wöhner

Modbus TCP and Modbus RTU protocol

User manual

ALLES MIT SPANNUNG

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1 Communication options

Each device is equipped with RS-485 or a local USB port and various other remote communication ports. The USB port can be used for data acquisition, configuration and status checks using the proprietary protocol supported by MIEZ software suite. With remote serial communication, Modbus RTU or TCP is supported respectively for easy and open access to all measured actual values.
With serial lines, the protocol is automatically recognized between proprietary KMB messages and the standard Modbus RTU. For this option, the device address, baud rate and parity must be specified (see user manual for more information). Spaces between bytes of maximum 1.5 characters (bytes) are allowed when a command is received, or a response is sent.
With the Ethernet option, different applications access different ports at their assigned addresses. Modbus TCP, the proprietary KMB protocol and web servers are supported as standard. Modbus Master (MM) and Ethernet-to-Serial Gateway (ES) can be optionally activated. For Modbus TCP, the monitoring port can be configured together with other TCP/IP settings (default port: 502). The device responds within a time frame of 200 ms after receiving each command. At least three parallel connections from different masters can be processed simultaneously by each device. Communication between each master and the device must follow the single request-response scheme. The master must wait for each response before sending a new request.

2 Description of the Modbus implementation

2.1 Supported standard functions

- 3 (0x03) Read holding register
- 4 (0x04) Read input register
- 16 (0x10) Write multiple registers

2.2 Supported user-defined functions

Some devices with an activated UP-Fw. module also support a range of user-defined Modbus functions that enable remote access to the various archives (see Chap. 4.5).

- 100 (0x64) Read archived average value
- 101 (0x65) Read archived minimum value
- 102 (0x66) Read archived maximum value

2.3 Modbus quantity coding

Access to data structure components is made possible by reading/writing from/to relevant register(s), as shown in the diagram in the following subsections. The Modbus protocol is based on variable assignments in 16-bit registers. Single-byte quantities are stored in such a register in the format 0x00 nn, where nn is a single-byte parameter. For multi-byte sets, the byte order is a big-endian. 32-bit and 64-bit integers and floating-point numbers are sorted serially in subsequent 16-bit registers from MSB to LSB. Floating point numbers are encoded using the IEEE 754 format for floating point numbers. See example below, the coded number in the example is 0.1875.

bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
meaning	sign	exponent (8 bits)								fraction (23 bits)																						
example	0	0	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The number format with double precision has 64 bits and is coded like a floating point number with an exponent of 11 bits and a 52-bit fraction.
The date and time are stored in 64-bit or 32-bit MBM time format. The value indicates the number of milliseconds (64-bit) or seconds (32-bit) since 1.1.2000 00:00 UTC. ANSI C, C++ and .NET C# functions (sample code) can be provided on request.
Each logical block of values is stored within the array of registers starting at the base address (organized like the chapters and sections in this document).

2.4 Addressing

The "transmission mode" ("broadcast mode") is not supported. Instead, address 0 in its configuration represents data from the master itself with the Modbus master module. Standard Modbus addressing applies to all three-phase single lead analyzers.
Devices with multiple leads and some multi-channel single phase devices limit the allowable base address range for a device from 1-20. The remaining Modbus address ranges 21-240 are reserved to reflect the tab for quantities from leads (channels) 2 to 12. The correct Modbus address for channel X is determined by this formula:
ModbusAddressX = (X − 1) × 20 + ModbusAddressBasis

2.5 Example

Modpoll is a free open source tool for Windows, Linux and Solaris that is available to download free of charge. We support this third-party tool for reference testing of our Modbus implementation. The following examples can be used as a starting point for developing an implementation with customer support and for troubleshooting other issues.

2.5.1 Modbus TCP example

Code to display the device number with:
modpoll −m tcp −a 1 −r 528 −t 3 : i n t −i −c 1 −1 −0 −p 502 IP
The default value for the port number (parameter -p) is 502 and does not need to be set explicitly. The default value for the slave address (-a) is 1. Shorter version with the same meaning:
modpoll −r 528 −t 3 : i n t −i −c 1 −1 −0 IP
Command -1 means only one iteration, -0 selects the Modbus PDU addressing mode1, and -c 1 is the number of retrieved values. The data type used is specified with the parameter -t: -t 3 = 16-bit integer, -t 3:hex = 16-bit hexadecimal value, -t 3:int = 32-bit integer, -t 3:float = 32-bit floating point number. Similar output with number 4. The parameter -r is the base address.

2.5.2 Modbus RTU example

The RTU variant is similar.

modpoll −m rtu −b 19200 −d 8 −s 1 −p none −a 1 −r 528 −t 3 : i n t −c 1 −i −1 −0 COM

Default values for data bits -d is 8, stop bits -s is 1, parity -p is even, but default values for universal meters are none; therefore it is usually necessary to set these. The default baud rate -b is 19200 and the usual command is simple:

modpoll −m rtu −p none −r 528 −c 1 −t 3 : i n t −i −1 −0 COM

Complete help is available with the command:

modpoll −−h e l p

Note: The Modpoll software uses the Modbus data model as the standard addressing mode, whereby the register addresses in each block always start with 1. Without the -0 parameter, each address would have to be incremented by one.

2.5.3 Further examples

Read all voltage values - examples of floating point values (complete output):

$ modpoll −r 4352 −c 4 −t 3 : float −f −1 −0 10.0.0.60

modpoll 3 . 4 − Field Talk (tm) Modbus(R) Master Simulator

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See http://www.modbusdriver.com for Modbus libraries and tools.

Protocol configuration	: MODBUS/TCP
Slave configuration	: Address = 1, start reference = 4352 (PDU), counter = 4
Communication	: 10.0.0.60, port 502, t/o 1.00 s, polling rate 1000 ms
Data type	: 32-bit floating point number, input register table
Word swapping	: Slave configured as a big-endian float machine

-- Query slave . . .

[4 3 5 2] :	236 . 074005
[4 3 5 4] :	236 . 056198
[4 3 5 6] :	236 . 089401
[4 3 5 8] :	236 . 033752

Read device number and software, hardware and bootloader versions - example for integer values (abbreviated output):

$ modpoll −r 528 −c 4 −t 3 −f −1 −0 147.230.72.5

. . .

-- Query slave . . .

[5 2 8] :	0	=> SN = 7
[5 2 9] :	7	

[530]: 3 => FW = 3.0.10.4478
[531]: 0
[532]: 10
[533]: 4478
[534]: 2 => HW = 2.0.0.0
[535]: 0
[536]: 0
[537]: 0
[538]: 4 => BL = 4.0.0.0
[539]: 0
[540]: 0
[541]: 0

2.6 Modbus RTU encapsulated via Ethernet

Since Fw. 3.0, the conversion between RTU and TCP takes place automatically on the Modbus Ethernet port. If a Modbus TCP request arrives via Ethernet, it is treated as Modbus TCP. If correct Modbus RTU packet data arrives at the Modbus port via Ethernet, the response is also coded as Modbus RTU.

2.7 Modbus TCP and Modbus RTU via ES module

Ethernet-to-serial (ES) module converts the communication between Ethernet and serial interface. It may often be necessary to read Modbus RTU data from slaves connected to the local serial line. The device configuration offers two different options:

Without conversion RTU <−> TCP:
RTU − request 01 04 12 00 00 02 74 B3
TCP − request 00 00 00 00 00 06 01 04 12 00 00 02

With conversion RTU <−> TCP:
RTU − request 01 04 12 00 00 02 74 B3
TCP − request 01 04 12 00 00 02 74 B3

The RTU request remains unchanged as received, regardless of whether the RTU<->TCP conversion is enabled or disabled. The TCP request is converted to RTU if RTU<->TCP conversion is enabled. The response is also translated accordingly.

3 Modbus register card

Shown register block	Base address		Type
	DEZ	HEX	
Authentication	0	0x0000	Holding register
Real-time clock (RTC)	256	0x0100	Input/holding register
Identification	512	0x0200	Input register
Archive control block	768	0x0300	Input/holding register
Counter control block	1536	0x0600	Input/holding register
Configurable settings	1792	0x0700	Holding register
Read-only settings	2048	0x0800	Input register
Actual data	4096	0x1000	Input register
Electricity meter	8192	0x2000	Input register
Aggregated values	16384	0x4000	Input register
Residual current monitoring	19712	0x4D00	Input register
Max. requirement	19968	0x4E00	Input register
Power quality indices	20480	0x5000	Input register
Ripple control signals	21248	0x5300	Input register
Modbus master	24576	0x6000	Input register
Actual data - direct current and alternating current/direct current	25088	0x6200	Input register
Inputs and outputs	36864	0x9000	Input register
Actual data - PFC	40960	0xA000	Input register

3.1 0x0000 Authentication

If the authentication function of the device is enabled, the Modbus client may need to write the user name and PIN to a special Modbus register to unlock the communication. This function is disabled by default. Please refer to AppNote_0004, available online or via our support channels, for information on how to enable and control authentication options. Authentication functions in instruments have been generally available since FW version 3.0.

	Example	Encoding	Hexadecimal
PIN	123456789	32 bit unsigned	0x075BCD15
User name	Albert	ASCII string	0x41 0x6C 0x62 0x65 0x72 0x75 0x00

	PIN		User name						
	MSB	LSB	Character 1, 2	3, 4	5, 6	7, 8	9, 10	11, 12	13, '\0'
Address	0x0	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08
Data	0x075B	0xCD15	0x416C	0x6265	0x7275	0x0000	Indifferent		

If the **GUEST** user does not have **Modbus read** and/or **Modbus write** authorization, the following procedure is required.

1. Write a **user name** and a **PIN** of the user with **Modbus read** or **Modbus write** authorization in the register range 0 to 8, as shown in Tables 1 and 2. The **PIN** is coded as a 32-bit unsigned number and written in two registers. The **user name** is coded in the form of ASCII characters ending with 0 (NULL) and consisting of two letters per register. Both the **PIN** and the **user name** are expected to be in big-endian format. The **user name**, the **PIN** or both together must be sent in a single Modbus message.
2. Proceed as usual.
3. Write 0x00000000 in the **PIN** register - this will immediately block any potentially illegal communication. This happens automatically one hour after entering the **PIN**.

All Modbus login registers are only enabled for writing.

3.2 0x0100 Device real-time clock control (RTC)

The time can be read, set or adjusted using the following tabs and with correct authentication.
In contrast to setting, adjustment ensures that the time is set correctly with regard to the record and that its consistency is maintained. It prevents duplicate records and ensures the correct spacing if a forward adjustment is required. The "Adjust time" function sets the time to the user's desired value regardless of recording consistency, which is why all archives must be deleted.
The adjustment only works within a time difference of 26 hours between the device time and the set time. Requests to adjust the time with a larger difference are ignored. The successful adjustment should be checked by reading out and comparing the register content again. If the time difference is more than 26 hours, the time must be adjusted. All device archives are deleted when the time is set.

Assigned data	Base address		Size/Type	Encoding
	DEZ	HEX		
Retrieve/set Unix time	256	0x0100	64b	Unix time (ms)
Retrieve/set KMB time (GMT)	260	0x0104	64b	KMB time (GMT)
Call up/set KMB time locally	264	0x0108	64b	KMB time (local)
Retrieve/customize Unix time	272	0x0110	64b	Unix time (ms)
Retrieve/adjust KMB time (GMT)	276	0x0114	64b	KMB time (GMT)
Retrieve/customize KMB time (local)	280	0x0118	64b	KMB time (local)
Last set time	288	0x0120	64b	KMB time (GMT)
Last adjusted time	292	0x0124	64b	KMB time (GMT)
Time zone	296	0x0128	16b	0..24, 12 = GMT
Summertime	297	0x0129	16b	1 .. Aktiviert
Time sync. 1	298	0x012A	16b	0 – keine, 1 – PPS, 2 – PPM, 3 – NMEA, 4 – NTP, 5 – Freq
Time sync. 2	299	0x012B	16b	0x0F – DI, 0x80 – PPS/PPM, 0x40 – 1/0
NTP server	300	0x012C	32b	a.b.c.d

3.3 0x0150 Aggregation

Assigned data	Base address		Size/Type	Encoding
	DEZ	HEX		
U/I averaging procedure	336	0x0150	16b	0: fixed, 1: floating, 2: temporal
U/I evaluation interval	337	0x0151	16b	0: at interval, 1: delete by user
U/I averaging period	338	0x0152	32b	200 ms step
U/I min/max reset	340	0x0154	32b	see 'Reset procedure' below...
P/Q averaging method	342	0x0156	16b	0: fixed, 1: floating, 2: time function
P/Q evaluation interval	343	0x0157	16b	0: at interval, 1: delete by user
P/Q averaging time	344	0x0158	32b	200 ms step
P/Q min/max reset	346	0x015A	32b	see 'Reset procedure' below...
Requirement averaging procedure	348	0x015C	16b	0: fixed, 1: floating, 2: time function

Request evaluation interval	349	0x015D	16b	0: day, 1: week, 2: month, 3: quarter, 4: year
Request averaging time	350	0x015E	32b	Second
Requirement limit value (3p)	352	0x0160	32b, Float	W
***Ircm* averaging time**	354	0x0162	32b	200 ms step
***Ircm* min/max reset**	356	0x0164	32b	see 'Reset procedure' below...

Reset procedure:

0xFFFFFFFFFF: manual,

<60: seconds,

<60*60: minutes,

<86400: hours,

=86400: every day,

=86400*7: every week,

=86400*30: every month,

=86400*365: every year

3.4 0x200 Device identification

Assigned data	Base address		Size/Type	Encoding
	DEZ	HEX		
Runtime	512	0x0200	64b	KMB time
GMT time	516	0x0204	64b	KMB time
PROPS_TYP	520	0x0208	16b	
DEVICE_TYPE	521	0x0209	16b	
LOWER UNIT TYPE 1	522	0x020A	16b	
LOWER UNIT TYPE 2	523	0x020B	16b	
LOWER UNIT TYPE 3	524	0x020C	16b	
LOWER UNIT TYPE 4	525	0x020D	16b	
LOWER UNIT TYPE 5	526	0x020E	16b	
LOWER UNIT TYPE 6	527	0x020F	16b	
DEVICE_NUMBER	528	0x0210	32b	
Firmware version	530	0x0212	64b	a.b.c.d
Hardware version	534	0x0216	64b	a.b.0.0
Bootloader version	538	0x021A	64b	a.b.0.0
Active firmware modules	542	0x021E	32b	
Date and time of manufacture	544	0x0220	64b	KMB time
Date and time of the last calibration	548	0x0224	64b	KMB time
GUID (8 highest bytes)	552	0x0228	64b	u64
GUID (8 lowest bytes)	556	0x022C	64b	u64

Date and time of the last GUID generation	560	0x0230	64b	KMB time

PROPS_TYPES and DEVICES_TYPE

Below you will find a list of the most common device types. There may be other options that are not listed here. In this case, please contact our support team for further information. The props type defines a group (family) of similar instruments, the device type specifies the exact device, and the sub-device types 1 to 6 can specify detailed option information.

