster.

This assembly is included in assembly 1.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
100	BoosterStatus	WORD, 0xD2	Array of Bools		Miscellaneous states/modes					
	0. RemoteLocal		Bool (state)	0, 1	Present status of Remote/ Local state	●	●	●	●	●
	1. OnOff				Present status of On/Off state	●	●	●	●	●
	2. CopyToLocal				Present status of Copy to local state				●	●
	3. AtMinSpeed				Speed/Performance at Minimum	●		●	●	●
	4. AtMaxSpeed				Speed/Performance at Maximum	●		●	●	●
	5. AtMaxPower				Power at Maximum				●	●
	6. Rotation				Rotation, at least one pump is running	●	●	●	●	●
	7. SetPointInfluence				Setpoint influence is active	●	●		●	●
	8. ResetAlarmAck				Set when "TrigResetAlarm" is activated	●	●	●	●	●
	9. ResetAccCntAck				Set when "TrigResetAccCnt" is activated	●	●		●	●
101	Digital Outputs	BYTE, 0xD1	Array of Bools		Digital outputs					
	0. DO1		Bool (state)	0, 1	Status of Digital Output 1	●	●	●	●	●
	1. DO2				Status of Digital Output 2	●	●		●	●
	2. DO3				Status of Digital Output 3				●	
	3. DO4				Status of Digital Output 4				●	
102	Digital Inputs	BYTE, 0xD1	Array of Bools		Digital inputs					
	0. DI1		Bool (state)	0, 1	Status of Digital Input 1	●	●	●	●	●
	1. DI2				Status of Digital Input 2	●	●		●	●
	2. DI3				Status of Digital Input 3	●	●		●	●
	3. DI4				Status of Digital Input 4	●	●		●	
	4. DI5				Status of Digital Input 5	●	●			
	5. DI6				Status of Digital Input 6	●	●			
	6. DI7				Status of Digital Input 7	●	●			
	7. DI8				Status of Digital Input 8	●	●			
103	ControlMode	SINT16, 0xC3	Enum	0-255	Present status of Control mode	●	●	●	●	●
104	OperatingMode				Present status of Operating mode	●	●	●	●	●
105	AlarmCode				Alarm code	●	●	●	●	●
106	WarningCode				Warning code	●	●		●	●
107	StatusReserved1				Reserved for future use					
108	FeedbackSensorUnit	SINT16, 0xC3	Enum	0-255	Feedback sensor unit 0: bar 1: mbar 2: m 3: kPa 4: psi 5: ft 6: m^3/h 7: m^3/s 8:/s 9: gpm 10: °C 11: °F 12: % 13: kelvin 14: l/h	●	●		●	●
109	FeedbackSensorMin		1	0-32767	Feedback sensor min (counting in units)	●	●		●	●
110	FeedbackSensorMax				Feedback sensor max (counting in units)	●	●		●	●
111	FeedbackSensorType	SINT8, 0xC2	Enum	0-127	Feedback sensor type: 3: Flow 6: Pressure	●				

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
112	PumpsPresent	BYTE, 0xD1	Array of Bools	Bits	One bit for each pump. "1" indicates pump present	●	●	●	●	●
113	PumpsRunning				One bit for each pump. "1" indicates pump running	●	●	●	●	●
114	PumpsFault				One bit for each pump. "1" indicates pump alarm	●	●	●	●	●
115	PumpsCommFaults				One bit for each pump. "1" indicates communication error	●	●	●	●	●
116	PumpsAutoMode				One bit for each pump. "1" indicates Auto mode	●	●			
117	SystemActiveFunctions	WORD, 0xD2	Array of Bools		A bit value of "1" indicates that the function is active	●	●			
	0. EmergencyRun		Bool (state)	0, 1	Emergency Run function is active					
	1. StandbyPump				A standby pump is activated					
	2. PumpTest				Pump Test Run is active					
	3. AltSetpoint				Booster is using the alternate setpoint					
	4. ClockProgram				Booster under Clock Program control					
	5. RemoteVNC				Virtual Network Computing (VNC) is active					
	6. RemoteBus				The remote bus (External GENIbus) is active					
	7. ServicePort				The Service port (GENI-TTL) is active					
	8. PressRelief				The Pressure Relief function is active					
	9. SoftPress				The Soft Pressure Buildup function is active					
	10. LowFlowBoost				The Low Flow Boost function is active					
	11. LowFlowStop				The Low Flow Stop function is active					
	12. PropPress				Proportional Pressure is active					

6.6.1 Explanation to dynamic status parameters

RemoteLocal

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 (Access mode is Local).
1:	The booster system is controlled from the bus (Access mode is Remote).

To allow the booster system to be controlled from EtherNet/IP, the SetRemoteLocal (parameter 1) control bit 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 set the RemoteLocal bit to "0", indicating that the actual control source is not EtherNet/IP.

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 SetOnOff (parameter 2) control bit.

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

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.

0:	Copying remote settings to local settings is not active.
1:	Copying remote settings to local settings is active.

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.

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.

AtMaxPower

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

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

Rotation

Status bit indicating that the booster system is pumping.

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

SetPointInfluence

Status bit indicating if the setpoint is influenced, for example by analog input. If influenced, ActualSetpoint (parameter 301) differs from UserSetpoint (parameter 300).

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

ResetAlarmAct

Acknowledge bit belonging to the TrigResetAlarm control bit. It is set when the control bit is set and the command is executed. It is cleared when the control bit is cleared.

ResetAccCntAck

Acknowledge bit belonging to the TrigResetAccCnt (parameter 9) control bit. It is set when the control bit is set and the command is executed. It is cleared when the control bit is cleared.

ControlMode

Status enumeration showing the actual booster system control mode.

See section *6.3.3 Explanation to control mode* for detailed explanation to the various control modes.

