Pioneering for You

OEM Technical guide

Wilo-Para MAXO

Modbus Communication Protocol

Ready for smart integrated solutions

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Description of content evolution	Version	Date
Initial release	V01.00	*18/06/2024*
Fall back mode : Append of Bus command timer state machine ModBus warning / error : Correction of "Over speed" error Reg 404 value	V01.01	*13/02/2025*

Modbus generalities

Context

Modbus is a communication protocol widely used in industrial automation, where robust communication protocols are required.

The use of Modbus in circulating pumps allow to build modern heating systems that focus on enhancing functionality, connectivity and energy efficiency, thanks to real-time communication capabilities.

It is a master-slave communication protocol where one master communicates to one or multiple slaves. It is known for its reliability, stability, and resilience to noise and interference, making it well-suited for industrial applications.

Modbus is supported by a large number of devices, software tools, and resources. This wide adoption ensures compatibility with existing systems and facilitates integration with other industrial equipment.

About this document

The present technical guide provides comprehensive instructions for the use of a Modbus circulator:

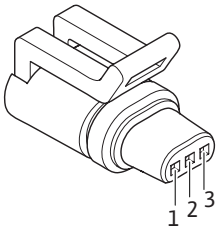
- Wiring diagram, configuration settings and guidelines for physical installation;
- Communication parameters, such as baud rate, parity, and data format and instructions on how to set the device address for proper communication on the Modbus network;
- Protocol Details: an overview of the Modbus protocol, explaining the message structure, function codes, and data formats used in Modbus communication. This information helps users understand the communication flow and the types of commands and data they can exchange with the circulator.
- Register Mapping: a register mapping table that defines the specific Modbus registers and their corresponding functions and data types in the circulator. This mapping helps users access and manipulate the circulator's parameters, such as flow rate, speed and status, through Modbus commands.

Overall, the technical guide serves as a comprehensive reference for users to understand and utilize the Modbus circulator effectively.

Hardware definition

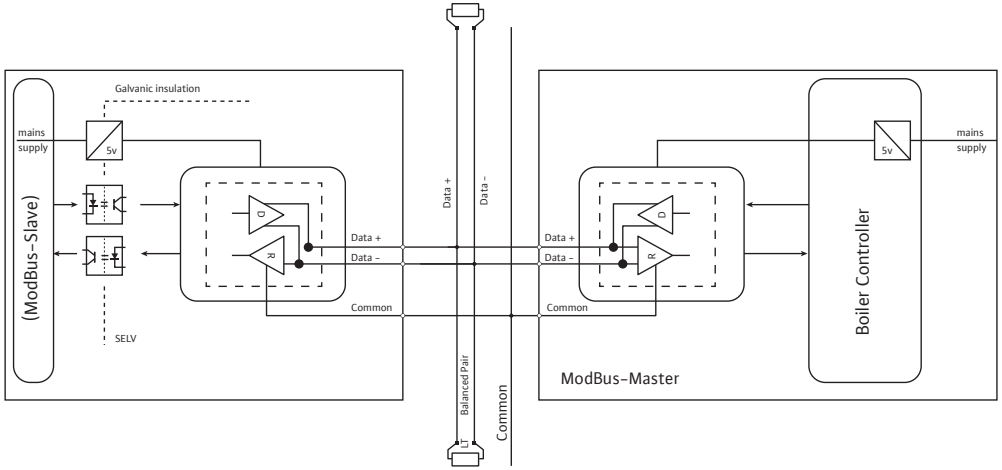
The **pin out** for the signal cable used on Wilo pumps is defined as follow:

Para MAXO



Core no. 1 (brown) → Data+ ; D1 ; B(+)
Core no. 2 (blue or grey) → Common
Core no. 3 (black) → Data- ; D0 ; A(-)

figure n°1



RS 485 network

figure n°2

Modbus over serial line **RTU** *(Remote Terminal Unit)* implements an electrical interface in accordance with EIA/TIA-485 standard (RS 485 standard).

This standard allows either point to point or multipoint systems, in a **two-wire configuration**.

In practice RS485 is limited to 32 slaves interfaces. Repeaters are mandatory if more slaves are needed.

As much as possible and especially for long distance application, twisted pair has to be used for Data+ and Data- to improve EMC immunity.

Line Termination resistor of 120-150 Ohm (cable used must have same impedance characteristic), 0.5W are required near each both ends of the bus to avoid reflection.

With the Wilo pump interface **no line polarization is required**.

Disturbance immunity

The major advantage of RS-485 over RS-232 is the use of a differential signal that greatly increases disturbance immunity and allows longer networks.

The consequence of using two wires for signal balancing is that the communication is half-duplex and can be established in one direction at a time.

Principle of the differential signal

A symmetric signal (equal amplitude with opposite polarity) is transmited on two wires:

Data+$_{RS485}$ and Data-$_{RS485}$. Both wires receive a similar disturbance (parasite e-m). The RS-485 receiver makes a differential amplification, which results in the addition of signal amplitudes and the substraction of interferences present on both wires, represented as V $_{RS485}$ in the sketch.

Then as the two wires (data+ and data-) are involved,

the communication is half-duplex. Meaning communication can be established in one direction at a time.

In comparison, the unblanced signal, represented by V$_{RS232}$, carries more disturbance.

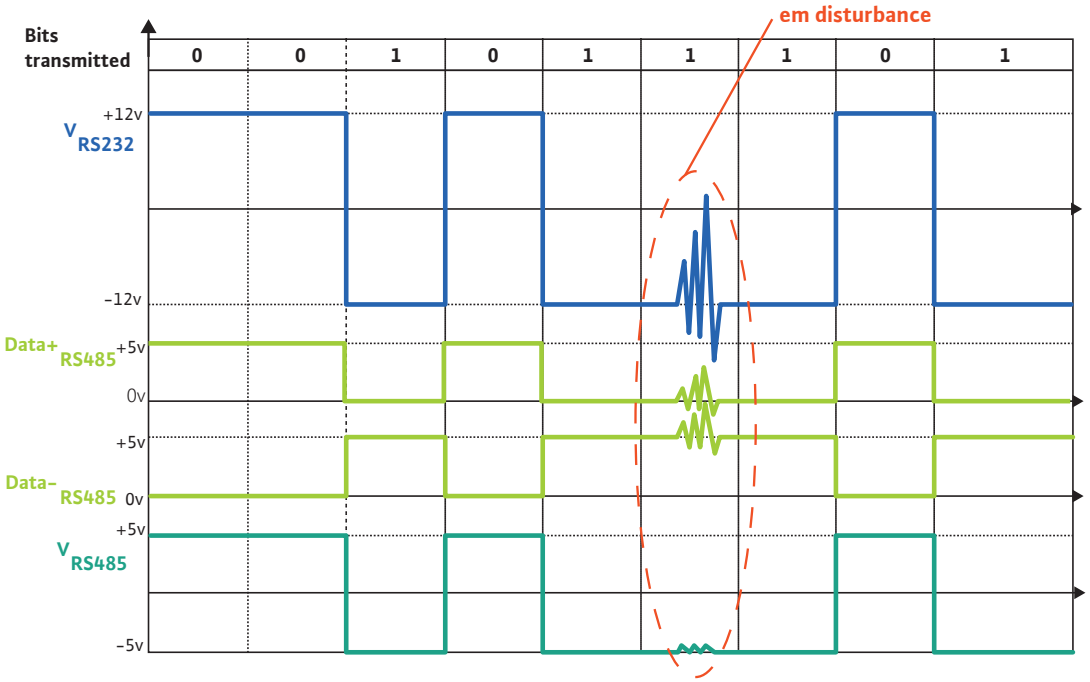


figure n°3

Connection Options

In such a Modbus system, a master and one or several slave devices communicate on passive differential serial line.

