

Modbus for Smart Digital Dosing

CIM 200 Modbus RTU

CIM 500 Ethernet for Modbus TCP

Functional profile and user manual



Original functional profile and user manual.

CONTENTS

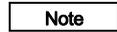
	Page
1. Symbols used in this document	2
2. Introduction	3
2.1 About this functional profile	3
2.2 Assumptions	3
2.3 Definitions and abbreviations	3
3. System description	4
4. Specifications	5
4.1 CIM module	5
4.2 CIM 200 Modbus RTU	5
4.3 CIM 500 Modbus TCP	5
5. Modbus RTU, CIM 200 setup	6
5.1 Setting the Modbus transmission speed	6
5.2 Setting the parity	6
5.3 Modbus address selection	7
5.4 Termination resistor	7
5.5 Status LEDs	7
6. Modbus TCP, CIM 500 setup	8
6.1 Connecting the Ethernet cable	8
6.2 Setting the Industrial Ethernet protocol	8
6.3 Setting up the IP addresses	8
6.4 Establish connection to the Web server	9
6.5 Status LEDs	9
6.6 DATA and LINK LEDs	9
7. Modbus function code overview	10
8. Modbus register addresses	11
8.1 Register block overview	11
8.2 CIM configuration register block	12
8.3 CIM status register block	13
8.4 GSM Real Time Clock	14
8.5 Control registers	15
8.6 Dosing settings	18
8.7 Other settings	18
8.8 Bus settings compared to pump HMI settings	19
8.9 Status registers	19
8.10 Measurement data modules	22
8.11 Alarms and warning	24
8.12 Device identification (DeviceIdentification)	25
9. Modbus RTU commissioning, step-by-step guides	26
9.1 Hardware setup (CIM 200)	26
9.2 Modbus TCP communication setup (CIM 500)	26
10. Fault finding	27
10.1 CIM 200	27
10.2 CIM 500	29
11. Grundfos alarm and warning codes	31

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 modules/units:

- CIM 200 Modbus RTU
- CIM 500 Modbus Ethernet for Modbus TCP.

They are used for Modbus communication with the Smart Digital Dosing pump, type DDA, referred to as "DDA pump" in the following.

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 Assumptions

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

It is also assumed that an existing Modbus network with a Modbus master is present.

2.3 Definitions and abbreviations

ARP	Address Resolution Protocol. Translates IP addresses to MAC addresses.
Auto-MDIX	Ensures that both crossover cable types and non-crossover cable types can be used.
CAT5	Ethernet cable with four twisted pairs of wires
CAT5e	Enhanced CAT5 cable with better performance.
CAT6	Cable with very high performance
CIM	Communication Interface Module
CRC	Cyclic Redundancy Check. A data error detection method.
DDA	Digital Dosing Advanced
DHCP	Dynamic Host Configuration Protocol. Used to configure network devices so that they can communicate on an IP network.
DNS	Domain Name System. Used to resolve host names to IP addresses.
GENIbus	Proprietary Grundfos fieldbus standard
GENIpro	Proprietary Grundfos fieldbus protocol
Grundfos GO	A Grundfos handheld remote control device for controlling Grundfos products via infrared or radio. Based on smart phone technology.
HMI	Human Machine Interface. Display and buttons on the DDA pump.
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
MAC	Media Access Control. Unique network address for a piece of hardware.
Modbus	A serial communications protocol commonly used in industry and building automation systems.
Modbus RTU	Modbus is a fieldbus used worldwide. The RTU version is used for wired networks (CIM 200) and for call-up connections over telephone networks (CIM 250).

Modbus TCP	Modbus is a fieldbus used worldwide. The TCP version is adapted for use as an application protocol on TCP/IP using either GPRS (CIM 250) or Ethernet (CIM 500) as basis.
Ping	Packet InterNet Groper. A software utility that tests connectivity between two TCP/IP hosts.
PLC	Programmable Logic Controller
R100	Grundfos handheld infrared remote control
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 clocks synchronization between computer systems.
TCP	Transmission Control Protocol. Protocol for Internet communication and Industrial Ethernet communication.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol for Internet communication.
Transmission speed	Bits transferred per second, bits/s
URL	Uniform Resource Locator. The IP address used to connect to a server.
UTC	Coordinated Universal Time, the primary time standard by which the world regulates clocks and time.
UTF-8	Unicode Transformation Format. Character encoding.

3. System description

The system diagrams provide an overview for the different technologies of how to connect the CIM module to the Grundfos DDA E-box that is to be connected to a Modbus network.

The CIM 200 and 500 are communication modules to be installed internally in the Grundfos DDA E-box, using a 10-pin connection. In this setup, the DDA pump will supply power to the CIM. See fig. 1.

For mounting of the CIM module, see the installation and operating instructions for the DDA E-box.

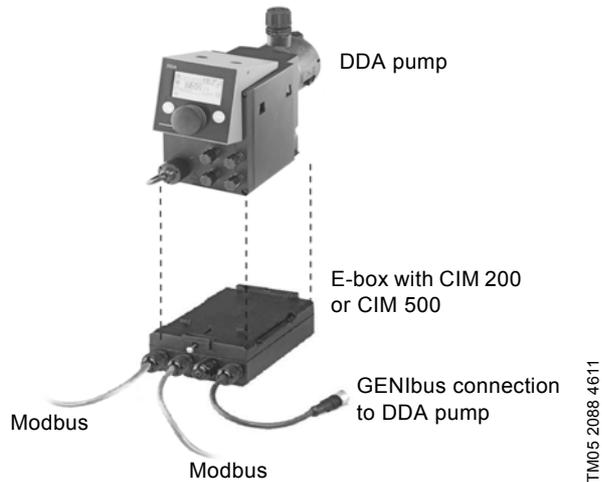


Fig. 1 DDA pump with E-box connected to a daisy chained Modbus network

4. Specifications

4.1 CIM module

General data	Description	Comments
Ambient humidity	30 % to 95 %	Relative, non-condensing.
Operating temperature	-20 °C to +45 °C	
Storage temperature	-25 °C to +70 °C	
GENIbus visual diagnostics	LED2	Will be in one of these states: Off, constantly green, flashing red, constantly red. See section 5.5 Status LEDs .

4.2 CIM 200 Modbus RTU

The table below provides an overview of the specifications for the Grundfos CIM 200. For further details, please refer to the specific sections of this functional profile.

Modbus RTU specifications	Description	Comments
Modbus connector	Screw-type terminal	3 pins. See section 5. Modbus RTU, CIM 200 setup .
Modbus connection type	RS-485, 2-wire + common	Conductors: D0, D1 and Common. See section 5. Modbus RTU, CIM 200 setup .
Maximum cable length	1200 m	Equals 4000 ft.
Slave address	1-247	Set via pump display. See instructions for DDA.
Line termination	On or Off	Set via DIP switches SW1 and SW2. See section 5.4 Termination resistor .
Recommended cable cross-section	0.20 - 0.25 mm ²	AWG24 or AWG23
Supported transmission speeds	1200*, 2400*, 4800*, 9600, 19200, 38400 bits/s	Set via DIP switches SW4 and SW5. See section 5.1 Setting the Modbus transmission speed .
Start bit	1	Fixed value.
Data bits	8	Fixed value.
Stop bits	1 or 2	Set via DIP switch SW3. See section 5.2 Setting the parity .
Parity bit	Even parity, odd parity* or no parity	Set via DIP switch SW3. See section 5.2 Setting the parity .
Modbus visual diagnostics	LED1	Off, flashing green, flashing red, constantly red. See section 5.5 Status LEDs .
Maximum number of Modbus devices	32	Using repeaters, this number can be increased. Legal address range is 1-247.
Maximum Modbus telegram size	256 bytes	Total length. Node address and CRC included.

* Can only be set via software.

4.3 CIM 500 Modbus TCP

The table below provides an overview of the specifications for the Grundfos CIM 500 for Modbus TCP. For further details, please refer to the specific sections of this functional profile.

Modbus TCP specifications	Description	Comments
Application layer	DHCP, HTTP, Ping, FTP, SMTP, SNMP, Modbus TCP	Rotary switch in position 1.
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, section 6.2 Setting the Industrial Ethernet protocol .

5. Modbus RTU, CIM 200 setup

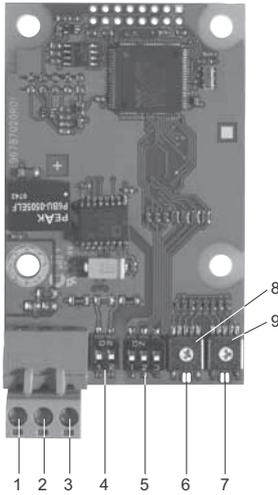


Fig. 2 CIM 200 Modbus module

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Pos.	Designation	Description
1	D1	Modbus terminal D1 (positive data signal)
2	D0	Modbus terminal D0 (negative data signal)
3	Common/GND	Modbus terminal Common/GND
4	SW1/SW2	On/off switches for termination resistor
5	SW3/SW4/SW5	Switches for selection of Modbus parity and transmission speed
6	LED1	Red/green status LED for Modbus communication
7	LED2	Red/green status LED for internal communication between the CIM 200 and the DDA pump
8	SW6	Not used for DDA
9	SW7	Not used for DDA

A screened, twisted-pair cable must be used. The cable screen must be connected to protective earth at both ends.

Recommended connection

Modbus terminal	Colour code	Data signal
D1-TXD1	Yellow	Positive
D0-TXD0	Brown	Negative
Common/GND	Grey	Common/GND

5.1 Setting the Modbus transmission speed

The transmission speed must be set correctly before the CIM 200 Modbus module is ready to communicate with the Modbus network. DIP switches SW4 and SW5 are used for setting the transmission speed. See fig. 3.

