AEG

POWER
SOLUTIONS

MCC2 Gateway

– Profibus DP

Operating Instructions

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1. GENERAL

Profibus (**Pro**cess **Fi**eld **Bus**) is a fieldbus communication standard for automation technology. There are three different variants; Profibus DP (**d**ecentralised **p**eriphery) is the most commonly used and is implemented in this gateway. Profibus DP is used to control sensors and actuators through a central control unit.

The Profibus DP gateway is an interface for connecting power supply units from AEG Power Solutions GmbH to a central control system. The gateway is based on the Anybus CompactCom M40 module from HMS Networks.

The gateway cyclically polls instantaneous values from the power supply unit and translates the data into the Profibus model. The interface works as a server in the Profibus network and provides all connected clients with current status messages, alarms and relevant measurement values. The power supply unit can also be controlled via Profibus.

Package content:

1 x Profibus DP gateway

1 x connection cable

1 x fixing material

1 x operating instructions

1 x Profibus DP bus interface connector

1 x terminating resistor 120R

1 x shield terminal block

Prerequisites...

for personnel:

The “Design”, “Installation” and “Configuration” chapters assume technical qualifications as an electrician. These qualifications may take the form of a completed professional training course in an electrical profession or an additional qualification as an “Elektrofachkraft für festgelegte Tätigkeiten” (“Skilled person for defined electrical work”) offered by a Chamber of Industry and Commerce (CIC).

for the power supply system:

1 x power supply unit with compatible bus system

1 x GSD file “PSS208BF.GSD”
(can be downloaded from http://www.aegpss.de)

on site:

1 x RS485 data line for connecting to a Profibus DP bus structure

2. TECHNICAL DATA

Profibus DP:

Protocol:	PROFIBUS DP-V0 and DP-V1
Profibus DP identity no.:	0x08BF
Configuration data:	acc. to GSD file
Synchronisation:	yes
Freeze:	yes
Address setting via Profibus:	yes
Speed:	up to 12 Mbps (autobaud)
Address range:	0–126

Hardware data

Connector:	D-sub 9-pin female
Max. line length:	max. 1200 m
Bus stations:	max. 32

Data line: shielded 1:1 data line (2 x 0.22; twisted pair), e.g. Lapp "UNITRONIC-BUS LD"

Performance

- ADI access via DP-V1 read/write services
- Support for modular unit mode
- Data refresh time (gateway): 500ms

Certifications

The Profibus DP module is certified by Profibus Nutzerorganisation e.V.

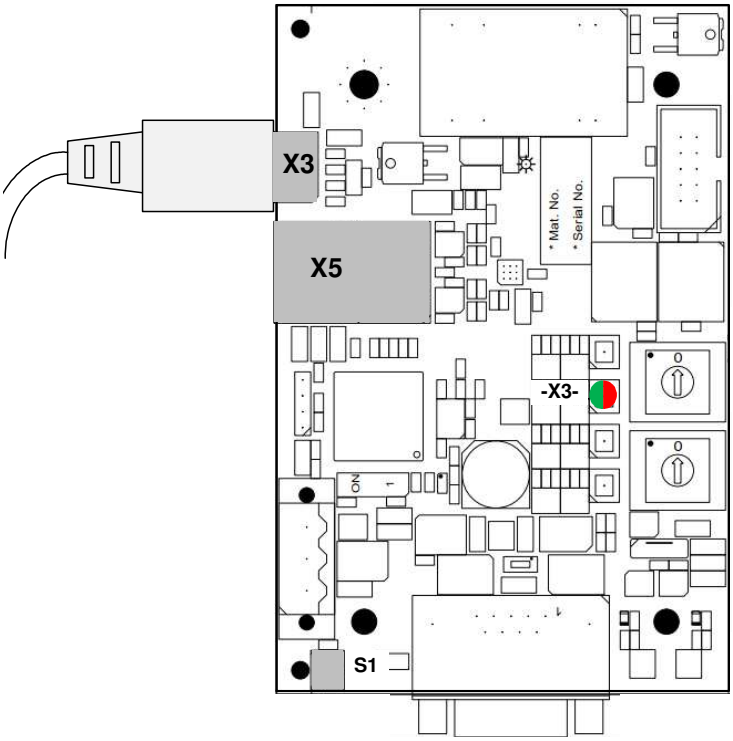
Factory setting

Address: 126

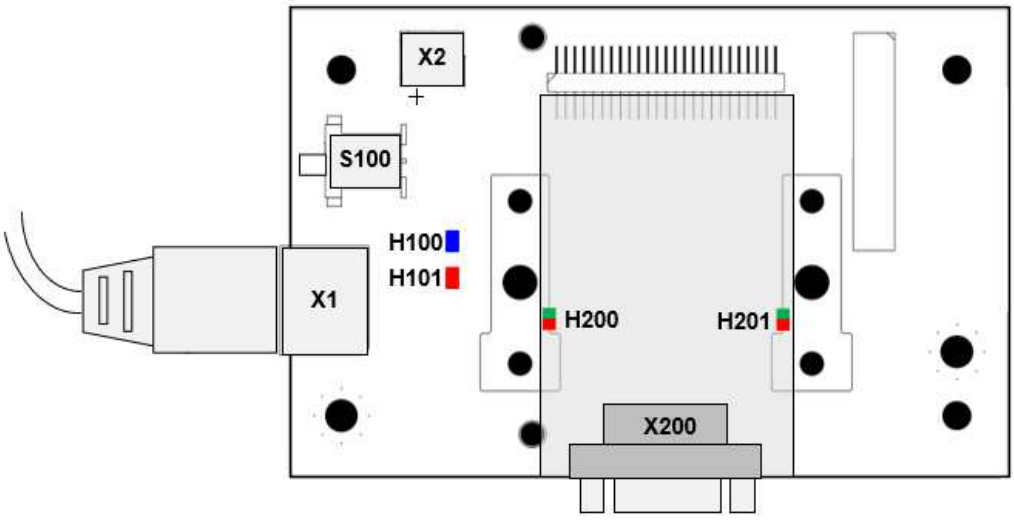
The Profibus gateway is an option for which position A27 is provided.

3. DESIGN

3.1 Structure of the Assemblies



MultiCom (top view)



Profibus DP gateway (top view)

MCC2 configuration button:

S1: Button for starting the configuration

MCC2 connections:

X3: Connection to the Profibus gateway

X5: Ethernet RJ45 port for configuration via web page

Gateway configuration switch:

S100: HDMI: Power supply via connector X1 (standard)
Ext.X2: Power supply via connector X2

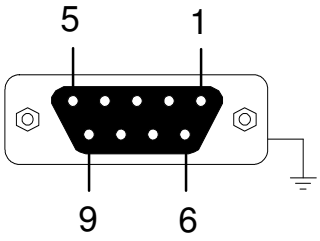
Gateway connections:

X1: Connection to MCC2,
internal communication and power supply

X2: Optional power supply (5–36 Vdc)

X200: D-sub 9-pin socket for Profibus DP

X200 pin assignment:



Pin	Signal	Meaning
3	B	Data High
4	RTS	Request to send
5	GND	Interface reference potential
6	+5V	Power supply output
8	A	Data Low
Housing		Device potential

LED signals:

-X3- Port Status

RED	GREEN	ORANGE (RED+GREEN)	Bedeutung
OFF	OFF	-	Gateway not connected to MCC2 or Gateway connected and Profibus inactive > 2min
OFF	blink	-	Gateway in Setup/Init. State (max. 1min)
OFF	ON	-	Gateway connected to MCC2 and Profibus inactive
OFF	flickering	-	Profibus active
-	-	flickering	Profibus active, profile data faulty, device not fully commissioned
ON	OFF	-	Gateway-Error

H100 Power LED

BLUE	Meaning
OFF	No power or module not plugged in correctly
ON	Power supply established

H101 Module Connection LED

RED	Meaning
OFF	Module connected
ON	Module Error

H200 Operation Mode

RED	GREEN	Meaning
OFF	OFF	No power no communication to MCC2 or Module in Setup/Init. State (LED -X3- on MCC2 is blinking)
OFF	flashing	Connection to MCC2 established, clear
OFF	ON	Connection to MCC2 established IO Controller in RUN State
1 flash	OFF	Parameterization error
2 flashes	OFF	Configuration error

H201 Status

RED	GREEN	Meaning
OFF	OFF	No power or Module in Setup/init. State (LED -X3- on MCC2 is blinking)
OFF	ON	Normal Operation
OFF	1 flash	Diagnostic event(s) present
ON	OFF	Exception error / Major internal error

3.2 Structure of the Wiring

HDMI cable:

The Profibus gateway requires an HDMI cable (A connector ⇔ mini C connector, 50 cm, included) to the MCC2.

RS485 bus line:

Connect the two RS485 wires of the data line to the bus interface connector. You must terminate the end of the bus by fitting the enclosed 120R resistor between connections A and B.
The data line is configured as follows:

9-pin D-sub socket (SCADA system)	9-pin D-sub male (Profibus gateway)	Terminal block (signal)
3	3	B
8	8	A

Shield connection of the RS485 bus line:

Shielding is a means of weakening (attenuating) magnetic, electrical or electromagnetic interference fields.
Interference currents on line shields are dissipated to earth by means of the shield busbar that has a conductive connection to the housing. A low-impedance connection to the PE conductor is especially important to prevent these interference currents from becoming a source of interference themselves.

If possible, only use lines with a braided shield. The shield coverage should be at least 80%. Avoid using lines with a foil shield because tensile and compressive stresses applied when fastening the line can easily damage the foil, resulting in a reduction in the shielding effect.

Please bear the following points in mind when handling the shield:

- Use cable clips or shield terminals made of metal to secure the braided shields. The clips must surround the shield and make good contact with it over a large area.
- Attach the shield to a shield busbar right after the line enters the cabinet. Run the shield right up to the assembly; however, ensure that it does not make contact there!

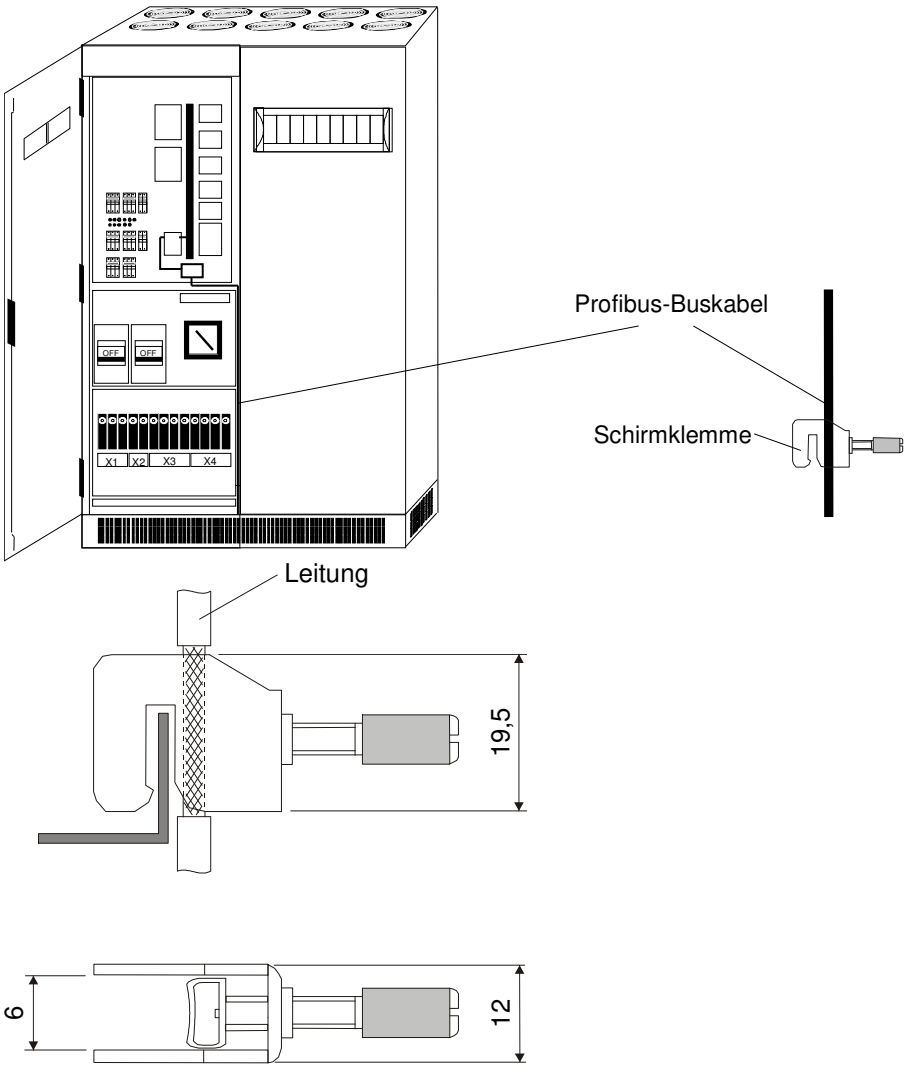
You can achieve **effective interference suppression** in the high-frequency range by **connecting the shield at both ends**. You should **therefore always** connect the shield **at both ends**.
If there is a potential difference between the earthing points, an equalising current can flow along the shield that is connected at both ends. In this case, you should route an additional potential equalising line.