OperatingMode

Status enumeration showing the actual booster system operating mode.

See section *6.3.4 Explanation to operating mode* for detailed explanation to the various operating modes.

6.7 Alarms and warnings

Parameter	Name	Description
105	AlarmCode	Code for booster system alarm.
106	WarningCode	Code for booster system warning.

In the AlarmCode parameter, 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 alarms have programmable alarm action types.

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

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	Signal fault, temperature 2 sensor (t_mo2)	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
228	Night flow limit exceeded	A/M	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
253	SMS data from DDD sensor not received within time	A	None
254	Inconsistent data model	A	None
From device	Pump alarms. See section *8. Product simulation*.	-	None

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

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

6.8 Static status parameters, input assembly 3

Static status parameters are parameters that describe characteristics of the booster. They are constants unable to change.
This assembly is included in assembly 1.

Table legend

●: Always available.

Parameter	Name	Data type	Scaling	Range/ Resolution	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
200	UnitFamily	SINT8, 0xC2	Enum	0-127	Unit family	21	21	17	39	38
201	UnitType				Unit type	1	3	1, 2	1	1
202	UnitVersion				Unit version	●	●	●	●	●
203	CIMSoftwareVersion		1		CIM 500 software version	●	●	●	●	●
204	CIMSoftwareRevision				CIM 500 software revision	●	●	●	●	●
205	CIMSoftwareFix				CIM 500 software fix	●	●	●	●	●
206	StatusReserved1				Reserved					
207	StatusReserved2				Reserved					

6.8.1 Device identification

The UnitFamily and the UnitType parameters identify what E-pump product EtherNet/IP is connected to.

UnitFamily [enumeration]	UnitType [enumeration]
17: Hydro Multi-E model G	1: With 3-phase pumps 2: With 1-phase pumps
21: Hydro MPC, CU 354 DDD	1: Hydro MPC, CU 352 3: Demand Driven Distribution, CU 354
39: Hydro Multi-E model H and later	1: With 3-phase pumps 2: With 1-phase pumps

6.9 Booster system measured parameters, input assembly 4

Measured parameters are physical values measured by internal and external sensors and values calculated by the booster itself based on measured values and its state/mode behaviour.

This assembly is included in assembly 1.

Table legend:

●: Always available.

S: Sensor required.

*: Without flow sensor, flow estimation can be used.

**: MPC-E only.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
300	UserSetpoint	SINT16, 0xC3	0.01 %	0 - 327.67 %	User setpoint (0-100 % of setpoint range)	●	●		●	●
301	ActualSetpoint				Actual setpoint in % of sensor max value	●	●	●	●	●
302	SystemFeedback				Closed-loop feedback	●	●	●	●	●
303	Head		0.001 bar	0 - 32.767 bar	Head value	S	S	S	S	●
304	OutletPressure				Outlet pressure	S	S		S	
305	DiffOutletPressure				Differential outlet pressure				S	
306	InletPressure			-1.000 to 32.767 bar	Inlet pressure	S	S		S	
307	DiffInletPressure			0 - 32.767 bar	Differential inlet pressure				S	
308	DiffPressure				Differential pressure				S	●
309	RemotePressure1				Remotely measured pressure 1	S	S		S	S
310	RemotePressure2				Remotely measured pressure 2				S	
311	RemoteDiffPressure				Remotely measured differential pressure				S	
312	Flow		0.1 m^3/h	0 - 3276.7 m^3/h	Flow	S*	S*	S	S	●
313	RemoteFlow				Remotely measured flow				S	
314	FlowMeas1				Flow measurement 1	S	S			
315	FlowMeas2				Flow measurement 2	S	S			
316	FlowMeas3				Flow measurement 3	S	S			
317	RemoteTemperature1		0.01 °C	-273.15 to 327.67 °C	Remotely measured temperature 1	S		S	S	
318	RemoteTemperature2				Remotely measured temperature 2				S	S
319	DiffTemperature				Differential temperature	S			S	
320	AmbientTemperature				Ambient temperature	S			S	
321	FluidTemperature				Fluid temperature				S	●
322	HeatDiffTemperature				Heat monitoring differential temperature				S	S
323	InletTemperature				Inlet temperature	S			S	S
324	OutletTemperature				Outlet temperature	S			S	
325	StorageTankLevel		0.01 m	-10.00 to 327.67 m	Storage tank level	S	S	S	S	
326	FeedTankLevel				Feed tank level	S	S		S	
327	AuxSensorInput		0.01 %	0 - 327.67 %	Auxiliary sensor input			S	S	
328	RelativePerformance				Relative performance	●	●	●	●	●
329	Current		0.1 A	0 - 3276.7 A	Sum of all motor currents			●		

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
330	SpecificEnergy	SINT16, 0xC3	0.1 Wh/m^3	0 - 3276.7 Wh/m3	Specific energy	S*, **	S*		S	●
331	SpecificEnergyAverage				Average value of the specific energy	S*, **	S*			
332	AnalogInfluence		0.01 %	0 - 327.67 %	Setpoint influencing analog input	●	●		●	●
333	NoOfPowerOns		1	0 - 32767	Number of booster power on times	●	●			
334	LatestNightFlowAverage		0.1 m^3/h	0 - 3276.7 m^3/h	Average flow latest night		●			
335	LatestNightPressAverage		0.001 bar	0 - 32.767 bar	Average pressure latest night		●			
336	SysMeasReserved1		-	-	Reserved for future use					
337	SysMeasReserved2		-	-	Reserved for future use					
338	SysMeasReserved3		-	-	Reserved for future use					
339	SysMeasReserved4		-	-	Reserved for future use					
350	Volume1	SINT32, 0xC4	1 m^3	0-(2^{31}-1) m^3	Pumped volume (direction 1)	S	S		S	S
351	Power		1 W	0-(2^{31}-1) W	Pump power	●**	●	●	●	●
352	Energy		1 Wh	0-(2^{31}-1) Wh	Consumed energy	●**	●	●	●	●
353	OperatingTime		1 h	0-(2^{31}-1) h	Operating time	●	●	●	●	●
354	TotalPoweredTime				Total powered time			●		
355	HeatPower		1 W	0-(2^{31}-1) W	Heat metering power				S	S
356	HeatEnergy1		1 Wh	0-(2^{31}-1) Wh	Heat metering energy (direction 1)				S	S
357	HeatEnergy2				Heat metering energy (direction 2)				S	S
358	Volume2		1 m^3	0-(2^{31}-1) m^3	Pumped volume (direction 2)				S	S
359	RealTimeClock		Unix time	0-(2^{31}-1) s	Present value of Real Time Clock				●	●