Each device may be connected either directly on the trunk cable forming a daisy-chain, either on a passive trap or active trap, both with derivation cable.

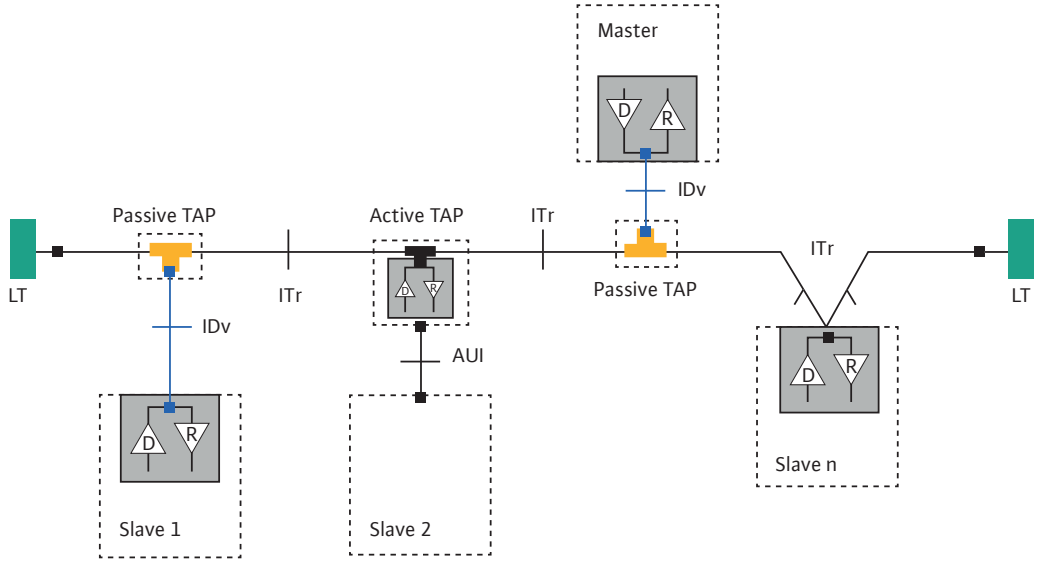


figure n°4

Thanks to the 2 mini super-seal connectors (MSS1 and MSS2) present on the pump, it can be connected directly to the bus in a daisy-chain manner (slave N), or can received the line termination plug.

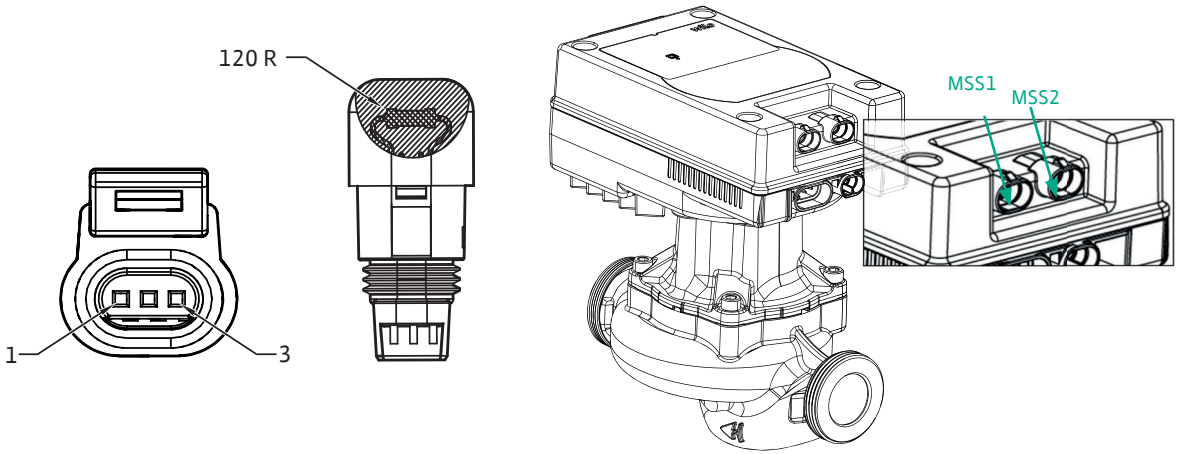


figure n°5

Modbus over serial line "RTU" :

Modbus operates in master–slave mode.

The master is the only active device in the bus. It must initiate reading and writing in each slave of the serial loop. Slaves are only passive. They cannot trigger an interaction with the master or with another slave. They can answer only when they receive a request.

To interact with a slave, the master sends a frame that contains the number of the slave (i.e. its address), the function to be processed (write or read), the data, as described in the figure below:

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END
	0 à 247 Identifies the recipient 1 Byte	1 à 127 Action to be taken 1 Byte	Data to be sent n Byte	Message integrity check 2 Byte	

Data frames are transferred over the bus by packet of 8 bits. The Wilo pump supports multiple speeds ranging from 300 to 115200 bauds, as well as options for parity and the number of stop bits. See later holding register 61441 & 61442.

By default, the Wilo–Para MAXO is configured with :

- *Baud rate = 19200 baud*
- *Data = 8 bits*
- *Parity = even*
- *Stop Bit = 1 stop bit*

Data transmission parameters :

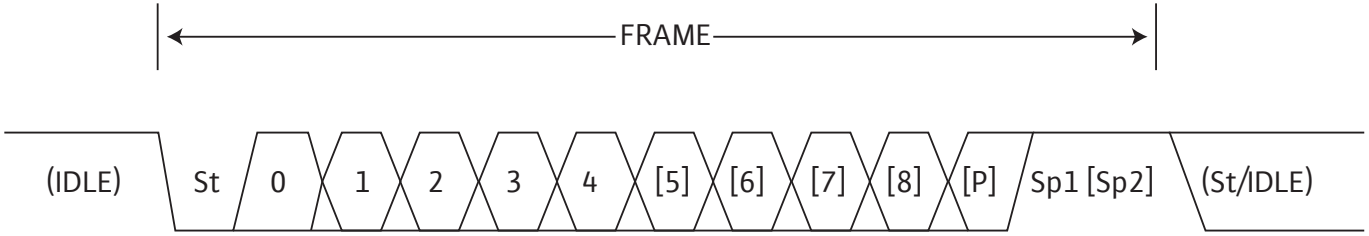


figure n°6

- **Even parity :** number of "1" data bit plus parity bit is even
- **Odd parity :** number of "1" data bit plus parity bit is odd

St	Start bit, always low
(n)	Data bits (0 to 8)
P	Parity bit. Can be odd or even
Sp	Stop bit, always high
IDLE	No transfers on the communication line.

- 8,N,1 : 0 to 8 data bits, no parity bit, one stop bit
- 8,E,1 : 0 to 8 data bits, even parity bit, one stop bit
- 8,O,1 : 0 to 8 data bits, odd parity bit, one stop bit
- 8,N,2 : 0 to 8 data bits, no parity bit, two stop bits

Communication Timing

Frames are separated by silent interval of at least 3.5 char times.

The entire message frame must be transmitted as a continuous stream of characters.

If a silent interval of more than 1.5 char times occurs between two characters, the message frame is declared “incomplete” and will be discarded by the receiver.

