# AGC-4

## Options H2 and H9
## Modbus communication

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# 1. General information

## 1.1 Warnings, legal information and safety

### 1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

**Warnings**

**DANGER!**
Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

**Notes**

**INFO**
Notes provide general information, which will be helpful for the reader to bear in mind.

### 1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

**DANGER!**
The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

**Disclaimer**

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

### 1.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

**DANGER!**
Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

### 1.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

### 1.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

# 2. Hardware information

## 2.1 Option H2

### 2.1.1 Terminal description

Option H2 is a hardware option, and therefore a separate PCB is installed in slot #2 in addition to the standard-installed hardware. These terminal positions are used in all products mentioned in this document.

| Terminal | Function | Description |
|---|---|---|
| 29 | DATA + (A) | Modbus RTU (RS-485) |
| 30 | DATA GND | |
| 31 | DATA - (B) | |
| 32 | | |
| 33 | DATA + (A) | |
| 34 | | |
| 35 | DATA - (B) | |
| 36 | | |

**INFO**
Terminals 29 and 33 are internally connected. Terminals 31 and 35 are internally connected.

### 2.1.2 Hardware settings

These are the RS-485 hardware settings:

1. 9600 or 19200 bps
2. 8 data bits
3. None parity
4. 1 stop bit
5. No flow control

## 2.2 Option H9

### 2.2.1 Terminal description

Option H9.2 is a hardware option, and therefore a separate PCB is installed in slot #2 in addition to the standard-installed hardware.

| Terminal | Function | Description |
|---|---|---|
| 29 | | Modbus RTU (RS-232) |
| 30 | DATA GND | |
| 31 | | |
| 32 | TxD | |
| 33 | | |
| 34 | RxD | |
| 35 | | |
| 36 | | |

### 2.2.2 Hardware settings

These are the RS-232 hardware settings:

1. 9600 or 19200 bps
2. 8 data bits
3. None parity
4. 1 stop bit
5. No flow control

## 2.3 Wiring

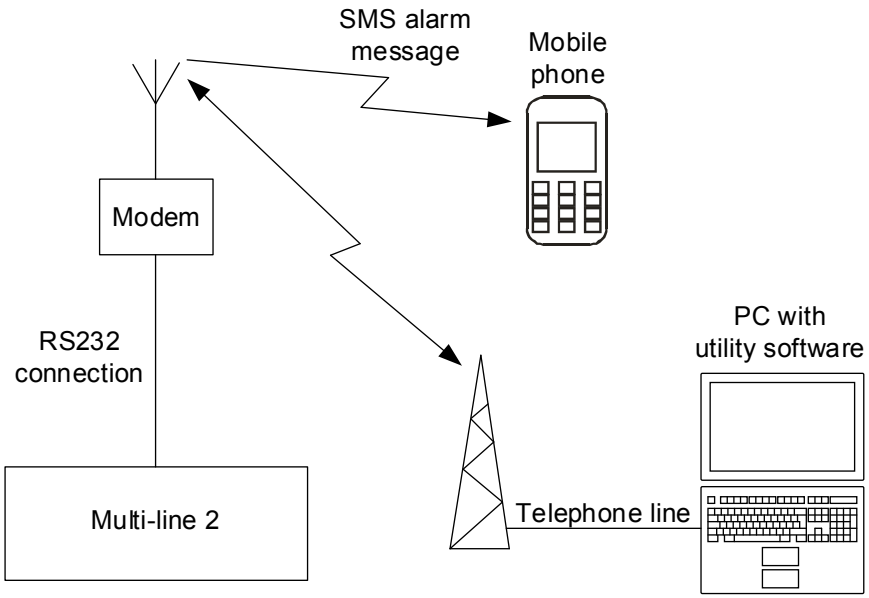
**MORE INFORMATION**
Refer to the Installation instructions for further information regarding wiring.