Props type 0x2001: IO module family

Device type: 0x101x IO-M 544

Device type: 0x102x IO-M 540

Props type 0x0030: MIEZ Poweranalyzer

Device type: 0x81xx MIEZ 3700x

Device type: 0x85xx MIEZ 37010

Props type 0x0050: MIEZ Poweranalyzer for DIN rail

Device type: 0x3xxx MIEZ 37020

Device type: 0x5xxx MIEZ 37020

Information about the version

FW, HW and BOOTLOADER version:

a is a generation number,

b is increased with each major update,

c is incremented with each public release,

d is an internal revision number.

Active firmware modules:

0x02 MIEZ Feature-Upgrade 21041 – Oscillogram+

0x20 MIEZ Feature-Upgrade 21040 – Power Quality

3.5 0x0300 Archive control block

The following section describes functions for reading previous values from archive files in the device. The functionality is available in devices with an internal archive where the UP module is activated in the firmware. The availability of the specified archived data is controlled via the following register control blocks for each archive type:

Archive type	Implemented	Base address	
		DEZ	HEX
Main archive	yes	768	**0x0300**
S-profile	x	784	**0x0310**
M-profile	x	800	**0x0320**
Protocol	x	816	**0x0330**
Main archive	x	832	**0x0340**
Voltage events	yes	848	**0x0350**
Electricity meter	yes	864	**0x0360**
reserved	x		
reserved	x		
reserved	x		
reserved	x		
General oscillograms	x	944	**0x03B0**
reserved	x		
Modbus	x	976	**0x03D0**
Histogram	x	992	**0x03E0**
Voltage collapse	x	1008	**0x03F0**
Event log	yes	1024	**0x0400**
Trends	x	1040	**0x0410**
H2M (SP12 only)	yes	1056	**0x0420**

The control registers are defined as follows for each archive. Modbus function 4 is supported to read the value and Modbus function 16 is supported to write the value. The following table shows an example of the main archive registers.

Archive type	Base address		Size	Type	Function 16	
Main archive	DEZ	HEX			Value	**Action**
Recording time	768	0x030 0	u64	KMB time (R/W)	0x1 0x2 0x3- 0xFF(..)FE 0xFF(..)FF	**Go to the next data record** **Go to the previous data record** **Go to the next data record after ... Go** **Go to the latest data record with auto-scroll**
For the first time	772	0x030	u64	KMB time	**N/V**	
For the last time	776	0x030	u64	KMB time	**N/V**	
Number of data sets	780	0x030 C	u32		0xFF(..)FF	**Delete archive**
Recording interval	782	0x030 E	u32	ms	**N/V**	

Archive values are read out using a customised Modbus function 100 (average or actual value), 101 (minimum value) and 102 (maximum value) via the same register set as for

actual data (Modbus function 4). If a value for a checked quantity is not available in the archive or is not defined at all, the (floating point or double) non-numerical value is returned in the respective register. If no command is written to the corresponding recording time register (0x0300, 0x0310, 0x0320...) for a period of 60 seconds, it automatically points to the time of the last recording.
The supported values are implemented in the respective register blocks, starting with

- - 0x1000, 0x1100, 0x1200 and 0x1300 for the main archive (function 100, 101, 102),
- - 0x2000, 0x2400, 0x2800 and 0x2B00 for the electricity meter archive (function 100),
- - 0x5100-0x5112 for flicker values from the main archive (function 100, 101, 102),
- - 0x532A-0x5330 for RCS level values from the main archive (function 100, 101, 102),
- - 0x5500 for the voltage event archive. If several events are stored with the same timestamp, the first of them is listed when its timestamp is accessed. Write 0x01 or 0x02 to register 0x0350 to list others. (function 100),
- - 0x6200-0x6206 for DC components of the voltages from the main archive (function 100, 101, 102).

3.6 0x0600 Resetting values

Resetting time-dependent values such as AVG, min/max, energy meter, RCM and voltage event table. Use function 4 to read the time and function 16 to delete the values.

Assigned data	Base address		Size/Type	Function 16
	DEZ	HEX		
Last energy meter deletion time	1536	0x0600	u32, KMB time	Write something to reset
Last AVG, min/max U/I deletion time	1538	0x0602	u32, KMB time	Write something to reset
Last AVG, min/max P/Q deletion time	1540	0x0604	u32, KMB time	Write something to reset
Last request deletion time	1542	0x0606	u32, KMB time	Write something to reset
Last RCM deletion time	1544	0x0608	u32, KMB time	Write something to reset
Last voltage event table deletion time	1546	0x060A	u32, KMB time	Write something to reset

3.7 0x0630 Reset to factory settings

Resets the device to the factory default configuration. All user-defined settings and recordings except for the communication parameters are reset to the factory settings.

Assigned data	Base address		Size/Type	Function 16
	DEZ	HEX		
Time of the last configuration change	1584	0x0630	u32, KMB time	Reset to factory settings: write 0xFFFF0001

3.8 0x0700 Configurable settings

The configurable settings, as shown in the following table, can be changed using Modbus function 16 (write multiple registers). When the device receives a message with this function, all associated registers are saved. If necessary, the soft erase action is performed before sending a response to the request. The need for this action results from the change of certain registers - see column "Soft Erase". The change is then also written to the device log so that it can be accessed later.

Assigned data	Base address		Size/Type	Soft Erase
	DEZ	HEX		
Connection type	1792	0x0700	16b	Yes
Connection mode	1793	0x0701	32b	Yes
Nominal frequency	1795	0x0703	32b, Float	Yes
Nominal voltage *Unom*	1797	0x0705	32b, Float	Yes
Nominal power *Pnom* (3P)	1799	0x0707	32b, Float	Yes
Primary VT	1801	0x0709	16b (Range 1 – 65535)	Yes
Secondary VT	1802	0x070A	16b (Range 1 – 65535)	Yes
Multiplier VT	1803	0x070B	32b, Float	Yes
Primary VTN	1805	0x070D	16b (Range 1 – 65535)	Yes
Secondary VTN	1806	0x070E	16b (Range 1 – 65535)	Yes
Multiplier VTN	1807	0x070F	32b, Float	Yes
Primary CT	1809	0x0711	16b	Yes
Secondary CT	1810	0x0712	16b	Yes
Multiplier CT	1811	0x0713	32b, Float	Yes
Primary CTN	1813	0x0715	16b	Yes
Secondary CTN	1814	0x0716	16b	Yes
Multiplier CTN	1815	0x0717	32b, Float	Yes
Nominal current Inom	1817	0x0719	32b, Float	Yes

3.9 0x0800 Read-only settings

If the device does not have a specific interface, there is no access to the corresponding addresses.

3.9.1 0x0800 COM1

- COM Modbus Master specifies which port is used for the Modbus master module when it is used. Indexed from zero, COM1 = 0, COM2 = 1.

- Device address: configurable address of the slave unit. 0 and 249..255 are reserved addresses.
- Baud rate: Communication speed in baud.
- Parity: 0 = none, 1 = even, 2 = odd.
- Data bit + parity: 0 = 8 data bits + no parity, 1 = 8 data bits + 1 parity bit (odd or even).
- Stop bit: 0 = one stop bit, 1 = two stop bits.

Assigned data	Base address		Size/Type
	DEZ	HEX	
COM Modbus Master	2048	0x0800	16b
Device address	2049	0x0801	16b
Baud rate	2050	0x0802	32b, uint
Parity	2052	0x0804	16b
Data bits + parity	2053	0x0805	16b
Stop bit	2054	0x0806	16b

3.9.2 0x0820 COM2

Assigned data	Base address		Size/Type
	DEZ	HEX	
Device address	2080	0x0820	16b
Baud rate	2081	0x0821	32b
Parity	2083	0x0823	16b
Data bits + parity	2084	0x0824	16b
Stop bit	2085	0x0825	16b

3.9.3 0x0840 ETH1

- DHCP: 0 = deactivated, 1 = activated

Assigned data	Base address address		Size/Type
	DEZ	HEX	
DHCP	2112	0x0840	**16b**
IP address	2113	0x0841	**32b**
Netmask	2115	0x0843	**32b**
Gateway	2117	0x0845	**32b**
KMB port	2119	0x0847	**16b**
Modbus port	2120	0x0848	**16b**
Web server port	2121	0x0849	**16b**
MAC PORT	2122	0x084A	**64b**

3.10 0x0900 MMB system configuration - local bus

- The registers 0x0982-0x0A18 are individual for each supply line and should be addressed via the Modbus address of the individual supply lines.

Assigned data	Base address address		Size/Type
	DEZ	HEX	
SN of the 1st configured (fce4)/non-configured (FCE3) module	2304	0x0900	**16b, R/W**
SN of the 2nd configured module on the local bus	2312	0x0908	**16b, R/W**
SN of the 3rd first configured module on the local bus	2320	0x0910	**16b, R/W**
SN of the 4th first configured module on the local bus	2328	0x0918	**16b, R/W**
SN of the 5th first configured module on the local bus	2336	0x0920	**16b, R/W**
Reserve 5	2337 - 2383	0x0921 -	
Device number	2384	0x0950	**16b, R**
DEVICE_TYPE	2385	0x0951	**16b, R**
PROPS_TYP	2386	0x0952	**16b, R**
Pv0	2387	0x0953	**16b, R**
Pv1	2388	0x0954	**16b, R**
Pv2	2389	0x0955	**16b, R**
Software version	2390	0x0956	**16b, R**
Hardware version	2391	0x0957	**16b, R**
Software modules	2392	0x0958	**16b, R**
DeviceAdr	2393	0x0959	**16b, R**
Bootloader version	2394	0x095A	**16b, R**
SUBDEVICE TYPE 1	2395	0x095B	**16b, R**
SUBDEVICE TYPE 2	2396	0x095C	**16b, R**
SUBDEVICE TYPE 3	2397	0x095D	**16b, R**
SUBDEVICE TYPE 4	2398	0x095E	**16b, R**
SUBDEVICE TYPE 5	2399	0x095F	**16b, R**
SUB-UNIT TYPE 6	2400	0x0960	**16b, R**
Number of current inputs	2401	0x0961	**16b, R**
Sn	2402	0x0962	**16b, R**
DEVICE_TYPE	2403	0x0963	**16b, R**
SUB UNIT TYPE	2404	0x0964	**16b, R**

SUB-DEVICE TYPE 2	2405	0x0965	**16b, R**
Modbus address of the first supply line	2416	0x0970	**16b, R/W**
Averaging mode	2417	0x0971	**16b, R/W**
Averaging interval	2418	0x0972	**32b, R/W**
Averaging auto-erase	2420	0x0974	**32b, R/W**
Activated/Deactivated	2432	0x0980	**16b, R/W**
Connection	2433	0x0981	**16b, R/W**
Primary CT - CH1	2434	0x0982	**32b, Float,**
Primary CT - CH2	2436	0x0984	**32b, Float,**
Primary CT - CH3	2438	0x0986	**32b, Float,**
Primary CT - CH4	2440	0x0988	**32b, Float,**
Secondary CT - CH1	2442	0x098A	**32b, Float,**
Secondary CT - CH2	2444	0x098C	**32b, Float,**
Secondary CT - CH3	2446	0x098E	**32b, Float,**
Secondary CT - CH4	2448	0x0990	**32b, Float,**
Multiplier CT - CH1	2450	0x0992	**32b, Float,**
Multiplier CT - CH2	2452	0x0994	**32b, Float,**
Multiplier CT - CH3	2454	0x0996	**32b, Float,**
Multiplier CT - CH4	2456	0x0998	**32b, Float,**
Nominal current Inom1	2458	0x099A	**32b, Float,**
Nominal current Inom2	2460	0x099C	**32b, Float,**
Nominal current Inom3	2462	0x099E	**32b, Float,**
Rated current Inom4	2464	0x09A0	**32b, Float,**
Polarity - CH1	2466	0x09A2	**16b, R/W**
Polarity - CH2	2467	0x09A3	**16b, R/W**
Polarity - CH3	2468	0x09A4	**16b, R/W**
Polarity - CH4	2469	0x09A5	**16b, R/W**
Current extension module name	2470 - 2489	0x09A6 -	**8b, R/W**
CH1 name	2495 - 2514	0x09BF -	**8b, R/W**
CH2 name	2520 - 2539	0x09D8 -	**8b, R/W**
CH3 name	2545 - 2559	0x09F1 -	**8b, R/W**
CH4 name	2565 - 2584	0x0A0A -	**8b, R/W**

3.11 0x0C00ELOG

ELOG registers can be accessed via Modbus function 100 to read out the history.

Assigned data	Base address		Size/Type
	DEZ	HEX	
Priority	3072	0x0C00	**16b**
Severity	3071	0x0C01	**16b**
ID	3074	0x0C02	**32b**

3.12 0x0D00 PQ configuration

The configurable settings, as shown in the following table, can be changed using Modbus function 16 (write multiple registers). When the device receives a message with this function, all associated registers are saved. If necessary, the soft erase action is performed before sending a response to the request. The need for this action results from the change of certain registers - see column "Soft Erase". The change is then also written to the device log so that it can be accessed later.

Assigned data	Base address		Size/Type	description
	DEZ	HEX		
Configuration	3328	0x0D00	32b, R/W	**0x00 = 3P voltage events 0x01 = 1P voltage events 0x02 = Floating reference voltage 0x04 = Create RVC events 0x08 - Reserved 0x10+0x20 == 0=basic/1=extended/2=complete 0x80000000=Support of the floating reference voltage 0x40000000=Support-RVC 0x20000000=Support basic/extended/complete**
Recording interval	3330	0x0D02	32b, R/W	
Frequency 100% upper limit	3332	0x0D04	32b, Float, R/W	
Frequency 100% lower limit	3334	0x0D06	32b, Float, R/W	
Frequency 95% upper limit	3336	0x0D08	32b, Float, R/W	
Frequency 95% lower limit	3338	0x0D0A	32b, Float, R/W	
Voltage 100% upper limit	3340	0x0D0C	32b, Float, R/W	
Voltage 100% lower limit	3342	0x0D0E	32b, Float, R/W	
Voltage 95% upper limit	3344	0x0D10	32b, Float, R/W	
Voltage 95% lower limit	3346	0x0D12	32b, Float, R/W	
Voltage unbalance 100% limit	3348	0x0D14	32b, Float, R/W	
Voltage unbalance 95% limit	3350	0x0D16	32b, Float, R/W	
Short-term flicker limit	3352	0x0D18	32b, Float, R/W	
Long-term flicker limit	3354	0x0D1A	32b, Float, R/W	
RCS limit	3356	0x0D1C	32b, Float, R/W	
Voltage THD limit	3358	0x0D1E	32b, Float, R/W	
Voltage event - voltage increase limit	3360	0x0D20	32b, Float, R/W	
Voltage event - sag limit	3362	0x0D22	32b, Float, R/W	
Voltage event - interruption limit	3364	0x0D24	32b, Float, R/W	
Voltage event - hysteresis	3366	0x0D26	32b, Float, R/W	
Overcurrent limit	3368	0x0D28	32b, Float, R/W	
Threshold value for rapid voltage changes	3370	0x0D2A	32b, Float, R/W	
Hysteresis for rapid voltage changes	3372	0x0D2C	32b, Float, R/W	
Evaluation time	3374	0x0D2E	16b, R/W	**in minutes Default value: 15**
for short-term flicker	3375	0x0D2F	16b, R/W	**Multiples of the short-term flicker default value: 8 (8×15 = 2 hours)**
Evaluation time	3376	0x0D30	16b, R/W	**Multiples of the short-term flicker standard value: 4 (4×15 = 1 hour)**
for long-term flicker	3377	0x0D31	32b, Float, R/W	
Flicker evaluation offset time	3379	0x0D33	32b, Float, R/W	

Limit value for the 2nd harmonic	3381 – 3421	0x0D35-0x0D5D	32b, Float, R/W	
Limit value for the 3rd harmonic	3423	0x0D5F	32b, Float, R/W	

3.13 0x1000 Actual data

3.13.1 0x1000 Released actual data

The **configuration change counter** counts the number of configuration changes and can therefore be used to recognise every change in the device configuration.

