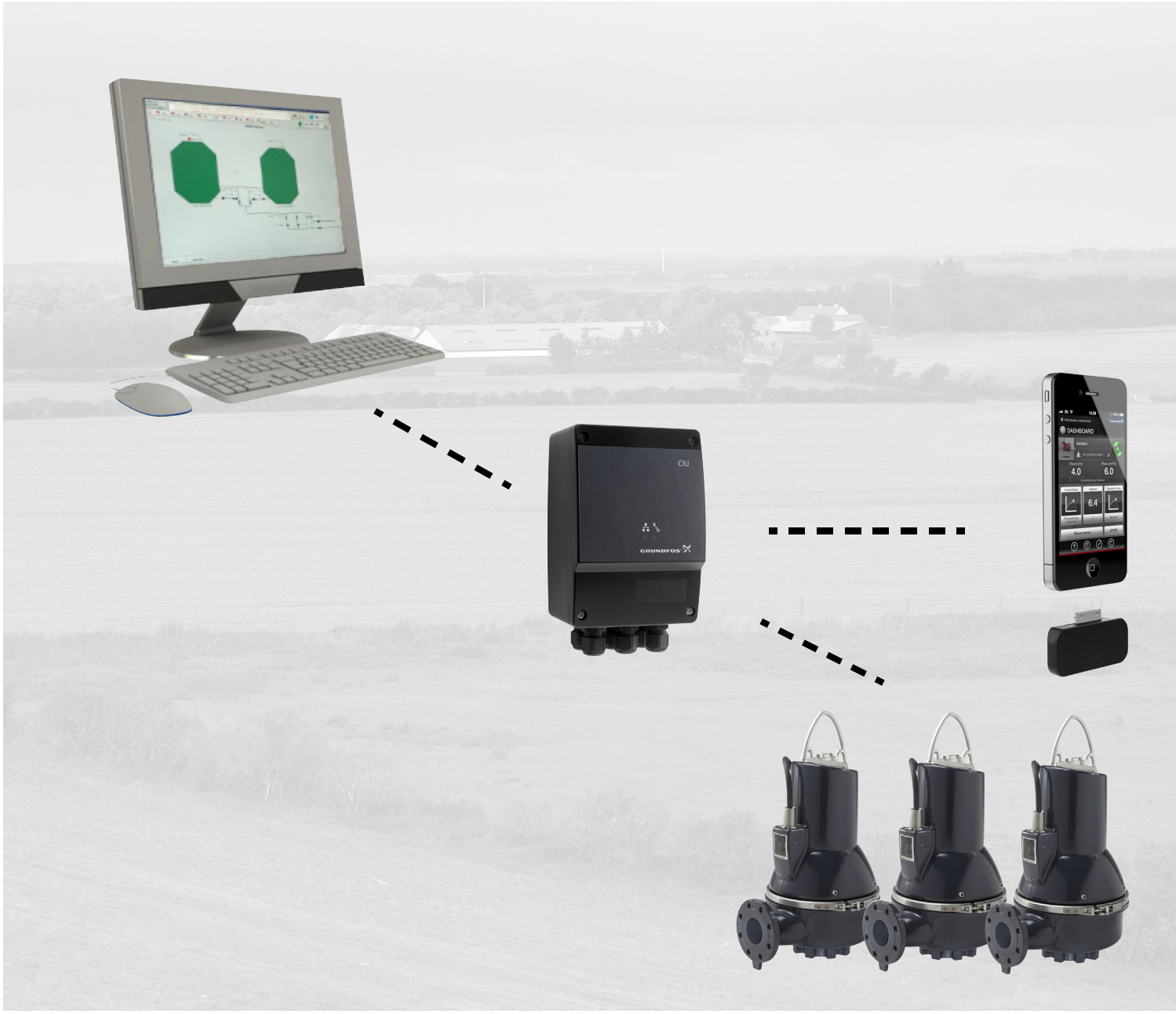
Modbus for SEG Auto*Adapt*

CIU 202 Modbus RTU
CIU 252 GSM/GPRS
CIU 502 Ethernet for Modbus TCP

Functional profile and user manual



be
think
innovate

GRUNDFOS

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.

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

Note ***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

- CIU 202 Modbus RTU
- CIU 252 Modbus GSM/GPRS
- CIU 502 Modbus Ethernet for Modbus TCP

for the Grundfos DP, EF, SL1, SLV and SEG AUTO$_{ADAPT}$ wastewater pumps.

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 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

3G	3rd-generation mobile telephony network.
4G	4th-generation mobile telephony network.
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 type: Has 4 twisted pairs of wires.
CAT5e	Enhanced CAT5 cable with better performance.
CAT6	Cable with very high performance.
CIM	Communication Interface Module.
CIU	Communication Interface Unit.
CRC	Cyclic Redundancy Check, a data error detection method.
DHCP	Dynamic Host Configuration Protocol. Used to configure network devices so that they can communicate on an IP network.
DNS	Domain Name System. Used to resolve host names to IP addresses.
GENIbus	Proprietary Grundfos fieldbus standard.
GENIpro	Proprietary Grundfos fieldbus protocol.
GPRS	General Packet Radio Service, technology to achieve TCP/IP communication and internet access via GSM.
Grundfos GO	A Grundfos handheld remote control device for controlling Grundfos products via infrared or radio. Based on smart phone technology.
GSM	Global System for Mobile communications.
H	Pressure (Head).
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.
PIN	Personal Identification Number (SIM cards).
Ping	Packet InterNet Groper. A software utility that tests connectivity between two TCP/IP hosts.
PUK	Personal Unblocking Key (SIM cards).
Q	Flow.
R100	Grundfos handheld infrared remote control.
SELV	Separated or Safety Extra-Low Voltage.
SELV-E	Separated or Safety Extra-Low Voltage with Earth connection.
SIM	SIM card, Subscriber Identity Module.
SMA	SubMiniature version A.Coaxial radio signal cable connection standard.
SMTP	Simple Mail Transfer Protocol
SNTP	Simple Network Time Protocol. Used for clocks synchronization between computer systems.
TCP	Transmission Control Protocol. Protocol suitable for Internet communication and Industrial Ethernet communication.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol suitable 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).
VPN	Virtual Private Network. A network using the Internet to connect nodes. These systems use encryption and other security mechanisms to ensure that only authorised users can access the network and that the data cannot be intercepted.

3. System description

The system diagrams provide an overview for the different technologies of how to connect the CIU XX2 to the Grundfos AUTO$_{ADAPT}$ pump that is to be connected to a Modbus network.

The CIU XX2 unit constitutes a communication interface to a system consisting of up to four Grundfos DP, EF, SL1, SLV or SEG AUTO$_{ADAPT}$ wastewater pumps installed in one or more pump pits. The pumps connect to the CIU XX2 running communication over a separate pair of wires.

Each pump has an integrated pressure sensor that enables it to monitor the water level in the pump pit according to a common reference level and an intermittent operation scheme.
By monitoring the water level, the pump will obtain enough information to know when to start and stop pumping.

The CIU XX2 unit is not involved in the control of the water level (starting and stopping of pumps), but merely provides the interface necessary for the following:

- Configuration of the pump parameters required for the level control.
- Online monitoring of pit and pump values.
- Individual (manual) control of each pump (forced start/stop).
- Obtaining of measured and logged data that is valuable for pump service and pit optimisation.
- The CIU XX2 can communicate with a Grundfos handheld device (R100 or Grundfos GO Remote). This is not shown in the pictures and is not discussed further in this manual.

3.1 Modbus RTU (CIM 200)

Communication can be established by using the Modbus RTU connection in the CIU 202.

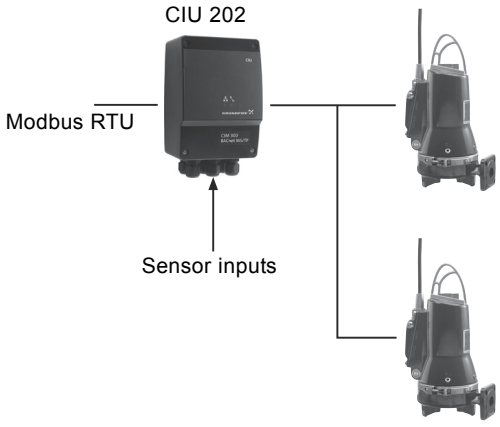


Fig. 1 CIU 202 solution for Grundfos DP, EF, SL1, SLV and SEG AUTO$_{ADAPT}$ pumps

3.2 Modbus GSM/GPRS (CIM 250)

Remote communication via the CIU 252 can be established by using one of the following options:

- Modbus RTU protocol via a GSM connection (call-up connection)
- Modbus TCP protocol via a GPRS connection (IP addressing)
- SMS commands from a mobile phone.

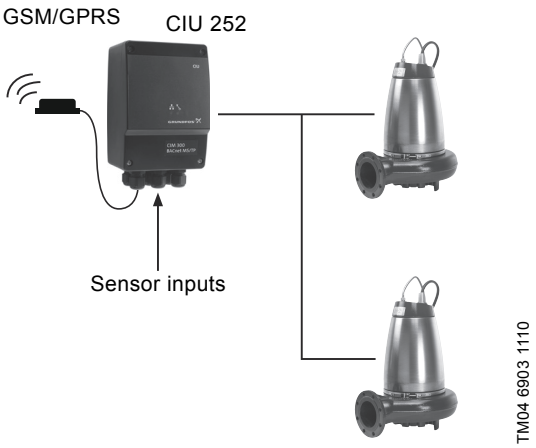


Fig. 2 CIU 252 solution for Grundfos DP, EF, SL1, SLV and SEG AUTO$_{ADAPT}$ pumps

Note ***3G/4G are not supported via CIM 250.***

3.3 Modbus TCP (CIM 500)

Communication can be established by using the Modbus TCP Ethernet connection in the CIU 502.

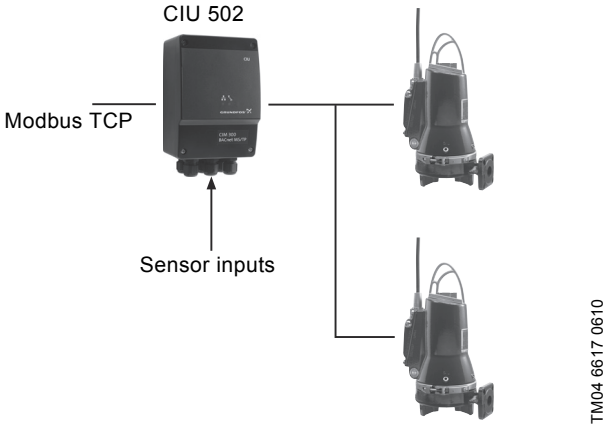


Fig. 3 CIU 502 solution for Grundfos DP, EF, SL1, SLV and SEG AUTO$_{ADAPT}$ pumps

4. Specifications

4.1 CIM module general data

General data	Description	Comments
Ambient humidity	30 % to 95 %	Relative, non-condensing.
Operating temperature	-20 °C to +45 °C	
Battery, lithium-ion	The battery will only be charged if the battery temperature is within 0 °C to +45 °C.	CIU 252 only.
GENIbus visual diagnostics	LED2	Will be in one of these states: Off, constantly green, flashing red, constantly red. See section *5.5 LEDs*.
Power supply (CIU)	24-240 V	Located in the CIU.
CIU box enclosure class	IP54	
CIU box dimensions (H x W x D)	182 x 108 x 82 mm	
Storage temperature	-25 °C to +70 °C -13 °F to +158 °F	

4.2 CIU 202 Modbus RTU

The table below provides an overview of the specifications for the Grundfos CIU 202. 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 rotary switches SW6 and SW7. See section *5.3 Modbus address selection*.
Line termination	On or Off	Set via DIP switches SW1 and SW2. See section *5.4 Termination resistor*.
Recommended cable cross sectional cobber area	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 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. See section *13. Modbus RTU telegram examples*.

* Can only be set via software.

4.3 CIU 252 GSM/GPRS

The table below provides an overview of the specifications for the Grundfos CIU 252. For further details, please refer to the specific sections of this functional profile.

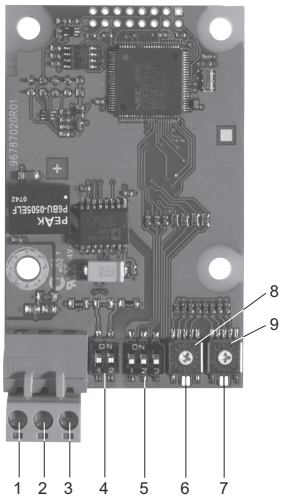
Modbus GSM/GPRS specifications	Description	Comments
Data protocol	Modbus RTU/Modbus TCP	GSM call-up uses RTU. GPRS uses TCP.
Slave address	Factory 231 (0xE7)	Can be changed via Modbus register 00003, SoftwareDefinedModbusAddress.
GSM/GPRS visual diagnostics	LED1	See section *6.2 LEDs*.
Maximum Modbus telegram size	260 bytes	Total Modbus TCP/IP application data unit. See fig. 21.

4.4 CIU 502 Modbus TCP

The table below provides an overview of the specifications for the Grundfos CIU 502 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, SNTP, 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, twisted-pair cables, CAT5, CAT5e or CAT6	Supports Auto-MDIX
Transmission speed	10 Mbits/s, 100 Mbits/s (auto-detected)	
Industrial Ethernet protocols	PROFINET IO, Modbus TCP	Selected with rotary switch, section 7.2.

5. Modbus RTU, CIM 200 setup



TM04 1697 0908

Fig. 4 CIM 200 Modbus module

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 CIU 202 unit.
8	SW6	Hex switch for setting the Modbus address (four most significant bits)
9	SW7	Hex switch for setting the Modbus address (four least significant bits)

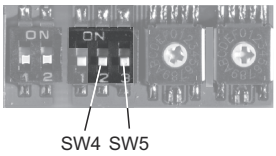
A screened, twisted-pair cable must be used. The cable screen must be connected to protective earth at both ends.

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. 5.



TM04 1710 0908

Fig. 5 Modbus transmission speed

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.***

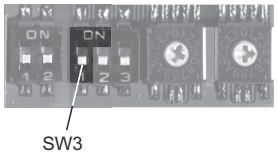
The parity can be set either manually by using SW3 or via software-defined settings.

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. 6.



TM04 1709 0908

Fig. 6 Parity

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 figs 5 and 6.

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

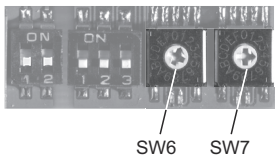
The software-defined parity and stop bit values will be stored in the communication interface and will remain after a power-off.

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.

To set the Modbus address, two hexadecimal rotary switches (SW6 and SW7) are used. See fig. 7.



TM04 1706 0908

Fig. 7 Setting the Modbus address

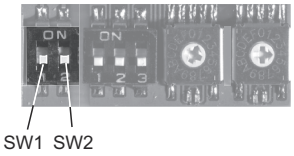
For a complete overview of Modbus addresses, see section *14. Fault finding*.

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 8 shows the DIP switches in cut-out state.



TM04 1701 0908

Fig. 8 Cutting the termination resistor in and out

DIP switch settings

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

Default setting: Termination resistor cut out.

