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Introduction

This document is used to describe the Modbus protocol used in the Xhouse (XH) and Xflat (XF) central units. The version of this manual is intended for **units with Firmware version 100 and higher**. The FW version number is indicated on the self-adhesive label on the PCB and in the FW version input register.

Let us start with some useful information for troubleshooting:

Only those registers that are available on the drive can be read from the unit. Otherwise, the unit responds with an error response with error code 0x02 - Illegal data address.

The unit requires a certain amount of time to process the request, so it is necessary to allow sufficient time for the unit to respond. The time before the unit responds varies according to the selected modbus function and number of registers read/written. The typical response time is around 4 ms

In case the unit is not communicating, make sure that the frames you are sending are correct and check that you are observing pauses of at least 4 ms on the communication bus for correct detection of frame ends.

The bus operates in so-called **Half-duplex** mode. This means that it is not able to accept further requests until the previous modbus frame has been answered.

To **check** or verify the correctness of **the modbus crc calculations** , it is possible to use the on-line calculator:
https://www.lammertbies.nl/comm/info/crc-calculation.html
It is necessary to switch the calculator to HEX characters and the subsequent CRC-16 (Modbus) result has the upper and lower byte swapped in the Modbus frame.

General description of the Modbus protocol

The Modbus protocol is a Master-Slave protocol. Only 1 master and up to 247 slave devices (in our case units) are present on the bus. Communication is always initiated by the master device. The slave only responds to requests from the master device. Modbus uses a Big-endian data representation. This means that for items over 1 B, the highest byte is sent first and the lowest byte afterwards.

Communication Modes

Unicast mode:

The master addresses **one specific slave device** using its Modbus address. The slave processes the message and responds.

Modbus Protocol Data Unit (PDU)

Modbus functions	Data
1 B	N* 1 B

The Modbus protocol defines three basic types of PDUs:

1) **Request PDU -** Used to address one or more slave devices by the master.

   The Modbus function field contains the given Modbus function code. The data field then according to the Modbus function addresses, number of variables, values of variables and other

2) **Response PDU -** Used to send a **positive response** to the slave devices to a received Request PDU.

   The **Modbus function** field contains the **same value** as in the received Request PDU. The data part then according to the given Modbus function operating values, read inputs, coils ...

3) **Exception Response PDU -** Used to send a **negative response** to the slave devices to a received Request PDU.

   The **Modbus function** field contains the **value of the Modbus function from the Request PDU + 0x80** as a failure indication. The data part then **identifies the error**.

Error codes in the Exception Response PDU

Code	*Function code type*	*Meaning*
0x01	Illegal Modbus function	The required Modbus function is not supported by the server (unit)
0x02	Illegal data address	The specified address (of the coil, register ...) is outside the range supported by the server
0x03	Illegal data value	The provided data is invalid
0x04	Device failure	A permanent error occurred during your request processing.
0x05	Confirmation	Code to be used in programming. The server reports receiving a valid request, but it will take longer to execute
0x06	Device busy	Code to be used in programming. The server is busy executing a long-running command.
0x08	Memory parity failed	Code for use when working with files. The server detected a parity error when trying to read the file
0x0A	Gateway - transmission path unavailable	Code for working with the gateway. The gateway is unable to reserve an internal transmission path from the input port to the output port. It is probably overloaded or incorrectly set.
0x0B	Gateway - target device does not match	Code for working with the gateway. The target device is not responding, probably not present.

Function Modbus codes

1) **Public function codes** - They are clearly defined and publicly documented. Their uniqueness is guaranteed. They also contain some unused codes for future use.
2) **User-defined function codes** - Allow the user to implement a function that is not defined by the protocol. Code uniqueness is not guaranteed.