By connecting the shield at one end, you can **only attenuate the low frequencies**. You should **therefore only** connect the shield at one end **in exceptional circumstances, namely if**:

- potential differences exist and you cannot route a potential equalising line
- foil shields (static shields) are used

On the gateway side, you must connect the **line screen to** the **housing potential of the unit** via the enclosed screen terminal block. Openings are provided in the plate of the unit for installation in the connection room area. Remove approximately 20 mm of the sheath at this point and fasten the line with the shield terminal block.
Ensure good contact between the terminal, the line shield and the unit housing!

CAUTION:
You must **route the shield up to the assembly**. **It <u>must not</u> be <u>connected to the bus interface connector</u>**.



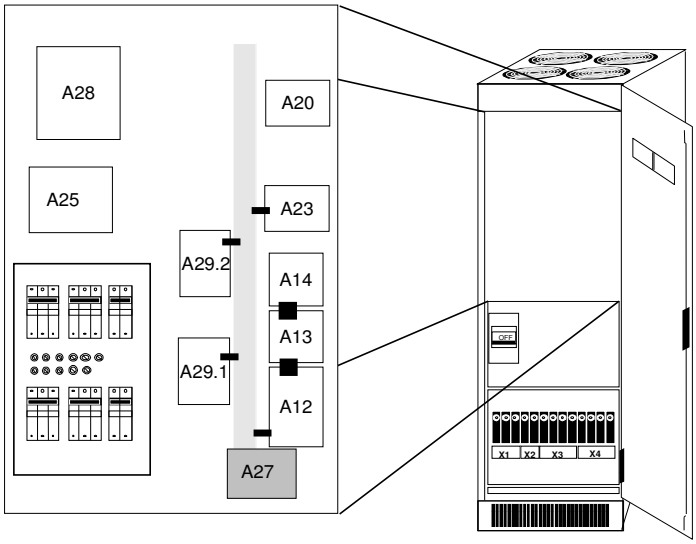
Shield connection

Profibus-Buskabel	Profibus bus cable
Schirmklemme	Screen terminal block
Leitung	Line

4. INSTALLATION

The Profibus gateway can be installed when the unit is switched on. **Position A27** is reserved for the interface. This position is located on the pivot plate, directly behind the cabinet door.

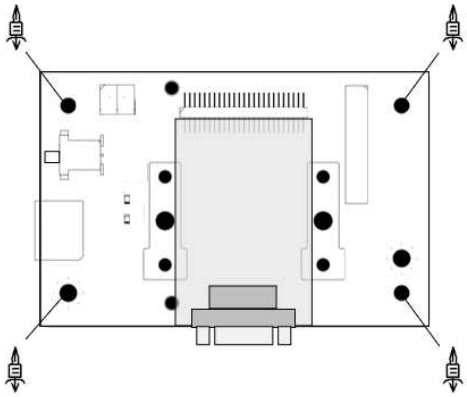
The figure shows a typical cabinet design. Please refer to the operating instructions for your device for the exact positions.



System / pivot plate arrangement of a UPS (example)

A29.1: MultiCom interface

A27: Profibus gateway



Attachment of PCB (top view)

- Insert the 4 plastic printed circuit board holders into the holes at position A27.
- Attach assembly A27 to the printed circuit board holders. When doing this, make sure connector X2 is pointing towards the cable duct.
- Connect the assembly to the MultiCom interface (A29.1) (gateway -X1 ⇔ MCC X3) using the HDMI cable.
- Fasten the connection cable using cable tie holders.
- The installation is now complete.

5. CONFIGURATION

5.1 Connection Structure

The Profibus gateway is configured via the MultiCom interface. Connect your PC directly to the MultiCom interface using a patch cable.

To be able to use the data connection, you must prepare your PC. There are 2 ways to do this, which require administrator rights:

1. PC with fixed IP Address in the same segment

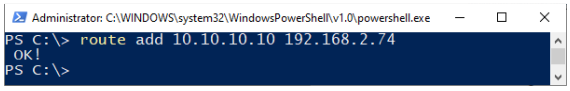
- Assign your PC a fixed IP address in the class B segment 10.10.xxx.xxx, e.g. 10.10.10.50.

2. Route any PC address to the MCC2 address

- Open Windows PowerShell with administrator rights
- Enter the following command:

route add 10.10.10.10 <PC IP address>

e.g.:

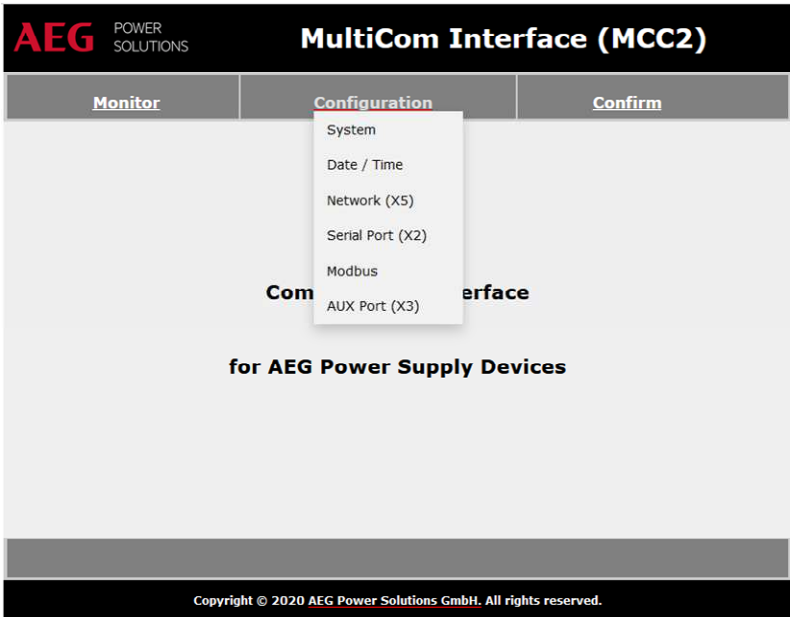


Press the S1 button, the MultiCom interface switches to configuration mode with the standard IP: 10.10.10.10.
In this state, LEDs X2-5 flash orange.

Now access the configuration pages via a standard browser by using the login details below.

Default login: http://10.10.10.10
Username: **admin**
Password: **1201**

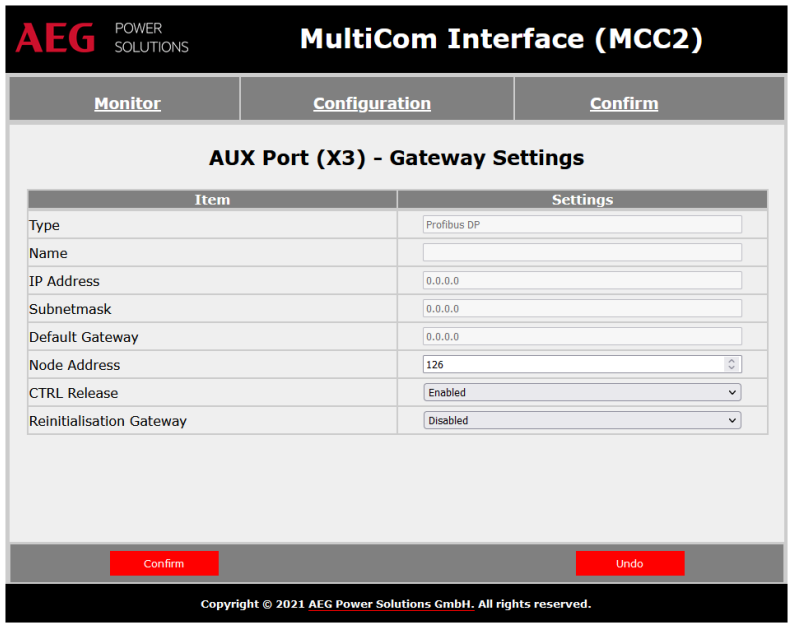
After logging in, it is possible to adjust the Profibus data via **Configuration – AUX Port (X3)**.



Configuration mode is exited automatically after 10 minutes of inactivity.

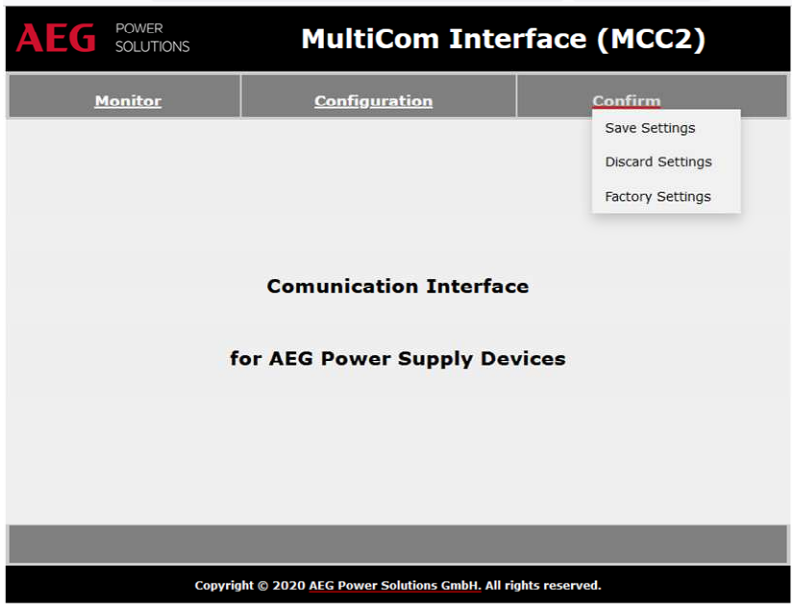
5.2 Profibus Configuration

Enter the Profibus address under **Configuration – AUX Port (X3)**. An address from 0–126 can be set here. If the address 126 is set, the address can subsequently be changed in the Profibus network. This function is locked for all other addresses. The address 126 is set by default (change enabled via Profibus).
The gateway is reinitialised with the set address when "Reinitialisation Gateway" is selected. This reinitialisation occurs once after exiting the configuration.
Under **Control Release**, you can block all control commands to the power supply unit via the Profibus gateway (default: Enabled).
Confirm the entries using **Confirm** (this applies the data but does not save it!).

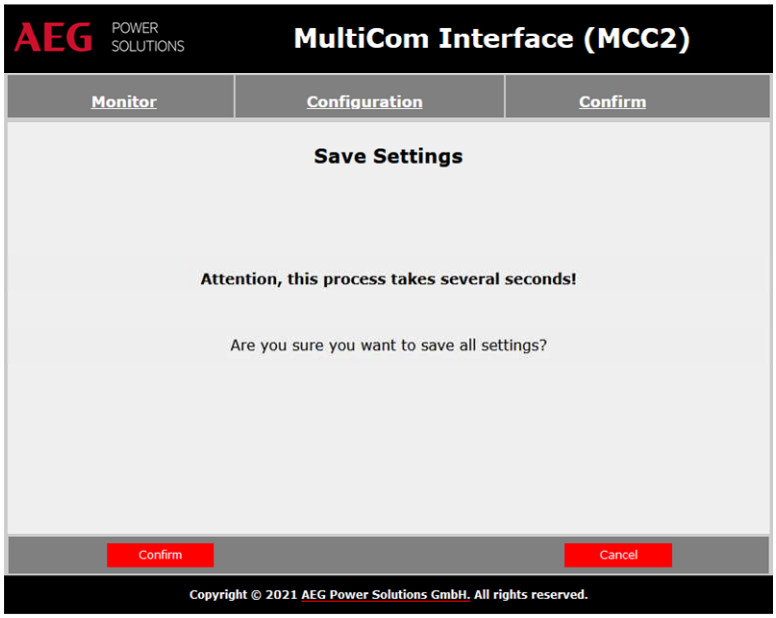


Profibus configuration page with default values

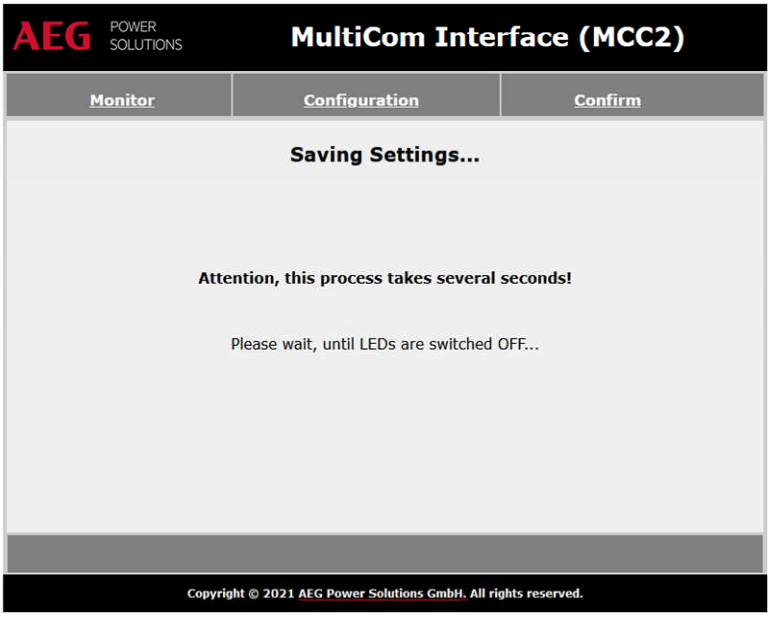
Save your configuration under **Confirm – Save Settings.**



Confirm using **Confirm**.