Cable length

Grundfos recommends the following maximum lengths:

Bits/s	Maximum cable length	
	Terminated cable	Unterminated cable
	[m/ft]	[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 LEDs

The CIM 200 Modbus module has two LEDs.See fig. 4.

- 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 CIU 202 unit.
Permanently red	The CIM 200 does not support the Grundfos product connected.
Permanently green	Internal communication between the CIM 200 and the CIU 202 unit is OK.

Note ***During start-up, there may be a delay of up to 5 seconds before the LED2 status is updated.***

6. Modbus GSM/GPRS, CIM 250 setup

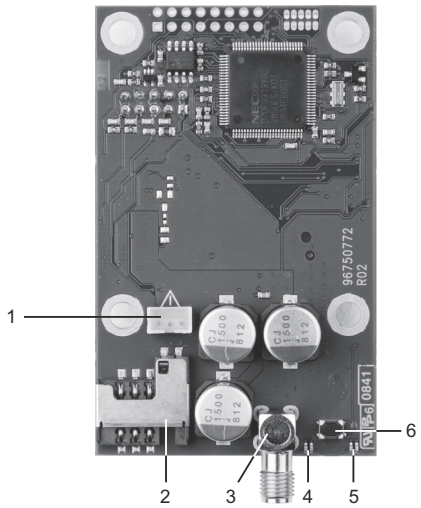


Fig. 9 CIM 250 GSM module (top-side view)

Pos.	Designation	Description
1		Battery socket
2		SIM card holder
3		SMA connection for GSM antenna
4	LED1	Yellow/green status LED for GSM/ GPRS communication
5	LED2	Red/green status LED for internal communication between the CIM 250 and the CIU 252 unit.
6	SW1	Reset button. Keep the button pressed for 5 seconds to return to default settings.

6.1 Installation

Note

Before installation, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

6.1.1 Fitting a GSM antenna

An antenna must be connected to the CIM 250 to establish connection to the GSM network.

Note

If the CIU 252 is installed in a metal control cabinet, Grundfos recommends fitting an external GSM antenna.

Grundfos offers different kinds of antennas. No antenna is supplied with the CIU 252. It must be ordered separately.

External antenna

Connect the antenna cable to the SMA connection (pos. 1) of the CIM 250. The antenna must be installed outside the control cabinet in a position with good reception conditions.

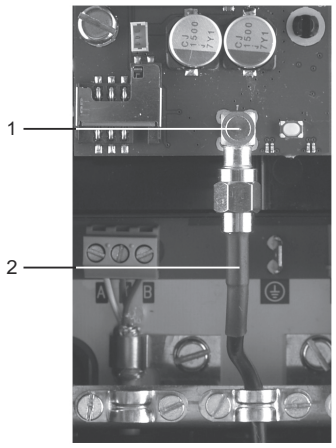


Fig. 10 Fitting an external GSM antenna

Pos.	Description
1	SMA connection for GSM antenna
2	Antenna cable for external GSM antenna

6.1.2 Inserting the SIM card

Before inserting the SIM card into the CIM 250, remove the PIN code, or set the PIN code to "4321".

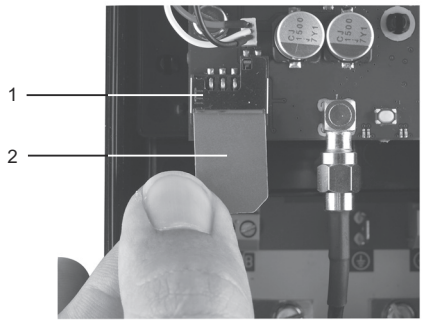
Procedure

1. Insert the SIM card into a mobile phone.
2. Remove the PIN code from the SIM card, or set the PIN code to "4321". See the manual of the mobile phone.
3. Insert the SIM card into the CIM 250. See fig. 11.

Note

The slanted edge of the SIM card must point downwards (away from the connector).

The connectors on the SIM card must face inwards towards the CIM 250. See fig. 11.



TM04 2643 2808

Fig. 11 Inserting the SIM card

Pos.	Description
1	SIM card holder
2	SIM card

6.1.3 Connecting the battery and power supply

Warning

The CIU 252 must only be connected to SELV or SELV-E circuits.

Warning

The safety precautions listed below must be observed carefully as improper handling of the lithium-ion battery may result in injury or damage from electrolyte leakage, heating ignition or explosion.

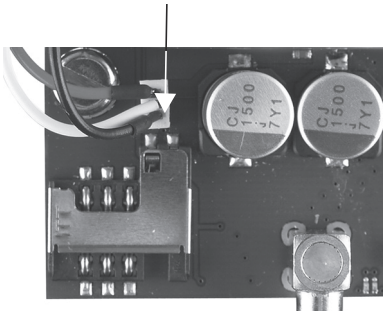
These safety precautions must be observed:

- Only insert the approved Grundfos battery pack (97631960).
- Never use this battery pack in other battery chargers.
- Do not dismantle or modify the battery.
- Do not heat or incinerate the battery.
- Do not pierce, crush or cause mechanical damage to the battery.
- Do not short-circuit the battery.
- Do not allow the battery to get wet or be immersed in water.
- Do not strike or throw the battery.
- For long periods of storage, the temperature should be below 45 °C.

The CIM 250 is fitted with a lithium-ion battery. It is secured by a velcro strap which absorbs vibrations and makes it easier to replace the battery. Connect the battery to the CIM 250 as shown in fig. 12.

Note

If a battery is not connected, the user will not receive any SMS alarm message in case of a power cut.



TM04 2645 2808

Fig. 12 Connecting the battery

Note

The battery will only be charged if the battery temperature is within 0 °C to +45 °C.

Switch on the power supply. The CIM 250 is powered either by the CIU 252 or by the battery.

The LED1 flashes yellow (searching for GSM network). When the connection to the GSM network has been established, the LED1 will pulsate yellow (GSM network active). See fig. 13.

The LED2 must be constantly green, indicating that the CIM 250 has been fitted correctly in the CIU 252.

6.1.4 Configuration

For software configuration of the CIU 252, which includes setting of SMS functions and SCADA communication parameters, see "CIM 250 SMS commands" (supplement to the installation and operating instructions) on the CD-ROM supplied with the GSM module.

6.2 LEDs

The CIM 250 GSM module has two LEDs. See fig. 9.

- Yellow/green status LED (LED1) for GSM/GPRS communication.

Red/green status LED (LED2) for internal communication between the CIM 250 and the CIU 252.

LED1 (yellow/green)

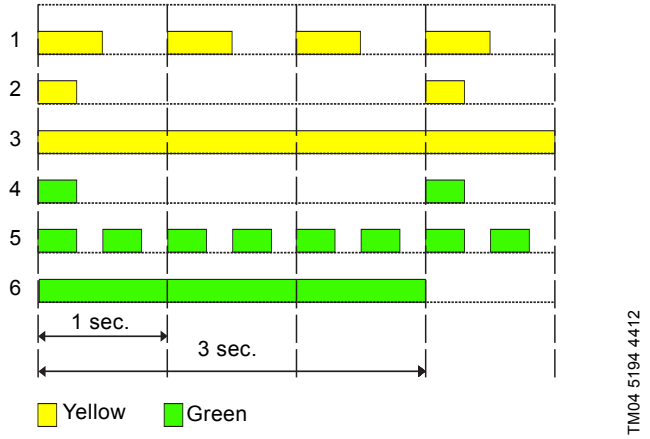


Fig. 13 LED1 status

Pos.	Status	Description
1	Flashing yellow	Searching for GSM network.
2	Pulsating yellow (single pulse)	Connection to the GSM network has been established.
3	Constantly yellow	Call-up connection has been established.
4	Pulsating green (single pulse)	Data are exchanged via GPRS.
5	Pulsating green (double pulse)	Data are exchanged via the call-up connection.
6	Green (3 sec.)	Sending or receiving an SMS message.

LED2 (red/green)

Status	Description
Off	The CIM 250 has been switched off.
Flashing red	No communication between the CIM 250 and the CIU 252 unit.
Constantly red	The CIM 250 does not support the connected Grundfos product.
Constantly green	The connection between the CIM 250 and the CIU 252 is OK.

7. Modbus TCP, CIM 500 setup

Warning

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

7.1 Connecting the Ethernet cable

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

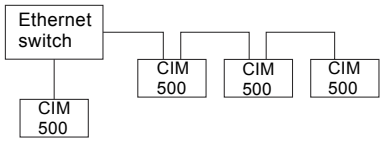
Note

It is important to connect cable shield to earth through earth clamp or to connect cable shield to earth in the connector.

Maximum cable length

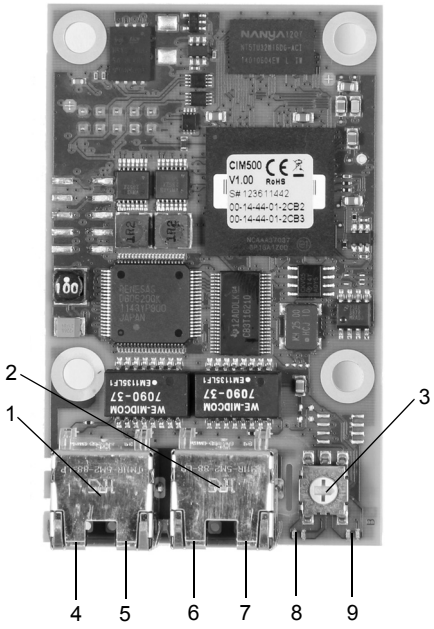
Speed [Mbits/s]	Cable type	Maximum cable length [m/ft]
10	CAT5	100 m / 328 ft
100	CAT5e, CAT6	100 m / 328 ft

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.



TM05 6435 4711

Fig. 14 Example of Industrial Ethernet network



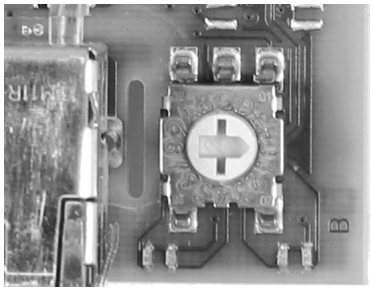
TM05 7431 1013

Fig. 15 Example of Ethernet connection

Pos.	Description	Designation
1	Industrial Ethernet RJ45 Connector 1	ETH1
2	Industrial Ethernet RJ45 Connector 2	ETH2
3	Rotary switch for protocol selection	SW1
4	Data activity LED for Connector 1	DATA1
5	Link LED for Connector 1	LINK1
6	Data activity LED for Connector 2	DATA2
7	Link LED for Connector 2	LINK2
8	Green/red status LED for Ethernet communication	LED 1
9	Green/red status LED for internal communication between module and CIU 502 unit.	LED 2

7.2 Setting the Industrial Ethernet protocol

The CIM 500 Ethernet module has a rotary switch for selection of the Industrial Ethernet protocol. See fig. 16.



TM05 7431 1013

Fig. 16 Selecting the Industrial Ethernet protocol

Pos.	Description
0	PROFINET IO (Default from factory)
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.

7.3 Setting up the IP-addresses

The CIM 500 Ethernet module is default set up to 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 setup by the Web server

7.4 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 55.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log in to the Web server using:

User	admin (factory default)
Password	Grundfos (factory default)

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

TM05 6436 4712

Fig. 17 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 55.

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.***

7.5 Status LEDs

The CIM 500 Ethernet module has two Status LEDs, (LED1 and LED2). See fig. 15.

- 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 14.3.1.
Permanently red and green	Error in firmware download. See section 14.3.1.
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 CIU 502 unit.
Permanently red	The CIM 500 does not support the Grundfos product connected.
Permanently green	Internal communication between the CIM 500 and the CIU 502 is OK.
Permanently red and green	Memory fault.

Note ***During start-up, there is a delay of up to 5 seconds before LED1 and LED2 status is updated.***

7.6 DATA and LINK LEDs

The CIM 500 Ethernet module has two connectivity LEDs related to each RJ45 Connector. See fig.15.

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.

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

8. 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 See section *13.6 Diagnostics (0x08)* for subcodes.

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.

9. Modbus register overview

9.1 Register block overview

The Modbus registers are grouped in the following register blocks:

Starting 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	Pit control and configuration	W	Registers for control and configuration of wastewater pit.
00201	Pit status	R	Registers for status from wastewater pit.
00301	Pit data	R	Registers for measured values from wastewater pit.
00401	Pump 1	R	Registers containing pump 1 data and status.
00451	Pump 2	R	Registers containing pump 2 data and status.
00501	Pump 3	R	Registers containing pump 3 data and status.
00551	Pump 4	R	Registers containing pump 4 data and status.
00701	Alarm simulation	R/W	Features for simulation of alarms and warnings.
00751-00800	User registers	R/W	This area is for device labelling by the user.

All addresses contain registers. Some are bit-interpreted while others are 16-bit values, or part of 32-bit values. A data value of 65535 (0xFFFF) indicates "not available" when reading registers. The value of 65535 (0xFFFF) does not imply a "disable" when writing values.

Each register block will be specified in more detail in the following sections.

9.2 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 250	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	SoftwareDefinedModbusAddress	This register holds the active Modbus address. The default value is 0xE7 (231), and there is normally no need to change this value. **Note:** For CIM 200 this value is used only when the transmission speed is set to "Software-defined" on the DIP switches SW4 and SW5. Otherwise, it will be ignored by the slave.	●	●	-
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 the 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/CIU. 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	ReadWriteSeparation	Used to select value read-back behaviour. The value in this register is stored in the device and will remain after a power-off. 0 = Register values can be written by both the Modbus master and the CIM [default]. 1 = Read-backs are put into separate registers by the CIM, hence separating inputs from outputs. See section *10.1 Separation of reads and writes*.	●	●	●
00007	ScadaCallBackRegister	Not used.	-	-	-
00008	NoDataActivityTimeout	The elapsed time with no data activity before the module issues a "GPRS restart".	-	●	-
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 the 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 the DIP switches SW4 and SW5. Otherwise, it will be ignored by the slave.	●	-	-

Address	Register name	Description	CIM 200	CIM 250	CIM 500
00011	ScadaPinCode	PIN code for SCADA systems, etc. If GeneralStatus.ScadaPinCodeEnabled (register 00029, bit 0) is enabled, the correct PIN code must be entered in this register in order to gain access to remote control and configuration. Verify acceptance in GeneralStatus.WriteAccess (register 00029, bit 1). Programming of the SCADA PIN code made via the SMS command SETSCADACODE. See "CIM 250 SMS commands" (supplement to installation and operating instructions) on the CD-ROM supplied with the GSM module.	-	●	-

9.3 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	CIM 200	CIM 250	CIM 500
00021	GENIbusCRCErrorCnt	Holds a CRC error counter for the GENIbus connection to the product.	●	●	●
00022	GENIbusDataErrorCnt	Holds a data error counter for the GENIbus connection to the product.	●	●	●
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 00026	GENIbusTXcountHI GENIbusTXcountLO	Holds a transmit counter for total number of telegrams sent to the product on the GENIbus connection.	●	●	●
00027 00028	GENIbusRXcountHI GENIbusRXcountLO	Holds a receive counter for total number of telegrams received from the product on the GENIbus connection.	●	●	●
00029	GeneralStatus Bit 0: ScadaPinCodeEnabled	PIN code functionality. 0: No PIN code required 1: PIN code required to perform remote control and configuration. Activation of SCADA PIN code protection takes place via the SMS command SCADACODE. See "CIM 250 SMS commands" (supplement to installation and operating instructions) on the CD-ROM supplied with the GSM module.	-	●	-
	GeneralStatus Bit 1: WriteAccess	Remote write access. 0: No write access (the PIN code is incorrect). 1: Full write access (the PIN code is either correct or not enabled).			
00030	UnitFamily	Grundfos product family.	●	●	●
00031	UnitType	Grundfos product type.	●	●	●
00032	UnitVersion	Grundfos product version.	●	●	●

9.4 Pit control and 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 code 0x06 and 0x10.

Address	Register name	Scale	Description
00101	Bit 0: ResetAlarm	bool	Control bit that resets system alarms and warnings. 0 = No resetting 1 = Resetting alarm. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 1: ResetHistory	bool	Control bit that resets pit history. 0 = No resetting 1 = Resetting history. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 2: PitPump1ResetHistory	bool	Control bit that resets counters in pump 1. 0 = No resetting 1 = Resetting history. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 3: PitPump2ResetHistory	bool	Control bit that resets counters in pump 2. 0 = No resetting 1 = Resetting history. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 4: PitPump3ResetHistory	bool	Control bit that resets counters in pump 3. 0 = No resetting 1 = Resetting history. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 5: PitPump4ResetHistory	bool	Control bit that resets counters in pump 4. 0 = No resetting 1 = Resetting history. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 6: PitPump1ResetAlarm	bool	Control bit that resets alarms and warnings from pump 1. 0 = No resetting 1 = Resetting alarm. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 7: PitPump2ResetAlarm	bool	Control bit that resets alarms and warnings from pump 2. 0 = No resetting 1 = Resetting alarm. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 8: PitPump3ResetAlarm	bool	Control bit that resets alarms and warnings from pump 3. 0 = No resetting 1 = Resetting alarm. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 9: PitPump4ResetAlarm	bool	Control bit that resets alarms and warnings from pump 4. 0 = No resetting 1 = Resetting alarm. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 10: PitPump1PumpDown	bool	Control bit that starts pump 1 as if the level control has started it, and pump 1 will pump down the water level and then be stopped by the level control. 0 = No pumping 1 = Pump down. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.