Frame timing definition :

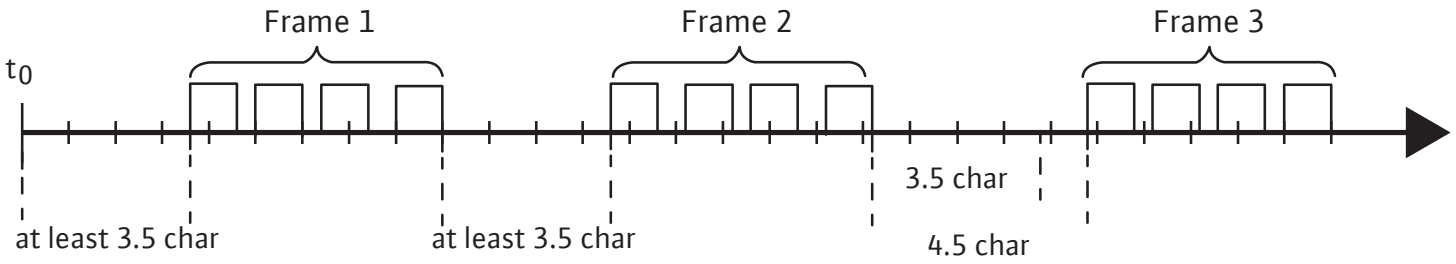


figure n°7

Frame timing acceptance criteria :

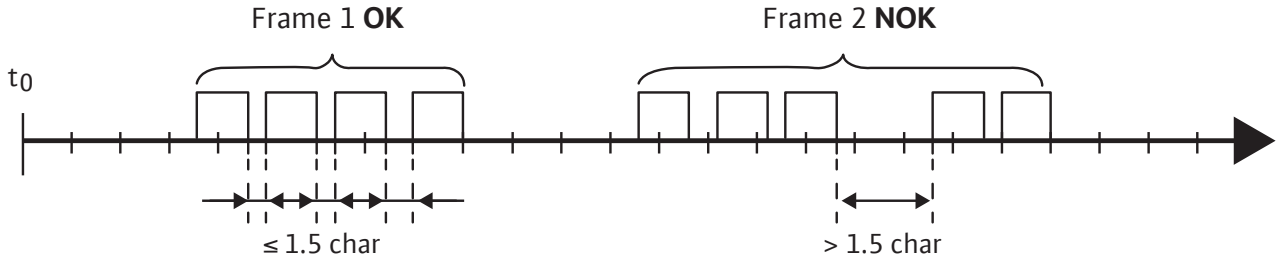


figure n°8

Example of character time with :
- Baud rate = 19200 baud
- Frame bits = 9 data bits + 1 parity bit + 1 stop bit = 11 bits

Char time = 11 / 19200 = 573 µs

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

Addressing model

The MODBUS addressing space comprises 256 different addresses.

0	From 1 to 247	From 248 to 255
Broadcast addresses	Slaves indivisual addresses	Reserved

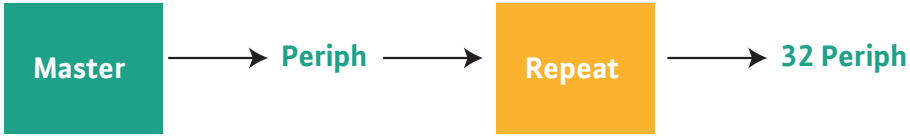
The address 0 is reserved as the broadcast address. All slave nodes must recognize the broadcast address.

The MODBUS Master node has no specific address, only the slave nodes must have an address. This address must be unique on a MODBUS serial bus.

The master can usually communicate with up to 247 slaves (case of Modbus via RS-485 with the use of repeaters) on the same network.

Addresses ranging from 248 to 255 are reserved addresses.

RS485 may usually not have more than 32 peripherals on the same node, so repeaters are used in order to be able to add other peripherals to the line.



By default, the Wilo-Para MAXO is configured with the address 101.

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

Data model

MODBUS bases its data model on a series of tables that have distinguishing characteristics.

The four primary table are :

Primary tables	Object type	Type of	Comments
Discretes inputs	Single bit	Read-Only	This type of data can be provided by an I/O system
Coils	Single bit	Read-Write	This type of data can be alterable by an application program.
Input Registers	16-bit word	Read-Only	Data provided by the pump
Holding Registers	16-bit word	Read-Write	Data provided to the pump (read or write)

** Not supported in Para MAXO*

For each of the primary tables, the protocol allows individual selection of 65536 data items, and the operations of read or write of those items are designed to span multiple consecutive data items up to a data size limit which is dependant on the transaction function code.

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

Registers facts

- Data can be written to HOLDING REGISTERS
- Data can be read from HOLDING REGISTERS and INPUT REGISTERS
- Register address range is 0...65535
- Value is 2 bytes long (if more is needed, registers in sequence are combined)
- Only request / response communication (no notifications, no peer-to-peer)
- Detailed specification can be found on www.modbus.org

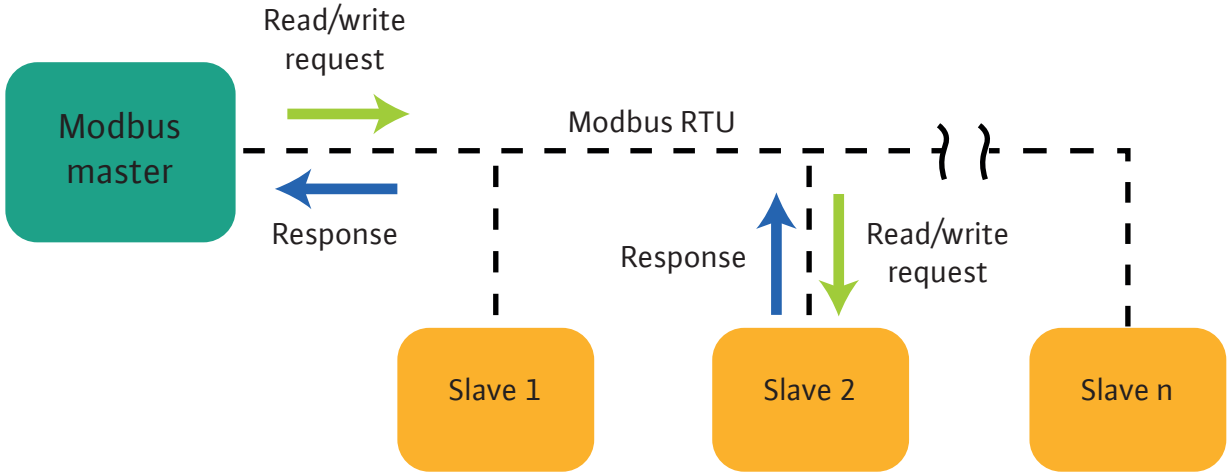


figure n°9

Reading in registers

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

READ INPUT REGISTER (function code 04)

Master request

	Slave address	Function code	Starting address		Quality of Input registers		CRC	
			MSB	LSB	MSB	LSB	MSB	LSB
UINT		0x04			0x00	0x01		
INT		0x04			0x00	0x01		
WORD		0x04			0x00	0x01		
UDINT		0x04			0x00	0x02		
DWORD		0x04			0x00	0x02		
BYTE		0x04			0x00	0x01		
REAL		0x04			0x00	0x02		

Slave answer

Slave address	Function code	Byte count	Data				CRC	
							MSB	LSB
	0x04	0x02	Data1	Data0				
	0x04	0x02	Data1	Data0				
	0x04	0x02	Data1	Data0				
	0x04	0x04	Data3	Data2	Data1	Data0		
	0x04	0x04	Data3	Data2	Data1	Data0		
	0x04	0x02	Data1	Data0				
	0x04	0x04	Data3	Data2	Data1	Data0		