# 3. Functional description

## 3.1 GSM communication

The GSM modem communication is used to send a GSM message to up to five mobile phones when an alarm appears on the display.

### 3.1.1 Principle overview




**INFO**
DEIF recommends using a MOXA OnCell G2150I, Wavecom WMOD2 or Westermo GDW-11 terminal, as the application has been tested with these terminals

### 3.1.2 Basic parameter settings

| Setting no. | Name | Function | Set to |
|---|---|---|---|
| GSM | GSM pin code | Set PIN code for GSM modem | None |
| GSM | 12345678901 | Set phone no. for SMS to mobile phone 1 | None |
| GSM | 12345678901 | Set phone no. for SMS to mobile phone 2 | None |
| GSM | 12345678901 | Set phone no. for SMS to mobile phone 3 | None |
| GSM | 12345678901 | Set phone no. for SMS to mobile phone 4 | None |
| GSM | 12345678901 | Set phone no. for SMS to mobile phone 5 | None |

**INFO**
Always enter “+ country code” instead of “00”.

**INFO**
The phone number can only be dialled using the PC utility software.

**INFO**
The SIM card used in the mobile phone must support data transfer.

### 3.1.3 PIN code configuration

After each auxiliary supply power up, the unit will send the required PIN code to the modem if this is necessary. The PIN code is adjusted in the PC utility software.

### 3.1.4 USW communication

It is possible to communicate with the unit via the PC utility software. The purpose is to be able to remote-monitor and control the genset application.

**CAUTION**
It is possible to remote-control the genset from the PC utility software if a modem is used. Take precautions that it is safe to remote-operate the genset to avoid personal injury or death.

### 3.1.5 Setup

The Modbus protocol type can be changed from RTU to ASCII in menu 7510. This menu can only be reached using the JUMP push-button. When set to 1, the ASCII protocol type is used, and the unit will allow for the slower modem communication.

### 3.1.6 Safety

If communication fails, the unit will operate according to the received data. If, for example, only half of the parameter file has been downloaded when the communication is interrupted, the unit will use this actual data.

# 4. Parameters

## 4.1 Parameters related to Modbus communication

The options H2 and H9 relate to the parameters 7500-7520.

**MORE INFORMATION**
Refer to the Parameter list for further information, document number 4189340688.

# 5. Data tables

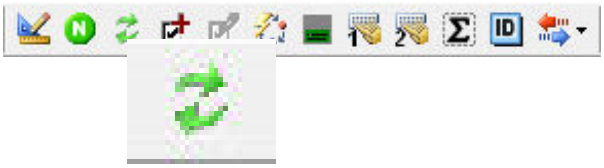
## 5.1 Configurable area (read only) (function code 04h)

### 5.1.1 Modbus configurator

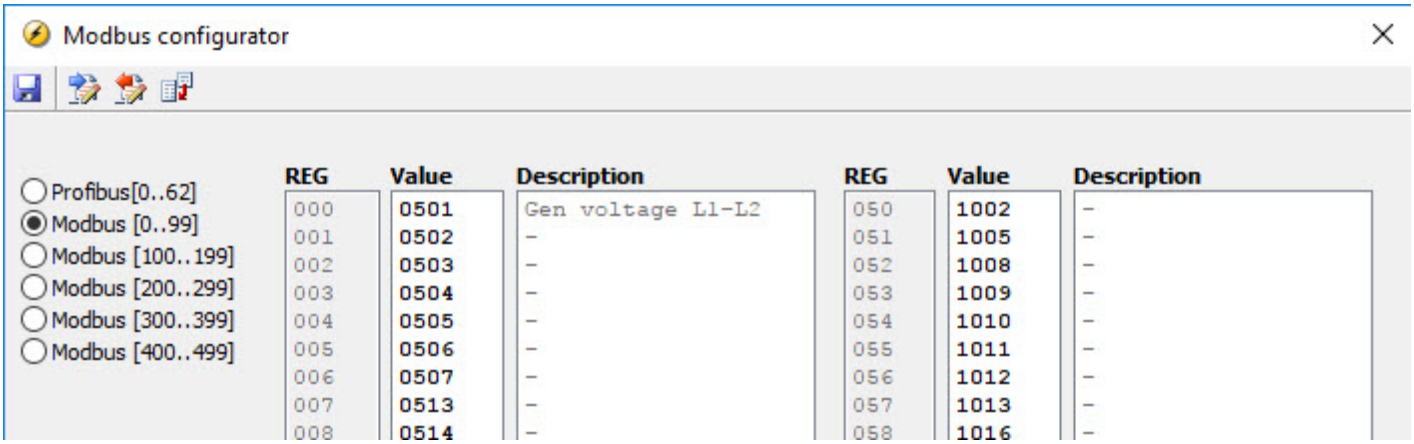
The Modbus configurator gives the user the possibility to select which data should be available for the first 500 Modbus addresses with the Modbus function 04.