Error code - 32 bits indicates the current status of device operation - value 0 of a specified bit indicates correct operation, value 1 indicates a possible problem**.**

0x01 RAM error

0x02 Device configuration error

0x04 Device calibration error

0x08 Error in the remote communication module (Wifi/Zigbee)

0x10 Clock error (RTC)

0x80 Device archive error

0x100 Flash memory error

0x200 Display error

Phase sequence recognises a current phase sequence.

0 - Unknown

1 - Correct phase sequence 1-2-3

-1 - Inverted phase sequence 1-3-2

Sampling overflow or **underflow flags** are set if one or more voltage or current channels measure a signal that is outside the channel linearity range. In this case, the accuracy is affected and the measured variables must be used carefully.

0x01, 0x02, 0x04, 0x08 – Sampled voltage value in channel 1,2,…,4 outside the range

0x10, 0x20, 0x40, 0x80, 0x100, 0x200, 0x400, 0x800 – Sampled current value in channel 1,2,…,4 outside the range

Flags – Indicate whether and which actual data measurement is influenced by voltage or other events

0x01, 0x02, 0x04, 0x08 – Voltage, current and power in channel 1,2,…,4

0x10, 0x20, 0x40, 0x80 – Short-term flicker in channel 1,2,...,4

0x100, 0x200, 0x400, 0x800 – Long-term flicker in channel 1,2,...,4

0x1000 – Frequency

0x2000 – Automatic current measuring range switching

Assigned data	Base address		Size/Type
	DEZ	HEX	
Configuration change counter	4096	0x1000	**16b**
Error codePhase sequence	4097	0x1001	**32b**
Actual frequency (f)	4099	0x1003	**16b**
10-second frequency (f10s)	4100	0x1004	**32b, Float**
Sampling overflow/underflow flags (per	4102	0x1006	**32b, Float**
Flags	4104	0x1008	**16b**
Configuration change counter	4105	0x1009	**32b**

3.13.2 0x1100 Actual voltage readings

*THD U*1−*N* = Harmonic distortion, *TID U*1−*N* = interharmonic distortion, *CFU 1*−*N* = Crest factor

Assigned data	Base address		Size/Type
	DEZ	HEX	
***ULN* 1**	4352	0x1100	**32b, Float**
***ULN* 2**	4354	0x1102	**32b, Float**
***ULN* 3**	4356	0x1104	**32b, Float**
UN	4358	0x1106	**32b, Float**
***ULL*1**	4360	0x1108	**32b, Float**
***ULL*2**	4362	0x110A	**32b, Float**
***ULL*3**	4364	0x110C	**32b, Float**
***THD U*1**	4366	0x110E	**32b, Float**
***THD U*2**	4368	0x1110	**32b, Float**
***THD U*3**	4370	0x1112	**32b, Float**
THD UN	4372	0x1114	**32b, Float**
***TID U*1**	4374	0x1116	**32b, Float**
***TID U*2**	4376	0x1118	**32b, Float**
***TID U*3**	4378	0x111A	**32b, Float**
TID UN	4380	0x111C	**32b, Float**
***CFU* 1**	4382	0x111E	**32b, Float**
***CFU* 2**	4384	0x1120	**32b, Float**
***CFU* 3**	4386	0x1122	**32b, Float**
CFUN	4388	0x1124	**32b, Float**
***Ufh*1**	4390	0x1126	**32b, Float**
***Ufh*2**	4392	0x1128	**32b, Float**
***Ufh*3**	4394	0x112A	**32b, Float**
UfhN	4396	0x112C	**32b, Float**
***φu*1**	4398	0x112E	**32b, Float**
***φu*2**	4400	0x1130	**32b, Float**
***φu*3**	4402	0x1132	**32b, Float**
φuN	4404	0x1134	**32b, Float**
***u*2**	4406	0x1136	**32b, Float**
positive Sequenz *U*1	4408	0x1138	**32b, Float**
negative Sequenz *U*2	4410	0x113A	**32b, Float**
Nullsequenz *U*0	4412	0x113C	**32b, Float**
***TDDU* 1**	4414	0x113E	**32b, Float**
***TDDU* 2**	4416	0x1140	**32b, Float**

***TDDU* 3**	4418	0x1142	**32b, Float**
***TDDU* 4**	4420	0x1144	**32b, Float**

3.13.3 0x1200 Actual current readings

Assigned data	Base address		Size/Type
	DEZ	HEX	
I1	4608	0x1200	**32b, Float**
I2	4610	0x1202	**32b, Float**
I3IN or I4	4612	0x1204	**32b, Float**
INc = sampled values(I1, I2, I3)	4614	0x1206	**32b, Float**
IP Ec = Samples(I1, I2, I3, IN)	4616	0x1208	**32b, Float**
THD I1	4618	0x120A	**32b, Float**
THD I2	4620	0x120C	**32b, Float**
THD I3	4622	0x120E	**32b, Float**
THD IN	4624	0x1210	**32b, Float**
TID I1	4626	0x1212	**32b, Float**
TID I2	4628	0x1214	**32b, Float**
TID I3	4630	0x1216	**32b, Float**
TID IN	4632	0x1218	**32b, Float**
CFI1	4634	0x121A	**32b, Float**
CFI2	4636	0x121C	**32b, Float**
CFI3	4638	0x121E	**32b, Float**
CFIN	4640	0x1220	**32b, Float**
Ifh1	4642	0x1222	**32b, Float**
Ifh2	4644	0x1224	**32b, Float**
Ifh3	4646	0x1226	**32b, Float**
IfhN	4648	0x1228	**32b, Float**
φi1	4650	0x122A	**32b, Float**
φi2	4652	0x122C	**32b, Float**
φi3	4654	0x122E	**32b, Float**
φiN	4656	0x1230	**32b, Float**
i2	4658	0x1232	**32b, Float**
positive sequence I1	4660	0x1234	**32b, Float**
negative sequence I2	4662	0x1236	**32b, Float**
Zero sequence I0	4664	0x1238	**32b, Float**
3I	4666	0x123A	**32b, Float**
TDDI1	4668	0x123C	**32b, Float**
TDDI2	4670	0x123E	**32b, Float**
TDDI3	4672	0x1240	**32b, Float**
TDDI4	4674	0x1242	**32b, Float**
I1	4676	0x1244	**32b, Float**

3.13.4 0x1300 Actual performance readings

0x1300 Power factor and cos(φ)

Assigned data	Base address		Size/Type
	DEZ	HEX	
3*PF*	4864	0x1300	**32b, Float**
3*cos*(*φ*)	4866	0x1302	**32b, Float**
***PF*1**	4868	0x1304	**32b, Float**
***PF*2**	4870	0x1306	**32b, Float**
***PF*3**	4872	0x1308	**32b, Float**
PFN	4874	0x130A	**32b, Float**
***cos*(*φ*)1**	4876	0x130C	**32b, Float**
***cos*(*φ*)2**	4878	0x130E	**32b, Float**
***cos*(*φ*)3**	4880	0x1310	**32b, Float**
cos*(*φ*)*N	4882	0x1312	**32b, Float**

0x1314 Active, reactive, apparent and distortion power

Assigned data	Base address		Size/Type
	DEZ	HEX	
3P	4884	0x1314	**32b, Float**
3Q	4886	0x1316	**32b, Float**
3S	4888	0x1318	**32b, Float**
3Pfh3Qfh	4890	0x131A	**32b, Float**
3D	4892	0x131C	**32b, Float**
P1	4894	0x131E	**32b, Float**
P2	4896	0x1320	**32b, Float**
P3	4898	0x1322	**32b, Float**
PN	4900	0x1324	**32b, Float**
Q1	4902	0x1326	**32b, Float**
Q2	4904	0x1328	**32b, Float**
Q3	4906	0x132A	**32b, Float**
QN	4908	0x132C	**32b, Float**
S1	4910	0x132E	**32b, Float**
S2	4912	0x1330	**32b, Float**
S3	4914	0x1332	**32b, Float**
SN	4916	0x1334	**32b, Float**
Pfh1	4918	0x1336	**32b, Float**
Pfh2	4920	0x1338	**32b, Float**
Pfh3	4922	0x133A	**32b, Float**
PfhN	4924	0x133C	**32b, Float**
Qfh1	4926	0x133E	**32b, Float**
Qfh2	4928	0x1340	**32b, Float**
Qfh3	4930	0x1342	**32b, Float**
QfhN	4932	0x1344	**32b, Float**
D1	4934	0x1346	**32b, Float**
D2	4936	0x1348	**32b, Float**
D3	4938	0x134A	**32b, Float**
DN	4940	0x134C	**32b, Float**
3P	4942	0x134E	**32b, Float**

0x1350 Active power import/export

The device supplies different data depending on the Modbus function used:

Function 3 provides AVG values (average values) according to the device setting.

Function 4 provides current values (200 ms/10 periods).

Function 100 is a user-defined Modbus function that returns the AVG value from the main archive.

Function 101 is a user-defined Modbus function that returns the MIN value from the main archive.

Function 102 is a user-defined Modbus function that returns the MAX value from the main archive.

Assigned data	Base address		Size/Type
	DEZ	HEX	
3*P*+	4944	0x1350	**32b, Float**
3P-	4946	0x1352	**32b, Float**
***P*1+**	4948	0x1354	**32b, Float**
P2+	4950	0x1356	**32b, Float**
P3+	4952	0x1358	**32b, Float**
P4+	4954	0x135A	**32b, Float**
***P*1-**	4956	0x135C	**32b, Float**
P2-	4958	0x135E	**32b, Float**
P3-	4960	0x1360	**32b, Float**
P4-	4962	0x1362	**32b, Float**

0x1364 Active power in four quadrants

The device supplies different data depending on the Modbus function used. Details can be found in chapter 3.13.4.

Assigned data	Base address		Size/Type
	DEZ	HEX	
3Pi	4964	0x1364	**32b, Float**
3Pii	4966	0x1366	**32b, Float**
3Piii	4968	0x1368	**32b, Float**
3Piv	4970	0x136A	**32b, Float**
P1i	4972	0x136C	**32b, Float**
P2i	4974	0x136E	**32b, Float**
P3i	4976	0x1370	**32b, Float**
P4i	4978	0x1372	**32b, Float**
P1ii	4980	0x1374	**32b, Float**
P2ii	4982	0x1376	**32b, Float**
P3ii	4984	0x1378	**32b, Float**
P4ii	4986	0x137A	**32b, Float**
P1iii	4988	0x137C	**32b, Float**
P2iii	4990	0x137E	**32b, Float**
P3iii	4992	0x1380	**32b, Float**
P4iii	4994	0x1382	**32b, Float**
P1iv	4996	0x1384	**32b, Float**
P2iv	4998	0x1386	**32b, Float**

P3iv	5000	0x1388	**32b, Float**
P4iv	5002	0x138A	**32b, Float**
|3P|	5004	0x138C	**32b, Float**
|P1|	5006	0x138E	**32b, Float**
|P2|	5008	0x1390	**32b, Float**
|P3|	5010	0x1392	**32b, Float**
|P4|	5012	0x1394	**32b, Float**

0x1390 Reactive power import/export and inductive/capacitive

The device supplies different data depending on the Modbus function used. Details can be found in chapter 3.13.4.

Assigned data	Base address		Size/Type
	DEZ	HEX	
3QL	5008	0x1390	**32b, Float**
3QC	5010	0x1392	**32b, Float**
3Q+	5012	0x1394	**32b, Float**
3Q-	5014	0x1396	**32b, Float**
Q1L	5016	0x1398	**32b, Float**
Q2L	5018	0x139A	**32b, Float**
Q3L	5020	0x139C	**32b, Float**
Q4L	5022	0x139E	**32b, Float**
Q1C	5024	0x13A0	**32b, Float**
Q2C	5026	0x13A2	**32b, Float**

Assigned data	Base address		Size/Type
	DEZ	HEX	
Q3C	5028	0x13A4	**32b, Float**
Q4C	5030	0x13A6	**32b, Float**
Q1+	5032	0x13A8	**32b, Float**
Q2+	5034	0x13AA	**32b, Float**
Q3+	5036	0x13AC	**32b, Float**
Q4+	5038	0x13AE	**32b, Float**
Q1-	5040	0x13B0	**32b, Float**
Q2-	5042	0x13B2	**32b, Float**
Q3-	5044	0x13B4	**32b, Float**
Q4-	5046	0x13B6	**32b, Float**

0x13B8 Blindleistung in vier Quadranten Das Gerät liefert je nach der verwendeten Modbus-Funktion unterschiedliche Daten. Einzelheiten finden Sie in Kapitel 3.13.4.