READ HOLDING (function code 03)

Master request

	Slave address	Function code	Starting address		Quality of Input registers		CRC	
			MSB	LSB	MSB	LSB	MSB	LSB
UINT		0x03			0x00	0x01		
INT		0x03			0x00	0x01		
WORD		0x03			0x00	0x01		
UDINT		0x03			0x00	0x02		
DWORD		0x03			0x00	0x02		
BYTE		0x03			0x00	0x01		
REAL		0x03			0x00	0x02		
USINT		0x03						

Slave answer

Slave address	Function code	Byte count	Data				CRC	
							MSB	LSB
	0x03	0x02	Data1	Data0				
	0x03	0x02	Data1	Data0				
	0x03	0x02	Data1	Data0				
	0x03	0x04	Data3	Data2	Data1	Data0		
	0x03	0x04	Data3	Data2	Data1	Data0		
	0x03	0x02	Data1	Data0				
	0x03	0x04	Data3	Data2	Data1	Data0		
	0x03		Data3	Data2				

Warning: Be aware that some registers may return error codes, those error values must be excluded from the physical data span. I.e: for flow input register (I 2), the value 65535 is an error code and should not be considered as 6553.5 m3/h. Those specific values are described in the "Input/Holding registers data model" chapters here after.

Writing in registers

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

WRITE SINGLE HOLDING REGISTER (function code 06)

Master request

	Slave address	Function code	Starting address		Data		CRC	
			MSB	LSB	MSB	LSB	MSB	LSB
UINT		0x06			Data1	Data0		
INT		0x06			Data1	Data0		
WORD		0x06			Data1	Data0		
BYTE		0x06			0x00	Data0		
USINT		0x06			0x00	Data0		

Slave answer

Slave address	Function code	Starting address		Data		CRC	
		MSB	LSB			MSB	LSB
	0x06			Data1	Data0		
	0x06			Data1	Data0		
	0x06			Data1	Data0		
	0x06			0x00	Data0		
	0x06			0x00	Data0		

WRITE MULTIPLE HOLDING REGISTER (function code 16)

Master request

	Slave address	Function code	Starting address		Quality of Input registers		Data				CRC	
			MSB	LSB	MSB	LSB					MSB	LSB
UINT		0x10			0x00	0x01	Data1	Data0				
INT		0x10			0x00	0x01	Data1	Data0				
WORD		0x10			0x00	0x01	Data1	Data0				
UDINT		0x10			0x00	0x02	Data3	Data2	Data1	Data0		
DWORD		0x10			0x00	0x02	Data3	Data2	Data1	Data0		
BYTE		0x10			0x00	0x01	0x00	Data0				
REAL		0x10			0x00	0x02	Data3	Data2	Data1	Data0		
USINT		0x10			0x00	0x01	0x00	Data0				

Slave answer

Slave address	Function code	Starting address		Quantity of Input registers		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
	0x06			0x06	0x06		
	0x06			0x06	0x06		
	0x06			0x06	0x06		
	0x10			0x10	0x10		
	0x10			0x10	0x10		
	0x06			0x06	0x06		
	0x10			0x10	0x10		
	0x06			0x06	0x06		

Warning: Be aware that some registers may return error codes, those error values must be excluded from the physical data span. I.e: for flow input register (I 2), the value 65535 is an error code and should not be considered as 6553.5 m3/h. Those specific values are described in the "Input/Holding registers data model" chapters here after.

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

CRC 16 Calculation

The sketch below describes the calculation of the 16 bits cyclic redundancy (CRC16)

Calculation algorithm of the CRC 16

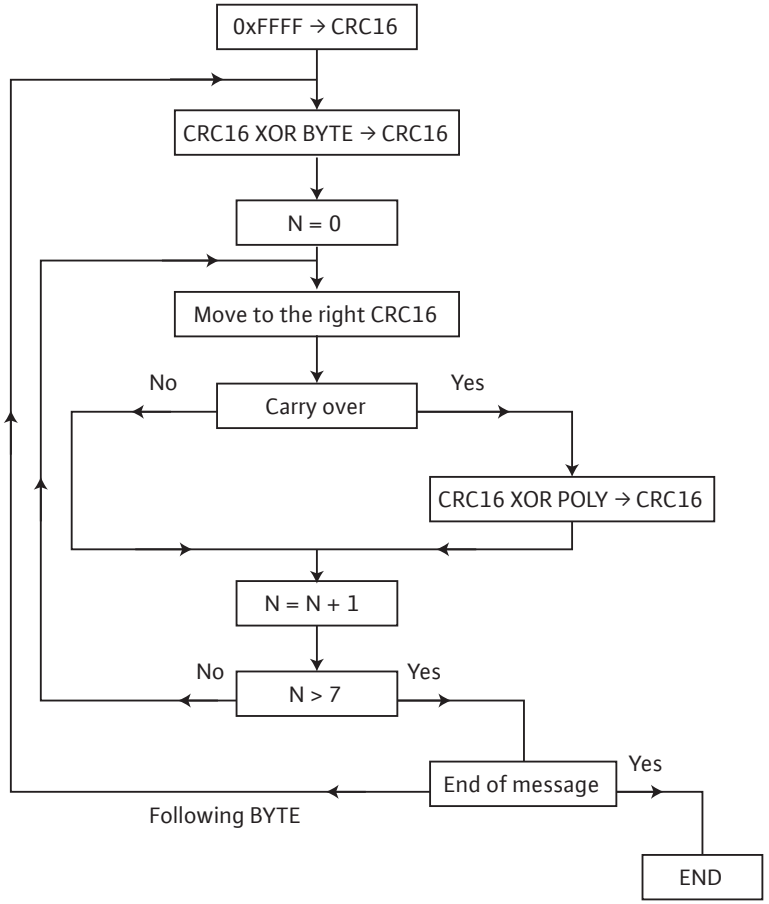


figure n°10

XOR = exclusive or
N = number of information bits
POLY = calculation polynomial of the CRC 16 = 1010 0000 0000 0001
(Generating polynomial = 1 + x2 + x15 + x16)
In the CRC 16, the 1st byte transmitted is the least significant one.

MODBUS Message

Silence	Slave address	Request code	Data	Control	Silence
Start	Address	Code function	Data	CRC	END

Holding register data model

Holding register											
Register	Wilo Register	Starting Register (in Byte)	Variable	Scope		Data type	Unit	Scale	Range low	Range high	Error value
400002	1	0001	duty point (rel.)	pump system	input value	INT	%	0,5	-32768	32766	32767
400041	40	0028	Pump Command in	pump system	input value	WORD					
400043	42	002A	Control Function	pump system	input value	WORD					
400301	300	012C	Bus Command Timer	pump system	input value / active value	BYTE			1	10	
400401	400	0190	Bus Command Timer Timeout	pump system	input value / active value	UINT	s	1	20	65534	65535
400403	402	0192	duty point (rel.) preset	pump system	input value / readback input value (A))	INT	%	0,5	-32768	32766	
400404	403	0193	Control Function preset	pump system	input value / readback input value (A))	WORD			0	140	
400405	404	0194	Pump Command preset	pump system	input value	BYTE					
461441	61440	F000	interface device identifier	pump system	input value / active value	USINT					
461442	61441	F001	transmission serial speed	pump system	input value / active value	USINT					
461443	61442	F002	transmission serial frame	pump system	input value / active value	USINT					
461695	61694	F0FE	parameter block acknowledge	pump system	input value	DWORD					

Warning: Wilo register numbers start from zero (Unlike the Modbus Standard that start at 1). Therefore the starting address is equal to the register number.