Address	Register name	Scale	Description
00101	Bit 11: PitPump2PumpDown	bool	Control bit that starts pump 2 as if the level control has started it, and pump 2 will pump down the water level and then be stopped by the level control. 0 = No pumping 1 = Pump down. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 12: PitPump3PumpDown	bool	Control bit that starts pump 3 as if the level control has started it, and pump 3 will pump down the water level and then be stopped by the level control. 0 = No pumping 1 = Pump down. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
	Bit 13: PitPump4PumpDown	bool	Control bit that starts pump 4 as if the level control has started it, and pump 4 will pump down the water level and then be stopped by the level control. 0 = No pumping 1 = Pump down. This control bit is triggered on rising edge only, i.e. setting logical 0 to 1. See section *9.2 CIM configuration register block*, address 00005, for acknowledgement behaviour.
00102	SetSinglePitStopLevel	0.01 m	Setting of stop level, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00103	SetSinglePitStartLevelMax	0.01 m	Setting of start level max., pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00104	SetSinglePitStartLevelBand	0.01 m	Setting of start level band, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00105	SetSinglePitHighWaterLevel	0.01 m	Setting of high water level, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00106	SetMultiPitPump1StopLevel	0.01 m	Setting of stop level, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00107	SetMultiPitPump1StartLevelMax	0.01 m	Setting of start level max., pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00108	SetMultiPitPump1StartLevelBand	0.01 m	Setting of start level band, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00109	SetMultiPitPump1HighWaterLevel	0.01 m	Setting of high water level, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00110	SetMultiPitPump2StopLevel	0.01 m	Setting of stop level, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00111	SetMultiPitPump2StartLevelMax	0.01 m	Setting of start level max., pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00112	SetMultiPitPump2StartLevelBand	0.01 m	Setting of start level band, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00113	SetMultiPitPump2HighWaterLevel	0.01 m	Setting of high water level, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00114	SetMultiPitPump3StopLevel	0.01 m	Setting of stop level, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.

Address	Register name	Scale	Description
00115	SetMultiPitPump3StartLevelMax	0.01 m	Setting of start level max., pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00116	SetMultiPitPump3StartLevelBand	0.01 m	Setting of start level band, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00117	SetMultiPitPump3HighWaterLevel	0.01 m	Setting of high water level, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00118	SetMultiPitPump4StopLevel	0.01 m	Setting of stop level, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00119	SetMultiPitPump4StartLevelMax	0.01 m	Setting of start level max., pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00120	SetMultiPitPump4StartLevelBand	0.01 m	Setting of start level band, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00121	SetMultiPitPump4HighWaterLevel	0.01 m	Setting of high water level, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00122	PitPump1Control	enum	Remote manual control of pump 1. 0 = "Auto" mode 1 = Forced start 2 = Forced stop.
00123	PitPump2Control	enum	Remote manual control of pump 2. 0 = "Auto" mode 1 = Forced start 2 = Forced stop.
00124	PitPump3Control	enum	Remote manual control of pump 3. 0 = "Auto" mode 1 = Forced start 2 = Forced stop.
00125	PitPump4Control	enum	Remote manual control of pump 4. 0 = "Auto" mode 1 = Forced start 2 = Forced stop.

9.5 Pit status register block

Address	Register name	Scale	Description
00201	Bit 0: ResetAlarmAck	bool	Indicates if a ResetAlarm control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 1: ResetHistoryAck	bool	Indicates if a ResetHistory control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 2: PitPump1ResetHistoryAck	bool	Indicates if a PitPump1ResetHistory control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 3: PitPump2ResetHistoryAck	bool	Indicates if a PitPump2ResetHistory control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 4: PitPump3ResetHistoryAck	bool	Indicates if a PitPump3ResetHistory control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 5: PitPump4ResetHistoryAck	bool	Indicates if a PitPump4ResetHistory control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 6: PitPump1ResetAlarmAck	bool	Indicates if a PitPump1ResetAlarm control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 7: PitPump2ResetAlarmAck	bool	Indicates if a PitPump2ResetAlarm control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 8: PitPump3ResetAlarmAck	bool	Indicates if a PitPump3ResetAlarm control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 9: PitPump4ResetAlarmAck	bool	Indicates if a PitPump4ResetAlarm control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged. Register continues on next page

Address	Register name	Scale	Description
	Bit 10: PitPump1PumpDownAck	bool	Indicates if a PitPump1PumpDown control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 11: PitPump2PumpDownAck	bool	Indicates if a PitPump2PumpDown control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 12: PitPump3PumpDownAck	bool	Indicates if a PitPump3PumpDown control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
	Bit 13: PitPump4PumpDownAck	bool	Indicates if a PitPump4PumpDown control bit was acknowledged by the device. This bit is only active if AutoAckControlBits (register 00005, bit 0) is set to "0". 0 = Not acknowledged 1 = Acknowledged.
00202	Bit 0: WarningInPumpOrPit	bool	Main status of warning(s). 0 = No active alarms. 1 = One or more active warnings.
	Bit 1: AlarmInPumpOrPit	bool	Main status of alarm(s). 0 = No active alarms. 1 = One or more active warnings.
	Bit 2: RESERVED	-	-
	Bit 3: ManualControlStatus	bool	Main status of manual pump control. 0 = No manual pump control enabled (full "Auto") 1 = Manual pump control enabled (partly or completely).
00203	PitMode	enum	Pit mode. 0 = Single-pit mode 1 = Multi-pit mode. See section *10.4 Single-pit and multi-pit mode*.
00204	SinglePitStopLevel	0.01 m	Stop level, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00205	SinglePitStartLevelMax	0.01 m	Start level max., pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00206	SinglePitStartLevelBand	0.01 m	Start level band, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00207	SinglePitHighWaterLevel	0.01 m	High water level, pit. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00208	MultiPitPump1StopLevel	0.01 m	Stop level, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00209	MultiPitPump1StartLevelMax	0.01 m	Start level max., pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00210	MultiPitPump1StartLevelBand	0.01 m	Start level band, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00211	MultiPitPump1HighWaterLevel	0.01 m	Actual high water level, pump 1. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00212	MultiPitPump2StopLevel	0.01 m	Stop level, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00213	MultiPitPump2StartLevelMax	0.01 m	Start level max., pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00214	MultiPitPump2StartLevelBand	0.01 m	Start level band, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00215	MultiPitPump2HighWaterLevel	0.01 m	High water level, pump 2. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00216	MultiPitPump3StopLevel	0.01 m	Stop level, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00217	MultiPitPump3StartLevelMax	0.01 m	Start level max., pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.

Address	Register name	Scale	Description
00218	MultiPitPump3StartLevelBand	0.01 m	Start level band, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00219	MultiPitPump3HighWaterLevel	0.01 m	High water level, pump 3. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00220	MultiPitPump4StopLevel	0.01 m	Stop level, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00221	MultiPitPump4StartLevelMax	0.01 m	Start level max., pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00222	MultiPitPump4StartLevelBand	0.01 m	Start level band, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00223	MultiPitPump4HighWaterLevel	0.01 m	High water level, pump 4. Used in multi-pit mode only. Pit mode = 1. Pit mode is set in register 00203.
00224	PitPump1OperationMode	enum	Operating mode of pump 1. 0 = "Auto" mode 1 = Started 2 = Stopped.
00225	PitPump2OperationMode	enum	Operating mode of pump 2. 0 = "Auto" mode 1 = Started 2 = Stopped.
00226	PitPump3OperationMode	enum	Operating mode of pump 3. 0 = "Auto" mode 1 = Started 2 = Stopped.
00227	PitPump4OperationMode	enum	Operating mode of pump 4. 0 = "Auto" mode 1 = Started 2 = Stopped.
00228	AlarmCode	enum	A Grundfos-specific alarm code. See section *14.2 Fault finding CIU 252*.
00229	WarningCode	enum	A Grundfos-specific warning code. See section *14.2 Fault finding CIU 252*.
00230	Bit 0: Pitpump1Present	bool	Presence of pump 1. 0 = Not present 1 = Present.
	Bit 1: Pitpump2Present	bool	Presence of pump 2. 0 = Not present 1 = Present.
	Bit 2: Pitpump3Present	bool	Presence of pump 3. 0 = Not present 1 = Present.
	Bit 3: Pitpump4Present	bool	Presence of pump 4. 0 = Not present 1 = Present.
00231	Bit 0: Pitpump1Running	bool	Running state of pump 1. 0 = Not running 1 = Running.
	Bit 1: Pitpump2Running	bool	Running state of pump 2. 0 = Not running 1 = Running.
	Bit 2: Pitpump3Running	bool	Running state of pump 3. 0 = Not running 1 = Running.
	Bit 3: Pitpump4Running	bool	Running state of pump 4. 0 = Not running 1 = Running.
00232	Bit 0: Pitpump1Alarm	bool	Alarm state of pump 1. 0 = No alarm 1 = Alarm.
	Bit 1: Pitpump2Alarm	bool	Alarm state of pump 2. 0 = No alarm 1 = Alarm.
	Bit 2: Pitpump3Alarm	bool	Alarm state of pump 3. 0 = No alarm 1 = Alarm.
	Bit 3: Pitpump4Alarm	bool	Alarm state of pump 4. 0 = No alarm 1 = Alarm.

Address	Register name	Scale	Description
00233	Bit 0: Pitpump1CommFault	bool	Indicates if there is a communication fault on pump 1. 0 = No fault 1 = Fault.
	Bit 1: Pitpump2CommFault	bool	Indicates if there is a communication fault on pump 2. 0 = No Fault 1 = Fault.
	Bit 2: Pitpump3CommFault	bool	Indicates if there is a communication fault on pump 3. 0 = No fault 1 = Fault.
	Bit 3: Pitpump4CommFault	bool	Indicates if there is a communication fault on pump 4. 0 = No fault 1 = Fault.
00234	OperatingMode	enum	Used in single-pit mode only. Pit mode = 0. Operating mode of the pump pit. 0 = Standby 1 = Start-up delay 2 = Pumping (level control) 5 = Stopped (level control) 9 = Manuel control (all enabled pumps in manual control mode) 11 = Mains supply failure 13 = Alarm on all enabled pumps 14 = All pumps out of operation.
00235	Bit 0: WarningInPumpOrPit		Main status of warning(s). 0 = No warning(s) 1 = Warning(s) on a pump or in the pit.
	Bit 1: AlarmInPumpOrPit		Main status of alarm(s). 0 = No alarm(s) 1 = Alarm(s) on a pump or in the pit.
	Bit 2: RESERVED		-
	Bit 3: ManualControlStatus		Main status of manual pump control. 0 = No manual pump control enabled (full "Auto") 1 = Manual pump control enabled (partly or completely).
00236	GSMSignalLevelActual	1 %	Actual level of GSM signal. (CIM 250 only)
00237	GSMSignalLevelAverage	1 %	Average level of GSM signal. (CIM 250 only)
00238 00239	IPAddressHI IPAddressLO	unscaled	IP address for GPRS communication. (CIM 250 only)
00240	Bit 0: AlarmBitsExternalFault		External fault signal
	Bit 1: AlarmBitsCommunicationFault		Communication fault, pump
	Bit 2: RESERVED		-
	Bit 3: AlarmBitsPump1Fault		Pump 1 fault
	Bit 4: AlarmBitsPump2Fault		Pump 2 fault
	Bit 5: AlarmBitsPump3Fault		Pump 3 fault
	Bit 6: AlarmBitsPump4Fault		Pump 4 fault
	Bit 7: AlarmBitsSensorLimit2Exceeded		Sensor limit 2 exceeded (High level)
	Bit 8: AlarmBitsSetupConflict		Setup conflict
00241	Bit 0: RESERVED		-
	Bit 1: WarningBitsCommunicationFault		Communication fault, pump
	Bit 2: WarningBitsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 3 -7: RESERVED		-
	Bit 8: WarningBits.SetupConflict		Setup conflict

9.6 Pit data register block

Registers in this block can be read by means of function codes 0x03 and/or 0x04. It is not possible to write to these registers. 0xFFFF indicates that the data value is not available.

Address	Register name	Scale	Description
00301	WaterLevel	0.01 m	Average of the pit water level as estimated by the pumps. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00302	MaxWaterLevel	0.01 m	Maximum value that the pit water level has had. Can be reset with register 00101, bit 1: ResetHistory. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00303 00304	PowerHI PowerLO	1 W	Pit power consumption.
00305 00306	EnergyTripCntHI EnergyTripCntLO	1 kWh	Pit energy consumption. Can be reset with register 00101, bit 1: ResetHistory.
00307 00308	OnTimeCntHI OnTimeCntLO	1 min.	Power-on time for the CIU. Cannot be reset.
00309 00310	OprTimeTripCntHI OprTimeTripCntLO	1 min.	Pit operating time where one or more pumps have been operating. Can be reset with register 00101, bit 1: ResetHistory.
00311	PumpOperationTimePct	0.01 %	Percentage of time where one or more pumps have been operating within the last 30 days. Can be reset with register 00101, bit 1: ResetHistory. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00312	MultiPumpOperationTimePct	0.01 %	Percentage of the pump operating time where more than one pump have been operating within the last 30 days. Can be reset with register 00101, bit 1: ResetHistory. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00313	MultiPumpOperationTimeMax	1 s	Logged value of maximum pump operating time where more than one pump have been operating continuously within the last 30 days. Can be reset with register 00101, bit 1: ResetHistory. Used in single-pit mode only. Pit mode = 0. Pit mode is set in register 00203.
00314	DigitalInput	bits	Digital inputs.

