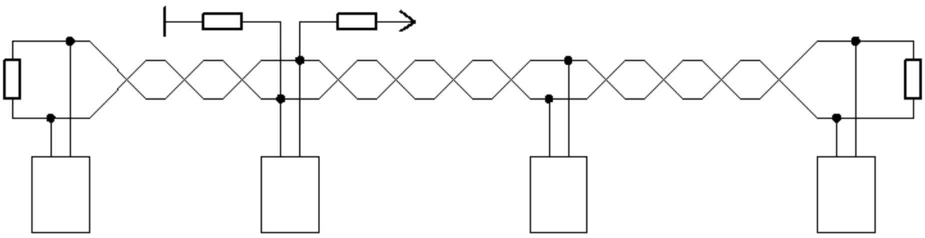
Technical Documentation



BLR-CM Modbus

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Document history

Date	Name	Revision	Comment
08.11.06	ATh	01	initial document release
20.03.07	ATh	02	features of new software (V2.1.x)
21.09.07	Le	03	New connector on Modbus hardware valid from firmware V 2.2.x
18.11.08	Le	04	Inserting additional bus address
24.09.18	SMi	05	Adaption to firmware V 2. 7.x Layout changes

Content

Important information!

If this sign appears besides a text passage, the reader is strongly advised to read the corresponding information. It may provide important information about the usage of the device, safety advices or information about the correct handling of the device. If the information is disregarded, the device may be inoperable or even damaged!

Additional Modbus protocol can be found at www.modbus.org.

The Modbus standards are also available from there.

1 Overview

The Modbus communication interface of the reactive power controller CM offers the possibility to read out measurement values or adjusting settings. This can be done by remote computer systems.

Attention: The BLR-CM can send max. 30 Values per request

The present manual describes the data transmission using the Modbus protocol, which defines methods of data transport and addressing, but does not generally determined a specific transmission medium (physical transmission level).

The reactive power controller CM uses the industrial standard RS485 for data transmission. This bus system offers the possibility to operate several devices at the same bus cable.

A multitude of commercial devices and programmable logic controllers (PLC) are compatible with the Modbus protocol, which is why a bus system can be set up with little effort.

2 Modbus/ RS485

The communication protocol Modbus RTU basically includes two levels:

- The RS485 industrial standard defines the data transmission medium. Here, the physical data byte transmission between the bus participants is controlled. This part of the protocol is embedded in higher Modbus levels.
- The Modbus application protocol uses the underlying RS485 protocol for data transmission. It defines commands ("Function Codes", FC), addresses and data structures.

2.1 RS485 (defined in EIA485/ISO8482)

The communication standard RS485 uses two wires for data transport D(+) and D(-). Signals are transmitted with a differential voltage level of at least ± 200 mV. Thus, the two logical levels "low" and "high" are possible. Due to its differential transmission technology, the standard RS485 is particularly resistant to electromagnetic interferences and wire lengths of more than 1000 meters may be reached.

The reactive power controller CM is compatible with the following transmission rates: 1200; 2400; 4800; 19200; 38400; 57600 and 115200 baud. All parity variations (even, odd and none) are supported.

In the RS485 standard, two transmission variations are defined:

- 2-wire RS485: This type uses two wires for the communication, which is why the same wire pair is used for both data directions. Therefore, it is necessary to switch between sending and receiving at each device (half-duplex mode).
- 4-wire RS485: In this case, a single wire pair is used for each data direction. However, due to the Modbus protocol, it is also only possible to use the half-duplex mode again. For this reason, it is not possible to increase the transmission capacity.

The power factor controller CM supports 2-wire RS485 only!

Next to the data lines, a common ground (GND) line must be interconnect all bus participants. It is not allowed to use the cable shield for this purpose. The shield must be connected to GND, in order to reduce electromagnetic influences.

According to the RS485 standard, up to 32 devices can be connected to a single bus segment. This is done by connecting all devices in parallel. This concerns the data lines D(+) and D(-) as well as the GND line.

In order to connect more than 32 devices to a bus, a "Repeater" must be used to between the bus-segments.

2.1.1 Connection

There are two Modbus interfaces:

a) 9-pin D-SUB

5 4 3 2 1

9 8 7 6

PIN1 +5V (For data line bias only. **It is not allowed to supply external circuits by this pin!**)

PIN2 Common ground (GND) for all bus participants.