INFO

You can find the full list of registers at this link or by flashing this QR code :

qr.wilo.com/para-maxo-Modbus-registers

Input register data model

Input registers 1/2

Register	Wilo Register	Starting Register (in Byte)	Variable	Scope		Data type	Unit	Scale	Range low	Range high	Error value
300001	1	**0001**	Pressure	pump system	output value	UINT	cm H□O	10	0	65534	65535
300002	2	**0002**	Flow (calculated)	pump system	output value	UINT	m³/h	0,1	0	65534	65535
300003	3	**0003**	Energy Consumption	pump system	output value	UINT	kWh	1	0	65534	65535
300004	4	**0004**	power input	pump system	output value	UINT	W	1	0	65534	65535
300005	5	**0005**	Operation Time	master pump	output value	UINT	h	10	0	65534	65535
300007	7	**0007**	Speed	master pump	output value	UINT	RPM	1	0	65534	65535
300010	10	**000A**	Control Function	pump system	active value	WORD					
300018	18	**0012**	Speed max-pres-value	pump system	active value	UINT	RPM	1	0	65534	65535
300019	19	**0013**	Speed min-pres-value	pump system	active value	UINT	RPM	1	0	65534	65535
300024	24	**0018**	Flow (calculated) max-pres-value	pump system	output value	UINT	m³/h	0,1	0	65534	65535
300025	25	**0019**	Flow (calculated) min-pres-value	pump system	output value	UINT	m³/h	0,1	0	65534	65535

Warning: Unlike the Modbus Standard, Wilo register numbers start from zero. So, the starting address is equal to the register number.

INFO

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qr.wilo.com/para-maxo-Modbus-registers

Input registers 2/2

Register	Wilo Register	Starting Register (in Byte)	Variable	Scope		Data type	Unit	Scale	Range low	Range high	Error value
300200	200	00C8	duty point (rel.)	pump system	active value	INT	%	0,5	-32768	32766	32767
300202	202	00CA	duty point (rel.) maximum-output	pump system	active value	INT	%	0,5	-32768	32766	32767
300204	204	00CC	duty point (rel.) minimum-output	pump system	active value	INT	%	0,5	-32768	32766	32767
300206	206	00CE	duty point 100 % value	pump system	active value	REAL	%	1			
300208	208	00D0	duty point (rel.) units	pump system	active value	UINT					
300400	400	0190	duty point (rel.)	pump system	output value	INT	%	0,5	-32768	32766	32767
300402	402	0192	Pump Command active	pump system	active value	BYTE					
300404	404	0194	Operation Status	pump system	output value	WORD					
300500	500	01F4	Heartbeat Count	pump system	output value	UDINT		1	0	4294967294	4294967295
300504	504	01F8	Bus Command Timer Time remain.	pump system	output value	UDINT	s	2			
300700	700	02BC	Application Version	pump system	output value	WORD					
300702	702	02BE	Vendor ID	pump system	output value	DWORD					
300940	940	03AC	Warning/Error Message	master pump	output value	BYTE					
361694	61694	F0FE	parameter block acknowledge	pump system	active value	DWORD					

Warning: Unlike the Modbus Standard, Wilo register numbers start from zero. So, the starting address is equal to the register number.

INFO

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qr.wilo.com/para-maxo-Modbus-registers

ModBus Pump control

The pump is set ON or OFF by using the Holding Registrer « pump command in » (H 40):

0 : OFF

1 : ON

The regulation mode is selected by the Holding register « Control Function » (H 42), with the following values:

1 : n-const

3 : Δp-c

4 : Δp-v

The setpoint is defined by the Holding Register « Duty point (rel.) » (H 1), with the value X:

X = relative value in 0,5% (i.e. 200 = 100%)

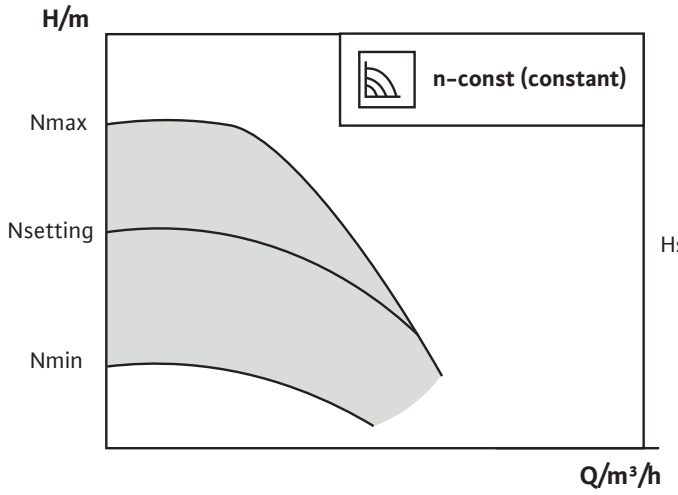

figure n°11

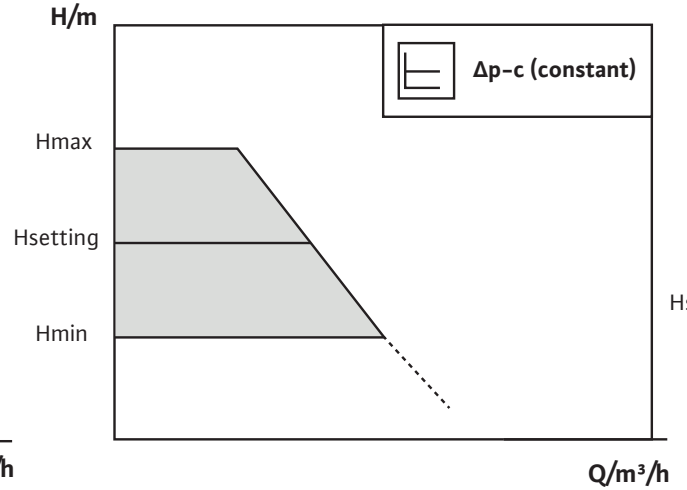

figure n°12

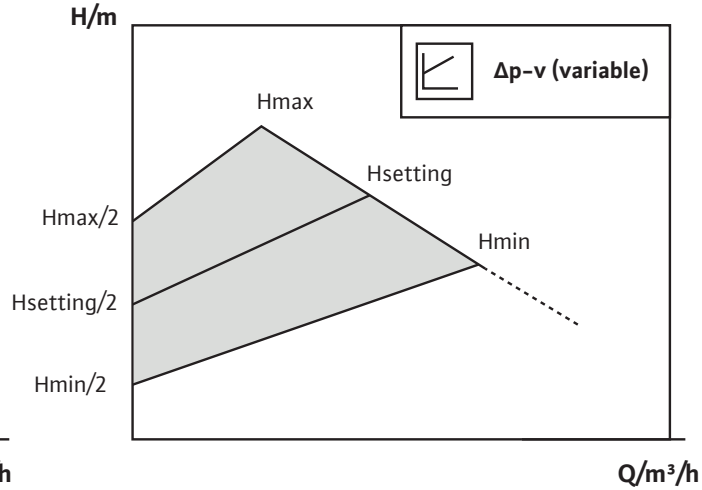

figure n°13

Holding register "Duty point Rel." (H 1) set the regulation duty point according the graph below.