Profibus users often apply this function to select the data they can use. That is why the first address range is called Profibus. This first address range is shared by the Profibus and the Modbus users alike, as they share the same data.

Open the Modbus configurator from the toolbar in the utility software by clicking the icon shown below.



It is possible to configure the Modbus addresses 0 to 499 to any of the Modbus addresses from 500 to 1999 through the Modbus configurator, as shown below.




The window has four different columns that are described below:

**Range:** Each Modbus range contains 100 Modbus addresses (63 for the Profibus range). In the screenshot above, the Modbus address range 0 to 99 is selected.

**REG:** The information in the specific address REG is duplicated from the Modbus address configured in Value. The number changes when another range is selected (0 to 499).

**Value:** The Modbus address of the information that will be copied to the corresponding REG Modbus address.

**Description:** Free text for the user to fill in. The text is only saved in the parameter file. In the screenshot, it is configured via the Modbus configurator that the Modbus address 000 duplicates the information of Modbus address 501, which displays the generator voltage between L1 and L2, as the description shows.

**INFO**
The popup window has its own dedicated "Read/write" and "Copy description" buttons, which must be used for manual configuration.

## 5.2 Reference tables

The Modbus reference tables can be downloaded from the product page at www.deif.com under **Documentation > Modbus tables**. The Modbus reference tables are stored in an .xmlx file that contains the following information:

- Command flags (01; 05; 15)
- Status flags (02)
- Digital inputs (02)
- Digital outputs (02)
- Control registers (03; 06; 16)
- Date and time registers (03; 06; 16)
- Profibus configurable area (04)
- Modbus configurable area (04)
- AC measurements (04)
- Alarms and status (04)
- Power management measurements (04)
- Power management alarms and status (04)

The number in brackets refers to the Modbus function code (as a decimal value) for the information, and corresponds to the sheet names in the spreadsheet.

## 5.3 Data scaling

Modbus data is processed as data bytes. This data cannot directly process decimal values. Therefore scaling is defined to convert decimal values to a form that can be sent using Modbus, or to correctly interpret values received from Modbus. Data in the *Holding register* and *Input register* is scaled according to the formula:

$$\text{Actual value} = \text{Value in register} * 10^{-\text{Scaling}}$$

The table below lists parameter types and the scaling values that are normally used for them. Parameter types that are not scaled, are not listed in the table.

**Table 5.1** Scaling values normally used by specific parameter types

| Parameter type | Scaling |
|---|---|
| Phase angle | 1 |
| DC supply voltage | 1 |
| Frequency | 2 |
| cos phi | 2 |
| Power factor | 2 |

**Scaling example**

Nominal frequency 1 is set to 50.00 Hz. Frequency normally has a scaling value of 2.

