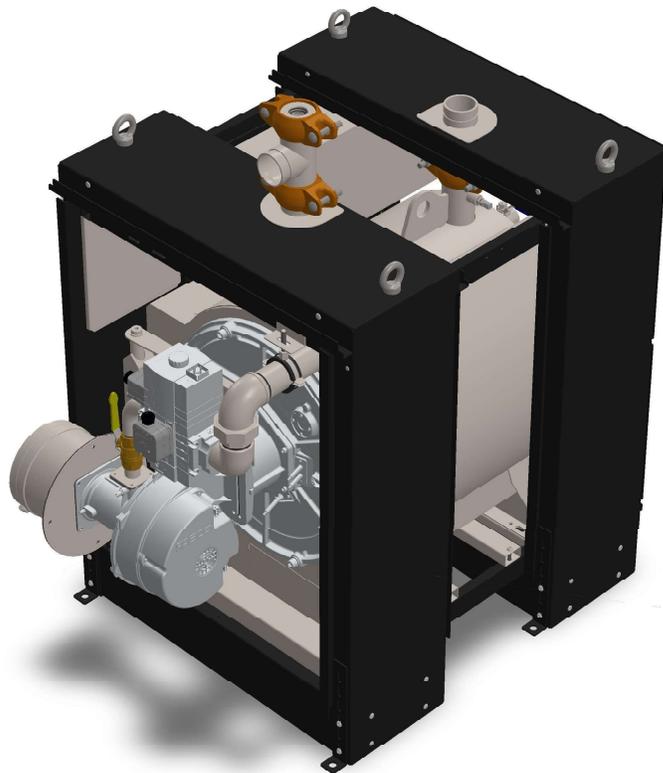




NX PLUS

MODBUS User Manual



E-1250 B and WH
E-2000 B and WH
E-3000 B and WH
E-4000 B and WH

INSTRUCTION: MODBUS USER MANUAL - COMMERCIAL AND RESIDENTIAL BOILER

This instruction must be left with owner and must be hung on or adjacent to the boiler for reference.

 WARNING!	Changing Modbus settings must be performed by a certified technician.
 WARNING!	The distributor is not responsible for client configuration / cabling / installation, but only for the functionality described in this manual.

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MODBUS

1 Configuration

Communication using Modbus is available on the boilers. The table below summarizes the Modbus configuration details.

Protocol	Modbus RTU (Remote Terminal Unit)
Default dependent addresses	Configurable with 900PB or LabVision. Boiler 1 default: 1 Boiler 2 default: 2 Boiler 3 default: 3 Boiler 4 default: 4 Boiler 5 default: 5 Boiler 6 default: 6 Boiler 7 default: 7 Boiler 8 default: 8
Supported Modbus commands	Read Holding registers (03) Write single holding register (06) Write multiple holding registers (10)
Baud rate	9600 bps
Data Length	8
Parity	None
Stop Bits	1/2, Configurable with 900PB or LabVision. Default: 2 stop bits
Physical layer	RS 485 (two wire + optional GND)

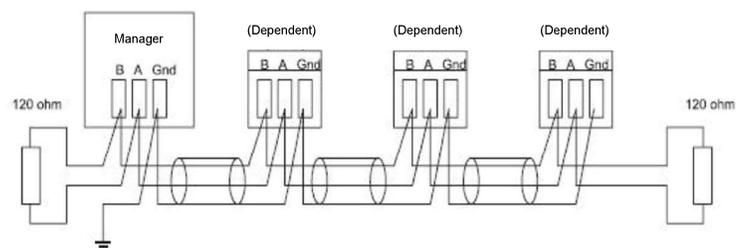
29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
						-	+	-	+	Gnd				-	+			-	+	B	A	Gnd						
Safety switch 2	Safety switch 1	Gas pressure switch	LWCO Extern	AL-BUS managing boiler	Pump control PWM	Flow switch DHW	0-10 Vdc	On/Off stat or Open therm heating circuit	AL-BUS depending boiler	Modbus			DHW sensor	System sensor	Outdoor sensor													
Sécurité passer 2	Sécurité passer 1	Gas la pression passer	Eau basse coupée à l'extérieur	AL-BUS chaudière gérant	Commande de pompe PWM	Interrupteur de débit ECS	0-10 Vcc	On/Off stat ou circuit de chauffage Open therm	AL-BUS chaudière dépendant				Capteur DHW	Capteur de système	Capteur extérieur													