Modbus function code ranges

Function code	*Function code type*
1 ... 64	Function public codes
65 ... 72	User-defined function codes
73 ... 100	Function public codes
101 ... 110	User-defined function codes
111 ... 127	Function public codes

Modbus Protocol General Address Space

The Modbus protocol address space is based on a set of tables with characteristic meanings. The following four basic tables are defined:

Table	*Description*	*Access*	*Address space (not required)*
Discrete inputs	1-bit	Read-only	0x2710 to 0x4E1F
Coils	1-bit	Both reading and writing	0x0000 to 0x270F
Input registers	16-bit	Read-only	0x7530 to 0x9C3F
Preservation registers	16-bit	Both reading and writing	0x9C40 to 0xC34F

Modbus on RS485 bus

Default settings of the RS485 bus

The Modbus RTU protocol defines the default serial link settings as follows:

Baud rate 19200
1 start bit
8 data bits
1 even parity bit
1 stop bit

The aforementioned parameters are the default unit settings

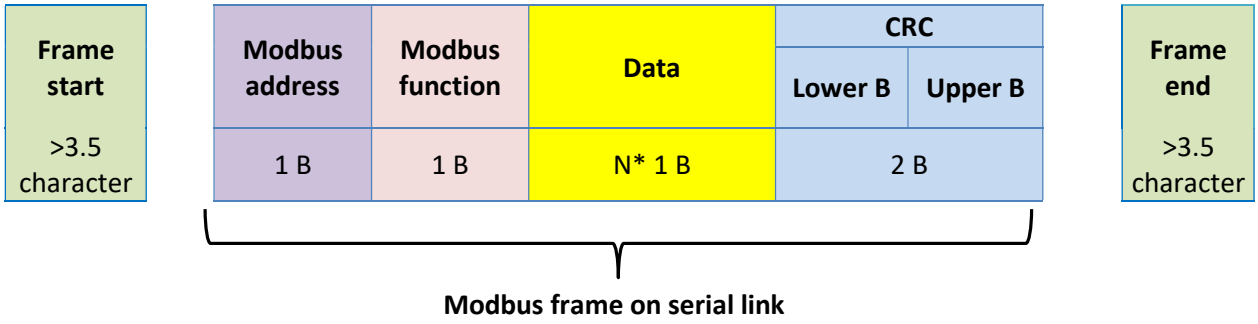
It is also possible to set Baud rate 4800, 9600 and no parity option.

Connecting the wire pins to the RJ45 connector for connection to XCONT-HUB

Pins 1, 2, 7, and 8 must be left unconnected
Pins 3, 4 - RS485 bus data wire A
Pins 5, 6 - RS485 bus data wire B

Structure of the Modbus RTU frame on the RS485 bus

In the Modbus RTU mode, 1 B consists of two four-bit hex characters. The Modbus frame transmission starts and ends with a dash on the bus longer than 3.5 characters. During the frame transmission, the spaces between the characters shall not exceed 1.5 characters.



Slave device addressing:

Address	*Meaning*
0	Broadcast address
1 to 247	Individual slave addresses
248 to 255	Reserved

In the Modbus RTU frames carrying responses intended for the master device, there the Modbus address of the corresponding slave device is retained.

CRC Calculation

The CRC calculation is performed from the entire frame including the Modbus slave address, the Modbus function, and frame data part.

1. Initialization of the 16-bit CRC register on 0xFFFF.
2. Complete the XOR of the first 8 bits of the frame with the lower byte of the CRC register and store the result in the CRC register.
3. Shift the CRC register by 1 b to the right (towards LSB), fill the MSB of the CRC register with 0. We capture and evaluate the lowest bit that has dropped out upon the shift.
4. If this bit was equal to 1, we perform XOR between the CRC register and the value 0xA001 (generating polynomial = 1+x2+x15+x16). The result is stored again in the CRC register.
5. Repeat steps 3 and 4 until eight CRC register shifts have been performed.
6. Perform the XOR of the next 8 bits of the frame with the lower byte of the CRC register and repeat steps 3 to 5.
7. Continue like this until the last byte of the frame.
8. The result of the CRC calculation is stored in the CRC register.
9. When placing the CRC value in the Modbus frame, the upper and lower bytes of the CRC register must be swapped (see the structure of the Modbus RTU frame on the serial link).

