# PROFIBUS and PROFINET for Demand Driven Distribution

CIM 150 PROFIBUS DP
CIM 500 Ethernet for PROFINET IO

Functional profile and user manual

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Original functional profile and user manual.
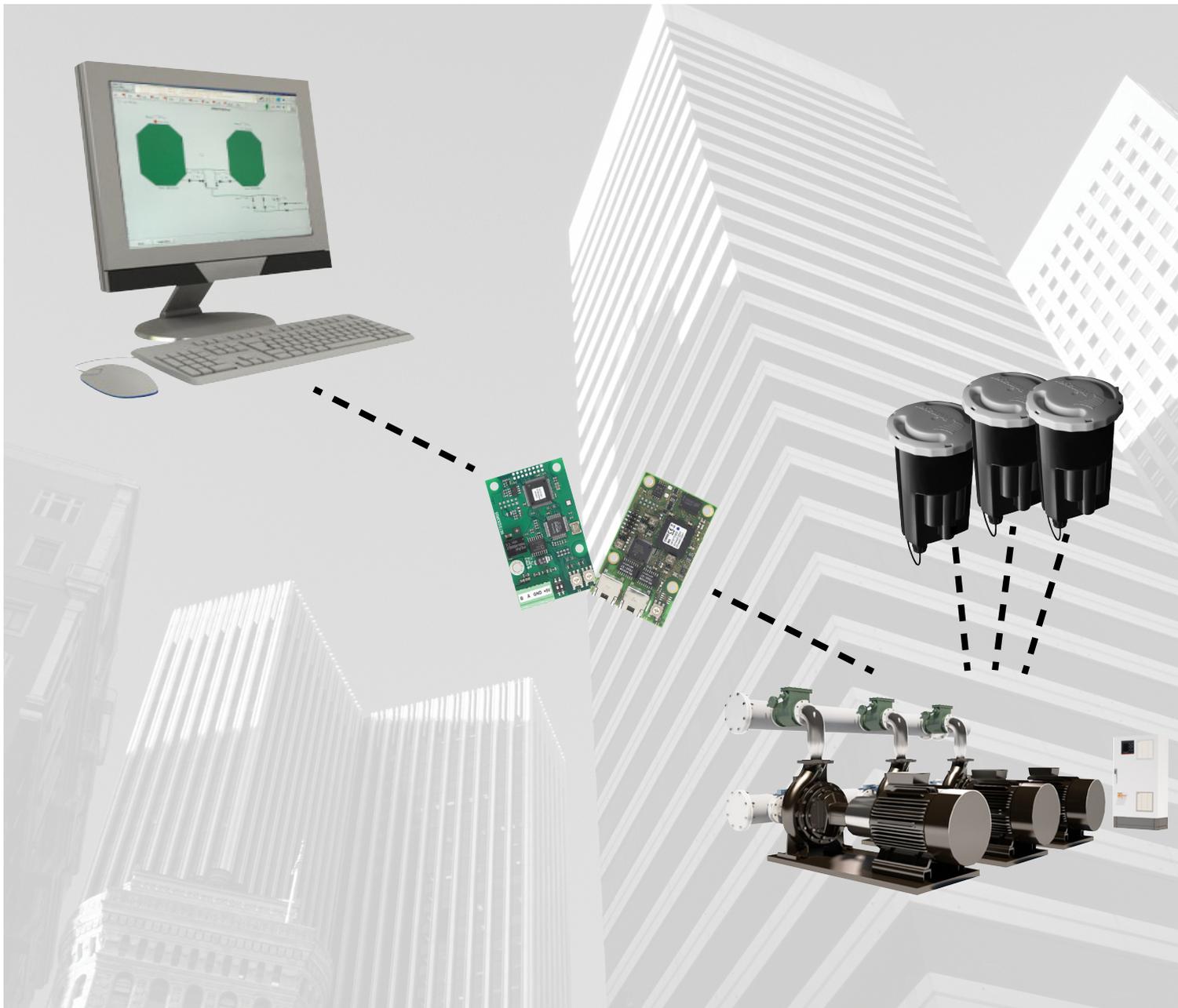
CONTENTS

1. Symbols used in this document

> **Warning**
> *If these safety instructions are not observed, it may result in personal injury.*

> *If these safety instructions are not observed, it may result in malfunction or damage to the equipment.*
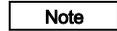
> *Notes or instructions that make the job easier and ensure safe operation.*

2. Introduction

2.1 About this functional profile

This functional profile describes the following protocols for the Grundfos DDD system (Demand Driven Distribution CU 354):

- CIM 150 PROFIBUS DP
- CIM 500 Ethernet for PROFINET IO.

The data in this document are subject to change without prior notice. 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 the 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	Cable with very high performance
CIM	Communication Interface Module
CRC	Cyclic Redundancy Check. A data error detection method.
CU 354	Control unit for Demand Driven Distribution.
DDD	Demand Driven Distribution, a Grundfos system for municipal water supply.
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
H	Head (pressure)
HTTP	Hyper Text Transfer Protocol. The protocol commonly used to navigate the world wide web.
IANA	Internet Assigned Numbers Authority
IP	Internet Protocol
LED	Light-emitting diode
Local mode	The DDD system uses the setpoint and operating mode set on the CU 354 controller.
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 DDD 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 clock 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 CIM to the Grundfos DDD system that is to be connected to a PROFIBUS/PROFINET network.

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

CIM

The CIM solution is an add-on communication module that is to be fitted into the back of the CU 354, using a 10-pin connection. The DDD system will supply power to the CIM module. See fig. 1 and fig. 3.

3.1 PROFIBUS DP (CIM 150)
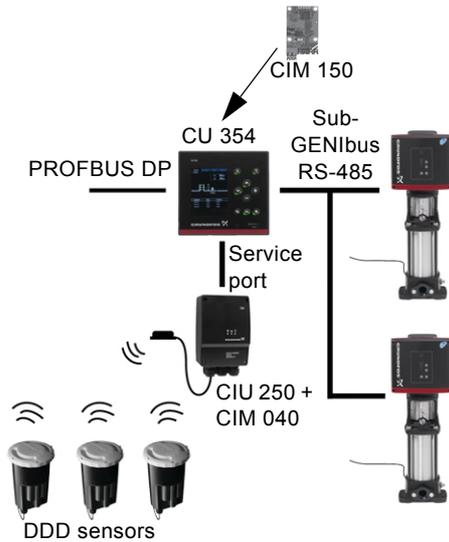
Fig. 1 Example of a CIM 150 solution. The CIM module is installed inside the CU 354 controller.

3.2 PROFINET IO (CIM 500)
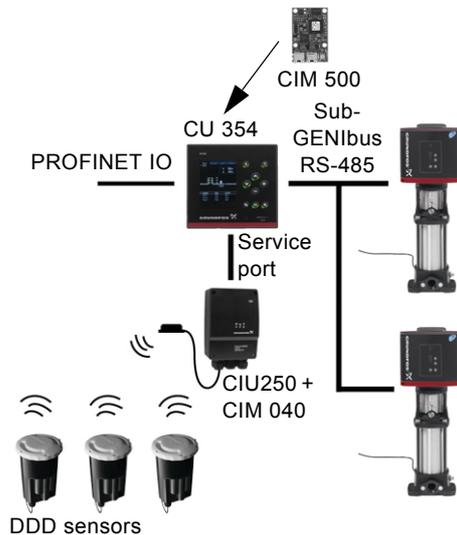
Fig. 2 Example of a CIM 500 solution. The CIM module is installed inside the CU 354 controller.