When nominal frequency 1 is read from the controller using Modbus, the Modbus register returns 5000. The actual value is determined by:

Actual value = Value in register * $10^{-Scaling}$

= 5000 * $10^{-2}$

= 50.00

To write a new value of 60.00 Hz to the controller using Modbus, the value that should be written to the register is:

Value in register = Actual value / $10^{-Scaling}$

= 60.00 / $10^{-2}$

= 6000

# 6. Parameter setting

## 6.1 Introduction

Modbus communication is used to read parameter data from the controller and write parameter data to the controller. The Modbus address for a specific parameter is determined using the "Address" in the Utility Software (USW) and the address area for a specific parameter setting. This chapter lists the different address areas, and describes how to determine the Modbus address for a parameter.

## 6.2 Address areas

### 6.2.1 Read coil (Function code 01)

Reads the ON/OFF status of discrete output coils in the slave unit. The controller returns **0** (FALSE) when the coil is not activated, and **1** (TRUE) when the coil is activated.

**Address area for reading status flags**

| Data to request | Address area |
|---|---|
| Enable | 2000-3999 |

### 6.2.2 Read discrete inputs (Function code 02)

Reads the ON/OFF status of discrete input contacts in the slave unit. The controller returns **0** (FALSE) when the discrete input is not activated, and **1** (TRUE) when the discrete input is activated.

**Address areas for reading status flags**

| Data to request | Address area |
|---|---|
| Alarm active | 4000-5999 |
| Alarm acknowledge | 6000-7999 |
| Timer output | 8000-9999 |
| Timer running | 10000-11999 |

### 6.2.3 Read holding registers (Function code 03)

Reads the data value contained in the holding registers. The data can be signed integers (16 or 32 bit) or boolean values. The controller returns the value stored in the holding register. Ensure that you know the scaling used for the address to interpret the value correctly.

**Address areas for reading holding registers**

| Data to request | Address area |
|---|---|
| Timers used | 2000-3999 |
| Values used | 4000-5999 |
| Values minimum | 6000-7999 |
| Values maximum | 8000-9999 |
| Output A | 10000-11999 |

| Data to request | Address area |
|---|---|
| Output B | 12000-13999 |
| Fail class used | 14000-15999 |
| Enable | 16000-17999 |
| Inhibit | 18000-19999 |

### 6.2.4 Read input registers (Function code 04)

Reads the data value contained in the input registers. The data can be signed integers (16 or 32 bit) or boolean values. The controller returns the value stored in the input register. Ensure that you know the scaling used for the address to interpret the value correctly.

**Address areas for reading input registers**

| Data to request | Address area |
|---|---|
| Timers minimum | 2000-3999 |
| Timers maximum | 4000-5999 |
| Output A minimum | 6000-7999 |
| Output A maximum | 8000-9999 |
| Output B minimum | 10000-11999 |
| Output B maximum | 12000-13999 |
| Fail class minimum | 14000-15999 |
| Fail class maximum | 16000-17999 |
| Timers elapsed time | 20000-21999 |

### 6.2.5 Write single/multiple coils (Function code 05/15)

Change the ON/OFF status of a single or multiple discrete output coils in the slave unit. Write **0** (FALSE) to deactivate the coil, or **1** (TRUE) to activate the coil.

**Address areas for writing status flags**

| Data to request | Address area |
|---|---|
| Enable | 2000-3999 |
| Acknowledge alarm | 6000-7999 |

### 6.2.6 Write single/multiple holding registers (Function code 06/16)

Change the value of a single or multiple holding registers in the slave unit. The data can be signed integers (16 or 32 bit) or boolean values. When writing values to holding registers, ensure that you use the correct scaling and data type for the register address.