List of Modbus functions			
Designation	***Function code***	***Command***	***Public/User***
Inp. registers	0x04	Read input registers	Public
Ret. registers	0x03	Read retention registers	Public
	0x10	Write multiple retention registers	Public

Address Modbus space of XCONT-CP units

List of input registers					
Input register	***Register address***	***Unit description***		***Format***	***R/W***
FW version	0x7530	Firmware version in the unit	-	unit16	R
act_state 1	0x7531	Status register 1: bit 0 - 3 - user interface status bit 4 - 7 - previous user interface status bit 8 - 11 - fan status bit 12 - 15 - previous fan status	-	uint16	R
act_state 2	0x7532	Status register 2: bit 0 - 3 - preheat status bit 4 - 7 - previous preheat status bit 8 - 11 - last preheat status with active fans bit 12 - 15 - fan modification stage	-	uint16	R
act_state 3	0x7533	Status register 3: bit 0 - 2 - reheat status bit 3 - 5 - previous reheat status bit 6 - filter status bit 7 - previous filter status bit 8 - UI status change flag bit 9 - fan status change flag bit 10 - preheat status change flag bit 11 - reheat status change flag bit 12 - filter status change flag bit 13 - overflow max. fan distribution flag according to ventilation requirement bit 14 - last frost protection change direction flag bit 15 - not used	-	uint16	R
AQS_state	0x7534	Air quality sensor status register: bit 0 - CO2 sensor error bit 1 - RH sensor error bit 2 - active ventilation request from AQS bit 3 - active CO2 level bit 4 - active RH level bit 5 - unused bit 6- 15 - required fan speed according to AQS values	- - - - - - 0.01 V	uint16	R
AQS_state.fan_flow	0x7535	Required flow value according to AQS values	0.1 m^3/h	uint16	R

List of input registers

Input register	Register address	Unit description		Format	R/W
set_FAN_FLOW	0x7536	Required fan flow (according to user and AQS settings)	0.1 m^3/h	uint16	R
act_PID.prop	0x7537	Proportional part of PID controller	1 mV	int16	R
act_PID.integ	0x7538	Integration part of PID controller	1 mV	uint16	R
act_PID.der	0x7539	Derivative part of the PID controller	1 mV	int16	R
act_PID.result	0x753A	PID output and status bits: bit 0 - 9 - PID controller output value bit 10 - PID calculation enable flag bit 11 - PID calculation reset flag bits 12 - 15 - unused	 0.01 V - - -	uint16	R
set_FAN_SPEED	0x753B	Required fan voltage (according to user and AQS settings)	0.01 V	uint16	R
set_T_ROOM	0x753C	Required temperature	0.1°C	int16	R
act_CO2	0x753D	Current CO2 sensor value	1 ppm	uint16	R
act_RH	0x753E	RH sensor current value	0.1% RH	uint16	R
act_Flow	0x753F	Current Flow sensor value	0.1 m^3/h	uint16	R
act_T_ROOM	0x7540	Room temperature sensor: bit 0 - 13 - temperature sensor value bit 14 - 15 - sensor status	 0.1°C -	int16	R
act_T_EXHAUST	0x7541	Frost protection temperature sensor: bit 0 - 13 - temperature sensor value bit 14 - 15 - sensor status	 0.1°C -	int16	R
FAN1.act_AO	0x7542	Actual fan 1 voltage	0.01 V	uint16	R
FAN1.act_tacho	0x7543	Fan 1 feedback: bit 0 - tacho input status bit 1 - successful motor start flag bit 2 - 15 - tacho input error timer	 1-OK, 0-NG 1-OK, 0-NG 0.01 s	uint16	R
FAN2.act_AO	0x7544	Actual fan 2 voltage	0.01 V	uint16	R
FAN2.act_tacho	0x7545	Fan 2 feedback: bit 0 - tacho input status bit 1 - successful motor start flag bit 2 - 15 - tacho input error timer	 1-OK, 0-NG 1-OK, 0-NG 0.01 s	uint16	R
timer.act_cool_preheat	0x7546	Preheat pre-cooling timer: bit 0 - timer enable bit 1 - 15 - timer value	 - 1 s	uint16	R
timer.act_cool_postheat	0x7547	Reheat after-cooling timer: bit 0 - timer enable bit 1 - 15 - timer value	 - 1 s	uint16	R
timer.act_summer_mode	0x7548	Summer mode duration timer: bit 0 - timer enable bit 1 - 15 - timer value	 - 1 s	uint16	R
timer.act_boost_mode	0x7549	Boost mode duration timer: bit 0 - timer enable bit 1 - 15 - timer value	 - 1 s	uint16	R
timers_1	0x754A	Boost signalling and preheat relay timers: bit 0 - enable signalling timer	 -	uint16	R