4. Specifications

4.1 CIM module

General data	Description	Comments
Ambient humidity	30-95 %	Relative, non-condensing.
Operating temperature	-20 - +45 °C	
Storage temperature	-25 - +70 °C	
GENIbus visual diagnostics	LED2	Will be in one of these states: Off, constantly green, flashing red, constantly red. See section *5.6 Status LEDs* for PROFIBUS DP and section *6.5 Status LEDs* for PROFINET IO.

4.2 CIM 150 PROFIBUS DP

The table below provides an overview of the specifications for the Grundfos CIM 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, constantly green, flashing red, constantly 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 the Grundfos CIM 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	Screened/unscreened, twisted-pair cables, 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. See 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. 3. 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.
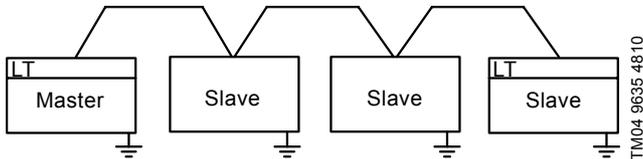
Fig. 3 Example of PROFIBUS bus segment with line termination

5.2 CIM 150 PROFIBUS module
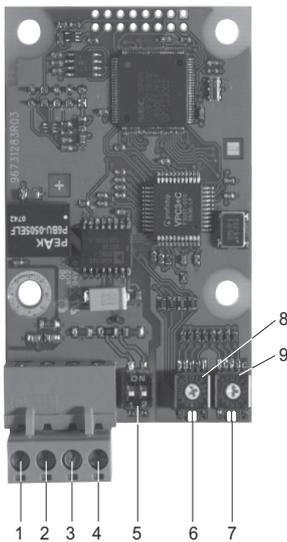
Fig. 4 CIM 150 PROFIBUS module

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/off switches for termination resistors
6	LED1	Red/green status LED for PROFIBUS communication
7	LED2	Red/green status LED for GENIbus communication between the CIM 150 and the Grundfos product
8	SW3	Hex switch for setting the PROFIBUS address (four most significant bits)
9	SW4	Hex switch for setting the PROFIBUS address (four least significant bits)

Note	*The power supply (pos. 4, fig. 4) 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. 5.

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).

Note	*For maximum safety and reliability, connect the cable screen to earth via the earth clamp, and make sure that all CIM 150 units are properly earthed via the mains supply earth wire.*
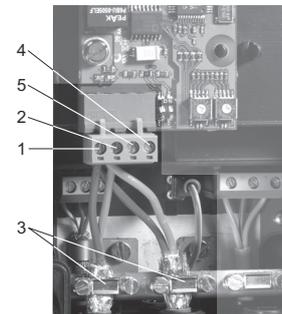
Fig. 5 Connecting the PROFIBUS

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. 6.
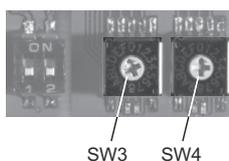
Fig. 6 Setting the PROFIBUS address

The table below shows examples of PROFIBUS address settings.

Note	*The PROFIBUS address must be set 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 the CIM 150 has to be performed for a PROFIBUS address change to take effect.

For 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. 7.
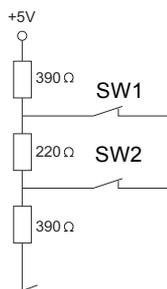

Fig. 7 Internal termination resistors

The CIM 150 has a DIP switch with two switches (SW1 and SW2) for cutting the termination resistors in and out. Figure 8 shows the DIP switches in cut-out state.
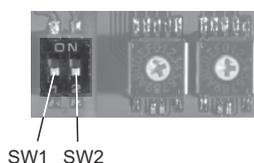
Fig. 8 Cutting termination resistors in and out

DIP switch settings

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

Note	*To ensure 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

The CIM 150 PROFIBUS module has two LEDs. See fig. 4.
• Red/green status LED (LED1) for PROFIBUS communication.
• Red/green status LED (LED2) for GENIbus communication between the CIM 150 and the connected Grundfos product.

LED1

Status	Description
Off	The CIM 150 has been switched off.
Constantly green	The CIM 150 is ready for PROFIBUS data transmission (data exchange state).
Constantly red	CIM 150 module fault. The 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	The CIM 150 is switched off.
Constantly green	GENIbus communication between the CIM 150 and the Grundfos product is OK.
Constantly red	The CIM 150 does not support the connected Grundfos product.
Flashing red	No GENIbus communication between the CIM 150 and the Grundfos product.

Note	*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, e.g. Siemens Simatic Manager. If the watchdog is enabled, all bits in the ControlModule (see section *7.2 Control module (ControlModule, module 1)*) are automatically set to "0" if the PROFIBUS communication is broken.

As a result, the DDD 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 DDD 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**
The CIM 500 must only be connected to SELV or SELV-E circuits.

RJ45 plugs and Ethernet cable must be used. The cable shield must be connected to protective earth at both ends.

Note *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.*

The CIM 500 is designed for flexible network installation. The built-in two-port switch makes it possible to daisy chain from product to product without 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.
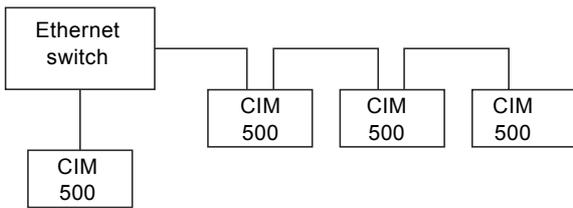
Fig. 9 Example of Industrial Ethernet network
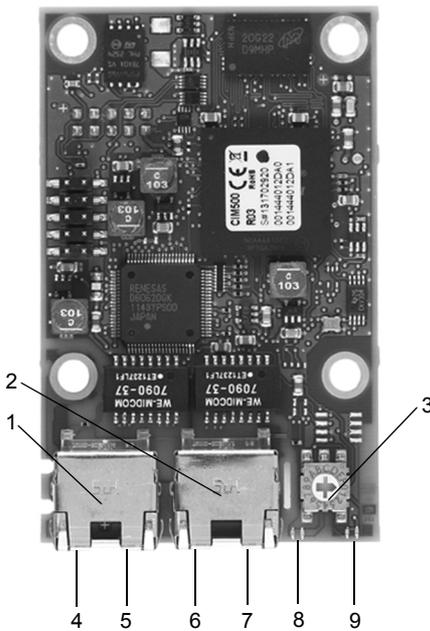
Fig. 10 Example of Ethernet connection (CIM 500)

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/red status LED for Ethernet communication	LED 1
9	Green/red status LED for internal communication between module and 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. 11.
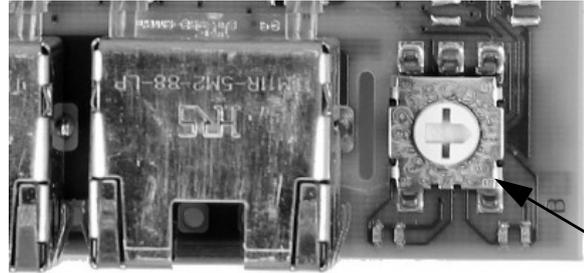
Fig. 11 Selecting the Industrial Ethernet protocol

Pos.	Description
0	PROFINET IO (default)
1	Modbus TCP
2..E	Reserved, LED1 will be permanently red to indicate an invalid configuration.
F	Reset to factory default. Note: The rotary switch has to be set in this position for 20 seconds before the CIM 500 resets to factory default. During this period, LED1 will be flashing red and green at the same time to indicate that a reset will occur.

