INSTRUCTION: MODBUS USER MANUAL

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.

Contents

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 addresses These addresses are important only when boilers are separately connected to Modbus.	Configurable with 900PB[1] 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[1]. Default: 2 stop bits
Physical layer	RS 485 (two wire + optional GND)

[1] On the boiler display: go to menu - settings - general settings - other settings

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 Sécurité passer 2		Safety switch 1 Sécurité passer 1		Gas pressure switch Gas la pression passer		LWCO Extern Eau basse coupée à l'extérieur		AL-BUS managing boiler AL-BUS chaudière gérant		Pump control PWM Commande de pompe PWM		Flow switch DHW Interrupteur de débit ECS		0-10 Vdc 0-10 Vcc		On/Off stat or Open therm heating circuit On/Off stat ou circuit de chauffage Open therm		AL-BUS depending boiler AL-BUS chaudière dépendant		Modbus			DHW sensor Capteur DHW		System sensor Capteur de système		Outdoor sensor Capteur extérieur	

Fig.: low voltage connections of the boiler

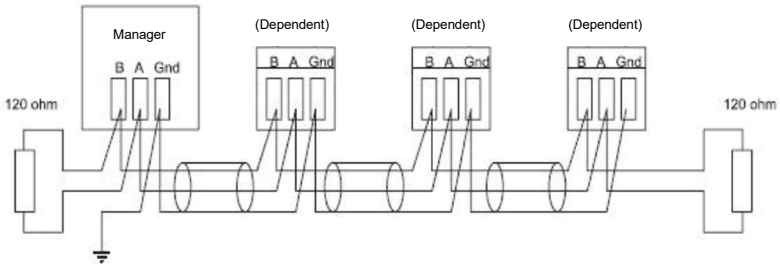
On the boiler, Modbus cabling is attached to connections 7 (ground), 8 (A) and 9 (B). Cable size: minimum AWG 20/22, twisted / shielded.

With a single boiler, all addresses mentioned in this manual can be used.

There are two possibilities to communicate with a boiler cascade using Modbus:

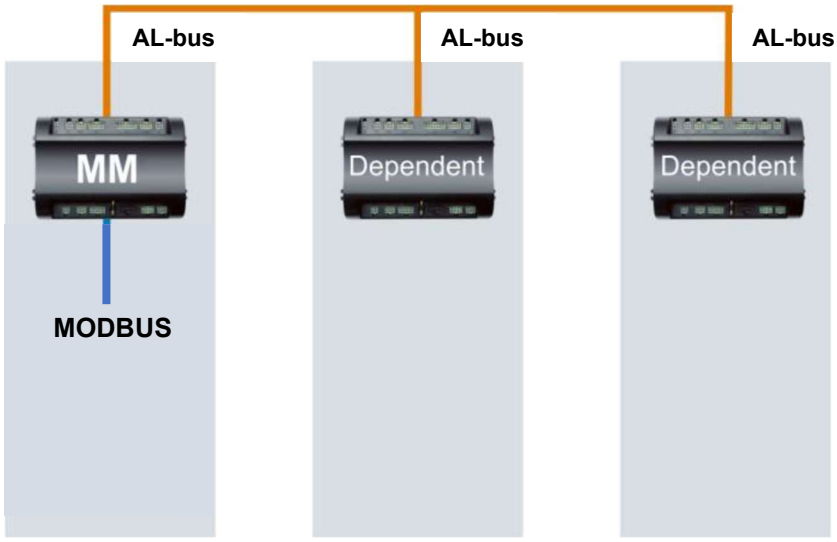
1. All boilers are connected over their Modbus connection, see the drawing below. All accessible data from all boilers can be viewed / changed.

   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 Ω ± 1%, 250 mW.



Backdraft from this method is that the built-in cascade manager cannot work. This cascademanager matches the amount of boilers burning to the heat demand. Also it rotates the sequence in which the boilers will be fired.

2. Only the Managing boiler is connected to Modbus, the Dependent boilers are connected to the Manager over the AL-bus cable (low voltage connections 10-11 and 20-21).



With the cascade manager you have a good control of all boilers. With a Modbus connection to the managing boiler you can access all data from the Managing boiler, and following data from Dependents:

- History (§ 3.3)
- Boiler register (§ 3.5)
- Error log (§ 3.8)
- Module register (§ 3.9)

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; 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.	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 (page 7)
101	0065	X		State	1	V	See state table (page 7)
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	xx.x (bar/psi)