9.7 Pump 1 register block

All register values are read-only, and 0xFFFF indicates that the data value is not available.

Address	Register name	Scale	Description
00401	Pump1.MotorTemperature	0.01 K	Motor temperature, pump 1.
00402	Pump1.ElectronicTemperature	0.01 K	Electronics temperature, pump 1.
00403	Pump1.AverageLineVoltage	0.1 V	Average supply voltage, pump 1.
00404	Pump1.AverageLineCurrent	0.1 A	Average supply current, pump 1.
00405	Pump1.AverageLineCurrentLatest	0.1 A	Average supply current the last time pump 1 was operating.
00406	Pump1.LineFrequency	0.1 Hz	Frequency of power supply, pump 1.
00407	Pump1.PhaseSequence	bool	Phase sequence of power supply, pump 1.
00408	Pump1.CosPhi	0.01	Power factor, pump 1.
00409	Pump1.Power	1 W	Power consumption, pump 1.
00410 00411	Pump1.EnergyTripCounterHI Pump1.EnergyTripCounterLO	1 kWh	Energy consumption, pump 1. Can be reset with register 00101, bit 2: PitPump1ResetHistory.
00412	Pump1.WaterLevel	0.01 m	Water level as estimated by pump 1.
00413	Pump1.WaterLevelMax	0.01 m	Logged maximum value of water level, pump 1. Can be reset with register 00101, bit 2: PitPump1ResetHistory.
00414	Pump1.MaxContinousTime	1 min.	Logged maximum value of continuous operating time within the last 30 days, pump 1. Can be reset with register 00101, bit 2: PitPump1ResetHistory.
00415 00416	Pump1.TotalPoweredTimeHI Pump1.TotalPoweredTimeLO	1 min.	Total time that pump 1 has been powered on. Used as time stamp for alarms in the alarm log the moment the alarm appears.
00417 00418	Pump1.OperationTimeHI Pump1.OperationTimeLO	1 min.	Total time that pump 1 has been operating.
00419 00420	Pump1.OperationTimeTripCounterHI Pump1.OperationTimeTripCounterLO	1 min.	Trip counter of the total time that pump 1 has been operating. Can be reset with register 00101, bit 2: PitPump1ResetHistory.
00421 00422	Pump1.NumberOfStartsHI Pump1.NumberOfStartsLO	unscaled	Total number of starts, pump 1.
00423 00424	Pump1.NumberOfStartsTripCounterHI Pump1.NumberOfStartsTripCounterLO	unscaled	Trip counter of total number of starts, pump 1.
00425	Pump1.AlarmCode	unscaled	Grundfos-specific alarm code, pump 1. See section *14.2 Fault finding CIU 252*.
00426	Pump1.WarningCode	unscaled	Grundfos-specific warning code, pump 1. See section *14.2 Fault finding CIU 252*.
00427	Pump1.OperatingMode	bits	Operating mode of pump 1. 0 = "Auto" mode (power-on default) 1 = Forced start 2 = Forced stop.
00428	Bit 0: Subpump1AlarmsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump1AlarmsOvervoltage		Overvoltage
	Bit 2: Subpump1AlarmsUndervoltage		Undervoltage
	Bit 3: Subpump1AlarmsOverload		Overload
	Bit 4: Subpump1AlarmsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump1AlarmsAlarmBit5		-
	Bit 6: Subpump1AlarmsMotorTemperature		Motor Temperature
	Bit 7: Subpump1AlarmsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump1AlarmsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump1AlarmsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump1AlarmsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump1AlarmsAlarmBit11		-
	Bit 12: Subpump1AlarmsSensorFault		Sensor Fault
	Bit 13: Subpump1AlarmsAlarmBit13		-

Address	Register name	Scale	Description
00429	Bit 0: Subpump1WarningsWarningsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump1WarningsOvervoltage		Overvoltage
	Bit 2: Subpump1WarningsUndervoltage		Undervoltage
	Bit 3: Subpump1WarningsOverload		Overload
	Bit 4: Subpump1WarningsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump1WarningsAlarmBit5		-
	Bit 6: Subpump1WarningsMotorTemperature		Motor Temperature
	Bit 7: Subpump1WarningsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump1WarningsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump1WarningsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump1WarningsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump1WarningsAlarmBit11		-
	Bit 12: Subpump1WarningsSensorFault		Sensor Fault
	Bit 13: Subpump1WarningsAlarmBit13		-

9.8 Pump 2 register block

All register values are read-only, and 0xFFFF indicates that the data value is not available.

Address	Register name	Scale	Description
00451	Pump2.MotorTemperature	0.01 K	Motor temperature, pump 2.
00452	Pump2.ElectronicTemperature	0.01 K	Electronics temperature, pump 2.
00453	Pump2.AverageLineVoltage	0.1 V	Average supply voltage, pump 2.
00454	Pump2.AverageLineCurrent	0.1 A	Average supply current, pump 2.
00455	Pump2.AverageLineCurrentLatest	0.1 A	Average supply current the last time pump 2 was operating.
00456	Pump2.LineFrequency	0.1 Hz	Frequency of power supply, pump 2.
00457	Pump2.PhaseSequence	bool	Phase sequence of power supply, pump 2.
00458	Pump2.CosPhi	0.01	Power factor, pump 2.
00459	Pump2.Power	1 W	Power consumption, pump 2.
00460 00461	Pump2.EnergyTripCounterHI Pump2.EnergyTripCounterLO	1 kWh	Energy consumption, pump 2. Can be reset with register 00101, bit 3: PitPump2ResetHistory.
00462	Pump2.WaterLevel	0.01 m	Water level as estimated by pump 2.
00463	Pump2.WaterLevelMax	0.01 m	Logged maximum value of water level, pump 2. Can be reset with register 00101, bit 3: PitPump2ResetHistory.
00464	Pump2.MaxContinousTime	1 min.	Logged maximum value of continuous operating time within the last 30 days, pump 2. Can be reset with register 00101, bit 3: PitPump2ResetHistory.
00465 00466	Pump2.TotalPoweredTimeHI Pump2.TotalPoweredTimeLO	1 min.	Total time that pump 2 has been powered on. Used as time stamp for alarms in the alarm log the moment the alarm appears.
00467 00468	Pump2.OperationTimeHI Pump2.OperationTimeLO	1 min.	Total time that pump 2 has been operating.
00469 00470	Pump2.OperationTimeTripCounterHI Pump2.OperationTimeTripCounterLO	1 min.	Trip counter of the total time that pump 2 has been operating. Can be reset with register 00101, bit 3: PitPump2ResetHistory.
00471 00472	Pump2.NumberOfStartsHI Pump2.NumberOfStartsLO	unscaled	Total number of starts, pump 2.
00473 00474	Pump2.NumberOfStartsTripCounterHI Pump2.NumberOfStartsTripCounterLO	unscaled	Trip counter of total number of starts, pump 2.
00475	Pump2.AlarmCode	unscaled	Grundfos-specific alarm code, pump 2. See section *14.2 Fault finding CIU 252*.
00476	Pump2.WarningCode	unscaled	Grundfos-specific warning code, pump 2. See section *14.2 Fault finding CIU 252*.
00477	Pump2.OperatingMode	bits	Operating mode of pump 2. 0 = "Auto" mode (power-on default) 1 = Forced start 2 = Forced stop.
00478	Bit 0: Subpump2AlarmsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump2AlarmsOvervoltage		Overvoltage
	Bit 2: Subpump2AlarmsUndervoltage		Undervoltage
	Bit 3: Subpump2AlarmsOverload		Overload
	Bit 4: Subpump2AlarmsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump2AlarmsAlarmBit5		-
	Bit 6: Subpump2AlarmsMotorTemperature		Motor Temperature
	Bit 7: Subpump2AlarmsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump2AlarmsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump2AlarmsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump2AlarmsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump2AlarmsAlarmBit11		-
	Bit 12: Subpump2AlarmsSensorFault		Sensor Fault
	Bit 13: Subpump2AlarmsAlarmBit13		-

Address	Register name	Scale	Description
00479	Bit 0: Subpump2WarningsWarningsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump2WarningsOvervoltage		Overvoltage
	Bit 2: Subpump2WarningsUndervoltage		Undervoltage
	Bit 3: Subpump2WarningsOverload		Overload
	Bit 4: Subpump2WarningsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump2WarningsAlarmBit5		-
	Bit 6: Subpump2WarningsMotorTemperature		Motor Temperature
	Bit 7: Subpump2WarningsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump2WarningsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump2WarningsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump2WarningsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump2WarningsAlarmBit11		-
	Bit 12: Subpump2WarningsSensorFault		Sensor Fault
	Bit 13: Subpump2WarningsAlarmBit13		-

9.9 Pump 3 register block

All register values are read-only, and 0xFFFF indicates that the data value is not available.

Address	Register name	Scale	Description
00501	Pump3.MotorTemperature	0.01 K	Motor temperature, pump 3.
00502	Pump3.ElectronicTemperature	0.01 K	Electronics temperature, pump 3.
00503	Pump3.AverageLineVoltage	0.1 V	Average supply voltage, pump 3.
00504	Pump3.AverageLineCurrent	0.1 A	Average supply current, pump 3.
00505	Pump3.AverageLineCurrentLatest	0.1 A	Average supply current the last time pump 3 was operating.
00506	Pump3.LineFrequency	0.1 Hz	Frequency of power supply, pump 3.
00507	Pump3.PhaseSequence	bool	Phase sequence of power supply, pump 3.
00508	Pump3.CosPhi	0.01	Power factor, pump 3.
00509	Pump3.Power	1 W	Power consumption, pump 3.
00510 00511	Pump3.EnergyTripCounterHI Pump3.EnergyTripCounterLO	1 kWh	Energy consumption, pump 3. Can be reset with register 00101, bit 4: PitPump3ResetHistory.
00512	Pump3.WaterLevel	0.01 m	Water level as estimated by pump 3.
00513	Pump3.WaterLevelMax	0.01 m	Logged maximum value of water level, pump 3. Can be reset with register 00101, bit 4: PitPump3ResetHistory.
00514	Pump3.MaxContinousTime	1 min.	Logged maximum value of continuous operating time within the last 30 days, pump 3. Can be reset with register 00101, bit 4: PitPump3ResetHistory.
00515 00516	Pump3.TotalPoweredTimeHI Pump3.TotalPoweredTimeLO	1 min.	Total time that pump 3 has been powered on. Used as time stamp for alarms in the alarm log the moment the alarm appears.
00517 00518	Pump3.OperationTimeHI Pump3.OperationTimeLO	1 min.	Total time that pump 3 has been operating.
00519 00520	Pump3.OperationTimeTripCounterHI Pump3.OperationTimeTripCounterLO	1 min.	Trip counter of the total time that pump 3 has been operating. Can be reset with register 00101, bit 4: PitPump3ResetHistory.
00521 00522	Pump3.NumberOfStartsHI Pump3.NumberOfStartsLO	unscaled	Total number of starts, pump 3.
00523 00524	Pump3.NumberOfStartsTripCounterHI Pump3.NumberOfStartsTripCounterLO	unscaled	Trip counter of total number of starts, pump 3.
00525	Pump3.AlarmCode	unscaled	Grundfos-specific alarm code, pump 3. See section *14.2 Fault finding CIU 252*.
00526	Pump3.WarningCode	unscaled	Grundfos-specific warning code, pump 3. See section *14.2 Fault finding CIU 252*.
00527	Pump3.OperatingMode	bits	Operating mode of pump 3. 0 = "Auto" mode (power-on default) 1 = Forced start 2 = Forced stop.
00528	Bit 0: Subpump3AlarmsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump3AlarmsOvervoltage		Overvoltage
	Bit 2: Subpump3AlarmsUndervoltage		Undervoltage
	Bit 3: Subpump3AlarmsOverload		Overload
	Bit 4: Subpump3AlarmsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump3AlarmsAlarmBit5		-
	Bit 6: Subpump3AlarmsMotorTemperature		Motor Temperature
	Bit 7: Subpump3AlarmsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump3AlarmsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump3AlarmsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump3AlarmsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump3AlarmsAlarmBit11		-
	Bit 12: Subpump3AlarmsSensorFault		Sensor Fault
	Bit 13: Subpump3AlarmsAlarmBit13		-

Address	Register name	Scale	Description
00529	Bit 0: Subpump3WarningsWarningsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump3WarningsOvervoltage		Overvoltage
	Bit 2: Subpump3WarningsUndervoltage		Undervoltage
	Bit 3: Subpump3WarningsOverload		Overload
	Bit 4: Subpump3WarningsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump3WarningsAlarmBit5		-
	Bit 6: Subpump3WarningsMotorTemperature		Motor Temperature
	Bit 7: Subpump3WarningsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump3WarningsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump3WarningsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump3WarningsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump3WarningsAlarmBit11		-
	Bit 12: Subpump3WarningsSensorFault		Sensor Fault
	Bit 13: Subpump3WarningsAlarmBit13		-

9.10 Pump 4 register block

All register values are read-only, and 0xFFFF indicates that the data value is not available.