Note *Any change of the rotary switch while the module is powered on will cause the module to restart.*

6.3 Setting up IP addresses

The CIM 500 Ethernet module is default set up to a fixed IP address. It is possible to change the IP address settings from the built-in web server.

Default IP settings used by web server	IP address: 192.168.1.100 Subnet mask: 255.255.255.0 Gateway: 192.168.1.1
IP settings for Modbus TCP	Must be set up via the web server.
Device name and IP settings for PROFINET IO	Static configuration from the web server or configuration from PROFINET IO configuration tool.

6.4 Establishing connection to the web server

The CIM 500 module can be configured using the built-in web server. To establish a connection from a PC to the CIM 500 the following steps are required:

- Connect the PC and the CIM 500 module using an Ethernet cable.
- Configure the PC Ethernet port to the same subnetwork as the CIM 500, e.g. 192.168.1.101, and the subnet mask to 255.255.255.0. See section *A.2 Web server configuration* on page 28.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log onto the web server:

User	admin (default)
Password	Grundfos (default)

Note	*User and password may have been changed from their factory default values.*

Fig. 12 CIM 500 connected to PC

Note	*Both ETH1 and ETH2 can be used to establish a connection to the web server.*

Note	*The web server can be accessed 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. 10.

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

LED1

Status	Description
Off	The CIM 500 is switched off.
Flashing green	Wink function. LED will flash 10 times when activated from master.
Permanently green	The 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 connection to master 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 firmware download. See section *9.2.1 LED status*.
Flashing red and green	After 20 seconds in this state, the CIM 500 factory settings are restored and the device is restarted.

LED2

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

Note	*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. 10.

DATA1 and DATA2

These yellow LEDs indicate data traffic activity.

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

LINK1 and LINK2

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

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

TM05 6436 4712

7. Detailed description of data modules

7.1 Data types

The Grundfos CIM 150/500 supports the following data types.

All data types, except for data type 10, comply with the data types according to specification standard IEC 61158-6 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 1)

The control module is a PROFIBUS/PROFINET output module used for the control of the DDD system from the bus. Its data type is 10, non-standard.

Note	*To control the DDD system from the bus, the control source "From bus" must be selected on the CU 354: 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]	
		3: ConstHead	
		4: ConstPressure	
		6: VarDiffPress	
		128: DDD AutoAdapt	
Byte 3 (data type 5)		**OperatingMode** [enumeration]	
		0: AutoControl (always)	
Bytes 4 and 5 (data type 6)		Setpoint [0.01 %]	

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 DDD system. In the CIM 150/500, the "actual state" of the DDD system as read from the StatusModule is continuously compared with the "requested" state in the ControlModule, and the CIM 150/500 writes the appropriate GENIbus command to the DDD system to make the two states correspond to each other. Due to state restrictions or priorities, this might not always be possible (see 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. The CIM 150/500 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 DDD system in remote mode (controlled from the bus) or local mode (controlled from the CU 354):

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

However, certain commands from other control sources (e.g. Stop or Max. from a local source or external Stop from a digital input) have higher priority and will overrule the control from the bus.

OnOff

Control bit used to start and stop the DDD system:

0:	For stopping the DDD system remotely.
1:	For starting the DDD 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 setpoint will be copied to the local setting during a remote-to-local transition.

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

English (GB)

7.2.3 Explanation to control mode

Control enumeration for selection of the remote control mode.

Control modes	Description	Illustration
> ConstHead (3) > ConstPressure (4)	The setpoint of the DDD system will be interpreted as setpoint for the pressure. In these modes, the DDD system operates in closed-loop control mode and will adapt its speed so that the pressure is constant, regardless of the flow. A pressure sensor is required.	TM04 2290 2208
> VarDiffPress (6)	The setpoint of the DDD system will be 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
> DDD AUTO$_{ADAPT}$ (128)	The setpoint of the DDD system will be interpreted as a proportional-pressure setpoint as shown in the figure. The proportional curve will be adjusted automatically once a day according to remote DDD sensor data.	TM05 3241 1012
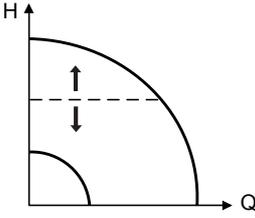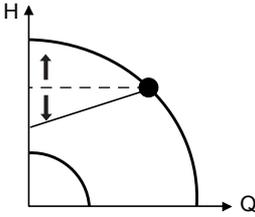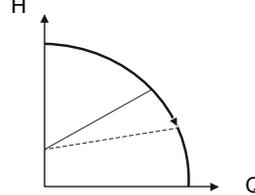
H: Pressure (head)

Q: Flow

Important:

When using the CIM 150/500 with the DDD system, 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.

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7.2.4 Explanation to operating mode

Control enumeration for selection of the remote operating mode.

	AutoControl
	This is the normal mode and cannot be changed.
0:	The DDD system is controlled according to the selected control mode and setpoint.
	See section *7.2.3 Explanation to control mode*.

7.2.5 Explanation to Setpoint

The 16-bit data item setpoint accepts values ranging from 0-10000 corresponding to 0-100 % of feedback sensor range.

This is illustrated in fig. 13.

The setpoint is always a pressure setpoint. In DDD AUTO$_{ADAPT}$, it is the maximum permissible setpoint of the system. A setpoint of 0 does not imply a stop.
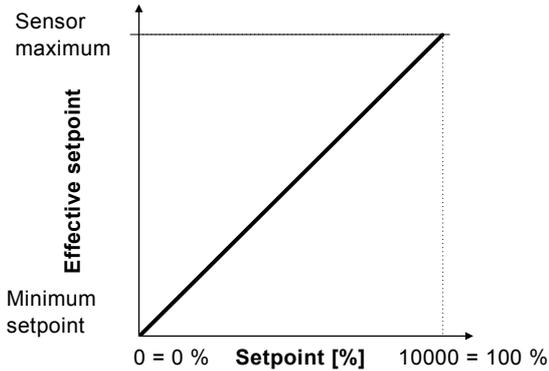
Fig. 13 Closed-loop setpoint

Example

If the control mode is set to constant pressure, and the pressure sensor range is 0-10 bar, a setpoint of 80 % will result in an effective setpoint of 8 bar.

If the sensor range was 0-16 bar, a 50 % setpoint would be 8 bar, a 25 % setpoint would be 4 bar, and so on.
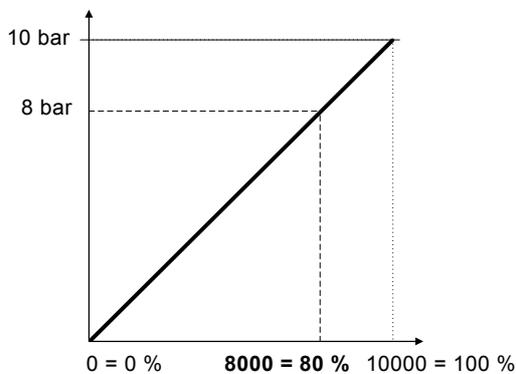
Fig. 14 Example of setpoint for constant pressure, with a pressure sensor range of 0-10 bar

7.2.6 Explanation to status module

AccessMode

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

0:	The DDD system is controlled from a local source (CU 354) or from an external digital input.
1:	The DDD system is controlled from the bus (remotely).

To allow the DDD 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 (e.g. Stop or Max. from a local source or external Stop from a digital input) have higher priority and will set the AccessMode to "0", indicating that the actual control source is not PROFIBUS/PROFINET.

OnOff

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

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

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

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

Fault

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

0:	No alarm.
1:	Alarm. DDD system stopped, red CU 354 LED on, FaultCode (module 4) will show the alarm code.

