Beghelli
PRÄZISA

Emergency Lighting

Documentation

MODBUS

Rev.5 23.01.2018

Index

1. Introduction

The Modbus protocol was developed in 1979. Simple and robust, it has since become a de facto standard communication protocol, and it is now a commonly available means of connecting industrial electronic devices.

Modbus is included in all Beghelli PRÄZISA GmbH central and low power supply systems and may be used without buying any other components.

Thereby all Stations can be connected to a building management system via Modbus for monitoring.

2. Connection

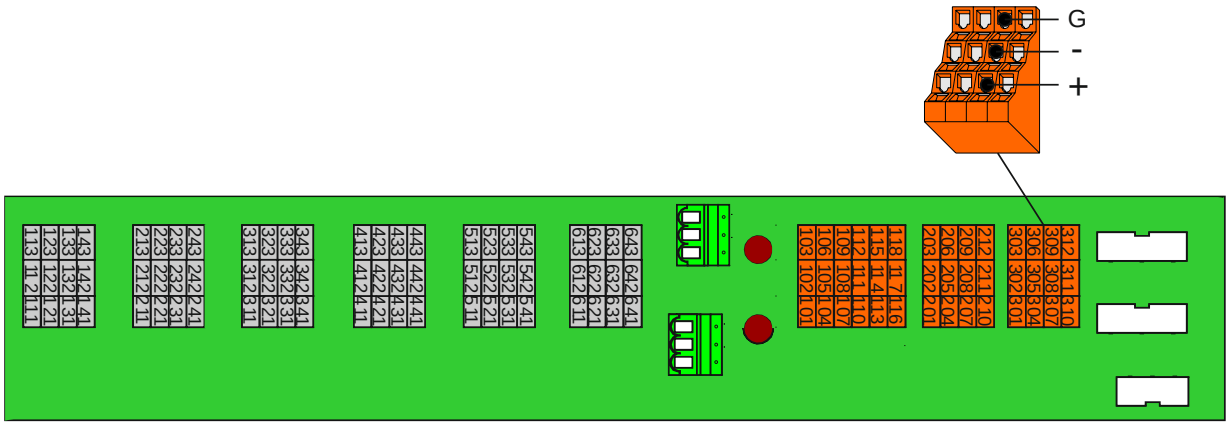
The Modbus-RTU protocol is used with a serial RS485 connection.
The serial settings are as follows:

- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: Even

The connection is always at the control frame X1 of the Main station.
Possible Sub stations are identified and monitored automatically via the Main station.

Indication on the control frame X1:

- 307 -> +
- 308 -> -
- 309 -> G



Pic. 1 – control frame X1

For Modbus the software version v80.15 (or higher) of the station is needed!

If Modbus is used, it is not possible to use other monitoring systems at the same time, e.g. Logica Visual, OPC-Server or LON-Bus.

2.1. Slave Address

The slave address is always the address of the Main station.
Main station 01 -> Slave address 1, Main station 02 -> Slave address 2 and so on.

If an address is already in use by another Modbus device, it is possible to change the address by changing the address of the Main station.

3. Data and Register

Only functionscode 3 (03H) „Read Holding Registers“ is used.

A total of 21846 (5556H) Register, from 1 (0001H) to 21846 (5556H), 2 Bytes each Register, are used.

Because of the internal structure of the Stations it is not possible to read all Registers at once.
The reading must be done at fixed addresses and with fixed length („Readings“).
Information can be found at the explanation of each Register.

To not disturb the system it must be added a break of 10 seconds in between each reading.

A response time of 5 seconds should be expected to avoid not receiving an answer on some Register.