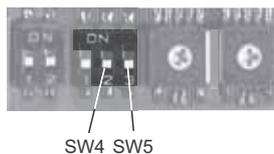


Fig. 3 Modbus transmission speed

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DIP switch settings

Available transmission speeds in bits/s: 1200, 2400, 4800, 9600, 19200 and 38400.

The first three transmission speeds are only available via software settings, whereas the last three are available via DIP switches.

Transmission speed [bits/s]	SW4	SW5
9600	OFF	ON
19200	OFF	OFF
38400	ON	OFF
Software-defined	ON	ON

Default transmission speed is 19200 bits per second, as per the Modbus RTU standard.

Software-defined

When SW4 and SW5 are set to "software-defined", writing a value to the holding register at address 00004 will set a new transmission speed.

Use the following values for software-defined transmission speeds:

Software-defined transmission speed	Value to set in register 00004
1200 bits/s	0
2400 bits/s	1
4800 bits/s	2
9600 bits/s	3
19200 bits/s	4
38400 bits/s	5

This value is set to 1200 bits/s as default.

The communication interface does not support transmission speeds above 38400 bits/s.

The software-defined transmission speed value will be stored in the communication interface and will remain after a power-off.

5.2 Setting the parity

Note When software-defined transmission speed is enabled (ON), software-defined parity and stop bits are also enabled.

The parity can be set either manually by using SW3 or via software-defined settings.

Manual setting of parity

Default byte format (11 bits):

- 1 start bit
- 8 data bits (least significant bit sent first)
- 1 parity bit (even parity)
- 1 stop bit.

The default setting of the CIM 200 Modbus module is even parity (1 stop bit). It is possible to change the parity using DIP switch SW3. The parity can be changed to no parity (2 stop bits). See fig. 4.

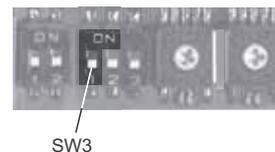


Fig. 4 Parity

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DIP switch settings

Parity	SW3
Even parity, 1 stop bit	OFF
No parity, 2 stop bits	ON

Software-defined parity and stop bits

When SW4 and SW5 are set to "software-defined", the value in the holding registers at addresses 00009 and 00010 will override the setting of SW3. See figures 3 and 4.

Software-defined parity	Value to set in register 00009
No parity [default]	0
Even parity	1
Odd parity	2

Software-defined stop bit	Value to set in register 00010
1 stop bit [default]	1
2 stop bits	2

The software-defined parity and stop bit values will be stored in the communication interface and will remain after a power-off.

Note

Before the parity and stop bits can be set via software-defined settings, SW4 and SW5 must be set to ON.

5.3 Modbus address selection

A Modbus slave on a Modbus network must have a unique address from 1-247. Address 0 is reserved for broadcasting, and is not a valid slave address.

The Modbus address is selected via the menu system in the pump display.

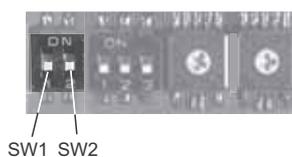
Note

The Modbus address must be set decimally from 1 to 247.

5.4 Termination resistor

The termination resistor is fitted on the CIM 200 Modbus module and has a value of 150 Ω .

The CIM 200 has a DIP switch with two switches (SW1 and SW2) for cutting the termination resistor in and out. Figure 5 shows the DIP switches in cut-out state.



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Fig. 5 Cutting the termination resistor in and out

DIP switch settings

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

Default setting: Termination resistor cut out.

Cable length

We recommend the following maximum lengths:

Bits/s	Maximum cable length	
	Terminated cable [m/ft]	Unterminated cable [m/ft]
1200-9600	1200/4000	1200/4000
19200	1200/4000	500/1700
38400	1200/4000	250/800

Note

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

Note

All switch settings will be effective immediately after setting the values, no power-off needed.

5.5 Status LEDs

The CIM 200 Modbus module has two LEDs. See fig. 2.

- Red/green status LED (LED1) for Modbus communication
- Red/green status LED (LED2) for internal communication between the CIM 200 and the Grundfos product.

LED1

Status	Description
Off	No Modbus communication.
Flashing green	Modbus communication active.
Flashing red	Fault in the Modbus communication.
Permanently red	Fault in the CIM 200 Modbus configuration.

LED2

Status	Description
Off	The CIM 200 has been switched off.
Flashing red	No internal communication between the CIM 200 and the Grundfos product.
Permanently red	The CIM 200 does not support the Grundfos product connected.
Permanently green	Internal communication between the CIM 200 and the Grundfos product is OK.

Note

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

6. Modbus TCP, CIM 500 setup



Warning

The CIM 500 must only be connected to SELV or SELV-E circuits.

6.1 Connecting the Ethernet cable

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 cable shield to earth through earth clamp or to connect 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.

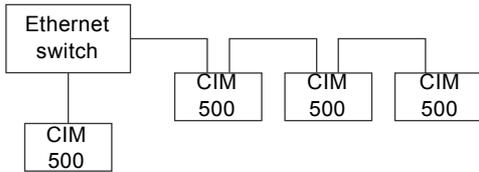


Fig. 6 Example of Industrial Ethernet network

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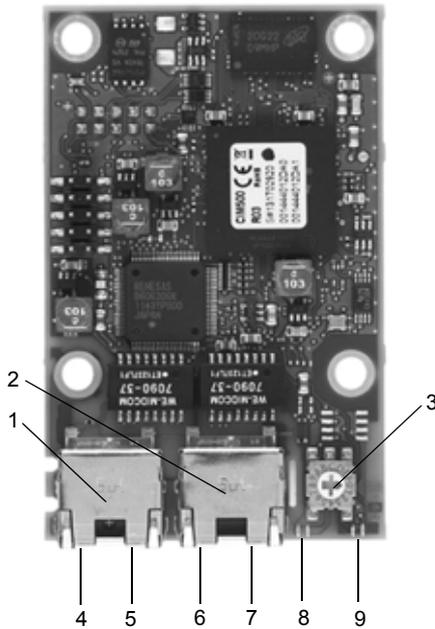


Fig. 7 Example of Ethernet connection

TM05 7431 1013

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. 8.



Fig. 8 Selecting the Industrial Ethernet protocol

TM05 7431 1013

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 to Reset to factory default. During this period LED1 will be flashing red and green at the same time to indicate reset will occur.

Note Every change of the rotary switch setting, when the module is powered on, will cause the module to restart.

6.3 Setting up the 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 by the Web server

6.4 Establish 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 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.1 How to configure an IP address on your PC](#)" on page 33.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log in to the Web server using:

User	admin (default)
Password	Grundfos (default)

Note

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



TM05 6436 4712

Fig. 9 CIM 500 connected to PC via Ethernet cable

For further information how to use the Web server, see section [A.2 Web server configuration](#) on page 33.

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. 7.

- 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	No Modbus TCP communication or switched off.
Flashing green	Modbus TCP communication active.
Permanently red	CIM 500 module configuration fault. See section 10.2.1 LED status .
Permanently red and green	Error in firmware download. See section 10.2.1 LED status .
Flashing red and green	Resetting to factory default. After 20 seconds the CIM 500 will restart.

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. 7.

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 shows 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.

7. Modbus function code overview

The supported function codes are shown in the table below:

Type	Code	Hex	Name
16-bit data (registers)	03	0x03	Read holding registers
	04	0x04	Read input registers
	06	0x06	Write single register
	16	0x10	Write multiple registers
Diagnostics	08	08	Diagnostics

Note *Reading or writing coils are not supported.*

The same data are available in both holding registers and input registers, meaning that either function (0x03 or 0x04) can be used for reading data.

8. Modbus register addresses

8.1 Register block overview

The Modbus RTU registers are grouped in the following register blocks:

Start address	Register block	Permissions	Description
00001	CIM configuration	R/W	Configuration of the CIM module.
00021	CIM status	R	Status registers for the CIM module.
00101	Pump control	R/W	Registers for control of the DDA pump.
00201	Pump status	R	Registers for reading mode status from the DDA pump.
00301	Pump data	R	Registers for reading measured data values from the DDA pump.
00701	Alarm simulation	R/W	Registers for simulating alarms and warnings in the DDA pump.

8.2 CIM configuration register block

Registers in this block can be read by means of function codes 0x03 and/or 0x04. They can be written as holding registers with function codes 0x06 and 0x10.

Address	Register name	Description	CIM 200	CIM 500
00001	SlaveMinimumReplyDelay	The minimum reply delay from the slave in ms. Value range: 0-10000, i.e. up to 10 seconds reply delay. This delay is typically used in conjunction with a radio modem. The delay value is stored in the device and will remain after a power-off. The delay set here will be added to the internal delay in the device. Default value is 0.	•	-
00002	RegisterOffset	An address offset that is added to all addresses above 00100. Default value is 0. Note: This offset does not affect the CIM configuration register block or the CIM status register block addresses. The register offset value is stored in the device and will remain after a power-off. For most applications, this offset should not be changed.	•	•
00003	RESERVED			
00004	SoftwareDefinedBitRate	Modbus software-defined transmission speed enumeration. The software-defined transmission speed value is stored in the device and will remain after a power-off. 0: 1200 bits/s 1: 2400 bits/s 2: 4800 bits/s 3: 9600 bits/s 4: 19200 bits/s 5: 38400 bits/s. Note: This value is used only when the transmission speed is set to "Software-defined" on DIP switches SW4 and SW5. Otherwise, it will be ignored by the slave.	•	-
00005	AutoAckControlBits	Used to select the behaviour of control bit acknowledgements from the CIM. 0: Disabled. Control bits are not automatically lowered when accepted by the device. The user must lower the triggered control bit manually before the control bit can be triggered again. 1: Enabled. Control bits are automatically lowered when accepted by the device. The user does not have to lower it manually [default].	•	•
00006	RESERVED			
00007	RESERVED			
00008	RESERVED			
00009	SoftwareDefinedParity	Parity setting to be used when using "software-defined" settings. 0: No parity [default] 1: Even parity 2: Odd parity. Note: For CIM 200, this value is used only when the transmission speed is set to "Software-defined" on DIP switches SW4 and SW5. Otherwise, it will be ignored by the slave.	•	-
00010	SoftwareDefinedStopBit	Stop bit setting to be used when using "software-defined" settings. 0: No stop bit 1: 1 stop bit [default] 2: 2 stop bits. Note: For CIM 200, this value is used only when the transmission speed is set to "Software-defined" on DIP switches SW4 and SW5. Otherwise, it will be ignored by the slave.	•	-
00011	RESERVED			

8.3 CIM status register block

Registers in this block can be read by means of function codes 0x03 and/or 0x04. They are read-only. This block can be used for various kinds of fault finding.