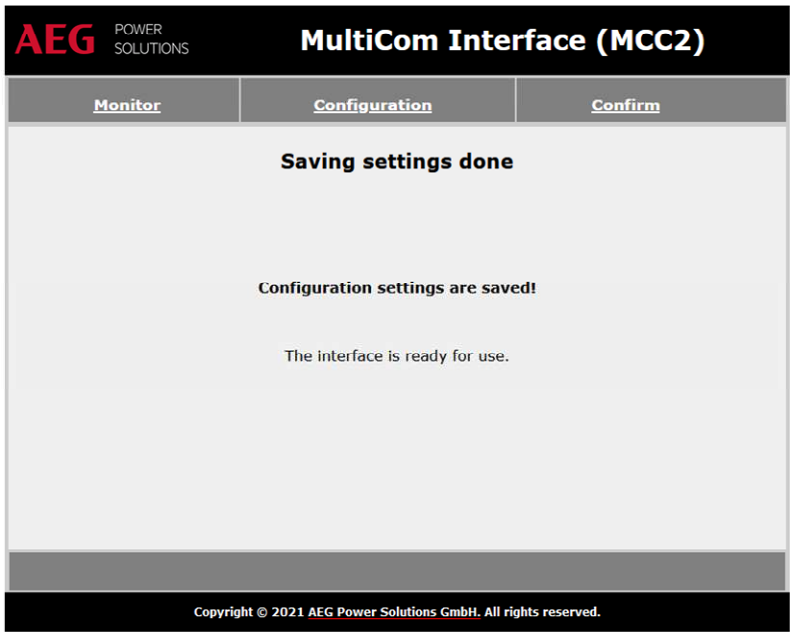


The **saving process** starts and **LEDs** X2–5 are constantly **orange**.



The saving process takes several seconds. During the saving process, the **power supply must not be interrupted** as this can destroy the data. In such an event, the data structure must be created again with default values via Confirm – Factory Settings and your configuration must be re-entered!

Once successfully saved, LEDs X2-5 are briefly green and the MultiCom interface is back in normal mode.



The **Profibus setting** (address) will only be effective if “Reinitialisation Gateway” has been enabled. Otherwise, the gateway is not restarted after exiting the configuration. A **CTRL release change** will be applied without a reset.

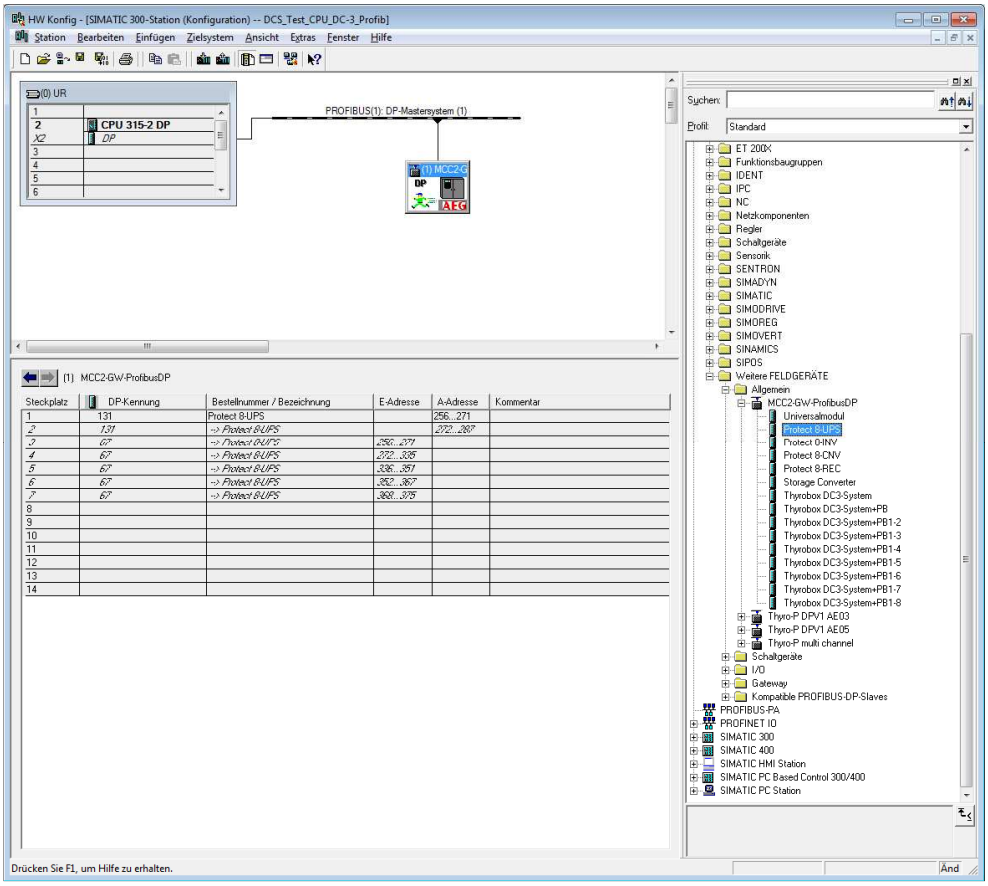
6. PROFIBUS DP COMMUNICATION

6.1 Profibus Gateway with Siemens Step 7

To configure the Profibus gateway, a GSD file that describes the connected unit via Profibus DP is required. To do this, you must load the GSD file in your project planning tool and select a module (according to your unit type). If you have a Thyrobox system, you can select the combined system data (Thyrobox DC3 system) or system data + data for the individual power blocks. To do this, you must select the module with the corresponding number of power blocks (Thyrobox DC3 system + PBx).
You can **download** the **GSD file from** the AEG Power Solutions GmbH **website**.

Website: **http://www.aegps.com**

Example of a Protect 8 UPS system with the available slots:



In this example, the output slot 1+2 of the Protect 8-UPS unit profile is located on slot 1 and 2. The input slots 1–5 are located on slot 3–7. See Protect 8-UPS unit profile for slot description.

7. UNIT PROFILES

7.1 General

Each Profibus DP-compliant client can exchange data with the Profibus gateway. After parameterisation, the client must send a configuration message to the gateway. The configuration message provides the server with information about the length of the output data as well as the baud rate parameters. The user assembles the configuration message in the project planning tool. To do this, you must load the GSD file in your project planning tool and select a module (according to your unit type).
You can **download** the **GSD file from** the AEG Power Solutions GmbH **website**.

Website: **http://www.aegps.com**

Modules for 3 unit series are defined in the GSD file:

- Protect 8 series
  - Protect 8-UPS
  - Protect 8-Inverter
  - Protect 8-Converter
  - Protect 8-Rectifier
- Storage converter
- Thyrobox DC

The following **data types** are used in the unit profile:

CHAR is a string comprising individual 8-bit characters in the displayable value range from 0x20 to 0x7A. If the string does not use the full range of bytes, it is zero-terminated.

BYTE is an 8-bit unsigned CHAR number in the value range from 0 to 255 (0xFF). The value to be displayed is a number between 0 and 255.

WORD is a 16-bit unsigned integer in the value range from 0 to 65535 (0xFFFF). The value to be displayed is a number between 0 and 65535.
The value is sent in the order MSB/LSB.

WORD10 is a 16-bit unsigned integer in the value range from 0 to 65535. The value to be displayed is a number between 0.0 and 6553.5. The number transmitted must be divided by 10 to obtain this value.
The value is sent in the order MSB/LSB.

WORD100 is a 16-bit unsigned integer in the value range from 0 to 65535. The value to be displayed is a number between 0.00 and 655.35. The number transmitted must be divided by 100 to obtain this value. The value is sent in the order MSB/LSB.

DoubleWORD is a 32-bit unsigned integer in the value range from 0 to 4294967265 (0xFFFFFFFF). The value to be displayed is a number between 0 and 4294967265. The value is sent in the order MSB/LSB.

INT10 is a 16-bit signed integer in the value range from -32768 to +32767 (0x8000-0x7FFF). The value to be displayed is a number between -3276.8 and +3276.7. The number transmitted must be divided by 10 to obtain this value. The value is sent in the order MSB/LSB.

INT100 is a 16-bit signed integer in the value range from -32768 to +32767 (0x8000-0x7FFF). The value to be displayed is a number between -327.68 and +327.67. The number transmitted must be divided by 100 to obtain this value. The value is sent in the order MSB/LSB.

INT1000 is a 16-bit signed integer in the value range from -32768 to +32767 (0x8000-0x7FFF). The value to be displayed is a number between -32768 and +32767. The number transmitted must be divided by 1000 to obtain this value. The value is sent in the order MSB/LSB.

The following **abbreviations** are used: **"O":** Optional

Statuses/alarms are 1=active, 0=inactive

Depending on the unit configuration, not all statuses, messages and measurement values are available in the unit.
Statuses/messages that are not available are read out as "0", while measurement values that are not available are recognised by the value 0x7fff. Control commands that are not released are also read out as 0x7fff.

All Profibus registers set to "-" are read out as "0".

Control commands can generally be disabled via the configuration. If they are disabled, the value 0x7fff (not possible) will be read out. Enabled is the default.

Control commands are only sent to the unit control if their value has changed. Therefore, it is advisable to write "0=idle" to some control registers if no changes have been made.

If control commands are sent cyclically, a minimum cycle time of 100ms must be observed in order not to overload the system.

Updating of all device values can take up to 1.8s depending on the device type and system structure.

7.2 Protect 8 Series Unit Profiles

The Protect 8 series consists of different power supply unit types. Each power supply unit can be operated in single operation or as a parallel system with up to 8 units. The profile contains registers with status and measurement values and control elements for one unit. In parallel systems, you need one Profibus gateway in each unit.

7.2.1 Protect 8-UPS Unit Profile

Status – Input Module: Slot 1

No	Byte	Bit	Type	Name	Definition		Description
1	0	15-0	WORD	UPSStatus	1 = NormalOperation		Inverter supplies the load
					2 = MainsOperation		SBS supplies the load
					3 = BatteryOperation		Inverter supplies the load from battery
					4 = EcoMode	“O”	SBS supplies the load, inverter is running in standby
					6 = Shutdown is pending		Inverter will be shutdown via NMS
					7 = OFF		Inverter and SBS is OFF the load is shut down
2	2	15-0	WORD	RectifierMode	0 = OFF		Rectifier is OFF
					1 = EqualisingCharge		Rectifier is running in equalising charge
					2 = Charge		Rectifier is running in charge
					3 = TrickleCharge		Rectifier is running in trickle charge
					4 = GenSetOperation	“O”	Rectifier is running at generator operation
					6 = Discharge		Rectifier is OFF, the battery is discharging
					7 = Battery Test		Rectifier is running with battery test
					16=no Battery		Rectifier isi running, no battery detected
3	4	0	WORD	Informations	UserdefInput1	“O”	<User defined>
		1			UserdefInput2	“O”	<User defined>
		2			UserdefInput3	“O”	<User defined>
		3			SBSReady		SBS is ready to take on the load
		4			RectifierON		Rectifier is running
		5			InverterOn		Inverter is running, inverter supplies the load
		6			SBSON		SBS is on, SBS supplies the load
		7			LifeCheck		Toggling every minute
4	6	0	WORD	Warnings	NonCriticalFault (Collecive Warn.)		Is set if any warning is set
		1			DouCanFault		Internal CAN fault
		2			MainsFault		Rectifier or SBS mains fault
		3			RectifierWarning		Warning in rectifier control unit
		4			InverterWarning		Warning in inverter control unit
		5			SBSWarning		Warning in SBS control unit
		6			BattTempSensorFault	“O”	Battery Temperature Sensor Fault
		7			BatteryTempHigh	“O”	Battery Temperature too high
		8			CircuitBreaker	“O”	Circuit Breaker tripped
		9			BatteryWarning		Battery Warning
		10			BatteryLow		Battery voltage is low
		11			Overload		Inverter is overloaded but still running
		12			FanFault		Fan is faulty
		13			SBSMainsFault		SBS mains fault
		14			SBSBlocked		SBS is blocked and cannot take the load
5	8	0	WORD	Alarms	CriticalFault (Collective fault)		Is set if any fault is set
		1			EmergencySwitchOff	“O”	The load is switched OFF
		2			RectifierFault		The rectifier is switched off by fault.
		3			BatteryFault		The load cannot be supplied from battery
		4			InverterFault		The inverter is switched off by fault
		5			SBSFault		The SBS is switched off by fault
		6			Overload		The inverter is switched off by overload
		7			ShortCircuit		The inverter is switched off by short circuit
		8			DcUnderVoltage		The inverter is switched off by DC undervoltage
		9			DcOverVoltage		The inverter is switched off by DC overvoltage
		10			powStackOverTemp		The inverter is switched off by PowStack Temp.

