SIEMENS

Manual

SENTRON

Circuit breakers

3WT air circuit breaker with communication capability - Modbus

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SENTRON

Circuit breakers
3WT air circuit breaker with communication capability - Modbus

System Manual

02/2019

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⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

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Introduction 1

1.1 About this documentation

Target readers of this documentation

The information contained in this manual is provided for the benefit of:

- Users
- Control cabinet manufacturers
- Switchgear manufacturers
- Maintenance personnel

1.2 Product-specific Information

Siemens Technical Support

You can find further support on the Internet at:

Technical Support (http://www.siemens.com/lowvoltage/technical-support)

1.3 Security instructions

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1.4 3WT Air Circuit Breakers

In power distribution systems the 3WT circuit breaker can transfer important information via bus systems to a central control room for the purpose of:

- Instantaneous values
- Energy values
- Demand values
- Min/max
- Diagnostics management
- Fault management
- Maintenance management

Data acquisition and evaluation

Transparency in power distribution enables a fast response to such statuses.

Important messages can be transmitted to the cell phones of the maintenance personnel as text messages by means of additional modules. Timely evaluation of this data enables selective intervention in the process and prevents plant failures.

Acquired data are:

- Status information
- Alarm messages

- Trigger information
- Threshold violations (e.g. overcurrent, phase unbalance, overvoltage)

Maintenance

Information for preventive maintenance (e.g. number of switching cycles or operating hours) enables timely planning of personnel and material. This increases the level of plant availability. Destruction of sensitive system components due to failures is prevented.

Communication helps to provide specific information about the location and cause of power failures. Recording of phase currents allows precise determination of the cause of the fault (e.g. triggered by short circuit of 2317 A in phase L2 on 27.08.2017 at 14:27). This is the basis for fast correction of the fault and creates a significant potential for cost savings.

Statistics and cost-effectiveness

Recording of power, energy and the power factor cos φ opens up further possibilities. Energy profiles can be created and the costs can be clearly allocated thanks to the transparent representation of energy consumption for business administration analysis. Energy costs can later be optimized by compensating for load peaks and troughs.

Modular and intelligent

The air circuit breaker program consists of a small number of components with a host of combination options, and it encompasses a performance range from 16 A to 6300 A. The versatility in power distribution achieved by this modularity enables low-cost, flexible integration of the air circuit breakers into higher-level system solutions using communication.

Saving costs

The benefits of the air circuit breakers result both from their modular design and compact construction. This saves costs for work processes in planning and trade, and for switchgear manufacturers and plant operators. It also saves space and energy.

Easy planning

This results from the use of the air circuit breakers and the SIMARIS design planning tool, which enables the solution of previously tedious and difficult processes, primarily for planning offices but also for control cabinet builders.

System solutions

Embedding of the air circuit breakers into a higher-level communication system makes it possible to parameterize the circuit breakers via Modbus RTU to optimize the entire power distribution system by means of an integrated power management system.

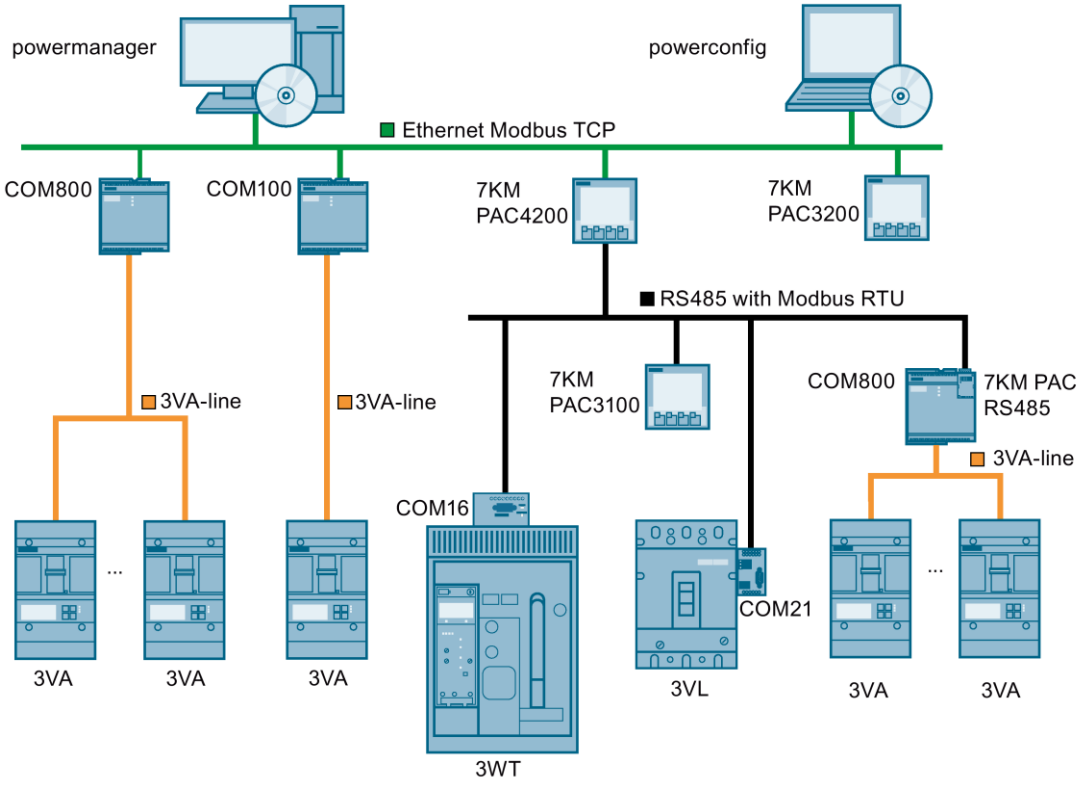
1.5 Power monitoring with powermanager

Siemens has developed the powermanager software for power and line monitoring.

Identifying cost-cutting potential

The powermanager power monitoring software processes and monitors the measured data obtained from 7KT/7KM PAC measuring devices and communication-capable 3WT/ 3VA / 3VL circuit breakers. Potential energy savings can easily be identified thanks to the transparency of the energy flows.

The entire SENTRON portfolio with power monitoring software, measuring devices and circuit breakers has been certified by the TÜV Rheinland for its suitability to support an energy management system in accordance with ISO 50001.



The 3WT electronic trip units ETU45WT and ETU47WT Release 2 are all capable of communication.

1.6 Order numbers

Complete circuit breaker

If a circuit breaker with communication and measuring function is to be ordered, then please order a breaker with Z-Option. All components are pre-assembled.

- F05: Metering with internal voltage tap
- F12: COM16WT communication module inclusive BSS

Like e.g. 3WT8 _ _ _ – _ _ _ _ _ – _ _ _ _ –Z F05+F12

Spare parts

- 3WT9844-0AT00 BSSWT
- 3WT9844-1AT00 COM16WT
- 3WT9844-2AT00 Adapter COM16 fixed-mounted
- 3WT9844-3AT00 Adapter COM16 draw-out
- 3WT9844-4AT00 V-Tap WT
- 3WT9844-5AT00 MF WT

1.7 General information about Modbus RTU

Definition/standard

Modbus RTU is an open, serial communication protocol based on the master-slave architecture. It can be implemented easily on any serial interfaces. Modbus RTU comprises one master and several slaves, with communication controlled exclusively by the master.

Communication

Modbus RTU has two fundamental communication mechanisms:

- Query/response (Polling): The master sends a request frame to any station and expects a response frame.
- Broadcast: The master sends a command to all stations on the network. These execute the command without acknowledgment.

References

You can find further information at www.modbus.org (http://www.modbus.org) in the following specification:
Modbus over Serial Line (http://modbus.org/docs/Modbus_over_serial_line_V1_02.pdf)

Message frames

The message frames allow process data (input/output data) to be written or read either individually or in groups.

Modbus RTU is used on different transmission media. Implementation on the RS485 physical bus, a shielded, twisted-pair cable with terminating resistors, is widespread.

Applications

The Modbus RTU protocol is used for:

- Industrial controllers
- Building automation systems

Use of Modbus RTU is recommended above all for applications with low time requirements.

Installation

2

2.1 Installation

You can find information about the installation of the components COM16WT, BSSWT, MF WT, V-Tap WT in the 3WT Operating Instructions.

Printed 3WT Operating Instructions are included with each circuit breaker or are available online via SIEMENS Industry Online Support (http://support.industry.siemens.com/cs/start?lc=en-US).

The COM16WT is connected by plugging it into position X400 of the auxiliary connecting terminals.

The figure below shows the label on the COM16WT, the external pin assignment for connecting the closing solenoid Y1, the shunt release F1 or F2, Modbus RTU write enable (protection), and the free user input/output.

The outputs are usable by DC 24 V with 400 mA.

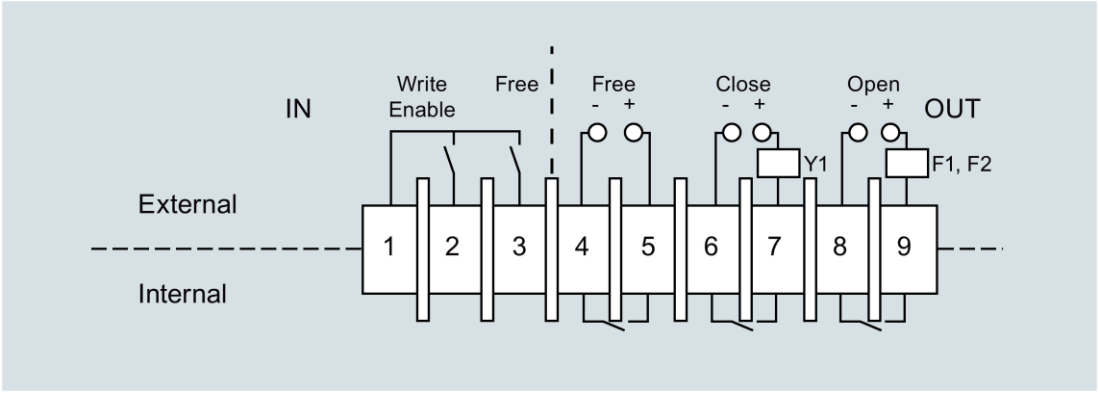


Figure 2-1 COM16WT pin assignment

2.2 COM16WT Modbus RTU module

With the COM16WT, the 3WT air circuit breaker can exchange data via Modbus RTU. The COM16WT fetches some of the most important information about the status of the breaker (on/off, spring energy store, ready, etc.) from the BSSWT (Breaker Status Sensor).

Securing

It is possible to disable control/write access (via write enable contact) to the circuit breaker via wire connection if this is necessary for security reasons, e.g. to prevent switching via Modbus RTU (manual/automatic mode) or to prevent the modification of parameters.

Integral clock

An integral clock adds a time stamp to all events such as minimum and maximum measured values, alarms, and tripping signals. This clock can be synchronized via Modbus RTU.

Temperature sensor

The COM16WT has an integral temperature sensor that provides the temperature in the control cabinet thanks to its installation location outside the circuit breaker.

The BSSWT also contains a temperature sensor that shows the temperature in the breaker. Both sensors are factory-calibrated and a recalibration is not necessary.

Detecting the switch position

The circuit breaker position (operating position, test position, disconnected position and not present) in the guide frame is detected automatically by means of three built-in micro switches on the underside of COM16WT, and can be read out via Modbus RTU.

The circuit breaker can only be switched ON and OFF via Modbus in the connected position and the test position.

2.3 Further components and connections

The output contacts (Pin 4 to 9) are able to switch up to 400 mA at DC 24 V.

If the switch-on and switch-off solenoids are designed for higher voltages than DC 24 V or higher current over 400 mA, coupling relays must be used.

Tripped signaling switch

Free user output on COM16WT is set by default as tripped signaling switch. A high level at the output means the circuit breaker has tripped. The function of the user output is selectable via the software powerconfig or via Modbus communication.

Terminating resistor

The terminating resistor supplied in the form of a RJ45 plug must be used.

The free user input can be connected via a contact element (NO or NC) to the DC 24 V voltages from Pin1 to transmit the status of the contact element.

2.4 Modbus RTU SUB-D9 socket

The Modbus RTU line is connected to the 9-pin interface on the front of COM16WT.

Assignment of the SUB-D9 socket regarding the Modbus Standard MODBUS over Serial Line Specification and Implementation Guide V1.02	
PIN1	Common
PIN5	B, Tx/Rx +
PIN9	A, Tx/Rx −

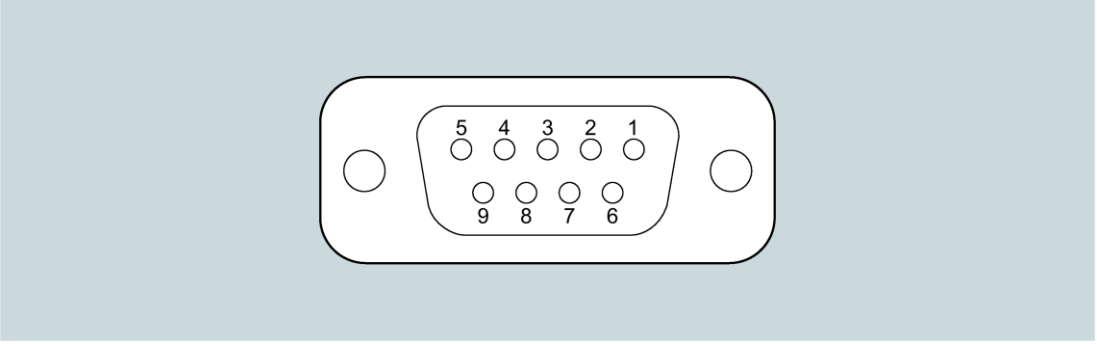


Figure 2-2 SUB-D9 socket

2.5 Connection of the COM16WT module

The figure below shows how COM16WT contacts for ON and OFF must be wired to allow switching the breaker on/off. This figure only applies for ON and OFF solenoids with DC 24 V!

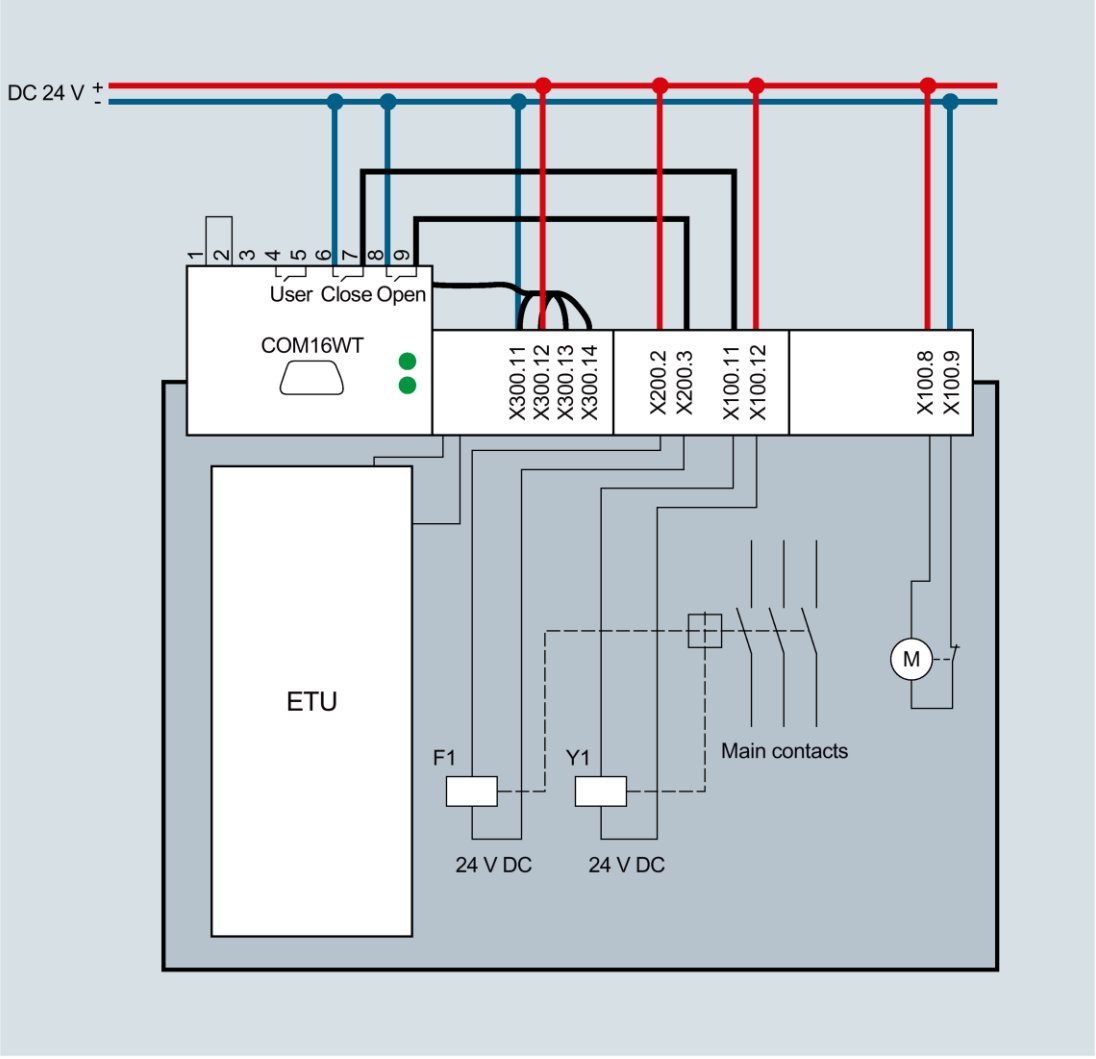


Figure 2-3 Wiring of COM16WT at DC 24 V

The figure below shows the wiring if contacts are installed with voltages not equal to DC 24 V.

- Coupling relays must be used.
- If F1 is not used for switching off, alternative F2 can be used.

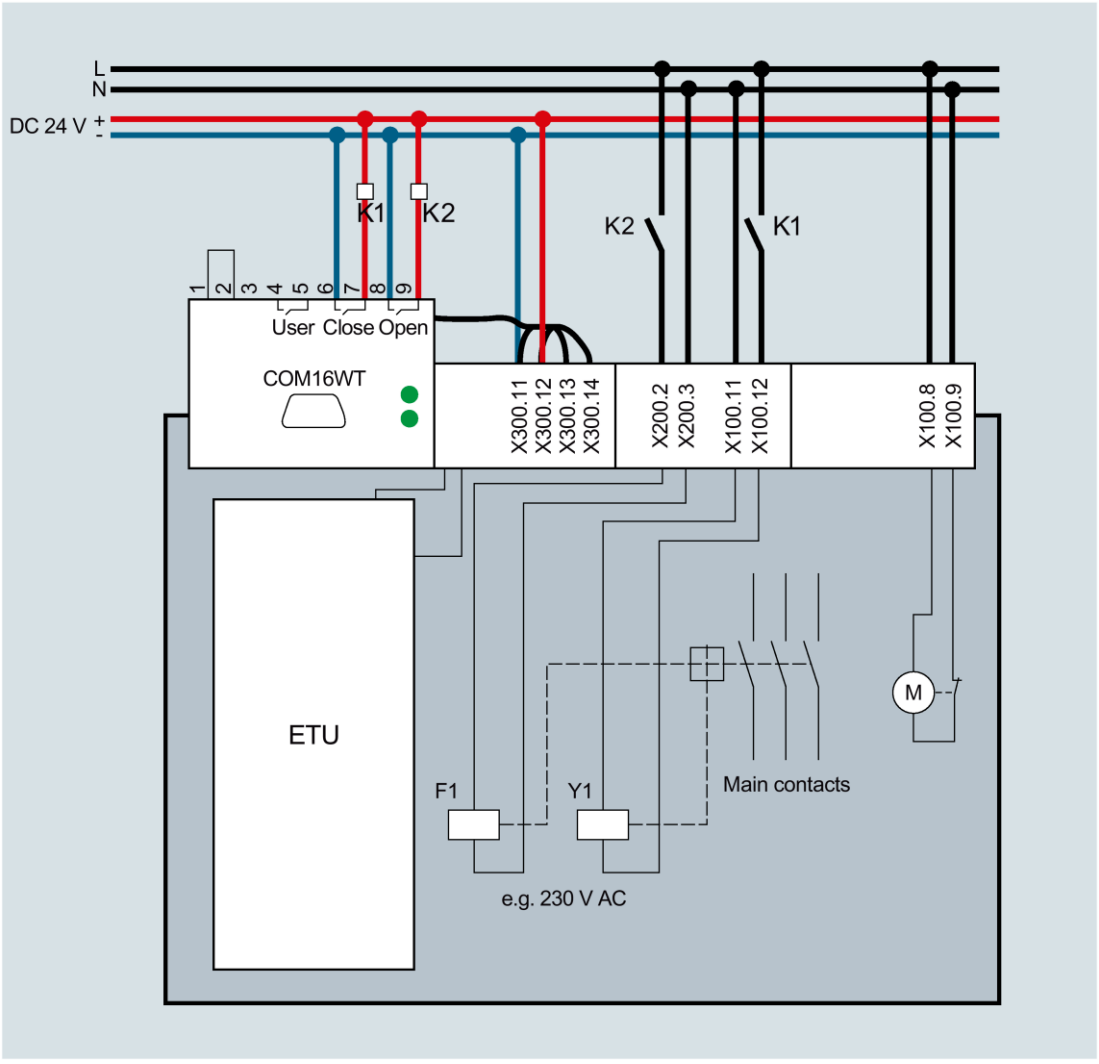


Figure 2-4 Wiring of COM16WT at voltage not equal to DC 24 V

2.6 RJ45 connection

The figure below shows COM16WT from behind. It shows the RJ45 connection, the bus must be terminated with the terminating resistor supplied.