PIN5 D (B) - Data signal B

PIN9 D (A) - Data signal A

b) 3-pin Connector

The power factor controller CM uses a 3-pin connector, which is shown on the right side.

In order to establish a Modbus connection, the data lines + and - and the common ground (middle pin) must be connected.

Attention: Various vendors uses the assignment A and B. Equating this designation (A = +) and (B = -) does not always apply. This must be checked for each device.

2.1.2 Line termination

The termination of the bus wire is strictly necessary, in order to prevent interferences and set up a stable connection. For this reason, both wire ends of the bus must be terminated with a resistor. The value of the resistor must fit to the cable impedance and is generally selected as 120 Ω. A resistor must be connected at each end of the bus-segment.

Some devices, particularly bus converters, include a termination resistor by default. Therefore, it is necessary to check the user manuals of all implemented bus devices. If devices, with integrated termination resistor, are connected within the bus segment, their termination resistors must be switched off. In case it is not possible to switch it off, the respective devices must be placed at the ends of the bus! Consequently, it is only possible to use two devices with fix termination resistors!

2.1.3 Line biasing

Without a bias voltage, the logic level in the data wires would be undefined while no data is transmitted. Additionally, external influences may lead to interferences of the signal level. For this reason, line biasing is required.

This is done by two resistors, which must be in the range of 450 Ω…650 Ω. The first resistor is used as pull-up resistor and is connected between the data wire + resp. D(+) and +5 V. The second resistor is used as pull-down resistor and is connected between the data wire – resp. D(-) and 0 V. These resistors are required once per bus segment and their position within the bus segments is freely selectable. However, it is recommend to select a position in the middle of the bus wire. Before installing these resistors, it must be checked if the implemented devices already include integrated bias resistors.

Attention: In case of the BLR-CM, a line bias voltage must be provided externally.

2.1.4 Communication indicator

The yellow LED on the backside of the device indicates an active transmission. It only flashes, when the device is actually communicating with the bus master.

The communication indicator LED is available for both connector variants.

2.2 The Modbus protocol

2.2.1 Modbus - description

The Modbus protocol uses the RS485 as an underlying physical layer and implements the data transmission control mechanisms. Therefore, it is located on layer 2 ("link layer") of the OSI layer model for data exchange systems.

2.2.2 Serial data format

The data is transmitted in fixed frames. The frames are separated by the bus being inactive for at least 3,5 characters. All data is organized in "protocol data units" (PDUs), which are transmitted over the serial bus system by the underlying physical protocol layer.

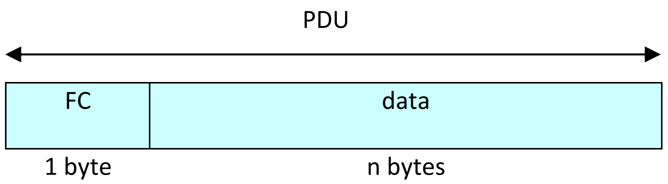

Illustration 1 : "Protocol Data Unit" - PDU

The PDU consists of two parts:

- The "function code" (FC) is a command, which defines how the slave has to respond.
- The data block contains information, which correspond to the FC. Its usage depends on the FC, it can either contain data or register addresses for slave data access.

The PDU defines a single data unit, which has to reach a certain bus device in order to perform an action. The type of the transfer differs dependent on the physical layer.

To be able to control the transmission, the PDU is extended by two additional blocks. In RS485, the frame is now called "application data unit" (ADU).

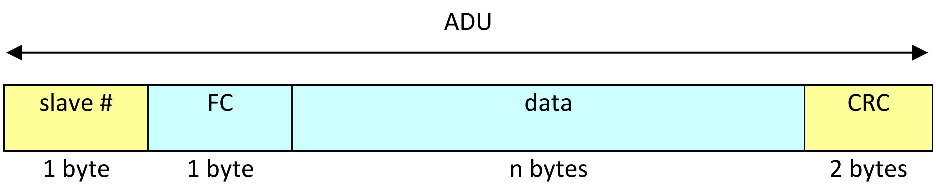

Illustration 2 : "Application Data Unit" - ADU

The application data unit, contains two additional blocks of data:

- The first field specifies the "slave number", which contains the slave address.
- In order to secure the transmission, the las block includes a cyclic redundancy check (CRC) value.

2.2.3 Serial transmission modes

The protocol defines two different encodings for the frames' data contents. The RTU- and ASCII-coding.