Address	Register name	Description
00021	GENIbusCRCErrorCnt	Holds a CRC error counter for the GENIbus connection to the DDA pump.
00022	GENIbusDataErrorCnt	Holds a data error counter for the GENIbus connection to the DDA pump.
00023	VersionNumber	A Grundfos-specific version number. This is an unsigned integer value.
00024	ActualModbusAddress	Holds the current Modbus slave address of the device. Valid value range: 1...247.
00025	GENIbusTXcountHI	Holds a transmit counter for total number of telegrams sent to the DDA pump on the GENIbus connection.
00026	GENIbusTXcountLO	
00027	GENIbusRXcountHI	Holds a receive counter for total number of telegrams received from the DDA pump on the GENIbus connection.
00028	GENIbusRXcountLO	
00029	RESERVED	
00030	UnitFamily	Grundfos product family.
00031	UnitType	Grundfos product type.
00032	UnitVersion	Grundfos product version.
00033	GSMBatteryState	State of GSM battery 0: Battery not present 1: Battery must be replaced 2: Battery charging 3: Battery needs charging, but temperature too high 4: Battery needs charging, but temperature too low 5: Battery low 6: Battery OK 255: Battery state not available

8.4 GSM Real Time Clock

Address	Register name	Description
00080	SetUNIXRealTimeClockHI	Set real time clock (32 bit UNIX format)
00081	SetUNIXRealTimeClockLO	Triggered on value change
00082	SetRtcSecond	Set real time clock (seconds)
00083	SetRtcMinute	Set real time clock (minutes)
00084	SetRtcHour	Set real time clock (hours)
00085	SetRtcDay	Set real time clock (day)
00086	SetRtcMonth	Set real time clock (month)
00087	SetRtcYear	Set real time clock (year)
00088	Bit 0: SetRtc	Triggers setting of real time clock (s/m/h/d/m/y format)
00089	StatusUNIXRealTimeClockHI	Real time clock (32 bit UNIX format)
00090	StatusUNIXRealTimeClockLO	
00091	StatusRtcSecond	Real time clock - seconds
00092	StatusRtcMinute	Real time clock - minutes
00093	StatusRtcHour	Real time clock - hours
00094	StatusRtcDay	Real time clock - day of month
00095	StatusRtcMonth	Real time clock - month
00096	StatusRtcYear	Real time clock - year (after 2000)
00097	Bit 0: StatusSetRTCAck	Acknowledge of set RTC command

8.4.1 Explanation to event trigger

State

Control bits with a state event trigger behave like a "state" that is forced upon the DDA pump. The CIM 200/500 will attempt to make the pump operate according to the "requested" state in the control registers 00101-00103. Due to certain state/mode restrictions, this might not always be possible (see explanation to the bit in question). The "actual state" of the pump can be read from the corresponding bit in the status registers 00201-00206.

Value change

Control bits/bytes with a value-change event trigger behave like a command that is executed when the bit/byte changes its value. The CIM 200/500 will attempt to make the DDA pump operate according to the "requested" value in the control registers 00101-00103. The change will be reflected in the corresponding bit/byte in the status registers 00201-00206. Bits/bytes that are controlled by a "value-change event trigger" can be controlled from both Modbus and the pump HMI. The last value change, no matter from which source, will become active if not prevented by other conditions (see explanation to the bit/byte in question).

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 status register 00203 which is set when the command is executed and cleared when the control bit is written back to "0".

8.5 Control registers

Modbus registers used for the control of the DDA pump.

Mode/state settings			
Address	Bit	Name	Event trigger
00101	0	RemoteAccessReq	State
	1	Deaerating (100 %)	Value change
	2	AnalogMode	Value change
	3	TimerMode	Value change
	4	SlowMode	Value change
	5	Velocity	Value change
	6-7	-	-
Enable/disable function			
Address	Bit	Name	Event trigger
00102	0	AutoDeaeratingEnable	Value change
	1	FlowControlEnable	Value change
	2	ModbusWatchdogEnable	Value change
	3	AutoFlowAdaptEnable	Value change
	4	PulseMemoryEnable	Value change
		5-7	-
Action commands			
Address	Bit	Name	Event trigger
00103	0	ResetFault	Rising edge
	1	Pulse	Rising edge
	2	ResetVolumeCounter	Rising edge
	3	SetRTC	Rising edge
		4-7	-
ReqStartStop [enumeration] Triggered by value change			
Address	Value	Name	
00104	0	ReqStart	
	1	ReqStop	
		2-255	-
OperatingMode [enumeration] Triggered by value change			
Address	Value	Name	
00105	0	Manual	
	1	Pulse	
	2	Analog	
	3	Timer	
	4	Batch	
	5-255	-	

8.5.1 Explanation to control bits in control registers

RemoteAccessReq

Control bit used by the CIM module to activate control from Modbus.

0: The pump can only be controlled via the pump HMI and from its external signal inputs. With this setting, all control bits in control registers and writing to any output module will have no influence.

1: The CIM module can control the pump according to the settings in the control registers and the writing to the other writable registers. The pump can also be controlled via the pump HMI and from its external signal inputs.

Deaerating

Control bit used to start and stop deaerating the pump.

0: Stop deaerating the pump.

1: Start deaerating the pump.
Equivalent to pressing .

If the pump has been stopped via the pump HMI (symbol ) , it is still possible to start and stop deaerating the pump from Modbus. If deaerating of the pump has been started from Modbus, it can be stopped by pressing  or  on the pump.

AnalogMode

Control bit used to select type of analog input signal.

0: 0-20 mA.

1: 4-20 mA.

The toggling of this bit has no effect unless the pump is in operating mode "Analog". The actual state (readable from corresponding status bit) will be reset to 4-20 mA whenever another operating mode is selected.

TimerMode

Control bit used to select timer mode.

Cycle timer mode.

0: The pump repeats a cyclical dosing of the batch volume which can be programmed from Modbus with data registers SetBatchDosingVolume and SetBatchDosingTime.

Week timer mode.

1: Up to 16 time-controlled dosing procedures are defined for a week. These procedures have to be programmed via the pump HMI.

SlowMode

Control bit used to slow down the suction stroke velocity.

0: SlowMode disabled.

No slow-down of suction stroke velocity.

SlowMode enabled.

1: Slows down the suction stroke velocity to the velocity selected with control bit Velocity.

Velocity

Control bit used to select SlowMode suction stroke velocity.

0: Select SlowMode velocity 50 %.

1: Select SlowMode velocity 25 %.

The toggling of this bit has no effect unless the pump operates in SlowMode. Will be reset to 50 % velocity whenever SlowMode is disabled.

AutoDeaeratingEnable

0:	Automatic pump deaeration disabled.
	Automatic pump deaeration enabled.
1:	The pump is automatically deaerated (degassed) at regular intervals.

Data register 00319 OutputRelays, bit 2, will signal whenever automatic pump deaeration is active.

FlowControlEnable

When the FlowControl function is enabled, various faults and deviations related to the dosing process will be detected and indicated.

0:	FlowControl function disabled.
1:	FlowControl function enabled.

The enabling/disabling of FlowControl means the enabling/disabling of all alarms/warnings that are associated with flow measurement. See section [8.10 Measurement data modules](#).

If the FlowControl function is disabled, the AutoFlowAdapt function (see control bits AutoFlowAdaptEnable) cannot be enabled.

ModbusWatchdogEnable

The Modbus software watchdog is used to monitor the Modbus connection. If the connection is broken, the DDA pump will stop dosing and indicate a Modbus communication fault. See section [8.11 Alarms and warning](#).

0:	Modbus software watchdog disabled.
1:	Modbus software watchdog enabled.

When "Bus control" is selected via the pump HMI, the Modbus watchdog is automatically enabled every time the pump is powered on. If Modbus communication is somehow interrupted (no communication with a Modbus master), this will be detected and the DDA pump will stop with an alarm indicating "bus error" (event code 15).

Enabling of Modbus will at the same time automatically enable the monitoring of the cable connection from the E-box to the DDA pump (event code 152).

After power-on, the Modbus master can at any time control the enabling and disabling of the Modbus software watchdog. The monitoring of the E-box cable connection will follow this choice.

When "Bus control" is disabled via the pump HMI, the Modbus software watchdog is also automatically disabled and so is the monitoring of the E-box connection.

AutoFlowAdaptEnable

The AutoFlowAdapt function detects changes in various parameters and responds accordingly to keep the flow constant. Dosing accuracy is increased when this function is enabled.

0:	AutoFlowAdapt function disabled.
1:	AutoFlowAdapt function enabled.

The AutoFlowAdapt function can only be enabled if the FlowControl function is also enabled.