List of input registers

Input register	Register address	Unit description		Format	R/W
		bit 1 - 7 - boost signalling timer value bit 8 - preheat relay timer enable bit 9 - 15 - preheat relay timer value	1 s - 1 s		
timers_2	0x754B	Reheat and AQS protection time relay timers bit 0 - enable the reheat relay timer bit 1 - 7 - value of the reheat relay timer bit 8 - enable the AQS protection time timer bit 9 - 15 - value of the AQS protection time timer	- 1 s - 1 s	uint16	R
act_FILTER_ELAPSED_TIME	0x754C	Filter active time timer	1 h	uint16	R
act_ui_timer	0x754D	Timing of user interface state transitions: bit 0 - timer enable bit 1 - 15 - timer value	- 0.01s	uint16	R
act_preheat_timer High	0x754E	Upper register of the preheat state timer: bit 0 - timer enable bit 1 - 15 - lower 15 bits of the timer value	- 1 s	uint16	R
act_preheat_timer Low	0x754F	Lower register of the preheat timer: bits 0 - 15 - upper 16 bits of the timer value	1 s	uint16	R
act_startup_timer	0x7550	Protection interval timing after device restart: bit 0 - timer enable bit 1 - 15 - timer value	- 1 s	uint16	R
Relay	0x7551	Relay status bits: bit 0 - preheat relay status bit 1 - reheat relay status bits 2 - 15 - unused	- - -	uint16	R

List of UCFG retention registries

Ret. register	Register address	Interface description		Default value	R/W
Front panel	0x9C40	Parameters set on the front panel: bit 0 - flag power on bit 1 - flag AQS auto/manual bit 2 - flag active summer mode bit 3 - flag summer mode auto off bit 4 - flag active boost mode bit 5 - flag touch button lock bit 6 - 9 - fan level bit 10 -15 - temperature level	 1-ON/ 0-OFF 1-AU/0-MAN 1-ANO/0-NO 1-ANO/0-NO 1-ANO/0-NO 1-LOCK/0-NO - -	2	 R/W R/W R/W R R/W R/W R/W R/W
set_CO2	0x9C41	CO2 value at which the fans switch on (1 ppm)	600-1000	800	R/W
set_RH	0x9C42	RH value at which the fans switch on (0.1% RH)	500-750	650	R/W