Attention: The BLR-CM supports the RTU-mode only!

"Remote Terminal Unit" (RTU)

At this transmission mode, every 8-bit data word contains two 4-bit hexadecimal numbers. They are transmitted as complete byte to reach a maximum transmission density. With every data word, the following information is transmitted:

- 1 Start bit
- 8 Data bits, "least significant bit" first
- 1 Parity bit (if set)
- 1 Stop bit for parity even or odd / 2 if parity is none to compensate missing parity bit

2.2.4 Function codes

As it was mentioned before, the data packet contains "function codes", which specify a command from the bus master to the bus slave. The slave executes the command (if possible) and answers with the same function code to acknowledge the command. The valid function code range is specified from 1 to 127, but only a part of it is actually used. Please refer to the Modbus specifications for detailed Information.

If it is impossible for a slave to execute a command, it replies with an error code (exception code). The function code of an exception package is the function code itself and the most significant bit is set by the slave to signal the error condition to the master. Moreover, the content of the data block specify the error in more detail.

The BLR-CM supports the function codes 03_{hex} (read holding register), 04_{hex} (read input register) and 06_{hex} (write single register).

2.2.5 Exception codes

If a slave is not able to execute a command, it answers with exception codes. A full list of codes can be found in the Modbus specification. The corresponding list is not provided at this point, because the master software handles the most exceptions automatically.

2.2.6 Master-Slave protocol

Since the master-slave protocol is used, only the bus master can initialize a transfer. The "master" starts an exchange by sending data and the corresponding function code (=command) to the slave. Afterwards the slave executes the command.

- Usually, the unicast-mode is used to communicate within a Modbus system. Here, data packages are send to a single slave, including its address. The valid address range is between 1 and 247. The slave executes the command and answers by sending a acknowledge data package back to the master.
- In multicast-mode all slaves on the bus are addressed in parallel. They all receive and execute the same command, but none of them respond. The master initiates a multicast command by using "0" as slave number.

3 BLR-CM Modbus

3.1 Setup

If the device supports Modbus, an additional entry is available in the “setup” - menu of the device. In this menu the following settings can be done:

- ADDRESS: This is the device’s slave address (slave ID). The valid range is 1-247.
- BAUD RATE: Here, the baud rate can be selected. The valid range is 1200 - 115200 baud.
- PARITY: The parity can be selected to be none, even or odd.

While baud rate and parity must be the same for all bus devices, the address must be unique for each device.

3.2 Address space

The data in the BLR-CM is organized and accessed by addresses. Each address accesses one data word. The size of a data word is always 16 bit.

The BLR-CM does not differ between the addresses and the function codes. There is one big address space available and in order to access each address’s data, any valid function code can be used. Nevertheless, the data will only make sense when interpreted the correct way!

The data can be of the following types:

- FLOAT: 32 bit floating-point number, as it is defined in IEEE-754.
- UINT16: Unsigned 16 bit integer value.
- UINT32, SINT32: Unsigned/signed 32 bit integer value.

Since the data is organized in 16 bit wide words, a set of sequential addresses has to be read in order to get longer data items. In this case, only the base address is given in the tables. For example, to read a FLOAT value with base address 12, two 16 bit words must be read (addresses 12 and 13). These two values need to be concatenated to form the desired result of 32 bits. Most SCADA software packages or PLCs can do this automatically.

There exist different types of addresses:

- **The Modbus address always starts with 0 and can go up to 65535. It can be used with any function code.**
- **Certain PLCs cannot handle the address 0 and therefore add 1 to the address. So their addresses system (Modbus address +1) always start with 1.**
- **Some SCADA tools add an offset to determine the function code, which is used to access the device at the given address. Sometimes, they also add 1 to the Modbus address. As an example, the address 40001 would be "read Modbus address 0 with function code 03_{hex}", 30012 would be "read Modbus address 11 with function code 04_{hex}". Please refer to the corresponding software's manual to find the correct addresses.**

Attention: The following tables always give the Modbus addresses mentioned first in above list.

3.3 Measurement values

The measured values are available in an interval of 2 data words, starting at address 0. All values can be accessed with function codes 03_{hex} and 04_{hex}.

If the current or voltage is too small to calculate valid harmonics, the value at the base address (= the fundamental) is 0.0%. This also indicates, that the higher harmonic current or voltage values are also invalid!

Attention: The values Apparent power sum, Active power sum, Reactive power sum, Lacking reactive power ΔQ and Power factor (P/S) refere to a symmetrical power system.