Address	Register name	Scale	Description
00551	Pump4.MotorTemperature	0.01 K	Motor temperature, pump 4.
00552	Pump4.ElectronicTemperature	0.01 K	Electronics temperature, pump 4.
00553	Pump4.AverageLineVoltage	0.1 V	Average supply voltage, pump 4.
00554	Pump4.AverageLineCurrent	0.1 A	Average supply current, pump 4.
00555	Pump4.AverageLineCurrentLatest	0.1 A	Average supply current the last time pump 4 was operating.
00556	Pump4.LineFrequency	0.1 Hz	Frequency of power supply, pump 4.
00557	Pump4.PhaseSequence	bool	Phase sequence of power supply, pump 4.
00558	Pump4.CosPhi	0.01	Power factor, pump 4.
00559	Pump4.Power	1 W	Power consumption, pump 4.
00560 00561	Pump4.EnergyTripCounterHI Pump4.EnergyTripCounterLO	1 kWh	Energy consumption, pump 4. Can be reset with register 00101, bit 5: PitPump4ResetHistory.
00562	Pump4.WaterLevel	0.01 m	Water level as estimated by pump 4.
00563	Pump4.WaterLevelMax	0.01 m	Logged maximum value of water level, pump 4. Can be reset with register 00101, bit 5: PitPump4ResetHistory.
00564	Pump4.MaxContinousTime	1 min.	Logged maximum value of continuous operating time within the last 30 days, pump 4. Can be reset with register 00101, bit 5: PitPump4ResetHistory.
00565 00566	Pump4.TotalPoweredTimeHI Pump4.TotalPoweredTimeLO	1 min.	Total time that pump 4 has been powered on. Used as time stamp for alarms in the alarm log the moment the alarm appears.
00567 00568	Pump4.OperationTimeHI Pump4.OperationTimeLO	1 min.	Total time that pump 4 has been operating.
00569 00570	Pump4.OperationTimeTripCounterHI Pump4.OperationTimeTripCounterLO	1 min.	Trip counter of the total time that pump 4 has been operating. Can be reset with register 00101, bit 5: PitPump4ResetHistory.
00571 00572	Pump4.NumberOfStartsHI Pump4.NumberOfStartsLO	unscaled	Total number of starts, pump 4.
00573 00574	Pump4.NumberOfStartsTripCounterHI Pump4.NumberOfStartsTripCounterLO	unscaled	Trip counter of total number of starts, pump 4.
00575	Pump4.AlarmCode	unscaled	Grundfos-specific alarm code, pump 4. See section *14.2 Fault finding CIU 252*.
00576	Pump4.WarningCode	unscaled	Grundfos-specific warning code, pump 4. See section *14.2 Fault finding CIU 252*.
00577	Pump4.OperatingMode	bits	Operating mode of pump 4. 0 = "Auto" mode (power-on default) 1 = Forced start 2 = Forced stop.
00528	Bit 0: Subpump4AlarmsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump4AlarmsOvervoltage		Overvoltage
	Bit 2: Subpump4AlarmsUndervoltage		Undervoltage
	Bit 3: Subpump4AlarmsOverload		Overload
	Bit 4: Subpump4AlarmsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump4AlarmsAlarmBit5		-
	Bit 6: Subpump4AlarmsMotorTemperature		Motor Temperature
	Bit 7: Subpump4AlarmsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump4AlarmsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump4AlarmsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump4AlarmsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump4AlarmsAlarmBit11		-
	Bit 12: Subpump4AlarmsSensorFault		Sensor Fault
	Bit 13: Subpump4AlarmsAlarmBit13		-

Address	Register name	Scale	Description
00529	Bit 0: Subpump4WarningsWarningsPhaseSequence		Phase sequence reversed
	Bit 1: Subpump4WarningsOvervoltage		Overvoltage
	Bit 2: Subpump4WarningsUndervoltage		Undervoltage
	Bit 3: Subpump4WarningsOverload		Overload
	Bit 4: Subpump4WarningsBlockedMotor		Blocked motor/pump
	Bit 5: Subpump4WarningsAlarmBit5		-
	Bit 6: Subpump4WarningsMotorTemperature		Motor Temperature
	Bit 7: Subpump4WarningsElectronicTemperature		Temperature, control electronics
	Bit 8: Subpump4WarningsTermoRelay1		Termo Relay 1 in motor (e.g. Clixon)
	Bit 9: Subpump4WarningsTermoRelay2		Termo Relay 2 in motor (e.g. termistor)
	Bit 10: Subpump4WarningsVerificationError		Verification error, code area (ROM, FLASH)
	Bit 11: Subpump4WarningsAlarmBit11		-
	Bit 12: Subpump4WarningsSensorFault		Sensor Fault
	Bit 13: Subpump4WarningsAlarmBit13		-

9.11 Alarm simulation register block

See alarm simulation example in section *10.3 Alarm simulation example*.

Address	Register name	Scale	Description
00701	Simulation.AlarmCode	enum	The Grundfos-specific alarm code to simulate. See section *14.2 Fault finding CIU 252*.
00702	Simulation.WarningCode	enum	The Grundfos-specific warning code to simulate. See section *14.2 Fault finding CIU 252*.
00703	Bit 0: Simulation.Activate	bool	Activation of alarm or warning simulation. 0 = Deactivate simulation 1 = Activate simulation.
00704	Bit 0: Simulation.Active	bool	Status of alarm or warning simulation. 0 = Simulation not active 1 = Simulation active.

9.12 User register block

Address	Register name	Scale	Description
00751-00800	UserRegisters	unscaled	This area is for device labelling by the user. The CIU will not modify this area by itself. The user area values are stored in the device and will remain after a power-off.

10. Detailed descriptions of registers

10.1 Separation of reads and writes

This functional profile supports Modbus holding registers, which means that registers can be both read and written. By default, most of the register values meant for writing by the Modbus master will also be updated by the CIU unit itself to reflect the actual value used by the CIU.

Differences arise due to internal value limitations and because some settings and control values can have other sources (e.g. service port and display) that can change the actual values. To avoid such conflicts, the profile has the option of read/write separation with the option Config.ReadWriteSeparation (register 00006, bit 1 = 1). Using this option means that all writing registers [W] use an associated reading location [R] where the resulting status of the writing always can be verified. In this case, reading and writing never take place via the same registers (Alarm simulation registers being the only exceptions). Reading a writing register only means reading what has previously been written to the Modbus interface, and in the general case this will not reflect what value the CIU unit is actually using.

Example 1

Setting and reading overflow level with ReadWriteSeparation disabled [default].

The user writes a new value to SinglePitStopLevel (register 00102).

The resulting overflow level is then read from SinglePitStopLevel (register 00102).

Note ***ReadWriteSeparation is disabled by default.***

Example 2

Setting and reading overflow level with ReadWriteSeparation enabled.

The user writes a new value to SinglePitStopLevel (register 00102).

The resulting overflow level is then read from SinglePitStopLevel (register 00204), hence separating reads from writes.

10.2 Control bit acknowledgement

All control bits in the functional profile are triggered on the rising edge of a bit. The system supports two different approaches to control bit acknowledgement: Auto and manual.

The AutoAckControlBits setting (register 00005) sets the desired approach:

0 = Disabled.
Control bits are not automatically lowered when accepted by the device. The user must lower the control bit manually before the control bit can be triggered again. When a control bit is accepted by the device, the corresponding control bit acknowledgement will be raised, and the user can lower the control bit.

1 = Enabled.
Control bits are automatically lowered when accepted by the device, so the user does not have to lower it manually [default].

Example 1

ResetAlarm with auto-acknowledgement enabled [default].

The user sets the PitControl.ResetAlarm control bit (register 00101, bit 0) to 1 to reset an alarm. When accepted by the slave, the PitControl.ResetAlarm control bit is automatically reset to 0. The user can then set the PitControl.ResetAlarm control bit to 1 again to reset an alarm again.

Note ***AutoAckEnabled is the default setting.***

Example 2

ResetAlarm with auto-acknowledgement disabled.

The user sets the PitControl.ResetAlarm control bit (register 00101, bit 0) to 1 to reset an alarm. When accepted by the slave, the AcknowledgeRegister.ResetAlarmAck (register 00201, bit 0) is set to 1, and the PitControl.ResetAlarm is still 1. The user must then manually set PitControl.ResetAlarm to 0 before another alarm can be reset. When doing so, the AcknowledgeRegister.ResetAlarmAck will revert to 0 as well.

10.3 Alarm simulation example

It is possible to simulate alarms or warnings for testing purposes. This is done by writing to one of the following registers:

- Simulation.AlarmCode (register 00701)
- Simulation.WarningCode (register 00702)

and afterwards activate simulation with the Simulation.Activate function (register 00703, bit 0). The simulated alarm or warning will be indicated as a real alarm or warning, but system operation will not be influenced. The Simulation.Active (register 00704, bit 0) can be used to check whether simulation is active or not. By writing a 0 to Simulation.Activate, the simulation is deactivated.

Procedure to simulate an alarm:

- Write the value 51 to register 00701 to simulate a "Blocked motor/pump" alarm.
- Activate alarm simulation by writing 1 to Simulation.Activate (register 00703).

10.4 Single-pit and multi-pit mode

10.4.1 Single-pit mode

In single-pit mode, all pumps connected to the CIU are installed in the same pit. The electronics in the pumps ensures that the load is automatically distributed among the pumps, i.e. pump alternation or operation in parallel, if necessary.

Actual pit mode can be read from register 00203.

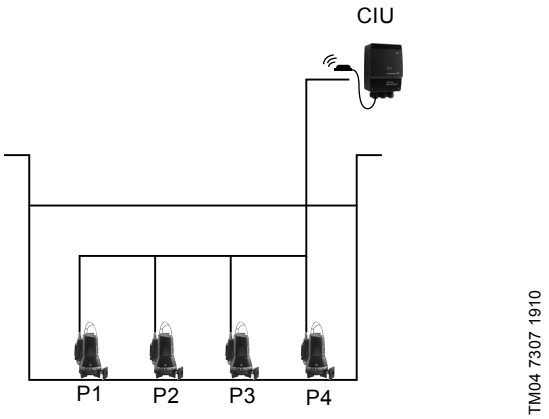


Fig. 18 Single-pit mode

10.4.2 Multi-pit mode

In multi-pit mode, all pumps connected to the CIU are installed in separate pump pits. One CIU can monitor up to four pits.
The pumps will operate as individual pumps.

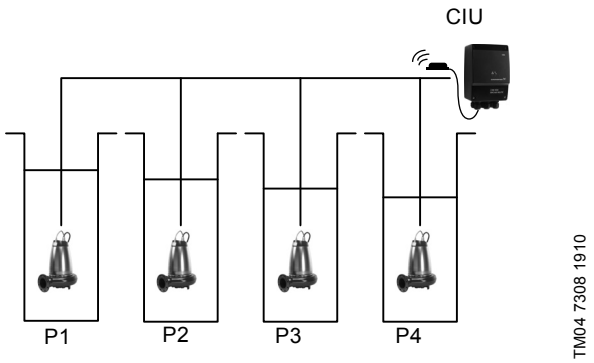


Fig. 19 Multi-pit mode

In multi-pit mode, the CIU does not regard the connected pumps as one system, but as four systems with their own settings.

The CIU will not monitor parameter mismatch between pumps or calculate common pit parameters.

Switching between single- and multi-pit mode can only be done via the Grundfos PC Tool Water Utility for sewage applications or with a handheld Grundfos remote control (Service mode).
Details can be found in the SEG AUTO$_{ADAPT}$/CIU XX2 multi-pit application note.

Note ***It is not possible to combine single-pit mode and multi-pit mode.***

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

Note

If the sensor configuration is changed, restart the CIU XX2 unit to ensure a correct scaling of the sensor value.

11.1 Hardware setup (CIU 202)

Step	Action
1	Complete the system configuration. This can be done either via the R100 or Grundfos GO remote control or Grundfos PC Tool Wastewater.
2	Select the Modbus slave address (1-247).
3	Select the transmission speed of the Modbus slave.
4	Select parity and stop bits of the Modbus slave (even parity with 1 stop bit or no parity with 2 stop bits).
5	If necessary, set line termination.
7	Connect the necessary cables from the CIU 202 to the Modbus network.
8	Connect the power supply cable to the CIU 202, and switch the unit on.
9	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).
The CIU 202 is now ready to be accessed via the Modbus network.	

11.2 Hardware setup (CIU 252 GSM call-up)

Step	Action
1	Connect the communication cables from the CIU 250 to the wastewater pumps (see CIU quick guide instruction).
2	Fit a GSM antenna to the CIM module SMA connector (see section *6.1.1 Fitting a GSM antenna*).
3	Insert the SIM card in the CIM 250 (see section *6.1.2 Inserting the SIM card*).
4	Connect the mains cable to the CIU 252 (see the CIU quick guide instruction) and power on the CIU 252.
5	Power on the Grundfos product
6	Observe that LED2 turns steady green (see section *6.2 LEDs*), indicating that the CIM 250 is fitted correctly in the CIU unit.
7	Observe that LED1 blinks yellow and changes to yellow pulsing after approximately 30 s (see section *6.2 LEDs*), indicating that the GSM connection is working. By making a call-up from a phone the connection can be verified (LED1 turns steady yellow).
8	For configuring the CIU 252 for a call-up connection, follow the instructions in the "CIM 250 SMS commands installation and operating instructions" (included on CIM/CIU support files CD), section 2.1-2.3.
9	To verify the GSM settings after completion, the SMS command GSMSETTINGS can be used.
The CIU 252 is now ready to be accessed from a Modbus RTU master via GSM call-up (or via SMS commands).	

11.3 Hardware setup (CIU 252 GPRS connection)

Step	Action
1	Connect the communication cables from the CIU 252 to the wastewater pumps (see CIU quick guide instruction).
2	Fit a GSM antenna to the CIM module SMA connector (see section *6.1.1 Fitting a GSM antenna*).
3	Insert the SIM card in the CIM 250 (see section *6.1.2 Inserting the SIM card*).
4	Connect the mains cable to the CIU 252 (see the CIU quick-guide instruction), and power on the CIU 252.
5	Power on the Grundfos product.
6	Observe that LED2 turns steady green (see section *6.2 LEDs*), indicating that the CIM 250 is fitted correctly in the CIU unit.
7	Observe that LED1 blinks yellow and changes to yellow pulsing after approximately 30 s (see section *6.2 LEDs*), indicating that the GSM connection is working.
8	For configuring the CIM 250 for a GPRS connection, follow the instructions in the "CIM 250 SMS commands installation and operating instructions" (included on CIM/CIU support files CD), sections 2.1, 2.2 and 2.4.
The CIU 252 is now ready to be accessed from a Modbus TCP master via GPRS (or via SMS commands).	

11.4 Modbus TCP communication setup (CIU 500)

Step	Action
1	Check that both CIU 502 unit and the wastewater pump are powered off.
2	Remove the front cover of the CIU 502 unit.
3	Select position 1 at the CIM 500 module protocol rotary switch (See section *7.2 Setting the Industrial Ethernet protocol*)
4	Connect the communication cables from the CIU 502 to the wastewater pump (see CIU quick guide instructions)
5	Power on the CIU 502 unit and the wastewater pump, and observe LED2 turn steady green and LED1 remaining off.
6	Connect one of the CIU 502 Ethernet ports (RJ45) to a PC using an Ethernet cable.
7	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 “A.1 How to configure an IP address on your PC” on page 55)
8	Open your internet browser and make contact to the CIM 500 Web server. Default address: 192.168.1.100
9	Log in to the Web server. Default: User: admin Password: Grundfos
10	In the menu column to the left select: Configuration > Real time Ethernet protocol
11	Type in an IP address belonging to the same subnet as your PC (e.g. 192.168.1.2).
12	Type in the subnet mask 255.255.255.0, and leave the rest of the settings at their factory default values.
13	Click [Submit] to transfer the new settings and close the Web browser.

CIU 502 is now ready to be accessed from a Modbus TCP master via one of its Ethernet ports. Use the IP address selected under step 10. The Modbus address (Unit ID) in the Modbus TCP telegram is not used.

- The CIU 502 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/CIU while connected to another Modbus TCP master.

12. Detailed descriptions of functionality

12.1 GSM

12.1.1 Call-up functional description

The call-up function is used for SCADA system communication via the GSM network. Connection is established when the SCADA system dials the CIU 252. The CIU 252 will automatically "pick up the phone" and wait for data traffic in the form of Modbus RTU telegrams.

If legal data traffic has not been initiated within one minute, the CIU 252 will hang up the line. This silence timeout is active during the whole communication session. Whenever the SCADA system has completed the Modbus communication, it hangs up the line. This is detected by the CIU 252, which also hangs up the line, and the call-up communication session is thereby completed. See fig. 20.