- **Protect 8-UPS unit profile**

Measurements – Input Module: Slot 2

No	Byte	Bit	Type	Name		Value range
1	0	15-0	WORD10	RectifierMainsFrequency		xx.x Hz
2	2	15-0	WORD	RectifierMainsVoltageL1		xxx V
3	4	15-0	WORD	RectifierMainsVoltageL2		xxx V
4	6	15-0	WORD	RectifierMainsVoltageL3		xxx V
5	8	15-0	WORD10	SBSMainsFrequency		xx.x Hz
6	10	15-0	WORD	SBSMainsVoltageL1		xxx V
7	12	15-0	WORD	SBSMainsVoltageL2	*1	xxx V
8	14	15-0	WORD	SBSMainsVoltageL3	*1	xxx V
9	16	15-0	WORD	BatteryVoltage		xxx V
10	18	15-0	INT10	BatteryCurrent		+- xxx.x A
11	20	15-0	WORD10	AutonomyTime		xxx.x min
12	22	15-0	WORD	BatteryCapacity		xxx %
13	24	15-0	INT10	BatteryTemperature	“O”	+- xx.x°C
14	26	15-0	WORD10	OutputFrequency		xx.x Hz
15	28	15-0	WORD	OutputVoltageL1		xxx V
16	30	15-0	WORD	OutputLoadL1		xxx %
17	32	15-0	WORD	OutputCurrentL1		xxxx A
18	34	15-0	WORD10	OutputPowerL1		xxx.x kW
19	36	15-0	WORD	OutputVoltageL2	*1	xxx V
20	38	15-0	WORD	OutputLoadL2	*1	xxx %
21	40	15-0	WORD	OutputCurrentL2	*1	xxxx A
22	42	15-0	WORD10	OutputPowerL2	*1	xxx.x kW
23	44	15-0	WORD	OutputVoltageL3	*1	xxx V
24	46	15-0	WORD	OutputLoadL3	*1	xxx %
25	48	15-0	WORD	OutputCurrentL3	*1	xxxx A
26	50	15-0	WORD10	OutputPowerL3	*1	xxx.x kW

***1: in 1 phase systems = 0**

Auxiliary Messages – Input Module: Slot 5

No	Byte	Bit	Type	Name		Description
1	0	0 1 2 3 4 5 6	WORD	Userdef_AUX1-Rectifier Userdef_AUX2-Rectifier Userdef_AUX3-Rectifier Userdef_AUX4-Rectifier Userdef_AUX5-Rectifier Userdef_AUX6-Rectifier Userdef_AUX7-Rectifier	“O”	
2	2	0 1 2 3 4 5 6	WORD	Userdef_AUX1-Inverter Userdef_AUX2-Inverter Userdef_AUX3-Inverter Userdef_AUX4-Inverter Userdef_AUX5-Inverter Userdef_AUX6-Inverter Userdef_AUX7-Inverter	“O”	
3	4	0 1 2 3 4 5 6	WORD	Userdef_AUX1-SBS Userdef_AUX2-SBS Userdef_AUX3-SBS Userdef_AUX4-SBS Userdef_AUX5-SBS Userdef_AUX6-SBS Userdef_AUX7-SBS	“O”	

- **Protect 8-UPS unit profile**

System Real Time Values

– Input Module: Slot 3
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RealTime	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

System Controls

– Input Module: Slot 4
– Output Module: Slot 2

No	Byte Slot4	Byte Slot2	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RectifierControl	0 = Idle 1 = ON 2 = OFF 9 = Fault ack. 10= Equalising charge 11= Charge 12 =Trickle charge	No command sent or command not accepted Set Rectifier ON Set Rectifier OFF Acknowledgment of all rectifier faults Set Rectifier to Equalising charge Set Rectifier to charge Set Rectifier to trickle charge
2	2	2	15-0	WORD	InverterControl	0 = Idle 1 = ON 2 = OFF 3 = EcoMode “O” 9 = Fault ack.	No command sent or command not accepted Set Inverter ON Set Inverter OFF Set Inverter in Eco Mode Acknowledgment of all inverter faults
3	4	4	15-0	WORD	SBSControl	0 = Idle 9 = Fault ack.	No command or illegal command Acknowledgment of all SBS faults
4	6	6	7-0 15-8	WORD	BatteryQuick Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
5	8	8	7-0 15-8	WORD	BatteryCapacity Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
6	10	-	15-0	WORD10	BatteryCapTest RemainingTime	xxxx.x min	

- **Protect 8-UPS unit profile**

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write “0=Idle” in the control registers that have defined “Idle” if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).

In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:

Rectifier off	=> inverter must be off
Inverter off	=> switching to bypass must be guaranteed
Battery test	=> the entire system must be in a normal state

Battery tests:

In low byte, the battery test registers contain the control commands and in high byte, the associated statuses of the battery tests. Depending on the unit configuration, different battery tests can be initiated:

The **Battery Quick Test** consists of briefly testing the battery charging circuit. This test is also performed cyclically by the unit.

The **Battery Capacity Test** consists of testing the battery capacity. For this purpose, the battery is discharged with the connected load or by a constant current and the battery status is evaluated.
The remaining time of the capacity test can be read in the **Remaining Time** register.

Control battery test (LB):

0x00:	The test has never been started via Profibus.
0x01/2:	The test has been started/cancelled (the control command remains in place until the next command).

Battery test status (HB):

0x00:	The test is not implemented in the unit.
0x01:	The test is implemented, but is presently not approved, or the start conditions to execute the test are lacking.
0x02:	The test is approved and can be started.
0x03-7:	The test result remains in place for a short time until another test is approved.

Example of battery cap. test 1004/1005:

0x0000 0000 Test not implemented, no cap. test approved
0x0100 1000 Test is implemented, not approved, waiting for approval, max. runtime 100.0min
0x0200 1000 Test is approved, max. runtime 100.0min
0x0301 805 Test running; max. remaining runtime 80.5min
0x0401 0000 Test successful, new test not possible
0x0201 1000 Test is re-approved (after approx. 30s)

For further information on the battery tests, see the unit operating instructions.

7.2.2 Protect 8-Inverter Unit Profile

Status **– Input Module: Slot 1**

No	Byte	Bit	Type	Name	Definition		Description
1	0	15-0	WORD	InverterStatus	1 = NormalOperation 2 = MainsOperation 4 = EcoMode 7 = OFF	 “O” 	Inverter supplies the load SBS supplies the load SBS supplies the load, inverter is running in standby Inverter and SBS is OFF the load is shut down
2	2		WORD	-			
3	4	0 1 2 3 4 5 6 7	WORD	Informations	UserdefInput1 UserdefInput2 UserdefInput3 SBSReady - InverterOn SBSON LifeCheck	“O” “O” “O” 	<User defined> <User defined> <User defined> SBS is ready to take on the load Inverter is running, inverter supplies the load SBS is on, SBS supplies the load Toggling every minute
4	6	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14	WORD	Warnings	NonCriticalFault (Collecive Warn.) DouCanFault - - InverterWarning SBSWarning - - - - DC VoltageLow Overload FanFault SBSMainsFault SBSBlocked		Is set if any warning is set Internal CAN fault Warning in inverter control unit Warning in SBS control unit DC Voltage is low Inverter is overloaded but still running Fan is faulty SBS mains fault SBS is blocked and cannot take the load
5	8	0 1 2 3 4 5 6 7 8 9 10	WORD	Alarms	CriticalFault (Collective fault) EmergencySwitchOff - - InverterFault SBSFault Overload ShortCircuit DcUnderVoltage DcOverVoltage PowStackOverTemp	 “O” 	Is set if any fault is set The load is switched OFF The inverter is switched off by fault The SBS is switched off by fault The inverter is switched off by overload The inverter is switched off by short circuit The inverter is switched off by DC undervoltage The inverter is switched off by DC overvoltage The inverter is switched off by PowStack Temp.

- **Protect 8-Inverter unit profile**

Measurements – Input Module: Slot 2

No	Byte	Bit	Type	Name		Value range
1-4	0-6	15-0	WORD	-		
5	8	15-0	WORD10	SBSMainsFrequency		xx.x Hz
6	10	15-0	WORD	SBSMainsVoltageL1		xxx V
7	12	15-0	WORD	SBSMainsVoltageL2	*1	xxx V
8	14	15-0	WORD	SBSMainsVoltageL3	*1	xxx V
9	16	15-0	WORD	DCVoltage		xxx V
10-13	18-24	15-0	WORD	-		
14	26	15-0	WORD10	OutputFrequency		xx.x Hz
15	28	15-0	WORD	OutputVoltageL1		xxx V
16	30	15-0	WORD	OutputLoadL1		xxx %
17	32	15-0	WORD	OutputCurrentL1		xxxx A
18	34	15-0	WORD10	OutputPowerL1		xxx.x kW
19	36	15-0	WORD	OutputVoltageL2	*1	xxx V
20	38	15-0	WORD	OutputLoadL2	*1	xxx %
21	40	15-0	WORD	OutputCurrentL2	*1	xxxx A
22	42	15-0	WORD10	OutputPowerL2	*1	xxx.x kW
23	44	15-0	WORD	OutputVoltageL3	*1	xxx V
24	46	15-0	WORD	OutputLoadL3	*1	xxx %
25	48	15-0	WORD	OutputCurrentL3	*1	xxxx A
26	50	15-0	WORD10	OutputPowerL3	*1	xxx.x kW

***1: in 1 phase systems = 0**

Auxiliary Messages – Input Module: Slot 5

No	Byte	Bit	Type	Name		Description
1	0	0 1 2 3 4 5 6	WORD	Userdef_AUX1-Inverter Userdef_AUX2-Inverter Userdef_AUX3-Inverter Userdef_AUX4-Inverter Userdef_AUX5-Inverter Userdef_AUX6-Inverter Userdef_AUX7-Inverter	"O"	
2	2	0 1 2 3 4 5 6	WORD	Userdef_AUX1-SBS Userdef_AUX2-SBS Userdef_AUX3-SBS Userdef_AUX4-SBS Userdef_AUX5-SBS Userdef_AUX6-SBS Userdef_AUX7-SBS	"O"	

- **Protect 8-Inverter unit profile**

System Real Time Values **– Input Module: Slot 3**
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	Real Time	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

System Controls **– Input Module: Slot 4**
– Output Module: Slot 2

No	Byte read	Byte write	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	InverterControl	0 = Idle 1 = ON 2 = OFF 3 = EcoMode “O” 9 = Fault ack.	No command sent or command not accepted Set Inverter ON Set Inverter OFF Set Inverter in Eco Mode Acknowledgment of all inverter faults
2	2	2	15-0	WORD	SBSControl	0 = Idle 9 = Fault ack.	No command sent or command not accepted Acknowledgment of all SBS faults

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write “0=Idle” in the control registers that have defined “Idle” if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).

In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:
Inverter off => switching to bypass must be guaranteed

7.2.3 Protect 8-Converter Unit Profile

Status **– Input Module: Slot 1**

No	Byte	Bit	Type	Name	Definition		Description
1	0	15-0	WORD	Converter Status	1 = Normal Operation 3 = Battery Operation 6 = Shutdown is pending 7 = OFF		Inverter supplies the load Inverter supplies the load from battery Inverter will be shutdown via NMS Inverter and SBS is OFF the load is shut down
2	2	15-0	WORD	RectifierMode	0 = OFF 1 = Equalising Charge 2 = Charge 3 = TrickleCharge 4 = GenSetOperation 6 = Discharge 7 = Battery Test 16=no Battery	 “O” 	Rectifier is OFF Rectifier is running in equalising charge Rectifier is running in charge Rectifier is running in trickle charge Rectifier is running at generator operation Rectifier is OFF, the battery is discharging Rectifier is running with battery test Rectifier is running, no battery detected
3	4	0 1 2 3 4 5 6 7	WORD	Informations	UserdefInput1 UserdefInput2 UserdefInput3 - RectifierON InverterOn - LifeCheck	“O” “O” “O” 	<User defined> <User defined> <User defined> Rectifier is running Inverter is running, inverter supplies the load Toggling every minute
4	6	0 1 2 3 4 5 6 7 8 9 10 11 12	WORD	Warnings	NonCriticalFault (Collecive Warn.) DouCanFault RectifierMainsFault RectifierWarning InverterWarning - BattTempSensorFault BatteryTempHigh CircuitBreaker BatteryWarning BatteryLow Overload FanFault	 “O” “O” “O” 	Is set, if any warning is set Internal CAN fault Rectifier mains fault Warning in rectifier control unit Warning in inverter control unit Battery Temperature Sensor Fault Battery Temperature too high Circuit Breaker tripped Battery Warning Battery voltage is low Inverter is overloaded but still running Fan is faulty
5	8	0 1 2 3 4 5 6 7 8 9 10	WORD	Alarms	CriticalFault (Collective fault) EmergencySwitchOff RectifierFault BatteryFault InverterFault - Overload ShortCircuit DcUnderVoltage DcOverVoltage PowStackOverTemp	 “O” 	Is set, if any fault is set The load is switched OFF The rectifier is switched off by fault. The load cannot be supplied from battery The inverter is switched off by fault The inverter is switched off by overload The inverter is switched off by short circuit The inverter is switched off by DC undervoltage The inverter is switched off by DC overvoltage The inverter is switched off by PowStack Temp.