Address	Value	Words	Type	Unit
0	Frequency	2	FLOAT	Hz
2	Voltage phase – phase	2	FLOAT	V
4	Voltage phase - neutral	2	FLOAT	V
6	Current I1	2	FLOAT	A
18	Apparent power S-sum	2	FLOAT	VA
26	Active power P-sum	2	FLOAT	W
34	Reactive power Q-sum	2	FLOAT	var
42	Lacking reactive power ΔQ	2	FLOAT	var
50	Power factor (P/S)	2	FLOAT	-
58	Total harmonic distortion THD U	2	FLOAT	%
60	Harmonics U 1. order = fundamental wave	2	FLOAT	%
62	Harmonics U 2. order	2	FLOAT	%
64	Harmonics U 3. order	2	FLOAT	%
…	…	…	…	…
122	Harmonics U 32. order	2	FLOAT	%
124	Total harmonic distortion THD I	2	FLOAT	%
130	Harmonics I 1. order = fundamental wave	2	FLOAT	%
132	Harmonics I 2. order	2	FLOAT	%
134	Harmonics I 3. order	2	FLOAT	%
…	…	…	…	…
192	Harmonics I 32. order	2	FLOAT	%
322	Ambient temperature	2	FLOAT	°C

3.4 Work counters

In order to reach an accurate value, work counters/accumulators are arranged in a special way. Each counter consists of two parts:

1. A FLOAT-type base counter which simply accumulates/integrates the power. If this counter reaches 1000000.0, the extended counter is increased by one and 1000000.0 is subtracted from the base counter.
2. A LONG-type extended counter, which is used to count portions of MW / Mvar up to $(2^{32}-1)\cdot 10^{6}$.

To get the real work value, the extended counter must be multiplied with 1000000 and afterwards the base counter value must be added. This keeps the precision of the FLOAT-type base counter in acceptable range, because huge values can be handled as well.

All values can be accessed with function codes 03_{hex} and 04_{hex}.

Address	Value	Words	Type	Unit
1792	WQ inductive – extended counter	2	UINT32	MVarh
1794	WQ inductive – base counter	2	FLOAT	Varh
1796	WQ capacitive – extended counter	2	UINT32	MVarh
1798	WQ capacitive – base counter	2	FLOAT	Varh
1800	WP import – extended counter	2	UINT32	MWh
1802	WP import – base counter	2	FLOAT	Wh
1804	WP export – extended counter	2	UINT32	MWh
1806	WP export – base counter	2	FLOAT	Wh

It is possible to read the work counters already summarized since firmware version 2.7.0. These values can be accessed with function codes 03_{hex} and 04_{hex}.

Address	Value	Words	Type	Unit
2048	WQ inductive	2	REAL	kVarh
2050	WQ capacitive	2	REAL	kVarh
2052	WP import	2	REAL	kWh
2054	WP export	2	REAL	kWh

3.5 Parameter settings

Parameters, which are set by the user, are stored in various data types. The base addresses and the data type can be found in the table below.

All values can be accessed with function codes 03_{hex}, 04_{hex} and 06_{hex}.

Address	Value	Words	Type	Unit
512	PT ratio x 10	1	UINT16	-
513	CT ratio x 10	1	UINT16	-
514	User parameters 1	1	UINT16	-
515	Phase correction	1	UINT16	°
517	Nominal voltage L - L	2	UINT32	V
519	Limit max. voltage	1	UINT16	%
520	Limit min. voltage	1	UINT16	%
522	Switching time delay x 10	1	UINT16	s
523	Target cos ϕ 1 (0..100..200 = i0.00..1.00..c0.00)	1	UINT16	-