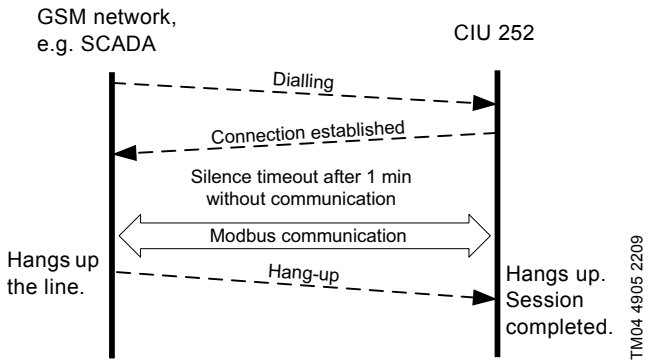


Fig. 20 Illustration of a GSM call-up session

12.1.2 SCADA PIN code protection

It is always possible to get read access via Modbus, but if the CIU 252 is SCADA PIN-code-protected (GeneralStatus register 00029, bit 0 = 1), write access requires that the correct PIN code (ScadaPinCode, register 00011) has been written. Writing the correct PIN code will trigger the write access control, and write access will be open, which can be verified with GeneralStatus, register 00029, bit 1 = 1).

For call-up connections with PIN code protection, the ScadaPinCode register has to be written each time a new call-up is made.

12.1.3 GSM call-up options setup

To prepare the CIU 252 for Modbus communication with a SCADA system via GSM, some settings have to be made via SMS commands:

- Setting a SCADA PIN code:
  SETSCADACODE <access code>
  will enable write access protection.

Default is an empty SCADA PIN code, meaning no protection.

- Activating the SCADA PIN code:
  SCADACODE <ON | OFF>.

Default is "Off".

- Selecting the Modbus address:
  MODBUSADDR <1-247>

Default value is 231.

To verify the SCADA GSM setting after completion, the SMS command "SCADA" can be used.

For details about the use of SMS commands, see "CIM 250 SMS commands" (supplement to the installation and operating instructions) on the CD-ROM supplied with the GSM module.

12.2 GPRS

12.2.1 What is GPRS and Modbus TCP?

GPRS (General Packet Radio Service) is a wireless, "always on" connection that remains active as long as the CIU 252 is within range of the service. With GPRS it is possible to establish a wireless connection to the Internet and thus enable a remote connection to a SCADA system computer or another PC application. Typical data rates are 32 to 48 kbit/s.

The GPRS itself takes care of the wireless data transfer via the GSM network. It plays the same role as Ethernet in a wired network. On top of GPRS is the TCP/IP protocol, which enables easy integration with the Internet. The Modbus TCP protocol is used on the application layer communicating with a TCP port number (default 502). The difference when compared to the fieldbus protocol Modbus RTU is the exclusion of the 16-bit CRC checksum and the adding of a Modbus application program header as illustrated in fig. 21.

12.2.2 Subscription

The GSM service providers have different technical solutions for GPRS to choose from. You have to select the service provider and the technical solution that best suit your system, and it must be based on static IP addressing. You will get the following from the GSM service provider:

- A Subscriber Identity Module (SIM card).
- An Access Point Name (APN), e.g. "Internet".
- A user name (is fixed and cannot be changed by the user).
- A password (is fixed and cannot be changed by the user).
- A static IP address.

Solutions based on a VPN (Virtual Private Network) involve the use of special routers, e.g. GRE (Generic Routing Encapsulation) routers, which you will also get from the service provider.

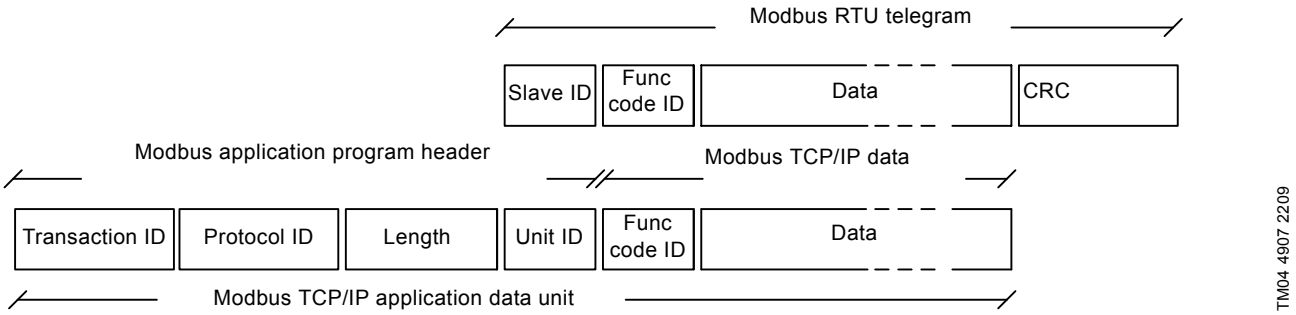


Fig. 21 Modbus TCP telegram

12.2.3 Installation

To prepare the CIU 252 for GPRS communication, some settings have to be made via SMS commands:

- Select Access Point Name:
  APN <ascii string>
  This is always mandatory.
- Select Username:
  USERNAME <ascii string>
  The need for a user name depends on your operator and the type of subscription.
- Select Password:
  PASSWORD <ascii string>
  The need for a password depends on your operator and the type of subscription.

Some advanced GPRS settings have default values that usually work, but in special cases, it might be necessary to change some of them. This is also done via SMS commands.

- Select Authentication:
  AUTHENTICATION <NORMAL | SECURE>
  Only used by some service providers. Default value is "Normal".
- Select Connection type:
  CONNECTION <SERVER | CLIENT | DISABLE>
  Default value is "Server".
- Set GPRS roaming:
  GPRSROAMING: <ON | OFF>
  Default value is "Off".
- Select Modbus TCP port number:
  MODBUSPORT <port no.>
  Default value is 502.
- Select GENIpro port number:
  GENIPROPORT <port no.>
  Default value is 49152. This is only relevant when using Grundfos PC Tools.

It is possible to configure the GPRS connection with a single multi-parameter command:

- SETGPRS <parameter 1, parameter 2, parameter 3, …>
  - <parameters>:<APN>,<Modbus port>,<GENIproport>, <username>,<password>,<authentication>,<connection>, <GPRS roaming>

Example

SETGPRS
Grundfos.dk2.tdc,502,49888,Grundfos,4321,normal,server,off

To verify the GPRS setting after completion, the SMS command GPRSSETTING can be used. The command GPRSSTATUS can verify if the GPRS connection is working.

The connection states have the following meaning:

- "Detached": Trying to locate GPRS service.
- "Attached": GPRS service located.
- "Context active": IP address has been assigned, ready for a client to establish a socket connection.
- "Connected": A client has established a socket connection. The system is ready for TCP/IP data exchange (or already exchanging data).

For details about the use of SMS commands, see "CIM 250 SMS commands" (supplement to the installation and operating instructions) on the CD-ROM supplied with the GSM module.

12.2.4 Operation

When powering on a CIU 252 with the correct GPRS setting, the following GPRS connection sequence will take place:

1. The CIU 252 locates the GPRS service. The connection state changes from "Detached" to "Attached".
2. The CIU 252 attempts to connect to the APN it has been given and requests an IP address. The base station looks through its record of legal SIM cards and finds the IP address (the address associated with this SIM card) to assign to the CIU 252. After the CIU 252 has got the IP address, the connection state changes to "Context active".
3. The CIU 252 is now ready for a client (e.g. SCADA system) to establish a socket connection and begin TCP/IP data exchange. When a client connects the CIU 252, the connection state will change to "Connected", and the GSM status LED1 will indicate when data transfer takes place. See section *5.5 LEDs*.

Note

When no GPRS data is being transferred, the connection states "Attached", "Context active" and "Connected".
All show the same LED1 status (short pulse).

A client, e.g. SCADA, establishes connection to a CIU 252 by specifying the IP address and the TCP port 502. Data transfer is always initiated from the client in the form of a Modbus TCP telegram embedded in a TCP/IP frame and directed to TCP port 502. To the client software, the connection to the CIU 252 is completely transparent.

The protection against unauthorised data access is high. The access to the GPRS network from the Internet can only take place via the VPN tunnel. See fig. 23. Moreover, data transfer requires a Modbus master client, knowledge of the Modbus functional profile and the use of a SCADA PIN code, if enabled.

The CIU 252 supervises the GPRS system to ensure that it is still working. An automatic procedure ensures restarting of the CIU 252 and repetition of the GPRS connection sequence in case a deadlock situation has occurred. It also closes down socket connections that are left open by the client and unused for more than 24 hours.

It is possible to use SMS communication while GPRS communication is active. However, in the "Connected" state the delay time between reception and reply will increase.

If the connection state is different from "Connected", it is possible to establish a call-up connection. When the call-up connection is established, GPRS data exchange will be blocked until the call-up is terminated by the caller.

A total of three Modbus clients can be connected to the Modbus TCP port of the CIU 252 and communicate simultaneously. Each connection, called a socket connection, is handled independently. If all three sockets are used simultaneously, a "Silence timeout" of only one minute is used to prevent a complete occupation for a long time.

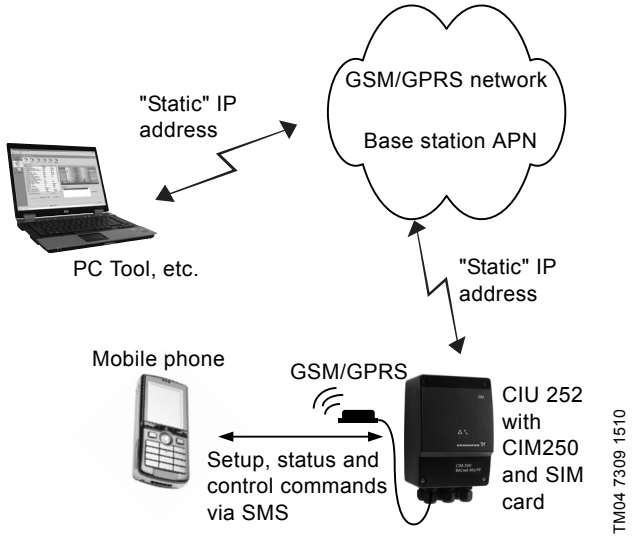


Fig. 22 GPRS connection from a PC to the CIU 252 directly via GPRS

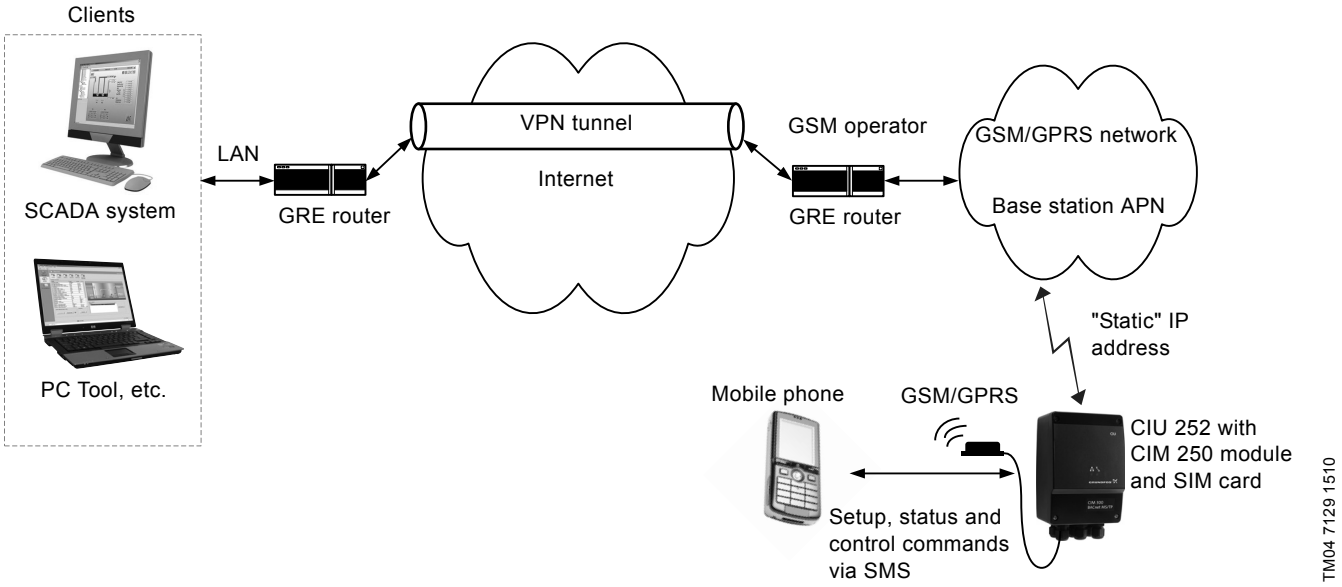


Fig. 23 GPRS connection via VPN tunnel

13. Modbus RTU telegram examples

Note ***CRC fields are not shown in the following examples.***

Note ***The Modbus data model states that registers numbered X are addressed in telegrams as X - 1, e.g. register 00104 (setpoint) is addressed as 00103 in a Modbus telegram.***

13.1 Modbus telegram overview

The maximum size of a Modbus RTU telegram is 256 bytes. Telegrams must be separated by a silent interval of at least 3.5 character times.

The standard Modbus RTU telegram format is shown in the table below.

Slave address	Function code	Data	CRC
1 byte	1 byte	0 to 252 bytes	2 bytes

A telegram starts with the slave address occupying one byte. Then comes a variable-size data field. For each telegram, a CRC is calculated and appended to the telegram (two bytes total). All bytes in the telegram, except for the CRC itself, are included in the check.

Note ***The CRC bytes are not shown in the examples in the following sections.***

13.2 Read holding registers (0x03)

This function is used for reading holding registers from the slave.

The request telegram specifies the starting address (the address of the first register to be read) and the number of holding registers to read. In the telegram, register addresses start from zero, meaning that registers numbered 0-16 are addressed as 0-15.

The register data in the response message are packed two bytes per register. For each register, the first byte contains the high-order bits while the second byte contains the low-order bits.

Example of request from master to slave

Field	Value
Address	0x01
Function code	0x03
Start address HI	0x00
Start address LO	0x6B
Quantity HI	0x00
Quantity LO	0x03

In the request, the slave with address 1 is asked to deliver three contiguous registers starting from address 0x006b = 107 (meaning register 108).

Example of response from slave to master

Field	Value
Address	0x01
Function code	0x03
Byte count	0x06
Register 108 HI	0x00
Register 108 LO	0x01
Register 109 HI	0x00
Register 109 LO	0x01
Register 110 HI	0x00
Register 110 LO	0x01

In the response, the byte count is six since there are three registers of two bytes. All three registers hold the value of 0x0001.

13.3 Read input registers (0x04)

This function is used for reading input registers from the slave. Input registers are read-only registers by definition. The request telegram specifies the starting address (the address of the first register to be read) and the number of holding registers to read. In the telegram, register addresses start from zero, meaning that registers numbered 0-16 are addressed as 0-15.

The register data in the response message are packed two bytes per register. For each register, the first byte contains the high-order bits while the second byte contains the low-order bits.

Example of request from master to slave

Field	Value
Address	0x01
Function code	0x04
Start address HI	0x10
Start address LO	0x10
Quantity HI	0x00
Quantity LO	0x03

In the request, the slave with address 1 is asked to deliver three contiguous registers starting from address 0x1010 = 4112 (meaning register 4113).