**Address area for writing holding registers**

| Data to request | Address area |
|---|---|
| Timers used | 2000-3999 |
| Values used | 4000-4999 |
| Output A | 10000-11999 |

| Data to request | Address area |
|---|---|
| Output B | 12000-13999 |
| Fail class used | 14000-15999 |
| Enable | 16000-17999 |
| Inhibit | 18000-19999 |

## 6.3 Parameter Modbus addresses

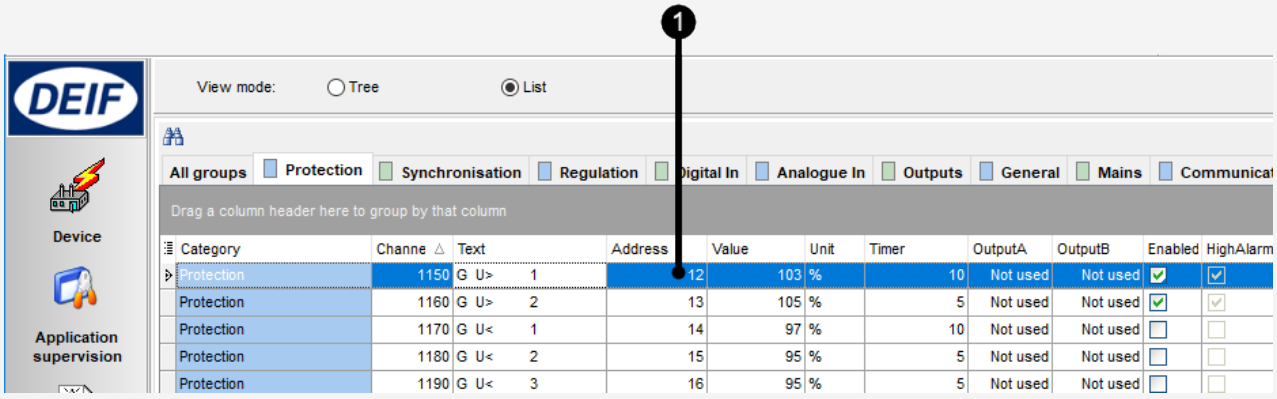
The Modbus address for a parameter is the sum of the **Address** in the Utility Software (USW) and the first value of the address area of interest. To find the address of a specific parameter, go to the **Parameters** tab in the USW, then find the parameter using the parameter's name or parameter number (**Channel** column). The parameter address is located in the **Address** column.

**Examples**

**Acknowledge alarm**

In this example an over-voltage 1 alarm is active and unacknowledged. First we will check if the alarm is already acknowledged, then acknowledge the alarm using Modbus.

1. The parameter number for the over-voltage 1 alarm is 1150. Find the parameter in the USW in the **Parameters** tab and note the **Address** value for the parameter (12 for over-voltage 1).
   - The parameter numbers are listed in the **Channel** column.