Assigned data	Base address		Size/Type
	DEZ	HEX	
3Qi	5048	0x13B8	**32b, Float**
3Qii	5050	0x13BA	**32b, Float**
3Qiii	5052	0x13BC	**32b, Float**
3Qiv	5054	0x13BE	**32b, Float**
Q1i	5056	0x13C0	**32b, Float**
Q2i	5058	0x13C2	**32b, Float**
Q3i	5060	0x13C4	**32b, Float**
Q4i	5062	0x13C6	**32b, Float**
Q1ii	5064	0x13C8	**32b, Float**

Q2ii	5066	0x13CA	**32b, Float**
Q3ii	5068	0x13CC	**32b, Float**
Q4ii	5070	0x13CE	**32b, Float**
Q1iii	5072	0x13D0	**32b, Float**
Q2iii	5074	0x13D2	**32b, Float**
Q3iii	5076	0x13D4	**32b, Float**
Q4iii	5078	0x13D6	**32b, Float**
Q1iv	5080	0x13D8	**32b, Float**
Q2iv	5082	0x13DA	**32b, Float**
Q3iv	5084	0x13DC	**32b, Float**
Q4iv	5086	0x13DE	**32b, Float**

3.13.5 0x1400 Current and voltage harmonics (magnitudes, angles)

Assigned data	Base address		Size/Type
	DEZ	HEX	
U1h1...h50	5120...5218	0x1400...0x1462	**32b, Float**
U2h1...h50	5220...5318	0x1464...0x14C6	**32b, Float**
U3h1...h50	5320...5418	0x14C8...0x152A	**32b, Float**
UNh1...h50	5420...5518	0x152C...0x158E	**32b, Float**
φU1h1...h50	5520...5618	0x1590...0x15F2	**32b, Float**
φU2h1...h50	5620...5718	0x15F4...0x1656	**32b, Float**
φU3h1...h50	5720...5818	0x1658...0x16BA	**32b, Float**
φUNh1...h50	5820..5918	0x16BC...0x171E	**32b, Float**
I1h1...h50	5920...6018	0x1720...0x1782	**32b, Float**
I2h1...h50	6020...6118	0x1784...0x17E6	**32b, Float**
I3h1...h50	6120...6218	0x17E8...0x184A	**32b, Float**
INh1...h50	6220...6318	0x184C...0x18AE	**32b, Float**
∆φI1h1...h50	6320...6418	0x18B0...0x1912	**32b, Float**
∆φI2h1...h50	6420...6518	0x1914...0x1976	**32b, Float**
∆φI3h1...h50	6520...6618	0x1978...0x19DA	**32b, Float**
∆φINh1...h50	6620...6718	0x19DC...0x1A3E	**32b, Float**

3.13.6 0x1B00 Interharmonics (with active PQ module)

Assigned data	Base address		Size/Type
	DEZ	HEX	
U1ih1...ih50	6812...6910	0x1B00...0x1B62	**32b, Float**
U2ih1...ih50	6912...7010	0x1B64...0x1BC6	**32b, Float**
U3ih1...ih50	7012...7110	0x1BC8...0x1C2A	**32b, Float**
UNih1...ih50	7112...7210	0x1C2C...0x1C8E	**32b, Float**
I1ih1...ih50	7212...7310	0x1C90...0x1CF2	**32b, Float**
I2ih1...ih50	7312...7410	0x1CF4...0x1D56	**32b, Float**
I3ih1...ih50	7412...7510	0x1D58...0x1DBA	**32b, Float**
INih1...ih50	7512...7610	0x1DBC...0x1E1E	**32b, Float**

3.13.7 0x1F00 Harmonics of local bus devices (SP12 only)

Base address

Assigned data	DEZ	HEX	Size/Type
U1h5	7936	0x1F00	**32b, Float**
U1h7	7938	0x1F02	**32b, Float**
U1h9	7940	0x1F04	**32b, Float**
U1h11	7942	0x1F06	**32b, Float**
U1h13	7944	0x1F08	**32b, Float**
U2h5	7946	0x1F0A	**32b, Float**
U2h7	7948	0x1F0C	**32b, Float**
U2h9	7950	0x1F0E	**32b, Float**
U2h11	7952	0x1F10	**32b, Float**
U2h13	7954	0x1F12	**32b, Float**
U3h5	7956	0x1F14	**32b, Float**
U3h7	7958	0x1F16	**32b, Float**
U3h9	7960	0x1F18	**32b, Float**
U3h11	7962	0x1F1A	**32b, Float**
U3h13	7964	0x1F1C	**32b, Float**
I1h5	7966	0x1F1E	**32b, Float**
I1h7	7968	0x1F20	**32b, Float**
I1h9	7970	0x1F22	**32b, Float**
I1h11	7972	0x1F24	**32b, Float**
I1h13	7974	0x1F26	**32b, Float**
I2h5	7976	0x1F28	**32b, Float**
I2h7	7978	0x1F2A	**32b, Float**
I2h9	7980	0x1F2C	**32b, Float**
I2h11	7982	0x1F2E	**32b, Float**
I2h13	7984	0x1F30	**32b, Float**
I3h5	7986	0x1F32	**32b, Float**
I3h7	7988	0x1F34	**32b, Float**
I3h9	7990	0x1F36	**32b, Float**
I3h11	7992	0x1F38	**32b, Float**
I3h13	7994	0x1F3A	**32b, Float**

3.14 0x2000 Electricity meter readings

3.14.1 0x2000 Two quadrants (2Q, import/export, **inductive/capacitive**), **three-phase active and reactive energy**

These total energies are most frequently required in all three-phase systems.

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
3-phase active energy	Importeed	3EP+	8192	0x2000	**64b, double**
	exported	3EP-	8196	0x2004	**64b, double**
3-phase reactive energy	inductive	3EQL	8200	0x2008	**64b, double**
	capacitive	3EQC	8204	0x200C	**64b, double**

3.14.2 0x2010 Two quadrants (2Q, import/export), single-phase active energy

For a detailed overview of the energy flow, we also provide registers for each phase.

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
Active energy	Imported	EP1+	8208	0x2010	**64b, double**
		EP2+	8212	0x2014	**64b, double**
		EP3+	8216	0x2018	**64b, double**
		EP4+	8220	0x201C	**64b, double**
Active energy	exported	EP1-	8224	0x2020	**64b, double**
		EP2-	8228	0x2024	**64b, double**
		EP3-	8232	0x2028	**64b, double**
		EP4-	8236	0x202C	**64b, double**

3.14.3 0x2010 Two quadrants (2Q, inductive/capacitive), single-phase reactive energy

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
Reactive energy	inductive	EQL1	8240	0x2030	**64b, double**
		EQL2	8244	0x2034	**64b, double**
		EQL3	8248	0x2038	**64b, double**
		EQL4	8252	0x203C	**64b, double**
Reactive energy	capacitive	EQC1	8256	0x2040	**64b, double**
		EQC2	8260	0x2044	**64b, double**
		EQC3	8264	0x2048	**64b, double**
		EQC4	8268	0x204C	**64b, double**

3.14.4 0x2400 Four quadrants (4Q), three-phase reactive energy

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
3-phase reactive energy	imported inductive	3EQL+	9216	0x2400	**64b, double**
	exported inductive	3EQL-	9220	0x2404	**64b, double**
	imported capacitive	3EQC+	9224	0x2408	**64b, double**
	exported capacitive	3EQC-	9228	0x240C	**64b, double**

3.14.5 0x2410 Four quadrants (4Q), single-phase reactive energy

For a detailed overview of the reactive energy flow, we also provide registers for each phase, separated by the flow direction of the active power in each phase.

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
Reactive energy	imported inductive	EQL1+	9232	0x2410	**64b, double**
		EQL2+	9236	0x2414	**64b, double**
		EQL3+	9240	0x2418	**64b, double**
		EQL4+	9244	0x241C	**64b, double**
Reactive energy	exported inductive	EQL1-	9248	0x2420	**64b, double**
		EQL2-	9252	0x2424	**64b, double**
		EQL3-	9256	0x2428	**64b, double**
		EQL4-	9260	0x242C	**64b, double**
Reactive energy	imported capacitive	EQC1+	9264	0x2430	**64b, double**
		EQC2+	9268	0x2434	**64b, double**
		EQC3+	9272	0x2438	**64b, double**
		EQC4+	9276	0x243C	**64b, double**
Reactive energy	exported capacitive	EQC1-	9280	0x2440	**64b, double**
		EQC2-	9284	0x2444	**64b, double**
		EQC3-	9288	0x2448	**64b, double**
		EQC4-	9292	0x244C	**64b, double**

3.14.6 0x2800 Two quadrants (2Q, import/export), three-phase active energy per tariff

Tariff (TOU) represents a time interval during the day with a specific energy rate. The number of such registers is specified by the configuration. The number of tariffs can be configured in the device configuration between 1 and 6 (T1, T2,... T6). For multi-phase devices, these tariff summary registers only count the energy consumption in phases 1, 2 and 3.

Energy	Direction	Assigned data	Base address		Size/Type
			DEZ	HEX	
Active energy	Import	T1.3EP+	10240	0x2800	**64b, double**
		T2.3EP+	10244	0x2804	**64b, double**
		T3.3EP+	10248	0x2808	**64b, double**
		T4.3EP+	10252	0x280C	**64b, double**
		T5.3EP+	10256	0x2810	**64b, double**
		T6.3EP+	10260	0x2814	**64b, double**
Active energy	Export	T1.3EP-	10264	0x2818	**64b, double**
		T2.3EP-	10268	0x281C	**64b, double**
		T3.3EP-	10272	0x2820	**64b, double**
		T4.3EP-	10276	0x2824	**64b, double**
		T5.3EP-	10280	0x2828	**64b, double**
		T6.3EP-	10284	0x282C	**64b, double**

3.14.7 0x2830 Two quadrants (2Q, inductive/capacitive), three-phase reactive energy per tariff

Energy	Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
Reactive energy	inductive	T1.3EQL	10288	0x2830	**64b, double**
		T2.3EQL	10292	0x2834	**64b, double**
		T3.3EQL	10296	0x2838	**64b, double**
		T4.3EQL	10300	0x283C	**64b, double**
		T5.3EQL	10304	0x2840	**64b, double**
		T6.3EQL	10308	0x2844	**64b, double**
Reactive energy	capacitive	T1.3EQC	10312	0x2848	**64b, double**
		T2.3EQC	10316	0x284C	**64b, double**
Reactive energy	capacitive	T3.3EQC	10320	0x2850	**64b, double**
		T4.3EQC	10324	0x2854	**64b, double**
		T5.3EQC	10328	0x2858	**64b, double**
		T6.3EQC	10332	0x285C	**64b, double**

3.14.8 0x2B00 Four quadrants (4Q), three-phase reactive energy per tariff

For multi-phase devices, these tariff summary registers only count the energy consumption in phases 1, 2 and 3.

Energy	Direction/Character	Assigned data	Base address		Size/Type
			DEZ	HEX	
Reactive energy	inductive import	T1.3EQL+	11008	0x2B00	**64b, double**
		T2.3EQL+	11012	0x2B04	**64b, double**
		T3.3EQL+	11016	0x2B08	**64b, double**
		T4.3EQL+	11020	0x2B0C	**64b, double**
		T5.3EQL+	11024	0x2B10	**64b, double**
		T6.3EQL+	11028	0x2B14	**64b, double**
Reactive energy	inductive export	T1.3EQL-	11032	0x2B18	**64b, double**
		T2.3EQL-	11036	0x2B1C	**64b, double**
		T3.3EQL-	11040	0x2B20	**64b, double**
		T4.3EQL-	11044	0x2B24	**64b, double**
		T5.3EQL-	11048	0x2B28	**64b, double**
		T6.3EQL-	11052	0x2B2C	**64b, double**
Reactive energy	capacitive import	T1.3EQC+	11056	0x2B30	**64b, double**
		T2.3EQC+	11060	0x2B34	**64b, double**
		T3.3EQC+	11064	0x2B38	**64b, double**
		T4.3EQC+	11068	0x2B3C	**64b, double**
		T5.3EQC+	11072	0x2B40	**64b, double**
		T6.3EQC+	11076	0x2B44	**64b, double**
Reactive energy	capacitive import	T1.3EQC-	11080	0x2B48	**64b, double**
		T2.3EQC-	11084	0x2B4C	**64b, double**
		T3.3EQC-	11088	0x2B50	**64b, double**
		T4.3EQC-	11092	0x2B54	**64b, double**
		T5.3EQC-	11096	0x2B58	**64b, double**
		T6.3EQC-	11100	0x2B5C	**64b, double**

3.15 0x4000 Aggregated values

This block contains several register blocks containing minimum, maximum, average and actual values for the most frequently required quantities. Sections 3.15.1, 3.15.2, 3.15.3 and 3.15.4 are only available for some devices.

3.15.1 0x4200-0x42FF Timestamp of the maximum value block

This block specifies the time of the events (time stamp for maximum average values since reset (chap. 3.15.3).

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
Time from max. U1	16952	4238	32b, KMB time	s
Time from max. U2	16954	423A	32b, KMB time	s
Time from max. U3	16956	423C	32b, KMB time	s
Time from max. U12	16958	423E	32b, KMB time	s
Time from max. U23	16960	4240	32b, KMB time	s
Time from max. U31	16962	4242	32b, KMB time	s
Time from max. I1	16964	4244	32b, KMB time	s
Time from max. I2	16966	4246	32b, KMB time	s
Time from max. I3	16968	4248	32b, KMB time	s
Time from max. IN	16970	424A	32b, KMB time	s
Time from max. P1	16972	424C	32b, KMB time	s

Time from max. P2	16974	424E	32b, KMB time	s
Time from max. P3	16976	4250	32b, KMB time	s
Time from max. 3P	16978	4252	32b, KMB time	s
Time from max. S1	16980	4254	32b, KMB time	s
Time from max. S2	16982	4256	32b, KMB time	s
Time from max. S3	16984	4258	32b, KMB time	s
Time from max. 3S	16986	425A	32b, KMB time	s
Time from max. Q1	16988	425C	32b, KMB time	s
Time from max. Q2	16990	425E	32b, KMB time	s
Time from max. Q3	16992	4260	32b, KMB time	s
Time from max. 3Q	16994	4262	32b, KMB time	s
Time from max. CosPhi1	16996	4264	32b, KMB time	s
Time from max. CosPhi2	16998	4266	32b, KMB time	s
Time from max. CosPhi3	17000	4268	32b, KMB time	s
Time from max. frequency (f)	17002	426A	32b, KMB time	s
RESERVED				
Time from max. THD U1	17062	42A6	32b, KMB time	s
Time from max. THD U2	17064	42A8	32b, KMB time	s
Time from max. THD U3	17066	42AA	32b, KMB time	s
Time from max. THD I1	17068	42AC	32b, KMB time	s
Time from max. THD I2	17070	42AE	32b, KMB time	s
Time from max. THD I3	17072	42B0	32b, KMB time	s

3.15.2 0x4400-0x44FF Timestamp of the minimum value block

This block specifies the time of the events (time stamp for minimum average values since reset (chap. 3.15.4).

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
Time from min. U1	17464	4438	32b, KMB time	s
Time from min. U2	17466	443A	32b, KMB time	s
Time from min. U3	17468	443C	32b, KMB time	s
Time from min. U12	17470	443E	32b, KMB time	s
Time from min. U23	17472	4440	32b, KMB time	s
Time from min. U31	17474	4442	32b, KMB time	s
Time from min. I1	17476	4444	32b, KMB time	s
Time from min. I2	17478	4446	32b, KMB time	s
Time from min. I3	17480	4448	32b, KMB time	s
Time from min. IN	17482	444A	32b, KMB time	s
Time from min. P1	17484	444C	32b, KMB time	s
Time from min. P2	17486	444E	32b, KMB time	s
Time from min. P3	17488	4450	32b, KMB time	s
Time from min. 3P	17490	4452	32b, KMB time	s
Time from min. S1	17492	4454	32b, KMB time	s
Time from min. S2	17494	4456	32b, KMB time	s
Time from min. S3	17496	4458	32b, KMB time	s
Time from min. 3S	17498	445A	32b, KMB time	s
Time from min. Q1	17500	445C	32b, KMB time	s
Time from min. Q2	17502	445E	32b, KMB time	s
Time from min. Q3	17504	4460	32b, KMB time	s
Time from min. 3Q	17506	4462	32b, KMB time	s
Time from min. CosPhi1	17508	4464	32b, KMB time	s

Time from min. CosPhi2	17510	4466	32b, KMB time	**s**
Time from min. CosPhi3	17512	4468	32b, KMB time	**s**
Time from min. frequency (f)	17514	446A	32b, KMB time	**s**
RESERVED				
Time from min. THD U1	17574	44A6	32b, KMB time	**s**
Time from min. THD U2	17576	44A8	32b, KMB time	**s**
Time from min. THD U3	17578	44AA	32b, KMB time	**s**
Time from min. THD I1	17580	44AC	32b, KMB time	**s**
Time from min. THD I2	17582	44AE	32b, KMB time	**s**
Time from min. THD I3	17584	44B0	32b, KMB time	**s**