Fig.: low voltage connections of the boiler

On the boiler, Modbus cabling is attached to connections 7 (ground), 8 (A) and 9 (B). Cable size: AWG 20/22 twisted / shielded.

If multiple boilers are connected in a serial line, at the last connection strip a termination resistance must be mounted over the connections A and B. Specification of the resistance: $120 \Omega \pm 1\%$, 250 mW.

With a cascade you can access some info about dependents over the Modbus connection of the managing boiler (see § 3.10).



2 General

2.1 Datatypes

Modbus communicates using words (the contents of 16-bit holding registers). This means data will be received / sent as 16-bit data for each holding register.

Some data types require a higher precision than a whole number (integer), these data types will be multiplied with a factor so the precision is not lost. When the value for that data type is read it must be divided by the same factor to get the real value.

This also applies to writing the value; then the value must first be multiplied by the factor before writing it to the Holding register.

Data type	Resolution	Factor	Unit
Temperature	xxx.x	10	°C / °F
Voltage	xxx.x	10	Volt
Pressure	xxx.x	10	Bar / psi
Flame current (micro amps)	xxx.x	10	µA
Percentage	xxx.x	10	%

Negative values are transmitted in a different way. A temperature of -10 °C is represented by the number 65436, -20 °C is 65336. Translating these numbers to normal values means subtracting 65536 and dividing by 10.

2.2 Control register

The control register can be used to gain access to special functions (writing or controller reset).

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
99	0063	X	X	Control register	1	V	Bit0: Write Enable. Bit14: Controller reset.

- The 'Write enable' bit controls if writing to Holding registers is allowed.
'Write enable' = 0: Holding registers cannot be written.
'Write enable' = 1: Holding registers (that support writing) can be written.

After a write sequence is completed the 'Write enable' bit will be automatically cleared. So before each new write action the 'Write enable' bit must be set again. After setting the 'Write enable' bit, a write action must be done within max 4 seconds, otherwise the bit is cleared and writing is disabled.

Remark:

Only enable writing when initiating a write command to a holding register.
Do not send this command when no write is needed to prevent holding registers from being corrupted.

- A controller can only be reset when it is in Lockout (lockout error is set, state = 13).
When the controller is in lockout, it can be reset by setting bit 14 in the control holding register.
This equals the (decimal) number 16384.

Once the reset is executed the bit will automatically be cleared

2.3 Volatility

Parameters can be volatile or non-volatile:

NV: Non-Volatile; this parameter is stored in the non-volatile memory (eeprom, flash etc.). These parameters will retain their value after a reset / power cycle. However, the parameters have a limited amount of allowed write cycles (10,000 times), which means that these parameters should not be used for dynamic control.

V: Volatile; this parameter is stored in the volatile memory (RAM). These parameters will lose their value after a reset/power cycle (value will be reset to the last know setting from non-volatile memory). These parameters have a unlimited amount of allowed write cycles and can be used for dynamic control.

2.4 Unit selection

For easier handling of holding registers, the data format can be changed. The data format that is selected will apply for both reading and writing of data.

Holding Register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
98	0062	X	X	Unit selection	1	NV	Bit0: °C / °F. Bit1: Bar / PSI.

Before you can change the unit selection, you must first enable writing (by setting the 'Write enabled' bit in the 'Control register'). After this you can set the appropriate bits in the 'Unit selection' register.