6.10 Pump 1 and pump 2 measured parameters, input assembly 6

Measured parameters are physical values measured by internal and external sensors, and values calculated by the pump based on measured values and its state/mode behaviour. The assembly contains measured parameters from pump 1 and pump 2.

This assembly is included in assembly 5.

Table legend:

●: Always available.

●**: MPC-E only.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
400	Pump1Status	BYTE, 0xD1	Array of Bools		Pump 1 miscellaneous status					
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 1: 0: Local 1: Remote	●	●		●	●
	1. OnOff				Actual running status of Pump 1: 0: Stopped 1: Running	●	●	●	●	●
	2. Alarm				Actual alarm status of Pump 1: 0: No alarm 1: Alarm	●	●	●	●	●
401	Pump1CtrSource	SINT8, 0xC2	Enum	0-127	Pump 1 control source					
					0: Unknown					
					1: Setpoint buttons on pump					
					2: GENIbus (from controller)	●	●		●	●
					3: GENIlink (IR)/GENIair (radio)					
					4: External control					
					5: Start/Stop button					
402	Pump1AlarmCode	SINT16, 0xC3		0-255	Pump1 Alarm Code	●	●		●	●
403	Pump1Speed	SINT16, 0xC3	0.01 %	0 - 327.67 %	Pump 1 speed	●	●		●	●
404	Pump1LineCurrent	SINT16, 0xC3	0.1 A	0 - 3276.7 A	Pump 1 line current	●**	●		●	●
405	Pump1MotorTemp	SINT16, 0xC3	0.01 °C	-273.15 to 327.67 °C	Pump 1 motor temperature	●**	●		●	●
406	PumpMeasReserved1	SINT16, 0xC3	-	-	Reserved for future use					
407	Pump1Power	SINT32, 0xC4	1 W	0-(2^{31}-1) W	Pump 1 power consumption	●**	●		●	●
408	Pump1Energy	SINT32, 0xC4	1 Wh	0-(2^{31}-1) Wh	Pump 1 energy consumption	●**	●		●	●
409	Pump1OprTime	SINT32, 0xC4	1 h	0-(2^{31}-1) h	Pump 1 operating time	●	●	●	●	●
410	Pump2Status	BYTE, 0xD1	Array of Bools		Pump 1 miscellaneous status					
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 1: 0: Local 1: Remote	●	●		●	●
	1. OnOff				Actual running status of Pump 1: 0: Stopped 1: Running	●	●	●	●	●
	2. Alarm				Actual alarm status of Pump 1: 0: No alarm 1: Alarm	●	●	●	●	●

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
411	Pump2CtrSource	SINT8, 0xC2	Enum	0-127	Pump 1 control source					
					0: Unknown					
					1: Setpoint buttons on pump					
					2: GENIbus (from controller)	●	●		●	●
					3: GENIlink (IR)/GENIair (radio)					
					4: External control					
					5: Start/Stop button					
412	Pump2AlarmCode	SINT16, 0xC3		0-255	Pump 2 alarm code	●	●		●	●
413	Pump2Speed		0.01 %	0 - 327.67 %	Pump 2 speed	●	●		●	●
414	Pump2LineCurrent		0.1 A	0 - 3276.7 A	Pump 2 line current	●**	●		●	●
415	Pump2MotorTemp		0.01 °C	-273.15 to 327.67 °C	Pump 2 motor temperature	●**	●		●	●
416	PumpMeasReserved1		-	-	Reserved for future use					
417	Pump2Power	SINT32, 0xC4	1 W	0-(2^{31}-1) W	Pump 2 power consumption	●**	●		●	●
418	Pump2Energy		1 Wh	0-(2^{31}-1) Wh	Pump 2 energy consumption	●**	●		●	●
419	Pump2OprTime		1 h	0-(2^{31}-1) h	Pump 2 operating time	●	●	●	●	●

6.11 Pump 3 and pump 4 measured parameters, input assembly 7

Measured parameters are physical values measured by internal and external sensors, and values calculated by the pump based on measured values and its state/mode behaviour. The assembly contains measured parameters from pump 3 and pump 4.

Notice that since TPED and MAGNA3 D twin pumps only represent two pumps, they are not present in this table.

This assembly is included in assembly 5.

Table legend:

●: Always available.