3.15.3 0x4600-0x46FF Maximum since data reset

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
U1	17976	4638	32-Bit, Float	**V**
U2	17978	463A	32-Bit, Float	**V**
U3	17980	463C	32-Bit, Float	**V**
U12	17982	463E	32-Bit, Float	**V**
U23	17984	4640	32-Bit, Float	**V**
U31	17986	4642	32-Bit, Float	**V**
I1	17988	4644	32-Bit, Float	**A**
I2	17990	4646	32-Bit, Float	**A**
I3	17992	4648	32-Bit, Float	**A**
IN=I1+I2+I3	17994	464A	32-Bit, Float	**A**
P1	17996	464C	32-Bit, Float	**W**
P2	17998	464E	32-Bit, Float	**W**
P3	18000	4650	32-Bit, Float	**W**
3P	18002	4652	32-Bit, Float	**W**
S1	18004	4654	32-Bit, Float	**VA**
S2	18006	4656	32-Bit, Float	**VA**
S3	18008	4658	32-Bit, Float	**VA**
3S	18010	465A	32-Bit, Float	**VA**
Q1	18012	465C	32-Bit, Float	**var**
Q2	18014	465E	32-Bit, Float	**var**
Q3	18016	4660	32-Bit, Float	**var**
3Q	18018	4662	32-Bit, Float	**var**
CosPhi1	18020	4664	32-Bit, Float	**–**
CosPhi2	18022	4666	32-Bit, Float	**–**
CosPhi3	18024	4668	32-Bit, Float	**–**
Frequency (f)	18026	466A	32-Bit, Float	**Hz**
RESERVED				
THD U1	18086	46A6	32-Bit, Float	**Prozent**
THD U2	18088	46A8	32-Bit, Float	**Prozent**
THD U3	18090	46AA	32-Bit, Float	**Prozent**
THD I1	18092	46AC	32-Bit, Float	**Prozent**
THD I2	18094	46AE	32-Bit, Float	**Prozent**
THD I3	18096	46B0	32-Bit, Float	**Prozent**

3.15.4 0x4800-0x48FF Minimum since data reset

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
U1	18488	4838	32-Bit, Float	**V**
U2	18490	483A	32-Bit, Float	**V**
U3	18492	483C	32-Bit, Float	**V**
U12	18494	483E	32-Bit, Float	**V**
U23	18496	4840	32-Bit, Float	**V**
U31	18498	4842	32-Bit, Float	**V**
I1	18500	4844	32-Bit, Float	**A**
I2	18502	4846	32-Bit, Float	**A**
I3	18504	4848	32-Bit, Float	**A**
IN=I1+I2+I3	18506	484A	32-Bit, Float	**A**
P1	18508	484C	32-Bit, Float	**W**
P2	18510	484E	32-Bit, Float	**W**
P3	18512	4850	32-Bit, Float	**W**
3P	18514	4852	32-Bit, Float	**W**
S1	18516	4854	32-Bit, Float	**VA**
S2	18518	4856	32-Bit, Float	**VA**
S3	18520	4858	32-Bit, Float	**VA**
3S	18522	485A	32-Bit, Float	**VA**
Q1	18524	485C	32-Bit, Float	**var**
Q2	18526	485E	32-Bit, Float	**var**
Q3	18528	4860	32-Bit, Float	**var**
3Q	18530	4862	32-Bit, Float	**var**
CosPhi1	18532	4864	32-Bit, Float	**–**
CosPhi2	18534	4866	32-Bit, Float	**–**
CosPhi3	18536	4868	32-Bit, Float	**–**
Frequency (f)	18538	486A	32-Bit, Float	**Hz**
RESERVED				
THD U1	18598	48A6	32-Bit, Float	**Prozent**
THD U2	18600	48A8	32-Bit, Float	**Prozent**
THD U3	18602	48AA	32-Bit, Float	**Prozent**
THD I1	18604	48AC	32-Bit, Float	**Prozent**
THD I2	18606	48AE	32-Bit, Float	**Prozent**
THD I3	18608	48B0	32-Bit, Float	**Prozent**

3.15.5 0x4A00-0x4AFF Actual/average data (19000 DEZ)

This data block provides a simple collection method for the most frequently used actual and average values in a simple block read request.
Modbus function 03 Read holding register **returns average values** for normal quantities.
Modbus function 04 Read input register **returns 200 ms actual values** for normal quantities.
For energy registers, both functions provide the total kWh/kVarh counters.

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
U1	19000	4A38	32-Bit, Float	**V**

U2	19002	4A3A	32-Bit, Float	**V**
U3	19004	4A3C	32-Bit, Float	**V**
U12	19006	4A3E	32-Bit, Float	**V**
U23	19008	4A40	32-Bit, Float	**V**
U31	19010	4A42	32-Bit, Float	**V**
I1	19012	4A44	32-Bit, Float	**A**
I2	19014	4A46	32-Bit, Float	**A**
I3	19016	4A48	32-Bit, Float	**A**
INc	19018	4A4A	32-Bit, Float	**A**
P1	19020	4A4C	32-Bit, Float	**W**
P2	19022	4A4E	32-Bit, Float	**W**
P3	19024	4A50	32-Bit, Float	**W**
3P	19026	4A52	32-Bit, Float	**W**
S1	19028	4A54	32-Bit, Float	**VA**
S2	19030	4A56	32-Bit, Float	**VA**
S3	19032	4A58	32-Bit, Float	**VA**
3S	19034	4A5A	32-Bit, Float	**VA**
Q1	19036	4A5C	32-Bit, Float	**var**
Q2	19038	4A5E	32-Bit, Float	**var**
Q3	19040	4A60	32-Bit, Float	**var**
3Q	19042	4A62	32-Bit, Float	**var**
CosPhi1	19044	4A64	32-Bit, Float	**–**
CosPhi2	19046	4A66	32-Bit, Float	**–**
CosPhi3	19048	4A68	32-Bit, Float	**–**
Frequency (f)	19050	4A6A	32-Bit, Float	**Hz**
Phase sequence	19052	4A6C	32-Bit, Float	**–**
EP1 total	19054	4A6E	32-Bit, Float	**Wh**
EP2 total	19056	4A70	32-Bit, Float	**Wh**
EP3 total	19058	4A72	32-Bit, Float	**Wh**
3EP total	19060	4A74	32-Bit, Float	**Wh**
EP1 consumed	19062	4A76	32-Bit, Float	**Wh**
EP2 consumed	19064	4A78	32-Bit, Float	**Wh**
EP3 consumed	19066	4A7A	32-Bit, Float	**Wh**
3EP consumed	19068	4A7C	32-Bit, Float	**Wh**
EP1 delivered	19070	4A7E	32-Bit, Float	**Wh**
EP2 delivered	19072	4A80	32-Bit, Float	**Wh**
EP3 delivered	19074	4A82	32-Bit, Float	**Wh**
3EP delivered	19076	4A84	32-Bit, Float	**Wh**
ES1	19078	4A86	32-Bit, Float	**VAh**
ES2	19080	4A88	32-Bit, Float	**VAh**
ES3	19082	4A8A	32-Bit, Float	**VAh**
3ES	19084	4A8C	32-Bit, Float	**VAh**
EQ1	19086	4A8E	32-Bit, Float	**varh**
EQ2	19088	4A90	32-Bit, Float	**varh**
EQ3	19090	4A92	32-Bit, Float	**varh**
3EQ	19092	4A94	32-Bit, Float	**varh**
EQL1	19094	4A96	32-Bit, Float	**varh**
EQL2	19096	4A98	32-Bit, Float	**varh**
EQL3	19098	4A9A	32-Bit, Float	**varh**
3EQL	19100	4A9C	32-Bit, Float	**varh**
EQC1	19102	4A9E	32-Bit, Float	**varh**
EQC2	19104	4AA0	32-Bit, Float	**varh**
EQC3	19106	4AA2	32-Bit, Float	**varh**
3EQC	19108	4AA4	32-Bit, Float	**varh**
THD U1	19110	4AA6	32-Bit, Float	**Prozent**
THD U2	19112	4AA8	32-Bit, Float	**Prozent**
THD U3	19114	4AAA	32-Bit, Float	**Prozent**

THD I1	19116	4AAC	32-Bit, Float	**Prozent**
THD I2	19118	4AAE	32-Bit, Float	**Prozent**
THD I3	19120	4AB0	32-Bit, Float	**Prozent**

3.16 0x4D00 Residual current monitoring (RCM)

This data block is available in devices with one or more RCM inputs. It contains several register blocks that contain the minimum, maximum, average and actual values for the RCM values. The meaning of the data varies depending on the Modbus function used:
Function 3 registers indicate aggregated average values (average, min. of average, max. of average).
Function 4 registers indicate aggregated actual values (actual value, min. of actual value, max. of actual value).

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
RCM min, Avg, max. reset timestamp	19726	0x4D0E	32b, KMB time	**s**
Time from last IΔ1 maximum	19728	0x4D10	32b, KMB time	**s**
Time from last IΔ2 maximum	19730	0x4D12	32b, KMB time	**s**
Time from last IΔ3 maximum	19732	0x4D14	32b, KMB time	**s**
Time from last IΔ4 maximum	19734	0x4D16	32b, KMB time	**s**
Time from last IΔ5 maximum	19736	0x4D18	32b, KMB time	**s**
Time from last IΔ6 maximum	19738	0x4D1A	32b, KMB time	**s**
Time from last IΔ7 maximum	19740	0x4D1C	32b, KMB time	**s**
Time from last IΔ8 maximum	19742	0x4D1E	32b, KMB time	**s**

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
Time from last IΔ1 minimum	19744	0x4D20	32b, KMB time	**s**
Time from last IΔ2 minimum	19746	0x4D22	32b, KMB time	**s**
Time from last IΔ3 minimum	19748	0x4D24	32b, KMB time	**s**
Time from last IΔ4 minimum	19750	0x4D26	32b, KMB time	**s**
Time from last IΔ5 minimum	19752	0x4D28	32b, KMB time	**s**
Time from last IΔ6 minimum	19754	0x4D2A	32b, KMB time	**s**
Time from last IΔ7 minimum	19756	0x4D2C	32b, KMB time	**s**
Time from last IΔ8 minimum	19758	0x4D2E	32b, KMB time	**s**

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
last IΔ1 maximum	19760	0x4D30	32b, Float	**A**
last IΔ2 maximum	19762	0x4D32	32b, Float	**A**
last IΔ3 maximum	19764	0x4D34	32b, Float	**A**
last IΔ4 maximum	19766	0x4D36	32b, Float	**A**
last IΔ5 maximum	19768	0x4D38	32b, Float	**A**
last IΔ6 maximum	19770	0x4D3A	32b, Float	**A**
last IΔ7 maximum	19770	0x4D3C	32b, Float	**A**
last IΔ8 maximum	19772	0x4D3E	32b, Float	**A**

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
last IΔ1 maximum	19776	0x4D40	32b, Float	**A**
last IΔ2 maximum	19778	0x4D42	32b, Float	**A**
last IΔ3 maximum	19780	0x4D44	32b, Float	**A**
last IΔ4 maximum	19782	0x4D46	32b, Float	**A**
last IΔ5 maximum	19784	0x4D48	32b, Float	**A**
last IΔ6 maximum	19786	0x4D4A	32b, Float	**A**
last IΔ7 maximum	19788	0x4D4C	32b, Float	**A**
last IΔ8 maximum	19790	0x4D4E	32b, Float	**A**

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
IΔ1	19792	0x4D50	32b, Float	**A**
IΔ2	19794	0x4D52	32b, Float	**A**
IΔ3	19796	0x4D54	32b, Float	**A**
IΔ4	19798	0x4D56	32b, Float	**A**
IΔ5	19800	0x4D58	32b, Float	**A**
IΔ6	19802	0x4D5A	32b, Float	**A**
IΔ7	19804	0x4D5C	32b, Float	**A**
IΔ8	19806	0x4D5E	32b, Float	**A**

3.17 0x4E00 Requirement and maximum requirement values

The demand in an evaluation period and maximum demand in the interval or since reset are listed in the following registers. Otherwise also referred to in the literature as PAvgMax, PAvgMax(E), monitoring of quarter-hourly maximum or EMAX. The behaviour of this function refers to the actual device configuration - namely the parameters in the "Maximum demand" field on the "Aggregation" tab in the device configuration.

3.17.1 0x4E00 Last, actual and expected requirement values

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
last average reset date/time	19968	4E00	32b, KMB time	**s**
last average request 3LD	19970	4E02	32b, Float	**W**
Last average request LD1	19972	4E04	32b, Float	**W**
last average request LD2	19974	4E06	32b, Float	**W**

last average request LD3	19976	4E08	32b, Float	**W**
Last average request LD4	19978	4E0A	32b, Float	**W**
Interval started since last average request	19980	4E0C	32b, KMB time	**s**
current average request 3AD	19982	4E0E	32b, Float	**W**
Current average request AD1	19984	4E10	32b, Float	**W**
current average request AD2	19986	4E12	32b, Float	**W**
current average request AD3	19988	4E14	32b, Float	**W**
current average request AD4	19990	4E16	32b, Float	**W**
next average reset date/time	19992	4E18	32b, KMB time	**s**
next average request 3ED	19994	4E1A	32b, Float	**W**
next average request ED1	19996	4E1C	32b, Float	**W**
next average request ED2	19998	4E1E	32b, Float	**W**
next average request ED3	20000	4E20	32b, Float	**W**
next average request ED4	20002	4E22	32b, Float	**W**

3.17.2 0x4E30 Maximum recorded request values since manual reset

**/ Highlighted quantities* are to be implemented in a future version. In firmware version 4.0, only the values with filled addresses are available, and all other values are a reserved register. Reading with block reading is possible and the value is NaN.

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
max. 3MD request date/time	20016	4E30	32b, KMB time	**s**
max. 3MD request	20018	4E32	32b, Float	**W**
associated request AD 1	20020	4E34		**NaN**
associated request AD 2	20022	4E36		**NaN**
associated request AD 3	20024	4E38		**NaN**
associated request AD 4	20026	4E3A		**NaN**
max. MD1 request date/time	20028	4E3C	32b, KMB time	**s**
associated request 3AD	20030	4E3E		**NaN**
Maximum request MD1	20032	4E40	32b, Float	**W**
associated request AD 2	20034	4E42		**NaN**
associated request AD 3	20036	4E44		**NaN**
associated request AD 4	20038	4E46		**NaN**
max. MD2 request date/time	20040	4E48	32b, KMB time	**s**
associated request 3AD	20042	4E4A		**NaN**
associated request AD 1	20044	4E4C		**NaN**
maximum request MD2	20046	4E4E	32b, Float	**W**
associated request AD 3	20048	4E50		**NaN**
associated request AD 4	20050	4E52		**NaN**
max. MD3 request date/time	20052	4E54	32b, KMB time	**s**
associated request 3AD	20054	4E56		**NaN**
associated request AD 1	20056	4E58		**NaN**
associated request AD 2	20058	4E5A		**NaN**
maximum request MD3	20060	4E5C	32b, Float	**W**
associated request AD 4	20062	4E5E		**NaN**
max. MD4 request date/time	20064	4E60	32b, KMB time	**s**
associated request 3AD	20066	4E62		**NaN**
associated request AD 1	20068	4E64		**NaN**
associated request AD 2	20070	4E66		**NaN**
associated request AD 3	20072	4E68		**NaN**

maximum request MD4	20074	4E6A	32b, Float	**W**

3.17.3 0x4E70 Maximum request values in the last observed interval

**/ Highlighted quantities* are to be implemented in a future version. In firmware version 4.0, only the following values are available with type and coding and all other values are a reserved register. Reading with block reading is possible and the value is NaN. The evaluation interval is part of the configuration and can be selected as day, week, month, quarter or year.