These settings only apply to Modbus communication. The unit setting on the boiler screen is not influenced.

3 Holding registers

Depending on the type of Modbus software used, the holding register addressing range starts either at 0x0000 or at 0x0001. If your Modbus software starts addressing from 0x0000 you can use the holding register addresses shown in the tables below. If your Modbus software addressing range starts at 0x0001 then add 1 to the holding register addresses listed in the tables below. This is also applicable for the various test tools available for Modbus.

Holding registers that support writing can only be written to when writing is enabled. Writing can be enabled by setting the 'Write enable' bit in the Control register (see § 2.2).

3.1 General Modbus registers (95-99)

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
95	005F	X		Group number	1	Const.	850 / 900
96	0060	X		Modbus version	10	Const	3.0
97	0061	X		Modbus device type / table	1	Const	20 = 900PB
98	0062	X	X	Unit selection (see § 2.4 "Unit selection" for more details)	1	NV	Bit0: °C / °F Bit1: bar / psi
99	0063	X	X	Control register (see § 2.2 "Control register" for more details)	1	V	Bit0: Write Enable. Bit14: Controller reset.

3.2 Status Information (100)

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
Status information							
100	0064	X		State	1	V	See state table (next page)
102	0066	X		Error Code	1	V	See error list in boiler manual
103	0067	X		Actual / calculated CH setpoint	10	NV	xx.x (°C/°F)
110	006E	X		CH pump	1	V	0/100 or 0...100%
111	006F	X		DHW pump	1	V	0/100 or 0...100%
112	0070	X		General pump	1	V	0/100 or 0...100%
Sensor / Feedback information							
120	0078	X		Supply temperature	10	V	xx.x (°C/°F)
121	0079	X		Return temperature	10	V	xx.x (°C/°F)
122	007A	X		DHW temperature	10	V	xx.x (°C/°F)
123	007B	X		Flue gas temperature	10	V	xx.x (°C/°F)
124	007C	X		System (Heat exchanger) temperature (if available)	10	V	xx.x (°C/°F)
125	007D	X		Outside temperature (if available)	10	V	xx.x (°C/°F)
140	008C	X		Firing rate (power output)	1	V	0...100%
142	008E	X		Flame (ionization) current	10	V	0...x µA
143	008F	X		Water pressure (if available)	10	V	Depending on units bar/psi

#	Burner state	Actions
0	INIT	<ul style="list-style-type: none"> Controller initialization
1	RESET	<ul style="list-style-type: none"> Software reset (and initialization)
2	STANDBY	<ul style="list-style-type: none"> Standby (waiting for demand)
3	PRE_PURGE_0	<ul style="list-style-type: none"> Fan is not running When an APS is enabled the APS position is checked
4	PRE_PURGE_1	<ul style="list-style-type: none"> Fan starts at ignition speed When an APS is enabled the APS position is checked
5	PRE_IGNIT	<ul style="list-style-type: none"> Fan stays at ignition speed Igniter is started When a LPG tank is selected, the tank valve is opened
6	IGNIT	<ul style="list-style-type: none"> Fan stays at ignition speed The gas valve is opened Igniter stays on When a LPG tank is selected, the tank valve stays opened
7	FLAME_PROVING	<ul style="list-style-type: none"> Fan stays at ignition speed The gas valve stays opened The igniter is stopped When a LPG tank is selected, the tank valve stays opened
8	BURN	<ul style="list-style-type: none"> The fan is modulating The gas valve stays opened When a LPG tank is selected, the tank valve stays opened When an APS is enabled the APS position is checked
9	POST_BURN	<ul style="list-style-type: none"> Fan is set to minimum speed The gas valve stays opened
10	POST_PURGE_0	<ul style="list-style-type: none"> The fan is set at ignition speed The gas valve is closed When a LPG tank is selected, the tank valve is closed
11	POST_PURGE_1	<ul style="list-style-type: none"> Fan stays at ignition speed When an APS is enabled the APS position is checked
12	ERROR_CHECK	<ul style="list-style-type: none"> Blocking error is set Checking if blocking error can be removed (error situation is solved)
13	ALARM	<ul style="list-style-type: none"> Lockout error is set User must reset the lockout error (and the controller will reboot)
14	BURNER_BOOT	<ul style="list-style-type: none"> Finalize processes and reboot the control