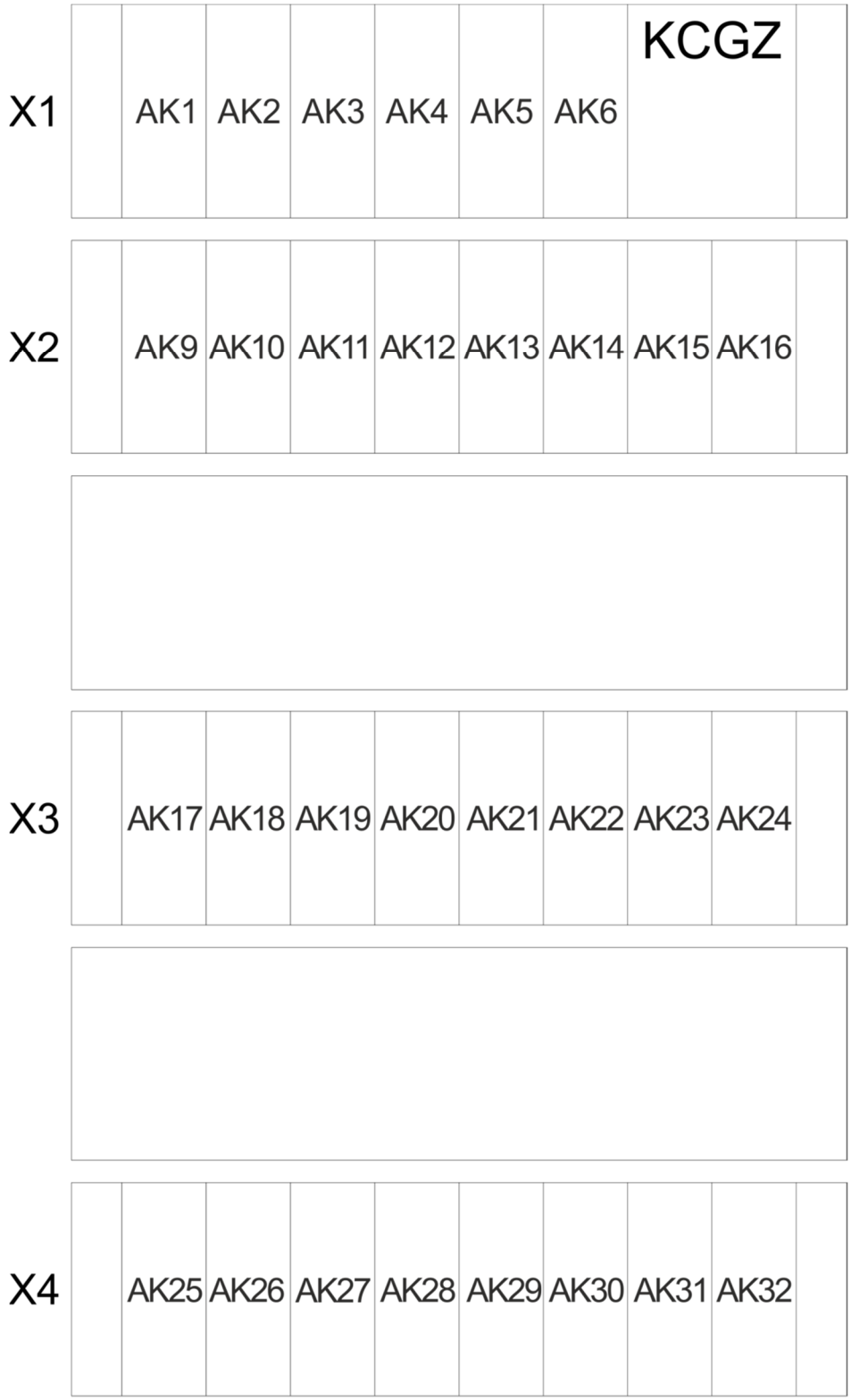
If the system is in a test mode (function or duration test) the Modbus function is deactivate except for 1 Register “Station in test mode”.

3.1. Overview of Register

Description	Register
Main station – Luminaire Status 512 Register	1 (0001H) 512 (0200H)
Sub station 01 – Luminaire Status 512 Register	513 (0201H) 1024 (0400H)
.	
Sub station 32 – Luminaire Status 512 Register	16358 (4001H) 16896 (4200H)
Main station – Circuit Status 128 Register	16897 (4201H) 17024 (4280H)
Sub station 01 – Circuit Status 128 Register	17025 (4281H) 17152 (4300H)
.	
Sub station 32 – Circuit Status 128 Register	20993 (5201H) 21120 (5280H)
Main station – Station Status 11 Register	21249 (5301H) 21259 (530BH)
Sub station 01 – Station Status 11 Register	21265 (5311H) 21275 (531BH)
.	
Sub station 32 – Station Status 11 Register	21761 (5501H) 21771 (550BH)
Main station – Battery data 2 Register	21777 (5511H) 21778 (5512H)
Main station – Battery monitoring 36 Register	21811 (5533H) 21846 (5556H)
Station in test mode 1 Register	24114 (5E32H)

3.2. Overview Output-Cards AKx

The Output-Cards „AK“ are numbered serially inside the Station. Bellow the overview of the configuration which is needed to use the Modbus.