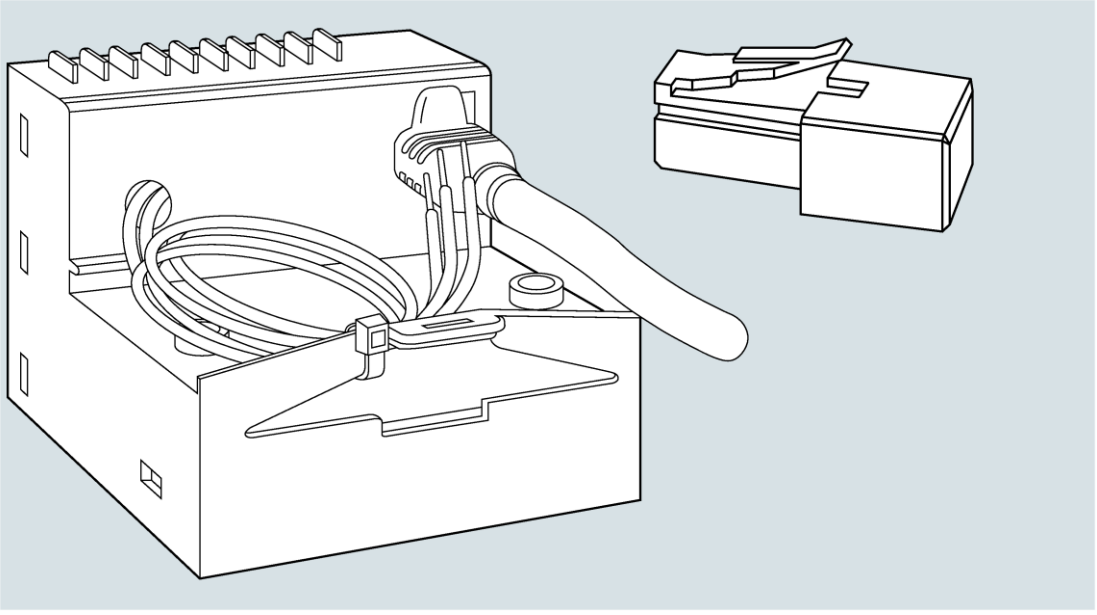


Figure 2-5 COM16WT with RJ45 connection

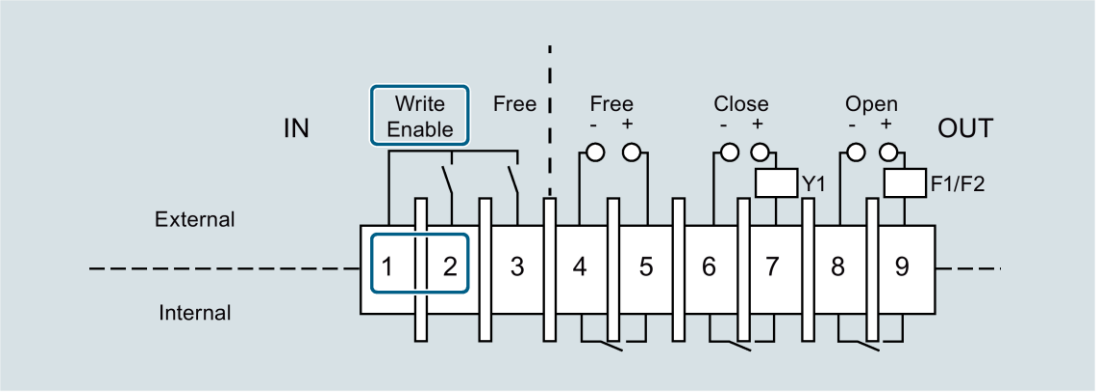
2.7 Connection of the breaker

The four black cables that are brought out of the COM16WT must be connected to X300.

Meaning	Position and printing on the cable
BUS −	X300:14
BUS +	X300:13
DC +24 V	X300:12
Ground DC 24 V	X300:11

2.8 Write protection (WriteEnable)

In applications in power distribution, it is necessary to disable write access via the COM module temporarily or permanently. There is a hardware input on the COM16WT for this purpose.



Pin 1 provides the DC 24 V supplies that can be run back via a contact to Pin2 (WriteEnable).

If this input is not bridged (that is, actively enabled), write access is not possible (with exceptions).

Without a bridge at the input of the write protection, the following actions will be disabled:

- Switching circuit breaker ON or OFF
- Resetting the current tripping operation
- Changing the protection parameters
- Changing the parameters for the extended protection function (metering function)
- Changing the parameters for communication
- Changing the parameters for measured value setting (metering function)
- Resetting maintenance information (counter)

The following actions are still permitted in write-protected mode:

- Modifying and setting of trigger functions for the waveform buffer
- Reading out the contents of the waveform buffer
- Changing the parameters for threshold values
- Setting/modifying the system time
- Modifying the free texts (comment, plant identifier)
- Resetting the min./max. values
- Modifying the free user output

Transfer of necessary information

Despite the write protection, all the necessary information can be transferred, but the status of the circuit breaker cannot be changed.

This is reserved for the operator of the power distribution system. All non-disabled actions are used only for remote diagnostics and do not affect the current status. However, it is possible to diagnose tripping operations and waveforms more precisely, even remotely.

Application

With the write protection function it is possible to prevent the switching the circuit breaker or changing of parameters via communication. The protection is temporarily or permanently possible. Here are some examples.

Permanently

- Do not bridge the PIN 1 to 2.

  Switching or changing of parameters via communication is not possible.

Temporarily, switch the write protection function ON or OFF via

- Door switch

  To protect the operator or service engineer.

  If the switchgear door is open, switching the circuit breaker or changing of parameters via communication is not possible.

- Selecting switch (remote/local)

  A selector switch in the switchgear door to select the function remote switching or only local switching of the circuit breaker.

- Cyber security

  Securing the system against unwanted switching or changing of protection settings.

  E.g. to use an alternative path, to switch the write protection function ON or OFF, e.g. via PLC.

2.9 Breaker Status Sensor (BSSWT)

To read the circuit breaker statuses via Modbus RTU, a BSSWT module must be installed.

The BSSWT detects the circuit breaker status.

Total 5 signals:

- Switch on/off
- Tripped
- Ready to close
- Spring charged
- Auxiliary release

A requirement for this is that the circuit breaker has an electronic trip unit of the type ETU45WT/ETU47WT.

Micro switches that receive the information on the status of the circuit breaker are attached to the BSS or connected to it. The BSSWT makes this digital information available on the Modbus RTU.

Commissioning

3

3.1 Availability of the data

Data library

Each data point from the data library of the 3WT can only be generated by a single module, the data source. If this data source (node) is available, the data points assigned to the data source will also be available.

This availability is described and also communicated in the "property bytes". If a data source (node) is not available, the data point will also not exist. This can also be seen in the associated property byte. Chapter Data library (Page 157) provides a precise description of the individual data points.

Data point groups

The table below provides an overview of the internal BUS nodes and their assigned data point groups (combination of several data points). The table below shows which data points from the data library are generated by which BUS module:

Data point group Data points with the same source	BUS nodes			
	ETU45WT ETU47WT	BSSWT	COM16WT	Metering
Protection parameters	✓	–	–	–
Extended protection parameters	–	–	–	✓
Parameters for threshold values	–	–	–	✓
Communication parameters	–	–	✓	–
Parameters for setting measured values	–	–	–	✓
Data for device identification	✓		✓	–
Switch position information	–	–	✓	–
Status information (switch on/off, spring energy store, etc.)	–	✓	–	–
Alarms	✓	–	–	–
Tripping operations	✓	–	–	✓
Threshold value messages	–	–	–	✓
Maintenance information	✓	–	✓	–
Temperature in circuit breaker		✓	–	–
Temperature in the control cabinet	–	–	✓	–
3-phase currents	✓	–	–	–
Current in N-conductor, ground-fault current; depending on equipment	✓	–	–	–
3-phase voltages	–	–	–	✓

Data point group Data points with the same source	BUS nodes			
	ETU45WT ETU47WT	BSSWT	COM16WT	Metering
Power P, Q, S, energy	–	–	–	✓
Cos φ	–	–	–	✓
Frequency, total harmonic distortion, form factor, peak factor	–	–	–	✓
Harmonic analysis	–	–	–	✓
Waveform buffer	–	–	–	✓
Logbook for events and tripping operations	–	–	✓	–
System time	–	–	✓	–

Electronic trip unit (ETU)

The core of each switch is the electronic trip unit (ETU). There are different options for adapting the protection functions, metering functions, and signaling functions to the requirements of the plant: From simple overload protection and short-circuit protection, up to trip units with a host of metering and signaling functions that can be parameterized remotely.

Communication capability

All circuit breakers with trip units of the type ETU45WT and ETU47WT have communication capability.

Connection

The circuit breaker is connected to Modbus RTU via the RS485 interface of the COM16WT module. Communication can also be implemented with the Modbus protocol on Ethernet using an appropriate gateway.

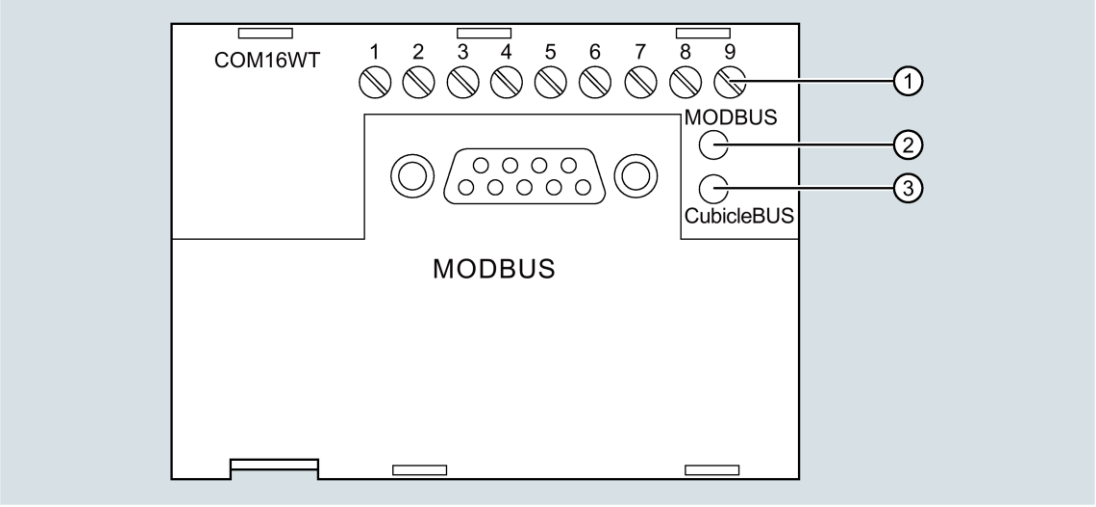
3.2 COM16WT default address

The COM16WT is supplied as standard with the Modbus RTU address 126. This must be changed by the user when configuring the system (e.g. with software *powerconfig*).

3.2.1 Diagnosing the communication system

The COM16WT has two LEDs labeled "MODBUS" and "CubicleBUS" for diagnosing the internal communication. The operating status for Modbus RTU and the CubicleBUS can be read from these.

The figure below shows the front view of the Modbus RTU module of the 3WT Air Circuit Breaker with the Modbus RTU connection and the two LEDs.



① Terminals
② "MODBUS" LED
③ "BUS" LED

Figure 3-1 COM16 Modbus RTU module of the 3WT

3.2.2 "Modbus" LED

The "Modbus" LED shows the status of the Modbus RTU communication of the COM16WT module.

"Modbus" LED	Meaning
Off	No voltage on the COM16WT
Red 	No Modbus RTU communication: No communication to the COM16WT active or wait time for new communication elapsed
Green 	Existing Modbus RTU communication: Valid Modbus RTU message frame detected and wait time for new communication not elapsed.

3.2.3 "CubicleBUS" LED

The "CubicleBUS" LED shows the status of the CubicleBUS communication of the COM16WT module.

"CubicleBUS" LED	Meaning
Off	No CubicleBUS module found
Red 	CubicleBUS fault
Flashing green 	A CubicleBUS node has been found but no metering function, and no trip unit
Steady green light 	CubicleBUS node found and connection with metering function, and/or trip unit

Two LEDs must be considered for assessing a functional CubicleBUS in the switch:

- The "COMM" LED on the trip unit must be green, that is, at least one other BUS node must be detected from the perspective of the trip unit.

At the least, this is only the metering function, if the BUS has been subsequently interrupted.

- The BUS LED on the COM16WT must then be considered. If this shows a steady green light, there is a connection from the COM16WT at least to the metering function.
- If both LEDs show a green light (steady light from BUS on the COM16WT module and "COMM" on the trip unit), there is continuous communication between the trip unit, the COM16WT and Modbus RTU.

3.2.4 Data exchange via Modbus RTU

Data exchange then functions as follows:

- An up-to-date image of all the data of the 3WT is always stored in the COM16WT module. Consequently, a data query from the COM16 module to the PLC can be answered within just a few milliseconds.
- Write data from the PLC is forwarded to the correct addressee on the CubicleBUS.

3.2.5 Detecting the circuit breaker position in the guide frame

The COM16WT module has three micro switches on the underside for determining the position of a slide-in circuit breaker in the guide frame. Depending on which switch is actuated, the position described above is communicated (1 = actuated).

The table below gives the definition of the position on:

Switch position	Rear switch	Middle switch	Front switch
Connected position	1	0	0
Test/check position	0	1	0
Disconnected position	0	0	1
Circuit breaker not present	0	0	0

When the circuit breaker is moved, the micro switch that has been actuated is released before the next one is actuated. No micro switch is actuated in the intervening period. As far as communication is concerned, this means that when the breaker is moved, the "old" status is communicated until a new defined status is reached.

Once the "disconnected position" micro switch has been released, there is no way of determining the direction in which the breaker is being moved.

If it is pushed in, the next position is the "test position". The COM16WT communicates "disconnected position" for a further 10 s until the "test position" switch is actuated and only then "switch not present".

In the case of fixed-mounted circuit breakers, a counter plate is screwed to the COM16WT and this transfers the connected position.

3.3 Modbus RTU data transfer

3.3.1 Integration of the circuit breakers into a communication system

There are diverse possibilities for integrating the air circuit breakers into a communication system.

3.3.2 Modbus RTU

3.3.2.1 Structure of the job message frame

Structure

Data traffic between the master and the slave and between the slave and the master begins with the address of the slave. The job message frame consists of the following elements:

- Address of the MODBUS slave
- Function code
- Data of the message frame
- Checksum of the message frame (CRC)

The structure of the data field depends on the function code used.

Address	Function code	Data	CRC
Byte	Byte	n byte	2 byte

Note

- A node address of 0 is called a broadcast message frame and is processed by each node without a response.
- Address range for circuit breakers limited to 1 to 126 (126 = delivery setting)

Cyclic redundancy check (CRC)

The cyclic redundancy check checks the data flow. The CRC consists of 2 byte:

- One LSB
- One MSB

The transmitting device calculates the CRC and appends it to the message. The receiving device calculates the CRC again and compares the newly calculated value with the received CRC. If the two values do not agree, an error has occurred.

For more details see "MODBUS organization" (http://www.modbus.org).

End of a message frame

If no characters are transferred for the space of 3.5 byte this is taken as the end of the message frame. A check is made to determine the validity of the message frame.

See also

Function codes (Page 34)

3.3.2.2 Character frames

The Modbus RTU specification defines the possible character frames.

Structure of the character frame

Data is exchanged between the circuit breaker and the Modbus RTU master via the serial interface in an 11-bit character frame.

Depending on the setting of the "PARITY" communication parameter in the circuit breaker, the 1st stop bit may be replaced by the "parity bit":

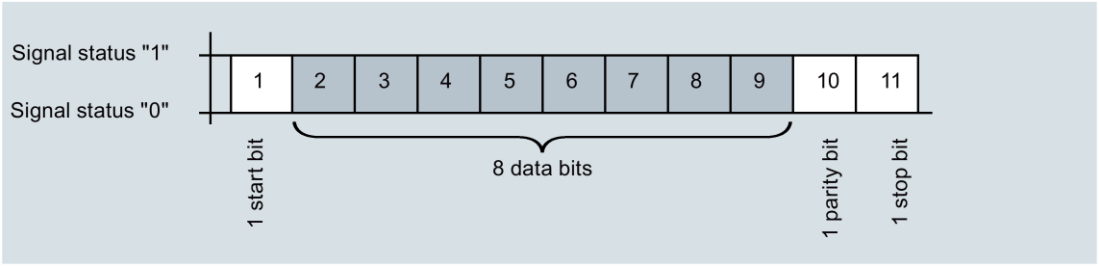


Figure 3-2 11-bit character frame with 8 data bits: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit ("8N1")

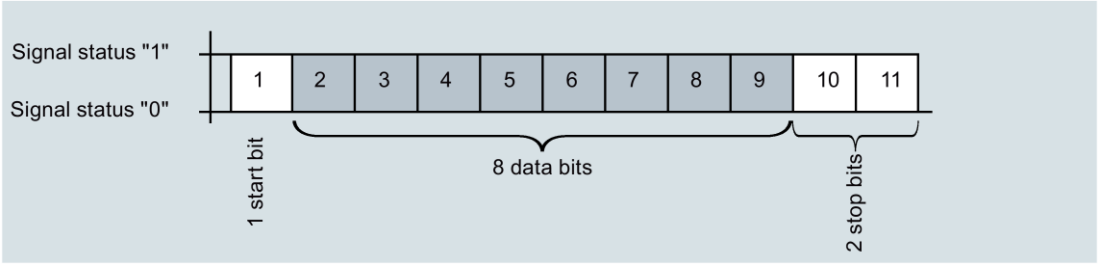


Figure 3-3 11-bit character frame with 8 data bits: 1 start bit, 8 data bits, 2 stop bits ("8N2")

3.3.2.3 Communication parameter settings

In the delivery condition the circuit breaker has the following parameter settings for communication purposes:

- Address: 126
- Baud rate: 19200 bps
- Parity: None

Note

All communication modules include an "autobaud search" on startup. This allows the parameters to adapt to an existing network, so that the Circuit Breaker is able to be communicated with immediately.

Settings

Register			Description
Address		High/Low	
Dec	Hex		
40963	0xA003	HIGH	MODBUS address
40985	0xA019	LOW	"MODBUS transmission rate (baud rate)"
40985	0xA019	HIGH	Parity

For more information about formats refer to chapter Formats (Page 106).

3.3.2.4 Data storage

Name of area	Function codes	Address range
Control bytes	01 (0x01) – Read output bits	0 (0x0000) … 15 (0x000F)
	05 (0x05) – Write individual output	
	15 (0x0F) – Write output block	
Status bytes	02 (0x02) – Read input	0 (0x0000) … 15 (0x000F)
Basic type data	04 (0x04) – Read basic type data	0 (0x0000) … 21 (0x0015)[1)]
Value buffer area	03 (0x03) – Read value buffer area	0 (0x0000) … 42336 (0xA560)
	16 (0x0A) – Write value buffer area	

1) Area is dependent on settings (basic type)

Control bytes

These are the outputs which trigger functions of the circuit breaker.