Table of possible burner controller states

3.3 History information (200)

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
System status information							
200	00C8	X		Ignit success	1	NV	0...65534
201	00C9	X		Ignit failed	1	NV	0...65534
202	00CA	X		Flame failed	1	NV	0...65534
203	00CB			Burn hours CH	1	NV	0...65534 [h]
204	00CC	X		Burn hours DHW	1	NV	0...65534 [h]
220	00DC	X		Lockout history boiler 1 (managing)	1	NV	See error list in boiler manual
221	00DD	X		Lockout history boiler 2 – 16 (depending)	1	NV	See error list in boiler manual
-	-						
235	00EB						
236	00EC	X		Lockout time boiler 1 (managing)	1	NV	0...xxx [h]
237	00ED	X		Lockout time boiler 2 – 16 (depending)	1	NV	0...xxx [h]
-	-						
251	00FD						
260	0104	X		Blocking history boiler 1 (managing)	1	NV	See error list in boiler manual
261	0105	X		Blocking history boiler 2 – 16 (depending)	1	NV	See error list in boiler manual
-	-						
275	0113						
276	0114	X		Blocking time boiler 1 (managing)	1	NV	0...xxx [h]
277	0115	X		Blocking time boiler 2 – 16 (depending)	1	NV	0...xxx [h]
-	-						
291	0123						

3.4 Settings / Parameters (500)

Holding Register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
Settings / Parameters							
500	01F4	X	X	CH mode	1	NV	0...x
501	01F5	X	X	DHW mode	1	NV	0...x
502	01F6	X	X	CH setpoint	10*	NV	20.0 – 90.0 (°C)*
503	01F7	X	X	DHW setpoint	10*	NV	20.0 – 85.0 (°C)*
504	01F8	X	X	Reset curve boiler design	10*	NV	20.0 – 90.0 (°C)*
505	01F9	X	X	Reset curve boiler mild weather	10*	NV	20.0 – 90.0 (°C)*
506	01FA	X	X	Reset curve outdoor mild weather	10*	NV	0.0 – 30.0 (°C)*
507	01FB	X	X	Reset curve outdoor design	10*	NV	-25.0 – 25.0 (°C)*
508	01FC	X	X	Warm weather shutdown	10*	NV	0.0 – 35.0 (°C)*
509	01FD	X	X	Reset curve boiler maximum	10*	NV	27.0 – 90.0 (°C)*
510	01FE	X	X	Reset curve boiler minimum	10*	NV	4.0 – 82.0 (°C)*
511	01FF	X	X	Night setback	10*	NV	0.0 – 30.0 (°C)*
520	0208	X	X	CH Enable	1	NV	0=Off, 1=On
521	0209	X	X	DHW Enable	1	NV	0=Off, 1=On

*: this setting is only possible in steps of 0.5 degrees

3.5 Service reminder (1500)

The service reminder status and settings can be read/written using the following holding registers. To check if the service reminder is active, the *Hours_Till_Service* (1501) holding register should be read. When the *Hours_Till_Service* value is 0, the service reminder is active.