524	Target cos ϕ 2 (0...100...200 = i0.00...1.00...c0.00)	1	UINT16	-
525	control sensitivity	1	UINT16	%
526	Tolerance switch cycles balancing	1	UINT16	%
527	Alarm Enable Output Mask 1 (OM1)	1	UINT16	-
528	Alarm action: „Switch Alarm Relay (M)“ (OM1)	1	UINT16	-
529	Alarm action: „Switch DO-Relay (DO)“ (OM1)	1	UINT16	-
530	Alarm action: „Show Display Message (D)“ (OM1)	1	UINT16	-
531	Alarm action: „Target COS-PHI 2 (CP)“ (OM1)	1	UINT16	-
532	Alarm action: „Switch Controll off (O)“ (OM1)	1	UINT16	-
533	Alarm action: „Freeze Control (F)” (OM1)	1	UINT16	-
533	Limit alarm temperature 1 x 10	1	UINT16	°C
534	Limit alarm temperature 2 x 10	1	UINT16	°C
535	Hysteresis temperature x 10	1	UINT16	°C
536	Limit alarm THD U x 10	1	UINT16	%
537	Limit alarm THD I x 10	1	UINT16	%
539	Limit warning step size	1	UINT16	%
540	Limit warning switch cycles	2	UINT32	-
542	Limit alarm active power P	2	UINT32	W
544	Limit alarm reactive power Q	2	UINT32	var
546	pf alarm min (0...100...200 = i0.00...1.00...c0.00)	1	UINT16	-
547	pf alarm max (0...100...200 = i0.00...1.00...c0.00)	1	UINT16	-
548	pf alarm delay time	1	UINT16	s
555	Switching time delay Step exchange x 10	1	UINT16	s
556	Delay time fast control	1	UIN16	per
557	Max. step size (fast control)	1	UINT16	var
559	Mean Q. (fast control)	1	UINT16	Var
560	Datalogger storage interval (0…720) (Only available with option –DM)	1	UINT16	Min
561	Fast Control Output Mask 1 (OM1) (Only available with option 1PH: -06T, -12T, -12RT) **Note: Just the THD-U Bit is allowed**	1	UINT16	-
562	Alarm frequency: lower limit (450…(MaxValue-10) = 45,0Hz…(MaxValue-0,1Hz))	1	UINT16	Hz
563	Alarm frequency: upper limit ((MinValue+10)…650 = (MinValue+0,1Hz)…65,0Hz)	1	UINT16	Hz
564	Alarm Enable Output Mask 2 (OM2)	1	UINT16	-
565	Alarm action: „Switch Alarm Relay (M)“ (OM2)	1	UINT16	-
566	Alarm action: „Switch DO-Relay (DO)“ (OM2)	1	UINT16	-

567	Alarm action: „Show Display Message (D)“ (OM2)	1	UINT16	-
568	Alarm action: „Target COS-PHI 2 (CP)“ (OM2)	1	UINT16	-
569	Alarm action: „Switch Controll off (O)“ (OM2)	1	UINT16	-
570	Alarm action: „Freeze Control (F)” (OM2)	1	UINT16	-
571	Language Setting SW 02.07.xx: Bit 0 =English, Bit 1 = German, Bit 2 = French SW 02.08.xx: Bit 0 =English, Bit 1 = Spanish, Bit 2 = Portuguese	1	UINT16	-
572	Asymmetry factor	1	SINT16	-
573	User parameters 2	1	UINT16	-
574	Q-Offset (-32000…32000 = -3200,0kvar…3200,0kvar)	1	SINT16	kvar
575	Temperature Offset (-100…100 = -10°C…10°C)	1	SINT16	°C

The addresses 514 (User parameters 1), 527 – 533 (Alarm Output Mask 1), 561 (Alarm Output Mask 1), 564 – 470 (Alarm Output Mask 2) und 573 (User parameters 2) are coded binary. The assignment of the single bits is depicted in the following tables.

User parameters 1

Bit 15															**Bit 0**

Bit 0	Synchronization Frequency	00 = Automatic	
Bit 1	Synchronization Frequency	01 = Fix 50 Hz	
		10 = Fix 60 Hz	
Bit 2	Measurement connection	1 = LL	0 = LN
Bit 3	Stage recognition	1 = Off	0 = On
Bit 4	Switch cycle distribution	1 = Yes	0 = No
Bit 5	Start AI count down (90 s after each restart)	1 = Yes	0 = No
Bit 6	1	1 = Yes	0 = No
Bit 7	Stage exchange	1 = Yes	0 = No
Bit 8	Control	00 = Auto	
Bit 9	Control	01 = LIFO	
		10 = Combi-filter	
Bit 10	I < Limit; lock stage	1 = Yes	0 = No
Bit 11	Fast control; Sync. Impulse	1 = Yes	0 = No
Bit 12	DO Type	1 = N. closed	0 = N. opened
Bit 13	DI Type	1 = Low-active	0 = High-active
Bit 14	Capacitive overcompensation	1 = Allowed	0 = Permitted
Bit 15	Progressive algorithm (Using „On“ Control must be set Auto)	1 = On	0 = Off