Circuit breaker output assignment

Bit	Value	3WT Air Circuit Breaker
0, 1	0 … 3	Switching the circuit breaker
	0	Not defined (no action)
	1	Circuit Breaker off (opening of the main contacts)
	2	Circuit Breaker on (closing of the main contacts)
	3	Not defined (no action)
2	–	A currently active tripping operation is acknowledged and reset
3	–	Not used
4	–	Setting of the free user output
5	–	Not used
6	–	Not used

Bit	Value	3WT Air Circuit Breaker
7	–	Not used
8	–	Not used
9	–	Not used
10	–	Delete tripping and event log
11	–	Reset all minimum/maximum value memories (on WL, except temperature)
12	–	Reset minimum/maximum value buffers for temperatures
13	–	Not used
14	–	Reset all maintenance information and counters which can be reset
15	–	Bit for synchronizing the system time to the current half hour

Status bytes

These are the inputs which return the status of the circuit breaker. (The status bytes included in each basic type as "binary status information").

Circuit breaker input assignment

Bit	Value	3WT Air Circuit Breaker
0, 1	0 … 3	Position of circuit breaker
	0	Disconnected position
	1	Connected position
	2	Test position
	3	Breaker is not available
2, 3	0 … 3	Status of the circuit breaker
	0	Not ready
	1	OFF
	2	ON
	3	Breaker has tripped
4	–	Ready-to-close signal available
5	0	With undervoltage release: Circuit Breaker has tripped With shunt release: Circuit Breaker has not tripped
	1	With undervoltage release: Circuit Breaker has not tripped With shunt release: Circuit Breaker has tripped
6	–	Spring energy store is compressed
7	–	Overload warning present
8	–	An activated threshold has been exceeded
9	–	An alarm signal is currently present
10	–	Write protection disable deactivated, changes allowed
11	–	Status of the free user output
12, 13, 14	0 … 7	Reason for last tripping operation
	0	No tripping operation or last tripping operation acknowledged

Bit	Value	3WT Air Circuit Breaker
	1	Overload tripping (L)
	2	Instantaneous short circuit
	3	Short time-delayed short circuit (I)
	4	Ground fault (G)
	5	Tripping operation as a result of extended protection function
	6	Overload in neutral conductor
	7	
15	–	Load shedding alarm

Basic type data

Due to the large volume of data provided by the air circuit breakers, there was a desire to find a compromise between data volume and performance on MODBUS. If each piece of data is retrieved individually when transferring large amounts of data, this has an adverse effect on performance capability on MODBUS.

In the interests of efficient and flexible transfer, there is therefore a choice of three basic types.

Depending on the application:

- The basic type is selected according to the volume of data.
- The data blocks included are defined by customer need, depending on the data required.

Register			Description
Address		High/Low	
Dec	Hex		
40964	0xA004	LOW	Basic type of MODBUS data transfer
40965	0xA005	–	Data in the cyclic profile of MODBUS

For more information about formats refer to chapter Formats (Page 106).

Basic type 1

Byte	Definition	Default	Data point
0, 1	Binary status information	Binary status information	–
2, 3	Data block 1	Current in phase 1	380
4, 5	Data block 2	Current in phase 2	381
6, 7	Data block 3	Current in phase 3	382
8, 9	Data block 4	Max. current in phase under highest load	374
10	PB of data block 1	PB of current phase 1	–
11	PB of data block 2	PB of current phase 2	–

Byte	Definition	Default	Data point
12	PB of data block 3	PB of current phase 3	–
13	PB of data block 4	PB of maximum current in phase under highest load	–

Basic type 2

Basic type 2 is pre-assigned for metering function.

Byte	Definition	Default	Data point
0, 1	Binary status information	Binary status information	–
2, 3	Data block 1	Current in phase 1	380
4, 5	Data block 2	Current in phase 2	381
6, 7	Data block 3	Current in phase 3	382
8, 9	Data block 4	Max. current in phase under highest load	374
10, 11	Data block 5	Current in neutral conductor	375
12, 13	Data block 6	Mean value of the phase-to-phase voltages	203[1)]
14, 15	Data block 7	Mean value of power factors of 3 phases	168[1)]
16, 17	Data block 8	Total active energy of 3 phases	238[1)]
18	PB of data block 1	PB of current phase 1	–
19	PB of data block 2	PB of current phase 2	–
20	PB of data block 3	PB of current phase 3	–
21	PB of data block 4	PB of max. current in phase under highest Id	–
22	PB of data block 5	PB of current in neutral conductor	–
23	PB of data block 6	PB of the mean value of phase-to-phase voltages	–
24	PB of data block 7	PB of the mean value of the three power factors	–
25	PB of data block 8	PB of total active energy	–

1) Alternatively, these fields can contain the default numbers of basic type 3. If there are no changes here, the default value is nevertheless transferred.

Basic type 3

Basic type 3 consists of 14 data blocks and has input data in the 44th byte on the PLC.

Byte	Definition	Default	Data point
0, 1	Binary status information	Binary status information	–
2, 3	Data block 1	Current in phase 1	380
4, 5	Data block 2	Current in phase 2	381
6, 7	Data block 3	Current in phase 3	382
8, 9	Data block 4	Max. current in phase under highest load	374
10, 11	Data block 5	Current in neutral conductor	375

Byte	Definition	Default	Data point
12, 13	Data block 6	Phase-to-phase voltage L12	197
14, 15	Data block 7	Phase-to-phase voltage L23	198
16, 17	Data block 8	Phase-to-phase voltage L31	199
18, 19	Data block 9	Neutral point voltage L1N	200
20, 21	Data block 10	Neutral point voltage L2N	201
22, 23	Data block 11	Neutral point voltage L3N	202
24, 25	Data block 12	Mean value of power factors of 3 phases	168
26, 27	Data block 13	Total active energy of 3 phases	238
28, 29	Data block 14	Total apparent power of 3 phases	217
30	PB of data block 1	PB of current phase 1	–
31	PB of data block 2	PB of current phase 2	–
32	PB of data block 3	PB of current phase 3	–
33	PB of data block 4	PB of max. current in phase under highest load	–
34	PB of data block 5	PB of current in neutral conductor	–
35	PB of data block 6	PB of the phase-to-phase voltage L12	–
36	PB of data block 7	PB of the phase-to-phase voltage L23	–
37	PB of data block 8	PB of the phase-to-phase voltage L31	–
38	PB of data block 9	PB of the neutral point voltage L1N	–
39	PB of data block 10	PB of the neutral point voltage L2N	–
40	PB of data block 11	PB of the neutral point voltage L3N	–
41	PB of data block 12	PB of the mean value of the three power factors	–
42	PB of data block 13	PB of total active energy	–
43	PB of data block 14	PB of total apparent power	–

Value buffer area

For more information about formats refer to chapter Formats (Page 106).

3.3.2.5 Function codes

Function codes control the data exchange. In doing so, a function code tells the node what action it is to take.

Function "01 – Read output bits"

This function reads the control bytes in the circuit breaker.

Request to node

Below an example of the request to read all control bytes from the circuit breaker.

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x01	Function code	"01 – Read output bits"
0x00	Start address (high)	Address 0 onwards
0x00	Start address (low)	
0x00	Number of bits (high)	Read 16 bits
0x10	Number of bits (low)	
0x3D	CRC check code "low"	Check calculation value (CRC16)
0xA0	CRC check code "high"	

Response from node

The response returns the control bytes.

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x01	Function code	"01 – Read output bits"
0x02	Number of bytes	2 bytes → 16 bits
0x_ _	Data byte 1	Bit 0 …7
0x_ _	Data byte 2	Bit 8 … 15
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "02 – Read input"

This function gets the status of the circuit breaker.

Request to node (Example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x02	Function code	"02 – Read input"
0x00	Start address (high)	Address 0 onwards
0x00	Start address (low)	

Bytes	Name of byte	Description
0x00	Number of bits (high)	Read 16 bits
0x10	Number of bits (low)	
0x3D	CRC check code "low"	Check calculation value (CRC16)
0xA0	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x02	Function code	"02 – Read input"
0x02	Number of bytes	2 bytes → 16 bits
0x_ _	Data byte 1	Bit 0 …7
0x_ _	Data byte 2	Bit 8 … 15
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "03 – Read value buffer area"

This function gets values from the value buffer area of the circuit breaker.

Request to node (Example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x03	Function code	"03 – Read value buffer area"
0x00	Start address (high)	Address 0 onwards
0x00	Start address (low)	
0x00	Number of registers (high)	Read 2 registers (4 bytes)
0x02	Number of registers (low)	
0xC4	CRC check code "low"	Check calculation value (CRC16)
0x6D	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x03	Function code	"03 – Read value buffer area"

Bytes	Name of byte	Description
0x04	Number of bytes	2 bytes → 16 bits
0x_ _	Data byte 1 (high)	1st register
0x_ _	Data byte 2 (low)	
0x_ _	Data byte 3 (high)	2nd register
0x_ _	Data byte 4 (low)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "04 – Read basic type data"

The function reads all basic type data of a circuit breaker. Depending on the settings, the structure and length of the requestable data may vary.

Request to node

Below an example for reading the 22 "basic type 3" registers of a circuit breaker at MODBUS address 7.

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x04	Function code	"04 – Read basic type data"
0x00	Start address (high)	Address 0 onwards
0x00	Start address (low)	
0x00	Number of registers (high)	Read 22 registers (44 bytes)
0x16	Number of registers (low)	
0x71	CRC check code "low"	Check calculation value (CRC16)
0xA2	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x04	Function code	"04 – Read basic type data"
0x2C	Number of bytes	44 bytes
0x_ _	Data byte 1 (high)	1st register
0x_ _	Data byte 2 (low)	
…	…	…

Bytes	Name of byte	Description
0x_ _	Data byte 43 (high)	22nd register
0x_ _	Data byte 44 (low)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "05 – Write individual output"

This function is used to write the control bytes for the circuit breaker.

Note

Command bits like the example below are edge-sensitive and must be reset each time they are used.

Request to node

This example shows how to set the bit for deleting the logbook entries in a circuit breaker with MODBUS address 7.

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x05	Function code	"05 – Write individual output"
0x00	Bit address (high)	Bit 10:
0x0A	Bit address (low)	"Delete logbooks"
0xFF	Control code (high)	0xFF00 = Set bit (0x0000 = Reset bit)
0x00	Control code (low)	
0xAC	CRC check code "low"	Check calculation value (CRC16)
0x5E	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x05	Function code	"05 – Write individual output"
0x00	Bit address (high)	Bit 10:
0x0A	Bit address (low)	"Delete logbooks"

Bytes	Name of byte	Description
0xFF	Control code (high)	0xFF00 = Bit set (0x0000 = Bit not set)
0x00	Control code (low)	
0xAC	CRC check code "low"	Check calculation value (CRC16)
0x5E	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "07 – Read diagnostic information"

Request to node (Example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x07	Function code	"07 – Read diagnostic information"
0x42	CRC check code "low"	Check calculation value
0x42	CRC check code "high"	(CRC16)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x07	Function code	"07 – Read diagnostic information"
0x_ _	Diagnostic information byte	Refer to table
0x_ _	CRC check code "low"	Check calculation value
0x_ _	CRC check code "high"	(CRC16)

Diagnostic information byte

Bit	Meaning
	WT
	COM16WT
0	1 = Contact load too high
1	1 = Communication with ETU present
2	1 = Communication module is OK
3	not used, always 0
4	
5	
6	
7	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "08 – Diagnostics"

This function comprises 2 sub functions which can be used for diagnosis.

Sub function selection

The diagnostic code defines the sub function:

- 0x0000 Resend test data
- 0x000A Reset communication counter

For more information, see chapter Function "12 – Communication events" (Page 42).

Resend test data

This function is used for checking communication between the master and the node.

Request to node (resend test data, example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x08	Function code	"08 – Diagnostics"
0x00	Diagnostic code (high)	0x0000 = Resend test data
0x00	Diagnostic code (low)	
0xF0	Test data (high)	Test data for resend check (0xF0A5)
0xA5	Test data (low)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Response from node (resend test data)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x08	Function code	"08 – Diagnostics"
0x00	Diagnostic code (high)	0x0000 = Resend test data
0x00	Diagnostic code (low)	
0xF0	Test data (high)	Test data for resend check (0xF0A5)
0xA5	Test data (low)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Reset communication counter

The communication module maintains statistics, which can be read using the following functions:

- "Function 11 – Get number of messages"
- "Function 12 – Communication events"

This command resets all statistics.

Note

Test data has to be transferred with 0x0000, otherwise an exception occurs with exception code "03 – Illegal value".

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "11 – Get number of messages"

Request to node (Example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x0B	Function code	"11 – Get number of messages"
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x0B	Function code	"11 – Get number of messages"
0x00	Status (high)	0x0000 = COM not busy (0xFFFF = COM still busy)
0x00	Status (low)	
0x00	Message number (high)	Number of correct messages (16)
0x10	Message number (low)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "12 – Communication events"

Request to node (Example)

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x0B	Function code	"12 – Communication events"
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x00	Status (low)	(0xFFFF = COM still busy)
0x00	Message number OK (high)	Number of correct messages (16)
0x10	Message number OK (low)	
0x00	Message number total (high)	Number of transmitted messages (16)
0x10	Message number total (low)	
0x80	01: Message status (receipt)	FIFO – message status 1 (last message)
0x40	02: Message status (send)	
0x80	63: Message status (receipt)	FIFO – message status 32
0x40	64: Message status (send)	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Message status (receipt)

Bit	Description
0	Not used
1	Communication error
2	Not used
3	Not used
4	Character buffer overflow
5	Always 0, "Listen-only mode" not supported
6	Receive message to all users ("broadcast")
7	Always 1

Message status (send)

Bit	Description
0	Exception for read errors (exception code 1 … 3)
1	Exception for node stop (exception code 4)
2	Exception for node busy (exception code 5 … 6)
3	Exception for node error (exception code 7)
4	Time error occurred when writing
5	Always 0, "Listen-only mode" not supported
6	Always 1
7	Always 0

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "15 – Write output block"

Writing multiple outputs in one command.

Request to node

In this example the status bytes of the circuit breaker are written:

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x0F	Function code	"15 – Write output block"
0x00	Bit start address (high)	Write block from bit 0
0x00	Bit start address (low)	–
0x00	Bit number (high)	Number of bits to write (16)
0x10	Bit number (low)	–
0x02	Number of bytes:	Number of data bytes (1)
0x02	Data byte 1 (low) – bit 0 … 7	Coded bits
0xCC	Data byte 2 (high) – bit 8 … 15	–
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	
0x07	Node address	MODBUS address 7

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Function "16 – Write value buffer area"

This command can be used to write complete data areas or complex data types and transfer them to the value buffer area.

Request to node

The system time area for communication modules COM16WT was chosen for this example. The command below sets the time of the circuit breaker (system time) to the following date and time:
Wednesday. May 27, 2009, 11:15:30:000

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x10	Function code	"16 – Write value buffer area"
0x44	Register start address (high)	Write from system time
0x02	Register start address (low)	DS 68 (0x44); Offset 2nd register
0x00	Register number (high)	Number to be written
0x04	Register number (low)	Register (4 – system time only)
0x08	Number of bytes:	Number of data bytes (8)
0x09	Data byte 1 (low) → year	Register 1
0x05	Data byte 2 (high) → month	
0x27	Data byte 3 (low) → day	Register 2
0x11	Data byte 4 (high) → hour	
0x15	Data byte 5 (low) → minute	Register 3
0x30	Data byte 6 (high) → second	
0x00	Data byte 7 (low) → …	Register 4
0x04	Data byte 8 (high) → …	
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Response from node

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x10	Function code	"16 – Write value buffer area"
0x44	Register start address (high)	Write from system time
0x02	Register start address (low)	DS 68 (0x44); Offset 2nd register
0x00	Register number (high)	Number to be written
0x04	Register number (low)	Register (4 – system time only)
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	–

Error from node

You will find more information on this in chapter Summary of exception messages (Page 45).

Summary of exception messages

Except for broadcast message frames, the requestor expects to receive a response. There are four possible events that can occur following a request:

- The node receives the request without communication errors and can process the request, so the normal response is sent by the node.
- The node does not receive the request because of a communication error. The node does not send a response. The master should install a TIMEOUT for such situations.
- The node receives an invalid request (parity or CRC). Once again no response is sent. The master should install a TIMEOUT for such situations.
- The node receives a request which it cannot process (e.g. reading a non-existent output or value range). It responds with an exception message. The exception code in this exception message indicates the cause of the problem.

The exception message contains two fields which differ from a normal response:

- **Field for function code:**
  In a normal message the node repeats the requested function code. In an exception message the most significant bit indicates that an error has occurred (= addition of 0x80). This information enables the master to interpret the error code in the next field.
- **Field for data:**
  In a normal response the content is dependent on the function code. In exception messages only the error code is returned. This contains the reason for/status of the exception message.

Example of exception message

Bytes	Name of byte	Description
0x07	Node address	MODBUS address 7
0x83	Function code + error code (0x80)	Error code + "03 – Read value buffer area"
0x02	Error code	02 – Illegal address
0x_ _	CRC check code "low"	Check calculation value (CRC16)
0x_ _	CRC check code "high"	

Error code for exception messages

Code	Name	Explanation
0x01	Illegal function	The function code received in the request is an illegal function for the node.
0x02	Illegal address	The data address received is not in a legal address range for the node.
0x03	Illegal value	A value transferred in the request is not in the legal range for the node.
0x04	Node error	An unknown error occurred during processing of the request at the node.
0x05	Confirmation	The request is being processed and a certain processing time is required. The message is used to prevent a timeout error and to allow processing of the request to be completed.
0x06	Node busy	The node is still processing and the request is rejected. A new request will have to be sent when the node is not busy.

Data library

4

4.1 The data library

The communication system of the air circuit breakers is extremely versatile and flexible. The majority of data points can be read, and to a certain extent written, via register blocks. Many of them can be integrated into the basic types. This chapter provides a detailed description of the different data points and their properties.

General

The basis for the shared profile of the air circuit breakers is an overall database referred to as a data library. This data library defines which circuit breaker supports which data points.

Properties of the data points

The data library also describes the properties of all data points:

- What is the data point number of this data point and what is its name?
- What is the source of this data point?
- What is the format of this data point?
- What is the size of this data point?
- What is the scaling of this data point?
- Which register address does the data point start with?
- In which register block is this data point available?

4.2 Chapter overview

This chapter describes the data points of the data library.

- In the first section, the data points are combined into function classes. Function classes are, for example, data for identification, device parameters, or measured values. This subdivision quickly enables users to find the desired data point and its properties.
- The second part of this chapter describes the structure of the read/write register blocks that in turn consist of the data points described in the previous section. This allows the register blocks transferred via Modbus RTU to be interpreted in the master.
- The third section of this chapter describes the different formats of the data points. This includes the description of the Motorola format used, e.g. "Int" and "Unsigned int", as well as, above all, the description of special formats. A special format is, for example, the binary breakdown of the data point that specifies the last tripping operation.

See also

Function classes (Page 49)

Register blocks for 3WT Air Circuit Breaker (Page 61)

Formats (Page 106)

4.3 Scaling

The measured values are always transferred as integer values (format "INTEGER" = "INT") and never as Floating Point numbers (format "REAL"). These values can be signed. For this, a scaling factor must be added in the case of some measured values so that the transferred measured value can be correctly interpreted. The scaling factor to be displayed in each case can be taken from the table shown below (from "data points").

Frequency example

The measured value of the current frequency (data point #262) varies between 15.00 and 440.00 Hz. The decimal places could not be communicated using the INTEGER format without scaling. For this reason, the measured value is scaled with 10^2, and a value of between 1500 and 44000 is communicated. At the receiver end (MODBUS master), this value must now be multiplied by the scaling factor corresponding to the exponent of 10 (−2, multiplication by 10^{-2}). The exponent at the receiver end is always specified for the scaling factor.

4.4 Abbreviations of the data sources

Abbreviation	Meaning
ETU	3WT Electronic trip unit
Meter. fct.	3WT Metering function
BSSWT	3WT Breaker Status Sensor

4.5 Units

The measured values have the following measuring units unless otherwise indicated in the tables:

Measured value	Measuring unit	Name
Current	A	Ampere
Voltage	V	Volts
Power	kW	Kilowatt
Power	kVA	Kilovolt ampere
Reactive power	kVAr	Kilovolt ampere (reactive)

Measured value	Measuring unit	Name
Energy	kWh	Kilowatt/hour
Reactive energy	kVArh	Kilovolt ampere (reactive)/hour
Energy	MWh	Megawatt/hour
Reactive energy	MVArh	Megavolt ampere (reactive)/hour
Temperature	°C	Degrees Celsius
THD/form factor/peak factor	%	Percent
Frequency	Hz	Hertz
Delay time	s	Seconds

This also applies to the min./max. values.