Pic. 2 - Overview AK configuration

3.3. Main station – Luminaire Status

Register amount	Start	End	Data typ	Readings
512	1 (0001H)	512 (0200H)	Unsigned Int16	8x á 64 Register

$First\ Register\ addresse = 512 \times X + i \times 64 + 1\ ;\quad 0 \leq i \leq 7$
$Main\ station \rightarrow X = 0$
$i = 0 \rightarrow AK1, AK2, AK3, AK4;\ i = 1 \rightarrow AK5, AK6, AK7, AK8;$
$i = 2 \rightarrow AK9, AK10, AK11, AK12;\ i = 3 \rightarrow AK13, AK14, AK15, AK16;$
$i = 4 \rightarrow AK17, AK18, AK19, AK20;\ i = 5 \rightarrow AK21, AK22, AK23, AK24;$
$i = 6 \rightarrow AK25, AK26, AK27, AK28;\ i = 7 \rightarrow AK29, AK30, AK31, AK32$

Description:

On single monitoring luminaires (EÜ) the failure status of each luminaire from the Main station is shown.

Possible failure:
- Bus error
- Bulb failure

Bit value 0 = No failure
Bit value 1 = Failure

Register 1 (AK1 Circuit1 Luminaire 1-16) Bus error																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 2 (AK1 Circuit1 Luminaire 17-32) Bus error																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 3 (AK1 Circuit1 Luminaire 1-16) Bulb failure																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 4 (AK1 Circuit1 Luminaire 17-32) Bulb failure																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

.
.
.

Register 511 (AK32 Circuit4 Luminaire 1-16) Bulb failure																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 512 (AK32 Kreis4 Luminaire 17-32) Bulb failure																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

3.4. Sub station X – Luminaire Status

Sub station 1:

Register amount	Start	End	Data typ	Readings
512	513 (0001H)	1024 (0200H)	Unsigned Int16	8x á 64 Register

…

Sub station 1:

Register amount	Start	End	Data typ	Readings
512	16358 (4001H)	16896 (4200H)	Unsigned Int16	8x á 64 Register

$First\ Register\ address = 512 \times X + i \times 64 + 1\ ;\quad 0 \leq i \leq 7$
$Sub\ station\ X \rightarrow X = X$
$i = 0 \rightarrow AK1, AK2, AK3, AK4;\ i = 1 \rightarrow AK5, AK6, AK7, AK8;$
$i = 2 \rightarrow AK9, AK10, AK11, AK12;\ i = 3 \rightarrow AK13, AK14, AK15, AK16;$
$i = 4 \rightarrow AK17, AK18, AK19, AK20;\ i = 5 \rightarrow AK21, AK22, AK23, AK24;$
$i = 6 \rightarrow AK25, AK26, AK27, AK28;\ i = 7 \rightarrow AK29, AK30, AK31, AK32$

Descirption:

On single monitoring luminaires (EÜ) the failure status of each luminaire from the Sub station X is shown.

Possible failure:
- Bus error
- Bulb failure

Bit value 0 = No failure
Bit value 1 = Failure

Register 513 Sub station 1 (AK1 Circuit1 Luminaire 1-16) Bus error																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 514 Sub station 1 (AK1 Cricuit1 Luminaire 17-32) Bus error																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 515 Sub station 1 (AK1 Circuit1 Luminaire 1-16) Bulb failure																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 516 Sub station 1 (AK1 Circuit1 Luminaire 17-32) Bulb failure																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

.
.
.

Register 1023 Sub station 1 (AK32 Circuit4 Luminaire 1-16) Bulb failure																
Luminaire	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Register 1024 Sub station 1 (AK32 Circuit4 Luminaire 17-32) Bulb failure																
Luminaire	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29	L30	L31	L32
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

3.5. Main station – Circuit Status

Register amount	Start	End	Data typ	Readings
128	16897 (4201H)	17024 (4280H)	Unsigned Int16	8x á 16 Register

$First\ Register\ address = 16896 + 128 \times X + i \times 16 + 1\ ;\quad 0 \leq i \leq 7$
$Main\ station \rightarrow X = 0$
$i = 0 \rightarrow AK1, AK2, AK3, AK4;\ i = 1 \rightarrow AK5, AK6, AK7, AK8;$
$i = 2 \rightarrow AK9, AK10, AK11, AK12;\ i = 3 \rightarrow AK13, AK14, AK15, AK16;$
$i = 4 \rightarrow AK17, AK18, AK19, AK20;\ i = 5 \rightarrow AK21, AK22, AK23, AK24;$
$i = 6 \rightarrow AK25, AK26, AK27, AK28;\ i = 7 \rightarrow AK29, AK30, AK31, AK32$

Description:

Status overview of each single circuit and type of Card.