User parameters 2

Bit 15															Bit 0

Bit 0	CT Type	1 = X/1A	0 = X/5A
Bit 1	Control	00 = Control ON	
Bit 2	Control	01 = Control OFF	
		10 = Control FREEZE	
Bit 3	Reserved	X	X
Bit 4	Start AI	1 = Start	0 = Stop
Bit 5	Status AI	1 = Active	0 = Inactive
Bit 6	Reserved	X	X
Bit 7	Reserved	X	X
Bit 8	Reserved	X	X
Bit 9	Reserved	X	X
Bit 10	Reserved	X	X
Bit 11	Reserved	X	X
Bit 12	Data logger synchronization via DI-data logger	1 = Active	0 = Inactive
Bit 13	Reserved	X	X
Bit 14	Logic of DI-Data logger input	1 = Low-active	0 = High-active
Bit 15	Reserved	X	X

Alarm Output Mask 1 (OM1)

Bit 15															Bit 0

Bit 0	VOLTAGE Alarm (Over- or undervoltage)	1 = Selected	0 = Deselected
Bit 1	I-HIGH Alarm (I secondary > 6A)	1 = Selected	0 = Deselected
Bit 2	I-LOW Alarm	1 = Selected	0 = Deselected
Bit 3	TEMP 1 Alarm	1 = Selected	0 = Deselected
Bit 4	TEMP 2 Alarm	1 = Selected	0 = Deselected
Bit 5	THD-U Alarm	1 = Selected	0 = Deselected
Bit 6	THD-I Alarm	1 = Selected	0 = Deselected
Bit 7	Stage warning Alarm (OPC, SPL)	1 = Selected	0 = Deselected
Bit 8	Faulty stage Alarm	1 = Selected	0 = Deselected
Bit 9	Digital input (HT/NT)	1 = Selected	0 = Deselected
Bit 10	Reserved	X	X
Bit 11	P-Overload Alarm	1 = Selected	0 = Deselected
Bit 12	Q-Overload Alarm	1 = Selected	0 = Deselected
Bit 13	P-Export Alarm	1 = Selected	0 = Deselected
Bit 14	CONTROL Alarm	1 = Selected	0 = Deselected
Bit 15	COS-PHI Alarm	1 = Selected	0 = Deselected

Alarm Output Mask 2 (OM2)

Bit 15															**Bit 0**

Bit 0	FREQUENCY Alarm	1 = Selected	0 = Deselected
Bit 1 - 15	Reserved	X	X

3.6 Stage status

Information about every stage are stored in the stage database. The referring information is available in different data types. The following bit assignment is used in the subsequent registers.

Output

Bit 15															**Bit 0**

S1 – S12	Output of stage 1 to 12	1 = Closed	0 = Open

The base addresses and the data types can be found in the table below. All values can be accessed with function codes $03_{hex\ and}$ $04_{\ hex}$.

Address	Value	Words	Type	Units
768	Fast stage (1 = fast, 0 = normal)	1	UINT16	-
769	Fix stage (1 = fix, 0 = automatic)	1	UINT16	-
770	Fix stage on/off (1 = on, 0 = off)	1	UINT16	-
772	Stage status (1 = defective, 0 = o.k.)	1	UINT16	-
1280	Switching state (1 = on, 0 = off)	1	UINT16	-

In the current firmware version it is possible to switch stages manually via Modbus. In order to switch a stage, the respective stage must be set to “1” under address 769. After this preparation, the stage can be switched on or off using the bits in address 770. While switching, the discharge time of the respective stage is considered.

Attention: Switching compensation stages via Modbus must not be done as long as it is not ensured that nobody is working at the compensation system.

Attention: Performing changes in register 769 result in switching all stages off and according to the respective setting on again.

All further base addresses and data types can be found in the table below. The values of the step sizes are based on the nominal voltage.