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
last max. 3MD request date/time	20080	4E70	32b, KMB time	**s**
last max. 3MD request	20082	4E72	32b, Float	**W**
last associated request AD 1	20084	4E74		**NaN**
last associated request AD 2	20086	4E76		**NaN**
last associated request AD 3	20088	4E78		**NaN**
last associated request AD 4	20090	4E7A		**NaN**
last max. MD1 request date/time	20092	4E7C	32b, KMB time	**s**
last associated request 3AD	20094	4E7E		**NaN**
last maximum request MD1	20096	4E80	32b, Float	**W**
last associated request AD 2	20098	4E82		**NaN**
last associated request AD 3	20100	4E84		**NaN**
last associated request AD 4	20102	4E86		**NaN**
last max. MD2 request date/time	20104	4E88	32b, KMB time	**s**
last associated request 3AD	20106	4E8A		**NaN**
last associated request AD 1	20108	4E8C		**NaN**
last max. request MD2	20110	4E8E	32b, Float	**W**
last associated request AD 3	20112	4E90		**NaN**
last associated request AD 4	20114	4E92		**NaN**
last max. MD3 request date/time	20116	4E94	32b, KMB time	**s**
last associated request 3AD	20118	4E96		**NaN**
last associated request AD 1	20120	4E98		**NaN**
last associated request AD 2	20122	4E9A		**NaN**
last max. request MD3	20124	4E9C	32b, Float	**W**
last associated request AD 4	20126	4E9E		**NaN**
last max. MD4 request date/time	20128	4EA0	32b, KMB time	**s**
last associated request 3AD	20130	4EA2		**NaN**
last associated request AD 1	20132	4EA4		**NaN**
last associated request AD 2	20134	4EA6		**NaN**
last associated request AD 3	20136	4EA8		**NaN**
last max. request MD4	20138	4EAA	32b, Float	**W**

3.17.4 0x4EC0 Maximum demand values in the currently observed interval

**/ Highlighted quantities* are to be implemented in a future version. In firmware version 4.0, only the following values are available with type and coding and all other values are a reserved register. Reading with block reading is possible and the value is NaN. The evaluation interval is part of the configuration and can be selected as day, week, month, quarter or year.

Assigned data	Base address		Size/Type	Unit
	DEZ	HEX		
this max. 3MD request date/time	20160	4EC0	32b, KMB time	**s**
this max. 3MD request	20162	4EC2	32b, Float	**W**
this associated request AD 1	20164	4EC4		**NaN**
this associated request AD 2	20166	4EC6		**NaN**
this associated requirement AD 3	20168	4EC8		**NaN**
this associated requirement AD 4	20170	4ECA		**NaN**
this max. MD1 request date/time	20172	4ECC	32b, KMB time	**s**
this associated requirement 3AD	20174	4ECE		**NaN**
this max. request MD1	20176	4ED0	32b, Float	**W**
this associated requirement AD 2	20178	4ED2		**NaN**
this associated request AD 3	20180	4ED4		**NaN**
this associated requirement AD 4	20182	4ED6		**NaN**
this max. MD2 request date/time	20184	4ED8	32b, KMB time	**s**
this associated requirement 3AD	20186	4EDA		**NaN**
this associated requirement AD 1	20188	4EDC		**NaN**
this max. requirement MD2	20190	4EDE	32b, Float	**W**
this associated requirement AD 3	20192	4EE0		**NaN**
this associated requirement AD 4	20194	4EE2		**NaN**
this max. MD3 request date/time	20196	4EE4	32b, KMB time	**s**
this associated requirement 3AD	20198	4EE6		**NaN**
this associated requirement AD 1	20200	4EE8		**NaN**
this associated requirement AD 2	20202	4EEA		**NaN**
this max. request MD3	20204	4EEC	32b, Float	**W**
this associated request AD 4	20206	4EEE		**NaN**
this max. MD4 request date/time	20208	4EF0	32b, KMB time	**s**
this associated requirement 3AD	20210	4EF2		**NaN**
this associated requirement AD 1	20212	4EF4		**NaN**
this associated requirement AD 2	20214	4EF6		**NaN**
this associated requirement AD 3	20216	4EF8		**NaN**
this maximum request MD4	20218	4EFA	32b, Float	**W**

3.18 0x5000 Power quality values (opt. PQ modules)

Valid readings are only listed in these registers if the PQ firmware module is activated.

Assigned data	Base address		Size/Type	Description
	DEZ	HEX		
Time of last PQ evaluation	20480	0x5000	64b, KMB-	**Actual reading value**
Last PQ evaluation	20484	0x5004	32b	**0x1 100%, 0x2 95%**
Time of the last failed 100	20486	0x5006	64b, KMB-	**ms since 1.1.2000**
last failed 100% crit.	20490	0x500A	32b	**Binary coded indices**
Time of the last failed 95%	20492	0x500C	64b, KMB-	**ms since 1.1.2000**
last failed 95% crit.	20496	0x500E	32b	**Binary coded indices**
Action recording in PQ buffer	20498	0x5012	32b	**Index for the following**
Buffer for PQ intervals	20500..20	0x5014..0x50	32b	**Array: 63×32b**

Coding of the valuation indices (last PQ assessment, last failed 100% and 95%): 0 - all correct, 0x0001 - frequency, 0x0002 — *U*1, 0x0004 — *U*2, 0x0008 — *U*3, 0x0020 — *THDU* 1, 0x0040 — *THDU* 2, 0x0080 — *THDU* 3, 0x0200 — *UNBU*, 0x0400 — *PST* 1, 0x0800 — *PST* 2, 0x1000 *PST* 3, 0x2000 — *UHARM* 1, 0x4000 — *UHARM* 2, 0x8000 — *UHARM* 3.

Coding of the interval evaluation buffer: bitwise true/false value for the last 32x63 PQ evaluation intervals. Updated in rounded form. Typically for a 10-minute interval, which is set by default in the devices; this buffer is sufficient for the data of the last two weeks. This can be changed in the device configuration.

3.18.1 0x5100 Actual index values for flicker degree (PQ module)

Valid readings are only listed in these registers if the PQ firmware module is activated.

P_{st1-4} are short-term flicker values - 10 minutes (configurable).

P_{lt1-4} are long-term flicker values - fixed, 2-hour average value of P_{st1-4} (configurable).

$P_{inst1-4}$ are instantaneous flicker values

Assigned data	Base address		Size/Type
	DEZ	HEX	
***Pst*1**	20736	0x5100, 0x5101	**32b, Float**
***Pst*2**	20738	0x5102, 0x5103	**32b, Float**
***Pst*3**	20740	0x5104, 0x5105	**32b, Float**
***Pst*4**	20742	0x5106, 0x5107	**32b, Float**
***Plt*1**	20744	0x5108, 0x5109	**32b, Float**
***Plt*2**	20746	0x510A, 0x510B	**32b, Float**
***Plt*3**	20748	0x510C, 0x510D	**32b, Float**
***Plt*4**	20750	0x510E, 0x510F	**32b, Float**
***Pinst*1**	20752	0x5110, 0x5111	**32b, Float**
***Pinst*2**	20754	0x5112, 0x5113	**32b, Float**
***Pinst*3**	20756	0x5114, 0x5115	**32b, Float**
***Pinst*4**	20758	0x5116, 0x5117	**32b, Float**

3.18.2 0x5200 Last PQ interval values (PQ module)

Valid readings are only listed in these registers if the PQ firmware module is activated.

The values in this table are calculated in 10-minute intervals (2).

favg is an average frequency during the PQ interval.

fmostly, *falways*, *fbelow*, *fabove* are counters. Each 10 s value is recorded and the corresponding counter(s) is/are incremented.

*U*1−4 and *THD*1−4 are average values for the 10-minute interval.

*Uharm*1−4 are coded harmonic values. 1 bit is available for each harmonic. 0 = OK, 1 = This harmonic is outside the defined range.

PST 1−4 are flicker values.

UNBU is the average value of the voltage unbalance in %.

RCSCount is the total number of 3-s RCS measurements in the last PQ interval.

*RCSL*1−3 is the number of measurements per channel which are outside the tolerance.

Assigned data	Base address		Size/Type
	DEZ	HEX	
favg	20992	0x5200	**32b, Float**
fmostly	20994	0x5202	**16b**

(2) The duration of the base interval for the power quality assessment can be changed by the user in the device configuration.

Assigned data	Base address		Size/Type
	DEZ	HEX	
falways	20995	0x5203	**16b**
fbelow	20996	0x5204	**16b**
fabove	20997	0x5205	**16b**
***U*1**	20998	0x5206	**32b, Float**
***U*2**	21000	0x5208	**32b, Float**
***U*3**	21002	0x520A	**32b, Float**
***U*4**	21004	0x520C	**32b, Float**
***THDU* 1**	21006	0x520E	**32b, Float**
***THDU* 2**	21008	0x5210	**32b, Float**
***THDU* 3**	21010	0x5212	**32b, Float**
***THDU* 4**	21012	0x5214	**32b, Float**
***Uharm*1**	21014	0x5216	**64b**
***Uharm*2**	21018	0x521A	**64b**
***Uharm*3**	21022	0x521E	**64b**
***Uharm*4**	21026	0x5222	**64b**
***PST* 1**	21030	0x5226	**32b, Float**
***PST* 2**	21032	0x5228	**32b, Float**
***PST* 3**	21034	0x522A	**32b, Float**
***PST* 4**	21036	0x522C	**32b, Float**
UNBU	21038	0x522E	**32b, Float**
RCScount	21040	0x522F	**16 Bit, uint**
***RCSL*1**	21041	0x5230	**16 Bit, uint**
***RCSL*2**	21042	0x5231	**16 Bit, uint**
***RCSL*3**	21043	0x5232	**16 Bit, uint**

3.18.3 0x5400 Voltage events - Table - Voltage increases (PQ module)

Assigned data	Base address		Size/Type	Description	
	DEZ	HEX		Overvoltage [%]	**Duration [ms]**
***S*1**	21504	0x5400	32b, int	*u* ≥ 120	**10 ≤ *t* ≤ 200**
***T* 1**	21506	0x5402	32b, int	120 > *u* > 110	
***S*2**	21508	0x5404	32b, int	*u* ≥ 120	**500 < *t* ≤ 5000**
***T* 2**	21510	0x5406	32b, int	120 > *u* > 110	
***S*3**	21512	0x5408	32b, int	*u* ≥ 120	**5000 < *t* ≤ 60000**
***T* 3**	21514	0x540A	32b, int	120 > *u* > 110	

3.18.4 0x540C Voltage events - Table - Voltage dips (PQ module)

Assigned data	Base address DEZ	Base address HEX	Size/Type	Description: Residual voltage [%]	Description: Duration [ms]
***A*1**	2151	0x540	32b, int	90 > *u* ≥ 80	**10 ≤ *t* ≤ 200**
***B*1**	2151	0x540E	32b, int	80 > *u* ≥ 70	

Assigned data	Base address DEZ	Base address HEX	Size/Type	Description: Residual voltage [%]	Description: Duration [ms]
***C*1**	2152	0x5410	32b, int	70 > *u* ≥ 40	**10 ≤ *t* ≤ 200**
***D*1**	2152	0x5412	32b, int	40 > *u* ≥ 5	
***X*1**	2152	0x5414	32b, int	5 > *u*	
***A*2**	2152	0x5416	32b, int	90 > *u* ≥ 80	**200 < *t* ≤ 500**
***B*2**	2152	0x5418	32b, int	80 > *u* ≥ 70	
***C*2**	2153	0x541A	32b, int	70 > *u* ≥ 40	
***D*2**	2153	0x541	32b, int	40 > *u* ≥ 5	
***X*2**	2153	0x541E	32b, int	5 > *u*	
***A*3**	2153	0x5420	32b, int	90 > *u* ≥ 80	**500 < *t* ≤ 1000**
***B*3**	2153	0x5422	32b, int	80 > *u* ≥ 70	
***C*3**	2154	0x5424	32b, int	70 > *u* ≥ 40	
***D*3**	2154	0x5426	32b, int	40 > *u* ≥ 5	
***X*3**	2154	0x5428	32b, int	5 > *u*	
***A*4**	2154	0x542A	32b, int	90 > *u* ≥ 80	**1000 < *t* ≤ 5000**
***B*4**	2154	0x542	32b, int	80 > *u* ≥ 70	
***C*4**	2155	0x542E	32b, int	70 > *u* ≥ 40	
***D*4**	2155	0x5430	32b, int	40 > *u* ≥ 5	
***X*4**	2155	0x5432	32b, int	5 > *u*	
***A*5**	2155	0x5434	32b, int	90 > *u* ≥ 80	**5000 < *t* ≤ 60000**
***B*5**	2155	0x5436	32b, int	80 > *u* ≥ 70	
***C*5**	2156	0x5438	32b, int	70 > *u* ≥ 40	
***D*5**	2156	0x543A	32b, int	40 > *u* ≥ 5	
***X*5**	2156	0x543	32b, int	5 > *u*	
Last	2156	0x543E	32b, int	**Last deletion time in s from 1.1.2000.**	

3.18.5 0x5500 Voltage events - Last event (PQ module)

Assigned data	Base address DEZ	Base address HEX	Size/Type	Description
Phase	2176	0x55	16b, int	**see note below***
Event type	2176 1	0x55 01	16b, int	**1 = voltage increase, 2 = voltage dip,**
Event time	2176 2	0x55 02	64b, int	**3 = interruption, 4 = power failure**
Duration	2176 6	0x55 06	32b, int	**Time of the event since 1.1.2000**
Value	2176 8	0x55 08	32b, Float	**Duration of the event in ms**

* 3×1p measurement: 0 = L1, 1 = L2, 2 = L3, 3 = L4

3p measurement: 0x80|0x01 = L1, 0x80|0x02 = L2, 0x80|0x04 = L3

3.19 0x5300 Ripple control signal (opt. RCS module)

These registers list valid readout values of ripple control signal levels only with activated RCS firmware module.
RCS L1 - 3*Time* are the time and date of the last RCS telegram received in KMB time - seconds since 1.1.2000.
RCS L1 - 3{*AVG*|*MIN* |*MAX*} are minimum, maximum and average values of the signal in V for all true bits (value = 1) in the last telegram received.