PulseMemoryEnable

The pulse memory function can be used in operating mode "Pulse". When it is enabled, up to 65000 unprocessed pulses can be saved for subsequent processing.

0:	Pulse memory function disabled.
1:	Pulse memory function enabled.

ResetFault

When this control bit is toggled 0 → 1, the pump will attempt to reset pending alarms and warnings and to restart the pump if it was stopped due to an alarm.

Pulse

When this control bit is toggled 0 → 1, a pulse signal is sent to the pump. This can be used in operating modes "Pulse" and "Batch" and is equivalent to a pulse signal from the signal inputs.

ResetVolumeCounter

When this control bit is toggled 0 → 1, VolumeTripCounter (module 30) is reset to "0".

SetRTC

When this control bit is toggled 0 → 1, the internal real-time clock (RTC) in the DDA pump will be updated. The values must have been previously written to the SetDataTime (registers 00116-00122).

8.5.2 Explanation to control mode

Control enumeration for remote start/stop of the pump.

Value	Name
0	<p>ReqStart</p> <p>If the pump is ready to be controlled from Modbus (status register 00201: bit 0: ActRemoteAccess = "1"), this value will start the pump and it will start dosing according to the selected operating mode. If the pump is stopped via the pump HMI, it will restart when  is pressed.</p>
1	<p>ReqStop</p> <p>If the pump is ready to be controlled from Modbus (status register 00201: bit 0: ActRemoteAccess = "1"), this value will stop the pump and the pump HMI will show . If the pump is stopped from Modbus, it cannot be started via the pump HMI (unless "Bus control" is deselected). ReqStop cannot stop the pump when it is deaerating.</p>

8.5.3 Explanation to operating mode

Control enumeration for selection of operating mode.

Value	Name
0	<p>Manual</p> <p>In this operating mode, the pump constantly doses the dosing flow set via SetpointManual (register 00106-00107) or the pump HMI.</p>
1	<p>Pulse</p> <p>In this operating mode, the pump doses the volume set via SetPulseVolume (register 00108-00109) or the pump HMI for each incoming pulse. Reception of the pulse command from Modbus has the same effect as an incoming contact pulse signal.</p> <p>If the pump receives more pulses than it can process at the maximum dosing flow, excess pulses will be ignored if the memory function (PulseMemoryEnable bit) is not enabled.</p>
2	<p>Analog</p> <p>In this operating mode, the pump doses according to the external analog signal. It can operate according to a 4-20 mA or 0-20 mA signal selected via the AnalogMode bit or the pump HMI.</p> <p>If the input value in analog mode 4-20 mA falls below 2 mA, an alarm will be displayed and the pump will stop. The relation between analog signal and dosing value is called analog scaling and must be set via the pump HMI.</p>
3	<p>Timer</p> <p>The time the dosing should take place is controlled by a cyclic timer or by week timers. The selection is done via the TimerMode bit or the pump HMI. Some other parameters are related to timer dosing. They can only be programmed via the pump HMI.</p>
4	<p>Batch</p> <p>In this operating mode, the pump doses the volume set via SetBatchDosingVolume (register 00110-00111) over a time period of SetBatchDosingTime (register 00112-00113) for each incoming pulse (or Modbus Pulse command).</p> <p>The remaining batch volume during dosing can be read from RemainingDosingVolume (register 00310-00311).</p>

8.6 Dosing settings

Unless otherwise stated, the data type used for counters and scaled values is always an unsigned integer.

Address	Register name	Scale	Description
00106 00107	SetSetpointManualHI SetSetpointManualLO	0.1 ml/h	Setting of the setpoint used in operating mode "Manual". Can also be set via the pump HMI. The present value can always be read from ActualSetpointManual (register 00207-00208).
00108 00109	SetPulseVolumeHI SetPulseVolumeLO	1 nl	Setting of the pulse volume used in operating mode "Pulse". Can also be set via the pump HMI. The present value can always be read from ActualPulseVolume (register 00209-00210).
00110 00111	SetBatchDosingVolumeHI SetBatchDosingVolumeLO	0.001 ml	Setting of the batch dosing volume used in operating mode "Batch". Can also be set via the pump HMI. The present value can always be read from ActualBatchDosingVolume (register 00211-00212).
00112 00113	SetBatchDosingTimeHI SetBatchDosingTimeLO	0.1 s	Setting of the batch dosing time used in operating mode "Batch". Can also be set via the pump HMI. The present value can always be read from ActualBatchDosingTime (register 00213-00214).
00114	SetPressureMax	0.1 bar	Setting of the (relative) pressure alarm limit. Can also be set via the pump HMI. The present value can always be read from ActualPressureMax (register 00215).

8.7 Other settings

Unless otherwise stated, the data type used for counters and scaled values is always an unsigned integer.

Address	Register name	Scale	Description
00115	SetOutputRelays	Bits	Used to enable and disable the output relays 1 and 2. A relay has to be set to "Bus control" via the pump HMI if it is to be controllable from Modbus via the SetOutputRelays register. Via the pump HMI, the relays can also be individually configured to be of type NO or NC. Bit 0: Relay 1 control: 0: Not active 1: Active. Bit 1: Relay 2 control: 0: Not active 1: Active. The present status of the output relays can always be read from OutputRelays (register 00319).
00116	SetAnalogOutput	0.001 mA	Used to control the analog output signal. The type of signal (4-20 mA or 0-20 mA) follows the setting of the AnalogMode bit. The analog output has to be set to "Bus control" via the pump HMI if it is to be controllable from Modbus. The present value of the analog output signal can always be read from AnalogOutput (register 00317).
00117	SetDateTimeYear		Used to set the internal real-time clock (RTC). Year (from year 2000)
00118	SetDateTimeMonth		Month [1-12] Day [1-31] Hour [0-23] Minute [0-59]
00119	SetDateTimeDay		Second [0-59].
00120	SetDateTimeHour	BCD string	Each byte is a binary-coded decimal (BCD) value.
00121	SetDateTimeMinute		Example: 15:38:00, April 24 2011, is coded with hexadecimal numbers as: Year = 11h, Month = 04h, Day = 24h, Hour = 15h, Minute = 38h, Second = 00h. Can also be set via the pump HMI.
00122	SetDateTimeSecond		The present value of the real-time clock can always be read from the DateTime status registers 00220-00225.

8.8 Bus settings compared to pump HMI settings

Name	Selectable from HMI	Setting preserved during power-off
Mode/state settings		
RemoteAccessReq	No	Yes
Deaerating (100 %)	Yes	Yes/No*
AnalogMode	Yes	Yes
TimerMode	Yes	Yes
SlowMode	Yes	Yes
Velocity	Yes	Yes
Enable/disable function		
AutoDeaeratingEnable	Yes	Yes
FlowControlEnable	Yes	Yes
ModbusWatchdogEnable	Yes**	Yes
AutoFlowAdaptEnable	Yes	Yes
PulseMemoryEnable	Yes	Yes
Action commands		
ResetFault	Yes	-
Pulse	No	-
ResetVolumeCounter	Yes	-
SetRTC	Yes	-
Operation control		
ReqStart	Yes	Yes
ReqStop	Yes	No
OperatingMode	Yes	Yes
Dosing settings		
SetpointManual	Yes	Yes
SetPulseVolume	Yes	Yes
SetBatchDosingVolume	Yes	Yes
SetBatchDosingTime	Yes	Yes
SetFlowControlPressMax	Yes	Yes
Output signal control		
SetOutputRelay (value)	No	Yes
SetAnalogOutput (value)	No	Yes
SetDateTime	Yes	Yes

* Deaerating will be preserved if commanded from bus.

** Selecting and deselecting "Bus control" will implicitly enable and disable the Modbus watchdog and the monitoring of the E-box connection to the DDA pump.

8.9 Status registers

The following are Modbus registers used for the status of the DDA pump settings. The actual status of all the pump modes and states are reflected, no matter if it is a result of a pump HMI setting or a setting written from Modbus via the control registers (00101-00105).

Actual mode/state settings [bits]		
Address	Bit	Name
00201	0	ActRemoteAccess
	1	ActDeaerating (100 %)
	2	ActAnalogMode
	3	ActTimerMode
	4	ActSlowMode
	5	ActVelocity
	6-7	-
Actual enable/disable function [bits]		
Address	Bit	Name
00202	0	ActAutoDeaeratingEnable
	1	ActFlowControlEnable
	2	ActModbusWatchdogEnable
	3	ActAutoFlowAdaptEnable
	4	ActPulseMemoryEnable
	5-7	-
Action command acknowledgement [bits]		
Address	Bit	Name
00203	0	ResetFaultAck
	1	PulseAck
	2	ResetVolumeCounterAck
	3	SetRTCAck
	4-7	-
Miscellaneous status [bits]		
Address	Bit	Name
00204	0	Dosing (running)
	1	Warning
	2	Fault
	3	BusControlLocallyEnabled
	4-7	-
ActualStartStop [enumeration]		
Address	Value	Name
00205	0	Started
	1	Stopped
	2	Calibrating
	3	Service
	4-255	-
ActualOperatingMode [enumeration]		
Address	Value	Name
00206	0	Manual
	1	Pulse
	2	Analog
	3	Timer
	4	Batch
5-255	-	

8.9.1 Explanation to status bits

ActRemoteAccess

Status bit indicating whether the pump is in a state where it is controllable from Modbus.

-
- 0: The pump can only be controlled from its HMI and its external signal inputs. In this state, all control bits in ControlModule and writing to any output module will have no influence.
-
- 1: In this state, the pump can be controlled by the bit settings in the control register 00101 (as well as from the pump HMI and external signal inputs) and the writing to the other output modules. To enter this state, the control register 00101 bit 0 must be set and the pump must be started via the pump HMI by pressing .
-

ActDeaerating

Status bit indicating whether the pump is deaerating or not.