- **Protect 8-Converter unit profile**

Measurements – Input Module: Slot 2

No	Byte	Bit	Type	Name		Value range
1	0	15-0	WORD10	RectifierMainsFrequency		xx.x Hz
2	2	15-0	WORD	RectifierMainsVoltageL1		xxx V
3	4	15-0	WORD	RectifierMainsVoltageL2		xxx V
4	6	15-0	WORD	RectifierMainsVoltageL3		xxx V
5-8	8-14		WORD	-		
9	16	15-0	WORD	BatteryVoltage		xxx V
10	18	15-0	INT10	BatteryCurrent		+- xxx.x A
11	20	15-0	WORD10	AutonomyTime		xxx.x min
12	22	15-0	WORD	BatteryCapacity		xxx %
13	24	15-0	INT10	BatteryTemperature	"O"	+- xx.x°C
14	26	15-0	WORD10	OutputFrequency		xx.x Hz
15	28	15-0	WORD	OutputVoltageL1		xxx V
16	30	15-0	WORD	OutputLoadL1		xxx %
17	32	15-0	WORD	OutputCurrentL1		xxxx A
18	34	15-0	WORD10	OutputPowerL1		xxx.x kW
19	36	15-0	WORD	OutputVoltageL2	*1	xxx V
20	38	15-0	WORD	OutputLoadL2	*1	xxx %
21	40	15-0	WORD	OutputCurrentL2	*1	xxxx A
22	42	15-0	WORD10	OutputPowerL2	*1	xxx.x kW
23	44	15-0	WORD	OutputVoltageL3	*1	xxx V
24	46	15-0	WORD	OutputLoadL3	*1	xxx %
25	48	15-0	WORD	OutputCurrentL3	*1	xxxx A
26	50	15-0	WORD10	OutputPowerL3	*1	xxx.x kW

***1: in 1 phase systems = 0**

Auxiliary Messages – Input Module: Slot 5

No	Byte	Bit	Type	Name		Description
1	0	0	WORD	Userdef_AUX1-Rectifier	"O"	
		1		Userdef_AUX2-Rectifier		
		2		Userdef_AUX3-Rectifier		
		3		Userdef_AUX4-Rectifier		
		4		Userdef_AUX5-Rectifier		
		5		Userdef_AUX6-Rectifier		
		6		Userdef_AUX7-Rectifier		
2	2	0	WORD	Userdef_AUX1-Inverter	"O"	
		1		Userdef_AUX2-Inverter		
		2		Userdef_AUX3-Inverter		
		3		Userdef_AUX4-Inverter		
		4		Userdef_AUX5-Inverter		
		5		Userdef_AUX6-Inverter		
		6		Userdef_AUX7-Inverter		

- **Protect 8-Converter unit profile**

System Real Time Values

– Input Module: Slot 3
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RealTime	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

System Controls

– Input Module: Slot 4
– Output Module: Slot 2

No	Byte Slot4	Byte Slot2	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RectifierControl	0 = Idle 1 = ON 2 = OFF 9 = Fault ack. 10= Equalising charge 11= Charge 12 =Trickle charge	No command sent or command not accepted Set Rectifier ON Set Rectifier OFF Acknowledgment of all rectifier faults Set Rectifier to Equalising charge Set Rectifier to charge Set Rectifier to trickle charge
2	2	2	15-0	WORD	InverterControl	0 = Idle 1 = ON 2 = OFF 9 = Fault ack.	No command sent or command not accepted Set Inverter ON Set Inverter OFF Acknowledgment of all inverter faults
3	4	4	7-0 15-8	WORD	BatteryQuick Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
4	6	6	7-0 15-8	WORD	BatteryCapacity Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
5	8	-	15-0	WORD10	BatteryCapTest Remaining Time	xxxx.x min	

- **Protect 8-Converter unit profile**

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write “0=Idle” in the control registers that have defined “Idle” if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).

In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:
Rectifier off => inverter must be off
Battery test => the entire system must be in a normal state

Battery tests:

In low byte, the battery test registers contain the control commands and in high byte, the associated statuses of the battery tests. Depending on the unit configuration, different battery tests can be initiated:

The **Battery Quick Test** consists of briefly testing the battery charging circuit. This test is also performed cyclically by the unit.

The **Battery Capacity Test** consists of testing the battery capacity. For this purpose, the battery is discharged with the connected load or by a constant current and the battery status is evaluated.
The remaining time of the capacity test can be read in the **Remaining Time** register.

Control battery test (LB):
0x00: The test has never been started via Profibus.
0x01/2: The test has been started/cancelled (the control command remains in place until the next command).
Battery test status (HB):
0x00: The test is not implemented in the unit.
0x01: The test is implemented, but is presently not approved, or the start conditions to execute the test are lacking.
0x02: The test is approved and can be started.
0x03-7: The test result remains in place for a short time until another test is approved.

Example of battery cap. test 1003/1004:
0x0000 0000 Test not implemented, no cap. test approved
0x0100 1000 Test is implemented, not approved, waiting for approval, max. runtime 100.0min
0x0200 1000 Test is approved, max. runtime 100.0min
0x0301 805 Test running; max. remaining runtime 80.5min
0x0401 0000 Test successful, new test not possible
0x0201 1000 Test is re-approved (after approx. 30s)

For further information on the battery tests, see the unit operating instructions.

7.2.4 Protect 8-Rectifier Unit Profile

Status **– Input Module: Slot 1**

No	Byte	Bit	Type	Name	Definition	Description
1	0	15-0	WORD	RectifierStatus	0 = OFF 1 = ON 2 = Remote OFF	Rectifier is switched OFF Rectifier is running Rectifier is switched off by remote contact
2	2	15-0	WORD	RectifierMode	0 = OFF 1 = EqualisingCharge 2 = Charge 3 = TrickleCharge 6 = Discharge 7 = Battery Test 16=no Battery	Rectifier is OFF Rectifier is running in equalising charge Rectifier is running in charge Rectifier is running in trickle charge Rectifier is OFF, the battery is discharging Rectifier is running with battery test Rectifier is running, no battery detected
3	4	0 1 2 6-3 7	WORD	Informations	UserdefInput1 “O” UserdefInput2 “O” UserdefInput3 “O” - LifeCheck	<User defined> <User defined> <User defined> Toggling every minute
4	6	0 1 2 3 4 5 6 7 8 9 10 11 12	WORD	Warnings	NonCriticalFault (Collecive Warn.) DouCanFault MainsFault RectifierWarning DC Earth fault - - BatteryTempHigh “O” - BatteryWarning - - FanFault	Is set, if any warning is set Internal CAN fault Rectifier mains fault Warning in rectifier control unit Warning from DC Earth monitoring Battery Temperature too high Battery Warning Fan is faulty
5	8	0 1 2 3 4 5	WORD	Alarms	CriticalFault (Collective fault) - RectifierFault BatteryFault - PowStackOverTemp	Is set, if any fault is set The rectifier is switched off by fault. The load cannot be supplied from battery The rectifier is switched off by PowStack Temp.

Measurements **– Input Module: Slot 2**

No	Byte	Bit	Type	Name	Value range
1	0	15-0	WORD10	RectifierMainsFrequency	xx.x Hz
2	2	15-0	WORD	RectifierMainsVoltageL1	xxx V
3	4	15-0	WORD	RectifierMainsVoltageL2	xxx V
4	6	15-0	WORD	RectifierMainsVoltageL3	xxx V
5	8	15-0	WORD	RectifierMainsCurrentL1	xxxx A
6	10	15-0	WORD	RectifierMainsCurrentL2	xxxx A
7	12	15-0	WORD	RectifierMainsCurrentL3	xxxx A
8	14	15-0	WORD	RectifierVoltage	xxx V
9	16	15-0	WORD	RectifierCurrent	xxxx A
10	18	15-0	WORD10	RectifierPower	xxxx.x kWA
11	20	15-0	WORD	BatteryVoltage	xxx V
12	22	15-0	INT10	BatteryCurrent “O”	+- xxx.x A
13	24	15-0	WORD	BatteryCapacity “O”	xxx %
14	26	15-0	INT10	BatteryRoomTemperature “O”	+- xx.x °C

- **Protect 8-Rectifier unit profile**

Auxiliary Messages **– Input Module: Slot 5**

No	Byte	Bit	Type	Name	Description
1	0	0	WORD	Userdef_AUX1-Rectifier "O"	
		1		Userdef_AUX2-Rectifier	
		2		Userdef_AUX3-Rectifier	
		3		Userdef_AUX4-Rectifier	
		4		Userdef_AUX5-Rectifier	
		5		Userdef_AUX6-Rectifier	
		6		Userdef_AUX7-Rectifier	

System Real Time Values **– Input Module: Slot 3**
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RealTime	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

- **Protect 8-Rectifier unit profile**

System Controls **– Input Module: Slot 4**
– Output Module: Slot 2

No	Byte Slot4	Byte Slot2	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RectifierControl	0 = Idle 1 = ON 2 = OFF 9 = Fault ack. 10= Equalising charge 11= Charge 12 =Trickle charge	No command sent or command not accepted Set Rectifier ON Set Rectifier OFF Acknowledgment of all rectifier faults Set Rectifier to Equalising charge Set Rectifier to charge Set Rectifier to trickle charge
2	2	2	7-0 15-8	WORD	BatteryQuick Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
3	4	4	7-0 15-8	WORD	BatteryCapacity Test	0 = Idle 1 = Start Test 2 = Abort Test 0 = No Test 1 = Wait for release 2 = Test released 3 = Test in progress 4 = Test done pass 5 = Test aborted 6 = Test done warning 7 = Test done error	Control (LB) : No test initiated or command not accepted Start Test Abort Test Status (HB) : Test not implemented Test implemented, waiting for release Test released, can be started Test in progress Test done pass Test aborted Test done warning Test done error
4	6	-	15-0	WORD10	BatteryCapTest Remaining Time	xxxx.x min	

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write “0=Idle” in the control registers that have defined “Idle” if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).

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In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:
Battery test => the rectifier must be in a normal state

- **Protect 8-Rectifier unit profile**

Battery tests:

In low byte, the battery test registers contain the control commands and in high byte, the associated statuses of the battery tests. Depending on the unit configuration, different battery tests can be initiated:

The **Battery Quick Test** consists of briefly testing the battery charging circuit. This test is also performed cyclically by the unit.

The **Battery Capacity Test** consists of testing the battery capacity. For this purpose, the battery is discharged with the connected load or by a constant current and the battery status is evaluated.
The remaining time of the capacity test can be read in the **Remaining Time** register.

Control battery test (LB):
0x00: The test has never been started via Profibus.
0x01/2: The test has been started/cancelled (the control command remains in place until the next command).
Battery test status (HB):
0x00: The test is not implemented in the unit.
0x01: The test is implemented, but is presently not approved, or the start conditions to execute the test are lacking.
0x02: The test is approved and can be started.
0x03-7: The test result remains in place for a short time until another test is approved.

Example of battery cap. test 1002/1003:
0x0000 0000 Test not implemented, no cap. test approved
0x0100 1000 Test is implemented, not approved, waiting for approval, max. runtime 100.0min
0x0200 1000 Test is approved, max. runtime 100.0min
0x0301 805 Test running; max. remaining runtime 80.5min
0x0401 0000 Test successful, new test not possible
0x0201 1000 Test is re-approved (after approx. 30s)

For further information on the battery tests, see the unit operating instructions.

7.3 Storage Converter Unit Profile

The profile contains registers with status and measurement values and control elements for a storage converter.

System Status and Events **– Input Module: Slot 1**

No	Byte	Bit	Type	Name	Definition/Description
1	0	15-0	WORD	Mode	0 = Idle 1 = Charge into battery 2 = Discharge 3 = Charge into P2H-Hybrid “O”
2	2	15-0	WORD	ConverterStatus	● 1 = Converter remote off by contact (Converter shut off by dry-contact) ● 2 = Converter off by remote monitoring device (Converter shut down by Remote monitoring device) ● 3 = Converter off by operator (Converter shut down via Display Operating Unit) ● 4 = Converter off by fault (Storage converter shut down via fault) ● 5 = Converter in sleep mode ● 7 = Converter waiting of operation conditions (Converter waits for right grid values like AC voltage and frequency) ● 11 = Derated Operation by temperature (Power derating by high converter temperature) ● 13 = Derated Operation by P(F) (Power derating, Converter internal function P(F) is running) ● 16 = Startrampe nach Netzausfall ● 17 = Derated Operation by stack current deviation (Power derating through fault of stack currents) ● 19 = Derated Operation by high DC voltage (Power derating through high dc voltage) ● 49 = Derated Operation by DC current derating (Power derating through derated DC current by high temperature) ● 50 = Derated Operation by DC voltage limit (Power derating by dc voltage limit set-point) ● 51 = Derated Operation by DC current limit (Power derating by dc current limit set-point) ● 52 = Operation with constant real power (Converter charge or discharge the battery by real-power set-points) ● 53 = Operation with constant DC voltage (Converter charge or discharge the battery by const. dc voltage set-point) ● 54 = Operation with constant DC current (Converter charge or discharge the battery by const. dc current set-point) ● 55 = Converter in maintenance mode ● 56 = Pre-charge in operation ● 57 = Converter in idle mode (Converter is connected to battery and Grid without charge or discharge) ● 58 = Initial charging (Converter is running in initial charge mode) ● 59 = Derated Operation by max. frequency limit (Power derating by maximum frequency limit set point) ● 60 = Derated Operation by min. frequency limit (Power derating by minimum frequency limit set point) ● 61 = Derated Operation by max. AC voltage limit (Power derating by maximum AC voltage set point) ● 62 = Derated Operation by min. AC voltage limit (Power derating by minimum AC voltage set point) ● 63 = Derated Operation by limited AC current regulator (Power derating by high AC current) ● 64 = Derated Operation by limited AC voltage regulator (Power derating by high AC voltage)