Warning

Status bit indicating that the DDD system has a warning.

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

CopyToLocal

Status bit indicating that the DDD will copy remote settings to local settings when it is switched from remote access mode to local access mode. The involved settings are control mode, operating mode and setpoint.

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 (e.g. 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 DDD system is pumping.

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

ProcessFeedback

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.

See section *7.10 System measurement modules*.

ControlMode

Status enumeration showing the actual DDD 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 DDD system operating mode. For a DDD system it is always 0=AutoControl.

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7.3 Illustration of closed-loop control
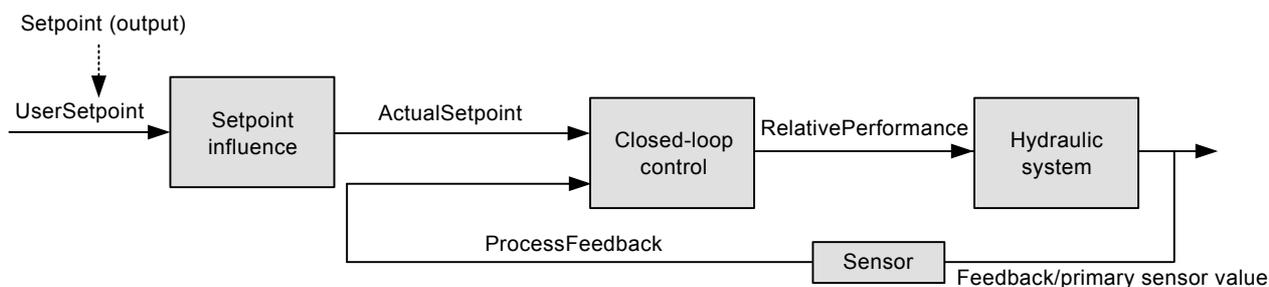
Fig. 15 Illustration of closed-loop control

7.4 Direct bus control of pumps (ControlPumps, module 2)

With this module it is possible to individually force each of the six zone pumps 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 the CU 354).
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 the CU 354).
2	ControlZonePump3	Value change	0: Zone pump 3 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 3 is in auto mode (controlled the CU 354).
3	ControlZonePump4	Value change	0: Zone pump 4 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 4 is in auto mode (controlled the CU 354).
4	ControlZonePump5	Value change	0: Zone pump 5 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 5 is in auto mode (controlled the CU 354).
5	ControlZonePump6	Value change	0: Zone pump 6 is forced to stop from PROFIBUS/PROFINET. 1: Zone pump 6 is in auto mode (controlled the CU 354).

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

7.5 Writing a setpoint to a DDD sensor

The DDD sensor setpoint is the minimum pressure that the system must maintain for the particular sensor.

Module	Name	Data type	Unit	Description
3	SetpointDDDSensor1	6	0.001 bar	Writing the setpoint of DDD sensor 1
4	SetpointDDDSensor2	6	0.001 bar	Writing the setpoint of DDD sensor 2
5	SetpointDDDSensor3	6	0.001 bar	Writing the setpoint of DDD sensor 3
6	SetpointDDDSensor4	6	0.001 bar	Writing the setpoint of DDD sensor 4
7	SetpointDDDSensor5	6	0.001 bar	Writing the setpoint of DDD sensor 5
8	SetpointDDDSensor6	6	0.001 bar	Writing the setpoint of DDD sensor 6
9	SetpointDDDSensor7	6	0.001 bar	Writing the setpoint of DDD sensor 7
10	SetpointDDDSensor8	6	0.001 bar	Writing the setpoint of DDD sensor 8
11	SetpointDDDSensor9	6	0.001 bar	Writing the setpoint of DDD sensor 9
12	SetpointDDDSensor10	6	0.001 bar	Writing the setpoint of DDD sensor 10

7.6 Setting of zone pump index

Module	Name	Data type	Unit	Description
13	SetZonePumpIndex	5	Enum	Set the zone pump index. This output module selects from which zone pump the measured data (modules 50 to 59) are to be read. Permissible range is [1; highest pump number]. Its actual value can be read from ZonePumpIndex (module 49).

7.7 Setting of DDD sensor index

Module	Name	Data type	Unit	Description
14	SetDDDSensorIndex	5	Enum	Set the DDD sensor index. This output module selects from which DDD sensor the measured DDDSensorModule data (module 60) are to be read. Permissible range is [1; highest DDD sensor number]. Its actual value can be read from byte 1 in the DDDSensorModule.

7.8 Status module (StatusModule, module 16)

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

Byte	Bit	Name
Byte 1 (data type 5)	0	AccessMode
	1	OnOff
	2	Fault
	3	Warning
	4-7	-
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] 2: - 3: ConstHead 4: ConstPressure 6: VarDiffPress 128: DDD AutoAdapt
Byte 6 (data type 5)		**OperatingMode** [enumeration] 0: AutoControl 1-6: -

7.9 Alarms and warnings

Module	Name	Description
17	WarningCode	Code for DDD system warning.
18	FaultCode	Code for DDD system alarm.

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

In the FaultCode module, the cause of a DDD system alarm can be read. A DDD system alarm will always lead to a reaction in the DDD system operation, usually all pumps will be stopped, but some DDD alarms have programmable alarm action types.

The complete list of possible alarm/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 time-out	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 *7.11 Zone pump measurement data modules*)	-	None

[1] This can be automatic (A) or selectable Automatic/Manual (A/M).

[2] This can be None or programmable (Prog.).
Event action programmable = Stop, Stop with delay, Min., UserDef, Max., Pumps in local, Emergency run.

7.10 System measurement modules

This is measurement data that can be read in the DDD.
PROFIBUS/PROFINET direction: Inputs.

Module	Name	Data type	Unit	Description
17	WarningCode	5	-	Grundfos-specific warning code. For a list of warning codes, see section *7.9 Alarms and warnings*.
18	FaultCode	5	-	Grundfos-specific alarm code. For a list of alarm codes, see section *7.9 Alarms and warnings*.
19	VolumeFlow	8	m^3/h	Provides the flow through the system as estimated or measured. A flow sensor is required.
20	InletPressure	8	bar	Provides the inlet pressure if a pressure sensor is configured and installed at the inlet.
21	OutletPressure	8	bar	Provides the outlet pressure measured by a pressure sensor.
22	StorageTankLevel	8	m	Provides the storage tank level. Requires that a level sensor is installed.
23	FeedTankLevel	8	m	Provides the feed tank level. Requires that a level sensor is installed.
24	Power	8	W	Provides the actual power consumed by the DDD system.
25	Energy	8	Wh	Provides the accumulated electric energy consumption of the system.
26	OperationTime	8	h	Provides the total operating hours of the DDD system.
27	ActualSetpoint	8	%	Selected system control-loop reference. This is the setpoint in percent of the sensor range that the system is currently using.
28	RelativePerformance	8	%	Value of speed control signal to pumps that are not stopped or running at maximum speed.
29	UserSetpoint	8	%	User setpoint as written from the bus or selected on the pump.
30	AnalogueInfluence	8	%	Influence from analog input.
31	NoOfPowerOn	8	-	Number of power-on cycles.
32	FlowMeasurement1	6	$0.1\ m^3/h$	Flow measurement 1 from sensor.
33	FlowMeasurement2	6	$0.1\ m^3/h$	Flow measurement 2 from sensor.
34	FlowMeasurement3	6	$0.1\ m^3/h$	Flow measurement 3 from sensor.
35	LatestNightFlowAverage	6	$0.1\ m^3/h$	Average of flow for latest night.
36	LatestNightPressAverage	6	0.001 bar	Average of pressure for latest night.
37	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: m^3/min 20: ft^3/s
38	FeedbackSensorMin	6	Sensor unit	Minimum value for the closed-loop feedback sensor.
39	FeedbackSensorMax	6	Sensor unit	Maximum value for the closed-loop feedback sensor.
41	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.