●**: MPC-E only.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E model H
420	Pump3Status	BYTE, 0xD1	Array of Bools		Pump 3 miscellaneous status				
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 3: 0: Local 1: Remote	●	●		●
	1. OnOff				Actual running status of Pump 3: 0: Stopped 1: Running	●	●	●	●
	2. Alarm				Actual alarm status of Pump 3: 0: No alarm 1: Alarm	●	●	●	●
421	Pump3CtrSource	SINT8, 0xC2	Enum	0-127	Pump 3 Control Source				
					0: Unknown	●	●		●
					1: Setpoint buttons on pump				
					2: GENIbus (from controller)				
					3: GENIlink (IR)/GENIair (radio)				
					4: External control				
					5: Start/Stop button				
422	Pump3AlarmCode	SINT16, 0xC3		0-255	Pump 3 alarm code	●	●		●
423	Pump3Speed		0.01 %	0 - 327.67 %	Pump 3 speed	●	●		●
424	Pump3LineCurrent		0.1 A	0 - 3276.7 A	Pump 3 line current	●**	●		●
425	Pump3MotorTemp		0.01 °C	-273.15 to 327.67 °C	Pump 3 motor temperature	●**	●		●
426	PumpMeasReserved1		-	-	Reserved for future use				
427	Pump3Power	SINT32, 0xC4	1 W	$0-(2^{31}-1)$ W	Pump 3 power consumption	●**	●		●
428	Pump3Energy		1 Wh	$0-(2^{31}-1)$ Wh	Pump 3 energy consumption	●**	●		●
429	Pump3OprTime		1 h	$0-(2^{31}-1)$ h	Pump 3 operating time	●	●	●	●
430	Pump4Status	BYTE, 0xD1	Array of Bools		Pump 4 miscellaneous status				
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 4: 0: Local 1: Remote	●	●		●
	1. OnOff				Actual running status of Pump 4: 0: Stopped 1: Running	●	●	●	●
	2. Alarm				Actual alarm status of Pump 4: 0: No alarm 1: Alarm	●	●	●	●

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E model H
431	Pump4CtrSource	SINT8, 0xC2	Enum	0-127	Pump 4 control source				
					0: Unknown				
					1: Setpoint buttons on pump				
					2: GENIbus (from controller)	●	●		●
					3: GENIlink (IR)/GENIair (radio)				
					4: External control				
					5: Start/Stop button				
432	Pump4AlarmCode	SINT16, 0xC3		0-255	Pump 4 alarm code	●	●		●
433	Pump4Speed		0.01 %	0 - 327.67 %	Pump 4 speed	●	●		●
434	Pump4LineCurrent		0.1 A	0 - 3276.7 A	Pump 4 line current	●**	●		●
435	Pump4MotorTemp		0.01 °C	-273.15 to 327.67 °C	Pump 4 motor temperature	●**	●		●
436	PumpMeasReserved1		-	-	Reserved for future use				
437	Pump4Power	SINT32, 0xC4	1 W	$0-(2^{31}-1)$ W	Pump 4 power consumption	●**	●		●
438	Pump4Energy		1 Wh	$0-(2^{31}-1)$ Wh	Pump 4 energy consumption	●**	●		●
439	Pump4OprTime		1 h	$0-(2^{31}-1)$ h	Pump 4 operating time	●	●	●	●

6.12 Pump 5 and pump 6 measured parameters, input assembly 8

Measured parameters are physical values measured by internal and external sensors, and values calculated by the pump based on measured values and its state/mode behaviour. The assembly contains measured parameters from pump 5 and pump 6.

Notice that since TPED and MAGNA3 D twin pumps only represent two pumps and Multi-E only represents four pumps they are not present in this table.

This assembly is included in assembly 5.

Table legend:

●: Always available.

●**: MPC-E only.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354
440	Pump5Status	BYTE, 0xD1	Array of Bools		Pump 5 miscellaneous status		
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 5: 0: Local 1: Remote	●	●
	1. OnOff				Actual running status of Pump 5: 0: Stopped 1: Running	●	●
	2. Alarm				Actual alarm status of Pump 5: 0: No alarm 1: Alarm	●	●
441	Pump5CtrSource	SINT8, 0xC2	Enum	0-127	Pump 5 control source		
					0: Unknown	●	●
					1: Setpoint buttons on pump		
					2: GENIbus (from controller)		
					3: GENIlink (IR)/GENIair (radio)		
					4: External control		
					5: Start/Stop button		
442	Pump5AlarmCode	SINT16, 0xC3	Enum	0-255	Pump 5 alarm code	●	●
443	Pump5Speed		0.01 %	0 - 327.67 %	Pump 5 speed	●	●
444	Pump5LineCurrent		0.1 A	0 - 3276.7 A	Pump 5 line current	●**	●
445	Pump5MotorTemp	SINT16, 0xC3	0.01 °C	-273.15 to 327.67 °C	Pump 5 motor temperature	●**	●
446	PumpMeasReserved1		-	-	Reserved for future use		
447	Pump5Power	SINT32, 0xC4	1 W	0-(2^{31}-1) W	Pump 5 power consumption	●**	●
448	Pump5Energy		1 Wh	0-(2^{31}-1) Wh	Pump 5 energy consumption	●**	●
449	Pump5OprTime		1 h	0-(2^{31}-1) h	Pump 5 operating time	●	●
450	Pump6Status	BYTE, 0xD1	Array of Bools		Pump 6 miscellaneous status		
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pump 6: 0: Local 1: Remote	●	●
	1. OnOff				Actual running status of Pump 6: 0: Stopped 1: Running	●	●
	2. Alarm				Actual alarm status of Pump 6: 0: No alarm 1: Alarm	●	●
451	Pump6CtrSource	SINT8, 0xC2	Enum	0-127	Pump 6 control source		
					0: Unknown	●	●
					1: Setpoint buttons on pump		
					2: GENIbus (from controller)		
					3: GENIlink (IR)/GENIair (radio)		
					4: External control		
					5: Start/Stop button		

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352	DDD, CU 354
452	Pump6AlarmCode	SINT16, 0xC3	Enum	0-255	Pump 6 alarm code	●	●
453	Pump6Speed		0.01 %	0 - 327.67 %	Pump 6 speed	●	●
454	Pump6LineCurrent		0.1 A	0 - 3276.7 A	Pump 6 line current	●**	●
455	Pump6MotorTemp		0.01 °C	-273.15 to 327.67 °C	Pump 6 motor temperature	●**	●
456	PumpMeasReserved1		-	-	Reserved for future use		
457	Pump6Power	SINT32, 0xC4	1 W	$0-(2^{31}-1)$ W	Pump 6 power consumption	●**	●
458	Pump6Energy		1 Wh	$0-(2^{31}-1)$ Wh	Pump 6 energy consumption	●**	●
459	Pump6OprTime		1 h	$0-(2^{31}-1)$ h	Pump 6 operating time	●	●

6.13 Pilot pump and backup pump measured parameters, input assembly 9

Measured parameters are physical values measured by internal and external sensors, and values calculated by the pump based on measured values and its state/mode behaviour. The assembly contains measured parameters from the pilot pump and the backup pump.