Example of response from slave to master

Field	Value
Address	0x01
Function code	0x04
Byte count	0x06
Register 4113 HI	0x22
Register 4113 LO	0x22
Register 4114 HI	0x22
Register 4114 LO	0x22
Register 4115 HI	0x22
Register 4115 LO	0x22

In the response, the byte count is six since there are three registers of two bytes. All three registers hold the value of 0x2222.

13.4 Write single register (0x06)

This function is used for writing a single holding register in the slave. The request telegram specifies the address of the register that is to be written. Register addresses start from zero, meaning that a register numbered 10 is addressed as 9.

The normal response is an echo of the request, indicating that the value was written.

Example of request from master to slave

Field	Value
Address	0x01
Function code	0x06
Address HI	0x10
Address LO	0x00
Value HI	0xAF
Value LO	0xFE

In the request, the slave with address 1 is asked to write the value of 0xAFFE to the register at address 0x1000.

Example of response from slave to master

Field	Value
Address	0x01
Function code	0x06
Address HI	0x10
Address LO	0x00
Value HI	0xAF
Value LO	0xFE

The response is an echo of the request.

13.5 Write multiple registers (0x10)

This function is used for writing a block of contiguous holding registers in the slave. Register addresses start from zero, meaning that a register numbered 100 is addressed as 99.

Example of request from master to slave

Field	Value
Address	0x01
Function code	0x10
Start address HI	0x00
Start address LO	0x20
Quantity HI	0x00
Quantity LO	0x02
Byte count	0x04
Register 33 HI	0x00
Register 33 LO	0x01
Register 34 HI	0xB0
Register 34 LO	0xB0

In the request, the slave with address 1 is asked to write the value of 0x0001 to the register at address 0x0020 and the value of 0xB0B0 to the register at address 0x0021.

Example of response from slave to master

Field	Value
Address	0x01
Function code	0x10
Start address HI	0x00
Start address LO	0x20
Quantity written HI	0x00
Quantity written LO	0x02

The response returns the function code, starting address and quantity of registers written.

13.6 Diagnostics (0x08)

This function provides a test for checking the communication system between the master and the Grundfos slave. It contains a single-byte subcode to identify the test to be performed.

The following subcodes are supported:

Subcode	Name
0x00	Return query data Data in this request are to be echoed in the response. The response must be identical to the request, so this function is often used to verify Modbus communication.
0x01	Restart communications All communication counters are cleared, and the device is restarted.
0x02	Return diagnostics register Returns the 16-bit diagnostics register. See section *13.7 Diagnostics register interpretation*.
0x04	Force listen only Forces the device into listen-only mode. This effectively mutes the device, making it unable to communicate on the network. To bring the device back to normal mode, a "Restart communications" command (code 0x08, subcode 0x01) must be issued.
0x0A	Clear counters and diagnostics register Clears all counters and the diagnostics register (these are also cleared on power-up/restart).
0x0B	Return bus message count Returns the number of messages detected by the slave.
0x0C	Return bus CRC error count Returns the number of CRC errors in the slave.
0x0D	Return bus exception count Returns the number of Modbus exception responses that the slave has transmitted.
0x0E	Return slave message count Returns the number of messages that the slave has processed.
0x0F	Return slave no response count Returns the number of messages for which the slave has sent no response.
0x12	Return bus character overrun count Returns the number of overruns in the slave.
0x14	Clear overrun counter Clears the overrun counter (this is also cleared on power-up/restart).

Example of request from master to slave

Field	Value
Address	0x01
Function code	0x08
Subcode	0x00
Data	0xAB
Data	0xCD

The response is identical to the request.

Example of response from slave to master

Field	Value
Address	0x01
Function code	0x08
Subcode	0x00
Data	0xAB
Data	0xCD

13.7 Diagnostics register interpretation

The diagnostics register is interpreted as follows:

Bit	Description
0	Communication failure (with the Grundfos product).
1	EEPROM self-test failed (the test is carried out when system is booted).
2	Grundfos product not supported.
3	Modbus address offset is different from default value, i.e. it differs from 0.
4	Using software-defined Modbus transmission speed (Modbus RTU only).
5	RESERVED
6	RESERVED
7	RESERVED
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

A bit value of 1 means true, unless otherwise specified.
The diagnostics register is read using function code 0x08 and subcode 0x02.

13.8 Diagnostics: Return query data

This function is useful to ensure that the communication path and slave configuration are correct. It will echo the request in the response.

In the example, slave address 0x01 is used.

Request from master to slave

Field	Value	Description
Slave address	0x01	-
Function code	0x08	Diagnostics
Subcode	0x00	Echo request
Data	0xAB	Test data
Data	0xCD	Test data

Example of response from slave to master

Field	Value	Description
Slave address	0x01	-
Function code	0x08	Diagnostics
Subcode	0x00	Echo request
Data	0xAB	Test data
Data	0xCD	Test data

If there is no response from the slave, see section *14. Fault finding*.

13.9 Reading the CIM configuration register block

This section shows how to read the first four registers of the CIM configuration register block.

In the example, slave address 0x01 is used.

Request from master to slave

Field	Value	Description
Slave address	0x01	-
Function code	0x04	Read input registers
Start address HI	0x00	Start address = 0x0001
Start address LO	0x00	
Quantity HI	0x00	Number of registers = 0x0004
Quantity LO	0x04	

Example of response from slave to master

Field	Value	Description
Slave address	0x01	-
Function code	0x04	Read input registers
Byte count	0x08	8 bytes follow
00001 HI	0x00	SlaveMinimumReplyDelay = 0x000A
00001 LO	0x0A	
00002 HI	0x00	RegisterOffset = 0x0000
00002 LO	0x00	
00003 HI	0x00	Reserved value = 0x0000
00003 LO	0x00	
00004 HI	0x00	SoftwareDefinedBitRate = 0x0004
00004 LO	0x04	

If there is no response from the slave, see section *14. Fault finding*.

13.10 Reading the pit water level

This section shows how to read and interpret the water level of the pit. In the example, slave address 0x01 is used.

Request from master to slave

Field	Value	Description
Slave address	0x01	-
Function code	0x04	Read input registers
Start address HI	0x01	Start address (00301) = 0x012D
Start address LO	0x2C	
Quantity HI	0x00	Number of registers = 0x0001
Quantity LO	0x01	

Example of response from slave to master

Field	Value	Description
Slave address	0x01	-
Function code	0x04	Read input registers
Byte count	0x02	2 bytes follow
00301 HI	0x00	Pit water level = 0x00DC (220)
00301 LO	0xDC	

A pit water level value of 220 [0.01 m] equals a water level of 2.20 metres.

If there is no response from the slave, see section *14. Fault finding*.

13.11 Reset alarm

This section shows how to reset an alarm. In the example, slave address 0x01 (1) is used. The ResetAlarm is the first bit in register 00101, so the bit must be set from 0 to 1.

Request from master to slave

Field	Value	Description
Slave address	0x01	-
Function code	0x06	Write single register
Start address HI	0x00	ControlRegister address = 00101 (0x0065)
Start address LO	0x64	-
Value HI	0x00	Set the value to 1.
Value LO	0x01	-

Example of response from slave to master

Field	Value	Description
Slave address	0x01	-
Function code	0x06	Write single register
Start address HI	0x00	ControlRegister address = 00101 (0x0065)
Start address LO	0x64	-
Value HI	0x00	Set the value to 1.
Value LO	0x01	-

If there is no response from the slave, see section *14. Fault finding*.

14. Fault finding

14.1 Fault finding CIU 202

Faults in a CIU 202 can be detected by observing the status of the two communication LEDs. See the table below and section *4. Specifications*.

14.1.1 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 CIU 202.	Ensure that the CIM 200 is fitted correctly.
	b) The CIU 202 is defective.	Replace the CIU 202.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIM 200 and the CIU 202.	• Ensure that the CIM 200 is fitted correctly in the CIU 202.
3. The LED for internal communication (LED2) is constantly red.	a) The CIM 200 does not support the in which it is installed.	Contact the nearest Grundfos company.
4. The Modbus LED (LED1) is constantly red.	a) Fault in the CIM 200 Modbus configuration.	• 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].
5. The Modbus LED (LED1) is flashing red.	a) Fault in the Modbus communication (fault in parity or cyclic redundancy check).	• 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*.

14.1.2 CIU 202 Modbus communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams.	a) Configuration or wiring error.	• 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 Grundfos product 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 CIU 202.	See section *8. 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 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 Grundfos product.	See section *9. Modbus register overview* for available data.
	b) The Grundfos product is not configured to show the value or lacks a sensor to read the value.	See section *9.6 Pit data register block* for data values that require a sensor.
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.

14.2 Fault finding CIU 252

Faults in the CIU 252 can be detected by observing the status of the two communication LEDs. See the table below and section *4. Specifications*.

14.2.1 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 250 is fitted incorrectly in the Grundfos product.	Ensure that the CIM 250 is fitted/connected correctly.
	b) The CIM 250 is defective.	Replace the CIM 250.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIM 250 and the Grundfos product.	Ensure that the CIM 50 is fitted correctly in the Grundfos product.
3. The LED for internal communication (LED2) is constantly red.	a) The CIM 250 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
4. The LED for GSM/GPRS communication (LED1) is flashing yellow. See signal 1 in fig. 13 on page 12.	a) The SIM card has not been inserted.	Insert the SIM card. See section *6.1.2 Inserting the SIM card*.
	b) The SIM card has not been inserted correctly.	Insert the SIM card. See section *6.1.2 Inserting the SIM card*.
	c) The SIM card PIN code is not correct.	Enter the correct PIN code. See section *6.1.2 Inserting the SIM card*.
	d) No connection to the GSM network.	• Check the connection to the antenna. • Check the GSM coverage of the area using e.g. a mobile phone. • Use an external antenna and experiment with the position.
5. The LED for GSM/GPRS communication is pulsating yellow with single pulse, but the CIM 250 cannot send or receive SMS messages.	a) The CIM 250 has not been initialised.	Follow the configuration procedure in "CIM 250 SMS commands" (supplement to installation and operating instructions) on the CD-ROM supplied with the GSM module.

14.2.2 CIU 252 Modbus GSM/GPRS communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams.	a) Configuration or installation error.	• Ensure that the CIU 252 has contact with the GSM network. The LED1 should be pulsing yellow. If the LED1 signal is incorrect, see section *6. Modbus GSM/GPRS, CIM 250 setup* for correct installation of the CIM 250. • Ensure that the correct slave address is used in the Modbus master poll. See register 00003 SoftwareDefinedModbusAddress (factory value is 00231).
	b) The slave may be in listen-only mode.	Either send a restart communications diagnostics command, or restart the product 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 reply delay in the master, or reduce the "SlaveMinimumReplyDelay" 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 CIU 252.	See section *13. Modbus RTU telegram examples* 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 register blocks in one telegram. This is not possible since there are unused addresses among the blocks.	Avoid reading or writing invalid data addresses. Ensure that register X is addressed as X-1 in Modbus telegrams, according to the Modbus standard.
4. The slave returns data value 0xFFFF (65535).	a) The availability of data will in some cases depend on a configuration or the actual conditions of the system (e.g. trying to request data from a pump which is not present will return "data not available" (0xFFFF)).	See section *9. Modbus register overview* for available data.
	b) With its present configuration or operating mode, the Grundfos product is unable to supply the requested data.	See section *9.6 Pit data register block* for data values that require a sensor.
5. The slave does not react to control actions or to writing of settings.	a) The CIU 252 is SCADA PIN-code-protected (GeneralStatus register 00029, bit 0 = 1), and an incorrect PIN code has been written.	Write access requires a correct PIN code (ScadaPinCode, register 00011). Writing the correct PIN code value will trigger the write access control, and write access will be open, which can be verified with GeneralStatus, register 00029, bit 1 = 1.

14.3 Fault finding CIU 502

Faults in the CIU 502 can be detected by observing the status of the two communication LEDs. See the table below and section *4.4 CIU 502 Modbus TCP*.

14.3.1 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.	Ensure that the CIM 500 is fitted/connected correctly.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIU 502 and the Grundfos product.	• Check the cable connection between the Grundfos product and the CIU 502. • Check that the individual conductors have been fitted correctly. e.g. not reversed. • Check the power supply to the Grundfos product.
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 Ethernet 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 56.
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.

14.3.2 CIU 502 Modbus TCP communication faults

Fault	Possible cause	Remedy
1. The slave does not respond to telegrams	a) Configuration or wiring error	• 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 this is not fulfilled, see section 14.3.1. • Ensure that the cable between the Modbus TCP master and the Modbus slave is connected correctly. See section 7.1. • 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 7.3.
2. The slave responds with exception response 0x01 "Invalid function"	The master is trying to use an unsupported function in the CIU 502.	See section 8. 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 Grundfos product.	See section *9. Modbus register overview* for available data.
	b) The Grundfos product is not configured to show the value or lacks a sensor to read the value.	See section *9.6 Pit data register block* for data values that require a sensor.

15. Modbus RTU rotary switch addresses

Modbus address	SW 6	SW 7
1	0	1
2	0	2
3	0	3
4	0	4
5	0	5
6	0	6
7	0	7
8	0	8
9	0	9
10	0	A
11	0	B
12	0	C
13	0	D
14	0	E
15	0	F
16	1	0
17	1	1
18	1	2
19	1	3
20	1	4
21	1	5
22	1	6
23	1	7
24	1	8
25	1	9
26	1	A
27	1	B
28	1	C
29	1	D
30	1	E
31	1	F
32	2	0
33	2	1
34	2	2
35	2	3
36	2	4
37	2	5
38	2	6
39	2	7
40	2	8
41	2	9
42	2	A
43	2	B
44	2	C
45	2	D
46	2	E
47	2	F
48	3	0
49	3	1
50	3	2

Modbus address	SW 6	SW 7
51	3	3
52	3	4
53	3	5
54	3	6
55	3	7
56	3	8
57	3	9
58	3	A
59	3	B
60	3	C
61	3	D
62	3	E
63	3	F
64	4	0
65	4	1
66	4	2
67	4	3
68	4	4
69	4	5
70	4	6
71	4	7
72	4	8
73	4	9
74	4	A
75	4	B
76	4	C
77	4	D
78	4	E
79	4	F
80	5	0
81	5	1
82	5	2
83	5	3
84	5	4
85	5	5
86	5	6
87	5	7
88	5	8
89	5	9
90	5	A
91	5	B
92	5	C
93	5	D
94	5	E
95	5	F
96	6	0
97	6	1
98	6	2
99	6	3
100	6	4

Modbus address	SW 6	SW 7
101	6	5
102	6	6
103	6	7
104	6	8
105	6	9
106	6	A
107	6	B
108	6	C
109	6	D
110	6	E
111	6	F
112	7	0
113	7	1
114	7	2
115	7	3
116	7	4
117	7	5
118	7	6
119	7	7
120	7	8
121	7	9
122	7	A
123	7	B
124	7	C
125	7	D
126	7	E
127	7	F
128	8	0
129	8	1
130	8	2
131	8	3
132	8	4
133	8	5
134	8	6
135	8	7
136	8	8
137	8	9
138	8	A
139	8	B
140	8	C
141	8	D
142	8	E
143	8	F
144	9	0
145	9	1
146	9	2
147	9	3
148	9	4
149	9	5
150	9	6

Modbus address	SW 6	SW 7
151	9	7
152	9	8
153	9	9
154	9	A
155	9	B
156	9	C
157	9	D
158	9	E
159	9	F
160	A	0
161	A	1
162	A	2
163	A	3
164	A	4
165	A	5
166	A	6
167	A	7
168	A	8
169	A	9
170	A	A
171	A	B
172	A	C
173	A	D
174	A	E
175	B	F
176	B	0
177	B	1
178	B	2
179	B	3
180	B	4
181	B	5
182	B	6
183	B	7
184	B	8
185	B	9
186	B	A
187	B	B
188	B	C
189	B	D
190	B	E
191	B	F
192	C	0
193	C	1
194	C	2
195	C	3
196	C	4
197	C	5
198	C	6
199	C	7
200	C	8

Modbus address	SW 6	SW 7
201	C	9
202	C	A
203	C	B
204	C	C
205	C	D
206	C	E
207	C	F
208	D	0
209	D	1
210	D	2
211	D	3
212	D	4
213	D	5
214	D	6
215	D	7
216	D	8
217	D	9
218	D	A
219	D	B
220	D	C
221	D	D
222	D	E
223	D	F
224	E	0
225	E	1
226	E	2
227	E	3
228	E	4
229	E	5
230	E	6
231	E	7
232	E	8
233	E	9
234	E	A
235	E	B
236	E	C
237	E	D
238	E	E
239	E	F
240	F	0
241	F	1
242	F	2
243	F	3
244	F	4
245	F	5
246	F	6
247	F	7

Example: To set the slave address to the value 142, set the rotary switches SW6 and SW7 to "8" and "E", respectively. Please note that 0 is not a valid slave address as this is used for broadcasting.