-
- 0: The pump is not deaerating.
-
- 1: The pump is deaerating.
-

ActAnalogMode

Status bit indicating the selected type of the analog input signal.

-
- 0: 0-20 mA.
4-20 mA.
-
- 1: This will always be the reading if the operating mode is not "Analog".
-

ActTimerMode

Status bit indicating the selected timer mode.

-
- 0: Cycle timer mode.
-
- 1: Week timer mode.
-

ActSlowMode

Status bit indicating whether SlowMode has been enabled.

-
- 0: SlowMode disabled.
No slow-down of suction stroke velocity.
-
- 1: SlowMode enabled.
Slows down the suction stroke velocity to the velocity selected with control bit "Velocity".
-

Velocity

Status bit indicating the selected SlowMode suction stroke velocity.

-
- 0: Selected SlowMode velocity 50 %.
This will always be the reading if SlowMode is disabled.
-
- 1: Selected SlowMode velocity 25 %.
-

ActAutoDeaeratingEnable

Status bit indicating whether automatic pump deaeration has been enabled.

-
- 0: Automatic pump deaeration disabled.
Automatic pump deaeration enabled.
-
- 1: OutputRelays (register 00319), bit 2, will signal whenever the automatic pump deaeration is active.
-

ActFlowControlEnable

Status bit indicating whether the FlowControl function has been enabled.

-
- 0: FlowControl function disabled.
-
- 1: FlowControl function enabled.
-

ActModbusWatchdogEnable

Status bit indicating whether the Modbus software watchdog has been enabled.

-
- 0: Modbus software watchdog disabled.
-
- 1: Modbus software watchdog enabled.
-

The Modbus software watchdog is automatically enabled/disabled when "Bus control" is selected/deselected via the pump HMI. The software watchdog can be enabled/disabled independently via Modbus.

ActAutoFlowAdaptEnable

Status bit indicating whether the AutoFlowAdapt function has been enabled.

-
- AutoFlowAdapt function disabled.
-
- 0: This will always be the reading if the FlowControl function is disabled.
-
- 1: AutoFlowAdapt function enabled.
-

ActPulseMemoryEnable

Status bit indicating whether the pulse memory function is enabled.

-
- 0: Pulse memory function disabled.
-
- 1: Pulse memory function enabled.
-

Dosing (running)

Status bit indicating whether the DDA pump is dosing (running) at the moment.

-
- 0: The pump is not dosing at the moment.
-
- 1: The pump is dosing at the moment.
-

Warning

Warning status bit.

-
- 0: No warning is present.
A warning is present.
-
- 1: The pump can, however, continue its precise dosing for the time being, but we recommend to have it serviced.
-

For further details about possible warnings and faults as well as the pump behaviour in these situations, see section [8.11 Alarms and warning](#).

Fault

Fault status bit. The pump will stop dosing as long as the fault is present.

-
- 0: No fault is present.
-
- 1: A fault is present, and the pump will remain stopped until the fault has been corrected.
-

For further details about possible warnings and faults as well as the pump behaviour in these situations, see section [8.11 Alarms and warning](#).

BusControlLocallyEnabled

Status bit indicating whether "Bus control" has been enabled in the "Settings" menu on the pump HMI.

	Bus control has not been enabled via the pump HMI.
0:	Setting of the RemoteAccess bit in control register 00101 has no effect.
1:	Bus control has been enabled via the pump HMI.

Explanation to command acknowledge bits (register 00203)

If the ActRemoteAccess bit is not set (status register 00201, bit 0, Modbus commands (and writings in general) will be prohibited and none of the acknowledge bits will ever be set. Command acknowledge bits can thus be used to check whether a command from a control register was sent or not.

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.

PulseAck

Acknowledge bit belonging to the pulse 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.

ResetVolumeCounterAck

Acknowledge bit belonging to the ResetVolumeCounter 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.

SetRTCAck

Acknowledge bit belonging to the SetRTC 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.

8.9.2 Explanation to ActualStartStop (register 00205)

Status enumeration for reading whether the pump is "Started", "Stopped", "Calibrating" or in "Service" mode:

Value	Name
	Started This has the following meaning for the different operating modes: <ul style="list-style-type: none"> "Manual": The pump will be dosing according to ActualSetpointManual (register 00207-00208). "Analog": The pump will be dosing according to the analog input signal and the analog scaling. "Pulse": The pump will be dosing according to the reception of pulses and the value of ActualPulseVolume (register 00209-00210). "Batch": The pump will be dosing according to the reception of pulses and the values of ActualBatchDosingVolume (register 00211-00212) and ActualBatchDosingTime (register 00213-00214). "Timer": The pump will be dosing according to the timer functions using the batch dosing settings.
0	
	Stopped The pump has been stopped by one of the control sources. The state of the control sources can be read from ControlSourceStates (register 00216).
1	
	Calibrating The pump is calibrating the dosing accuracy. This is only possible via the pump HMI by selecting "Calibration" in the "Settings" menu.
2	
	Service The pump has stopped and has been brought into service mode. This is only possible via the pump HMI and can be done by pressing  and  simultaneously.
3	

8.9.3 Explanation to ActualOperatingMode

Status enumeration for reading of the actual operating mode. For an explanation of these modes and the belonging enumeration, see section [8.5.3 Explanation to operating mode](#).

8.10 Measurement data modules

Unless otherwise stated, the data type used for counters and scaled values is always an unsigned integer.

Address	Register name	Scale	Description
00207	ActualSetpointManualHI	0.1 ml/h	The actual setpoint used in operating mode "Manual".
00208	ActualSetpointManualLO		Can be set via SetpointManual (register 00106-00107) or via the pump HMI.
00209	ActualPulseVolumeHI	1 nl	The actual pulse volume used in operating mode "Pulse".
00210	ActualPulseVolumeLO		Can be set via SetPulseVolume (register 00108-00109) or via the pump HMI.
00211	ActualBatchDosingVolumeHI	0.001 ml	The actual batch dosing volume used in operating mode "Batch".
00212	ActualBatchDosingVolumeLO		Can be set via SetBatchDosingVolume (register 00110-00111) or via the pump HMI.
00213	ActualBatchDosingTimeHI	0.1 s	The actual batch dosing time used in operating mode "Batch".
00214	ActualBatchDosingTimeLO		Can be set via SetBatchDosingTime (register 00112-00113) or via the pump HMI.
00215	ActualPressureMax	0.1 bar	Actual value of (relative) pressure alarm limit setting. Can be set via SetPressureMax (register 00114) or via the pump HMI.
00216	ControlSourceStates	Bits	Status of start/stop control sources, "1" means "Active". They can be active simultaneously. Bit 0: Stop via pump HMI Bit 1: External stop Bit 2: Stop from bus.
00217	FaultCode	Enum	See section 8.11 Alarms and warning .
00218	WarningCode	Enum	
00219	WarningBits	Bits	
00220	DateTimeYear	BCD string	Present value of the internal real-time clock (RTC). Can be set via SetDateTime (register 00117-00122) or via the pump HMI.
00221	DateTimeMonth		Year (from year 2000) Month [1-12]
00222	DateTimeDay		Day [1-31] Hour [0-23]
00223	DateTimeHour		Minute [0-59] Second [0-59]
00224	DateTimeMinute		Each byte is a binary-coded decimal (BCD) value.
00225	DateTimeSecond	Example 15:38:00, April 24 2011, is coded with hexadecimal numbers as: Year = 11h, Month = 04h, Day = 24h, Hour = 15h, Minute = 38h, Second = 00h.	
00301	DosingPressureMax	Bar	Maximum dosing pressure, fixed factory-set value for this pump type.
00302	DosingCapacityMaxHI	0.1 ml/h	Maximum dosing capacity, fixed factory-set value for this pump type.
00303	DosingCapacityMaxLO		
00304	DosingCapacityReferenceHI	0.1 ml/h	The dosing capacity setpoint shown in the pump display. It represents the actual setpoint belonging to the actual operating mode and dosing state.
00305	DosingCapacityReferenceLO		
00306	MeasuredDosingCapacityHI	0.1 ml/h	Measured (actual) dosing capacity.
00307	MeasuredDosingCapacityLO		FlowControl bit in control register 00102 must be enabled for this value to be available.
00308	MeasuredPressure	0.1 bar	Measured absolute pressure. FlowControl bit in control register 00102 must be enabled. Except for the atmospheric pressure, it corresponds to "Backpressure" reading in the display.
00309	PulseInputFrequency	1 Hz	Frequency of pulse input (external pulse input signal or Modbus Pulse command in control register 00103).
00310	RemainingDosingVolumeHI	0.001 ml	Actual remaining volume to be dosed. Used in "Batch" mode.
00311	RemainingDosingVolumeLO		
00312	VolumeTotalHI	0.001 l	Total volume dosed (non-resettable).
00313	VolumeTotalLO		
00314	VolumeTripCounterHI	0.001 l	Dosed-volume trip counter (reset with ResetVolumeCounter command in control register 00103).
00315	VolumeTripCounterLO		
00316	AnalogInput	0.001 mA	Analog input signal 0-20 mA or 4-20 mA (used as setpoint in "Analog" mode).
00317	AnalogOutput	0.001 mA	Analog output signal. The parameter to map to the output is selected via the pump HMI. If control from Modbus is selected, the analog output signal will be controlled from SetAnalogOutput (register 00116).