#	Burner state	Actions
0	INIT	▪ Controller initialization
1	RESET	▪ Software reset (and initialization)
2	STANDBY	▪ Standby (waiting for demand)
3	PRE_PURGE_0	▪ Fan is not running ▪ When an APS is enabled the APS position is checked
4	PRE_PURGE_1	▪ Fan starts at ignition speed ▪ When an APS is enabled the APS position is checked
5	PRE_IGNIT	▪ Fan stays at ignition speed ▪ Igniter is started ▪ When a LPG tank was programmed, the tank valve is opened
6	IGNIT	▪ Fan stays at ignition speed ▪ The gas valve is opened ▪ Igniter stays on ▪ When a LPG tank was programmed, the tank valve stays opened
7	FLAME_PROVING	▪ Fan stays at ignition speed ▪ The gas valve stays opened ▪ The igniter is stopped ▪ When a LPG tank was programmed, the tank valve stays opened
8	BURN	▪ The fan is modulating ▪ The gas valve stays opened ▪ When a LPG tank was programmed, the tank valve stays opened ▪ When an APS is enabled the APS position is checked
9	POST_BURN	▪ Fan is set to minimum speed ▪ The gas valve stays opened
10	POST_PURGE_0	▪ The fan is set at ignition speed ▪ The gas valve is closed ▪ When a LPG tank was programmed, the tank valve is closed
11	POST_PURGE_1	▪ Fan stays at ignition speed ▪ When an APS is enabled the APS position is checked
12	ERROR_CHECK	▪ Blocking error is set ▪ Checking if blocking error can be removed (error situation is solved)
13	ALARM	▪ Lockout error is set ▪ User must reset the lockout error (and the controller will reboot)
14	BURNER_BOOT	▪ 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 - 235	00DC - 00EB	X		Lockout history boiler 1 -16	1	NV	See error list in boiler manual
236 - 251	00EC - 00FD	X		Lockout time boiler 1 – 16	1	NV	0…xxx [h]
260 - 275	0104 - 0113	X		Blocking history boiler 1 – 16	1	NV	See error list in boiler manual
276 - 291	0114 - 0123	X		Blocking time boiler 1 – 16	1	NV	0…xxx [h]

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	Depending on units °C/°F
503	01F7	X	X	DHW setpoint	10*	NV	Depending on units °C/°F
504	01F8	X	X	Reset curve boiler design	10*	NV	Depending on units °C/°F
505	01F9	X	X	Reset curve boiler mild weather	10*	NV	Depending on units °C/°F
506	01FA	X	X	Reset curve outdoor mild weather	10*	NV	Depending on units °C/°F
507	01FB	X	X	Reset curve outdoor design	10*	NV	Depending on units °C/°F
508	01FC	X	X	Warm weather shutdown	10*	NV	Depending on units °C/°F
509	01FD	X	X	Reset curve boiler maximum	10*	NV	Depending on units °C/°F
510	01FE	X	X	Reset curve boiler minimum	10*	NV	Depending on units °C/°F
511	01FF	X	X	Night setback	10*	NV	Depending on units °C/°F
520	0208	X	X	CH Enable	1	NV	0=Off, 1=On
521	0209	X	X	DHW Enable	1	NV	0=Off, 1=On
530	0212	X	X	DHW store setpoint	10*	NV	Depending on units °C/°F

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

3.5 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		Module 1 (Managing) available / present	1	V	0 = No, 1 = Yes
30101	7595	X		Module 2 (Dep2) available / present	1	V	0 = No, 1 = Yes
30102 - 30115	7596 - 75A3	X		Module 3 (Dep3) – Module 16 (Dep 16) available / present	1	V	0 = No, 1 = Yes
Module / Burner active (heating)							
30132	75B4	X		Module 1 (Managing) burning	1	V	0 = No, 1 = Yes
30133	75B5	X		Module 2 (Dep2) burning	1	V	0 = No, 1 = Yes
30134 - 30147	75B6 - 75C3	X		Module 3 (Dep3) – Module 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

3.6 Date- and time register (32000)

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

3.7 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 *Service_Hour_Counter* setting).	1	NV	0…65534 hours
33001	80E9	X		Hours till service is required (Burn hours or operation hours, depends on the *Service_Hour_Counter* setting).	1	V	0…*Service_Interval*
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)

3.8 Error log (34000)

The error log items can be read via the Managing boiler in blocks of 8 holding registers, from errror 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	X		Errors number 1 – 47 in blocks of 8 registers	1	NV	

3.9 Module register (40000)

Module holding registers can be accessed by address 40000 + (module number - 1) * 100 + offset.
For example the registers for module (dependent) 2 run from addresses 40100 until 40199.

Offset	Access		Description	Factor	V / NV	Range
	R	W				
System status information						
0	X		Status	1	V	See state table (3.2)
1	X		Error number	1	V	See error list in boiler manual
2	X		Module supply setpoint (calculated)	10	V	xx.x (°C/°F)
3	X		Power level	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	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 temp 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. First activate 'writing enable'.

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 seconds, therefore the next write command has to be sent within 4 sec.	01h 06h 00h 63h 00h 01h B8h 14h	Modbus-device → BCU

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	BCU → Modbus Device

Explanation: 01 is the address of the 900 PB (Boiler menu screen)
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)

Now write the CH setpoint.

WRITE CH-SETPOINT VALUE	COMMAND ON MODBUS	WRITE FROM … TO… *
Write in register 502 (CH Setpoint) the value 610. This number represents a value of 61 °C.	01h 06h 01h F6h 02h 62h E8h 8Dh	Modbus Device → BCU

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	BCU → 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 (Boiler screen)
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 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 (Boiler screen)
03 is the read command
18 is hexadecimal for 24, the number of 8-bit values that follow. These result in 12 16-bit 'words'

- 00 00 is hexadecimal for 0, register 500 (CH mode=0)
- 00 00 is hexadecimal for 0, register 501 (DHW mode=0)
- 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

-------END-------