4.6 Function classes

4.6.1 Function classes of the data points

In this section, the data points are combined into function classes. Function classes are, for example, data for identification, device parameters, or measured values. This subdivision quickly enables users to find the desired data point and its properties.

4.6.2 Data points for controlling the air circuit breakers

The air circuit breakers can be controlled with the data points listed in the table below (e.g. Circuit Breaker on, Circuit Breaker off).

Description	Data point	Source WT	Contained in RB.Byte	Format	Length (bits)	Scaling
Controls the functions/commands (e.g. reset min./max. values) of the communication module	18	COM16WT	DS51.181	Format (18)	8	–
Controls the outputs of the communication module (e.g. switching the breaker)	19	COM16WT	DS93.10	Format (19)	8	–
Date of the last parameter change	84	COM16WT	DS51.182	Time	64	–
System time of the circuit breaker	90	COM16WT	DS93.11	Time	64	–
Controls the trip unit	406	ETU	DS68.4	Format (406)	16	–

4.6.3 Data points for detailed diagnostics of the air circuit breakers

The air circuit breakers provide a host of data for detailed diagnostics shown in the table below:

Description	Data point	Source WT	Contained in RB.Byte	Format	Length (bits)	Scaling
Write protection (DPWriteEnable)	14	COM16WT	DS69.11	Format (14)	1	–
Trip log of the last 5 tripping operations with time	15	COM16WT	DS51.0	Format (15)	480	–
Event log of the last 10 events with time	16	COM16WT	DS51.60	Format (16)	960	–
Number of switching operations under load	80	COM16WT	DS92.42	Unsigned int	16	0
Number of switching operations caused by trips	81	COM16WT	DS91.0	Unsigned int	16	0
Switching cycle counter (for switching cycle on/off)	82	COM16WT	DS91.2	Unsigned int	16	0
Runtime meter (when On + current > 0)	83	COM16WT	DS91.4	Unsigned long	32	0
Number of short-circuit trips (SI)	104	ETU	DS91.6	Unsigned int	16	0
Number of overload trips (L)	105	ETU	DS91.18	Unsigned int	16	0
Number of ground-fault tripping operations (G)	106	ETU	DS91.20	Unsigned int	16	0
Total of deactivated I^2t values L1, L2, L3, N	107	ETU	DS91.22	Format (107)	128	0
Tripping operations by metering function PLUS	307	Meter. fct.	DS91.24	Format (307)	16	–
Threshold warnings	308	Meter. fct.	DS92.28	Format (308)	32	–
Order number of the trip unit	371	ETU	DS64.0	18 x char	144	–
Time until presumed overload trip	379	ETU	DS97.126	Unsigned int	16	0
Last unacknowledged tripping operation of the trip unit	401	ETU	DS51.1	Format (401)	8	–
Currently pending alarms	402	ETU	DS92.26	Format (402)	16	–
Current at the moment of shutdown	403	ETU	DS92.24	Unsigned int	16	1
Phase at the moment of shutdown	404	ETU	DS92.34	Format (373)	3	–
Shows the phase with maximum load	373	ETU	DS69.6	Format (373)	3	–
Position and status of the circuit breaker in the frame	24	COM16WT	DS51.183	Format (24)	4	–
Status of the connected MODBUS	17	COM16WT	DS91.48	Format (17)	3	–

Description	Data point	Source WT	Contained in RB.Byte	Format	Length (bits)	Scaling
Status of the circuit breaker on/off/powered, etc.	328	BSSWT	DS69.0	Format (328)	8	–
Maintenance information about the main contacts	405	ETU	DS69.1	Format (405)	2	–

4.6.4 Data points for identifying the air circuit breakers

The air circuit breakers provide a host of data for detailed diagnostics shown in the table below:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
User text (freely editable)	20	COM16WT	64 x char	512	–	DS165.4
Plant identifier (freely editable)	21	COM16WT	64 x char	512	–	DS165.68
Date (freely editable)	22	COM16WT	Time	64	–	DS165.132
Author (freely editable)	23	COM16WT	30 x char	240	–	DS165.140
Identification number of COM	91	COM16WT	16 x char	128	–	DS162.4
Market in which the trip unit is used	95	ETU	Format (95)	2	–	DS97.47
Identification number of circuit breaker	96	ETU	20 x char	160	–	DS97.48
Test date of circuit breaker	98	ETU	Time	64	–	DS97.74 DS100.4
Switching capacity class	99	ETU	Format (99)	4	–	DS97.82
Size	100	ETU	Format (100)	2	–	DS97.83
Rated voltage (LL) of the circuit breaker	101	ETU	Unsigned int	16	0	DS97.84
Rated current of the external g transformer	102	ETU	Unsigned int	16	0	DS97.86 DS129.70
Order number of the circuit breaker	103	ETU	Format (103)	160	–	DS162.20 DS97.88
Number of poles of circuit breaker	108	ETU	Format (108)	3	–	DS97.144
Type (metering function, metering function PLUS)	138	Meter. fct.	Format (138)	8	–	DS162.40
Rating plug	377	ETU	Unsigned int	16	0	DS51.208 DS97.146
Circuit breaker frame	378	ETU	Unsigned int	16	0	DS97.148
Order number of the trip unit	407	ETU	16 x char	144	–	DS97.0
Date of manufacture of trip unit	408	ETU	Time	64	–	DS97.18
Identification number of trip unit	409	ETU	17 x char	136	–	DS97.26
N transformer connected	411	ETU	Format (411)	1	–	DS97.45
Type of trip unit	412	ETU	Format (412)	5	–	DS162.41

4.6.5 Data points for measured values current

The table below contains the data points for measured values current:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Phase unbalance current (as %)	172	Meter. fct.	Unsigned char	8	0	DS94.0
Long-time mean value of 3-phase current	193	Meter. fct.	Unsigned int	16	0	DS94.2
Long-time mean value of current L1	194	Meter. fct.	Unsigned int	16	0	DS94.4
Long-time mean value of current L2	195	Meter. fct.	Unsigned int	16	0	DS94.6
Long-time mean value of current L3	196	Meter. fct.	Unsigned int	16	0	DS94.8
Minimum long-time mean value for current	244	Meter. fct.	Unsigned int	16	0	DS72.24
Maximum long-time mean value for current	245	Meter. fct.	Unsigned int	16	0	DS72.26
Current of phase with maximum load	374	ETU	Unsigned int	16	0	DS51.186
Current in neutral conductor	375	ETU	Unsigned int	16	0	DS51.190 DS94.18
Current which flows to ground	376	ETU	Unsigned int	16	0	DS51.192 DS94.20
Current in phase 1	380	ETU	Unsigned int	16	0	DS94.10
Current in phase 2	381	ETU	Unsigned int	16	0	DS94.12
Current in phase 3	382	ETU	Unsigned int	16	0	DS94.14
Mean current value over the three phases	383	ETU	Unsigned int	16	0	DS94.16
Minimum current in phase 1	384	ETU	Unsigned int	16	0	DS72.0
Maximum current in phase 1	385	ETU	Unsigned int	16	0	DS72.2
Minimum current in phase 2	386	ETU	Unsigned int	16	0	DS72.4
Maximum current in phase 2	387	ETU	Unsigned int	16	0	DS72.6
Minimum current in phase 3	388	ETU	Unsigned int	16	0	DS72.8
Maximum current in phase 3	389	ETU	Unsigned int	16	0	DS72.10
Minimum current in neutral conductor	390	ETU	Unsigned int	16	0	DS72.12
Maximum current in neutral conductor	391	ETU	Unsigned int	16	0	DS72.14
Minimum current which flows to ground	392	ETU	Unsigned int	16	0	DS72.16
Maximum current which flows to ground	393	ETU	Unsigned int	16	0	DS72.18

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Minimum mean value over the three phases	394	ETU	Unsigned int	16	0	DS72.20
Maximum mean value over the three phases	395	ETU	Unsigned int	16	0	DS72.22

4.6.6 Data points for measured values voltage

The table below contains the data points for measured values voltage:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Phase unbalance voltage (in %)	173	Meter. fct.	Unsigned char	8	0	DS94.22
Phase-to-phase voltage between phase L1 and L2	197	Meter. fct.	Unsigned int	16	0	DS94.24
Phase-to-phase voltage between phase L2 and L3	198	Meter. fct.	Unsigned int	16	0	DS94.26
Phase-to-phase voltage between phase L3 and L1	199	Meter. fct.	Unsigned int	16	0	DS94.28
Neutral point voltage phase L1	200	Meter. fct.	Unsigned int	16	0	DS94.30
Neutral point voltage phase L2	201	Meter. fct.	Unsigned int	16	0	DS94.32
Neutral point voltage phase L3	202	Meter. fct.	Unsigned int	16	0	DS94.34
Mean value of phase-to-phase voltage	203	Meter. fct.	Unsigned int	16	0	DS94.36
Mean value of neutral-point star voltage	204	Meter. fct.	Unsigned int	16	0	DS94.38
Minimum phase-to-phase voltage between phase L1 and L2	205	Meter. fct.	Unsigned int	16	0	DS73.0
Maximum phase-to-phase voltage between phase L1 and L2	206	Meter. fct.	Unsigned int	16	0	DS73.2
Minimum phase-to-phase voltage between phase L2 and L3	207	Meter. fct.	Unsigned int	16	0	DS73.4
Maximum phase-to-phase voltage between phase L2 and L3	208	Meter. fct.	Unsigned int	16	0	DS73.6
Minimum phase-to-phase voltage between phase L3 and L1	209	Meter. fct.	Unsigned int	16	0	DS73.8
Maximum phase-to-phase voltage between phase L3 and L1	210	Meter. fct.	Unsigned int	16	0	DS73.10
Minimum of the neutral point voltage phase L1	211	Meter. fct.	Unsigned int	16	0	DS73.12
Maximum of the neutral point voltage phase L1	212	Meter. fct.	Unsigned int	16	0	DS73.14
Minimum of the neutral point voltage phase L2	213	Meter. fct.	Unsigned int	16	0	DS73.16

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Maximum of the neutral point voltage phase L2	214	Meter. fct.	Unsigned int	16	0	DS73.18
Minimum of the neutral point voltage phase L3	215	Meter. fct.	Unsigned int	16	0	DS73.20
Maximum of the neutral point voltage phase L3	216	Meter. fct.	Unsigned int	16	0	DS73.22

4.6.7 Data points for measured values power

The table below contains the data points for measured values power:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Total apparent power	217	Meter. fct.	Unsigned int	16	0	DS94.40
Apparent power in phase L1	218	Meter. fct.	Unsigned int	16	0	DS94.62
Apparent power in phase L2	219	Meter. fct.	Unsigned int	16	0	DS94.64
Apparent power in phase L3	220	Meter. fct.	Unsigned int	16	0	DS94.66
Total active power	221	Meter. fct.	Signed int	16	0	DS94.42
Active power in phase L1	222	Meter. fct.	Signed int	16	0	DS94.44
Active power in phase L2	223	Meter. fct.	Signed int	16	0	DS94.46
Active power in phase L3	224	Meter. fct.	Signed int	16	0	DS94.48
Total reactive power	225	Meter. fct.	Signed int	16	0	DS94.50
Reactive power in phase L1	226	Meter. fct.	Signed int	16	0	DS94.76
Reactive power in phase L2	227	Meter. fct.	Signed int	16	0	DS94.78
Reactive power in phase L3	228	Meter. fct.	Signed int	16	0	DS94.80
Long-time mean value of 3-phase active power	229	Meter. fct.	Signed int	16	0	DS94.52
Long-time mean value of active power in phase L1	230	Meter. fct.	Signed int	16	0	DS94.54
Long-time mean value of active power in phase L2	231	Meter. fct.	Signed int	16	0	DS94.56
Long-time mean value of active power in phase L3	232	Meter. fct.	Signed int	16	0	DS94.58
Long-time mean value of 3-phase apparent power	233	Meter. fct.	Unsigned int	16	0	DS94.60
Long-time mean value of apparent power in phase L1	234	Meter. fct.	Unsigned int	16	0	DS94.68
Long-time mean value of apparent power in phase L2	235	Meter. fct.	Unsigned int	16	0	DS94.70
Long-time mean value of apparent power in phase L3	236	Meter. fct.	Unsigned int	16	0	DS94.72
Long-time mean value of 3-phase reactive power	237	Meter. fct.	Signed int	16	0	DS94.74

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Minimum of the mean value of the apparent power	246	Meter. fct.	Unsigned int	16	0	DS74.4
Maximum of the mean value of the apparent power	247	Meter. fct.	Unsigned int	16	0	DS74.6
Minimum of the mean value of the reactive power	248	Meter. fct.	Signed int	16	0	DS74.12
Maximum of the mean value of the reactive power	249	Meter. fct.	Signed int	16	0	DS74.14
Minimum of the mean value of the active power	250	Meter. fct.	Signed int	16	0	DS74.8
Maximum of the mean value of the active power	251	Meter. fct.	Signed int	16	0	DS74.10

4.6.8 Data points for other measured values

The table below contains the data points for other measured values:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Mean value of the power factor	168	Meter. fct.	Signed int	16	−3	DS51.184 DS94.98
Power factor in phase L1	169	Meter. fct.	Signed int	16	−3	DS94.100
Power factor in phase L2	170	Meter. fct.	Signed int	16	−3	DS94.102
Power factor in phase L3	171	Meter. fct.	Signed int	16	−3	DS94.104
Minimum of the mean value of the power factor	242	Meter. fct.	Signed int	16	−3	DS74.0
Maximum of the mean value of the power factor	243	Meter. fct.	Signed int	16	−3	DS74.2
Temperature in the control cabinet (acc. in COM16WT)	71	COM16WT	Unsigned char	8	0	DS94.114
Minimum temperature in the control cabinet	72	COM16WT	Unsigned char	8	0	DS77.0
Maximum temperature in the control cabinet	73	COM16WT	Unsigned char	8	0	DS77.1
Temperature in circuit breaker (acc. in BSSWT)	330	BSSWT	Unsigned char	8	0	DS94.115
Minimum temperature in the circuit breaker	74	COM16WT	Unsigned char	8	0	DS77.2
Maximum temperature in the circuit breaker	75	COM16WT	Unsigned char	8	0	DS77.3
Active energy in normal direction [MWh]	238	Meter. fct.	Unsigned long	32	0	DS94.82
Active energy in normal direction [kWh]	433	Meter. fct.	Unsigned long	32	0	DS94.116

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Active energy in reverse direction [MWh]	239	Meter. fct.	Unsigned long	32	0	DS94.86
Active energy in reverse direction [kWh]	434	Meter. fct.	Unsigned long	32	0	DS94.120
Reactive energy in normal direction [MVarh]	240	Meter. fct.	Unsigned long	32	0	DS94.90
Reactive energy in normal direction [kVarh]	435	Meter. fct.	Unsigned long	32	0	DS94.124
Reactive energy in reverse direction [MVarh]	241	Meter. fct.	Unsigned long	32	0	DS94.94
Reactive energy in reverse direction [kVarh]	436	Meter. fct.	Unsigned long	32	0	DS94.128
Frequency	262	Meter. fct.	Unsigned int	16	−2	DS94.106
Minimum frequency	252	Meter. fct.	Unsigned int	16	−2	DS76.2
Maximum frequency	253	Meter. fct.	Unsigned int	16	−2	DS76.0
Peak factor	260	Meter. fct.	Unsigned char	8	−1	DS94.111
Minimum peak factor	263	Meter. fct.	Unsigned char	8	−1	DS72.28
Maximum peak factor	264	Meter. fct.	Unsigned char	8	−1	DS72.29
Form factor	261	Meter. fct.	Unsigned char	8	−1	DS94.110
Minimum form factor	265	Meter. fct.	Unsigned char	8	−1	DS72.30

4.6.9 Data points for the stamp (TS) of the measured values

The table below contains the data points for the time stamp (TS) of the measured values:

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
TS minimum current in phase L1	25	COM16WT	Time	64	–	DS72.32
TS maximum current in phase L1	26	COM16WT	Time	64	–	DS72.40
TS minimum current in phase L2	27	COM16WT	Time	64	–	DS72.48
TS maximum current in phase L2	28	COM16WT	Time	64	–	DS72.56
TS minimum current in phase L3	29	COM16WT	Time	64	–	DS72.64
TS maximum current in phase L3	30	COM16WT	Time	64	–	DS72.72
TS minimum current in neutral conductor	33	COM16WT	Time	64	–	DS72.112
TS maximum current in neutral conductor	34	COM16WT	Time	64	–	DS72.120

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
TS minimum current that flows to ground	35	COM16WT	Time	64	–	DS72.128
TS maximum current that flows to ground	36	COM16WT	Time	64	–	DS72.136
TS minimum mean value over the three phases	31	COM16WT	Time	64	–	DS72.80
TS maximum mean value over the three phases	32	COM16WT	Time	64	–	DS72.88
TS minimum long-time mean value for current	55	COM16WT	Time	64	–	DS72.96
TS maximum long-time mean value of current	56	COM16WT	Time	64	–	DS72.104
TS minimum phase-to-phase voltage between phase L1 and L2	37	COM16WT	Time	64	–	DS73.24
TS maximum phase-to-phase voltage between phase L1 and L2	38	COM16WT	Time	64	–	DS73.32
TS minimum phase-to-phase voltage between phase L2 and L3	39	COM16WT	Time	64	–	DS73.40
TS maximum phase-to-phase voltage between phase L2 and L3	40	COM16WT	Time	64	–	DS73.48
TS minimum phase-to-phase voltage between phase L3 and L1	41	COM16WT	Time	64	–	DS73.56
TS maximum phase-to-phase voltage between phase L3 and L1	42	COM16WT	Time	64	–	DS73.64
TS minimum of the neutral point voltage phase L1	43	COM16WT	Time	64	–	DS73.72
TS maximum of the neutral point voltage phase L1	44	COM16WT	Time	64	–	DS73.80
TS minimum of the neutral point voltage phase L2	45	COM16WT	Time	64	–	DS73.88
TS maximum of the neutral point voltage phase L2	46	COM16WT	Time	64	–	DS73.96
TS minimum of the neutral point voltage phase L3	47	COM16WT	Time	64	–	DS73.104
TS maximum of the neutral point voltage phase L3	48	COM16WT	Time	64	–	DS73.112
TS minimum of the mean value of the apparent power	57	COM16WT	Time	64	–	DS74.16
TS maximum of the mean value of the apparent power	58	COM16WT	Time	64	–	DS74.24
TS minimum of the mean value of the active power	49	COM16WT	Time	64	–	DS74.32

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
TS maximum of the mean value of the active power	50	COM16WT	Time	64	–	DS74.40
TS minimum of the mean value of the reactive power	51	COM16WT	Time	64	–	DS74.48
TS maximum of the mean value of the reactive power	52	COM16WT	Time	64	–	DS74.56
TS minimum of the mean value of the power factor	53	COM16WT	Time	64	–	DS74.64
TS maximum of the mean value of the power factor	54	COM16WT	Time	64	–	DS74.72
TS minimum temperature in the control cabinet	76	COM16WT	Time	64	–	DS77.4
TS maximum temperature in the control cabinet	77	COM16WT	Time	64	–	DS77.12
TS minimum temperature in the circuit breaker	78	COM16WT	Time	64	–	DS77.20
TS maximum temperature in the circuit breaker	79	COM16WT	Time	64	–	DS77.28
TS minimum frequency	59	COM16WT	Time	64	–	DS76.8
TS maximum frequency	60	COM16WT	Time	64	–	DS76.16
TS minimum peak factor	65	COM16WT	Time	64	–	DS72.144
TS maximum peak factor	66	COM16WT	Time	64	–	DS72.152
TS minimum form factor	67	COM16WT	Time	64	–	DS72.160
TS maximum form factor	68	COM16WT	Time	64	–	DS72.168

4.6.10 Parameters of the air circuit breakers (primary protection function)

The table below contains the parameters of the air circuit breakers (primary protection function):