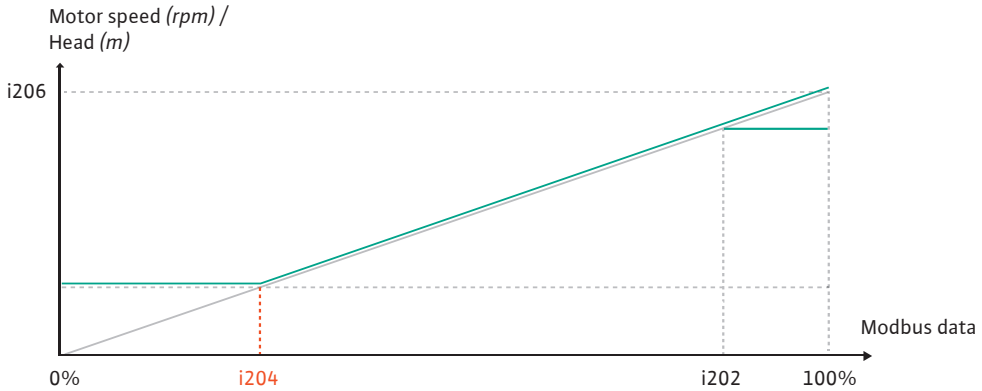

figure n°14

Example 1 : Set pump to Δp-c 6m

- Write "Control Function " (H 42) = 3 — *Control mode is changed to "Δp-c"*
- Write "Duty point Rel." (H 1) = 0 — *Nota: When changing "Control Function" (H 42) , it is necessary to force a refresh of register "duty point (rel.)" (I 200). This is can be realized by forcing "Duty point Rel." (h 1) to zero before setting the desired value.*
- Read "Duty point 100%" (I 206) = 8 — *The head at 100% of the scale is 8m.*
- Read "Duty point min output" (I 204) = 13 — *The minimum head that the pump can reach is 13*0.5 = 6.5% (scale = 0.5%) It corresponds to 6.5%*8m= 0.5 m*
- Read "Duty point max output" (I 202) = 200 — *The maximum head that the pump can reach is 200*0.5 = 100% (scale = 0.5%). It corresponds to 100%*8m= 8 m*
- Write "Duty point Rel. " (H 1) = 150 — *It corresponds to a Head of 6m, with the calculation: 100/0.5 * 6/8 = 150. Note: the value can be set to any number between 13 (as defined in I 204) and 200 (as defined in I 202). If a value below 13 is selected, the pump will consider 13.*
- Write " Pump Command In" (H 40) = 1 — *Set the pump ON in case it was previously OFF*
- Read "Duty point (rel.) " (I 200) = 150 — *The current duty point is 150*0.5*8/100 = 6 m*
- Read "Duty point (rel.) " (I 400) = 140 — *The current operating point is 140*0.5*8/100 = 5.6 m*

Example 2: Set pump to Constant speed 2450 Rpm

• Write "Control Function " (H 42) = 1	*Control mode is changed to “n-const”*
• Write "Duty point Rel." (H 1) = 0	*Nota: When changing "Control Function" (H 42) , it is necessary to force a refresh of register "duty point (rel.)" (I 200). This is can be realized by forcing "Duty point Rel." (h 1) to zero before setting the desired value.*
• Read “Duty point 100%” (I 206) = 3500	*The maximum pump speed at 100% of the scale is 3500 RPM.*
• Read “Duty point min output” (I 204) = 0	*The minimum speed that the pump can reach is 0*0.5 = 0%. Note: In reality the pump will not go below its minimum speed (750RPM).*
• Read “Duty point max output” (I 202) = 200	*The maximum speed that the pump can reach is 200*0.5 = 100% (scale = 0.5%). It corresponds to 100%*3500= 3500 RPM.*
• Write "Duty point Rel. " (H 1) = 140	*It to a speed of 2450 RPM, with the calculation: 100/0.5 * 2450/3500 = 140.Note: the value can be set to any number between 13 (as defined in I 204) and 200 (as defined in I 202). If a value below 13 is selected, the pump will consider 13.*
• Write " Pump Command In" (H 40) = 1	*Set the pump ON in case it was previously OFF*
• Read "Duty point (rel.) " (I 200) = 140	*The current duty point is 140*0.5*3500/100 = 2450 RPM*
• Read "Duty point (rel.) " (I 400) = 120	*The current operating point is 120*0.5*3500/100 = 2100 RPM*

Fallback mode emulation

In Modbus communication, there is no native fallback mode. However, it is possible to emulate a fallback mode when the pump loses communication.

Initialization:

- Write the desired value for the fallback timer in the holding register "Bus Command Timer Timeout" (**H 400**), ranging from 20 to 65534 seconds. The factory default is 300 seconds.
- Use the Holding Register "Pump Command preset" (**H 404**) to define whether the pump should run (value = 1) or stop (value = 0) during the fallback.
- Use the Holding Register "Control Function preset" (**H 403**) to define the desired control mode during the fallback.
  The possible values are 1=n-cst, 2=dp-c and 3=dp-v.
- Set the Holding Register "Duty point (rel.) preset" (**H 402**), to determine the desired duty point to be followed during fallback. The valid range is from 0 (0%) to 200 (100%).

Execution:

- To initiate the fallback timer, set the holding register "Bus Command Timer" (**H 300**) to 6 "set preset".
- The fallback timer remains active, so it is necessary to regularly set the holding register "Bus Command Timer" (**H 300**) to 6 "set preset" to prevent the timer from reaching 0. If the timer reaches 0, the pump assumes that Modbus communication is lost and follows the fallback instructions
- The remaining time in seconds can be read using the Input register "Bus Command Timer Time remain" (**H 504**).
- The *figure 15* below describes the state machine of the holding register "Bus Command Timer" (**H 300**)