● ● ● ● : Colour-coding of the rectifier status in a monitoring system

- **Storage converter unit profile**

No	Byte	Bit	Type	Name	Definition/Description
3	4	0 1 2	WORD	DcInformation	- Contactor K5.1 is closed, first step of P2H "O" Contactor K5.2 is closed, second step of P2H "O"
4	6	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	WORD	DcWarning	Circuit breaker Q4 for dc-input is open - - Isolation fault monitor level 1 is active (ISO1) (option) Isolation fault monitor level 2 is active (ISO1) (option) Fuse F5.1 from P2H is blown (option) Fuse F5.2 from P2H is blown (option) Manual switch Q1 for dc-input is in OFF position (option) Feedback fault from contactor Q4 for dc-input (not active) - - Collective alarm of water heater device appears (temperature, pressure, etc.) - - - Communication fault to CAN-I/O
5	8	15-0	WORD	DcFault	-
6	10	15-0	WORD	DcFaultSelfACK	-
7	12	0 1 2	WORD	Converter Information	Voltage mode: FP active Voltage mode: VQ active Stack current limiting
8	14	0 1 2 3 4 5 6 7 8 9 10 11 12 13	WORD	Converter Warning1	Power stack temperature is out of warning level range (-<>+) Power stack temperature sensor has a fault Cubicle temperature is out of warning level range (-<>+) Cubicle temperature sensor has a fault One or more fans of the converter has a fault System fault of controller - Communication fault with remote monitoring device Power stack current deviation - - - Contactor K91 feedback fault Signalling fault CAN I/O
9	16	14-0 15	WORD	Converter Warning2	- DOU CAN fault

- **Storage converter unit profile**

10	18	15-0	WORD	Converter Fault	1 =Selftest fault 2 =Watchdog 3 =Load cur. transducer/AC earth fault 4 =K7: Feedback fault 5 =AC voltage deviation 6 =Mains voltage deviation 7 =Stack overcurrent 8 =Voltage sensor fault 10-15=Stack fault 16 =Short circuit 17 =15V supply voltage fault 30 =I/O parameter fault 31 =EEPROM fault 32 =DC voltage deviation 33 =DC current deviation 34 =Stack current transducer fault 35 =Stack current transducer fault 40-45 =Stack fault 48 =Stack overcurrent 49 =Difference current deviation 50 =Stack overcurrent 51 =Stack overcurrent 54 =Program code checksum fault 55 =FPGA Boot fault 94= F26 is blown 95 =V1/2: Does not lock 96 = V1/2: Does not conduct 97 = P2H: Fan fault 98 = K40: Feedback fault 99 =Q26: Circuit breaker is open 100-102=AC overcurrent 103=Transformer fault 104=K8: Feedback fault 105=K9: Feedback fault 106=R8: Precharge fault 107=R9: Precharge fault 108=Q4: Feedback fault 109=Q4: Overcurrent 110=Emergency shutdown 111=DC overcurrent at charging 112=DC overcurrent at discharging 113=24V supply voltage fault 114=Auxiliary power supply failed 115=Isolation monitoring fault “O” 116=Isolation monitoring fault “O” 117=Discharge circuit fault 118/119=Overcurrent / short circuit “O” 120=K5.1: Feedback fault “O” 121=K5.2: Feedback fault “O” 122=Overtemperature “O” 123=Battery cur. transducer fault “O” 124=Thyristor stack fault “O” 125-127=<User defined> “O”	Internal converter error Internal controller error Load current transducer or AC earth fault Problems with contactor K7 The grid voltage is too high The grid voltage is too high Stack1 current is too high Voltage sensor cable break or sensor fault Fault in stack1 The grid current is too high / short circuit 15V power supply fault on interface A17 Internal controller error Internal controller error The DC voltage is too high The DC current is too high Current transducer fault in stack1 Current transducer fault in stack2 Fault in stack2 Stack2 current is too high Difference current deviation out of range Stack1 current is too high (hardware) Stack2 current is too high (hardware) Internal controller error Internal controller error Fuse F26 is blown Problem mit dem P2H Thyristor Problem mit dem P2H Thyristor Lüfterfehler in der P2H-Einheit Problem mit dem Schütz K40 AC circuit breaker is in off position AC current L1-3 is too high Alarm from ext. transformer monitoring Problems with contactor K8 Problems with contactor K9 Problems with resistor R8 Problems with resistor R9 Problems with contactor Q4 Q4 tripped by overcurrent Someone has used the EPO switch The DC current at charging is too high The DC current at discharging is too high 24V power supply fault on interface A17 Aux. power fault on interface device A17 Isolation monitoring 1 Level 2 is active Isolation monitoring 2 Level 2 is active Fault on discharge device A123 Overcurrent / short circuit in stack 1/2 Problems with contactor K5.1 Problems with contactor K5.2 Thyristor temperature is too high Battery current transducer fault Fault in Thyristor stack Customized fault over remote signalling
11	20	0 1 2 3 4 5 6 7 8 9 10	WORD	ConverterFaultSelfACK	Synchronisation fault Converter dc over-voltage Power stack temperature sensor has a fault Cubicle temperature sensor has a fault Power stack temperature is > error level Cubicle temperature is > error level - - Inverter dc under-voltage Communication fault with remote monitoring device AC voltage is higher than dc voltage	

- **Storage converter unit profile**

12	22	0	WORD	AcInformation	Cubicle door of device is open
13	24	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	WORD	AcWarning1	- - Circuit breaker F60 or F61 for mains 2 dropped - Mains Circuit breaker Q26 in OFF position - Surge volt. protection F81 or heater devices F84,F87 (depends on type) have responded Feedback fault of contactor F86 for heater control Grid transformer warning (LV or MV) “O” Circuit breaker F4 for power supply of Q4 dropped Circuit breaker F18 for power supply of contactor K7 dropped Isolation fault monitor level 1 is active (ISO2) (option) Isolation fault monitor level 2 is active (ISO2) (option) - - Communication fault to CAN-I/O
14	26	15-0	WORD	AcWarning2	-
15	28	15-0	WORD	AcFault	-
16	30	0 1 2 3 4 5 6 7 8	WORD	AcFaultSelfACK	Grid over-frequency fault Grid under-frequency fault Grid over-voltage fault Grid under-voltage fault - Grid short circuit Rotating field fault Reactive power and under-voltage protection responded Phase of Grid dropped

System Measurements – Input Module: Slot 2

No	Byte	Bit	Type	Name	Value range	Description
1	0	15-0	WORD	BatteryVoltage	xxxx V	
2	2	15-0	INT	BatteryCurrent	±xxxx A	(+) = discharge of battery (-) = charge of battery
3	4	15-0	INT	BatteryPower	±xxxx kW	(+) = discharge of battery (-) = charge of battery
4	6	15-0	WORD	-		
5	8	15-0	INT10	PowerStackInputTemp	±xx.x °C	
6	10	15-0	INT1000	CosPhi	±x.xxx	(-) = over-excited or leading; (+) = under-excited or lagging *3
7	12	15-0	WORD100	ConFrequency	xx.xx Hz	
8	14	15-0	WORD	ConVoltL1-L2	xxx V	
9	16	15-0	WORD	ConVoltL2-L3	xxx V	
10	18	15-0	WORD	ConVoltL3-L1	xxx V	
11	20	15-0	INT10	ConCurrentL1	±xxxx.x A	(+) = current and power from battery into the grid (produce state) (-) = current and power from the grid into battery (consume state)
12	22	15-0	INT10	ConCurrentL2	±xxxx.x A	
13	24	15-0	INT10	ConCurrentL3	±xxxx.x A	
14	26	15-0	WORD10	ConApparentPower	xxxx.x KVA	
15	28	15-0	INT10	ConTruePower	±xxxx.x KW	(+/-) see Current
16	30	15-0	INT10	ConReactivePower	±xxx.x kvar	(-) = over-excited or leading (+) = under-excited or lagging

- **Storage converter unit profile**

17	32	15-0	WORD	DayEnergyProduced	xxxx KWh	
18	34	31-0	Double WORD	TotalEnergyProduced	xxxxxxxxxx KWh	
19	38	15-0	WORD	DayEnergyConsumed	xxxx KWh	
20	40	31-0	Double WORD	TotalEnergyConsumed	xxxxxxxxxx KWh	
21	44	15-0	WORD	-		
22	46	15-0	WORD100	GridFrequency	xx.xx Hz	
23	48	15-0	WORD	GridVoltL1-L2	xxxx V	
24	50	15-0	WORD	GridVoltL2-L3	xxxx V	
25	52	15-0	WORD	GridVoltL3-L1	xxxx V	

System Real Time Values

– Input Module: Slot 3
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RealTime	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

- **Storage converter unit profile**

System Controls **– Input Module: Slot 4**
– Output Module: Slot 2

No	Byte Slot4	Byte Slot2	Bit	Type	Name	Definition/ Value range	Description
1	0	0	15-0	WORD	ChargeControl	0 = Idle 1 = Into Battery 2 = Into P2H-Hybird device	
2	2	2	0	WORD	ResetSetPoints	0 = Idle 1 = Reset the set-points and limit values to their defaults	*0
3	4	4	15-0	INT10	TruePowerSetPoint (P0)	±xxxx.x kW	*1
4	6	6	15-0	INT10	ReactivePowerSetPoint (Q0)	±xxxx.x kvar	*2
5	8	8	15-0	INT1000	CosPhiSetPoint	±x.xxx	*3C
6	10	10	15-0	WORD10	ConstantDcVoltageSetPoint	xxxx.x V	
7	12	12	15-0	INT10	ConstantDcCurrentSetPoint	±xxxx.x A	*4
8	14	14	15-0	WORD10	LimitVdcChargeSetPoint	xxxx.x V	
9	16	16	15-0	WORD10	LimitVdcDischargeSetPoint	xxxx.x V	
10	18	18	15-0	WORD10	LimitIDcChargeSetPoint	xxxx.x A	
11	20	20	15-0	WORD10	LimitIDcDischargeSetPoint	xxxx.x A	
12	22	22	0	WORD	P(F-Grid)Release	0 = Idle 1 = Release 2 = Block	Converter internal function *C
13	24	24	0	WORD	Q(U-Grid)Release	0 = Idle 1 = Release 2 = Block	Converter internal function *C
14	26	26	0	WORD	Q(P-Inv)Release	0 = Idle 1 = Release 2 = Block	Converter internal function *C
15	28	28		WORD	-		
16	30	30	15-0	WORD	OperationMode	0 = Idle 1 = Constant Real-power 2 = Constant DC-voltage 3 = Constant DC-current	*6 *7 *8
17	32	32	15-0	WORD	ConverterOnOff	0 = Idle (Default) 1 = Converter ON 2 = Converter OFF 3 = Initial charging	*9
18	34	34	15-0	WORD	ConverterIdleOnOff	0 = Idle (Default) 1 = Converter Idle Mode ON 2 = Converter Idle Mode OFF	*10C
19	36	36	15-0	WORD	ConverterSystem	0 = Idle 1 = Acknow. fault and restart the Conv. 2 = Write Settings to NV Memory	*11
20	38	38	0	WORD	SoftstartRelease	0 = Idle 1 = Release 2 = Block	*12V
21	40	40	0	WORD	FPDroopRelease	0 = Idle 1 = Release 2 = Block	*13V
22	42	42	0	WORD	VQDroopRelease	0 = Idle 1 = Release 2 = Block	*14V
23	44	44	15-0	WORD10	FPDroop	xxx.x %	*13V
24	46	46	15-0	WORD100	F0	xx.xx Hz	*13V
25	48	48	15-0	INT10	PMin	±xxxx.x kW	*13V
26	50	50	15-0	WORD10	PMax	xxxx.x kW	*13V
27	52	52	15-0	WORD10	VQDroop	xxx.x %	*14V

- **Storage converter unit profile**

28	54	54	15-0	WORD10	V0	xxxx.x V	*14V
29	56	56	15-0	INT10	QMin	±xxxx.x kvar	*14V
30	58	58	15-0	WORD10	QMax	xxxx.x kvar	*14V
31	60	60	15-0	WORD	MonitoringHeartbeat	xxxxx	*15
32	62	62	15-0	WORD10	TimerX	xx.x s (0=not active) After timer x → communication fault **Default: 10 seconds**	Communication monitoring
33	64	64	0	WORD	Q(U-Grid-Limit)Release	0 = Idle 1 = Release 2 = Block	Converter internal function *C
34	66	66	15-0	WORD10	Uref Q(U-Grid)	xxx.x %	*C
35	68	68	15-0	WORD10	Uref Q(U-Grid-Limit)	xxx.x %	*C

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write "0=Idle" in the control registers that have defined "Idle" if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).
- Control registers with individual value definitions (0 = ..., 1 = ...) briefly acknowledge the command with the value sent or "0" if it was not executed and then show the real status of the register.
- If control commands are sent cyclically, a minimum cycle time of 100ms must be observed in order not to overload the system.
- Updating of all device values can take up to 1.2s.
- [C] Only in current mode available, [V] Only in voltage mode available

Reset of set-points:
To *0: If "ResetSetPoints" is set to 1, all set-points and release registers are set to factory settings, means:
TruePowerSetPoint = 0.0kW; ReactivePowerSetPoint = 0.0 kvar; CosPhiSetPoint = 1.000; all release registers are blocked via 0.