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Active parameter set	370	ETU	Format (370)	1	–	DS129.65
Overload parameter I_R parameter set A	333	ETU	Unsigned int	16	0	DS129.4
Time-lag class t_R	335	ETU	Unsigned int	16	−1	DS129.8
Short-circuit protection instantaneous I_i	336	ETU	Unsigned int	16	1	DS129.10
Short-circuit protection delayed I_{sd}	337	ETU	Unsigned int	16	1	DS129.12
Delay time for short-circuit protection t_{sd}	338	ETU	Unsigned int	16	−3	DS129.14
Overload protection neutral conductor I_N (WT)	334	ETU	Unsigned int	16	0	DS129.6

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Ground-fault protection I_g	339	ETU	Unsigned int	16	0	DS129.16
Delay time for ground-fault protection t_g	340	ETU	Unsigned int	16	−3	DS129.18
Ground fault alarm I_{g2}	341	ETU	Unsigned int	16	0	DS129.20
Delay time for ground fault alarm t_{g2}	342	ETU	Unsigned int	16	−3	DS129.22
I^4t characteristic for overload protection	345	ETU	Format (345)	1	–	DS129.26
I^2t characteristic for delayed short-circuit protection	343	ETU	Format (343)	1	–	DS129.24
I^2t characteristic for ground-fault protection	344	ETU	Format (344)	1	–	DS129.25
Thermal memory	346	ETU	Format (346)	1	–	DS129.27
Phase loss sensitivity	347	ETU	Format (347)	1	–	DS129.28
Cooling time constant	348	ETU	Unsigned int	16	0	DS129.30
Load shedding	367	ETU	Unsigned int	16	0	DS129.60
Load pick up	368	ETU	Unsigned int	16	0	DS129.62
Delay time for load shedding/pick up	366	ETU	Unsigned char	8	0	DS129.64
Active parameter set	370	ETU	Format (370)	1	–	DS129.65

4.6.11 Parameters of the air circuit breakers (parameters for threshold alarms)

The table below contains the parameters of the air circuit breakers (parameters for threshold warnings):

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Overcurrent	267	Meter. fct.	Unsigned int	16	0	DS130.48
Delay time for overcurrent	268	Meter. fct.	Unsigned char	8	0	DS130.56
Current that flows to ground	269	Meter. fct.	Unsigned int	16	0	DS130.50
Delay time of current that flows to ground	270	Meter. fct.	Unsigned char	8	0	DS130.57
Overcurrent in neutral conductor	271	Meter. fct.	Unsigned int	8	0	DS130.52
Delay time for overcurrent in neutral conductor	272	Meter. fct.	Unsigned char	8	0	DS130.58
Phase unbalance current	273	Meter. fct.	Unsigned char	8	0	DS130.59
Delay time for current phase unbalance	274	Meter. fct.	Unsigned char	8	0	DS130.60
Long-time mean value of current	275	Meter. fct.	Unsigned int	16	0	DS130.54
Delay time for long-time mean value of current	276	Meter. fct.	Unsigned char	8	0	DS130.61

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
Active power in normal direction	283	Meter. fct.	Unsigned int	16	0	DS130.4
Delay time for active power in normal direction	284	Meter. fct.	Unsigned char	8	0	DS130.12
Active power in reverse direction	285	Meter. fct.	Unsigned int	16	0	DS130.6
Delay time for active power in reverse direction	286	Meter. fct.	Unsigned char	8	0	DS130.13
Power factor, capacitive	287	Meter. fct.	Signed int	16	−3	DS130.8
Delay time for power factor, capacitive	288	Meter. fct.	Unsigned char	8	0	DS130.14
Power factor, inductive	289	Meter. fct.	Signed int	16	−3	DS130.10
Delay time for power factor, inductive	290	Meter. fct.	Unsigned char	8	0	DS130.15
Long-time mean value of active power	291	Meter. fct.	Unsigned int	16	0	DS130.30
Delay time for long-time mean value of active power	292	Meter. fct.	Unsigned char	8	0	DS130.34
Long-time mean value of apparent power	293	Meter. fct.	Unsigned int	16	0	DS130.32
Delay time for long-time mean value of apparent power	294	Meter. fct.	Unsigned char	8	0	DS130.35
Long-time mean value of reactive power	295	Meter. fct.	Unsigned int	16	0	DS130.36
Delay time for long-time mean value of reactive power	296	Meter. fct.	Unsigned char	8	0	DS130.40
Reactive power in normal direction	297	Meter. fct.	Unsigned int	16	0	DS130.38
Delay time for reactive power in normal direction	298	Meter. fct.	Unsigned char	8	0	DS130.41
Reactive power in reverse direction	299	Meter. fct.	Unsigned int	16	0	DS130.42
Delay time for reactive power in reverse direction	300	Meter. fct.	Unsigned char	8	0	DS130.46
Apparent power	301	Meter. fct.	Unsigned int	16	0	DS130.44
Delay time for apparent power	302	Meter. fct.	Unsigned char	8	0	DS130.47

4.6.12 Parameters of the air circuit breakers (communication, measured value adjustment, etc.)

The table below contains the parameters of the air circuit breakers (communication, measured value adjustment, etc.):

Description	Data point	Source WT	Format	Length (bits)	Scaling	Contained in DS.Byte
MODBUS address	5	COM16WT	Unsigned int	8	0	DS160.5
Basic type of MODBUS data transfer	6	COM16WT	Hex	2	–	DS160.6
Data in the cyclic profile of MODBUS	7	COM16WT	Format (7)	224	–	DS160.8
Normal direction of incoming supply	145	Meter. fct.	Format (145)	1	–	DS128.20
Direction of rotation of phase	146	Meter. fct.	Format (146)	1	–	DS128.21
The voltage transformer can be star or delta-connected on the primary side	162	Meter. fct.	Format (162)	1	–	DS128.4
Rated voltage of the system (on the primary side)	164	Meter. fct.	Unsigned int	16	0	DS128.6
Secondary voltage of transformer	165	Meter. fct.	Unsigned char	8	0	DS128.8
Length of period for calculating long-time mean value	166	Meter. fct.	Unsigned char	8	0	DS128.9
Number of sub-periods for calculating long-time mean value	167	Meter. fct.	Unsigned char	8	0	DS128.10
Lower limit of power transmission	372	ETU	Unsigned int	16	0	DS128.12
Ground fault transformer detection type	410	ETU	Format (410)	2	–	DS97.44 DS129.69

4.7 Register blocks for 3WT Air Circuit Breaker

4.7.1 Register block RB 51 main overview

The table below shows the content of register block 51 that copies the most important information from other register blocks and makes it available in the form of a complete overview. This register block is used for displaying the data of the main overview.

The table below contains the register blocks RB 51: Main overview (length 119 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
13057	0x3301	–	Trip log of the last 5 tripping operations with time	15	COM16 WT	Format (15)	480	–
13087	0x331F	–	Event log of the last 10 events with time	16	COM16 WT	Format (16)	960	–
13147	0x335B	LOW	Status of the connected Modbus	17	COM16 WT	Format (17)	3	–
13147	0x335B	HIGH	Controls the commands/functions (e.g. delete/reset min./max. values) of the communication module	18	COM16 WT	Format (18)	8	–
13148	0x335C	LOW	Controls the outputs of the communication module (e.g. switching the breaker)	19	COM16 WT	Format (19)	8	–
13148	0x335C	HIGH	Shows the phase with maximum load	373	ETU	Format (373)	3	–
13149	0x335D	–	Mean value of the power factor		Meter. fct.	Signed int	16	–3
13150	0x335E	–	Current of phase with maximum load	374	ETU	Unsigned int	16	0
13151	0x335F	–	Time until presumed overload trip	379	ETU	Unsigned int	16	0
13152	0x3360	–	Current in neutral conductor	375	ETU	Unsigned int	16	0
13153	0x3361	–	Current which flows to ground	376	ETU	Unsigned int	16	0
13154	0x3362	–	System time of the circuit breaker	90	COM16 WT	Time	64	–
13158	0x3366	LOW	Position of the circuit breaker in the frame	24	COM16 WT	Format (24)	4	–
13158	0x3366	HIGH	Status of the circuit breaker (on/off/powered, etc.)	328	BSSWT	Format (328)	8	–
13159	0x3367	–	Overload parameter IR parameter set A	333	ETU	Unsigned int	16	0
13162	0x336A	–	Reserved	–	–	–	72	–
13167	0x336F	LOW	Property byte (trip log of the last 5 tripping operations with time)	–	COM16 WT	PB	8	–
13167	0x336F	HIGH	Property byte (event log of the last 10 events with time)	–	COM16 WT	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
13168	0x3370	LOW	Property byte for byte 180 (status of the connected Modbus)	–	COM16 WT	PB	8	–
13168	0x3370	HIGH	Property byte (controls the commands/functions (e.g. delete/reset min./max. values) of the communication module)	–	COM16 WT	PB	8	–
13169	0x3371	–	Property byte (controls the outputs of the communication module (e.g. switching the breaker))	–	COM16 WT	PB	8	–
13169	0x3371	HIGH	Property byte for byte 183 (shows the phase with maximum load)	–	ETU	PB	8	–
13170	0x3372	LOW	Property byte (mean value of the power factor)	–	Meter. fct.	PB	8	–
13170	0x3372	HIGH	Property byte (current of phase with maximum load)	–	ETU	PB	8	–
13171	0x3373	LOW	Property byte for byte 188 (time until presumed overload trip)	–	ETU	PB	8	–
13171	0x3373	HIGH	Property byte (current in neutral conductor)	–	ETU	PB	8	–
13172	0x3374	LOW	Property byte (current which flows to ground)	–	ETU	PB	8	–
13172	0x3374	HIGH	Property byte (system time of the circuit breaker)	–	COM16 WT	PB	8	–
13173	0x3375	LOW	Property byte (position of the circuit breaker in the frame)	–	COM16 WT	PB	8	–
13173	0x3375	HIGH	Property byte (status of the circuit breaker (on/off/powered, etc.))	–	BSSWT	PB	8	–
13174	0x3376	LOW	Property byte (overload parameter IR parameter set A)	–	ETU	PB	8	–

4.7.2 Register block RB 68 data for the BUS module

The table below shows the content of register block 68 via which the outputs of the digital output modules can be read and also controlled, and the system time can be read out. In addition, it is possible to set the system time and also the outputs of the communication module for switching breakers on or off.

The table below contains the register blocks RB 68: Data of the module (length 23 registers, read/write):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
17409	0x4401	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
17411	0x4403	–	System time of the circuit breaker	90	COM16 WT	Time	64	–
17415	0x4407	HIGH	Reserved	–	–	–	8	–
17429	0x4415	LOW	Property byte (system time of the circuit breaker)	–	COM16 WT	PB	8	–
17429	0x4415	HIGH	Property byte (controls the outputs of the communication module (e.g. switching the breaker))	–	COM16 WT	PB	8	–

4.7.3 Register block RB 69 status of the modules

The table below shows the content of register block 69 in which the statuses of the inputs on the digital input modules and the input on the COM16WT module are transmitted. It also contains the switch positions on the digital input modules and output modules on the CubicleBUS.

The table below contains the register blocks RB 69: Status of the modules (length 22 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
17666	0x4502	LOW	Controls the outputs of the communication module (e.g. switching the breaker) and checkback signals	19	COM16 WT	Format (19)	8	–
17668	0x4504	–	Reserved	–	–	–	32	–
17670	0x4506	HIGH	Communication module write protection (WriteEnable)	14	COM16 WT	Format (14)	1	–
17671	0x4507	LOW	Reserved	–	–	–	8	–
17672	0x4508	–	Reserved	–	–	–	120	–
17681	0x4511	LOW	Property byte (controls the outputs of the communication module (e.g. switching the breaker) and checkback signals)	–	COM16 WT	PB	8	–
17683	0x4513	–	Reserved	–	–	–	32	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
17685	0x4515	HIGH	Property byte (communication module write protection (WriteEnable))	–	COM16 WT	PB	8	–
17686	0x4516	LOW	Reserved	–	–	–	8	–

4.7.4 Register block RB 72 min. and max. measured values

The table below shows the content of register block 72 in which the minimum and maximum measured values of the currents are transmitted. It also contains the associated time stamps for these minimum and maximum measured values.

The table below contains the register blocks RB 72: Min./max. measured values of the currents and the associated time stamps (length 118 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18433	0x4801	–	Minimum current in phase 1	384	ETU	Un-signed int	16	0
18434	0x4802	–	Maximum current in phase 1	385	ETU	Un-signed int	16	0
18435	0x4803	–	Minimum current in phase 2	386	ETU	Un-signed int	16	0
18436	0x4804	–	Maximum current in phase 2	387	ETU	Un-signed int	16	0
18437	0x4805	–	Minimum current in phase 3	388	ETU	Un-signed int	16	0
18438	0x4806	–	Maximum current in phase 3	389	ETU	Un-signed int	16	0
18439	0x4807	–	Minimum current in neutral conductor	390	ETU	Un-signed int	16	0
18440	0x4808	–	Maximum current in neutral conductor	391	ETU	Un-signed int	16	0
18441	0x4809	–	Minimum current which flows to ground	392	ETU	Un-signed int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18442	0x480A	–	Maximum current which flows to ground	393	ETU	Un-signed int	16	0
18443	0x480B	–	Minimum mean value over the three phases	394	ETU	Un-signed int	16	0
18444	0x480C	–	Maximum mean value over the three phases	395	ETU	Un-signed int	16	0
18445	0x480D	–	Minimum long-time mean value for current	244	Meter. fct.	Un-signed int	16	0
18446	0x480E	–	Maximum long-time mean value for current	245	Meter. fct.	Un-signed int	16	0
18447	0x480F	LOW	Minimum peak factor	263	Meter. fct.	Un-signed char	8	−1
18447	0x480F	HIGH	Maximum peak factor	264	Meter. fct.	Un-signed char	8	−1
18448	0x4810	LOW	Minimum form factor	265	Meter. fct.	Un-signed char	8	−1
18448	0x4810	HIGH	Maximum of the form factor	266	Meter. fct.	Un-signed char	8	−1
18449	0x4811	–	TS minimum current in phase L1	25	COM16 WT	Time	64	–
18453	0x4815	–	TS maximum current in phase L1	26	COM16 WT	Time	64	–
18457	0x4819	–	TS minimum current in phase L2	27	COM16 WT	Time	64	–
18461	0x481D	–	TS maximum current in phase L2	28	COM16 WT	Time	64	–
18465	0x4821	–	TS minimum current in phase L3	29	COM16 WT	Time	64	–
18469	0x4825	–	TS maximum current in phase L3	30	COM16 WT	Time	64	–
18473	0x4829	–	TS minimum mean value over the three phases	31	COM16 WT	Time	64	–
18477	0x482D	–	TS maximum mean value over the three phases	32	COM16 WT	Time	64	–
18481	0x4831	–	TS minimum long-time mean value for current	55	COM16 WT	Time	64	–
18485	0x4835	–	TS maximum long-time mean value of current	56	COM16 WT	Time	64	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18489	0x4839	–	TS minimum current in neutral conductor	33	COM16 WT	Time	64	–
18493	0x483D	–	TS maximum current in neutral conductor	34	COM16 WT	Time	64	–
18497	0x4841	–	TS minimum current that flows to ground	35	COM16 WT	Time	64	–
18501	0x4845	–	TS maximum current that flows to ground	36	COM16 WT	Time	64	–
18505	0x4849	–	TS minimum peak factor	65	COM16 WT	Time	64	–
18509	0x484D	–	TS maximum peak factor	66	COM16 WT	Time	64	–
18513	0x4851	–	TS minimum form factor	67	COM16 WT	Time	64	–
18517	0x4855	–	TS maximum form factor	68	COM16 WT	Time	64	–
18521	0x4859	–	Reserved	–	–	–	192	–
18533	0x4865	LOW	Property byte (minimum current in phase 1)	–	ETU	PB	8	–
18533	0x4865	HIGH	Property byte (maximum current in phase 1)	–	ETU	PB	8	–
18534	0x4866	LOW	Property byte (minimum current in phase 2)	–	ETU	PB	8	–
18534	0x4866	HIGH	Property byte (maximum current in phase 2)	–	ETU	PB	8	–
18535	0x4867	LOW	Property byte (minimum current in phase 3)	–	ETU	PB	8	–
18535	0x4867	HIGH	Property byte (maximum current in phase 3)	–	ETU	PB	8	–
18536	0x4868	LOW	Property byte (minimum current in neutral conductor)	–	ETU	PB	8	–
18536	0x4868	HIGH	Property byte (maximum current in neutral conductor)	–	ETU	PB	8	–
18537	0x4869	LOW	Property byte (minimum current that flows to ground)	–	ETU	PB	8	–
18537	0x4869	HIGH	Property byte for byte 18 (maximum current that flows to ground)	–	ETU	PB	8	–
18538	0x486A	LOW	Property byte (minimum mean value over the three phases)	–	ETU	PB	8	–
18538	0x486A	HIGH	Property byte (maximum mean value over the three phases)	–	ETU	PB	8	–
18539	0x486B	LOW	Property byte (minimum long-time mean value for current)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18539	0x486B	HIGH	Property byte (maximum long-time mean value for current)	–	Meter. fct.	PB	8	–
18540	0x486C	LOW	Property byte (minimum peak factor)	–	Meter. fct.	PB	8	–
18540	0x486C	HIGH	Property byte (maximum peak factor)	–	Meter. fct.	PB	8	–
18541	0x486D	LOW	Property byte (minimum form factor)	–	Meter. fct.	PB	8	–
18541	0x486D	HIGH	Property byte (maximum form factor)	–	Meter. fct.	PB	8	–
18542	0x486E	LOW	Property byte (TS minimum current in phase L1)	–	COM16 WT	PB	8	–
18542	0x486E	HIGH	Property byte (TS maximum current in phase L1)	–	COM16 WT	PB	8	–
18543	0x486F	LOW	Property byte (TS minimum current in phase L2)	–	COM16 WT	PB	8	–
18543	0x486F	HIGH	Property byte (TS maximum current in phase L2)	–	COM16 WT	PB	8	–
18544	0x4870	LOW	Property byte (TS minimum current in phase L3)	–	COM16 WT	PB	8	–
18544	0x4870	HIGH	Property byte (TS maximum current in phase L3)	–	COM16 WT	PB	8	–
18545	0x4871	LOW	Property byte (TS minimum mean value over the three phases)	–	COM16 WT	PB	8	–
18545	0x4871	HIGH	Property byte (TS maximum mean value over the three phases)	–	COM16 WT	PB	8	–
18546	0x4872	LOW	Property byte (TS minimum long-time mean value for current)	–	COM16 WT	PB	8	–
18546	0x4872	HIGH	Property byte (TS maximum long-time mean value for current)	–	COM16 WT	PB	8	–
18547	0x4873	LOW	Property byte (TS minimum current in neutral conductor)	–	COM16 WT	PB	8	–
18547	0x4873	HIGH	Property byte (TS maximum current in neutral conductor)	–	COM16 WT	PB	8	–
18548	0x4874	LOW	Property byte (TS minimum current that flows to ground)	–	COM16 WT	PB	8	–
18548	0x4874	HIGH	Property byte (TS maximum current that flows to ground)	–	COM16 WT	PB	8	–
18549	0x4875	LOW	Property byte (TS minimum peak factor)	–	COM16 WT	PB	8	–
18549	0x4875	HIGH	Property byte (TS maximum peak factor)	–	COM16 WT	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18550	0x4876	LOW	Property byte (TS minimum form factor)	–	COM16 WT	PB	8	–
18550	0x4876	HIGH	Property byte (TS maximum form factor)	–	COM16 WT	PB	8	–

4.7.5 Register block RB 73 min. and max. measured values of the voltages

The table below shows the content of register block 73 in which the minimum and maximum measured values of the voltages are transmitted. It also contains the associated time stamps for these minimum and maximum measured values.