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
Service reminder counters							
1500	05DC	X		Hours since last service (Burn hours or operation hours, depends on the <i>Service_Hour_Counter</i> setting).	1	NV	0...65534 hours
1501	05DD	X		Hours till service is required (Burn hours or operation hours, depends on the <i>Service_Hour_Counter</i> setting).	1	V	0... <i>Service_Interval</i>
Service settings							
1530	05FA	X	X	Reset service reminder	1	V	0...1 (1=Reset)
1531	05FB	X	X	Service hour counter setting. The counted hours (1500 or 1501) are burn / operation hours.	1	NV	0=Burn hours, 1=Operation hours
1532	05FC	X	X	Service interval	1	NV	0...25500 hours (Steps of 100 hours)

Possibly the 1500 addresses won't work with your boiler. In that case use the addresses starting at 33000 (see § 3.8)

3.6 Boiler register (30000)

Holding Register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
System status information							
30000	7530	X		Power level for the boiler	10	V	0.0... 100.0 (%)
30001	7531	X		Boiler supply setpoint (calculated)	10	V	Depending on units °C/°F
30020	7544	X		Boiler supply temperature	10	V	Depending on units °C/°F
30021	7545	X		DHW temperature	10	V	Depending on units °C/°F
30060	756C	X		System pump status	1	V	0 = Off, 1 = On
30061	756D	X		DHW pump status	1	V	0 = Off, 1 = On
30080	7580	X		Burning hours (total of all boilers)	1	V	0...65534 (h)
Module / Burner available							
30100	7594	X		Boiler 1 (Managing) available / present	1	V	0 = No, 1 = Yes
30101	7595	X		Boiler 2 (Dep2) available / present	1	V	0 = No, 1 = Yes
30102 - 30115	7596 - 75A3	X		Boiler 3 (Dep3) – Ketel 16 (Dep 16) available / present	1	V	0 = No, 1 = Yes
Module / Burner active (heating)							
30132	75B4	X		Boiler 1 (Managing) burning	1	V	0 = No, 1 = Yes
30133	75B5	X		Boiler 2 (Dep2) burning	1	V	0 = No, 1 = Yes
30134 - 30147	75B6 - 75C3	X		Boiler 3 (Dep3) – Boiler 16 (Dep 16) burning	1	V	0 = No, 1 = Yes
Control settings							
31001	7919	X	X	(48) DHW setpoint	10	NV	20.0 – 85.0 (°C) Settable in steps of 0,5 °C
31003	791B	X	X	(184) Module adress (0 = stand-alone, 1 = Managing, 2-16 Dependent)	1	NV	1...16
31004	791C	X	X	(147) Expected number of burners	1	NV	1...16

3.7 Date- and time register (32000)

Holding Register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
System status information							
32000	7D00	X	X	Seconds	1	V	0...59 (s)
32001	7D01	X	X	Minutes	1	V	0...59 (min)
32002	7D02	X	X	Hours	1	V	0...23 (h)
32003	7D03	X	X	Day	1	V	1...31 (d)
32004	7D04	X	X	Month	1	V	1...12 (mnd)
32005	7D05	X	X	Year	1	V	0...225 (2000...2225)
32006	7D06	X	X	Time zone	1	NV	-720...840 (min)
32007	7D07	X	X	Daylight saving time	1	NV	0: disable 1: Europa 2: Noord-Amerika

3.8 Service reminder (33000)

The service reminder status and settings can be read/written using the following holding registers. To check if the service reminder is active, the *Hours_Till_Service* 33001 holding register should be read. When the *Hours_Till_Service* value is 0, the service reminder is active.

Holding register		Access		Description	Factor	V / NV	Range
dec	hex	R	W				
Service reminder counters							
33000	80E8	X		Hours since last service (Burn hours or operation hours, depends on the <i>Service_Hour_Counter</i> setting).	1	NV	0...65534 hours
33001	80E9	X		Hours till service is required (Burn hours or operation hours, depends on the <i>Service_Hour_Counter</i> setting).	1	V	0... <i>Service_Interval</i>
Service settings							
33040	8110	X	X	Reset service reminder	1	NV	0...1 (1 = Reset)
33041	8111	X	X	Service hour counter setting. The counted hours (33000 or 33001) are burn / operation hours.	1	NV	0 = Burn hours, 1 = Operation hours
33042	8112	X	X	Service interval	1	NV	0...25500 hours (Steps of 100 hours)

3.9 Error log (34000)

The error log items can be read in blocks of 8 holding registers, from error index 0 to 47. When more than 48 errors are logged, the newest error index number can be found at address 34000.