Notice that since TPED and MAGNA3 D twin pumps only represent two pumps, Multi-E only represents four pumps and DDD only represent 6 pumps they are not present in this table.

This assembly is included in assembly 5.

Table legend:

●: Always available.

●**: MPC-E only.

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352
460	PilotPumpStatus	BYTE, 0xD1	Array of Bools		Pilot pump miscellaneous status	
	0. AccessMode		Bool (state)	0, 1	Actual access mode of Pilot pump: 0: Local 1: Remote	●
	1. OnOff				Actual running status of Pilot pump: 0: Stopped 1: Running	●
	2. Alarm				Actual alarm status of Pilot pump: 0: No alarm 1: Alarm	●
461	PilotPumpCtrSource	SINT8, 0xC2	Enum	0-127	Pilot pump control source	
					0: Unknown	●
					1: Setpoint buttons on pump	
					2: GENIbus (from controller)	
					3: GENIlink (IR)/GENIair (radio)	
					4: External control	
					5: Start/Stop button	
462	PilotPumpAlarmCode	SINT16, 0xC3	Enum	0-255	Pilot pump alarm code	●
463	PilotPumpSpeed		0.01 %	0 - 327.67 %	Pilot pump speed	●
464	PilotPumpLineCurrent		0.1 A	0 - 3276.7 A	Pilot pump line current	●**
465	PilotPumpMotorTemp		0.01 °C	-273.15 to 327.67 °C	Pilot pump motor temperature	●**
466	PumpMeasReserved1		-	-	Reserved for future use	
467	PilotPumpPower	SINT32, 0xC4	1 W	$0-(2^{31}-1)$ W	Pilot pump power consumption	●**
468	PilotPumpEnergy		1 Wh	$0-(2^{31}-1)$ Wh	Pilot pump energy consumption	●**
469	PilotPumpOprTime		1 h	$0-(2^{31}-1)$ h	Pilot pump operating time	●
470	BackupPumpStatus	BYTE, 0xD1	Array of Bools		Backup pump miscellaneous status	
	0. AccessMode		Bool (state)	0, 1	Actual access mode of backup pump: 0: Local 1: Remote	●
	1. OnOff				Actual running status of backup pump: 0: Stopped 1: Running	●
	2. Alarm				Actual alarm status of backup pump: 0: No alarm 1: Alarm	●
471	BackupPumpCtrSource	SINT8, 0xC2	Enum	0-127	Backup pump control source	
					0: Unknown	
					1: Setpoint buttons on pump	
					2: GENIbus (from controller)	●
					3: GENIlink (IR)/GENIair (radio)	
					4: External control	
					5: Start/Stop button	

Parameter	Name	Data type	Scaling	Range	Description	MPC, CU 352
472	BackupPumpAlarmCode	SINT16, 0xC3	Enum	0-255	Backup pump alarm code	●
473	BackupPumpSpeed		0.01 %	0 - 327.67 %	Backup pump speed	●
474	BackupPumpLineCurrent		0.1 A	0 - 3276.7 A	Backup pump line current	●**
475	BackupPumpMotorTemp		0.01 °C	-273.15 to 327.67 °C	Backup pump motor temperature	●**
476	PumpMeasReserved1		-	-	Reserved for future use	
477	BackupPumpPower	SINT32, 0xC4	1 W	$0-(2^{31}-1)$ W	Backup pump power consumption	●**
478	BackupPumpEnergy		1 Wh	$0-(2^{31}-1)$ Wh	Backup pump energy consumption	●**
479	BackupPumpOprTime		1 h	$0-(2^{31}-1)$ h	Backup pump operating time	●

7. Pump alarms

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

Code	Alarm/warning description
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)
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

7.1 Sensor dependent measurements

All the parameters. SetSetpoint, SystemFeedback, ActualSetpoint and UserSetpoint have a scaling relative to the feedback sensor. By using the scaling information of the feedback sensor (FeedbackSensorUnit, FeedbackSensorMin, FeedbackSensorMax) these parameters can be expressed in absolute units.

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

The table below shows the relationship between the EtherNet/IP measurement parameters and the sensor value selected for the individual booster systems.

Hydro MPC and DDD				
Parameter	**Register name**	**FeedBack SensorUnit**	**Measuring sensor selected via controller display**	**Primary sensor selected via controller display**
303	Head	0.01 m	Differential pressure, pump	Differential pressure, pump Differential pressure, Series 2000
312	Flow	0.1 m^3/h	Flow rate	Flow rate Flow rate, Series 2000
306	InletPressure	0.001 bar	Differential pressure, inlet	Differential pressure, inlet
309	RemotePressure1	0.001 bar	Differential pressure, external External pressure	Differential pressure, external External pressure
317	RemoteTemperature1	0.01 K	Return-pipe temperature, external	Return-pipe temperature, external
320	AmbientTemperature	0.01 K	Ambient temperature	Ambient temperature
323	InletTemperature	0.01 K	Return-pipe temperature	Return-pipe temperature
324	OutletTemperature	0.01 K	Flow-pipe temperature	Flow-pipe temperature
319	DiffTemperature	0.01 K	Differential temperature	Differential temperature
304	OutletPressure	0.001 bar	Outlet pressure Differential pressure, outlet	Outlet pressure Differential pressure, outlet
	-	-	0-100 % signal	0-100 % signal

The table below shows the relationship between the measurement parameters for the Hydro Multi-E model G and the measurement unit selected with Grundfos GO Remote for the feedback sensor. Only one of the measurement parameter groups in the table below will be available at a time.