Address	Register name	Scale	Description
			Status of the external digital inputs. Logical "0": The input is not active. Logical "1": The input is active.
00318	DigitalInputs	Bits	The relay input type (NO or NC) is selected via the pump HMI. Signals are fixed to the following: Bit 0: Low-level signal Bit 1: Empty signal Bit 2: External stop.
			Status of the two output relays. Logical "0": The output is not active. Logical "1": The output is active. The relay output type (NO or NC) is selected via the pump HMI.
00319	OutputRelays	Bits	The output relay modules are defined as follows: Bit 0: Relay 1 (select signal parameter via the pump HMI). Bit 1: Relay 2 (select signal parameter via the pump HMI). Bit 2: Auto-deaerating (deaerating valve open). If "Bus control" has been selected as the relay signal parameter, the relay can be controlled from SetOutputRelays (register 00115).
00320	NumberOfPowerOns	-	Counts the number of times the pump has been powered on (non-resettable).
00321	RunTimeHI	1	Counts the time the DDA pump has been dosing (non-resettable).
00322	RunTimeLO		
00323	OperatingHoursHI	1 s	Counts the number of hours the DDA pump has been switched on. It counts both when the pump is dosing and when it is not dosing.
00324	OperatingHoursLO		
00325	StrokeCounterHI	-	Counts the number of strokes (non-resettable).
00326	StrokeCounterLO		
00327	TimeToNextDosingHI	1 s	Time before the next dosing takes place (only in "Timer" mode).
00328	TimeToNextDosingLO		

8.11 Alarms and warning

Address	Name	Description
00217	FaultCode	Code for active pump alarm. See event code in the table below.
00218	WarningCode	Code for first active pump warning. See event code in the table below. All active warnings. The belonging event code in parenthesis.
		Byte 1 Bit 0:Backpressure low (211)* Bit 1:Air bubbles (35)* Bit 2:Cavitation (208)* Bit 3:Discharge valve leakage (36)* Bit 4:Suction valve leakage (37)* Bit 5:-- reserved --
00219	WarningBits	Bit 6:Service now (12) Bit 7:Service soon (33) Byte 2 Bit 0:Low level in tank (206) Bit 1:-- reserved -- Bit 2:FlowControl cable breakdown (169)* Bit 3:- Bit 4:- Bit 5:Flow deviation (17)* Bit 6:- Bit 7:-

* Requires FlowControlEnable bit in control register 00102 to be set.

In case of a pump alarm or pump warning, the registers WarningCode and FaultCode will contain an event code for the cause of the problem.

The complete list of possible alarm/warning codes from a DDA pump is shown in the table below.

Alarm events will make the pump stop. Some of them require acknowledgement of the alarm before the pump can be restarted. This acknowledgement can come from the pump HMI or Modbus by using the ResetFault command in control register 00103.

The pump can only indicate one active alarm at a time, even when there are many simultaneously active warnings. The complete status of warnings can be read from the WarningBits register.

Event code	Event group	Event description	Depends on FlowControl enabled	Event action	Auto-acknowledge
210	Pump head	Maximum pressure limit exceeded. ActualPressureMax (register 00215).	Yes	Alarm	Yes
211	Pump head	Backpressure too low. Fixed underpressure limit (1.5 bar).	Yes	Alarm/ Warning ¹⁾	Yes
35	Pump head	Air bubbles, gas in pump head, deaerating problem.	Yes	Warning	Yes
208	Pump head	Cavitation.	Yes	Warning	Yes
36	Pump head	Discharge (pressure) valve leakage.	Yes	Warning	Yes
37	Pump head	Suction valve leakage.	Yes	Warning	Yes
12	Pump head	Service now (time for service exceeded).	No	Warning	No
33	Pump head	Soon time for service (general service information).	No	Warning	No
17	Pump head	Flow deviation (performance requirement not met).	Yes	Warning	Yes
51	Pump head	Blocked motor/pump.	No	Alarm	Yes
206	Tank	Low level in tank.	No	Warning	Yes
57	Tank	Empty tank (dry running).	No	Alarm	Yes
169	Input signals	Cable breakdown on FlowControl.	Yes	Warning	Yes
97	Input signals	Defective analog 4-20 mA cable.	No	Alarm	Yes
15	Communication	Modbus communication fault (main network communication fault).	No	Alarm ²⁾	No
152	Communication	Extension box communication fault (GENIbus communication fault). Defective cable between E-box and DDA pump.	No	Alarm ²⁾	No

¹⁾ Warning or alarm is selected in the "Settings" menu via the pump HMI.

²⁾ An alarm only occurs when the ActModbusWatchdogEnable bit has been set.

See sections [8.5.1 Explanation to control bits in control registers](#) and [8.9.1 Explanation to status bits](#).

8.12 Device identification (DeviceIdentification)

The data type is 10, non-standard.

Address	Name/description																				
	<table border="1"> <thead> <tr> <th>UnitFamily [enumeration]</th> <th>UnitType [enumeration]</th> </tr> </thead> <tbody> <tr> <td>1: UPE/MAGNA circulator pump</td> <td>5: UPE, 3-phase 7: MAGNA, 1-phase 9: MAGNA, 1-phase, small 10: MAGNA3</td> </tr> <tr> <td>2: E-pump, 1-phase/3-phase, based on MGE motor or CUE frequency converter</td> <td>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</td> </tr> <tr> <td>7: MP 204 motor protector</td> <td>1: MP 204</td> </tr> <tr> <td>17: Hydro Multi-E model G and earlier models</td> <td>1: With 3-phase pumps 2: With 1-phase pumps</td> </tr> <tr> <td>21: Hydro MPC/Control MPC, Hydro Multi-B</td> <td>1: Hydro MPC/Control MPC, CU 351 2: Hydro Multi-B, CU 323</td> </tr> <tr> <td>25: CR Monitor</td> <td>1: CR Monitor, CU 351</td> </tr> <tr> <td>26: Dedicated Controls</td> <td>1: Dedicated Controls, CU 361</td> </tr> <tr> <td>30: Smart Digital Dosing, DDA</td> <td>1: Smart Digital Dosing, DDA</td> </tr> <tr> <td>39: Hydro Multi-E model H and later models</td> <td>1: With 3-phase pumps 2: With 1-phase pumps</td> </tr> </tbody> </table>	UnitFamily [enumeration]	UnitType [enumeration]	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 and earlier models	1: With 3-phase pumps 2: With 1-phase pumps	21: Hydro MPC/Control MPC, Hydro Multi-B	1: Hydro MPC/Control MPC, CU 351 2: Hydro Multi-B, CU 323	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 and later models	1: With 3-phase pumps 2: With 1-phase pumps
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00030																					
00031	UnitType [enumeration] According to description above.																				
00032	UnitVersion [enumeration] Used by Grundfos.																				

9. Modbus RTU commissioning, step-by-step guides

Note If the sensor configuration is changed, restart the CIM unit to ensure a correct scaling of the sensor value.

9.1 Hardware setup (CIM 200)

Step	Action
1	Install the CIM 200 in the Grundfos E-box according to the E-box documentation.
2	Select the Modbus slave address (1-247) using the pump HMI.
3	Select the transmission speed of the Modbus slave. See section 5.1 Setting the Modbus transmission speed .
4	Select parity and stop bits of the Modbus slave (even parity with 1 stop bit or no parity with 2 stop bits). See section 5.2 Setting the parity .
5	If necessary, set line termination. See section 5.4 Termination resistor .
6	Connect the necessary cables from the CIM 200 to the Modbus network.
7	Confirm that the GENIbus LED is constantly green and that the Modbus LED is either off (if no master is actively polling the slave) or flashing green (indicating error-free communication). See section 5.5 Status LEDs .

The CIM 200 is now ready to be accessed via the Modbus network.

9.2 Modbus TCP communication setup (CIM 500)

Step	Action
1	Install the CIM 500 in the Grundfos E-box according to the E-box documentation.
2	Select position 1 at the protocol rotary switch. See section 6.2 Setting the Industrial Ethernet protocol .
3	Power on the pump, and observe LED2 turn steady green and LED1 remaining off.
4	Connect one of the CIM 500 Ethernet ports (RJ45) to a PC using an Ethernet cable.
5	Configure the PC Ethernet port to the same subnetwork as the CIM 500 (e.g. 192.168.1.1) and the subnet mask to 255.255.255.0. See section A.1 How to configure an IP address on your PC on page 33.
6	Open your internet browser and make contact to the CIM 500 Web server. Factory default address: 192.168.1.100
7	Log on to the Web server, factory default: User: admin Password: Grundfos
8	In the menu column to the left select: Configuration > Real time Ethernet protocol
9	Type in an IP address belonging to the same subnet as your PC (e.g. 192.168.1.2).
10	Type in the subnet mask 255.255.255.0, and leave the rest of the settings at their factory default values.
11	Click [Submit] to transfer the new settings, and close the Web browser.

CIM 500 is now ready to be accessed from a Modbus TCP master via one of its Ethernet ports. Use the IP address selected under step 9. The Modbus address (Unit ID) in the Modbus TCP telegram is not used.

- The CIM 500 LED 1 will be flashing green when Modbus TCP communication takes place.
- You can use the two Ethernet ports for daisy chaining of CIM 500 modules.
- It is possible to have connection to the Web server simultaneously with a connection to a Modbus TCP master.
- It is possible to have connection to more Modbus TCP masters simultaneously, e.g. to have connection to PC Tool CIM while connected to another Modbus TCP master.

10. Fault finding

10.1 CIM 200

Faults in a CIM 200 can be detected by observing the status of the two communication LEDs. See the table below and section [4. Specifications](#).