Caution

It is very important to ensure that two devices do not have the same address on the network. If two devices have the same address, the result will be an abnormal behaviour of the whole serial bus.

16. Grundfos alarm and warning codes

This is a general Grundfos alarm and warning code list. Not all codes apply to Grundfos wastewater pumps.

Code	Description	Code	Description	Code	Description
1	Leakage current	36	Discharge valve leakage	77	Communication fault, twin-head pump
2	Missing phase	37	Suction valve leakage	78	Fault, speed plug
3	External fault signal	38	Vent valve defective	79	Functional fault, add-on module
4	Too many restarts	40	Undervoltage	80	Hardware fault, type 2
5	Regenerative braking	41	Undervoltage transient	81	Verification error, data area (RAM)
6	Mains fault	42	Cut-in fault (dV/dt)	82	Verification error, code area (ROM, FLASH)
7	Too many hardware shutdowns	45	Voltage asymmetry	83	Verification error, FE parameter area (EEPROM)
8	PWM switching frequency reduced	48	Overload	84	Memory access error
9	Phase sequence reversal	49	Overcurrent (i_line, i_dc, i_mo)	85	Verification error, BE parameter area (EEPROM)
10	Communication fault, pump	50	Motor protection function, general shutdown (mpf)	88	Sensor fault
11	Water-in-oil fault (motor oil)	51	Blocked motor/pump	89	Signal fault, feedback sensor 1
12	Time for service (general service information)	52	Motor slip high	90	Signal fault, speed sensor
13	Moisture alarm, analog	53	Stalled motor	91	Signal fault, temperature 1 sensor
14	Electronic DC-link protection activated (ERP)	54	Motor protection function, 3 sec. limit	92	Calibration fault, feedback sensor
15	Communication fault, main system (SCADA)	55	Motor current protection activated (MCP)	93	Signal fault, sensor 2
16	Other	56	Underload	94	Limit exceeded, sensor 1
17	Performance requirement cannot be met	57	Dry running	95	Limit exceeded, sensor 2
18	Commanded alarm standby (trip)	58	Low flow	96	Setpoint signal outside range
19	Diaphragm break (dosing pump)	59	No flow	97	Signal fault, setpoint input
20	Insulation resistance low	60	Low input power		
21	Too many starts per hour	64	Overtemperature	98	Signal fault, input for setpoint influence
22	Moisture switch alarm, digital	65	Motor temperature 1 (t_m or t_mo or t_mo1)	99	Signal fault, input for analog setpoint
23	Smart trim gap alarm	66	Temperature, control electronics (t_e)	104	Software shutdown
24	Vibration	67	Temperature too high, internal frequency converter module (t_m)	105	Electronic rectifier protection activated (ERP)
25	Setup conflict	68	External temperature/water temperature (t_w)	106	Electronic inverter protection activated (EIP)
26	Load continues even if the motor has been switched off	69	Thermal relay 1 in motor (e.g. Klixon)	110	Skew load, electrical asymmetry
27	External motor protector activated (e.g. MP 204)	70	Thermal relay 2 in motor (e.g. thermistor)	111	Current asymmetry
28	Battery low	71	Motor temperature 2 (Pt100, t_mo2)	112	Cos φ too high
29	Turbine operation (impellers forced backwards)	72	Hardware fault, type 1	113	Cos φ too low
30	Change bearings (specific service information)	73	Hardware shutdown (HSD)	120	Auxiliary winding fault (single-phase motors)
31	Change varistor(s) (specific service information)	74	Internal supply voltage too high	121	Auxiliary winding current too high (single-phase motors)
32	Overvoltage	75	Internal supply voltage too low	122	Auxiliary winding current too low (single-phase motors)
35	Gas in pump head, deaerating problem	76	Internal communication fault	123	Start capacitor, low (single-phase motors)

Code	Description	Code	Description	Code	Description
124	Run capacitor, low (single-phase motors)	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing	213	VFD not ready
144	Motor temperature 3 (Pt100, t_mo3)	180	Signal fault, bearing temperature sensor (Pt100), middle bearing	214	Water shortage, level 2
145	Bearing temperature high (Pt100), in general or top bearing	181	Signal fault, PTC sensor (short-circuited)	215	Soft pressure build-up timeout
146	Bearing temperature high (Pt100), middle bearing	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing	216	Pilot pump alarm
147	Bearing temperature high (Pt100), bottom bearing	183	Signal fault, extra temperature sensor	217	Alarm, general-purpose sensor high
148	Motor bearing temperature high (Pt100) in drive end (DE)	184	Signal fault, general-purpose sensor	218	Alarm, general-purpose sensor low
149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	185	Unknown sensor type	219	Pressure relief not adequate
152	Communication fault, add-on module	186	Signal fault, power meter sensor	220	Fault, motor contactor feedback
153	Fault, analog output	187	Signal fault, energy meter	221	Fault, mixer contactor feedback
154	Communication fault, display	188	Signal fault, user-defined sensor	222	Time for service, mixer
155	Inrush fault	189	Signal fault, level sensor	223	Maximum number of mixer starts per hour exceeded
156	Communication fault, internal frequency converter module	190	Sensor limit 1 exceeded (e.g. alarm level in WW application)	224	Pump fault (due to auxiliary component or general fault)
157	Real-time clock out of order	191	Sensor limit 2 exceeded (e.g. high level in WW application)	225	Communication fault, pump module
158	Hardware circuit measurement fault	192	Sensor limit 3 exceeded (e.g. overflow level in WW application)	226	Communication fault, I/O module
159	CIM fault (Communication Interface Module)	193	Sensor limit 4 exceeded	227	Combi event
160	GSM modem, SIM card fault	194	Sensor limit 5 exceeded	228	Not used
161	Sensor supply fault, 5 V	195	Sensor limit 6 exceeded	229	Not used
162	Sensor supply fault, 24 V	196	Operation with reduced efficiency	230	Network alarm
163	Measurement fault, motor protection	197	Operation with reduced pressure	231	Ethernet: No IP address from DHCP server
164	Signal fault, Liqtec sensor	198	Operation with increased power consumption	232	Ethernet: Auto-disabled due to misuse
165	Signal fault, analog input 1	199	Process out of range (monitoring/ estimation/calculation/control)	233	Ethernet: IP address conflict
166	Signal fault, analog input 2	200	Application alarm	236	Pump 1 fault
167	Signal fault, analog input 3	201	External sensor input high	237	Pump 2 fault
168	Signal fault, pressure sensor	202	External sensor input low	238	Pump 3 fault
169	Signal fault, flow sensor	203	Alarm on all pumps	239	Pump 4 fault
170	Signal fault, water-in-oil (WIO) sensor	204	Inconsistency between sensors	240	Lubricate bearings (specific service information)
171	Signal fault, moisture sensor	205	Level float switch sequence inconsistency	241	Motor phase failure
172	Signal fault, atmospheric pressure sensor	206	Water shortage, level 1	242	Automatic motor model recognition failed
173	Signal fault, rotor position sensor (Hall sensor)	207	Water leakage	243	Motor relay has been forced (manually operated/commanded)
174	Signal fault, rotor origo sensor	208	Cavitation	244	Fault, On/Off/Auto switch
175	Signal fault, temperature 2 sensor	209	Non-return valve fault	245	Pump continuous runtime too long
176	Signal fault, temperature 3 sensor	210	High pressure	246	User-defined relay has been forced (manually operated/ commanded)
177	Signal fault, smart trim gap sensor	211	Low pressure	247	Power-on notice (device/system has been switched off)
178	Signal fault, vibration sensor	212	Diaphragm tank precharge pressure out of range	248	Fault, battery/UPS

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 CIM 500 Installation & Operating instructions.

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 tab "Alternate Configuration".
7. Configure an IP address and subnet mask to be used by your PC. See fig. 24.

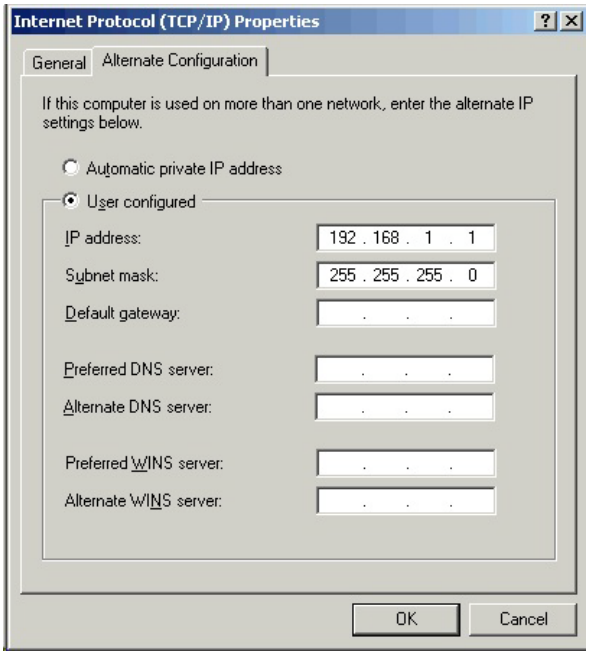


Fig. 24 Example from Windows XP

A.2 Web server configuration

The built-in web server is an easy and effective way to monitor 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:

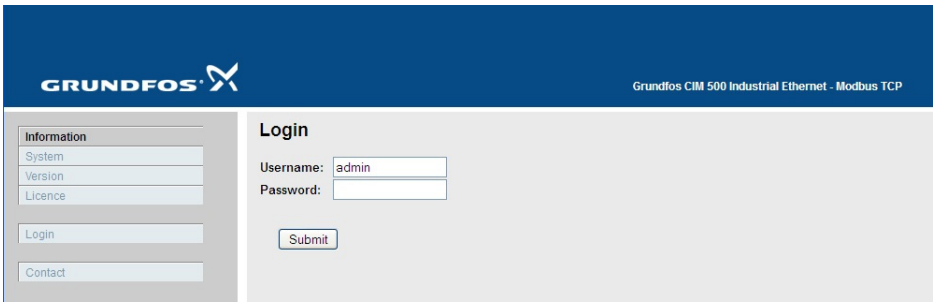
Before configuration

- Check that 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



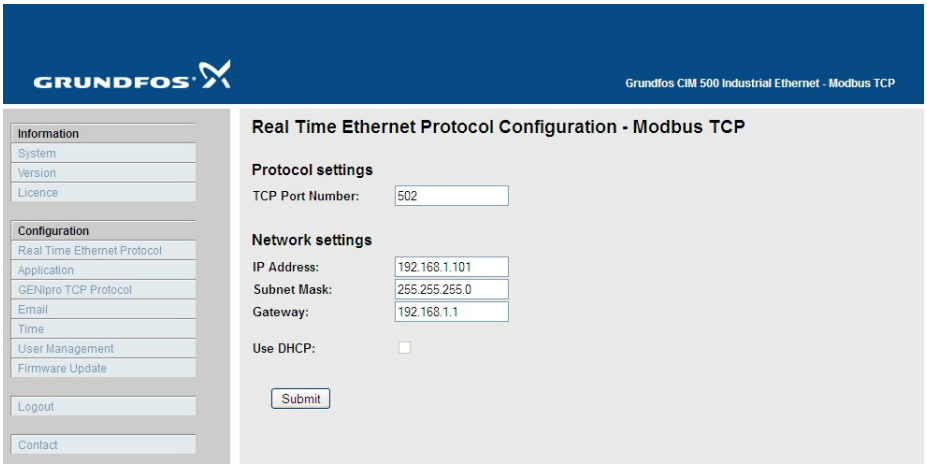
TM05 6063 4412

Fig. 25 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 Modbus TCP configuration



TM05 6064 4412

Fig. 26 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, ramal Campana Centro Industrial Garín - Esq. Haendel y Mozart
AR-1619 Garín Pcia. de Buenos Aires
Pcia. de Buenos Aires
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
Тел.: +7 (375 17) 286 39 72, 286 39 73
Факс: +7 (375 17) 286 39 71
E-mail: minsk@grundfos.com

Bosnia/Herzegovina
GRUNDFOS Sarajevo
Trg Heroja 16,
BiH-71000 Sarajevo
Phone: +387 33 713 290
Telefax: +387 33 659 079
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.
50/F Maxdo Center No. 8 XingYi Rd.
Hongqiao development Zone
Shanghai 200336
PRC
Phone: +86 21 612 252 22
Telefax: +86 21 612 253 33

Croatia
GRUNDFOS CROATIA d.o.o.
Cebini 37, Buzin
HR-10010 Zagreb
Phone: +385 1 6595 400
Telefax: +385 1 6595 499
www.grundfos.hr

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 Mahabalipuram Road
Thoraipakkam
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
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 Москва, ул. Школьная 39
Тел. (+7) 495 737 30 00, 564 88 00
Факс (+7) 495 737 75 36, 564 88 11
E-mail grundfos.moscow@grundfos.com

Serbia
GRUNDFOS Predstavništvo Beograd
Dr. Milutina Ivkovića 2a/29
YU-11000 Beograd
Phone: +381 11 26 47 877 / 11 26 47 496
Telefax: +381 11 26 48 340

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

Slovenia
GRUNDFOS d.o.o.
Šlandrova 8b, SI-1231 Ljubljana-Črnuče
Phone: +386 1 568 0610
Telefax: +386 1 568 0619
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.: +41-1-806 8111
Telefax: +41-1-806 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
ТОВ ГРУНДФОС УКРАЇНА
01010 Київ, Вул. Московська 8б,
Тел.:(+38 044) 390 40 50
Фах.: (+38 044) 390 40 59
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
Представительство ГРУНДФОС в Ташкенте
700000 Ташкент ул.Усмана Носира 1-й тупик 5
Телефон: (3712) 55-68-15
Факс: (3712) 53-36-35

Revised 18.04.2013

96846341 0513

ECM: 1113692