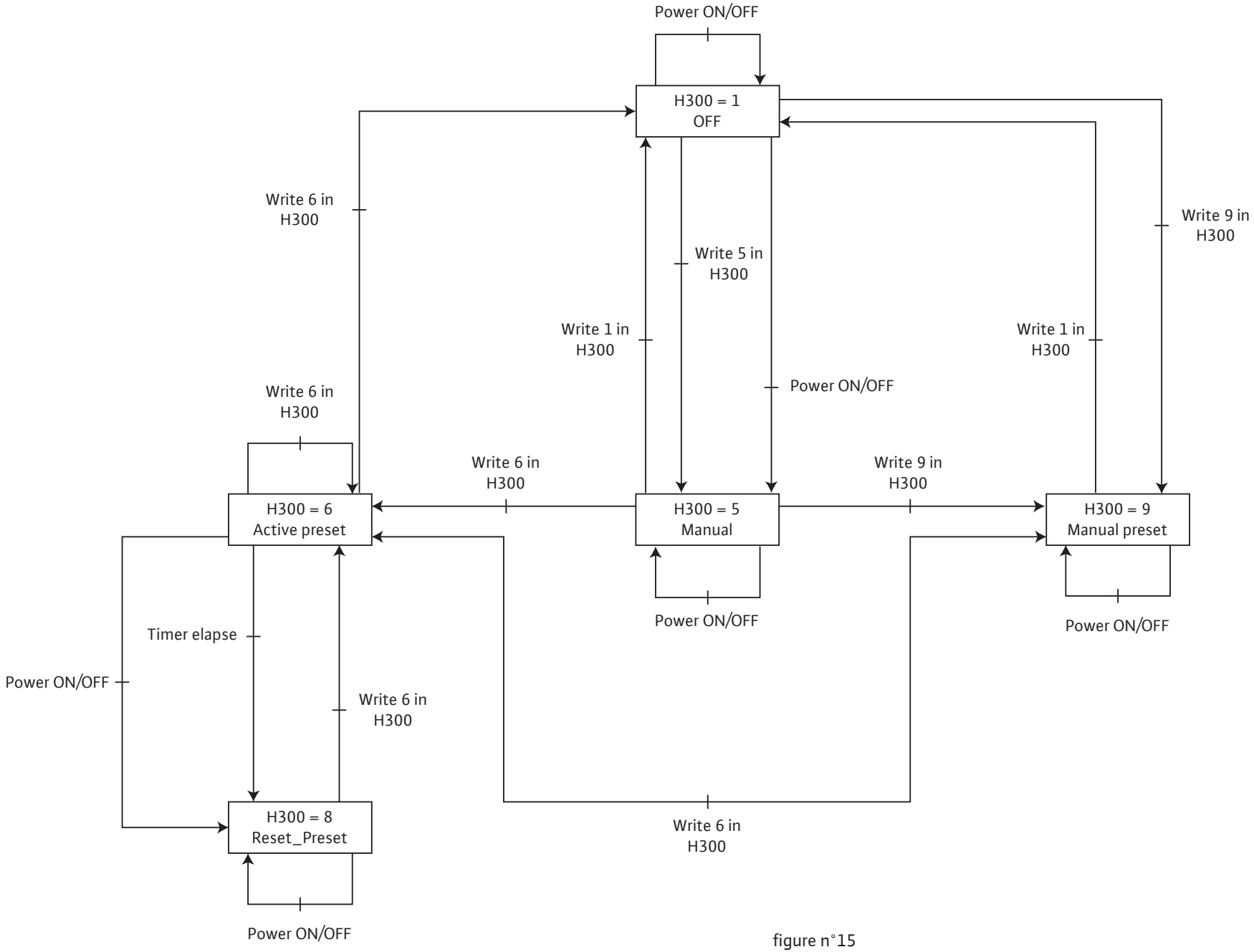

figure n°15

Pump communication settings

By default, the pump is configured with the following delivery state :

Parameters	Standard value
Address	101
Baud rate	19.200 kbps
Frame parity	8E1

To change these parameters, please follow the steps below:

1. Set the desired address in the Holding register "interface device identifier" (H 61440) within the range of 1 to 247.
2. Set the desired baud rate in the Holding register "transmission serial speed" (H 614441) using the appropriate value from the provided table.
3. Set the desired data frame in the Holding register "transmission serial frame" (H 614442) using the appropriate value from the provided table.

Holding Register "transmission serial speed" **(H 614441)**			
Value	**Name**	**Description**	**Status**
0	UART_B300	transmission speed 300 bits/s	Supported
1	UART_B600	transmission speed 600 bits/s	Supported
2	UART_B1200	transmission speed 1200 bits/s	Supported
3	UART_B2400	transmission speed 2400 bits/s	Supported
4	UART_B4800	transmission speed 4800 bits/s	Supported
5	UART_B9600	transmission speed 9600 bits/s	Supported
6	UART_B19200	transmission speed 19200 bits/s	Supported
7	UART_B38400	transmission speed 38400 bits/s	Supported
8	UART_B57600	transmission speed 57600 bits/s	Supported
9	UART_B115200	transmission speed 115200 bits/s	Supported
10	UART_B76800	transmission speed 76800 bits/s	Supported
12	UART_B0	transmission speed invalid on this interface	Supported

Holding Register " transmission serial frame" **(H 614442)**			
Value	**Name**	**Description**	**Status**
2	UART_FRAME_8N1	data frame 8 bits, no parity, 1 stopbit	Supported
3	UART_FRAME_8N2	data frame 8 bits, no parity, 2 stopbits	Supported
6	UART_FRAME_8E1	data frame 8 bits, even parity, 1 stopbit	Supported
10	UART_FRAME_8O1	data frame 8 bits, odd parity, 1 stopbit	Supported
15	UART_FRAME_ INVALID	data frame invalid	Supported

It's important to note that at this stage, the new values are stored in the holding registers but have not yet been applied by the pump.

1. Read the key value from the Input register "parameter block acknowledge" (I 61694) and write it to the Holding register "parameter block acknowledge" (H 61694). This action will trigger the adoption of the new settings during the next power reset. But until the power reset is done, the pump continues to respond on old parameters.
2. Perform a power reset of the pump.

After the power reset, the new settings are now effective.

Warning / Error generalities

Failure reporting is depending on the failure timing and its duration. The following figure gives an overview about the failure reporting depending on different failure timings. The assumption is that a single failure only counts if it lasts at least one second.

- **Failure reporting :** Failures can be reported on Modbus and/or LED after a maximum of time called **Treport**
- **Failure cancelation :** Failure reports are canceled if the same error is not repeated within **Trecover**