Module	Name	Data type	Unit	Description
42	DigitalInputs	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.
43	DigitalOutputs	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.
44	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 6-7: Reserved.
45	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 6-7: Reserved.
46	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 6-7: Reserved.
47	PumpsCommFault	5	Bits	One bit for each pump indicating that the communication to the pump is OK. 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 6-7: Reserved.
48	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 the CU 354). 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 6-7: Reserved. The data module ControlPumps (module 2) is used to command the individual pumps.

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 DDD 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 the CU 354.

PROFIBUS/PROFINET module	FeedBackSensorUnit	Measuring sensor, options	Primary sensor, options
VolumeFlow (19)	3: 0.1 m^3/h	Flow rate	Flow rate
InletPressure (20)	7: 0.001 bar	Differential pressure, inlet	Differential pressure, inlet
OutletPressure (21)	6: 0.001 bar	Discharge pressure Differential pressure, outlet	Discharge pressure Differential pressure, outlet

7.11 Zone pump measurement data modules

A number of data modules shown below are available for reading of zone pump measurements and status. Since the data modules are common for all the zone pumps, the actual pump to be represented is selected with data module 13 SetPumpIndex.

Module	Name	Data type	Unit	Description
49	PumpIndex	5	Enum	Actual zone pump index (use module 13 SetPumpIndex to change)
50	PumpStatus	5	Bits	BitName 0: PumpAccessMode 0: Locally controlled (buttons, digital input) 1: Controlled from DDD controller CU 354 1: PumpOnOff 0: Off (stopped) 1: On (started) 2: PumpFault 0: No fault condition 1: Fault, alarm on pump 3-7:-
51	PumpAlarmCode	5	Enum	Pump alarm code (see table below)
52	PumpOperationTime	8	Float	Pump operation time
53	PumpSpeed	7	0.01 %	Pump speed
54	PumpCurrent	8	A	Pump current consumption
55	PumpPower	8	W	Pump power consumption
56	PumpMotorTemp	5	C	Pump motor temperature
57	PumpControlSource	5	Enum	Pump control source 0:- 1:Buttons 2:GENIbus 3:GENIlink/GENIair (handheld controller) 4:External control (e.g. digital stop) 5-255:-
58	PumpRESERVED1	7	-	Reserved for future use, set to 0xFFFF
59	PumpRESERVED2	8	-	Reserved for future use, set to 0xFFFFFFFF

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/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 (e.g. thermistor)
72	Hardware fault, type 1
73	Hardware shutdown (HSD)
76	Internal communication fault
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 sensor 1
93	Signal fault, temperature 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	Measurement fault, motor drive protection function

Code	Alarm/warning description
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 sensor 2 (t_mo2)
176	Signal fault, temperature sensor 3 (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

7.12 Device identification (DeviceIdentification, module 40)

The data type is 10, non-standard.

Byte	Name/description	
	UnitFamily [enumeration]	**UnitType [enumeration]**
1	1:UPE/MAGNA 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/I
	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, DDD	1: Hydro MPC/Control MPC, CU 351/CU 352 2: Hydro Multi-B, CU 323 3: DDD system, CU 354
	25:CR Monitor	1: CR Monitor, CU 351
	26:Dedicated Controls	1: Dedicated Controls, CU 361
	30:Smart Digital Dosing, DDA	1: Smart Digital Dosing, DDA
	39:Hydro Multi-E model H	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]	

7.13 DDD sensor data module

Byte	Bit	Name	Unit	Description
Byte 1		DDDSensorIndex	Enum	Actual DDD sensor index (use module 14 SetDDDSensorIndex to change)
Byte 2	0	BatteryWarningDDDSensor	Bool	The sensor battery must be replaced.
	1	PressLowDDDSensor	Bool	The pressure at sensor location is below its warning limit.
	2	MissingDataDDDSensor	Bool	Sensor pressure measurement not received within time.
	3	DataWarningDDDSensor	Bool	Sensor data inconsistency warning
	4-7	RESERVED	-	-
Byte 3-4		PressYesterday	0.001 bar	Average of pressure measured yesterday.
Byte 5-6		ActualSetpoint	0.001 bar	The pressure setpoint of the sensor location
Byte 7-10		LatestDataUnixTime	Unix time	Unix time stamp for latest received sensor data
Byte 11-12		RESERVED1	-	-
Byte 13-14		RESERVED2	-	-

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 a CIU 150 / CIU 500 (Communication Interface Unit) 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 (e.g. 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	DDD 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
F	6	DDD 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 web server.
See section *A.4 PROFINET IO configuration* on page 29.

9. Fault finding

9.1 CIM 150

Faults in a CIM 150 PROFIBUS module can be detected by observing the status of the two communication LEDs.
See the table below.

9.1.1 LED status

CIM 150 fitted in a Grundfos DDD system

Fault (LED status)		Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected.	a)	The CIM 150 is fitted incorrectly in the Grundfos product.	Check that the CIM 150 is fitted/connected correctly.
	b)	The CIM 150 is defective.	Replace the CIM 150.
2. The LED for internal communication (LED2) is flashing red.	a)	No internal communication between the CIM 150 and the Grundfos product.	Check that the CIM 150 is fitted correctly in the Grundfos product.
3. The LED for internal communication (LED2) is constantly red.	a)	The CIM 150 does not support the connected Grundfos product.	Contact the nearest Grundfos company.
4. The PROFIBUS LED (LED1) is constantly red.	a)	Fault in the CIM 150.	Contact the nearest Grundfos company.
5. The PROFIBUS LED (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*.

9.2 CIM 500

Faults in the CIM 500 PROFINET module can be detected 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 DDD system

Fault (LED status)		Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected.	a)	The CIM 500 is fitted incorrectly in the Grundfos product.	Check that the CIM 500 is fitted/connected correctly.
	b)	The CIM 500 is defective.	Replace the CIM 500.
2. The PROFINET IO LED (LED1) remains off.	a)	The protocol selection switch (SW1) has been set in Modbus TCP position	Set the switch to "0".
3. The LED for internal communication (LED2) is flashing red.	a)	No internal communication between the CIM 500 and the Grundfos product.	Check that the CIM 500 is fitted correctly in the Grundfos product.
4. The LED for internal communication (LED2) is permanently red.	a)	The CIM 500 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
5. The PROFINET IO LED (LED1) is permanently red.	a)	The 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. The 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 *29*. • Check device name in the CIM 500 and PROFINET IO master.
7. The PROFINET IO (LED1) is pulsing red.	a)	Connection to master lost.	• Check cables. • Check that the master is running.
8. LED1 is permanently red and green at the same time.	a)	Error in firmware download.	Use the web server to download the firmware again.
9. LED2 is permanently red and green at the same time.	a)	Memory fault.	Replace the 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			

Subject to alterations.

11. Grundfos alarm and warning codes

This is a complete list of alarm and warning codes for Grundfos products. For the codes supported by booster systems, see the Alarms and warnings section.