10.1.1 LED status

Fault (LED status)	Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected.	a) The CIM 200 is fitted incorrectly in the Grundfos E-box.	Ensure that the CIM 200 is fitted/connected correctly.
	b) The cable from the E-box to the DDA pump is improperly connected or defective.	Check the cable connection between the E-box and DDA pump.
	c) The CIM 200 is defective.	Replace the CIM 200.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIM 200 and the E-box to the DDA pump.	Check that the CIM 200 is fitted correctly in the E-box and that the cable connection between the E-box and DDA pump is fitted correctly.
3. The LED for internal communication (LED2) is constantly red.	a) The CIM 200 does not support the E-box connected.	Contact the nearest Grundfos company.
4. The Modbus LED (LED1) is constantly red.	a) Fault in the CIM 200 Modbus configuration.	<ul style="list-style-type: none"> • Check the transmission speed (switches SW4 and SW5). If the switches are set to "software-defined", an invalid value may have been set via Modbus. Try one of the preselected transmission speeds, e.g. 19200 bits/s. • Check that the Modbus address (switches SW6 and SW7) has a valid value [1-247].
		<ul style="list-style-type: none"> • Check the transmission speed (switches SW4 and SW5). See section 5.1 Setting the Modbus transmission speed. • Check the parity setting (switch SW3). See section 5.2 Setting the parity. • Check the cable connection between the CIM 200 and the Modbus network. • Check the termination resistor settings (switches SW1 and SW2). See section 5.4 Termination resistor.
5. The Modbus LED (LED1) is flashing red.	a) Fault in the Modbus communication (fault in parity or cyclic redundancy check).	<ul style="list-style-type: none"> • Check the transmission speed (switches SW4 and SW5). See section 5.1 Setting the Modbus transmission speed. • Check the parity setting (switch SW3). See section 5.2 Setting the parity. • Check the cable connection between the CIM 200 and the Modbus network. • Check the termination resistor settings (switches SW1 and SW2). See section 5.4 Termination resistor.

10.1.2 CIM 200 Modbus communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams.	a) Configuration or wiring error.	<ul style="list-style-type: none"> • Check the visual diagnostics on the Modbus slave. Is the Grundfos GENIbus LED flashing green and the Modbus LED off or flashing green? • Ensure that the cable between the Modbus master and the Modbus slave is connected correctly. See section 5. Modbus RTU, CIM 200 setup for wiring recommendations. • Ensure that the slave address is configured correctly, and that the correct slave address is used in the Modbus master poll. See section 5.3 Modbus address selection for slave address selection. • Ensure that the transmission speed and stop bit/parity settings are configured correctly in both master and slave. • Ensure that each end of the Modbus trunk cable is terminated, if necessary. See section 5.4 Termination resistor for line termination of the Grundfos slave. • Ensure that the bus topology for a Modbus network is correct.
	b) The slave may be in listen-only mode.	Either send a restart communications diagnostics command, or restart the DDA pump manually.
	c) If the holding register of address 00001 "SlaveMinimumReplyDelay" is set too high, the master may time out before receiving the response from the slave.	Increase the timeout span in the master in order to communicate.
2. The slave responds with exception response 0x01: "Invalid function".	a) The master is trying to use an unsupported function in the CIM 200.	See section 7. Modbus function code overview for supported function codes. Note that reading and writing coils are not supported, so only register functions and diagnostics will be valid.
3. The slave responds with exception response 0x02: "Invalid data address".	a) The master is trying to read or write an invalid data address. If a master tries to read register addresses that are not listed in the tables, the slave will respond with this exception response. Some masters may automatically try to read large blocks in one telegram, which will cause problems if some of the registers in the block are not supported. An example would be reading the CIM configuration and CIM status blocks in one telegram. This is not possible since there are unused addresses between the blocks.	<ul style="list-style-type: none"> • Avoid reading or writing invalid data addresses. • Ensure that register X is addressed as X - 1 in Modbus telegrams, according to the Modbus standard.
	b) The register address offset may have been changed from default.	Read the holding register at address 00002 "Register Offset" to see if this value is different from 0. If so, write the value 0 to this address to make the slave return to the default used in this functional profile.
4. The slave returns data value 0xFFFF (65535).	a) The value is unavailable. A data value of 0xFFFF does not necessarily indicate an error condition. It means that the value is unavailable from the DDA pump.	See section 8. Modbus register addresses for available data.
5. The slave does not change Modbus transmission speed with register 0004.	a) Configuration error.	Set the transmission speed switches to "Software-defined". Otherwise, the value in register 0004 is ignored by the slave.
	b) An invalid value may be set in register 00004.	See section 5.1 Setting the Modbus transmission speed for invalid values, and set correct value in register 00004.

10.2 CIM 500

Faults in the CIM 500 can be detected by observing the status of the two communication LEDs. See the table below and section [4.3 CIM 500 Modbus TCP](#).

10.2.1 LED status

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 cable from the E-box to the DDA pump is improperly connected or defective.	Check the cable connection between the E-box and DDA pump.
	c) The CIM 500 is defective.	Replace the CIM 500.
2. 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 E-box and that the cable connection between the E-box and DDA pump is fitted correctly.
3. 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.
4. The Modbus LED (LED1) is permanently red.	a) Fault in the CIM 500 Modbus TCP configuration.	Check that the rotary switch SW1 is set to 1. Check that Modbus TCP IP address configuration is correct. See section A.4 Modbus TCP configuration on page 34.
5. LED1 is permanently red and green at the same time.	a) Error in firmware download.	Use the Web server to download the firmware again.
6. LED2 is permanently red and green at the same time.	a) Memory fault.	Replace the CIM 500.

10.2.2 CIM 500 Modbus TCP communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams	a) Configuration or wiring error	<ul style="list-style-type: none"> • Check the visual diagnostics on the Modbus slave. Normal conditions are that the Grundfos GENiBus LED (LED2) is constantly green and that the Modbus TCP LED (LED1) is off or flashing green. If not, see section 10.2.1 LED status. • Ensure that the cable between the Modbus TCP master and the Modbus slave is connected correctly. See section 6.1 Connecting the Ethernet cable. • Ensure that the slave IP address is configured correctly, and that the correct slave IP address is used in the Modbus master poll. See section 6.3 Setting up the IP addresses.
2. The slave responds with exception response 0x01 "Invalid function"	a) The master is trying to use an unsupported function in the CIM 500.	See section 7. Modbus function code overview for supported function codes. Note that reading and writing coils are not supported, so only register functions and diagnostics will be valid.
3. The slave responds with exception response 0x02 "Invalid data address"	a) The master is trying to read or write an invalid data address. If a master tries to read register addresses that are not listed in the tables, the slave will respond with this exception response. Some masters may automatically try to read large blocks in one telegram, which will cause problems if some of the registers in the block are not supported. An example would be reading the CIM configuration and CIM status blocks in one telegram: this is not possible since there are unused addresses between the blocks.	Avoid reading or writing invalid data addresses. Ensure that a block of registers starting at address X is addressed as X - 1 in Modbus telegrams, according to the Modbus standard.
	b) The register address offset may have been changed from default.	Read the holding register at address 00002 "Register Offset" to see if this value is different from 0. If so, write the value 0 to this address to make the slave return to the default used in this functional profile.
4. The slave returns data value 0xFFFF (65535)	a) The value is unavailable. A data value of 0xFFFF does not necessarily indicate an error condition. It means that the value is unavailable from the DDA pump.	See section 8. Modbus register addresses for available data.
5. The slave does not react to control actions or to writing of settings.	a) The DDA pump might be in "Local" mode, in which case Operating mode, Control mode and Setpoint cannot be changed from bus. Register 00201 bit 8 AccessMode must be "1" (= Remote) for bus control to be active.	Set the DDA pump in "Remote mode" by setting register 00101 bit 0 RemoteAccessReq to "1" (= Remote). The DDA pump should show "Controlled from bus" when status is read by handheld controller GO Remote or R100.

11. Grundfos alarm and warning codes

This is a complete list of alarm and warning codes for Grundfos products. Not all codes apply to all Grundfos products.

Code	Description	Code	Description	Code	Description
1	Leakage current	78	Fault, speed plug	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing
2	Missing phase	79	Functional fault, add-on module	183	Signal fault, extra temperature sensor
3	External fault signal	80	Hardware fault, type 2	184	Signal fault, general-purpose sensor
4	Too many restarts	81	Verification error, data area (RAM)	185	Unknown sensor type
5	Regenerative braking	82	Verification error, code area (ROM, FLASH)	186	Signal fault, power meter sensor
6	Mains fault	83	Verification error, FE parameter area (EEPROM)	187	Signal fault, energy meter
7	Too many hardware shutdowns	84	Memory access error	188	Signal fault, user-defined sensor
8	PWM switching frequency reduced	85	Verification error, BE parameter area (EEPROM)	189	Signal fault, level sensor
9	Phase sequence reversal	88	Sensor fault	190	Limit exceeded, sensor 1 (e.g. alarm level in WW application)
10	Communication fault, pump	89	Signal fault, (feedback) sensor 1	191	Limit exceeded, sensor 2 (e.g. high level in WW application)
11	Water-in-oil fault (motor oil)	90	Signal fault, speed sensor	192	Limit exceeded, sensor 3 (e.g. overflow level in WW application)
12	Time for service (general service information)	91	Signal fault, temperature 1 sensor	193	Limit exceeded, sensor 4 (e.g. low level in WW/tank filling application)
13	Moisture alarm, analog	92	Calibration fault, (feedback) sensor	194	Limit exceeded, sensor 5
14	Electronic DC-link protection activated (ERP)	93	Signal fault, sensor 2	195	Limit exceeded, sensor 6
15	Communication fault, main system (SCADA)	94	Limit exceeded, sensor 1	196	Operation with reduced efficiency
16	Other	95	Limit exceeded, sensor 2	197	Operation with reduced pressure
17	Performance requirement cannot be met	96	Setpoint signal outside range	198	Operation with increased power consumption
18	Commanded alarm standby (trip)	97	Signal fault, setpoint input	199	Process out of range (monitoring/estimation/calculation/control)
19	Diaphragm break (dosing pump)	98	Signal fault, input for setpoint influence	200	Application alarm
20	Insulation resistance low	99	Signal fault, input for analog setpoint	201	External sensor input high
21	Too many starts per hour	104	Software shutdown	202	External sensor input low
22	Moisture switch alarm, digital	105	Electronic rectifier protection activated (ERP)	203	Alarm on all pumps
23	Smart trim gap alarm	106	Electronic inverter protection activated (EIP)	204	Inconsistency between sensors
24	Vibration	110	Skew load, electrical asymmetry	205	Level float switch sequence inconsistency
25	Setup conflict	111	Current asymmetry	206	Water shortage, level 1
26	Load continues even if the motor has been switched off	112	Cos ϕ too high	207	Water leakage
27	External motor protector activated (e.g. MP 204)	113	Cos ϕ too low	208	Cavitation
28	Battery low	120	Auxiliary winding fault (single-phase motors)	209	Non-return valve fault
29	Turbine operation (impellers forced backwards)	121	Auxiliary winding current too high (single-phase motors)	210	High pressure
30	Change bearings (specific service information)	122	Auxiliary winding current too low (single-phase motors)	211	Low pressure
31	Change varistor(s) (specific service information)	123	Start capacitor, low (single-phase motors)	212	Diaphragm tank precharge pressure out of range
32	Overvoltage	124	Run capacitor, low (single-phase motors)	213	VFD not ready
33	Soon time for service (general service information)	144	Motor temperature 3 (Pt100, t _{mo3})	214	Water shortage, level 2
35	Gas in pump head, deaerating problem	145	Bearing temperature high (Pt100), in general or top bearing	215	Soft pressure build-up timeout