Hydro Multi-E model G	
Sensor unit configuration with Grundfos GO Remote	**EtherNet/IP parameter generated from feedback sensor measurement**
bar	Head (303) OutletPressure (304)
mbar	
m	
kPa	
psi	
ft	
m^3/h	Flow (312)
m^3/s	
l/s	
gpm	
°C	RemoteTemperature1 (317)
°F	
%	-

Hydro Multi-E/TPED model H

Measured parameters (Selected from display or Grundfos GO Remote)			
Value	**Analog input AI1, AI2, AI3**	**Temperature Pt100 input T1, T2**	**Mapped to EtherNet/IP parameter**
Head	●		Head (303)
Pump outlet pressure	●		OutletPressure (304)
Pump outlet differential pressure	●		DiffOutletPressure (305)
Pump inlet pressure	●		InletPressure (306)
Pump inlet differential pressure	●		DiffInletPressure (307)
Remote pressure 1	●		RemotePressure1 (309)
Remote pressure 2	●		RemotePressure2 (310)
Remote differential pressure	●		RemoteDiffPressure (311)
Pump flow	●		Flow (312)
Remote flow	●		RemoteFlow (313)
Temperature 1	●	●	RemoteTemperature1 (317)
Temperature 2	●	●	RemoteTemperature2 (318)
Differential temperature	●		DiffTemperature (319)
Ambient temperature	●	●	AmbientTemperature (320)
Fluid temperature	●		FluidTemperature (321)
Heat monitor differential temperature	●		HeatDiffTemperature (322)
Inlet temperature	●		InletTemperature(323)
Outlet temperature	●		OutletTemperature(324)
Feed tank level	●		FeedTankLevel (326)
Storage tank level	●		StorageTankLevel (325)
Other parameter	●		AuxSensorInput (327)

MAGNA3 D

Measured parameters (Selected from display or Grundfos GO Remote)			
Value	**Analog input AI1, AI2, AI3**	**Temperature Pt100 input T1, T2**	**Mapped to EtherNet/IP parameter**
Remote pressure 1	●		RemotePressure1 (309)
Temperature 2	●		RemoteTemperature2 (318)

7.2 Special parameter, input explicit messaging

Special parameters are parameters that might be used by the PLC but bear no relation to the operation of the booster.

Parameter	Name	Data type	Scaling	Range/ Resolution	Description	MPC, CU 352	DDD, CU 354	Multi-E model G	Multi-E/TPED model H	MAGNA3 D
500	RPILimits	UINT32, 0xC8	1 µs	15000 - 200000 µs	Requested Packet Interval	●	●	●	●	●
500	TCPIPCapability	DWORD32, 0xD3	-	-	For Logix EDS AOP integration	●	●	●	●	●

8. Product simulation

The CIM module can be put in product simulation mode in which case it generates life-like simulated values of all the EtherNet/IP input data parameters.

It will thus be possible to connect an EtherNet/IP master to 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 master application program, for example PLC program, before the equipment is installed under real-life conditions.

Product simulation mode is entered via the webserver. See section *Webserver configuration*.

The below functional profiles can be selected from the webserver.

Simulated product
Pump profile
Booster system profile
Digital Dosing DDA profile

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

9. Fault finding the product

9.1 EtherNet/IP

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

CIM 500 fitted in a Grundfos booster system or CIM 500 fitted in a CIU 500

Ensure that SW1 is in position "3".

Fault (LED status)	Possible cause	Remedy
1. LED1 and LED2 remain off when the power supply is connected.	a) The module is fitted incorrectly in the Grundfos product.	Check that the module is fitted and connected correctly.
	b) The module is defective.	Replace the module.
	c) CIU 500 is defective.	Replace CIU 500.
2. LED1 remains off.	a) SW1 is not set correctly.	Set the switch to "3".
3. LED2 is flashing red.	a) No internal communication between the module and the Grundfos product.	Check that the module is fitted correctly.
	b) 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 connected correctly, for example not reversed. • Check the power supply to the Grundfos product.
4. LED2 is permanently red.	a) The module does not support the connected Grundfos product.	Contact the nearest Grundfos company.
5. LED1 is permanently red.	a) IP address conflict.	Check the IP address configuration.
	b) SW1 is in illegal position.	Check that SW1 is set to "3".
6. LED1 is flashing red.	a) Connection time-out.	Verify the connection and communication between PLC and CIM 500.
7. LED1 is permanently red and green at the same time.	a) Error in firmware download.	Use the webserver to download the firmware again. See section *Update* in the appendix.
8. LED2 is permanently red and green at the same time.	a) Memory fault.	Replace the module.

10. Disposing of the product

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.

11. Grundfos alarm and warning codes

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

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

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

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

1. Webserver configuration

The built-in webserver offers easy monitoring of the CIM 500 module, and makes it possible to configure the selected Industrial Ethernet protocol. Using the webserver, you can also update the firmware of the CIM 500 module and store or restore settings, among other functions.

To connect a PC to CIM 500, proceed as follows:

1. Connect the PC and the module using an Ethernet cable.
2. Configure the Ethernet port of the PC to the same subnetwork as CIM 500, for example 192.168.1.101. See section *1.1 How to configure an IP address on your PC using Windows 7* or *1.2 How to configure an IP address on your PC using Windows 10*.
3. Open a standard Internet browser and type 192.168.1.100 in the URL field.