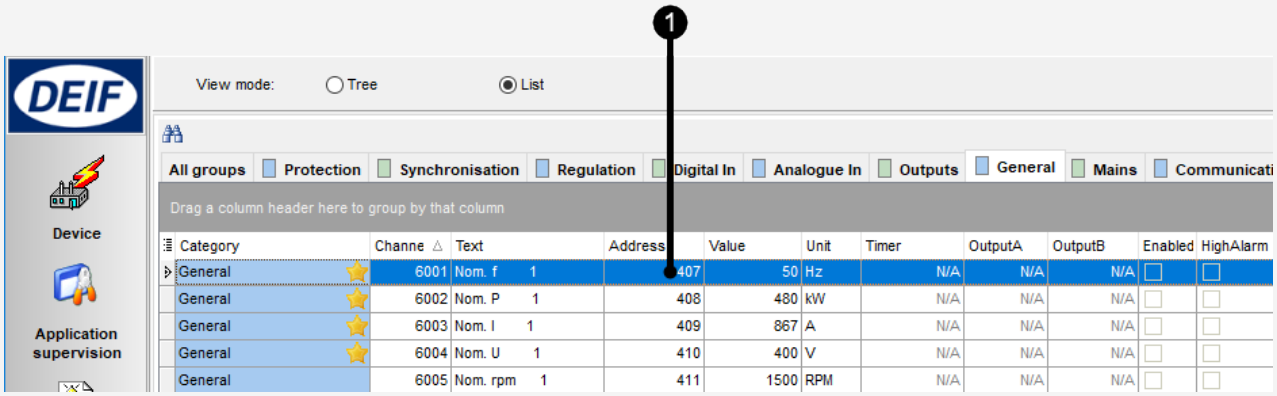



2. To read if the alarm is acknowledged, go to the table in **Address areas > Read discrete input (Function code 02)**. The address area for *Alarm acknowledge* starts at 6000.
3. The Modbus address to read the parameter is: Parameter **Address** + Address area start = 12 + 6000 = 6012.
4. Use function code 02 to read address 6012.
   - For this example when the address is read, the controller returns **0** (FALSE). This means that the alarm is not acknowledged.
5. To acknowledge the alarm, go to the table in **Address areas > Write single/multiple coils (Function code 05/15)**. The address area for *Acknowledge alarm* starts at 6000.
6. The Modbus address to read the parameter is: Parameter **Address** + Address area start = 12 + 6000 = 6012.
7. Use function code 05 to write **1** (TRUE) to address 6012.
   - The alarm is now acknowledged and reading address 6012 using function code 02 returns **1** (TRUE). This means the alarm is acknowledged.

**Change nominal frequency**

In this example nominal frequency 1 is changed from 50 Hz to 60 Hz.

1. The parameter number for the nominal frequency 1 is 6001. Find the parameter in the USW in the **Parameters** tab and note the **Address** value for the parameter (407 for nominal frequency 1).




2. To change the nominal frequency, go to the table in **Address areas > Write single/multiple holding registers (Function code 06/16)**. The address area for *Values used* starts at 4000.
3. The Modbus address to write the new value to is: Parameter **Address** + Address area start = 407 + 4000 = 4407.
4. The nominal frequency has a scaling of 2. To write 60 Hz to the address a value of 6000 must be written to the address. Use function code 06 to write 6000 to address 4407.
   - Nominal frequency 1 is now 60.00 Hz. To confirm the change use function code 03 to read address 4407. The address returns 6000. (Also scaled by a factor of 2.)

## 6.4 Modbus address offset for alarms on CIO modules

The Modbus offset addresses related to the CIO modules are not listed in the USW like all other offset addresses. The tables in the following pages show the CIO modules' Modbus offset addresses. The procedure for reading/writing in Modbus is still the same as previously described.