Data Register		Toegang		Omschrijving	Factor	V / NV	Bereik
dec	hex	R	W				
Last error index							
34000	84D0	X		Last error index	1	NV	0...47
Error log index 0							
34008	84D8	X		Error number	1	NV	See error list in boiler manual
34009	84D9	X		Boiler ID: 0=Stand-alone, 1=Managing, 2-16=Dependent	1	NV	0...16
34010	84DA	X		Timestamp: Day of week	1	NV	0...6 (Sunday...Saturday)
34011	84DB	X		Timestamp: Day of month	1	NV	1...31
34012	84DC	X		Timestamp: Month	1	NV	1...12
34013	84DD	X		Timestamp: Year	1	NV	2000...2255
34014	84DE	X		Timestamp: Hour	1	NV	0...23
34015	84DF	X		Timestamp: Minute	1	NV	0...59
Error log index 1 - 47							
34016 - 34391	84E0 - 8657			Errors number 1 – 47 in blocks of 8 registers	1	NV	

3.10 Module register (40000)

Module holding registers can be accessed by $40000 + (\text{module number} - 1) * 100 + \text{offset}$. For example the registers for module 2 run from 40100 until 40199.

Offset	Access		Description	Factor	V / NV	Range
	R	W				
System status information						
0	X		Status	1	V	Zie statustabel (2.2)
1	X		Foutnummer	1	V	Zie foutenlijst in ketelhandleiding
2	X		Ketel aanvoer setpoint (berekend)	10	V	xx.x (°C/°F)
3	X		Brandervermogen (power output)	10	V	0.0...100,0 (%)
4	X		CH pump status	1	V	0 = off, 1 = on
5	X		DHW pump status	1	V	0 = off, 1 = on
6	X		General pump status	1	V	0 = off, 1 = on
7	X		Ionization	10	V	0.0...x.x (µA)
8	X		Water pressure	10	V	0.0...x.x (bar/psi)
9	X		Flow rate DHW	10	V	0.0...x.x (l/min)
10	X		Target fan speed	1	V	0...x (rpm)
11	X		Actual fan speed	1	V	0...x (rpm)
12	X		Minimum fanspeed	1	NV	0...x (rpm)
13	X		Maximum fanspeed	1	NV	0...x (rpm)
14	X		Ignition fan speed	1	NV	0...x (rpm)
30	X		Supply sensor temperature	10	V	xx.x (°C/°F)
32	X		Return sensor temperature	10	V	xx.x (°C/°F)
33	X		DHW sensor temperature	10	V	xx.x (°C/°F)
35	X		Flue sensor temperature	10	V	xx.x (°C/°F)
37	X		Outside sensor temperature	10	V	xx.x (°C/°F)
50	X		Burning hours CH	1	NV	0...65534 (h)
51	X		Burning hours DHW	1	NV	0...65534 (h)
52	X		Burning hours total	1	V	0...65534 (h)
53	X		Operational days	1	NV	0...65534
54	X		Successful ignitions	1	V	0...65534
55	X		Failed ignitions	1	NV	0...65534
56	X		Flame failures	1	NV	0...65534
80		X	Reset	1	V	0...1 (1=reset)
81	X	X	System test	1	V	System test ¹

¹ The system test has the following options:

0: Not active 1: Fan max 2: Low power 3: Ignition power 4: High power
5: Power limited 6: Max error 7: LWCO 1 error 8: LWCO 2 error

4 Examples

4.1 Example of a simple write command

The following example shows how to update a register with a simple write request via Modbus.