Set-point for true-power:
To *1: The signed value of "TruePowerSetPoint" describes the real-power into the Grid as well as from the Grid; (**+**) means produce power into the Grid (discharge of battery) and (**-**) means consume power from the Grid (charge of battery).

Set-points for reactive power:
To *2: The signed value of "ReactivePowerSetPoint" means: (-) = over-excited or leading; (+) under-excited or lagging.

Set-points for cosPhi:
To *3: The signed value of "CosPhiSetPoint" means: (-) = over-excited or leading; (+) under-excited or lagging.

Set-point for constant DC current:
To *4: The signed value of "ConstantDcCurrentSetPoint" means: (**+**) discharge of battery; (**-**) charge of battery.

Operation modes:
To *6: If "Constant Real-power" mode is selected, the PCS can charge or discharge the batteries, controlled by the "TruePowerSetPoint" signed value in register 4. For battery protection the real-power value on this operation mode could be limited by charge/discharge voltage and or charge/discharge current.
Limits of charge mode use the registers for voltage "LimitVdcChargeSetPoint" 14 and or for current "LimitIdcChargeSetPoint" 18.
Limits of discharge mode use the registers for voltage "LimitVdcDischargeSetPoint" 16 and or for current "LimitIdcDischargeSetPoint" 20.
To *7: If "Constant DC-voltage" mode is selected, the PCS charge or discharge the batteries controlled by the "ConstantDcVoltageSetPoint" value in register 10. For battery protection the DC-voltage value on this operation mode could be limited by charge/discharge current.
Limit of charge mode use the register for current "LimitIdcChargeSetPoint" 18.
Limit of discharge mode use the register for current "LimitIdcDischargeSetPoint" 20.
To *8: If "Constant DC-current" mode is selected, the PCS charge or discharge the batteries controlled by the "ConstantDcCurrentSetPoint" signed value in register 12. For battery protection the DC-current value on this operation mode could be limited by charge/discharge voltage.
Limit of charge mode use the register for voltage "LimitVdcChargeSetPoint" 14.
Limit of discharge mode use the register for voltage "LimitVdcDischargeSetPoint" 16.

Converter ON / OFF
To *9: IF "ConverterOnOff" is set to 1 the converter switches ON; means: start-up of the converter system. If this register is set to 2 the converter switches OFF. If this register is set to 3 the converter switches ON to "Initial charging". Be careful using this remote ON/OFF-command.

Converter idle ON / OFF
To *10: If "Converter idle" is set to 1 the converter switches in idle mode; means: the grid and the batteries are connected to the PCS without firing the IGBT Stack. The PCS is synchronized with the grid. If this register is set to 2 the converter jumps back to the last operation mode.

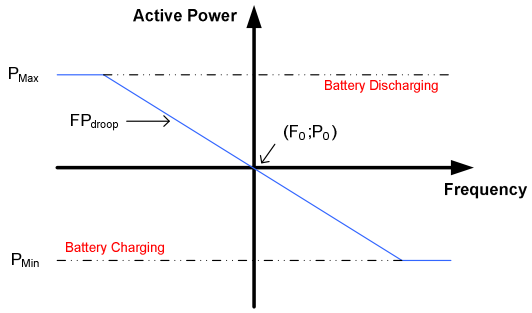
System functions:
To *11: If "ConverterSystem" is set to 1 the current fault of converter will be acknowledged and the converter starts automatically again. If "ConverterSystem" is set to 2 the current settings of registers 10 up to 20 will be saved into nonvolatile memory (EEPROM). Attention, consider the maximum EEPROM write cycles of 100000!

Specially controls for **storage converter in voltage mode** are available using droop characteristics:

Softstart Release (can only be used for for storage converter in voltage mode)
To *12: IF "SoftstartRelease" is set to 1, the converter starts up with output voltage zero to the rated voltage after switch ON the converter via register 32.

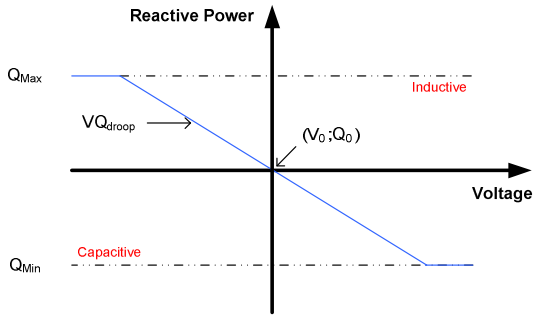
To *13: Following parameters are adjustable for droop characteristic of active power and frequency (FPdroop)

Register 40 to release the FPdroop function
Register 50 to set Pmax limit value in 0.1 kW
Register 48 to set PminLimit value in 0.1 kW
Register 44 for gradient value FPdroop in 0.1%
Register 46 for frequency set-point in 0.01 Hz
Register 4 for true power set-point in 0.1 kW



To *14: Following parameters are adjustable for droop characteristic of reactive power and voltage (VQdroop)

Register 42 to release the VQdroop function
Register 58 to set Qmax limit value in 0.1 kvar
Register 56 to set Qmin limit value in 0.1 kvar
Register 52 to set gradient value VQdroop in 0.1%
Register 54 for the voltage set-point V0 in 0.1 V
Register 6 for reactive power set-point in 0.1 kvar



Monitoring Heartbeat:
To *15: The "MonitoringHeartbeat" can be set as counter between 0–65535 or as toggle value 0/1. Writing this register can be used to reset communication supervision to monitoring/control unit. The register should be written in a 1 Hz synchronic cycle. The communication supervision is also reset by writing any other control register.

7.4 Thyrobox DC Unit Profile

The Thyrobox DC is a modular process rectifier. It can be operated in single operation or as a parallel system with up to 8 units. The profile contains registers with status and measurement values and control elements for the overall system and for the individual power blocks. You can select the combined system data (Thyrobox DC3 system) or system data + data for the individual power blocks. To do this, you must select the module with the corresponding number of power blocks (Thyrobox DC3 system + PBx).

7.4.1 Thyrobox DC – Overall Rectifier System

Rectifier System Status and Events – Input Module: Slot 1

No	Byte	Bit	Type	Name	Definition	Description
1	0	15-0	WORD	Operation Mode	0 = - 1 = Voltage Control 2 = Current Control 3 = Power Control	Indicates the active control operation mode
2	2	15-0	WORD	RectifierStatus	1 = Rectifier startup 2 = Rectifier operation 3 = Rectifier operation limited 10= Rectifier remote off A12 11= Rectifier remote off X100 12= Rectifier off by EcoMode 13= Rectifier off by operator 14= Rect. off by mains fault 15= Rectifier off by fault 16= Rectifier initial state 20= Rect. in maintenance mode	● Rectifier is starting ● Rectifier supplies the load ● Rectifier supplies the load with current limited set-values ● Rectifier shut off by dry-contact of remote signalling A12 ● Rectifier shut off by dry-contact via connector X100 ● Rectifier is switched off by EcoMode ● Rectifier shut down via Display Operating Unit or fieldbus ● Rectifier shut down via mains fault ● Rectifier shut down via fault ● Rectifier in initial mode ● A manual control of rectifier and the installed devices
3	4	0 1 2 3 4 5 6 7	WORD	VoltageLimit	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Voltage limit of rectifier(s) reached Transfer of power block number (bit-coded)
4	6	0 1 2 3 4 5 6 7	WORD	CurrentLimit	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Current limit of rectifier(s) reached Transfer of power block number (bit-coded)
5	8	0 1 2 3 4 5 6 7	WORD	PowerLimit	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Power limit of rectifier(s) reached Transfer of power block number (bit-coded)
6	10	15-0	WORD	ControlMode	0 = - 1 = Set-point digital 2 = Set-point analogue	Indicates the way to change the source of set-points Digital = via field bus Analogue = directly on connector X100

● ● ● ● : Colour-coding of the rectifier status in a monitoring system

- **Thyrobox DC unit profile**

No	Byte	Bit	Type	Name	Definition	Description
7	12	0 1 2 3 4 5 6 7	WORD	System RectifierOn	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Rectifier collective information Transfer of power block number (bit-coded)
8	14	0 1 2 3 4 5 6 7	WORD	System GeneralWarni ng	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Rectifier collective warning Transfer of power block number (bit-coded)
9	16	0 1 2 3 4 5 6 7	WORD	System GeneralFault	Rectifier 1 Rectifier 2 Rectifier 3 Rectifier 4 Rectifier 5 Rectifier 6 Rectifier 7 Rectifier 8	Rectifier collective fault Transfer of power block number (bit coded)
10	18	0 1 2 3	WORD	System Status	EcoMode active WaterCoolingFlow active SkidFilter on WaterCooling active	The system is running in EcoMode Water cooling: Flow is aktiv (valve is switched on) Skid filter is switched on Water cooling is running

Rectifier System Measurements – Input Module: Slot 2

No	Byte	Bit	Type	Name	Value range
1	0	15-0	INT10	OutputVoltDc	xxxx.x V
2	2	15-0	INT	OutputCurrentDc	xxxxx A
3	4	15-0	INT	OutputPowerDc	xxxxx kW
4	6	15-0	WORD	InsolationResistor “O”	xxxx kOhm
5	8	15-0	INT10	TransformerTemperature “O”	+- xxx.x °C

Rectifier System Real Time Values

– Input Module: Slot 3
– Output Module: Slot 1

No	Byte Slot3	Byte Slot1	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RealTime	Year	2021
2	2	2	15-0	WORD		Day	1-31
3	4	4	15-0	WORD		Month	1-12
4	6	6	15-0	WORD		Hour	00-23
5	8	8	15-0	WORD		Minute	00-59
6	10	10	15-0	WORD		Second	00-59
7	12	12	15-0	WORD		Millisecond	000-999
8	14	14	15-0	WORD		Weekday	1=Mon, 2=Tu, etc

Writing a new value in Byte 0-8 directly starts a real time synchronisation of all device components.

- **Thyrobox DC unit profile**

Rectifier System Controls **– Input Module: Slot 4**
– Output Module: Slot 2

No	Byte Slot4	Byte Slot2	Bit	Type	Name	Definition	Description
1	0	0	15-0	WORD	RectifierOnOff	0 = Idle 1 = ON of all Rectifier 2 = OFF of all Rectifier 3 = Activate EcoMode 4 = Deactivate EcoMode 101 = Rectifier 1 ON 102 = Rectifier 1 OFF 201 = Rectifier 2 ON 202 = Rectifier 2 OFF 301 = Rectifier 3 ON 302 = Rectifier 3 OFF 401 = Rectifier 4 ON 402 = Rectifier 4 OFF 501 = Rectifier 5 ON 502 = Rectifier 5 OFF 601 = Rectifier 6 ON 602 = Rectifier 6 OFF 701 = Rectifier 7 ON 702 = Rectifier 7 OFF 801 = Rectifier 8 ON 802 = Rectifier 8 OFF	*1
2	2	2	15-0	WORD	RectifierSystem	0 = Idle 1 = Acknowledge fault 2 = Write settings in non-volatile memory	*2
3	4	4	15-0	WORD	OperationMode	0 = Idle 1 = Constant DC-voltage 2 = Constant DC-current 3 = Constant DC-power	*3
4	6	6	15-0	WORD100	ConstantVoltageSetpoint	xxx.xx %	*4
5	8	8	15-0	WORD100	ConstantCurrentSetpoint	xxx.xx %	*5
6	10	10	15-0	WORD100	ConstantPowerSetpoint	xxx.xx %	*6
7	12	12	15-0	WORD	VoltageControlCoefficient_P	xxxxx	*7
8	14	14	15-0	WORD	VoltageControlCoefficient_I	xxxxx	*8
9	16	16	15-0	WORD	CurrentControlCoefficient_P	xxxxx	*9
10	18	18	15-0	WORD	CurrentControlCoefficient_I	xxxxx	*10
11	20	20	15-0	WORD10	RampTime	xxxx.x s	*11
12	22	22	15-0	WORD100	LimitOutputVoltage	xxx.xx %	*12
13	24	24	15-0	WORD100	LimitOutputCurrent	xxx.xx %	*13
14	26	26	15-0	WORD100	LimitOutputPower	xxx.xx %	*14
15	28	28	15-0	WORD	MonitoringHeartBeat	xxxxx	*15

General

- The control messages are only executed if the control value has been changed. It is therefore advisable to write “0=Idle” in the control registers that have defined “Idle” if no control changes are made.
- Control functions could generally be enabled or disabled, see configuration. If disabled (all controls are blocked), you will read the value 0x7fff (not available).
- If control commands are sent cyclically, a minimum cycle time of 100ms must be observed in order not to overload the system.
- Updating of all device values can take up to 1.2s.

Rectifier ON / OFF
To *1: Via this register the whole rectifier system as well as the individual rectifier can be switched ON and OFF. If "RectifierOnOff" is set to 1 all installed rectifiers switch ON; means: start-up of the complete rectifier system. If this register is set to 2 all installed rectifiers switch OFF. To switch ON/OFF individual rectifiers you have to write the corresponding value. Be careful using this remote ON/OFF-command. After sending of one command value this can be read for about 5 seconds. After this time the value fall back to "0" for idle. In general, the status of rectifier can be read in the corresponding registers.