**INFO**
DEIF recommends using the USW to configure the CIO modules.

### 6.4.1 Modbus alarm offset addresses for CIO 116

| Description | Address offset | | Description | Address offset |
|---|---|---|---|---|
| CIO 116 no. 1. Input 10 | 1047 | | CIO 116 no. 2. Input 21 | 1260 |
| CIO 116 no. 1. Input 11 | 1048 | | CIO 116 no. 2. Input 22 | 1261 |
| CIO 116 no. 1. Input 12 | 1049 | | CIO 116 no. 2. Input 23 | 1264 |
| CIO 116 no. 1. Input 13 | 1050 | | CIO 116 no. 2. Input 24 | 1266 |
| CIO 116 no. 1. Input 14 | 1051 | | CIO 116 no. 2. Input 25 | 1267 |
| CIO 116 no. 1. Input 15 | 1052 | | CIO 116 no. 2. Input 26 | 1272 |
| CIO 116 no. 1. Input 16 | 1053 | | CIO 116 no. 3. Input 10 | 1296 |
| CIO 116 no. 1. Input 17 | 1054 | | CIO 116 no. 3. Input 11 | 1316 |
| CIO 116 no. 1. Input 19 | 1055 | | CIO 116 no. 3. Input 12 | 1323 |
| CIO 116 no. 1. Input 20 | 1056 | | CIO 116 no. 3. Input 13 | 1324 |
| CIO 116 no. 1. Input 21 | 1057 | | CIO 116 no. 3. Input 14 | 1325 |
| CIO 116 no. 1. Input 22 | 1058 | | CIO 116 no. 3. Input 15 | 1327 |
| CIO 116 no. 1. Input 23 | 1059 | | CIO 116 no. 3. Input 16 | 1328 |
| CIO 116 no. 1. Input 24 | 1060 | | CIO 116 no. 3. Input 17 | 1329 |
| CIO 116 no. 1. Input 25 | 1061 | | CIO 116 no. 3. Input 19 | 1330 |
| CIO 116 no. 1. Input 26 | 1062 | | CIO 116 no. 3. Input 20 | 1331 |
| CIO 116 no. 2. Input 10 | 1194 | | CIO 116 no. 3. Input 21 | 1332 |
| CIO 116 no. 2. Input 11 | 1195 | | CIO 116 no. 3. Input 22 | 1333 |
| CIO 116 no. 2. Input 12 | 1196 | | CIO 116 no. 3. Input 23 | 1334 |
| CIO 116 no. 2. Input 13 | 1197 | | CIO 116 no. 3. Input 24 | 1362 |
| CIO 116 no. 2. Input 14 | 1198 | | CIO 116 no. 3. Input 25 | 1363 |
| CIO 116 no. 2. Input 15 | 1199 | | CIO 116 no. 3. Input 26 | 1364 |
| CIO 116 no. 2. Input 16 | 1200 | | CIO 116 no. 1 missing | 957 |
| CIO 116 no. 2. Input 17 | 1237 | | CIO 116 no. 2 missing | 960 |
| CIO 116 no. 2. Input 19 | 1238 | | CIO 116 no. 3 missing | 963 |
| CIO 116 no. 2. Input 20 | 1257 | | | |

**INFO**
Address offset 957, 960 and 963 are read only addresses.

### 6.4.2 Modbus alarm offset addresses for CIO 208

| Description | Address offset |
|---|---|
| CIO 208 no. 1 missing | 958 |
| CIO 208 no. 2 missing | 961 |
| CIO 208 no. 3 missing | 964 |