1.1 How to configure an IP address on your PC using Windows 7

1. Open "Control Panel".
2. Select "Network and Sharing Center".
3. Click [Change adapter settings].
4. Right-click and select "Properties" for the Ethernet adapter. Typically "Local Area Connection".
5. Select properties for "Internet Protocol Version 4 (TCP/IPv4)".
6. Select the "Alternate Configuration" tab and enter the user-configured IP address and the subnet mask you would like to assign to your PC. See fig. 1.

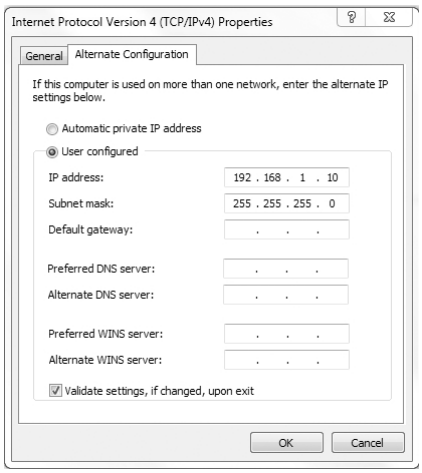


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Fig. 1 Example from Windows 7

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.

1.3 Login

For administration of username and password, see also *User Management*.

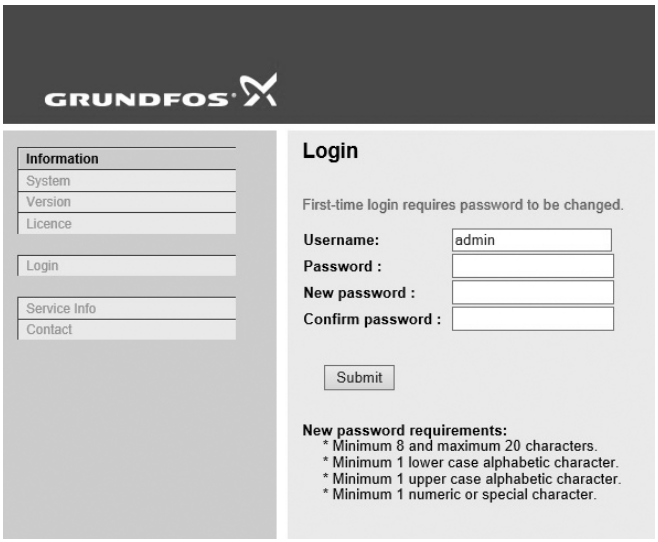

Fig. 2 Login

Object	Description
Username	Enter username. Default: admin.
Password	Enter password. Default: Grundfos. After the first login, 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 CIM 500 resets the back-off algorithm.

1.4 EtherNet/IP configuration

This web page is used to configure all the parameters relevant to the EtherNet/IP protocol standard.

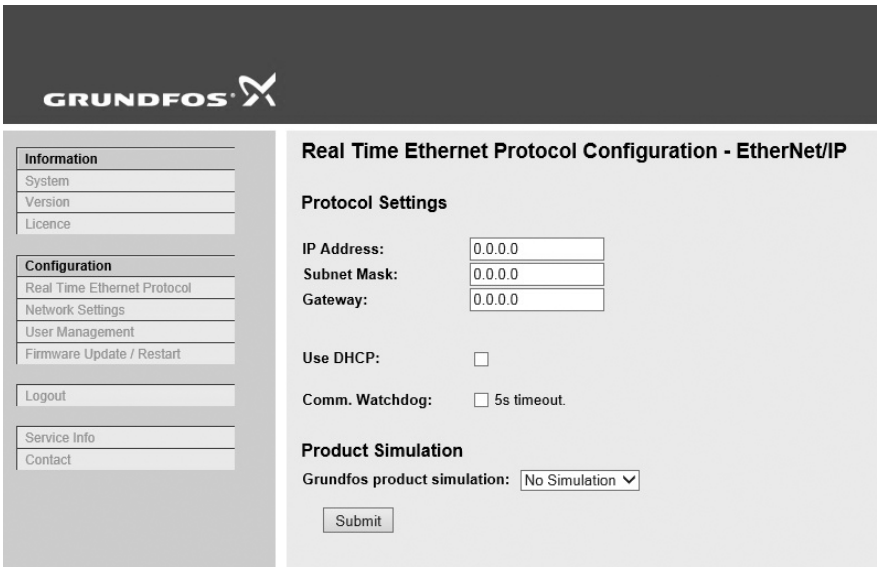

Fig. 3 Real Time Ethernet Protocol Configuration - EtherNet/IP

Object	Description
IP Address	Configuration of the static IP address if a DHCP server is not used. EtherNet/IP is not allowed to share the IP address with a CIM 500 webserver.
Subnet Mask	Configuration of the subnet mask if a DHCP server is not used.
Gateway	Configuration of the gateway address if a DHCP server is not used.
Use DHCP	The CIM 500 module can be configured to automatically obtain its EtherNet/IP network settings from a DHCP server, if available on the network. Default: No use of DHCP.
Communication Watchdog	For enabling of a 5 seconds communication watchdog timer. Only active for pump or booster products. Unchecked: Watchdog is disabled (default). Checked: Watchdog is enabled, time-out is 5 seconds. Watchdog action: The pump or the booster is set to local mode.
Grundfos product simulation	The module can be put in product simulation mode to generate realistic simulated values of all the EtherNet/IP input data. It will thus be possible to connect an EtherNet/IP master to a module fitted in a CIU or an 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 is received and handled correctly by the EtherNet/IP master application program (for example PLC program) before installing the device. To enable product simulation, select a product type from the dropdown list. To terminate product simulation, select "No Simulation".

You need a contract with Grundfos and an external router with Internet connection to gain access to the GRM server.

1.5 Network settings

This web page is used to configure the network settings of the webserver and of the GENIpro TCP protocol. The network settings here are also used for BACnet IP. Additional configuration of BACnet IP is done in the Real Time Ethernet Protocol menu. See *EtherNet/IP configuration*.