Register 16897 Main station (AK1 Circuit1) Status		Register 17024 Main station (AK32 Circuit4) Status	
Bit	Description	Bit	Description
0	AK-Bus error	0	AK-Bus error
1	Luminaire failure	1	Luminaire failure
2	Fuse failure	2	Fuse failure
3	Current to high	3	Current to high
4	Isolation failure	4	Isolation failure
5	-	5	-
6	Mains supply	6	Mains supply
7	Battery supply	7	Battery supply
Hex	Description	Hex	Description
8AH	Single monitoring EÜ	8AH	Single monitoring EÜ
8BH	Current monitoring SÜ	8BH	Current monitoring SÜ
8CH	High-pressure-lamp SÜ-HL	8CH	High-pressure-lamp SÜ-HL
8DH	Inverter SÜ-W	8DH	Inverter SÜ-W

3.6. Sub station X – Circuit Status

Sub station 1:

Register amount	Start	End	Data typ	Readings
128	17025 (4281H)	17152 (4300H)	Unsigned Int16	8x á 16 Register

…

Sub station 32:

Register amount	Start	End	Data typ	Readings
128	20993 (5201H)	21120 (5280H)	Unsigned Int16	8x á 16 Register

$First\ Register\ address = 16896 + 128 \times X + i \times 16 + 1\ ;\quad 0 \leq i \leq 7$
$Sub\ station\ X \rightarrow X = X$
$i = 0 \rightarrow AK1, AK2, AK3, AK4;\ i = 1 \rightarrow AK5, AK6, AK7, AK8;$
$i = 2 \rightarrow AK9, AK10, AK11, AK12;\ i = 3 \rightarrow AK13, AK14, AK15, AK16;$
$i = 4 \rightarrow AK17, AK18, AK19, AK20;\ i = 5 \rightarrow AK21, AK22, AK23, AK24;$
$i = 6 \rightarrow AK25, AK26, AK27, AK28;\ i = 7 \rightarrow AK29, AK30, AK31, AK32$

Description:

Status overview of each single circuit and type of Card.

Register 17025 Sub station 1 (AK1 Circuit1) Status	
Bit	Description
0	AK-Bus error
1	Luminaire failure
2	Fuse failure
3	Current to high
4	Isolation failure
5	-
6	Mains supply
7	Battery supply
Hex	Description
8AH	Single monitoring EÜ
8BH	Current monitoring SÜ
8CH	High-pressure-lamp SÜ-HL
8DH	Inverter SÜ-W

Register 21120 Sub station 32 (AK32 Circuit4) Status	
Bit	Description
0	AK-Bus error
1	Luminaire failure
2	Fuse failure
3	Current to high
4	Isolation failure
5	-
6	Mains supply
7	Battery supply
Hex	Description
8AH	Single monitoring EÜ
8BH	Current monitoring SÜ
8CH	High-pressure-lamp SÜ-HL
8DH	Inverter SÜ-W

3.7. Main station – Station Status

Register amount	Start	End	Data typ	Readings
11	21249 (5301H)	21259 (530BH)	Unsigned Int16	1x á 11 Register

$First\ Register\ address = 21248 + 16 \times X + 1$
$Mainstation \rightarrow X = 0$

Beschreibung:

Main station overview regarding failure.

Register 21250 Main station Station Status	
Cause of emergency mode	
Bit/Hex	Description
00H	No Emergency mode
01H	Mains failure
02H	Follow-up time after emergency mode
03H	Function test
04H	Duration test
05H	-
06H	-
07H	-
08H	-
09H	Allocation
0AH	Isolation test
Register 21251 Main station Station Status	
Collective failure	
0	Emergency mode failure, no emergency possible
1	Failure last F-/D-Test
2	Luminaire/Circuit-Failure
3	System blocked
4	Deep discharge
5	Battery failure
6	Charger failure
7	Mains failure
Emergency mode triggering	
00H	None
01H	Automatic (Mains failure)
02H	Manuel
03H	System
04H	Bus

Register 21252 Main station Station Status	
Failure charger	
0	-
1	-
2	-
3	-
4	-
5	-
6	-
7	Charger / chraging failure
Mains failure	
8	-
9	-
10	-
11	-
12	Mains failure sub-distribution, critical circuit
13	Mains failure Phase 3
14	Mains failure Phase 2
15	Mains failure Phase 1
Register 21253 Main station Station Status	
Failure control device	
0	-
1	-
2	-
3	-
4	-
5	-
6	Protocol memory full
7	Fan failure
Battery failure	
8	-
9	-
10	Fuse failure Symmetrie
11	Symmetry failure
12	Isolation failure Minuspol
13	Isolation failure Pluspol
14	-
15	Battery failure