List of DCFG retention registries					
Ret. register	***Register address***	***Description***	***Range***	***Default value***	***R/W***
bits	0x9C50	Bit setting items: bit 0 - 2 - not used bit 3 - flag automatic shutdown after reset bit 4 - flag permanently active fans at min. speed bit 5 - 6 - modbus baud rate setting bit 7 - modbus parity setting bit 8 -15 modbus address setting	 - 1-YES/0-NO 1-YES/0-NO - 1-NONE/0-EVE 1 – 247	 3 0 1	 R/W R/W R/W R/W R/W R/W
corr_T_ROOM	0x9C51	Room temperature value correction (0.1°C)	-100 – 100	0	R/W
set_SUMMER_ MODE_DURATION	0x9C52	Summer mode duration (1 s)	3600 – 32400	28800	R/W
set_BOOST_ MODE_FAN_SPEED	0x9C53	Fan voltage in the Boost mode (0.01 V)	XF: 500 - 800 XH: 600 – 900	XF: 800 XH: 900	R/W
set_BOOST_ MODE_FAN_FLOW	0x9C54	Fan flow in the Boost mode (0.1m^3/h)	XF: xx - xx XH: xx – xx	XF: xx XH: xx	R/W
set_BOOST_ MODE_DURATION	0x9C55	Boost mode duration (1 s)	30 – 3600	60	R/W
set_FAN_OFFSET_STATIC	0x9C56	Fan modification settings (%)	0 – 35	0	R/W
set_FILTER_ LIFETIME	0x9C57	Filter lifetime (1 h):	2200 – 8800	4400	R/W

A more detailed description of the importance of the individual registers

Description of input registers

- ***act_state 1***

  the UI and previous UI state bits can take on these values:
  0 = UI_STATE_OFF - unit off
  1 = UI_STATE_OFF_COOLING - device off, preheating or reheating cooling is in progress
  2 = UI_STATE_FAN1_ERROR - fan 1 error
  3 = UI_STATE_FAN2_ERROR - fan 2 error
  4 = UI_STATE_T_ROOM_ERROR - room sensor error
  5 = UI_STATE_T_EXHAUST_ERROR - frost sensor error
  6 = UI_STATE_ACTIVE_LOCK - active touch button lock
  7 = UI_STATE_ACT_DEACT_LOCK - touch button lock deactivation status
  8 = UI_STATE_SHOW_SETTINGS - status of the active controller, displays the current settings
  9 = UI_STATE_SET_FAN - fan range setting mode
  10 = UI_STATE_SET_HEAT - temperature range setting mode
  11 = UI_STATE_RUN normal power ON mode if no button is pressed
  12 = UI_STATE_SERVICE_MENU - service menu mode
  13 = UI_STATE_CUSTOMER_MENU - user menu mode

  Fan status bits and previous fan status bits can take on these values:
  0 = FAN_STATE_OFF - unit is OFF
  1 = FAN_STATE_OFF_COOL - unit is OFF, fans are preheating or reheating
  2 = FAN_STATE_FAN1_ERROR - fan 1 error
  3 = FAN_STATE_FAN2_ERROR - fan 2 error
  4 = FAN_STATE_ACTIVE - fans active in normal mode
  5 = FAN_STATE_ACTIVE_ANTIFREEZE - fans active in antifreeze mode
  6 = FAN_STATE_INACTIVE - inactive fans in normal mode
  7 = FAN_STATE_INACTIVE_ANTIFREEZE - inactive fans in antifreeze mode
  8 = FAN_STATE_SUMMER_MODE - fans in summer mode
  9 = FAN_STATE_BOOST_MODE - fans in Boost mode

- ***act_state 2***

  the bits of the preheat state, the previous preheat state and the last preheat state with active fans can take these values:
  0 = PREHEAT_STATE_OFF - unit is OFF
  1 = PREHEAT_STATE_OFF_COOL, unit is OFF, preheating after-cooling
  2 = PREHEAT_STATE_T_ROOM_ERROR - room temperature sensor error
  3 = PREHEAT_STATE_T_EXHAUST_ERROR - frost sensor error
  4 = PREHEAT_STATE_ACTIVE_LOW - first level of frost protection with active preheating
  5 = PREHEAT_STATE_ACTIVE_MED1 - second level of frost protection with fan modification
  6 = PREHEAT_STATE_ACTIVE_MED2 - third level of frost protection with FAN 1 switched off
  7 = PREHEAT_STATE_ACTIVE_HIGH - highest level of protection with both FAN 1 and FAN 2 switched off
  8 = PREHEAT_STATE_INACTIVE - inactive frost protection, active fans
  9 = PREHEAT_STATE_INACTIVE_FAN_OFF - inactive frost protection, inactive fans