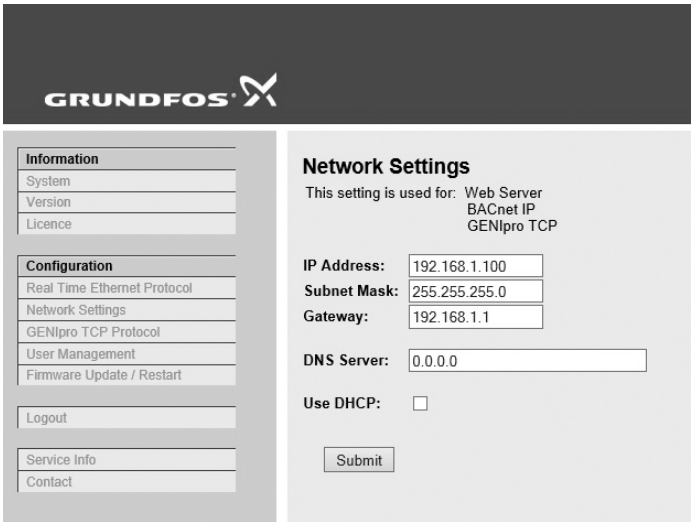

Fig. 4 Network settings

Object	Description
IP Address	Configuration of the static IP address if a DHCP server is not used. Default: 192.168.1.100.
Subnet Mask	Configuration of the subnet mask if a DHCP server is not used. Default: 255.255.255.0.
Gateway	Configuration of the gateway address if a DHCP server is not used. Default: 192.168.1.1.
DNS Server	The module can be configured to use a specific domain name server, if available on the network. Default: 0.0.0.0.
Use DHCP	The module can be configured to automatically obtain the IP address from a DHCP server, if available on the network. Default: Do not use DHCP.

1.6 User Management

A login is required for any change of the CIM 500 settings, and this web page is used to configure the username and password. See *Login*.

It is only possible to configure one user.

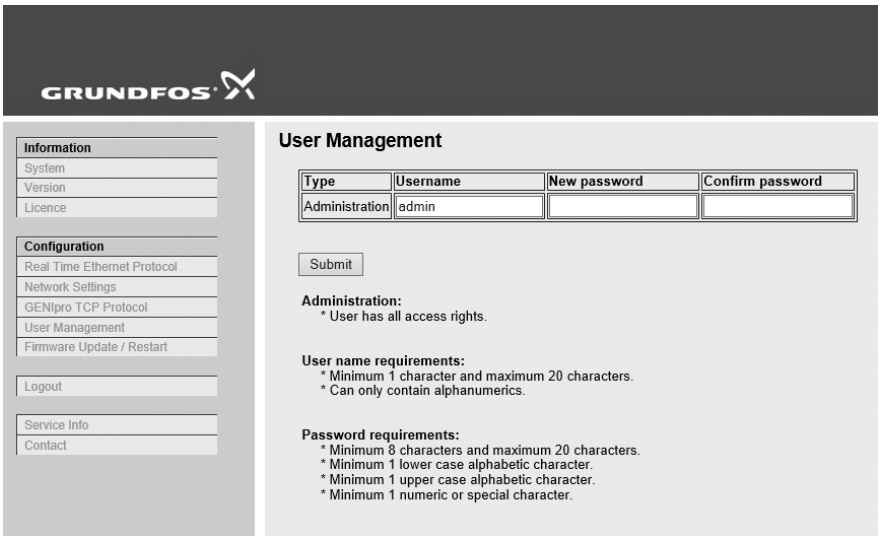

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Fig. 5 User management

1.7 Update

You can update the firmware by means of the built-in webserver. The binary file is supplied by Grundfos.

To make installation and configuration easier, you can upload the configuration to a PC for backup or distribution to multiple modules.

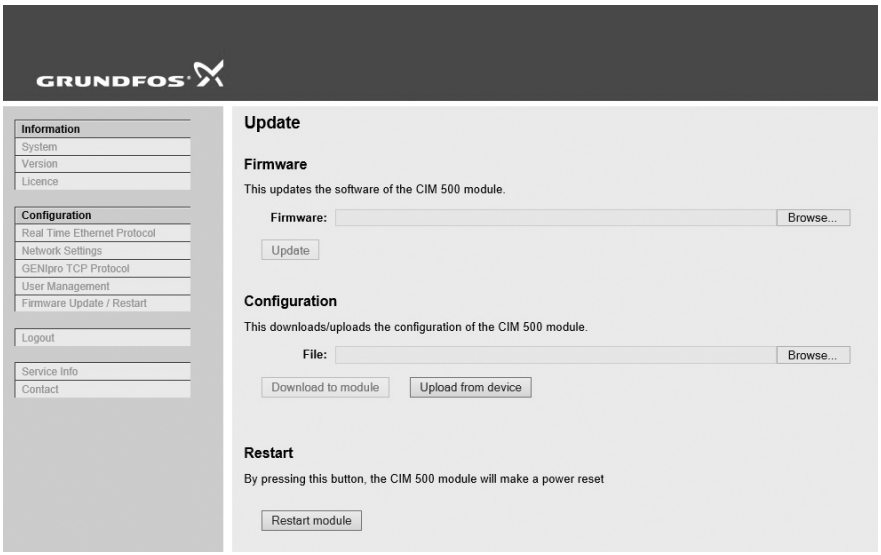

Fig. 6 Update

Object	Description
Firmware	Path to binary firmware image that can be used for updating the module.
Update	Click [Update] to start the update. The procedure takes approximately one minute.
File	Path to the configuration file.
Download to module	Click here to transfer the configuration file to the module.
Upload from device	Click here to upload the configuration of the module to a file on your PC.
Restart module	By pressing this button, the CIM 500 module performs a power-up reset.

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