Adress	Value	Words	Type	Unit
773	Step size L-value step 1	2	SINT32	var
779	Step size L-value step 2	2	SINT32	var
773+(6*(n-1))	Step size L-value step n	2	SINT32	var
...	...			
839	Step size L-value step 12	2	SINT32	var
845	Step size F-value step 1	2	SINT32	var
851	Step size F-value step 2	2	SINT32	var
845+((6*(n-1))	Step size F-value step n	2	SINT32	var
...	...			
911	Step size F-value step 12	2	SINT32	var
917	Switch cycles step 1	2	SINT32	-
919	Switch cycles step 2	2	SINT32	-
...	...			
939	Switch cycles step 12	2	SINT32	-
941	Discharge time step 1 x 10	1	UINT16	s
942	Discharge time step 2 x 10	1	UINT16	s
...	...			
952	Discharge time step 12 x 10	1	UINT16	s

3.7 Device status

The following mentioned registers contain information of alarms, messages and the status of the digital outputs. The assignment of the alarms can be seen in the bit mask below. If the referring bit = 1, the alarm is active.

All these values can be accessed with function codes $03_{hex\ and}$ 04_{hex}.

Address	Value	Words	Type	Unit
1536	Alarm status	1	UINT16	-

Output

Bit 15															Bit 0

Bit 0	Over- or undervoltage	1 = Active	0 = Inactive
Bit 1	Overcurrent	1 = Active	0 = Inactive
Bit 2	No current	1 = Active	0 = Inactive
Bit 3	Temperature 1 too high	1 = Active	0 = Inactive
Bit 4	Temperature 2 too high	1 = Active	0 = Inactive
Bit 5	Alarm voltage harmonics	1 = Active	0 = Inactive
Bit 6	Alarm current harmonics	1 = Active	0 = Inactive
Bit 7	Warning decreased stage capacity	1 = Active	0 = Inactive
Bit 8	Alarm defective stage	1 = Active	0 = Inactive
Bit 9	Alarm signal via digital input	1 = Active	0 = Inactive
Bit 10	System error	1 = Active	0 = Inactive
Bit 11	Absolute active power too high	1 = Active	0 = Inactive
Bit 12	Absolute reactive power too high	1 = Active	0 = Inactive
Bit 13	Export active energy	1 = Active	0 = Inactive
Bit 14	Under- or overcompensation	1 = Active	0 = Inactive
Bit 15	Alarm cosϕ is not reached	1 = Active	0 = Inactive

The assignment of the alarm reactions can be seen in the bit mask below. If the referring bit = 1, the output or the message is active.

Address	Value	Words	Type	Unit
1537	Status messages	1	UINT16	-

Output

Bit 15															Bit 0

Bit 0	Alarm relais	1 = Active	0 = Inactive
Bit 1	Digital output	1 = Active	0 = Inactive
Bit 2	Show display message	1 = Active	0 = Inactive
Bit 3	Target cosϕ 2	1 = Active	0 = Inactive
Bit 4	Controller stopped, stages off	1 = Active	0 = Inactive
Bit 5	Freeze stages	1 = Active	0 = Inactive
Bit 6 - 15	Reserved	X	X

All settings send by Modbus are considered immediately, but are stored in the working memory only. In case of a power blackout, these settings will be lost. To store settings durable, they must be written into the non-volatile memory.

3.8 Storage settings

Since entered settings are only saved in the RAM, address 4096 can be written with function code 03_{hex}, 04_{hex} or 06_{hex} to save settings permanently.

Address	Value	Words	Type	Unit
4096	Store parameter data in EPROM	1	UINT16	-

If “29864” is written to the upper address, the previous entered parameters are stored into the EPROM. A successful writing process is confirmed by a “1” in the same register.

It is not recommended to write data cyclically into the EPROM, since the lifetime of the flash cells is limited!

There are further values in the device’s memory, which are not mentioned in this document. Since they can contain important device data, the mentioned addresses must be written only.

4 Trouble shooting

If the bus connection is not working correctly, please check the following points:

1. If no communication can be set up, the error must be searched between the BLR-CM and the PC:

   Approaching:

   - Check the adjustment of baud rate, parity and slave number at the BLR-CM. If necessary, change the configuration.
   - Are the bus lines A and B correct connected? Maybe they are interchanged.
   - Check the adjustments of the converter RS485/RS232, possibly consult the data sheet of the converter
   - Perhaps the PC port is already used by another application. Avoid multiple port reservations.
   - Check the termination and bias resistors.
2. Has the bus cable any damages? Are all plugs connected correctly? If necessary, they must be replace.
3. Is the pin assignment of the RS485 connection correct? If necessary, it must be changed.
4. The shielding of the bus line must not be used as bus ground. Nevertheless, the shielding should be connected to ground.
5. Is the communication possible, but there are problems with the software:
   - Check the adjustment of baud rate, parity and slave number in the software. If necessary, change the configuration.
   - Check used data format