- **Thyrobox DC unit profile**

Rectifier system functions:
To *2: If "RectifierSystem" is set to 1 the current fault of rectifiers will be acknowledged. The rectifiers don't start automatically and should be switched on again via register "RectifierOnOff". If "RectifierSystem" is set to 2 the current settings of registers "OperationMode" and "VoltageControlCoefficient_P" up to "LimitOutputPower" will be stored into the non-volatile memory (EEPROM). Attention, consider the maximum EEPROM write cycles of 100000! The control register will be set in idle state when the command has been executed.

Operation Mode:
To *3: To change the operation mode of the rectifier system, all rectifiers should be switched off via register "RectifierOnOff". You can choose between three different operation modes, **1** = constant dc-voltage or **2** = constant dc-current or **3** = constant dc-power. The new chosen operation mode isn't stored in memory. You can store the change via register "RectifierSystem" into non-volatile memories of the rectifiers. With read command you briefly see the acknowledge of the command or "0" if it was not executed. Then the current operation mode of rectifier system is displayed.

Set-point for constant voltage:
To *4: The value of "ConstantVoltageSetPoint" in percent describes the value for a constant voltage output. The percent value refers on the nominal value for the output voltage of the overall rectifier system; refer also to the Profibus register "RectifierOutputVoltNom". The value range can be between 0.0%–100.0%. Depending on the selected operation mode, the value of register "ConstantVoltageSetPoint" (read) is 0x7FFF when this mode is not active. For a rectifier system with 2 or more blocks, the setpoint may only be set after the rectifier system has been switched ON.

Set-point for constant current:
To *5: The value of "ConstantCurrentSetPoint" in percent describes the value for a constant current output. The percent value refers on the nominal value for the output current of the overall rectifier system; refer also to Profibus register "RectifierOutputCurrentNom". The value range can be between 0.0%–100.0%. Depending on the selected operation mode, the value of register "ConstantCurrentSetPoint" (read) is 0x7FFF when this mode is not active. For a rectifier system with 2 or more blocks, the setpoint may only be set after the rectifier system has been switched ON.

Set-point for constant power:
To *6: The value of "ConstantPowerSetPoint" in percent describes the value for a constant power output. The percent value refers on the nominal value for the output power of the overall rectifier system; refer also to Profibus register "RectifierOutputPowerNom". The value range can be between 0.0%–100.0%. Depending on the selected operation mode, the value of register "ConstantPowerSetPoint" (read) is 0x7FFF when this mode is not active. For a rectifier system with 2 or more blocks, the setpoint may only be set after the rectifier system has been switched ON.

Control coefficient settings:
To *7–10: The ControlCoefficient settings can be changed during operation. Be careful with changing of these values. The values are stored only in the RAM device. The value range can be between 0–32000. You can store the new values via register "RectifierSystem" into non-volatile memory of the rectifiers.

RampTime:
To *11: The "RampTime" can be set between 0.0s–6500.0s. This is the time that the rectifier takes to start a new output value. You can store the new value via register "RectifierSystem" into non-volatile memory.
The RampTime relates to the total rectifier system.
Example 1, single unit:

- 1 Rectifier with 1200 A output current.
- Operation mode: Current regulation
- RampTime: 600. This corresponds to 60s for the increase from 0 … 1200 A. The inclination is 1200 A / 60 s = 20 A/s.

Example 2, parallel system:

- 3 Rectifier, each with 1200 A output current. Parallel system output current is 3600 A.
- Operation mode: Current regulation
- RampTime: 600. This corresponds to 60s for the increase from 0 … 3600 A. The inclination is 3600 A / 60 s = 60 A/s.
- If all 3 rectifier are in operation: 20 A/s for each unit. Makes in total 60 A/s.
- If only 2 rectifier are in operation: 30 A/s for the running rectifier. Makes in total 60 A/s.
- If only 1 rectifier is in operation: 60 A/s for the running rectifier.

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Limit set-point for voltage:
To *12: The “LimitOutputVoltage” can be set between 10.0%–100.0%. This means that the output-voltage is limited by this value. You can store the new value via register “RectifierSystem” into non-volatile memory.

Limit set-point for current:
To *13: The “LimitOutputCurrent” can be set between 10.0%–100.0%. This means that the output-current is limited by this value. You can store the new value via register “RectifierSystem” into non-volatile memory.

Limit set-point for power:
To *14: The “LimitOutputPower” can be set between 10.0%–100.0%. This means that the output-power is limited by this value. You can store the new value via register “RectifierSystem” into non-volatile memory.

Monitoring Heartbeat:
To *15: The “MonitoringHeartbeat” can be set as counter between 0–65535 or as toggle value 0/1. Writing this register can be used to reset communication supervision to monitoring/control unit. The register should be written in a 1 Hz to 10 Hz synchronic cycle. The
communication supervision is also reset by writing any other control register.

7.4.2 Thyrobox DC – Rectifier Block 1–8

Rectifier Block 1–8 Status/Events and Measurements – Input Module: Slot 5–12

No	Byte	Bit	Type	Name		Description
1	0	15-0	WORD	Rectifier n Status	1 = Rectifier startup 2 = Rectifier operation 3 = Rectifier operation limited 10= Rectifier remote off A12 11= Rectifier remote off X100 12= Rectifier off by EcoMode 13= Rectifier off by operator 14= Rect. off by mains fault 15= Rectifier off by fault 16= Rectifier initial state 20= Rect. in maintenance mode	● Rectifier is starting ● Rectifier supplies the load ● Rect. supplies the load with current limited set-values ● Rect. shut off by dry-contact of remote signalling A12 ● Rectifier shut off by dry-contact via connector X100 ● Rectifier is switched off by EcoMode ● Rect. shut down via Display Operating Unit or fieldbus ● Rectifier shut down via mains fault ● Rectifier shut down via fault ● Rectifier in initial mode ● A manual control of rectifier and the installed devices ● ● ● ● : Colour-coding in a monitoring system
2	2	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	WORD	Rectifier n Warning1	Parameter limit fault System fault Watchdog warning DC link under-voltage Signalization fault (back-feed status) Remote monitoring fault DC output under-voltage Fan fault Thyristor stack temp. > warning level IGBT stack temp. > warning level Cold air 1 temp. > warning level Cold air 1 temp. < warning level Cold air 2 temp. > warning level Cold air 2 temp. < warning level Warm air 1 temp. > warning level Warm air 2 temp. > warning level	Internal controller error Internal controller error Internal controller error DC link voltage is too low Internal device error No communication to external control device DC output voltage is low One or more fans have a fault Device over-temperature fault (thyristor stack) Device over-temperature fault (IGBT stack) Device over-temperature fault (heat exchanger output) Device under-temperature fault (heat exchanger output) Device over-temperature fault (heat exchanger output) Device under-temperature fault (heat exchanger output) Device over-temperature fault (heat exchanger input) Device over-temperature fault (heat exchanger input)
3	4	0 1 2 3 4 5 6 7 8 9 10 12-11 13 14 15	WORD	Rectifier n Warning2	Warning in slave unit Configuration fault PARCAN Communication fault PARCAN No system redundancy Transformer overtemperature AC filter overtemperature Transf. temp. sensor circuit fault - Communication fault to I/O control 1 Communication fault to I/O control 2 Communication fault to I/O control 3 - Cabinet heater fault Isolation monitoring warning level Synchronisation fault	There is a warning in a slave unit The configuration of bus system is faulty Communication fault in internal bus system Currently no system redundancy is available Transformer temperature too high AC filter temperature too high Transf. temp. sensor circuit fault CAN I/O device A13.1 CAN I/O device A13.2 CAN I/O device A13.3 Fuse 85 could be blown Isolation warning of dc system Rectifier cannot synchronise
4	6	0 1 14-2 15	WORD	Rectifier n Warning3	Leak in water cooling system EPO switch active - DOU CAN fault	Water inside cabinet detected Rectifier is switched off by user and EPO switch is active Communication problem with a CAN node of rect. device
5	8	0 1 2 3 4 5 6 7 8 9 10 11 12 13 15-14	WORD	Rectifier n MainsFault	Mains 1 under-voltage - Mains2 under-voltage - Mains1 over-voltage - Mains2 over-voltage - Mains under-frequency Mains over-frequency Vac1: Field rotation fault Vac2: Field rotation fault Vac1-Vac2: Connection is swapped Synchronisation fault -	Mains voltage too low Mains voltage too low Mains voltage too high Mains voltage too high Frequency < 45 Hz Frequency > 65 Hz Field rotation fault in Vac1 Field rotation fault in Vac2 Wrong mains connections Rectifier cannot synchronise

- **Thyrobox DC unit profile**

6	10	15-0	WORD	Rectifier n Fault	1=Selftest fault	Internal rectifier error
					2=Watchdog	Internal controller error
					3=EEPROM fault	Internal controller error
					4=I/O parameter fault	Internal controller error
					5=FPGA boot fault	Internal controller error
					6=Program code checksum fault	Internal controller error
					7=±15V Power supply fault	Aux. power fault on interface device A17
					8=24V Power supply fault	Aux. power fault on interface device A17
					9=230V Aux. power supply fault	External fuse or fuse F1 can be blown
					10=Thyristor stack fault	Input fuses of thyristor stack F10-15 can be blown
					11=K1 Feedback fault	Problems with contactor K1
					12=K2 Feedback fault	Problems with contactor K2
					13=Discharge circuit fault	Fault on discharge device A123
					14=Leak in water cooling	Water inside cabinet detected
					15=Emergency shutdown	Someone has used the EPO switch
					16=EPO control unit fault	EPO controller has a fault Option
					24=<Userdef (RemSig)>	
					25=IGBT Stack fault	Fault in the IGBT stack
					26=Meas. range fault (Vac mains1)	Mains1 voltage sensor cable break
					27=Meas. range fault (Vac mains2)	Mains2 voltage sensor cable break
					28=-	-
					29=-	-
					30=Measuring range fault (Vdc)	DC-link voltage sensor cable break
					31=Measuring range fault (Idc1)	DC1 current sensor cable break or sensor fault
					32=Measuring range fault (Idc2)	DC2 current sensor cable break or sensor fault
					33=Measuring range fault (Vout)	Output Voltage sensor cable break
					36=Measuring range fault (IL1)	DC current sensor cable break or sensor fault
					37=Measuring range fault (IL2)	DC current sensor cable break or sensor fault
					38=Measuring range fault (IL3)	DC current sensor cable break or sensor fault
					39=Thyristor stack over-current	Current of thyristor stack too high
					40=IGBT Stack over-current	Current of IGBT stack too high
					41=Water cooling fault	Water cooling system has a fault
					42=Water cooling lack of water	Water cooling system has a lack of water
					43=Transformer overtemperature	Transformer temperature is too high
					44=Filter 17: Feedback fault	Filter 17: Feedback fault
					45=Filter 35: Feedback fault	Filter 35: Feedback fault
					46=Filter comp.: Feedback fault	Filter comp.: Feedback fault
					47=Skid comm. fault	Comm. Fault to skid
					48=Skid fault	Skid common fault
					49=Temp. sensor fault (IGBT Stack)	Sensor cable break or sensor fault
					50=Temp. sensor fault (Thyr. Stack)	Sensor cable break or sensor fault
					51=Temp. sensor fault (cold air 1)	Sensor cable break or fault (heat exchanger output)
					52=Temp. sensor fault (cold air 2)	Sensor cable break or fault (heat exchanger output)
					53=Temp. sensor fault (warm air 1)	Sensor cable break or fault (heat exchanger input)
					54=Temp. sensor fault (warm air 2)	Sensor cable break or fault (heat exchanger input)
					55=Analogue set-point circuit fault	Current loop for set-point out of area (4-20 mA)
					56=Temp. fault (Thyristor stack)	Temperature of thyristor stack too high
					57=Temperature fault (IGBT stack)	Temperature of IGBT stack too high
					58=Temperature fault (cold air 1)	Temperature of heat exchanger output too high
					59=Temperature fault (cold air 2)	Temperature of heat exchanger output too high
					60=Temperature fault (warm air 1)	Temperature of heat exchanger input too high
					61=Temperature fault (warm air 2)	Temperature of heat exchanger input too high
					62=Remote monitoring fault	Communication fault to external control device
					63=Isol. monitoring alarm (level2)	Isolation fault in the system
					64=Water cooling flow rate fault	Fault by water cooling system, flow rate too low
					65=Water cooling flow temp. fault	Cooling water inlet temperature too high
					66=Diodes temperature fault	Temperature of output-diodes F20-F21 too high
					67=Cabinet door is open	Door of device open or door-contact failure
					68=Thyristor stack over-current	Current of thyristor stack too high
					69=DC link over-voltage	DC ink voltage too high
					70=Output over-voltage	Output dc voltage too high
					71=Output over-current	Output dc current too high
					72=Output over-power	Output dc power too high
					73=Comm. error to slave unit	No comm. to slave device
					74=Comm. error to master unit	No comm. to master device

- **Thyrobox DC unit profile**

7	12	0 1 15-2	WORD	Rectifier n DeviceStatus	DC link not discharged Magnetic valve is open -	The DC link voltage is high The water flow is active
8	14	15-0	INT10	OutputVoltDc	xxxx.x V	
9	16	15-0	INT10	OutputCurrDc	xxxx.x A	
10	18	15-0	INT10	InternalTemp.	+- xx.x °C	