The table below contains the register blocks RB 73: Min./max. measured values of the voltages and the associated time stamps (length 87 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18689	0x4901	–	Minimum phase-to-phase voltage between phase L1 and L2	205	Meter. fct.	Unsigned int	16	0
18690	0x4902	–	Maximum phase-to-phase voltage between phase L1 and L2	206	Meter. fct.	Unsigned int	16	0
18691	0x4903	–	Minimum phase-to-phase voltage between phase L2 and L3	207	Meter. fct.	Unsigned int	16	0
18692	0x4904	–	Maximum phase-to-phase voltage between phase L2 and L3	208	Meter. fct.	Unsigned int	16	0
18693	0x4905	–	Minimum phase-to-phase voltage between phase L3 and L1	209	Meter. fct.	Unsigned int	16	0
18694	0x4906	–	Maximum phase-to-phase voltage between phase L3 and L1	210	Meter. fct.	Unsigned int	16	0
18695	0x4907	–	Minimum of the neutral point voltage phase L1	211	Meter. fct.	Unsigned int	16	0
18696	0x4908	–	Maximum of the neutral point voltage phase L1	212	Meter. fct.	Unsigned int	16	0
18697	0x4909	–	Minimum of the neutral point voltage phase L2	213	Meter. fct.	Unsigned int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18698	0x490A	–	Maximum of the neutral point voltage phase L2	214	Meter. fct.	Un-signed int	16	0
18699	0x490B	–	Minimum of the neutral point voltage phase L3	215	Meter. fct.	Un-signed int	16	0
18700	0x490C	–	Maximum of the neutral point voltage phase L3	216	Meter. fct.	Un-signed int	16	0
18701	0x490D	–	TS minimum phase-to-phase voltage between phase L1 and L2	37	COM16 WT	Time	64	–
18705	0x4911	–	TS maximum phase-to-phase voltage between phase L1 and L2	38	COM16 WT	Time	64	–
18709	0x4915	–	TS minimum phase-to-phase voltage between phase L2 and L3	39	COM16 WT	Time	64	–
18713	0x4919	–	TS maximum phase-to-phase voltage between phase L2 and L3	40	COM16 WT	Time	64	–
18717	0x491D	–	TS minimum phase-to-phase voltage between phase L3 and L1	41	COM16 WT	Time	64	–
18721	0x4921	–	TS maximum phase-to-phase voltage between phase L3 and L1	42	COM16 WT	Time	64	–
18725	0x4925	–	TS minimum of the neutral point voltage phase L1	43	COM16 WT	Time	64	–
18729	0x4929	–	TS maximum of the neutral point voltage phase L1	44	COM16 WT	Time	64	–
18733	0x492D	–	TS minimum of the neutral point voltage phase 2	45	COM16 WT	Time	64	–
18737	0x4931	–	TS maximum of the neutral point voltage phase L2	46	COM16 WT	Time	64	–
18741	0x4935	–	TS minimum of the neutral point voltage phase L3	47	COM16 WT	Time	64	–
18745	0x4939	–	TS maximum of the neutral point voltage phase L3	48	COM16 WT	Time	64	–
18749	0x493D	–	Reserved	–	–	–	240	–
18764	0x494C	LOW	Property byte (minimum phase-to-phase voltage between phase L1 and L2)	–	Meter. fct.	PB	8	–
18764	0x494C	HIGH	Property byte (maximum phase-to-phase voltage between phase L1 and L2)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18765	0x494D	LOW	Property byte (minimum phase-to-phase voltage between phase L2 and L3)	–	Meter. fct.	PB	8	–
18765	0x494D	HIGH	Property byte (maximum phase-to-phase voltage between phase L2 and L3)	–	Meter. fct.	PB	8	–
18766	0x494E	LOW	Property byte (minimum phase-to-phase voltage between phase L3 and L1)	–	Meter. fct.	PB	8	–
18766	0x494E	HIGH	Property byte for byte 10 (maximum phase-to-phase voltage between phase L3 and L1)	–	Meter. fct.	PB	8	–
18767	0x494F	LOW	Property byte (minimum of the neutral point voltage phase L1)	–	Meter. fct.	PB	8	–
18767	0x494F	HIGH	Property byte (maximum of the neutral point voltage phase L1)	–	Meter. fct.	PB	8	–
18768	0x4950	LOW	Property byte (minimum of the neutral point voltage phase L2)	–	Meter. fct.	PB	8	–
18768	0x4950	HIGH	Property byte (maximum of the neutral point voltage phase L2)	–	Meter. fct.	PB	8	–
18769	0x4951	LOW	Property byte (minimum of the neutral point voltage phase L3)	–	Meter. fct.	PB	8	–
18769	0x4951	HIGH	Property byte (maximum of the neutral point voltage phase L3)	–	Meter. fct.	PB	8	–
18770	0x4952	LOW	Property byte (TS minimum phase-to-phase voltage between phase L1 and L2)	–	COM16 WT	PB	8	–
18770	0x4952	HIGH	Property byte (TS maximum phase-to-phase voltage between phase L1 and L2)	–	COM16 WT	PB	8	–
18771	0x4953	LOW	Property byte (TS minimum phase-to-phase voltage between phase L2 and L3)	–	COM16 WT	PB	8	–
18771	0x4953	HIGH	Property byte for byte 48 (TS maximum phase-to-phase voltage between phase L2 and L3)	–	COM16 WT	PB	8	–
18772	0x4954	LOW	Property byte (TS minimum phase-to-phase voltage between phase L3 and L1)	–	COM16 WT	PB	8	–
18772	0x4954	HIGH	Property byte (TS maximum phase-to-phase voltage between phase L3 and L1)	–	COM16 WT	PB	8	–
18773	0x4955	LOW	Property byte (TS minimum of the neutral point voltage phase L1)	–	COM16 WT	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18773	0x4955	HIGH	Property byte (TS maximum of the neutral point voltage phase L1)	–	COM16 WT	PB	8	–
18774	0x4956	LOW	Property byte (TS minimum of the neutral point voltage phase 2)	–	COM16 WT	PB	8	–
18774	0x4956	HIGH	Property byte (TS maximum of the neutral point voltage phase L2)	–	COM16 WT	PB	8	–
18775	0x4957	LOW	Property byte (TS minimum of the neutral point voltage phase L3)	–	COM16 WT	PB	8	–
18775	0x4957	HIGH	Property byte (TS maximum of the neutral point voltage phase L3)	–	COM16 WT	PB	8	–

4.7.6 Register block RB 74 min. and max. measured values of the powers

The table below shows the content of register block 74 in which the minimum and maximum measured values of the powers are transmitted. It also contains the associated time stamps for these minimum and maximum measured values.

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18945	0x4A01	–	Minimum of the mean value of the power factor	242	Meter. fct.	Signed int	16	– 3
18946	0x4A02	–	Maximum of the mean value of the power factor	243	Meter. fct.	Signed int	16	– 3
18947	0x4A03	–	Minimum of the mean value of the apparent power	246	Meter. fct.	Un-signed int	16	0
18948	0x4A04	–	Maximum of the mean value of the apparent power	247	Meter. fct.	Un-signed int	16	0
18949	0x4A05	–	Minimum of the mean value of the active power	250	Meter. fct.	Signed int	16	0
18950	0x4A06	–	Maximum of the mean value of the active power	251	Meter. fct.	Signed int	16	0
18951	0x4A07	–	Minimum of the mean value of the reactive power	248	Meter. fct.	Signed int	16	0
18952	0x4A08	–	Maximum of the mean value of the reactive power	249	Meter. fct.	Signed int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
18953	0x4A09	–	TS minimum of the mean value of the apparent power	57	COM16 WT	Time	64	–
18957	0x4A0D	–	TS maximum of the mean value of the apparent power	58	COM16 WT	Time	64	–
18961	0x4A11	–	TS minimum of the mean value of the active power	49	COM16 WT	Time	64	–
18965	0x4A15	–	TS maximum of the mean value of the active power	50	COM16 WT	Time	64	–
18969	0x4A19	–	TS minimum of the mean value of the reactive power	51	COM16 WT	Time	64	–
18973	0x4A1D	–	TS maximum of the mean value of the reactive power	52	COM16 WT	Time	64	–
18977	0x4A21	–	TS min. of the mean value of the power factor	53	COM16 WT	Time	64	–
18981	0x4A25	–	TS max. of the mean value of the power factor	54	COM16 WT	Time	64	–
18985	0x4A29	–	Reserved	–	–	–	320	–
19005	0x4A3D	LOW	Property byte (minimum of the mean value of the power factor)	–	Meter. fct.	PB	8	–
19005	0x4A3D	HIGH	Property byte (maximum of the mean value of the power factor)	–	Meter. fct.	PB	8	–
19006	0x4A3E	LOW	Property byte (minimum of the mean value of the apparent power)	–	Meter. fct.	PB	8	–
19006	0x4A3E	HIGH	Property byte (maximum of the mean value of the apparent power)	–	Meter. fct.	PB	8	–
19007	0x4A3F	LOW	Property byte (minimum of the mean value of the active power)	–	Meter. fct.	PB	8	–
19007	0x4A3F	HIGH	Property byte (maximum of the mean value of the active power)	–	Meter. fct.	PB	8	–
19008	0x4A40	LOW	Property byte (minimum of the mean value of the reactive power)	–	Meter. fct.	PB	8	–
19008	0x4A40	HIGH	Property byte (maximum of the mean value of the reactive power)	–	Meter. fct.	PB	8	–
19009	0x4A41	LOW	Property byte (TS minimum of the mean value of the apparent power)	–	COM16 WT	PB	8	–
19009	0x4A41	HIGH	Property byte (TS maximum of the mean value of the apparent power)	–	COM16 WT	PB	8	–
19010	0x4A42	LOW	Property byte (TS minimum of the mean value of the active power)	–	COM16 WT	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
19010	0x4A42	HIGH	Property byte (TS maximum of the mean value of the active power)	–	COM16 WT	PB	8	–
19011	0x4A43	LOW	Property byte (TS minimum of the mean value of the reactive power)	–	COM16 WT	PB	8	–
19011	0x4A43	HIGH	Property byte (TS maximum of the mean value of the reactive power)	–	COM16 WT	PB	8	–
19012	0x4A44	LOW	Property byte (TS min. of the mean value of the power factor)	–	COM16 WT	PB	8	–
19012	0x4A44	HIGH	Property byte (TS max. of the mean value of the power factor)	–	COM16 WT	PB	8	–

4.7.7 Register block RB 76 min. and max. measured values of the frequency

The table below shows the content of register block 76 in which the minimum and maximum measured values of the frequency are transmitted. It also contains the associated time stamps for these minimum and maximum measured values.

The table below contains the register blocks RB 76: Min./max. measured values of the frequency/THD and the associated time stamps (length 46 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
19457	0x4C01	–	Maximum frequency	253	Meter. fct.	Un-signed int	16	−2
19458	0x4C02	–	Minimum frequency	252	Meter. fct.	Un-signed int	16	−2
19461	0x4C05	–	TS minimum frequency	59	COM16 WT	Time	64	–
19465	0x4C09	–	TS maximum frequency	60	COM16 WT	Time	64	–
19485	0x4C1D	–	Reserved	–	–	–	192	–
19497	0x4C29	LOW	Property byte (maximum of the frequency)	–	Meter. fct.	PB	8	–
19497	0x4C29	HIGH	Property byte (minimum of the frequency)	–	Meter. fct.	PB	8	–
19500	0x4C2C	LOW	Property byte (TS minimum of the frequency)	–	COM16 WT	PB	8	–
19500	0x4C2C	HIGH	Property byte (TS maximum of the frequency)	–	COM16 WT	PB	8	–

4.7.8 Register block RB 77 min. and max. measured values of the temperatures

The table below shows register block 77 in which the minimum and maximum measured values of the temperatures are transmitted. It also contains the associated time stamps for these minimum and maximum measured values.

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
19713	0x4D01	LOW	Minimum temperature in the control cabinet	72	COM16 WT	Unsigned char	8	0
19713	0x4D01	HIGH	Maximum temperature in the control cabinet	73	COM16 WT	Unsigned char	8	0
19714	0x4D02	LOW	Minimum temperature in the circuit breaker	74	BSSWT	Unsigned char	8	0
19714	0x4D02	HIGH	Maximum temperature in the circuit breaker	75	BSSWT	Unsigned char	8	0
19715	0x4D03	–	TS minimum temperature in the control cabinet	76	COM16 WT	Time	64	–
19719	0x4D07	–	TS maximum temperature in the control cabinet	77	COM16 WT	Time	64	–
19723	0x4D0B	–	TS minimum temperature in the circuit breaker	78	COM16 WT	Time	64	–
19727	0x4D0F	–	TS maximum temperature in the circuit breaker	79	COM16 WT	Time	64	–
19731	0x4D13	–	Reserved	–	–	–	112	–
19738	0x4D1A	LOW	Property byte (minimum temperature in the control cabinet)	–	COM16 WT	PB	8	–
19738	0x4D1A	HIGH	Property byte (maximum temperature in the control cabinet)	–	COM16 WT	PB	8	–
19739	0x4D1B	LOW	Property byte (minimum temperature in the circuit breaker)	–	BSSWT	PB	8	–
19739	0x4D1B	HIGH	Property byte (maximum temperature in the circuit breaker)	–	BSSWT	PB	8	–
19740	0x4D1C	LOW	Property byte (TS minimum temperature in the control cabinet)	–	COM16 WT	PB	8	–
19740	0x4D1C	HIGH	Property byte (TS maximum temperature in the control cabinet)	–	COM16 WT	PB	8	–
19741	0x4D1D	LOW	Property byte (TS minimum temperature in the circuit breaker)	–	COM16 WT	PB	8	–
19741	0x4D1D	HIGH	Property byte (TS maximum temperature in the circuit breaker)	–	COM16 WT	PB	8	–

4.7.9 Register block RB 91 statistics information

The table below shows the content of register block 91 in which the statistical information on the air circuit breakers is transmitted. As with the other register blocks, the property of each data point is additionally transmitted in the property byte.

The table below contains the register blocks RB 91: Statistical information (length 42 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
23297	0x5B01	–	Number of switching operations under load	80	COM16 WT	Un-signed int	16	0
23298	0x5B02	–	Number of switching operations caused by trips	81	COM16 WT	Un-signed int	16	0
23299	0x5B03	–	Switching cycle counter (for switching cycle on/off)	82	COM16 WT	Un-signed int	16	0
23300	0x5B04	–	Runtime meter (when On + current > 0)	83	COM16 WT	Un-signed long	32	0
23302	0x5B06	–	Date of the last parameter change	84	COM16 WT	Time	64	–
23306	0x5B0A	–	Number of short-circuit trips (SI)	104	ETU	Un-signed int	16	0
23307	0x5B0B	–	Number of overload trips (L)	105	ETU	Un-signed int	16	0
23308	0x5B0C	–	Number of ground-fault tripping operations (G)	106	ETU	Un-signed int	16	0
23309	0x5B0D	–	Total of deactivated I^2t values L1, L2, L3, N	107	ETU	Format (107)	128	0
23317	0x5B15	LOW	Maintenance information about the main contacts	405	ETU	Format (405)	2	–
23317	0x5B15	–	Reserved	–	–	–	56	–
23321	0x5B19	–	Modules connected to the CubicleBUS	88	COM16 WT	Format (88)	32	–
23323	0x5B1B	–	Reserved	–	–	–	144	–
23332	0x5B24	LOW	Property byte (number of switching operations under load)	–	COM16 WT	PB	8	–
23332	0x5B24	HIGH	Property byte (number of switching operations caused by trips)	–	COM16 WT	PB	8	–
23333	0x5B25	LOW	Property byte (switching cycle counter (for On/Off switching cycle))	–	COM16 WT	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
23333	0x5B25	HIGH	Property byte (runtime meter (when On + current > 0))	–	COM16 WT	PB	8	–
23334	0x5B26	LOW	Property byte (date of the last parameter change)	–	COM16 WT	PB	8	–
23334	0x5B26	HIGH	Property byte (number of short-circuit trips (SI))	–	ETU	PB	8	–
23335	0x5B27	LOW	Property byte (number of overload trips (L))	–	ETU	PB	8	–
23335	0x5B27	HIGH	Property byte (number of ground-fault tripping operations (G))	–	ETU	PB	8	–
23336	0x5B28	LOW	Property byte (total of deactivated I^2t values L1, L2, L3, N)	–	ETU	PB	8	–
23336	0x5B28	HIGH	Property byte (maintenance information about the main contacts)	–	ETU	PB	8	–
23337	0x5B29	–	Reserved	–	–	–	32	–

4.7.10 Register block RB 92 diagnostics data

The table below shows the content of register block 92 via which the data for detailed diagnostics of the air circuit breakers is transmitted.

The table below contains the register blocks RB 92: Diagnostics data (length 97 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
23553	0x5C01	LOW	Device status 1 (identical standard diagnostics)	–	COM16 WT	DP standard	8	–
23553	0x5C01	HIGH	Device status 2 (identical standard diagnostics)	–	COM16 WT	DP standard	8	–
23554	0x5C02	LOW	Device status 3 (identical standard diagnostics)	–	COM16 WT	DP standard	8	–
23554	0x5C02	HIGH	Address of the class 1 master	–	COM16 WT	Unsigned char	8	0
23555	0x5C03	–	Identification number (0x80C0)	–	COM16 WT	Hex	16	–
23556	0x5C04	LOW	Fixed value 0x42	–	COM16 WT	Hex	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
23556	0x5C04	HIGH	External diagnostics bit; 1 = diagnosis; 0 = no diagnosis	–	COM16 WT	Hex	1	–
23557	0x5C05	–	Fixed header; value 0x05 82 00 00 00	–	COM16 WT	Hex	40	–
23559	0x5C07	HIGH	Reserved	–	–	Un-signed char	8	–
23560	0x5C08	–	Diagnostic messages	–	COM16 WT	Diagnos-tics	16	–
23562	0x5C0A	–	Module affected by diagnostics	–	COM16 WT	Format (88)	32	–
23563	0x5C0B	–	Modules connected to the CubicleBUS	88	COM16 WT	Format (88)	32	–
23565	0x5C0D	–	Currently pending alarms	402	ETU	Format (402)	16	–
23566	0x5C0E	LOW	Last unacknowledged tripping operation of the trip unit	401	ETU	Format (401)	8	–
23566	0x5C0E	HIGH	Reserved	–	–	Un-signed char	8	–
23567	0x5C0F	–	Tripping operations by metering function/metering function PLUS	307	Meter. fct.	Format (307)	16	–
23568	0x5C10	–	Threshold warnings	308	Meter. fct.	Format (308)	32	–
23570	0x5C12	–	Current at the moment of shut-down	403	ETU	Un-signed int	16	1
23571	0x5C13	LOW	Phase at the moment of shut-down	404	ETU	Format (373)	3	–
23571	0x5C13	HIGH	Position of the circuit breaker in the frame	24	COM16 WT	Format (24)	4	–
23572	0x5C14	–	Reserved	–	–	Un-signed char	16	–
23573	0x5C15	LOW	Status of the circuit breaker (on/off/powered, etc.)	328	BSSWT	Format (328)	8	–
23573	0x5C15	HIGH	Reserved	–	–	Un-signed char	8	–
23574	0x5C16	–	Event log of the last 10 events with time	16	COM16 WT	Format (16)	960	–
23634	0x5C52	–	Reserved	–	–	Un-signed char	144	–

Register		High/Low	Description	Data point	Source WT	Format	Length (bits)	Scaling
Address								
Dec	Hex							
23643	0x5C5B	LOW	Property byte (modules connected to the CubicleBUS)	–	COM16 WT	PB	8	–
23643	0x5C5B	HIGH	Property byte (currently pending alarms)	–	ETU	PB	8	–
23644	0x5C5C	LOW	Property byte (last unacknowledged tripping operation of the trip unit)	–	ETU	PB	8	–
23644	0x5C5C	HIGH	Property byte (tripping operations by metering function/metering function PLUS)	–	Meter. fct.	PB	8	–
23645	0x5C5D	LOW	Property byte (threshold warnings)	–	Meter. fct.	PB	8	–
23645	0x5C5D	HIGH	Property byte (current at the moment of shutdown)	–	ETU	PB	8	–
23646	0x5C5E	LOW	Property byte (phase at the moment of shutdown)	–	ETU	PB	8	–
23646	0x5C5E	HIGH	Property byte (position of the circuit breaker in the frame)	–	COM16 WT	PB	8	–
23647	0x5C5F	LOW	Reserved	–	–	Unsigned char	8	–
23647	0x5C5F	HIGH	Property byte (status of the circuit breaker (on/off/powered, etc.))	–	BSSWT	PB	8	–
23648	0x5C60	LOW	Property byte (event log of the last 10 events with time)	–	COM16 WT	PB	8	–
23648	0x5C60	–	Reserved	–	–	Unsigned char	24	–

4.7.11 Register block RB 93 control of the circuit breakers

The table below shows register block RB 93 via which the air circuit breakers are switched on, the min./max. buffer deleted, the outputs of the digital output modules forced, and the 6 available Modbus RTU bits (can be output via the configurable digital output module) set.