Assigned data	Base address		Size/Type
	DEZ	HEX	
Urc1Time	21248	0x5300	**64b**
Urc1AVG	21252	0x5304	**32b, Float**
Urc1MIN	21254	0x5306	**32b, Float**
Urc1MAX	21256	0x5308	**32b, Float**
Urc2Time	21258	0x530A	**64b**
Urc2AVG	21262	0x530E	**32b, Float**
Urc2MIN	21264	0x5310	**32b, Float**
Urc2MAX	21266	0x5312	**32b, Float**
Urc3Time	21268	0x5314	**64b**
Urc3AVG	21272	0x5318	**32b, Float**
Urc3MIN	21274	0x531A	**32b, Float**
Urc3MAX	21276	0x531C	**32b, Float**

RCS-Meldung Startbit 1 und 2 (RMS-Wert)

Assigned data	Base address		Size/Type
	DEZ	HEX	
Urc1 b1	21278	0x531E	**32b, Float**
Urc1 b2	21280	0x5320	**32b, Float**
Urc2 b1	21282	0x5322	**32b, Float**
Urc2 b2	21284	0x5324	**32b, Float**
Urc3 b1	21286	0x5326	**32b, Float**
Urc3 b2	21288	0x5328	**32b, Float**
Urc150ms	21290	0x532A	**32b, Float**
Urc250ms	21292	0x532C	**32b, Float**
Urc350ms	21294	0x532E	**32b, Float**

3.20 0x6000 Modbus master readout values (opt. MM module)

The Modbus master reads its own configured input data or from other devices (slaves) that are connected to its serial line. It converts all input data into a block of uniform values (floating point number type), starting at register 0x6000. The data source is assigned in a device configuration (MIEZ.daq). Modbus master result values are specified in actual data, on the website or in the tab of a master device. MM data is organized in up to 20 sets. One

set can process up to 100 floating point number results, all 20 sets together can process 300 results. Each set represents only one slave address. More than one MM set can be used to process data from the specified slave device. In the following mapping table, Modbus RTU protocol addressing is used to select different sets - Modbus TCP address 1 provides data from set 1, address 2 from set 2 and so on. (X in the table indicates the set number).
As of FW 4.0, you can also read all 300 values from TCP address 1 on registers 0x6400+ without taking the configured sets into account.
Reading is performed automatically by the master in a predefined time period, and under normal conditions this can only be interrupted with an ES gateway module connection to the same master. The incoming ES connections have priority over the MM to access the slave bus so that any third-party protocol can also reach the specified slave. With such a connection, proprietary values from the slave units can be configured, updated or occasionally read out.

Assigned data	Base address		Size/Type
	DEZ	HEX	
First MM value for set X	2457	0x6000	**32b,**
up to 98× per set, 300 in total	...	...	**...**
Last MM value for set X	2477	0x60C	**32b,**
First MM value (all 300 values in one line, sets not taken into	2560	0x6400	**32b,**
up to 298× without consideration of sets	...	...	**32b,**
Last MM value	2619	0x6656	**32b,**

3.21 0x6200 Actual data for direct current and alternating current/direct current

The devices provide average voltage and current readings in the aggregation interval - the DC component. As part of a special configuration option, this even allows fixed sampling to be used and f, U, I, P and ˜Q to be calculated in the time domain for signals with a power frequency of 0 or 5 Hz up to 500 Hz. The lower limit value differs for devices with different current sensors. This function can be used to correctly evaluate certain quantities for DC networks such as photovoltaics, UPS and buffer batteries, transportation, etc. or to monitor devices powered by a frequency inverter.
avg ... Average value of the sampled voltage or current signal of the respective channel, i.e. the DC component thereof.
min, max ... Extreme value of the sampled voltage or current signal of the respective channel
Devices with more than 4 current inputs use address multiplexing for the variables derived from I5 channels and higher.

Assigned data	Base address		Size/Type
	DEZ	HEX	
UavgL1	25088	0x6200	**32b, Float**
UavgL2	25090	0x6202	**32b, Float**
UavgL3	25092	0x6204	**32b, Float**
UavgL4	25094	0x6206	**32b, Float**

Assigned data	Base address		Size/Type
	DEZ	HEX	
UminL1	25096	0x6208	**32b, Float**
UminL2	25098	0x620A	**32b, Float**
UminL3	25100	0x620C	**32b, Float**
UminL4	25102	0x621E	**32b, Float**
UmaxL1	25104	0x6210	**32b, Float**
UmaxL2	25106	0x6212	**32b, Float**
UmaxL3	25108	0x6214	**32b, Float**
UmaxL4	25110	0x6216	**32b, Float**

Assigned data	Base address		Size/Type
	DEZ	HEX	
IavgL1	25112	0x6218	**32b, Float**
IavgL2	25114	0x621A	**32b, Float**
IavgL3	25116	0x621C	**32b, Float**
IavgL4	25118	0x621E	**32b, Float**
IminL1	25120	0x6220	**32b, Float**
IminL2	25122	0x6222	**32b, Float**
IminL3	25124	0x6224	**32b, Float**
IminL4	25126	0x6226	**32b, Float**
ImaxL1	25128	0x6228	**32b, Float**
ImaxL2	25130	0x622A	**32b, Float**
ImaxL3	25132	0x622C	**32b, Float**
ImaxL4	25134	0x622E	**32b, Float**

3.22 0x9000 Input and output values

3.22.1 0x9000 Input values

Assigned data	Base address		Size/Type
	DEZ	HEX	
Digital inputs (1-16)	36864	0x9000	16b
Digital inputs (17-32)	36865	0x9001	16b
Frequency counter 1 (FC1)	36866	0x9002	32b, Float
Frequency counter 2 (FC2)	36868	0x9004	32b, Float
Frequency counter 3 (FC3)	36870	0x9006	32b, Float
Frequency counter 4 (FC4)	36872	0x9008	32b, Float
Frequency counter 5 (FC5)	36874	0x900A	32b, Float
Frequency counter 6 (FC6)	36876	0x900C	32b, Float
Frequency counter 7 (FC7)	36878	0x900D	32b, Float
Frequency counter 8 (FC8)	36880	0x900F	32b, Float
Pulse counter 1 (PC1)	36882	0x9012	32b, Float
Pulse counter 2 (PC2)	36884	0x9016	32b, Float
Pulse counter 3 (PC3)	36886	0x901A	32b, Float
Pulse counter 4 (PC4)	36888	0x901E	32b, Float

Assigned data	Base address		Size/Type
	DEZ	HEX	
Pulse counter 5 (PC5)	36890	0x9022	32b, Float
Pulse counter 6 (PC6)	36892	0x9026	32b, Float
Pulse counter 7 (PC7)	36894	0x902A	32b, Float
Pulse counter 8 (PC8)	36896	0x902E	32b, Float
Clear time of PC1	36914	0x9032	64b, KMB time
Clearing time of PC2	36918	0x9036	64b, KMB time
Clearing time of PC3	36922	0x903A	64b, KMB time
Extinguishing time of PC4	36926	0x903E	64b, KMB time
Clearing time of PC5	36930	0x9042	64b, KMB time
Deletion time of PC6	36934	0x9046	64b, KMB time
Deletion time of PC7	36938	0x904A	64b, KMB time
Deletion time of PC8	36942	0x904E	64b, KMB time
Analog input 1	36994	0x9082	32b, Float
Analog input 2	36996	0x9084	32b, Float
Analog input 3	36998	0x9086	32b, Float
Analog input 4	37000	0x9088	32b, Float
Temperature 1 - Internal (Ti)	37056	0x90C0	32b, Float
Temperature 2 - External (Te)	37058	0x90C2	32b, Float
Temperature 3	37060	0x90C4	32b, Float
Temperature 4	37062	0x90C6	32b, Float

3.22.2 0x9300 Output values

It is possible to control real and virtual outputs and alarms. If an output is used in the I/O management configuration, it is blocked in the Modbus and cannot be controlled remotely. The value of the controlled output(s) can be set to 0 or 1. The selection of the outputs to be assigned is controlled by the mask (high byte of the register). Controlled outputs have the corresponding mask bit set to 1. The other mask bits are set to 0.

Assigned data	Base address		Size/Type	Encoding
	DEZ	HEX		
Digital outputs (1-8)	37632	0x9300	16b	**High byte mask, low byte status**
Digital outputs (9-16)	37633	0x9301	16b	**High byte mask, low byte status**
Digital outputs (17-24)	37634	0x9302	16b	**High byte mask, low byte status**
Digital outputs (25-32)	37635	0x9303	16b	**High byte mask, low byte status**
I/O variables (1-8)	37636	0x9304	16b	**High byte mask, low byte status**
I/O variables (9-16)	37638	0x9305	16b	**High byte mask, low byte status**
Analog output 1	3769	0x934	32b,	
Analog output 2	3769	0x934	32b,	
Analog output 3	3770	0x934	32b,	
Analog output 4	3770	0x934	32b,	

Example of digital output coding:

	MSB			**16b Registerwert**												LSB
	Maske des Ausgangs								**Status des Ausgangs**							
Ausgang Nr.	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	**1**
Abgerufener Wert	0	**1**	**0**	**0**	**1**	**1**	**1**	**1**	0	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Beschreibung	0 = Ausgang ist nicht verfügbar 1 = verfügbar für Steuerung								**0 = Ausgang ist nicht aktiv** **1 = Ausgang ist aktiv**							

	MS			**16b Registerwert**												**LSB**
	Maske des Ausgangs								**Status des Ausgangs**							
Ausgang Nr.	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	**1**
Abgerufener Wert	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**1**
Beschreibung	**0** = Ausgang ändert sich nicht **1** = Ausgang ändert sich								**0 = Ausgang deaktivieren** **1 = Ausgang aktivieren**							
Ergebnis	**X X 1 X 1 0 X 1**															

During writing, the new value of each output is evaluated according to the following equation:

$y_n = (y_a \wedge \neg m) \vee (s \wedge m)$, whereby m . . . the mask bit, s . . . the status bit, y_a . . . the current initial state and y_n . . . are the new output status. The specified output therefore only assumes the value "Status" if the corresponding "Mask" bit has the value 1. Otherwise, the output does not change.

3.22.3 0x9700 Hour meter (HM)

Devices with more than 4 channels can have more than 4 hour counters configured in the I/O configuration. In this case, more than 4 hour meters are available in a virtual device area whose Modbus address is the current device address incremented by 20.

Assigned data	Base address		Size/Type
	DEZ	HEX	
Hour counter HM1 active	38656	0x9700	**64b, int**
Hour counter HM1 passive	38660	0x9704	**64b, int**
Hour counter HM2 active	38664	0x9708	**64b, int**
Hour counter HM2 passive	38668	0x970C	**64b, int**
Hour counter HM3 active	38672	0x9710	**64b, int**
Hour counter HM3 passive	38676	0x9714	**64b, int**
Hour counter HM4 active	38680	0x9718	**64b, int**
Hour counter HM4 passive	38684	0x971C	**64b, int**
Hour counter HM1 counter	38688	0x9720	**32b, int**
Hour counter HM2 counter	38690	0x9722	**32b, int**
Hour counter HM3 counter	38692	0x9724	**32b, int**
Hour counter HM4 counter	38694	0x9726	**32b, int**
Extinguishing time of HM1	38696	0x9728	**32b, KMB time**
Extinguishing time of HM2	38698	0x972A	**32b, KMB time**
Extinguishing time of HM3	38700	0x972C	**32b, KMB time**
Extinguishing time of HM4	38702	0x972E	**32b, KMB time**
First ON time HM1	38704	0x9730	**32b, KMB time**
First ON time HM2	38706	0x9732	**32b, KMB time**
First ON time HM3	38708	0x9734	**32b, KMB time**
First ON time HM4	38710	0x9736	**32b, KMB time**
Last ON time HM1	38712	0x9738	**32b, KMB time**
Last ON time HM2	38714	0x973A	**32b, KMB time**
Last ON time HM3	38716	0x973C	**32b, KMB time**
Last ON time HM4	38718	0x973E	**32b, KMB time**
Last OFF time HM1	38720	0x9740	**32b, KMB time**
Last OFF time HM2	38722	0x9742	**32b, KMB time**
Last OFF time HM3	38724	0x9744	**32b, KMB time**
Last OFF time HM4	38726	0x9746	**32b, KMB time**

3.23 0xB000 Firmware update

The firmware file (.frm) must be written to the device in blocks of 1 kB (1024 B). Each block must be divided into packets of 512 × 16 bits, which are written to registers 0xB001 to 0xB200 via Modbus. After every 1 kB, the checksum must be written and its result checked. When all 1 kB blocks have been written, the CRC check must be performed and then the update must take place. This function is only supported by devices with internal memory for data logging.

Assigned data	Base address		Size/Type	R/W
	DEZ	HEX		
Zeiger des 1-kB-Blocks	45056	0xB000	16b	**W**
1-kB-Block, aufgeteilt in 512×16b-Teile. [3]	45057-45568	0xB001 - 0xB200	16b	**W**
Prüfsumme von 1 kB4	45569	0xB201	16b	**W**
Befehle/Ergebnisse	45570	0xB202	16b	**R/W**

Command	45570 (0xB202) (Write)
100	**Update to the new (written) FW**
101	**Update to factory FW**
102	**Update to backup FW**
103	**Backup current FW**
110	**CRC check of the written FW**

Result	45570 (0xB202) (Read)
0	**Ready to receive data**
1	**Process successful (checksum confirmed, FW written, backup successful, etc.)**
2	**CRC check of the firmware is running**
3	**Firmware update in progress**
4	**Firmware backup in progress**
6	**CRC check successful**
7	**CRC check not successful**
8	**CRC check successful, slave device is being updated**
9	**CRC check successful, update of slave device completed**
201	**Checksum check failed**
202	**Update via Modbus not supported**
203	**Invalid firmware file**
204	**This firmware is not supported by your hardware**
205	**1 kB block not entered in the correct order. 0xB000 must be in the order 0, 1, 2, 3**
206	**Invalid command sequence (device is not ready to receive data)**
210	**The update cannot be started. CRC check failed or has not yet been started**
211	**Requested FW is not available. The update to the backup or factory FW is not possible**
212	**FW backup failed**
213	**Operation with this firmware not permitted**

Assigned data	Base address		Size/Type	R/W
	DEZ	HEX		
Bootloader version	4633	0xB500	16b	**R**
FW main version (4. . .)	4633	0xB501	16b	**R**
FW minor version (.0. .)	4633	0xB502	16b	**R**
FW revision (. .13.)	4633	0xB503	16b	**R**
FW build (. . .4125)	4634	0xB504	16b	**R**
Factory FW main version (4. . .)	46341	0xB505	16b	**R**

3) Big endian byte sequence

4) Checksum = sum of all bytes & 0xFFFF

Assigned data	Base address		Size/Type	R/W
	DEZ	HEX		
Factory FW sub-version	46342	0xB50	16b	**R**
Factory FW revision (_._.13._)	46343	0xB50	16b	**R**
Factory FW build (_._._.4125)	46344	0xB50	16b	**R**
Backup FW main version (4._._._)	46345	0xB509	16b	**R**
Backup-FW subversion (_0._._._)	46346	0xB50A	16b	**R**
Backup FW revision (_._.13._)	46347	0xB50B	16b	**R**
Backup-FW build (_._._.4125)	46348	0xB50C	16b	**R**
Write date of factory firmware	46349	0xB50D	32b	**KMB time**
Write date of backup firmware	46351	0xB50F	32b	**KMB time**
Timeout for FW update	46353	0xB51	32b	**R/W**

Firmware update step by step

1. check whether the device is ready to receive data in 0xB202.
2. set 0 to 0xB000 for the first 1 kB data block. (For the second block, set 1, etc.)
3. write a 1 kB data block, divided into 512 chunks of 16 b, in 0xB001-0xB200.
4. write the checksum of the 1 kB block to 0xB201.
5. check the result of the checksum in 0xB202. If the result is 1, return to point 2 and continue with another 1 kB block.
6. when all 1 kB blocks have been written: Write 110 after 0xB202 to start the CRC check.
7. wait for the result of the CRC check by checking 0xB202. This may take a few seconds. If you are updating a slave device via the local bus, this is the last step. Do not continue!
8. if the CRC check was successful (6), we recommend to define a timeout for the automatic FW rollback in 0xB511. This timeout is defined in seconds, after which the firmware is automatically reset. Numbers in the order of 900 (15 minutes) should be fine.
9. if the CRC check was successful (result code 6), you can continue with the FW update by writing 100 to 0xB202.