3.8. Sub station X – Station Status

Sub station 1:

Register amount	Start	End	Data typ	Readings
11	21265 (5311H)	21275 (531BH)	Unsigned Int16	1x á 11 Register

Sub station 32:

Register amount	Start	End	Data typ	Readings
11	21761 (5501H)	21771 (550BH)	Unsigned Int16	1x á 11 Register

$First\ Register\ address = 21248 + 16 \times X + 1$
$Sub\ station\ X \rightarrow X = X$

Description:

Sub station overview regarding failure.

Register 21266 Sub station 1 Station Status	
Cause of emergency mode	
Bit/Hex	Description
00H	No Emergency mode
01H	Mains failure
02H	Follow-up time after emergency mode
03H	Function test
04H	Duration test
05H	-
06H	-
07H	-
08H	-
09H	Allocation
0AH	Isolation test
Register 21267 Sub station 1 Station Status	
Collective failure	
0	Emergency mode failure, no emergency possible
1	Failure last F-/D-Test
2	Luminaire/Circuit-Failure
3	System blocked
4	Deep discharge
5	Battery failure
6	Charger failure
7	Mains failure

Emergency mode triggering	
00H	None
01H	Automatic (Mains failure)
02H	Manuel
03H	System
04H	Bus
Register 21268 Sub station 1 Station Status	
Failure charger	
0	-
1	-
2	-
3	-
4	-
5	-
6	-
7	Charger / chraging failure
Mains failure	
8	-
9	-
10	-
11	-
12	Mains failure sub-distribution, critical circuit
13	Mains failure Phase 3
14	Mains failure Phase 2
15	Mains failure Phase 1
Register 21269 Sub station 1 Station Status	
Failure control device	
0	-
1	-
2	-
3	-
4	-
5	-
6	Protocol memory full
7	Fan failure
Battery failure	
8	-
9	-
10	Fuse failure Symmetrie
11	Symmetry failure
12	Isolation failure Minuspol
13	Isolation failure Pluspol
14	-
15	Battery failure

3.9. Main station – Battery data

Register amount	Start	End	Data typ	Readings
2	21777 (5511H)	21778 (5512H)	Unsigned / Signed Int16	1x á 2 Register

$$First\ Register\ address = 21776 + 2 \times X + 1$$
$$Main\ station \rightarrow X = 0$$

Description:

Overview of the Battery data (current and voltage) of the installed batteries at the Main station.

Register	Description	Data typ
21777	Voltage	Unsigned Int16
21778	Current	Signed Int16

Multiply the decimal value of the register with 0.1V / 0.1A to receive the actual value of the batteries.

3.10. Main station – Battery monitoring

Register amount	Start	End	Data typ	Readings
36	21811 (5533H)	21846 (5556H)	Unsigned Int16	1x á 36 Register

$$First\ Register\ address = 21810 + 2 \times X + 1$$
$$Main\ station \rightarrow X = 0$$

Description:

Status of each single battery block connected (if Battery Monitoring system is installed) at the Main station.

Each battery block has 2 registers.

Register 21811 Main station - Battery monitoring	
Block 1 - Status	
Bit	Description
0	Equalization – 1=active; 0=not active
1	End of charging – 1=reached; 0=not reached
2	Failure – over voltage
3	Failure – under voltage
4	Failure - wiring
5	-
6	Failure - communication
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-
Register 21812 Main station - Battery monitoring	
Block 1 - Voltage	
Bit	Description
0-7	Voltage 1
8-15	Voltage 2
Register 21845 Main station - Battery monitoring	
Block 18 - Status	
Bit	Description
0	Equalization – 1=active; 0=not active
1	End of charging – 1=reached; 0=not reached
2	Failure – over voltage
3	Failure – under voltage
4	Failure - wiring
5	-
6	Failure - communication
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-

Register 21846 Main station - Battery monitoring	
Block 18 - Voltage	
Bit	Description
0-7	Voltage 1
8-15	Voltage 2

Battery block voltage = Voltage 1.Voltage 2

3.11. Station in test mode

Register amount	Start	End	Data typ	Readings
1	24114 (5E32H)	24114 (5E32H)	Unsigned Int16	1x á 1 Register

Description:

During a function or duration test, the Modbus will be deactivated to avoid communication problems.

If the register is activated, Modbus is deactivated and it is not possible to read any other registers till the test is finished.