Code	Description	Code	Description	Code	Description
1	Leakage current	84	Memory access error	181	Signal fault, PTC sensor (short-circuited)
2	Missing phase	85	Verification error, BE parameter area (EEPROM)	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing
3	External fault signal	86	Fault (add-on) I/O module	183	Signal fault, extra temperature sensor
4	Too many restarts	88	Sensor fault	184	Signal fault, general-purpose sensor
5	Regenerative braking	89	Signal fault, (feedback) sensor 1	185	Unknown sensor type
6	Mains fault	90	Signal fault, speed sensor	186	Signal fault, power meter sensor
7	Too many hardware shutdowns	91	Signal fault, temperature sensor 1	187	Signal fault, energy meter
8	PWM switching frequency reduced	92	Calibration fault, (feedback) sensor	188	Signal fault, user-defined sensor
9	Phase sequence reversal	93	Signal fault, sensor 2	189	Signal fault, level sensor
10	Communication fault, pump	94	Limit exceeded, sensor 1	190	Limit exceeded, sensor 1 (e.g. alarm level in WW application)
11	Water-in-oil fault (motor oil)	95	Limit exceeded, sensor 2	191	Limit exceeded, sensor 2 (e.g. high level in WW application)
12	Time for service (general service information)	96	Setpoint signal outside range	192	Limit exceeded, sensor 3 (e.g. overflow level in WW application)
13	Moisture alarm, analog	97	Signal fault, setpoint input	193	Limit exceeded, sensor 4 (e.g. low level in WW/tank filling application
14	Electronic DC-link protection activated (ERP)	98	Signal fault, input for setpoint influence	194	Limit exceeded, sensor 5
15	Communication fault, main system (SCADA)	99	Signal fault, input for analog setpoint	195	Limit exceeded, sensor 6
16	Other	100	RTC time synchronisation with GSM occured	196	Operation with reduced efficiency
17	Performance requirement cannot be met	102	Dosing pump not ready	197	Operation with reduced pressure
18	Commanded alarm standby (trip)	103	Emergency stop	198	Operation with increased power consumption
19	Diaphragm break (dosing pump)	104	Software shutdown	199	Process out of range (monitoring/estimation/calculation/control)
20	Insulation resistance low	105	Electronic rectifier protection activated (ERP)	200	Application alarm
21	Too many starts per hour	106	Electronic inverter protection activated (EIP)	201	External sensor input high
22	Moisture switch alarm, digital	110	Skew load, electrical asymmetry	202	External sensor input low
23	Smart trim gap alarm	111	Current asymmetry	203	Alarm on all pumps
24	Vibration	112	Cos φ too high	204	Inconsistency between sensors
25	Setup conflict	113	Cos φ too low	205	Level float switch sequence inconsistency
26	Load continues even if the motor has been switched off	114	Motor heater function activated (frost protection)	206	Water shortage, level 1
27	External motor protector activated (e.g. MP 204)	115	Too many grinder reversals or grinder reversal attempt failed	207	Water leakage
28	Battery low	116	Grinder motor over temperature	208	Cavitation
29	Turbine operation (impellers forced backwards)	118	Signal fault, hydrogen sulfide H2S sensor	209	Non-return valve fault
30	Change bearings (specific service information)	119	Signal fault, analog input AI4	210	High pressure
31	Change varistor(s) (specific service information)	120	Auxiliary winding fault (single-phase motors)	211	Low pressure
32	Overvoltage	121	Auxiliary winding current too high (single-phase motors)	212	Diaphragm tank precharge pressure out of range
33	Soon time for service (general service information)	122	Auxiliary winding current too low (single-phase motors)	213	VFD not ready
34	No priming water	123	Start capacitor, low (single-phase motors)	214	Water shortage, level 2

Code	Description	Code	Description	Code	Description
35	Gas in pump head, deaerating problem	124	Run capacitor, low (single-phase motors)	215	Soft pressure build-up time-out
36	Discharge valve leakage	125	Signal fault, outdoor temperature sensor	216	Pilot pump alarm
37	Suction valve leakage	126	Signal fault, air temperature sensor	217	Alarm, general-purpose sensor high
38	Vent valve defective	127	Signal fault, shunt relative pressure sensor	218	Alarm, general-purpose sensor low
39	Valve stuck/defective	128	Strainer clogged	219	Pressure relief not adequate
40	Undervoltage	144	Motor temperature 3 (Pt100, t_mo3)	220	Fault, motor contactor feedback
41	Undervoltage transient	145	Bearing temperature high (Pt100), in general or top bearing	221	Fault, mixer contactor feedback
42	Cut-in fault (dV/dt)	146	Bearing temperature high (Pt100), middle bearing	222	Time for service, mixer
45	Voltage asymmetry	147	Bearing temperature high (Pt100), bottom bearing	223	Maximum number of mixer starts per hour exceeded
48	Overload	148	Motor bearing temperature high (Pt100) in drive end (DE)	224	Pump fault (due to auxiliary component or general fault)
49	Overcurrent (i_line, i_dc, i_mo)	149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	225	Communication fault, pump module
50	Motor protection function, general shutdown (MPF)	150	Fault (add-on) pump module	226	Communication fault, I/O module
51	Blocked motor/pump	151	Fault, display (HMI)	227	Combi event
52	Motor slip high	152	Communication fault, add-on module	228	Night flow max. limit exceeded
53	Stalled motor	153	Fault, analog output	229	Water on floor
54	Motor protection function, 3 sec. limit	154	Communication fault, display	230	Network alarm
55	Motor current protection activated (MCP)	155	Inrush fault	231	Ethernet: No IP address from DHCP server
56	Underload	156	Communication fault, internal frequency converter module	232	Ethernet: Auto-disabled due to misuse
57	Dry running	157	Real-time clock out of order	233	Ethernet: IP address conflict
58	Low flow	158	Hardware circuit measurement fault	234	Backup pump alarm
59	No flow	159	CIM fault (Communication Interface Module)	235	Gas detected
60	Low input power	160	GSM modem, SIM card fault	236	Pump 1 fault
64	Overtemperature	161	Sensor supply fault, 5 V	237	Pump 2 fault
65	Motor temperature 1 (t_m or t_mo or t_mo1)	162	Sensor supply fault, 24 V	238	Pump 3 fault
66	Temperature, control electronics (t_e)	163	Measurement fault, motor protection	239	Pump 4 fault
67	Temperature too high, internal frequency converter module (t_m)	164	Signal fault, LiqTec sensor	240	Lubricate bearings (specific service information)
68	External temperature/water temperature (t_w)	165	Signal fault, analog input 1	241	Motor phase failure
69	Thermal relay 1 in motor (e.g. Klixon)	166	Signal fault, analog input 2	242	Automatic motor model recognition failed
70	Thermal relay 2 in motor (e.g. thermistor)	167	Signal fault, analog input 3	243	Motor relay has been forced (manually operated/commanded)
71	Motor temperature 2 (Pt100, t_mo2)	168	Signal fault, pressure sensor	244	Fault, On/Off/Auto switch
72	Hardware fault, type 1	169	Signal fault, flow sensor	245	Pump continuous runtime too long
73	Hardware shutdown (HSD)	170	Signal fault, water-in-oil (WIO) sensor	246	User-defined relay has been forced (manually operated/commanded)
74	Internal supply voltage too high	171	Signal fault, moisture sensor	247	Power-on notice (device/system has been switched off)
75	Internal supply voltage too low	172	Signal fault, atmospheric pressure sensor	248	Fault, battery/UPS
76	Internal communication fault	173	Signal fault, rotor position sensor (Hall sensor)	249	User-defined event 1
77	Communication fault, twin-head pump	174	Signal fault, rotor origo sensor	250	User-defined event 2

Code	Description	Code	Description	Code	Description
78	Fault, speed plug	175	Signal fault, temperature sensor 2 (t_mo2)	251	User-defined event 3
79	Functional fault, add-on module	176	Signal fault, temperature sensor 3 (t_mo3)	252	User-defined event 4
80	Hardware fault, type 2	177	Signal fault, Smart trim gap sensor	253	SMS data from DDD sensor not received within time
81	Verification error, data area (RAM)	178	Signal fault, vibration sensor	254	Inconsistent data model
82	Verification error, code area (ROM, FLASH)	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing		
83	Verification error, FE parameter area (EEPROM)	180	Signal fault, bearing temperature sensor (Pt100), middle bearing		

Subject to alterations.