We want to change the CH setpoint to 61.0 °C

ENABLE WRITE ACTION	COMMAND ON MODBUS	WRITE FROM ... TO... *
Enable the control Register (99) by writing value 1 in register 99. The register 99 will be cleared after 4 sec. from the 900PB, therefore the next write command has to be sent within 4 sec.	01h 06h 00h 63h 00h 01h B8h 14h	Modbus-device → 900PB

CONFIRMATION WRITE ENABLED	COMMAND ON MODBUS	WRITE FROM ... TO... *
The confirm for the simple write request is the repetition of the previous request command.	01h 06h 00h 63h 00h 01h B8h 14h	900PB → Modbus Device

Explanation: 01 is the address of the 900 PB
 06 is the write command
 00 63 is hexadecimal 99, the address of the control register
 00 01 is the value you write
 B8 14 is the checksum (2 stop bits)

WRITE CH-SETPOINT VALUE	COMMAND ON MODBUS	WRITE FROM ... TO... *
Write in register 502 (CH Setpoint) the value 610. Send a request for update the CH Setpoint at a value of 61 °C.	01h 06h 01h F6h 02h 62h E8h 8Dh	Modbus Device → 900PB

CONFIRMATION NEW CH-SETPOINT VALUE	COMMAND ON MODBUS	WRITE FROM ... TO... *
The confirm for the simple write request is the repetition of the previous request command.	01h 06h 01h F6h 02h 62h E8h 8Dh	900PB → Modbus Device

Explanation: 01 is the address of the 900 PB
 06 is the write command
 01 F6 is hexadecimal for 502, the address of the CH Setpoint
 02 62 is hexadecimal for 610, the value you write
 E8 8D is the checksum

4.2 Example of a multiple read command

The following example shows how to read registers:

Address 900PB: 01 (hex)
 Command read: 03 (hex)
 Registers to read: 01F4 – 01FF (hex) (= 500 - 511 decimal, see 3.4)

READ PARAMETERS	COMMAND ON MODBUS	WRITE FROM ... TO... *
Read parameters 500 to 511.	01h 03h 01h F4h 00h 0Ch 05h C1h	Modbus Device → 900PB

Explanation: 01 is the address of the 900 PB
 03 is the read command
 01 F4 is hexadecimal for 500, the start register to read
 00 0C is hexadecimal for 12, the number of registers to read
 05 C1 is the checksum

ANSWER	COMMAND ON MODBUS	WRITE FROM ... TO... *
The message that is returned.	01h 03h 18h 00h 00h 00h 03h 52h 01h F4h 03h 20h 01h 90h 00h C8h FFh CEh 00h E6h 03h 84h 00h C8h 00h 64h 7Eh 07h	900PB → Modbus Device

Explanation: 01 is the address of the 900 PB
 03 is the read command
 18 is hexadecimal for 24, the number of 8-bit values that follow
 00 00 is hexadecimal for 0, register 500 (CH mode)
 00 00 is hexadecimal for 0, register 501 (DHW mode)
 03 52 is hexadecimal for 850, divided by 10 this is the CH Setpoint
 01 F4 is hexadecimal for 500, divided by 10 this is the DHW Setpoint
 03 20 is hexadecimal for 800, divided by 10 this is the reset curve boiler design
 01 90 is hexadecimal for 400, divided by 10 this is the reset curve boiler mild weather
 00 C8 is hexadecimal for 200, divided by 10 this is the reset curve outdoor mild weather
 FF CE is hexadecimal for 65486, subtracting 65536 and divided by 10 this is the reset
 curve outdoor design
 00 E6 is hexadecimal for 230, divided by 10 this is the warm weather shutdown
 03 84 is hexadecimal for 900, divided by 10 this is the boiler maximum
 00 C8 is hexadecimal for 200, divided by 10 this is the boiler minimum
 00 64 is hexadecimal for 100, divided by 10 this is the night setback
 7E 07 is the checksum

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