Code	Description	Code	Description	Code	Description
36	Discharge valve leakage	146	Bearing temperature high (Pt100), middle bearing	216	Pilot pump alarm
37	Suction valve leakage	147	Bearing temperature high (Pt100), bottom bearing	217	Alarm, general-purpose sensor high
38	Vent valve defective	148	Motor bearing temperature high (Pt100) in drive end (DE)	218	Alarm, general-purpose sensor low
40	Undervoltage	149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	219	Pressure relief not adequate
41	Undervoltage transient	152	Communication fault, add-on module	220	Fault, motor contactor feedback
42	Cut-in fault (dV/dt)	153	Fault, analog output	221	Fault, mixer contactor feedback
45	Voltage asymmetry	154	Communication fault, display	222	Time for service, mixer
48	Overload	155	Inrush fault	223	Maximum number of mixer starts per hour exceeded
49	Overcurrent (i_line, i_dc, i_mo)	156	Communication fault, internal frequency converter module	224	Pump fault (due to auxiliary component or general fault)
50	Motor protection function, general shutdown (MPF)	157	Real-time clock out of order	225	Communication fault, pump module
51	Blocked motor/pump	158	Hardware circuit measurement fault	226	Communication fault, I/O module
52	Motor slip high	159	CIM fault (Communication Interface Module)	227	Combi event
53	Kipped motor	160	GSM modem, SIM card fault	228	User-defined event
54	Motor protection function, 3 sec. limit	161	Sensor supply fault, 5 V	229	Water on floor
55	Motor current protection activated (MCP)	162	Sensor supply fault, 24 V	230	Network alarm
56	Underload	163	Measurement fault, motor protection	231	Ethernet: No IP address from DHCP server
57	Dry running	164	Signal fault, LiqTec sensor	232	Ethernet: Auto-disabled due to misuse
58	Low flow	165	Signal fault, analog input 1	233	Ethernet: IP address conflict
59	No flow	166	Signal fault, analog input 2	234	Back-up pump alarm
60	Low input power	167	Signal fault, analog input 3	235	Gas detected
64	Overtemperature	168	Signal fault, pressure sensor	236	Pump 1 fault
65	Motor temperature 1 (t_m or t_mo or t_mo1)	169	Signal fault, flow sensor	237	Pump 2 fault
66	Temperature, control electronics (t_e)	170	Signal fault, water-in-oil (WIO) sensor	238	Pump 3 fault
67	Temperature too high, internal frequency converter module (t_m)	171	Signal fault, moisture sensor	239	Pump 4 fault
68	External temperature/water temperature (t_w)	172	Signal fault, atmospheric pressure sensor	240	Lubricate bearings (specific service information)
69	Thermal relay 1 in motor (e.g. Klixon)	173	Signal fault, rotor position sensor (Hall sensor)	241	Motor phase failure
70	Thermal relay 2 in motor (e.g. thermistor)	174	Signal fault, rotor origo sensor	242	Automatic motor model recognition failed
71	Motor temperature 2 (Pt100, t_mo2)	175	Signal fault, temperature 2 sensor (t_mo2)	243	Motor relay has been forced (manually operated/commanded)
72	Hardware fault, type 1	176	Signal fault, temperature 3 sensor (t_mo3)	244	Fault, On/Off/Auto switch
73	Hardware shutdown (HSD)	177	Signal fault, Smart trim gap sensor	245	Pump continuous runtime too long
74	Internal supply voltage too high	178	Signal fault, vibration sensor	246	User-defined relay has been forced (manually operated/commanded)
75	Internal supply voltage too low	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing	247	Power-on notice (device/system has been switched off)
76	Internal communication fault	180	Signal fault, bearing temperature sensor (Pt100), middle bearing	248	Fault, battery/UPS
77	Communication fault, twin-head pump	181	Signal fault, PTC sensor (short-circuited)		

Subject to alterations.

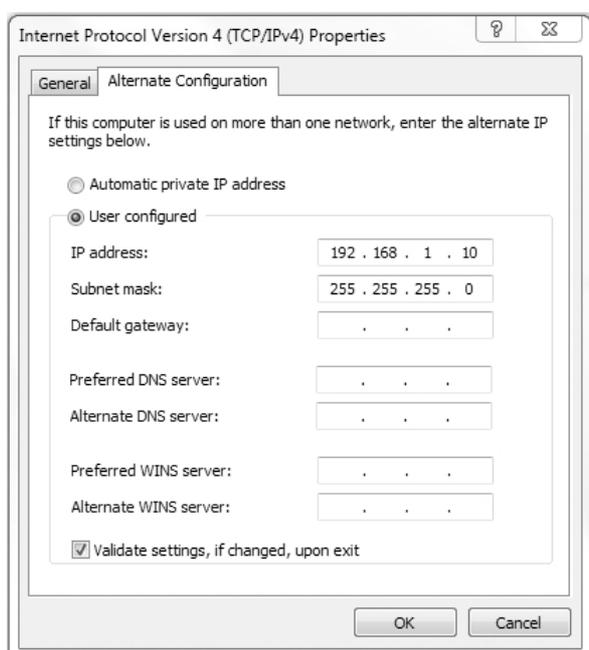
Appendix

The appendix describes the parts of the CIM 500 web server needed for the configuration of a Modbus TCP Ethernet connection. For other CIM 500 web server features, not specifically related to Modbus TCP, 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.



TM05 7422 1814

Fig. 1 Example from Windows 7

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.

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

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 the CIM 500 for the first time, the following steps are required:

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

A.4 Modbus TCP configuration

Fig. 3 Real Time Ethernet Protocol Configuration - Modbus TCP

Object	Description
TCP Port Number	The default value is 502, the official IANA-assigned Modbus TCP port number. Number 502 will always be active implicitly. If you select another value in the web server configuration field, both the new value and value 502 will be active.
IP Address	The static IP address for CIM 500 on the Modbus TCP network.
Subnet Mask	The subnet mask for the CIM 500 module on the Modbus TCP network.
Gateway	The default gateway for the Modbus TCP network.
Use DHCP	The CIM 500 module can be configured to automatically obtain the IP address from a DHCP server on the network.

Argentina

Bombas GRUNDFOS de Argentina S.A.
Ruta Panamericana km. 37.500 Centro
Industrial Garin
1619 Garin 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.
Boomssesteenweg 81-83
B-2630 Aartselaar
Tél.: +32-3-870 7300
Télécopie: +32-3-870 7301

Belarus

Представительство ГРУНДФОС в
Минске
220125, Минск
ул. Шафарьянская, 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

Bosna 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
Mestarintie 11
FIN-01730 Vantaa
Phone: +358-(0)207 889 900
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

HILGE GmbH & Co. KG

Hilgestrasse 37-47
55292 Bodenheim/Rhein
Germany
Tel.: +49 6135 75-0
Telefax: +49 6135 1737
e-mail: hilge@hilge.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 Mahaballipuram Road
Thoraiakkam
Chennai 600 096
Phone: +91-44 2496 6800

Indonesia

PT GRUNDFOS Pompa
Jl. Rawa Sumur III, Blok III / CC-1
Kawasan Industri, Pulogadung
Jakarta 13930
Phone: +62-21-460 6909
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.
Gotanda Metalion Bldg., 5F,
5-21-15, Higashi-gotanda
Shiagawa-ku, Tokyo
141-0022 Japan
Phone: +81 35 448 1391
Telefax: +81 35 448 9619

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
Stramsveien 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.
Prievozska 4D
821 09 BRATISLAVA
Phona: +421 2 5020 1426
sk.grundfos.com

Slovenia

GRUNDFOS d.o.o.
Štandrova 8b, SI-1231 Ljubljana-Črnuče
Phone: +386 31 718 808
Telefax: +386 (0)1 5680 619
E-mail: slovenia@grundfos.si

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 Chaloom 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 10.03.2015

98473491 0715

ECM: 1162991