10 = PREHEAT_STATE_COOL - preheat after-cooling, inactive fan requirement
11 = PREHEAT_STATE_COOL_TO_MED2 - preheat after-cooling when FAN 1 is off, transition to MED2
12 = PREHEAT_STATE_COOL_TO_INACTIVE - after-cooling between LOW and INNACTIVE states
The degree bits in the fan modification symbolize the voltage difference between FAN 1 and FAN 2 in units of 0.5V.

- ***act_state 3***

  the bits of the reheat state and the previous reheat state can take these values:
  0 = POSTHEAT_STATE_OFF - the unit is OFF 1 = POSTHEAT_STATE_OFF_COOL - the unit is OFF, reheat after-cooling
  2 = POSTHEAT_STATE_T_ROOM_ERROR - room sensor error
  3 = POSTHEAT_STATE_T_EXHAUST_ERROR - frost sensor error
  4 = POSTHEAT_STATE_ACTIVE - active reheat 5 = POSTHEAT_STATE_INACTIVE - inactive reheat
  6 = POSTHEAT_STATE_COOL - reheat after-cooling

- ***AQS_state***

  bits 0 and 1 - indicate the error state of the AQS in case the sensor is present
  bit 2 - indicates that one of the AQS is active (activates the fans if the automatic mode is enabled)
  bit 3 - active CO2 level - the sensor value exceeded the level required to activate the fan
  bit 4 - active RH level - the sensor value exceeded the level required to activate the fan
  bit 5 - unused
  bit 6-15 - calculated voltage requirement of the fans according to the AQS

- ***AQS_state. aqs_fan_flow***

  bit 0-15 - calculated fan flow requirement according to AQS

- ***act_T_ROOM and act_T_EXHAUST***

  bit 0 - 13 - represent the value of the given temperature
  bit 14 - 15 - sensor status - 0 = ok, 1 = sensor disconnected, 2 = sensor shorted

Description of UCFG retention registers

Front panel

bit 0 - flag power on - indicates whether the unit is on or off (1 = ON, 0 = OFF). The unit can be switched on or off remotely by writing.
bit 1 - flag AQS auto/manual - indicates the currently selected fan mode (1 = automatic, according to AQS, 0 = manual). You can change the mode by enrolling here.
bit 2 - flag of active summer mode - indicates active summer mode (1 = summer mode active, 0 = summer mode inactive). The summer mode can be activated/deactivated by writing (if the conditions for activation are met)
bit 3 - flag summer mode auto off - signals the automatic termination of the summer mode. Not used for writing. When writing, leave set to the current value
bit 4 - active boost mode flag - indicates active boost mode (1 = active boost mode, 0 = inactive boost mode). Writing can activate/deactivate (if requirements are met)
bit 5 - touch button lock flag - indicates an active "child" lock (1 = button lock active, 0 = button lock inactive). Writing can change
bit 6 - 9 - fan level level - indicates the currently selected fan level. Writing can change.
Do not set value 8 for the Boost mode. Bit 4 activates the Boost mode

Value of bits 6-9	XFLAT150 fans voltage	XHOUSE300 fans voltage
0	0 V	0 V
1	2 V	2 V
2	2.8 V	3 V
3	3.7 V	4 V
4	4.5 V	5 V
5	5.3 V	6 V
6	6.2 V	7 V
7	7 V	8 V

bit 10 -15 - Temperature level step - For E type units, indicates the current selected temperature level. Data can be changed.