Appendix

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

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

For connecting a PC to the CIM 500 via Ethernet, the PC must be set up to use a fixed (static) IP address belonging to the same subnetwork as the 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.
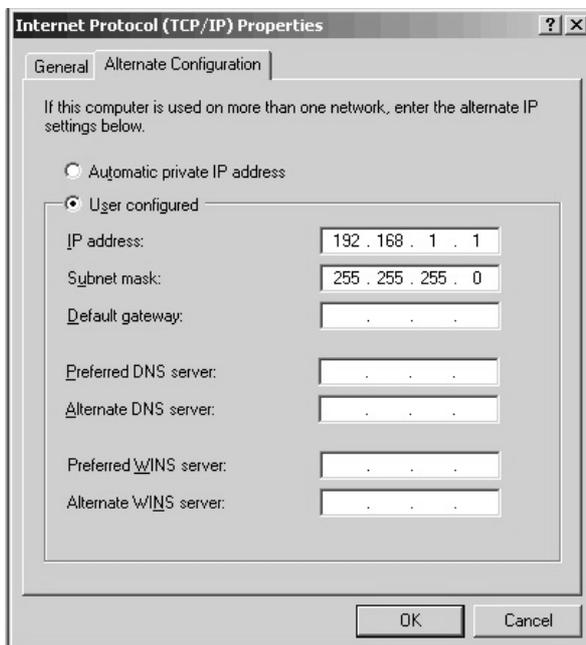
Fig. 1 Example from Windows XP

A.2 Web server configuration

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

Before configuration

- Check that the PC and CIM module are connected via an Ethernet cable.
- Check that the PC Ethernet port is set to the same network as the CIM module. 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 web server.

A.3 Login

Fig. 2 Login

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

Note *User name and password can be changed on the web server under "Grundfos 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), which is available on Internet.

Fig. 3 Real Time Ethernet Protocol Configuration - PROFINET IO

Object	Description
Device Name	The PROFINET IO device name. This must be unique.
IP Address	The static IP address for CIM 500 on the PROFINET IO network.
Subnet Mask	Configure the subnet mask for the CIM 500 module on the PROFINET IO network.
Gateway	Configure the default gateway for the PROFINET IO network.
Use DHCP	The CIM 500 module can be configured to automatically obtain the IP address from a DHCP server on the network.
Grundfos product simulation	The 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 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 will be terminated by a module power cycle.

Argentina
Bombas GRUNDFOS de Argentina S.A.
Ruta Panamericana km. 37.500 Centro
Industrial Garin
1619 Garín Pcia. de B.A.
Phone: +54-3327 414 444
Telefax: +54-3327 45 3190

Australia
GRUNDFOS Pumps Pty. Ltd.
P.O. Box 2040
Regency Park
South Australia 5942
Phone: +61-8-8461-4611
Telefax: +61-8-8340 0155

Austria
GRUNDFOS Pumpen Vertrieb Ges.m.b.H.
Grundfosstraße 2
A-5082 Grödig/Salzburg
Tel.: +43-6246-883-0
Telefax: +43-6246-883-30

Belgium
N.V. GRUNDFOS Bellux S.A.
Boomsesteenweg 81-83
B-2630 Aartselaar
Tél.: +32-3-870 7300
Télécopie: +32-3-870 7301

Belarus
Представительство ГРУНДФОС в
Минске
220125, Минск
ул. Шафарнянская, 11, оф. 56, БЦ
«Порт»
Тел.: +7 (375 17) 286 39 72/73
Факс: +7 (375 17) 286 39 71
E-mail: minsk@grundfos.com

Bosnia and Herzegovina
GRUNDFOS Sarajevo
Zmaja od Bosne 7-7A,
BH-71000 Sarajevo
Phone: +387 33 592 480
Telefax: +387 33 590 465
www.ba.grundfos.com
e-mail: grundfos@bih.net.ba

Brazil
BOMBAS GRUNDFOS DO BRASIL
Av. Humberto de Alencar Castelo Branco,
630
CEP 09850 - 300
São Bernardo do Campo - SP
Phone: +55-11 4393 5533
Telefax: +55-11 4343 5015

Bulgaria
Grundfos Bulgaria EOOD
Slatina District
Iztochna Tangenta street no. 100
BG - 1592 Sofia
Tel. +359 2 49 22 200
Fax. +359 2 49 22 201
email: bulgaria@grundfos.bg

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

China
GRUNDFOS Pumps (Shanghai) Co. Ltd.
10F The Hub, No. 33 Suhong Road
Minhang District
Shanghai 201106
PRC
Phone: +86 21 612 252 22
Telefax: +86 21 612 253 33

Croatia
GRUNDFOS CROATIA d.o.o.
Buzinski prilaz 38, Buzin
HR-10010 Zagreb
Phone: +385 1 6595 400
Telefax: +385 1 6595 499
www.hr.grundfos.com

Czech Republic
GRUNDFOS s.r.o.
Čajkovského 21
779 00 Olomouc
Phone: +420-585-716 111
Telefax: +420-585-716 299

Denmark
GRUNDFOS DK A/S
Martin Bachs Vej 3
DK-8850 Bjerringbro
Tlf.: +45-87 50 50 50
Telefax: +45-87 50 51 51
E-mail: info_GDK@grundfos.com
www.grundfos.com/DK

Estonia
GRUNDFOS Pumps Eesti OÜ
Peterburi tee 92G
11415 Tallinn
Tel: + 372 606 1690
Fax: + 372 606 1691

Finland
OY GRUNDFOS Pumput AB
Trukkikuja 1
FI-01360 Vantaa
Phone: +358-(0) 207 889 500
Telefax: +358-(0) 207 889 550

France
Pompes GRUNDFOS Distribution S.A.
Parc d'Activités de Chesnes
57, rue de Malacombe
F-38290 St. Quentin Fallavier (Lyon)
Tél.: +33-4 74 82 15 15
Télécopie: +33-4 74 94 10 51

Germany
GRUNDFOS GMBH
Schlüterstr. 33
40699 Erkrath
Tel.: +49-(0) 211 929 69-0
Telefax: +49-(0) 211 929 69-3799
e-mail: infoservice@grundfos.de
Service in Deutschland:
e-mail: kundendienst@grundfos.de

Greece
GRUNDFOS Hellas A.E.B.E.
20th km. Athinon-Markopoulou Av.
P.O. Box 71
GR-19002 Peania
Phone: +0030-210-66 83 400
Telefax: +0030-210-66 46 273

Hong Kong
GRUNDFOS Pumps (Hong Kong) Ltd.
Unit 1, Ground floor
Siu Wai Industrial Centre
29-33 Wing Hong Street &
68 King Lam Street, Cheung Sha Wan
Kowloon
Phone: +852-27861706 / 27861741
Telefax: +852-27858664

Hungary
GRUNDFOS Hungária Kft.
Park u. 8
H-2045 Törökbálint,
Phone: +36-23 511 110
Telefax: +36-23 511 111