**INFO**
Address offset 958, 961 and 964 are read only addresses.

## 6.4.3 Modbus alarm offset addresses for CIO 308

| Description | Address offset | | Description | Address offset |
|---|---|---|---|---|
| CIO 308 no. 1. Input 8 alarm 1 | 999 | | CIO 308 no. 3. Input 17 alarm 1 | 1567 |
| CIO 308 no. 1. Input 8 alarm 2 | 1000 | | CIO 308 no. 3. Input 17 alarm 2 | 1568 |
| CIO 308 no. 1. Input 11 alarm 1 | 1001 | | CIO 308 no. 3. Input 20 alarm 1 | 1569 |
| CIO 308 no. 1. Input 11 alarm 2 | 1002 | | CIO 308 no. 3. Input 20 alarm 2 | 1570 |
| CIO 308 no. 1. Input 14 alarm 1 | 1003 | | CIO 308 no. 3. Input 23 alarm 1 | 1571 |
| CIO 308 no. 1. Input 14 alarm 2 | 1004 | | CIO 308 no. 3. Input 23 alarm 2 | 1572 |
| CIO 308 no. 1. Input 17 alarm 1 | 1005 | | CIO 308 no. 3. Input 26 alarm 1 | 1573 |
| CIO 308 no. 1. Input 17 alarm 2 | 1006 | | CIO 308 no. 3. Input 26 alarm 2 | 1574 |
| CIO 308 no. 1. Input 20 alarm 1 | 1007 | | CIO 308 no. 3. Input 29 alarm 1 | 1575 |
| CIO 308 no. 1. Input 20 alarm 2 | 1008 | | CIO 308 no. 3. Input 29 alarm 2 | 1576 |
| CIO 308 no. 1. Input 23 alarm 1 | 1009 | | CIO 308 no. 1 missing | 959 |
| CIO 308 no. 1. Input 23 alarm 2 | 1010 | | CIO 308 no. 1 missing | 962 |
| CIO 308 no. 1. Input 26 alarm 1 | 1011 | | CIO 308 no. 1 missing | 965 |
| CIO 308 no. 1. Input 26 alarm 2 | 1012 | | CIO 308 no. 1. Input 8 wire fail | 1031 |
| CIO 308 no. 1. Input 29 alarm 1 | 1013 | | CIO 308 no. 1. Input 11 wire fail | 1032 |
| CIO 308 no. 1. Input 29 alarm 2 | 1014 | | CIO 308 no. 1. Input 14 wire fail | 1033 |
| CIO 308 no. 2. Input 8 alarm 1 | 1015 | | CIO 308 no. 1. Input 17 wire fail | 1034 |
| CIO 308 no. 2. Input 8 alarm 2 | 1016 | | CIO 308 no. 1. Input 20 wire fail | 1035 |
| CIO 308 no. 2. Input 11 alarm 1 | 1017 | | CIO 308 no. 1. Input 23 wire fail | 1036 |
| CIO 308 no. 2. Input 11 alarm 2 | 1018 | | CIO 308 no. 1. Input 26 wire fail | 1037 |
| CIO 308 no. 2. Input 14 alarm 1 | 1019 | | CIO 308 no. 1. Input 29 wire fail | 1038 |
| CIO 308 no. 2. Input 14 alarm 2 | 1020 | | CIO 308 no. 2. Input 8 wire fail | 1039 |
| CIO 308 no. 2. Input 17 alarm 1 | 1021 | | CIO 308 no. 2. Input 11 wire fail | 1040 |
| CIO 308 no. 2. Input 17 alarm 2 | 1022 | | CIO 308 no. 2. Input 14 wire fail | 1041 |
| CIO 308 no. 2. Input 20 alarm 1 | 1023 | | CIO 308 no. 2. Input 17 wire fail | 1042 |
| CIO 308 no. 2. Input 20 alarm 2 | 1024 | | CIO 308 no. 2. Input 20 wire fail | 1043 |
| CIO 308 no. 2. Input 23 alarm 1 | 1025 | | CIO 308 no. 2. Input 23 wire fail | 1044 |
| CIO 308 no. 2. Input 23 alarm 2 | 1026 | | CIO 308 no. 2. Input 26 wire fail | 1045 |
| CIO 308 no. 2. Input 26 alarm 1 | 1027 | | CIO 308 no. 2. Input 29 wire fail | 1046 |
| CIO 308 no. 2. Input 26 alarm 2 | 1028 | | CIO 308 no. 3. Input 8 wire fail | 1083 |
| CIO 308 no. 2. Input 29 alarm 1 | 1029 | | CIO 308 no. 3. Input 11 wire fail | 1085 |
| CIO 308 no. 2. Input 29 alarm 2 | 1030 | | CIO 308 no. 3. Input 14 wire fail | 1086 |
| CIO 308 no. 3. Input 8 alarm 1 | 1531 | | CIO 308 no. 3. Input 17 wire fail | 1110 |
| CIO 308 no. 3. Input 8 alarm 2 | 1532 | | CIO 308 no. 3. Input 20 wire fail | 1391 |
| CIO 308 no. 3. Input 11 alarm 1 | 1560 | | CIO 308 no. 3. Input 23 wire fail | 1392 |
| CIO 308 no. 3. Input 11 alarm 2 | 1563 | | CIO 308 no. 3. Input 26 wire fail | 1427 |
| CIO 308 no. 3. Input 14 alarm 1 | 1565 | | CIO 308 no. 3. Input 29 wire fail | 1529 |
| CIO 308 no. 3. Input 14 alarm 2 | 1566 | | | |

**INFO**
Address offset 959, 962 and 965 are read only addresses.