Description of DCFG retention registers

bits

bit 0 - 2 - not used - When writing, replace with 0
bit 3 - auto shutdown flag after reset - indicates whether the unit will automatically shut down or restore the previous state in the event of an unexpected reset. (1 = automatically switch off, 0 = previous state). By writing it is possible to change
bit 4 - flag of permanently active fans to min. speed - it indicates the mode when fans cannot be switched off. The fans are always running at minimum speed (1 = fans always at minimum speed, 0 = fans off). Writing can change.
bit 5 - 6 - modbus baud rate setting - modbus baud rate setting (0 = disabled value, 1 = 4800, 2 = 9600, 3 = 19200). Writing can change.
bit 7 - modbus parity setting - indicates the modbus parity setting (0 = even parity, 1 = no parity). Writing can change.
bit 8 - 15 of the modbus address setting - indicates the current modbus address of the unit.

For bits 5 to 15, in case of writing, the unit immediately starts behaving according to the new parameters. Therefore, if any of the parameters are changed, the unit will typically stop communicating until the network master changes the parameters.

Description, syntax, and example of the Modbus functions used

(0x04) Read Input Registers Function

This function is used to read the contents of a contiguous block of input registers. The request specifies the address of the first register and the number of registers. In the answer, every register corresponds to a pair of bytes.

1) Request PDU

Modbus function 0x04 1 B	First register address see List of int. reg. 2 B	Number of registers 1 to max. 13 2 B

Example of reading input registers act_CO2 and act_RH:

0x04	act_CO2		Number of registers = 2	
	0x75	0x37	0x00	0x02

2) Response PDU

Modbus function 0x04 1 B	Number of bytes 2*N 1 B	Register statuses 2*N B

N = Number of registers (see the Request PDU)

Example of the response to reading the act_CO2 and act_RH input registers:

0x04	Number of bytes 0x04	CO2 = 980 ppm 0x03 0xD4	RH = 335 ‰ 0x01 0x4F

3) Exception Response PDU

Modbus function |0x80 0x84 1 B	Error code 1, 2, 3 or 4 1 B

(0x03) Read retention registers function

This function is used to read the contents of a contiguous block of retention registers. The request specifies the address of the first register and the number of registers. In the answer, every register corresponds to a pair of bytes.

1) Request PDU

Modbus function	First register address	Number of registers
0x03	**See List of ret. reg.**	**1 to max. 13**
1 B	2 B	2 B

Example of reading the set_CO2 and set_RH retention registers:

0x03	**Set_CO2**		**Number of registers = 2**	
	0x9C	**0x41**	**0x00**	**0x02**

2) Response PDU

Modbus function	Number of bytes	Register statuses
0x03	**2*N**	
1 B	1 B	**2*N** B

N = Number of registers (see the Request PDU)

Example response to read set_CO2 and set_RH retention registers:

0x03	**Number of bytes**		**CO2=750**		**RH=550**	
	0x06		**0x02**	**0xEE**	**0x02**	**0x26**

3) Exception Response PDU

Modbus function |0x80	Error code
0x83	**1, 2, 3 or 4**
1 B	1 B

(0x10) Write multiple retention registers function

This function is used to write a contiguous block of retention registers. The request specifies the address of the first register to be written, the number of registers, and the values to be written. The normal response contains the starting address and the number of registers written.

1) Request PDU

Modbus function	First register address	Number of registers	Number of bytes	Register statuses
0x10	**See List of ret. reg.**	**1 to max. 11**	**2*N**	
1 B	2 B	2 B	1 B	**2*N** B

N = Number of registers

Example of writing retention registers set_FILTER_LIFE_TIME

0x10	Set_FIL_LT	Number of registers = 1	Number of bytes = 2	8800 h
	0x9C 0x55	0x00 0x01	0x04	0x22 0x60

2) Response PDU

Modbus function	First register address	Number of registers
0x10	**See Request PDU**	**See Request PDU**
1 B	2 B	2 B

N = Number of registers

Example of a response to writing the set_FILTER_LIFE_TIME retention registers:

0x10	Set_FIL_LT	Number of registers = 1
	0x9C 0x55	0x00 0x01

3) Exception Response PDU

Modbus function |0x80	Error code
0x90	**1, 2, 3 or 4**
1 B	1 B