India
GRUNDFOS Pumps India Private Limited
118 Old Mahabalipuram Road
Thoraipakkam
Chennai 600 096
Phone: +91-44 2496 6800

Indonesia
PT. GRUNDFOS POMPA
Graha Intirub Lt. 2 & 3
Jln. Cililitan Besar No.454. Makasar,
Jakarta Timur
ID-Jakarta 13650
Phone: +62 21-469-51900
Telefax: +62 21-460 6910 / 460 6901

Ireland
GRUNDFOS (Ireland) Ltd.
Unit A, Merrywell Business Park
Ballymount Road Lower
Dublin 12
Phone: +353-1-4089 800
Telefax: +353-1-4089 830

Italy
GRUNDFOS Pompe Italia S.r.l.
Via Gran Sasso 4
I-20060 Truccazzano (Milano)
Tel.: +39-02-95838112
Telefax: +39-02-95309290 / 95838461

Japan
GRUNDFOS Pumps K.K.
1-2-3, Shin-Miyakoda, Kita-ku,
Hamamatsu
431-2103 Japan
Phone: +81 53 428 4760
Telefax: +81 53 428 5005

Korea
GRUNDFOS Pumps Korea Ltd.
6th Floor, Aju Building 679-5
Yeoksam-dong, Kangnam-ku, 135-916
Seoul, Korea
Phone: +82-2-5317 600
Telefax: +82-2-5633 725

Latvia
SIA GRUNDFOS Pumps Latvia
Deglava biznesa centrs
Augusta Deglava ielā 60, LV-1035, Rīga,
Tālr.: + 371 714 9640, 7 149 641
Fakss: + 371 914 9646

Lithuania
GRUNDFOS Pumps UAB
Smolensko g. 6
LT-03201 Vilnius
Tel: + 370 52 395 430
Fax: + 370 52 395 431

Malaysia
GRUNDFOS Pumps Sdn. Bhd.
7 Jalan Peguam U1/25
Glenmarie Industrial Park
40150 Shah Alam
Selangor
Phone: +60-3-5569 2922
Telefax: +60-3-5569 2866

Mexico
Bombas GRUNDFOS de México S.A. de
C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
Apodaca, N.L. 66600
Phone: +52-81-8144 4000
Telefax: +52-81-8144 4010

Netherlands
GRUNDFOS Netherlands
Veluwezoom 35
1326 AE Almere
Postbus 22015
1302 CA ALMERE
Tel.: +31-88-478 6336
Telefax: +31-88-478 6332
E-mail: info_gnl@grundfos.com

New Zealand
GRUNDFOS Pumps NZ Ltd.
17 Beatrice Tinsley Crescent
North Harbour Industrial Estate
Albany, Auckland
Phone: +64-9-415 3240
Telefax: +64-9-415 3250

Norway
GRUNDFOS Pumper A/S
Strømsveien 344
Postboks 235, Leirdal
N-1011 Oslo
Tlf.: +47-22 90 47 00
Telefax: +47-22 32 21 50

Poland
GRUNDFOS Pompy Sp. z o.o.
ul. Klonowa 23
Baranowo k. Poznania
PL-62-081 Przeźmierowo
Tel: (+48-61) 650 13 00
Fax: (+48-61) 650 13 50

Portugal
Bombas GRUNDFOS Portugal, S.A.
Rua Calvet de Magalhães, 241
Apartado 1079
P-2770-153 Paço de Arcos
Tel.: +351-21-440 76 00
Telefax: +351-21-440 76 90

Romania
GRUNDFOS Pompe România SRL
Bd. Biruintei, nr 103
Pantelimon county Ilfov
Phone: +40 21 200 4100
Telefax: +40 21 200 4101
E-mail: romania@grundfos.ro

Russia
ООО Грундфос Россия
109544, г. Москва, ул. Школьная, 39-41,
стр. 1
Тел. (+7) 495 564-88-00 (495) 737-30-00
Факс (+7) 495 564 88 11
E-mail grundfos.moscow@grundfos.com

Serbia
Grundfos Srbija d.o.o.
Omladinskih brigada 90b
11070 Novi Beograd
Phone: +381 11 2258 740
Telefax: +381 11 2281 769
www.rs.grundfos.com

Singapore
GRUNDFOS (Singapore) Pte. Ltd.
25 Jalan Tukang
Singapore 619264
Phone: +65-6681 9688
Telefax: +65-6681 9689

Slovakia
GRUNDFOS s.r.o.
Prievozská 4D
821 09 BRATISLAVA
Phona: +421 2 5020 1426
sk.grundfos.com

Slovenia
GRUNDFOS LJUBLJANA, d.o.o.
Leskoškova 9e, 1122 Ljubljana
Phone: +386 (0) 1 568 06 10
Telefax: +386 (0)1 568 06 19
E-mail: tehnika-si@grundfos.com

South Africa
GRUNDFOS (PTY) LTD
Corner Mountjoy and George Allen Roads
Wilbart Ext. 2
Bedfordview 2008
Phone: (+27) 11 579 4800
Fax: (+27) 11 455 6066
E-mail: lsmart@grundfos.com

Spain
Bombas GRUNDFOS España S.A.
Camino de la Fuentecilla, s/n
E-28110 Algete (Madrid)
Tel.: +34-91-848 8800
Telefax: +34-91-628 0465

Sweden
GRUNDFOS AB
Box 333 (Lunnagårdsgatan 6)
431 24 Mölndal
Tel.: +46 31 332 23 000
Telefax: +46 31 331 94 60

Switzerland
GRUNDFOS Pumpen AG
Bruggacherstrasse 10
CH-8117 Fällanden/ZH
Tel.: +41-44-806 8111
Telefax: +41-44-806 8115

Taiwan
GRUNDFOS Pumps (Taiwan) Ltd.
7 Floor, 219 Min-Chuan Road
Taichung, Taiwan, R.O.C.
Phone: +886-4-2305 0868
Telefax: +886-4-2305 0878

Thailand
GRUNDFOS (Thailand) Ltd.
92 Chaloem Phrakiat Rama 9 Road,
Dokmai, Pravej, Bangkok 10250
Phone: +66-2-725 8999
Telefax: +66-2-725 8998

Turkey
GRUNDFOS POMPA San. ve Tic. Ltd. Sti.
Gebze Organize Sanayi Bölgesi
Ihsan dede Caddesi,
2. yol 200. Sokak No. 204
41490 Gebze/ Kocaeli
Phone: +90 - 262-679 7979
Telefax: +90 - 262-679 7905
E-mail: satis@grundfos.com

Ukraine
Бізнес Центр Європа
Столичне шосе, 103
м. Київ, 03131, Україна
Телефон: (+38 044) 237 04 00
Факс.: (+38 044) 237 04 01
E-mail: ukraine@grundfos.com

United Arab Emirates
GRUNDFOS Gulf Distribution
P.O. Box 16768
Jebel Ali Free Zone
Dubai
Phone: +971 4 8815 166
Telefax: +971 4 8815 136

United Kingdom
GRUNDFOS Pumps Ltd.
Grovebury Road
Leighton Buzzard/Beds. LU7 4TL
Phone: +44-1525-850000
Telefax: +44-1525-850011

U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Telefax: +1-913-227-3500

Uzbekistan
Grundfos Tashkent, Uzbekistan The Repre-
sentative Office of Grundfos Kazakhstan in
Uzbekistan
38a, Oybek street, Tashkent
Телефон: (+998) 71 150 3290 / 71 150
3291
Факс: (+998) 71 150 3292

Addresses Revised 29.07.2016

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www.grundfos.com

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