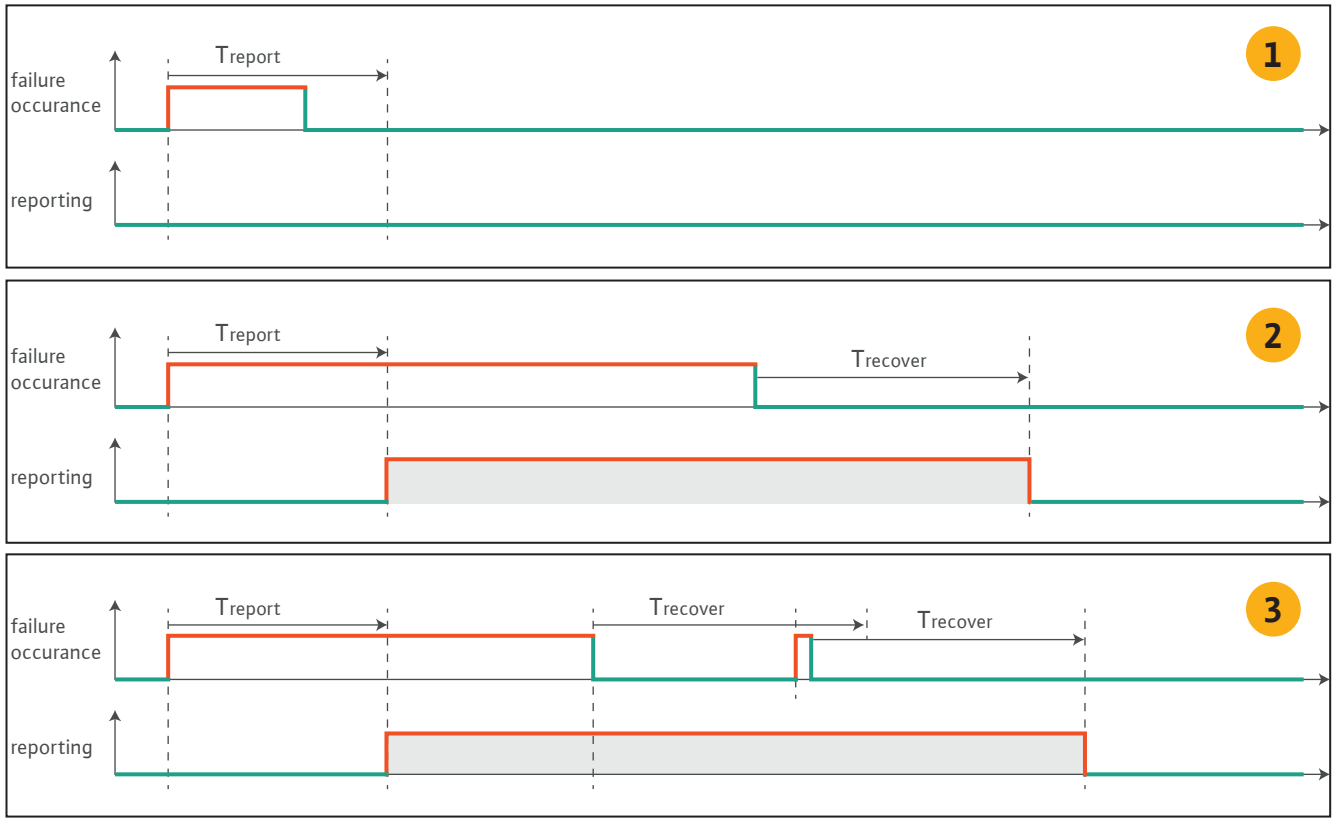

figure n°16

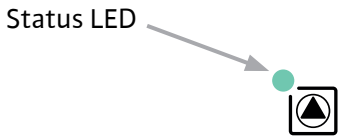

figure n°17

1. No reporting, since failure does not show minimum duration.
2. Failure reported, since pump did not recover within Treport.
3. Failure withdrawing delayed because of an additional failure occurance within Trecover.

Warning / Error management

Modbus warning / Error information overview 1/4

Modbus – Reg 404	Modbus – Reg 940	LED Status	Error name	Error type	Error type	Short description of warning consequences and/or pump actions	T report (s)	T recover (s)
bit4 + bit5	25	●	Missing motor windings contact or disconnected electronic box	Final error	0	The connection between the motor and the inverter is interrupted or the motor winding is damaged.	≤ 6	≤ 6
bit4 + bit5	23	●	Driver fault	Final error	1	The motor is defective.	≤ 6	≤ 6
bit4	111	✳	Over current	Error	2	The motor currents exceeds the acceptable limit.	≤ 6	≤ 6
bit4 + bit5	10	●	Blocked rotor	Final error	3	The pump has tried with the routine to unblock without success. **Action : try to change the fluid or remove the particles blocking the pump**	≤ 6	NA
bit4	21	✳	Overload motor	Error	6	The pump is stopped because the speed is lower than the permissible tolerance. This is caused by high friction due to mechanical ageing or particles in the medium. **Action : try to change the fluid or remove the particles blocking the pump.**	≤ 6	≤ 6
bit4	33	✳	Overvoltage VDC ≥ **263 VAC** The pump could stop and, if stopped, must reliably issue the assigned error code	Error	5	The pump will stop if a voltage above 263 Vac is detected. In order to recover from overvoltage, supply voltage has to go below 253 Vac. The main voltage measure is influenced by operation point, impedance power line, components tolerance and the operation point (main factor) **Action: check the power supply stability**	≤ 6	≤ 12

● Green constant

✳ Green blinking
ON : 100ms – OFF : 5s

✳ Green blinking
ON : 500ms – OFF : 500ms

✳ Red – Green blinking
RED : 500ms – GREEN : 500ms

✳ Red blinking
ON : 500ms – OFF : 500ms

● Red constant

Modbus warning / Error information overview 2/4

Modbus – Reg 404	Modbus – Reg 940	LED Status	Error name	Error type	Error type	Short description of warning consequences and/or pump actions	T report (s)	T recover (s)
bit4	32		Undervoltage : Fast Voltage drop	Error	7	Fast voltage drop : This occurs when a high voltage dip is detected – Undervoltage reported when U ≤ 160 VAC : When the pump stops, a signal is delivered after a short time. – Recover when U ≥ 170VAC : When the pump starts, it can be with limitation of performances. – The main voltage measure is influenced by operation point, impedance power line, components tolerance and the operation point (main factor). **Action : check the power supply**	≤ 6	≤ 6
bit4	112		Over speed	Error	8	Motor speed over the acceptable limits	≤ 6	≤ 6
bit4	119		Turbine mode	Error	9	The pump is stopped becaue of a negative flow. It could happen if there is another device generative opposite flow. **Action : Check the installation/setup.**	≤ 6	≤ 6
bit4	4		Undervoltage : Slow voltage drop	Error	10	Slow voltage drop : This occurs when the voltage is slowly decreasing until reaching the threshold : – Undervoltage reported when U ≤ 160 VAC : When the pump stops, a signal is delivered after a short time. – Recover when U ≥ 170VAC : When the pump starts, it can be with limitation of performances. – The main measure is influenced by operation point, impedance power line, components tolerance and the operation point (main factor). **Action : Check the power supply**	≤ 6	≤ 6

Green constant

Green blinking
ON : 100ms – OFF : 5s

Green blinking
ON : 500ms – OFF : 500ms

Red – Green blinking
RED : 500ms – GREEN : 500ms

Red blinking
ON : 500ms – OFF : 500ms

Red constant

Modbus warning / Error information overview 3/4

Modbus – Reg 404	Modbus – Reg 940	LED Status	Error name	Error type	Error type	Short description of warning consequences and/or pump actions	T report (s)	T recover (s)
bit4	30		Over temperature module	Error	14	Over temperature: the temperature of the module is too high, pump stops **Action: reduce the ambient temperature**	≤ 6	≤ 6
bit4	31		Over temperature power bridge – components	Error	15	The pump is stopped because the temperature of some electronic components is too high. **Action: reduce the ambient temperature**	≤ 6	≤ 6
bit3	7		Generator operation	Warning	16	The pump is still operating and detects a positive throughflow. It could happen if there is another device generating direct flow. **Action: check the installation/setup**	≤ 6	≤ 6
bit3	11		Dry running	Warning	17	The pump is still operating but there is no fluid in the installation. **Action: fill the installation**	≤ 6	≤ 6
bit3	21		Overload motor	Warning	18	The pump is still operating but detects an overload of the motor. This is caused by a high friction due to high fluid viscosity or particles in the medium. **Action: clean or change the medium**	≤ 6	≤ 6
bit3	30		Over temperature module	Warning	19	The pump reduces its performances because the temperature in the electronic module is too high.	≤ 6	≤ 6
bit4	10		Blocked rotor	Error	20	The pump is trying to unblock itself. **Action: wait (maintain power supply) until routine is completed or remove the particles blocking the pump**	≤ 6	≤ 6
bit3	38		Medium temperature sensor	Warning	21	The pump detects a disconnected temperature sensor.	≤ 6	≤ 6

Modbus warning / Error information overview 4/4

Modbus – Reg 404	Modbus – Reg 940	LED Status	Error name	Error type	Error type	Short description of warning consequences and/or pump actions	T report (s)	T recover (s)
bit3	4		Undervoltage Vmains	Warning	24		≤ 6	≤ 6
bit3	19		Low flow	Warning	25		≤ 6	≤ 6
bit3	31		Overtemperature IPM	Warning	27		≤ 6	≤ 6
[bit3, bit4, bit5] = [0,0,0]	0		No error	Warning	255	The pump is running without issue		
bit3	50		Bus Communication	Warning	18	The pump is running is fallback mode	≤ 6	≤ 6

 Green constant

 Green blinking
ON : 100ms – OFF : 5s

 Green blinking
ON : 500ms – OFF : 500ms

 Red – Green blinking
RED : 500ms – GREEN : 500ms

 Red blinking
ON : 500ms – OFF : 500ms

 Red constant

wilo

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