The table below contains the register blocks RB 93: Controlling the circuit breakers (length 14 registers, write-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
23809	0x5D01	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
23811	0x5D03	–	Controls the trip unit	406	ETU	Format (406)	16	–
23812	0x5D04	–	Reserved	–	–	Un-signed char	16	–
23814	0x5D06	LOW	Controls the buffers (e.g. min./max. values) of the communication module	18	COM16 WT	Format (18)	8	–
23814	0x5D06	HIGH	Controls the outputs of the communication module (e.g. switching the breaker)	19	COM16 WT	Format (19)	8	–
23815	0x5D07	LOW	Reserved	–	–	Un-signed char	8	–
23816	0x5D08	–	Reserved	–	–	Un-signed char	40	–
23819	0x5D0B	LOW	Property byte (controls the trip unit)	–	ETU	PB	8	–
23819	0x5D0B	HIGH	Property byte (reserved)	–	Meter. fct.	PB	8	–
23821	0x5D0D	LOW	Property byte (controls the buffers (e.g. min./max. values) of the communication module)	–	COM16 WT	PB	8	–
23821	0x5D0D	HIGH	Property byte (controls the outputs of the communication module (e.g. switching the breaker))	–	COM16 WT	PB	8	–
23822	0x5D0E	LOW	Reserved	–	–	Un-signed char	8	–

4.7.12 Register block RB 94 current measured values

The table below shows register block 94 in which all current measured values are transmitted. The additional property bytes provide information on the availability and correctness of the measured values.

The table below contains the register blocks RB 94; current measured values (length 99 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24065	0x5E01	LOW	Phase unbalance current (as %)	172	Meter. fct.	Un-signed char	8	0
24065	0x5E01	HIGH	Reserved	–	–	Un-signed char	8	–
24066	0x5E02	–	Long-time mean value of 3-phase current	193	Meter. fct.	Un-signed int	16	0
24067	0x5E03	–	Long-time mean value of current L1	194	Meter. fct.	Un-signed int	16	0
24068	0x5E04	–	Long-time mean value of current L2	195	Meter. fct.	Un-signed int	16	0
24069	0x5E05	–	Long-time mean value of current L3	196	Meter. fct.	Un-signed int	16	0
24070	0x5E06	–	Current in phase L1	380	ETU	Un-signed int	16	0
24071	0x5E07	–	Current in phase L2	381	ETU	Un-signed int	16	0
24072	0x5E08	–	Current in phase L3	382	ETU	Un-signed int	16	0
24073	0x5E09	–	Mean current value over the three phases	383	ETU	Un-signed int	16	0
24074	0x5E0A	–	Current in neutral conductor	375	ETU	Un-signed int	16	0
24075	0x5E0B	–	Current which flows to ground	376	ETU	Un-signed int	16	0
24076	0x5E0C	LOW	Phase unbalance voltage (in %)	173	Meter. fct.	Un-signed char	8	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24076	0x5E0C	HIGH	Reserved	–	–	–	8	–
24077	0x5E0D	–	Phase-to-phase voltage between phase L1 and L2	197	Meter. fct.	Un-signed int	16	0
24078	0x5E0E	–	Phase-to-phase voltage between phase L2 and L3	198	Meter. fct.	Un-signed int	16	0
24079	0x5E0F	–	Phase-to-phase voltage between phase L3 and L1	199	Meter. fct.	Un-signed int	16	0
24080	0x5E10	–	Neutral point voltage phase L1	200	Meter. fct.	Un-signed int	16	0
24081	0x5E11	–	Neutral point voltage phase L2	201	Meter. fct.	Un-signed int	16	0
24082	0x5E12	–	Neutral point voltage phase L3	202	Meter. fct.	Un-signed int	16	0
24083	0x5E13	–	Mean value of phase-to-phase voltage	203	Meter. fct.	Un-signed int	16	0
24084	0x5E14	–	Mean value of neutral-point star voltage	204	Meter. fct.	Un-signed int	16	0
24085	0x5E15	–	Total apparent power	217	Meter. fct.	Un-signed int	16	0
24086	0x5E16	–	Total active power	221	Meter. fct.	Signed int	16	0
24087	0x5E17	–	Active power in phase L1	222	Meter. fct.	Signed int	16	0
24088	0x5E18	–	Active power in phase L2	223	Meter. fct.	Signed int	16	0
24089	0x5E19	–	Active power in phase L3	224	Meter. fct.	Signed int	16	0
24090	0x5E1A	–	Total reactive power	225	Meter. fct.	Signed int	16	0
24091	0x5E1B	–	Long-time mean value of 3-phase active power	229	Meter. fct.	Signed int	16	0
24092	0x5E1C	–	Long-time mean value of active power in phase L1	230	Meter. fct.	Signed int	16	0
24093	0x5E1D	–	Long-time mean value of active power in phase L2	231	Meter. fct.	Signed int	16	0
24094	0x5E1E	–	Long-time mean value of active power in phase L3	232	Meter. fct.	Signed int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24095	0x5E1F	–	Long-time mean value of 3-phase apparent power	233	Meter. fct.	Un-signed int	16	0
24096	0x5E20	–	Apparent power in phase L1	218	Meter. fct.	Un-signed int	16	0
24097	0x5E21	–	Apparent power in phase L2	219	Meter. fct.	Un-signed int	16	0
24098	0x5E22	–	Apparent power in phase L3	220	Meter. fct.	Un-signed int	16	0
24099	0x5E23	–	Long-time mean value of apparent power in phase L1	234	Meter. fct.	Un-signed int	16	0
24100	0x5E24	–	Long-time mean value of apparent power in phase L2	235	Meter. fct.	Un-signed int	16	0
24101	0x5E25	–	Long-time mean value of apparent power in phase L3	236	Meter. fct.	Un-signed int	16	0
24102	0x5E26	–	Long-time mean value of 3-phase reactive power	237	Meter. fct.	Signed int	16	0
24103	0x5E27	–	Reactive power in phase L1	226	Meter. fct.	Signed int	16	0
24104	0x5E28	–	Reactive power in phase L2	227	Meter. fct.	Signed int	16	0
24105	0x5E29	–	Reactive power in phase L3	228	Meter. fct.	Signed int	16	0
24106	0x5E2A	–	Active energy in normal direction [MWh]	238	Meter. fct.	Un-signed long	32	0
24108	0x5E2C	–	Active energy in reverse direction [MWh]	239	Meter. fct.	Un-signed long	32	0
24110	0x5E2E	–	Reactive energy in normal direction [MVArh]	240	Meter. fct.	Un-signed long	32	0
24112	0x5E30	–	Reactive energy in reverse direction [MVArh]	241	Meter. fct.	Un-signed long	32	0
24114	0x5E32	–	Mean value of the power factor	168	Meter. fct.	Signed int	16	−3
24115	0x5E33	–	Power factor in phase L1	169	Meter. fct.	Signed int	16	−3
24116	0x5E34	–	Power factor in phase L2	170	Meter. fct.	Signed int	16	–3

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24117	0x5E35	–	Power factor in phase L3	171	Meter. fct.	Signed int	16	−3
24118	0x5E36	–	Frequency	262	Meter. fct.	Un-signed int	16	−2
24120	0x5E38	LOW	Form factor	261	Meter. fct.	Un-signed char	8	−1
24120	0x5E38	HIGH	Peak factor	260	Meter. fct.	Un-signed char	8	−1
24122	0x5E3A	LOW	Temperature in the control cabinet (measured in the COM16WT)	71	COM16 WT	Un-signed char	8	0
24122	0x5E3A	HIGH	Temperature in circuit breaker (measured in the BSSWT)	330	BSSWT	Un-signed char	8	0
24123	0x5E3B	–	Active energy in normal direction [kWh]	433	Meter. fct.	Un-signed long	32	–
24125	0x5E3D	–	Active energy in reverse direction [kWh]	434	Meter. fct.	Un-signed long	32	–
24127	0x5E3F	–	Reactive energy in normal direction [kVArh]	435	Meter. fct.	Un-signed long	32	–
24129	0x5E41	–	Reactive energy in reverse direction [kVArh]	436	Meter. fct.	Un-signed long	32	–
24131	0x5E43	–	Reserved	–	–	Un-signed char	32	–
24133	0x5E45	LOW	Property byte (active energy in normal direction)	–	Meter. fct.	PB	8	–
24133	0x5E45	HIGH	Property byte (active energy in reverse direction)	–	Meter. fct.	PB	8	–
24134	0x5E46	LOW	Property byte (reactive energy in normal direction)	–	Meter. fct.	PB	8	–
24134	0x5E46	HIGH	Property byte (reactive energy in reverse direction)	–	Meter. fct.	PB	8	–
24135	0x5E47	LOW	Property byte (phase unbalance current (as %))	–	Meter. fct.	PB	8	–
24135	0x5E47	HIGH	Property byte (long-time mean value of 3-phase current)	–	Meter. fct.	PB	8	–
24136	0x5E48	LOW	Property byte (long-time mean value of current L1)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24136	0x5E48	HIGH	Property byte (long-time mean value of current L2)	–	Meter. fct.	PB	8	–
24137	0x5E49	LOW	Property byte (long-time mean value of current L3)	–	Meter. fct.	PB	8	–
24137	0x5E49	HIGH	Property byte (current in phase L1)	–	ETU	PB	8	–
24138	0x5E4A	LOW	Property byte (current in phase L2)	–	ETU	PB	8	–
24138	0x5E4A	HIGH	Property byte (current in phase L3)	–	ETU	PB	8	–
24139	0x5E4B	LOW	Property byte (mean current value over the three phases)	–	ETU	PB	8	–
24139	0x5E4B	HIGH	Property byte (current in neutral conductor)	–	ETU	PB	8	–
24140	0x5E4C	LOW	Property byte (current which flows to ground)	–	ETU	PB	8	–
24140	0x5E4C	HIGH	Property byte (phase unbalance voltage (in %))	–	Meter. fct.	PB	8	–
24141	0x5E4D	LOW	Property byte (phase-to-phase voltage between phase L1 and L2)	–	Meter. fct.	PB	8	–
24141	0x5E4D	HIGH	Property byte (phase-to-phase voltage between phase L2 and L3)	–	Meter. fct.	PB	8	–
24142	0x5E4E	LOW	Property byte (phase-to-phase voltage between phase L3 and L1)	–	Meter. fct.	PB	8	–
24142	0x5E4E	HIGH	Property byte (neutral point voltage phase L1)	–	Meter. fct.	PB	8	–
24143	0x5E4F	LOW	Property byte (neutral point voltage phase L2)	–	Meter. fct.	PB	8	–
24143	0x5E4F	HIGH	Property byte (neutral point voltage phase L3)	–	Meter. fct.	PB	8	–
24144	0x5E50	LOW	Property byte (mean value of phase- to-phase voltage)	–	Meter. fct.	PB	8	–
24144	0x5E50	HIGH	Property byte (mean value of neutral point voltage)	–	Meter. fct.	PB	8	–
24145	0x5E51	LOW	Property byte (total apparent power)	–	Meter. fct.	PB	8	–
24145	0x5E51	HIGH	Property byte (total active pow-er)	–	Meter. fct.	PB	8	–
24146	0x5E52	LOW	Property byte (active power in phase L1)	–	Meter. fct.	PB	8	–
24146	0x5E52	HIGH	Property byte (active power in phase L2)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24147	0x5E53	LOW	Property byte (active power in phase L3)	–	Meter. fct.	PB	8	–
24147	0x5E53	HIGH	Property byte (total reactive power)	–	Meter. fct.	PB	8	–
24148	0x5E54	LOW	Property byte (long-time mean value of 3-phase active power)	–	Meter. fct.	PB	8	–
24148	0x5E54	HIGH	Property byte (long-time mean value of active power in phase L1)	–	Meter. fct.	PB	8	–
24149	0x5E55	LOW	Property byte (long-time mean value of active power in phase L2)	–	Meter. fct.	PB	8	–
24149	0x5E55	HIGH	Property byte (long-time mean value of active power in phase L3)	–	Meter. fct.	PB	8	–
24150	0x5E56	LOW	Property byte (long-time mean value of 3-phase apparent power)	–	Meter. fct.	PB	8	–
24150	0x5E56	HIGH	Property byte (apparent power in phase L1)	–	Meter. fct.	PB	8	–
24151	0x5E57	LOW	Property byte (apparent power in phase L2)	–	Meter. fct.	PB	8	–
24151	0x5E57	HIGH	Property byte (apparent power in phase L3)	–	Meter. fct.	PB	8	–
24152	0x5E58	LOW	Property byte (long-time mean value of apparent power in phase L1)	–	Meter. fct.	PB	8	–
24152	0x5E58	HIGH	Property byte (long-time mean value of apparent power in phase L2)	–	Meter. fct.	PB	8	–
24153	0x5E59	LOW	Property byte (long-time mean value of apparent power in phase L3)	–	Meter. fct.	PB	8	–
24153	0x5E59	HIGH	Property byte (long-time mean value of 3-phase reactive power)	–	Meter. fct.	PB	8	–
24154	0x5E5A	LOW	Property byte (reactive power in phase L1)	–	Meter. fct.	PB	8	–
24154	0x5E5A	HIGH	Property byte (reactive power in phase L2)	–	Meter. fct.	PB	8	–
24155	0x5E5B	LOW	Property byte (reactive power in phase L3)	–	Meter. fct.	PB	8	–
24155	0x5E5B	HIGH	Property byte (active energy in normal direction)	–	Meter. fct.	PB	8	–
24156	0x5E5C	LOW	Property byte (active energy in reverse direction)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24156	0x5E5C	HIGH	Property byte (reactive energy in normal direction)	–	Meter. fct.	PB	8	–
24157	0x5E5D	LOW	Property byte (reactive energy in reverse direction)	–	Meter. fct.	PB	8	–
24157	0x5E5D	HIGH	Property byte (mean value of the power factor)	–	Meter. fct.	PB	8	–
24158	0x5E5E	LOW	Property byte (power factor in phase L1)	–	Meter. fct.	PB	8	–
24158	0x5E5E	HIGH	Property byte (power factor in phase L2)	–	Meter. fct.	PB	8	–
24159	0x5E5F	LOW	Property byte (power factor in phase L3)	–	Meter. fct.	PB	8	–
24159	0x5E5F	HIGH	Property byte (frequency)	–	Meter. fct.	PB	8	–

4.7.13 Register block RB 97 detailed identification

The table below shows register block 97 via which all necessary information for precise identification of the air circuit breakers can be retained.

The table below contains the register blocks RB 97: Detailed identification (length 112 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24833	0x6101	–	Order number of the trip unit	407	ETU	16 x char	144	–
24842	0x610A	–	Date of manufacture of trip unit	408	ETU	Time	64	–
24846	0x610E	–	Identification number of trip unit	409	ETU	17 x char	136	–
24854	0x6116	HIGH	Reserved	–	–	–	8	–
24855	0x6117	LOW	Ground fault transformer detection type	410	ETU	Format (410)	2	–
24855	0x6117	HIGH	N transformer connected	411	ETU	Format (411)	1	–
24856	0x6118	LOW	Reserved	–	–	–	8	–
24857	0x6119	–	Identification number of circuit breaker	96	ETU	20 x char	160	–
24867	0x6123	–	Reserved	–	–	–	48	–
24870	0x6126	–	Test date of circuit breaker	98	ETU	Time	64	–
24874	0x612A	LOW	Switching capacity class	99	ETU	Format (99)	4	–
24874	0x612A	HIGH	Size	100	ETU	Format (100)	2	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24875	0x612B	–	Rated voltage (LL) of the circuit breaker	101	ETU	Un-signed int	16	0
24876	0x612C	–	Rated current of the external g transformer	102	ETU	Un-signed int	16	0
24877	0x612D	–	Order number of the circuit breaker (trip unit VL)	103	ETU	Format (103)	160	–
24887	0x6137	–	Reserved	–	–	–	144	–
24896	0x6140	–	Order number of the trip unit	371	ETU	18 x char	144	–
24905	0x6149	LOW	Number of poles of circuit breaker	108	ETU	Format (108)	3	–
24905	0x6149	HIGH	Reserved	–	–	–	8	–
24907	0x614B	–	Circuit breaker frame	378	ETU	Un-signed int	16	0
24908	0x614C	–	Reserved	–	–	–	400	–
24933	0x6165	LOW	Property byte (order number of the trip unit)	–	ETU	PB	8	–
24933	0x6165	HIGH	Property byte (date of manufac-ture of trip unit)	–	ETU	PB	8	–
24934	0x6166	LOW	Property byte (identification number of trip unit)	–	ETU	PB	8	–
24934	0x6166	HIGH	Property byte (ground fault transformer detection method)	–	ETU	PB	8	–
24935	0x6167	LOW	Property byte (N transformer connected)	–	ETU	PB	8	–
24935	0x6167	HIGH	Reserved	–	–	–	8	–
24936	0x6168	HIGH	Property byte (identification number of circuit breaker)	–	ETU	PB	8	–
24937	0x6169	LOW	Reserved	–	–	–	8	–
24937	0x6169	HIGH	Property byte (test date for switch)	–	ETU	PB	8	–
24938	0x616A	LOW	Property byte (switching capacity class)	–	ETU	PB	8	–
24938	0x616A	HIGH	Property byte (size)	–	ETU	PB	8	–
24939	0x616B	LOW	Property byte (rated voltage (LL) of the circuit breaker)	–	ETU	PB	8	–
24939	0x616B	HIGH	Property byte (rated current of the external g transformer)	–	ETU	PB	8	–
24940	0x616C	LOW	Property byte (order number of the circuit breaker (trip unit VL))	–	ETU	PB	8	–
24940	0x616C	HIGH	Reserved	–	–	–	8	–
24941	0x616D	LOW	Property byte (order number of the trip unit)	–	ETU	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
24941	0x616D	HIGH	Property byte (number of poles of circuit breaker)	–	ETU	PB	8	–
24942	0x616E	HIGH	Property byte (circuit breaker frame)	–	ETU	PB	8	–
24943	0x616F	LOW	Reserved	–	–	–	8	–
24943	0x616F	–	Reserved	–	–	PB	16	–

4.7.14 Register block RB 100 identification in overview

The table below shows register block 100 that contains the identification of the relevant circuit breaker (test data, manufacturer, device name or family, device class, etc.).

The table below contains the register blocks RB 100: Identification overview (length 50 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
25601	0x6401	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
25603	0x6403	–	Test date of circuit breaker	–	ETU	Time	64	–
25607	0x6407	–	Manufacturer	–	COM16 WT	20 x char	160	–
25617	0x6411	–	Device name	–	COM16 WT	24 x char	192	–
25629	0x641D	LOW	Device family (fixed value 0x03)	–	COM16 WT	Hex	8	–
25629	0x641D	HIGH	Device bus family (fixed value 0x01)	–	COM16 WT	Hex	8	–
25630	0x641E	LOW	Device class (1 = air circuit breaker; 2 = compact circuit breaker)	–	COM16 WT	Hex	8	–
25630	0x641E	HIGH	System (fixed value 0x06)	–	COM16 WT	Hex	8	–
25631	0x641F	HIGH	Reserved	–	–	–	8	–
25640	0x6428	–	HW version	–	COM16 WT	4 x char	32	–
25642	0x642A	–	Modbus identification number (0x00 00 80 C0)	–	COM16 WT	Hex	32	–
25644	0x642C	–	Reserved	–	–	–	16	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
25645	0x642D	–	Service number (lower part of circuit breaker identification number)	–	COM16 WT	8 x char	64	–
25649	0x6431	–	Firmware version of Modbus module	–	COM16 WT	4 x char	32	–

4.7.15 Register block RB 128 parameters of the metering function and extended protection function

The table below shows register block 128 via which the parameters of the metering function and the extended protection function can be read out but also set. It also contains the assignments of the configurable digital output module.