10. if the new firmware is running and behaving properly, deactivate the automatic rollback by writing 0 to 0xB511.

3.24 0xC000 Supra-Harmonics (SH)

This data block is available in devices with optional SH firmware modules. It contains 35 harmonic bands (200 Hz each) from 2.1 kHz to 9 kHz and a further 705 harmonic bands from 9 kHz to 150 kHz.

Function 4 registers indicate aggregated actual values (act).

Assigned data	Base address		Size/Type
	DEZ	HEX	
U1.sh, g2100...sh,	49152...4922	0xC000...0xC044	**32b,**
U2sh, g2100...sh,	49222...4929	0xC046...0xC08A	**32b,**
U3sh, g2100...sh,	49292...4936	0xC08C...0xC0D0	**32b,**
UNsh, g2100...sh,	49362...4943	0xC0D2...0xC116	**32b,**
I1sh, g2100...sh,	49432...4950	0xC118...0xC15C	**32b,**

Assigned data	Base address		Size/Type
	DEZ	HEX	
I2sh, g2100...sh,	49502...4957	0xC15E...0xC1A2	**32b,**
I3sh, g2100...sh,	49572...4964	0xC1A4...0xC1E8	**32b,**
INsh, g2100...sh,	49642...4971	0xC1EA...0xC230	**32b,**
U1sh, g9100...sh,	49920..5132	0xC300...0xC880	**32b,**
U2sh, g9100...sh,	51330...5273	0xC882...0xCE02	**32b,**
U3sh, g9100...sh,	52740...5414	0xCE04...0xD384	**32b,**
UNsh, g9100...sh,	54150...5555	0xD386...0xD906	**32b,**
I1sh, g9100...sh,	55560...5696	0xD908…0xDE88	**32b,**
I2sh, g9100...sh,	56970...5837	0xDE8A...0xE40A	**32b,**
I3sh, g9100...sh,	58380...5978	0xE40C...0xE98C	**32b,**
INsh, g9100...sh,	59790...6120	0xE98E...0xEF10	**32b,**

3.25 Local Bus Register

The register assignments for MIEZ 37100 are listed in table form below.

Please ensure that your MIEZ 37100 is equipped with firmware 4.0.49 or newer.
Consequently, the register addresses are available via an additional access and any device address used.
You therefore need one port for the MIEZ power analyzer data and one for all values of the 37100 current extension module.

37100-1.F1	0xC000 - 0xC07A
37100-1.F2	0xC100 - 0xC17A
37100-1.F3	0xC200 - 0xC27A
37100-1.F4	0xC300 - 0xC37A
37100-2.F1	0xC400 - 0xC47A
37100-2.F2	0xC500 - 0xC57A
37100-2.F3	0xC600 - 0xC67A
37100-2.F4	0xC700 - 0xC77A
37100-3.F1	0xC800 - 0xC87A
37100-3.F2	0xC900 - 0xC97A
37100-3.F3	0xCA00 - 0xCA7A
37100-3.F4	0xCB00 - 0xCB7A
37100-4.F1	0xCC00 - 0xCC7A
37100-4.F2	0xCD00 - 0xCD7A
37100-4.F3	0xCE00 - 0xCE7A
37100-4.F4	0xCF00 - 0xCF7A
37100-5.F1	0xD000 - 0xD07A
37100-5.F2	0xD100 - 0xD17A
37100-5.F3	0xD200 - 0xD27A
37100-5.F4	0xD300 - 0xD37A

Wert	37100-1.F1	37100-1.F2	37100-1.F3	37100-1.F4	37100-2.F1	37100-2.F2	37100-2.F3	37100-2.F4
U1	49152	49408	49664	49920	50176	50432	50688	50944
U2	49154	49410	49666	49922	50178	50434	50690	50946
U3	49156	49412	49668	49924	50180	50436	50692	50948
U12	49158	49414	49670	49926	50182	50438	50694	50950
U23	49160	49416	49672	49928	50184	50440	50696	50952
U31	49162	49418	49674	49930	50186	50442	50698	50954
I1	49164	49420	49676	49932	50188	50444	50700	50956
I2	49166	49422	49678	49934	50190	50446	50702	50958
I3	49168	49424	49680	49936	50192	50448	50704	50960
INc	49170	49426	49682	49938	50194	50450	50706	50962
P1	49172	49428	49684	49940	50196	50452	50708	50964
P2	49174	49430	49686	49942	50198	50454	50710	50966
P3	49176	49432	49688	49944	50200	50456	50712	50968
3P	49178	49434	49690	49946	50202	50458	50714	50970
S1	49180	49436	49692	49948	50204	50460	50716	50972
S2	49182	49438	49694	49950	50206	50462	50718	50974
S3	49184	49440	49696	49952	50208	50464	50720	50976
3S	49186	49442	49698	49954	50210	50466	50722	50978
Q1	49188	49444	49700	49956	50212	50468	50724	50980
Q2	49190	49446	49702	49958	50214	50470	50726	50982
Q3	49192	49448	49704	49960	50216	50472	50728	50984
3Q	49194	49450	49706	49962	50218	50474	50730	50986
CosPhi1	49196	49452	49708	49964	50220	50476	50732	50988
CosPhi2	49198	49454	49710	49966	50222	50478	50734	50990
CosPhi3	49200	49456	49712	49968	50224	50480	50736	50992
Frequenz (f)	49202	49458	49714	49970	50226	50482	50738	50994
Phasenfolge	49204	49460	49716	49972	50228	50484	50740	50996
EP1 gesamt	49206	49462	49718	49974	50230	50486	50742	50998
EP2 gesamt	49208	49464	49720	49976	50232	50488	50744	51000
EP3 gesamt	49210	49466	49722	49978	50234	50490	50746	51002
3EP gesamt	49212	49468	49724	49980	50236	50492	50748	51004

Wert	37100-1.F1	37100-1.F2	37100-1.F3	37100-1.F4	37100-2.F1	37100-2.F2	37100-2.F3	37100-2.F4
EP1 bezogen	49214	49470	49726	49982	50238	50494	50750	51006
EP2 bezogen	49216	49472	49728	49984	50240	50496	50752	51008
EP3 bezogen	49218	49474	49730	49986	50242	50498	50754	51010
3EP bezogen	49220	49476	49732	49988	50244	50500	50756	51012
EP1 geliefert	49222	49478	49734	49990	50246	50502	50758	51014
EP2 geliefert	49224	49480	49736	49992	50248	50504	50760	51016
EP3 geliefert	49226	49482	49738	49994	50250	50506	50762	51018
3EP geliefert	49228	49484	49740	49996	50252	50508	50764	51020
ES1	49230	49486	49742	49998	50254	50510	50766	51022
ES2	49232	49488	49744	50000	50256	50512	50768	51024
ES3	49234	49490	49746	50002	50258	50514	50770	51026
3ES	49236	49492	49748	50004	50260	50516	50772	51028
EQ1	49238	49494	49750	50006	50262	50518	50774	51030
EQ2	49240	49496	49752	50008	50264	50520	50776	51032
EQ3	49242	49498	49754	50010	50266	50522	50778	51034
3EQ	49244	49500	49756	50012	50268	50524	50780	51036
EQL1	49246	49502	49758	50014	50270	50526	50782	51038
EQL2	49248	49504	49760	50016	50272	50528	50784	51040
EQL3	49250	49506	49762	50018	50274	50530	50786	51042
3EQL	49252	49508	49764	50020	50276	50532	50788	51044
EQC1	49254	49510	49766	50022	50278	50534	50790	51046
EQC2	49256	49512	49768	50024	50280	50536	50792	51048
EQC3	49258	49514	49770	50026	50282	50538	50794	51050
3EQC	49260	49516	49772	50028	50284	50540	50796	51052
THD U1	49262	49518	49774	50030	50286	50542	50798	51054
THD U2	49264	49520	49776	50032	50288	50544	50800	51056
THD U3	49266	49522	49778	50034	50290	50546	50802	51058
THD I1	49268	49524	49780	50036	50292	50548	50804	51060
THD I2	49270	49526	49782	50038	50294	50550	50806	51062
THD I3	49272	49528	49784	50040	50296	50552	50808	51064
3CosPhi	49274	49530	49786	50042	50298	50554	50810	51066

Wert	37100-3.F1	37100-3.F2	37100-3.F3	37100-3.F4	37100-4.F1	37100-4.F2	37100-4.F3	37100-4.F4	37100-5.F1	37100-5.F2	37100-5.F3	37100-5.F4
U1	51200	51456	51712	51968	52224	52480	52736	52992	53248	53504	53760	54016
U2	51202	51458	51714	51970	52226	52482	52738	52994	53250	53506	53762	54018
U3	51204	51460	51716	51972	52228	52484	52740	52996	53252	53508	53764	54020
U12	51206	51462	51718	51974	52230	52486	52742	52998	53254	53510	53766	54022
U23	51208	51464	51720	51976	52232	52488	52744	53000	53256	53512	53768	54024
U31	51210	51466	51722	51978	52234	52490	52746	53002	53258	53514	53770	54026
I1	51212	51468	51724	51980	52236	52492	52748	53004	53260	53516	53772	54028
I2	51214	51470	51726	51982	52238	52494	52750	53006	53262	53518	53774	54030
I3	51216	51472	51728	51984	52240	52496	52752	53008	53264	53520	53776	54032
INc	51218	51474	51730	51986	52242	52498	52754	53010	53266	53522	53778	54034
P1	51220	51476	51732	51988	52244	52500	52756	53012	53268	53524	53780	54036
P2	51222	51478	51734	51990	52246	52502	52758	53014	53270	53526	53782	54038
P3	51224	51480	51736	51992	52248	52504	52760	53016	53272	53528	53784	54040
3P	51226	51482	51738	51994	52250	52506	52762	53018	53274	53530	53786	54042
S1	51228	51484	51740	51996	52252	52508	52764	53020	53276	53532	53788	54044
S2	51230	51486	51742	51998	52254	52510	52766	53022	53278	53534	53790	54046
S3	51232	51488	51744	52000	52256	52512	52768	53024	53280	53536	53792	54048
3S	51234	51490	51746	52002	52258	52514	52770	53026	53282	53538	53794	54050
Q1	51236	51492	51748	52004	52260	52516	52772	53028	53284	53540	53796	54052
Q2	51238	51494	51750	52006	52262	52518	52774	53030	53286	53542	53798	54054
Q3	51240	51496	51752	52008	52264	52520	52776	53032	53288	53544	53800	54056
3Q	51242	51498	51754	52010	52266	52522	52778	53034	53290	53546	53802	54058
CosPhi1	51244	51500	51756	52012	52268	52524	52780	53036	53292	53548	53804	54060
CosPhi2	51246	51502	51758	52014	52270	52526	52782	53038	53294	53550	53806	54062
CosPhi3	51248	51504	51760	52016	52272	52528	52784	53040	53296	53552	53808	54064
Frequenz (f)	51250	51506	51762	52018	52274	52530	52786	53042	53298	53554	53810	54066
Phasenfolge	51252	51508	51764	52020	52276	52532	52788	53044	53300	53556	53812	54068
EP1 gesamt	51254	51510	51766	52022	52278	52534	52790	53046	53302	53558	53814	54070
EP2 gesamt	51256	51512	51768	52024	52280	52536	52792	53048	53304	53560	53816	54072
EP3 gesamt	51258	51514	51770	52026	52282	52538	52794	53050	53306	53562	53818	54074
3EP gesamt	51260	51516	51772	52028	52284	52540	52796	53052	53308	53564	53820	54076

Wert	37100-3.F1	37100-3.F2	37100-3.F3	37100-3.F4	37100-4.F1	37100-4.F2	37100-4.F3	37100-4.F4	37100-5.F1	37100-5.F2	37100-5.F3	37100-5.F4
EP1 bezogen	51262	51518	51774	52030	52286	52542	52798	53054	53310	53566	53822	54078
EP2 bezogen	51264	51520	51776	52032	52288	52544	52800	53056	53312	53568	53824	54080
EP3 bezogen	51266	51522	51778	52034	52290	52546	52802	53058	53314	53570	53826	54082
3EP bezogen	51268	51524	51780	52036	52292	52548	52804	53060	53316	53572	53828	54084
EP1 geliefert	51270	51526	51782	52038	52294	52550	52806	53062	53318	53574	53830	54086
EP2 geliefert	51272	51528	51784	52040	52296	52552	52808	53064	53320	53576	53832	54088
EP3 geliefert	51274	51530	51786	52042	52298	52554	52810	53066	53322	53578	53834	54090
3EP geliefert	51276	51532	51788	52044	52300	52556	52812	53068	53324	53580	53836	54092
ES1	51278	51534	51790	52046	52302	52558	52814	53070	53326	53582	53838	54094
ES2	51280	51536	51792	52048	52304	52560	52816	53072	53328	53584	53840	54096
ES3	51282	51538	51794	52050	52306	52562	52818	53074	53330	53586	53842	54098
3ES	51284	51540	51796	52052	52308	52564	52820	53076	53332	53588	53844	54100
EQ1	51286	51542	51798	52054	52310	52566	52822	53078	53334	53590	53846	54102
EQ2	51288	51544	51800	52056	52312	52568	52824	53080	53336	53592	53848	54104
EQ3	51290	51546	51802	52058	52314	52570	52826	53082	53338	53594	53850	54106
3EQ	51292	51548	51804	52060	52316	52572	52828	53084	53340	53596	53852	54108
EQL1	51294	51550	51806	52062	52318	52574	52830	53086	53342	53598	53854	54110
EQL2	51296	51552	51808	52064	52320	52576	52832	53088	53344	53600	53856	54112
EQL3	51298	51554	51810	52066	52322	52578	52834	53090	53346	53602	53858	54114
3EQL	51300	51556	51812	52068	52324	52580	52836	53092	53348	53604	53860	54116
EQC1	51302	51558	51814	52070	52326	52582	52838	53094	53350	53606	53862	54118
EQC2	51304	51560	51816	52072	52328	52584	52840	53096	53352	53608	53864	54120
EQC3	51306	51562	51818	52074	52330	52586	52842	53098	53354	53610	53866	54122
3EQC	51308	51564	51820	52076	52332	52588	52844	53100	53356	53612	53868	54124
THD U1	51310	51566	51822	52078	52334	52590	52846	53102	53358	53614	53870	54126
THD U2	51312	51568	51824	52080	52336	52592	52848	53104	53360	53616	53872	54128
THD U3	51314	51570	51826	52082	52338	52594	52850	53106	53362	53618	53874	54130
THD I1	51316	51572	51828	52084	52340	52596	52852	53108	53364	53620	53876	54132
THD I2	51318	51574	51830	52086	52342	52598	52854	53110	53366	53622	53878	54134
THD I3	51320	51576	51832	52088	52344	52600	52856	53112	53368	53624	53880	54136
3CosPhi	51322	51578	51834	52090	52346	52602	52858	53114	53370	53626	53882	54138