The table below contains the register blocks RB 128: Parameters of the metering function and the extended protection function (length 52 registers, read/write):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
32769	0x8001	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
32771	0x8003	HIGH	Reserved	–	–	–	8	–
32772	0x8004	–	Rated voltage of the system (on the primary side)	164	Meter. fct.	Unsigned int	16	0
32773	0x8005	LOW	Secondary voltage of transformer	165	Meter. fct.	Unsigned char	8	0
32773	0x8005	HIGH	Length of period for calculating long-time mean value	166	Meter. fct.	Unsigned char	8	0
32774	0x8006	LOW	Number of sub-periods for calculating long-time mean value	167	Meter. fct.	Unsigned char	8	0
32774	0x8006	HIGH	Reserved	–	–	–	8	–
32775	0x8007	–	Lower limit of power transmission	372	ETU	Unsigned int	16	0
32776	0x8008	–	Active power in normal direction	141	Meter. fct.	Unsigned int	16	0
32777	0x8009	–	Active power in reverse direction	143	Meter. fct.	Unsigned int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
32778	0x800A	LOW	Delay time for active power in normal direction	142	Meter. fct.	Un-signed char	8	0
32778	0x800A	HIGH	Delay time for active power in reverse direction	144	Meter. fct.	Un-signed char	8	0
32779	0x800B	LOW	Normal direction of incoming supply	145	Meter. fct.	Format (145)	1	–
32779	0x800B	HIGH	Direction of rotation of phase	146	Meter. fct.	Format (146)	1	–
32780	0x800C	–	Underfrequency	147	Meter. fct.	Un-signed int	16	0
32781	0x800D	LOW	Delay time for overfrequency	150	Meter. fct.	Un-signed char	8	0
32781	0x800D	HIGH	Delay time for underfrequency	148	Meter. fct.	Un-signed char	8	0
32782	0x800E	–	Overfrequency	149	Meter. fct.	Un-signed int	16	0
32785	0x8011	LOW	Voltage unbalance	151	Meter. fct.	Un-signed char	8	0
32785	0x8011	HIGH	Delay time for voltage unbalance	152	Meter. fct.	Un-signed char	8	0
32786	0x8012	–	Undervoltage	153	Meter. fct.	Un-signed int	16	0
32787	0x8013	–	Overvoltage	155	Meter. fct.	Un-signed int	16	0
32788	0x8014	LOW	Delay time for undervoltage	154	Meter. fct.	Un-signed char	8	0
32788	0x8014	HIGH	Delay time for overvoltage	156	Meter. fct.	Un-signed char	8	0
32789	0x8015	LOW	Reserved	–	–	–	8	–
32789	0x8015	HIGH	Current unbalance	139	Meter. fct.	Un-signed char	8	0
32790	0x8016	LOW	Delay time for current unbalance	140	Meter. fct.	Un-signed char	8	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
32790	0x8016	HIGH	Reserved	–	–	–	8	–
32791	0x8017	–	Reserved	–	–	–	16	0
32802	0x8022	–	Reserved	–	–	–	24	–
32804	0x8024	LOW	Property byte (voltage transformer can be star or delta-connected on the primary side)	–	Meter. fct.	PB	8	–
32804	0x8024	HIGH	Reserved	–	–	–	8	–
32805	0x8025	LOW	Property byte (rated voltage of the system (on the primary side))	–	Meter. fct.	PB	8	–
32805	0x8025	HIGH	Property byte (secondary voltage of transformer)	–	Meter. fct.	PB	8	–
32806	0x8026	LOW	Property byte (length of period for calculating long-time mean value)	–	Meter. fct.	PB	8	–
32806	0x8026	HIGH	Property byte (number of subperiods for calculating long-time mean value)	–	Meter. fct.	PB	8	–
32807	0x8027	LOW	Reserved	–	–	–	8	–
32807	0x8027	HIGH	Property byte 2 (lower limit of power transmission)	–	ETU	PB	8	–
32808	0x8028	LOW	Property byte (active power in normal direction)	–	Meter. fct.	PB	8	–
32808	0x8028	HIGH	Property byte (active power in reverse direction)	–	Meter. fct.	PB	8	–
32809	0x8029	LOW	Property byte (delay time for active power in normal direction)	–	Meter. fct.	PB	8	–
32809	0x8029	HIGH	Property byte (delay time for active power in reverse direction)	–	Meter. fct.	PB	8	–
32810	0x802A	LOW	Property byte (normal direction of incoming supply)	–	Meter. fct.	PB	8	–
32810	0x802A	HIGH	Property byte (direction of rotation of phase)	–	Meter. fct.	PB	8	–
32811	0x802B	LOW	Property byte (underfrequency)	–	Meter. fct.	PB	8	–
32811	0x802B	HIGH	Property byte (delay time for overfrequency)	–	Meter. fct.	PB	8	–
32812	0x802C	LOW	Property byte (delay time for underfrequency)	–	Meter. fct.	PB	8	–
32812	0x802C	HIGH	Property byte (overfrequency)	–	Meter. fct.	PB	8	–
32815	0x802F	LOW	Property byte (voltage unbalance)	–	Meter. fct.	PB	8	–
32815	0x802F	HIGH	Property byte (delay time for voltage unbalance)	–	Meter. fct.	PB	8	–

Register		High/Low	Description	Data point	Source WT	Format	Length (bits)	Scaling
Address								
Dec	Hex							
32816	0x8030	LOW	Property byte (undervoltage)	–	Meter. fct.	PB	8	–
32816	0x8030	HIGH	Property byte (overvoltage)	–	Meter. fct.	PB	8	–
32817	0x8031	LOW	Property byte (delay time for undervoltage)	–	Meter. fct.	PB	8	–
32817	0x8031	HIGH	Property byte (delay time for overvoltage)	–	Meter. fct.	PB	8	–
32818	0x8032	LOW	Property byte (reserved)	–	Meter. fct.	PB	8	–
32818	0x8032	HIGH	Property byte (current unbalance)	–	Meter. fct.	PB	8	–
32819	0x8033	LOW	Property byte (delay time for current unbalance)	–	Meter. fct.	PB	8	–
32819	0x8033	HIGH	Reserved	–	–	PB	8	–

4.7.16 Register block RB 129 parameters of the protection function and settings for load shedding and load pick up

The table below shows RB 129 that contains the parameters (overload protection, time-lag class, short-circuit protection, thermal memory, phase loss sensitivity, etc.) of the protection function, and the settings for load shedding and load pick up.

The table below shows RB 129 that contains the parameters of the protection function, and the settings for load shedding and load pick up:

Register		High/Low	Description	Data point	Source WT	Format	Length (bits)	Scaling
Address								
Dec	Hex							
33025	0x8101	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
33027	0x8103	–	Overload parameter IR parameter set A	333	ETU	Unsigned int	16	0
33028	0x8104	–	Overload protection neutral conductor I_N (WL)	334	ETU	Unsigned int	16	0
33029	0x8105	–	Time-lag class t_R	335	ETU	Unsigned int	16	−1
33030	0x8106	–	Short-circuit protection instantaneous I_i	336	ETU	Unsigned int	16	1

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33031	0x8107	–	Short-circuit protection delayed I_{sd}	337	ETU	Unsigned int	16	1
33032	0x8108	–	Delay time for short-circuit protection t_{sd}	338	ETU	Unsigned int	16	−3
33033	0x8109	–	Ground-fault protection I_g	339	ETU	Unsigned int	16	0
33034	0x810A	–	Delay time for ground fault t_g	340	ETU	Unsigned int	16	−3
33035	0x810B	–	Ground fault alarm I_{g2}	341	ETU	Unsigned int	16	0
33036	0x810C	–	Delay time for ground fault alarm t_{g2}	342	ETU	Unsigned int	16	−3
33037	0x810D	LOW	I^2t characteristic for delayed short-circuit protection	343	ETU	Format (343)	1	–
33037	0x810D	HIGH	I^2t characteristic for ground-fault protection	344	ETU	Format (344)	1	–
33038	0x810E	LOW	I^4t characteristic for overload protection	345	ETU	Format (345)	1	–
33038	0x810E	HIGH	Thermal memory	346	ETU	Format (346)	1	–
33039	0x810F	LOW	Phase loss sensitivity	347	ETU	Format (347)	1	–
33039	0x810F	HIGH	Reserved	–	–	–	8	–
33040	0x8110	–	Cooling time constant	348	ETU	Unsigned int	16	0
33055	0x811F	–	Load shedding	367	ETU	Unsigned int	16	0
33056	0x8120	–	Load pick up	368	ETU	Unsigned int	16	0
33057	0x8121	LOW	Delay time for load shedding/pick up	366	ETU	Unsigned char	8	0
33057	0x8121	HIGH	Active parameter set	370	ETU	Format (370)	1	–
33058	0x8122	–	Reserved	–	–	–	16	0
33059	0x8123	LOW	Reserved	–	–	–	8	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33059	0x8123	HIGH	Ground fault transformer detection type	410	ETU	Format (410)	2	–
33060	0x8124	–	Rated current of the external g transformer	102	ETU	Unsigned int	16	0
33061	0x8125	–	Reserved	331	–	–	208	–
33074	0x8132	LOW	Property byte (rated current of the external g transformer)	333	ETU	PB	8	–
33074	0x8132	HIGH	Reserved	–	–	–	8	–
33075	0x8133	LOW	Property byte (overload parameter IR parameter set A)	335	ETU	PB	8	–
33075	0x8133	HIGH	Property byte (overload protection neutral conductor I_N (WL))	336	ETU	PB	8	–
33076	0x8134	LOW	Property byte (time-lag class t_R)	337	ETU	PB	8	–
33076	0x8134	HIGH	Property byte (short-circuit protection instantaneous I_i)	338	ETU	PB	8	–
33077	0x8135	LOW	Property byte (short-circuit protection delayed I_{sd})	339	ETU	PB	8	–
33077	0x8135	HIGH	Property byte (delay time for short-circuit protection t_{sd})	340	ETU	PB	8	–
33078	0x8136	LOW	Property byte (ground-fault protection I_g)	341	ETU	PB	8	–
33078	0x8136	HIGH	Property byte (delay time for ground fault t_g)	342	ETU	PB	8	–
33079	0x8137	LOW	Property byte (ground-fault alarm I_{g2})	343	ETU	PB	8	–
33079	0x8137	HIGH	Property byte (delay time for ground fault alarm t_{g2})	344	ETU	PB	8	–
33080	0x8138	LOW	Property byte (I^2t characteristic for delayed short-circuit protection)	345	ETU	PB	8	–
33080	0x8138	HIGH	Property byte (I^2t characteristic for ground-fault protection)	346	ETU	PB	8	–
33081	0x8139	LOW	Property byte (I^4t characteristic for overload protection)	347	ETU	PB	8	–
33081	0x8139	HIGH	Property byte (thermal memory)	348	ETU	PB	8	–
33082	0x813A	LOW	Property byte (phase loss sensitivity)	349	ETU	PB	8	–
33082	0x813A	HIGH	Property byte (cooling time constant)	350	ETU	PB	8	–
33091	0x8143	LOW	Property byte (load shedding)	366	ETU	PB	8	–
33091	0x8143	HIGH	Property byte (load pick up)	370	ETU	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33092	0x8144	LOW	Property byte (delay time for load shedding/pick up)	365	ETU	PB	8	–
33092	0x8144	HIGH	Property byte (active parameter set)	421	–	PB	8	–
33093	0x8145	–	Reserved	–	–	–	16	–

4.7.17 Register block RB 131 switching the parameters for the extended protection function and the threshold values on and off

The table below shows RB 131 via whose property bytes the parameters of the protection function, the extended protection function, and the threshold parameters can be switched on and off.

The table below contains the register blocks RB 131: Parameters for switching the parameters for the extended protection function and the threshold values on and off (length 35 registers, read/write):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33537	0x8301	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
33539	0x8303	LOW	Property byte (overload parameter I_R parameter set A)	–	ETU	PB	8	–
33539	0x8303	HIGH	Property byte (overload protection neutral conductor I_N (WL))	–	ETU	PB	8	–
33540	0x8304	LOW	Property byte (short-circuit protection instantaneous I_i)	–	ETU	PB	8	–
33540	0x8304	HIGH	Property byte (short-circuit protection delayed I_{sd})	–	ETU	PB	8	–
33541	0x8305	LOW	Property byte (ground-fault alarm I_{g2})	–	ETU	PB	8	–
33541	0x8305	HIGH	Property byte (ground-fault alarm I_{g2})	–	ETU	PB	8	–
33545	0x8309	LOW	Property byte (active power in normal direction)	–	Meter. fct.	PB	8	–
33545	0x8309	HIGH	Property byte (active power in reverse direction)	–	Meter. fct.	PB	8	–
33546	0x830A	LOW	Property byte (direction of rotation of phase)	–	Meter. fct.	PB	8	–
33546	0x830A	HIGH	Property byte (underfrequency)	–	Meter. fct.	PB	8	–
33547	0x830B	LOW	Property byte (overfrequency)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33548	0x830C	HIGH	Property byte (voltage unbalance)	–	Meter. fct.	PB	8	–
33549	0x830D	LOW	Property byte (undervoltage)	–	Meter. fct.	PB	8	–
33549	0x830D	HIGH	Property byte (overvoltage)	–	Meter. fct.	PB	8	–
33550	0x830E	LOW	Property byte (current unbalance)	–	Meter. fct.	PB	8	–
33550	0x830E	HIGH	Property byte (active power in normal direction)	–	Meter. fct.	PB	8	–
33551	0x830F	LOW	Property byte (active power in reverse direction)	–	Meter. fct.	PB	8	–
33551	0x830F	HIGH	Property byte (capacitive power factor)	–	Meter. fct.	PB	8	–
33552	0x8310	LOW	Property byte (inductive power factor)	–	Meter. fct.	PB	8	–
33552	0x8310	HIGH	Property byte (overfrequency)	–	Meter. fct.	PB	8	–
33553	0x8311	LOW	Property byte (underfrequency)	–	Meter. fct.	PB	8	–
33554	0x8312	HIGH	Property byte (peak factor)	–	Meter. fct.	PB	8	–
33555	0x8313	LOW	Property byte (form factor)	–	Meter. fct.	PB	8	–
33555	0x8313	HIGH	Property byte (long-time mean value for active power)	–	Meter. fct.	PB	8	–
33556	0x8314	LOW	Property byte (long-time mean value for apparent power)	–	Meter. fct.	PB	8	–
33556	0x8314	HIGH	Property byte (long-time mean value for reactive power)	–	Meter. fct.	PB	8	–
33557	0x8315	LOW	Property byte (reactive power in normal direction)	–	Meter. fct.	PB	8	–
33557	0x8315	HIGH	Property byte (reactive power in reverse direction)	–	Meter. fct.	PB	8	–
33558	0x8316	LOW	Property byte (apparent power)	–	Meter. fct.	PB	8	–
33558	0x8316	HIGH	Property byte (overcurrent)	–	Meter. fct.	PB	8	–
33559	0x8317	LOW	Property byte (current that flows to ground)	–	Meter. fct.	PB	8	–
33559	0x8317	HIGH	Property byte (overcurrent in neutral conductor)	–	Meter. fct.	PB	8	–
33560	0x8318	LOW	Property byte (long-time mean value of current)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33560	0x8318	HIGH	Property byte (phase unbalance current)	–	Meter. fct.	PB	8	–
33561	0x8319	LOW	Property byte (undervoltage)	–	Meter. fct.	PB	8	–
33561	0x8319	HIGH	Property byte (phase unbalance voltage)	–	Meter. fct.	PB	8	–
33562	0x831A	LOW	Property byte (overvoltage)	–	Meter. fct.	PB	8	–
33562	0x831A	HIGH	Reserved	–	–	–	8	–
33563	0x831B	LOW	Property byte (thermal memory)	–	ETU	PB	8	–
33563	0x831B	HIGH	Reserved	–	–	–	8	–
33564	0x831C	LOW	Property byte (N transformer connected)	–	ETU	PB	8	–
33564	0x8301	–	Reserved	–	–	–	120	–

4.7.18 Register block RB 130 parameters of the threshold values

The table below shows RB 130 via which the parameters for generating threshold warnings can be read out and modified.

The table contains the register blocks RB 130: Parameters for the threshold values (length 74 registers, read/write) Part 1:

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33281	0x8201	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
33283	0x8203	–	Active power in normal direction	283	Meter. fct.	Un-signed int	16	0
33284	0x8204	–	Active power in reverse direction	285	Meter. fct.	Un-signed int	16	0
33285	0x8205	–	Power factor, capacitive	287	Meter. fct.	Signed int	16	−3
33286	0x8206	–	Power factor, inductive	289	Meter. fct.	Signed int	16	−3
33287	0x8207	LOW	Delay time for active power in normal direction	284	Meter. fct.	Un-signed char	8	0
33287	0x8207	HIGH	Delay time for active power in reverse direction	286	Meter. fct.	Un-signed char	8	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33288	0x8208	LOW	Delay time for power factor, capacitive	288	Meter. fct.	Un-signed char	8	0
33288	0x8208	HIGH	Delay time for power factor, inductive	290	Meter. fct.	Un-signed char	8	0
33289	0x8209	LOW	Overfrequency	303	Meter. fct.	Un-signed char	8	0
33289	0x8209	HIGH	Delay time for overfrequency	304	Meter. fct.	Un-signed char	8	0
33290	0x820A	LOW	Underfrequency	305	Meter. fct.	Un-signed char	8	0
33290	0x820A	HIGH	Delay time for underfrequency	306	Meter. fct.	Un-signed char	8	0
33293	0x820D	–	Peak factor	323	Meter. fct.	Un-signed int	16	−2
33294	0x820E	–	Form factor	325	Meter. fct.	Un-signed int	16	−2
33295	0x820F	LOW	Delay time for peak factor	324	Meter. fct.	Un-signed char	8	0
33295	0x820F	HIGH	Delay time for the form factor	326	Meter. fct.	Un-signed char	8	0
33296	0x8210	–	Long-time mean value of active power	291	Meter. fct.	Un-signed int	16	0
33297	0x8211	–	Long-time mean value of apparent power	293	Meter. fct.	Un-signed int	16	0
33298	0x8212	LOW	Delay time for long-time mean value of active power	292	Meter. fct.	Un-signed char	8	0
33298	0x8212	HIGH	Delay time for long-time mean value of apparent power	294	Meter. fct.	Un-signed char	8	0
33299	0x8213	–	Long-time mean value of reactive power	295	Meter. fct.	Un-signed int	16	0
33300	0x8214	–	Reactive power in normal direction	297	Meter. fct.	Un-signed int	16	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33301	0x8215	LOW	Delay time for long-time mean value of reactive power	296	Meter. fct.	Un-signed char	8	0
33301	0x8215	HIGH	Delay time for reactive power in normal direction	298	Meter. fct.	Un-signed char	8	0
33302	0x8216	–	Reactive power in reverse direc-tion	299	Meter. fct.	Un-signed int	16	0
33303	0x8217	–	Apparent power	301	Meter. fct.	Un-signed int	16	0
33304	0x8218	LOW	Delay time for reactive power in reverse direction	300	Meter. fct.	Un-signed char	8	0
33304	0x8218	HIGH	Delay time for apparent power	302	Meter. fct.	Un-signed char	8	0
33305	0x8219	–	Overcurrent	267	Meter. fct.	Un-signed int	16	0
33306	0x821A	–	Current that flows to ground	269	Meter. fct.	Un-signed int	16	0
33307	0x821B	–	Overcurrent in neutral conductor	271	Meter. fct.	Un-signed int	16	0
33308	0x821C	–	Long-time mean value of current	275	Meter. fct.	Un-signed int	16	0
33309	0x821D	LOW	Delay time for overcurrent	268	Meter. fct.	Un-signed char	8	0
33309	0x821D	HIGH	Delay time of current that flows to ground	270	Meter. fct.	Un-signed char	8	0
33310	0x821E	LOW	Delay time for overcurrent in neutral conductor	272	Meter. fct.	Un-signed char	8	0
33310	0x821E	HIGH	Phase unbalance current	273	Meter. fct.	Un-signed char	8	0
33311	0x821F	LOW	Delay time for current phase unbalance	274	Meter. fct.	Un-signed char	8	0
33311	0x821F	HIGH	Delay time for long-time mean value of current	276	Meter. fct.	Un-signed char	8	0

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33312	0x8220	–	Undervoltage	277	Meter. fct.	Un-signed int	16	0
33313	0x8221	LOW	Delay time for undervoltage	278	Meter. fct.	Un-signed char	8	0
33313	0x8221	HIGH	Phase unbalance voltage	279	Meter. fct.	Un-signed char	8	0
33314	0x8222	LOW	Delay time for voltage phase unbalance	280	Meter. fct.	Un-signed char	8	0
33314	0x8222	HIGH	Reserved	–	–	–	8	–
33315	0x8223	–	Overvoltage	281	Meter. fct.	Un-signed int	16	0
33316	0x8224	LOW	Delay time for overvoltage	282	Meter. fct.	Un-signed char	8	0
33316	0x8224	–	Reserved	–	–	–	232	–
33331	0x8233	LOW	Property byte (active power in normal direction)	–	Meter. fct.	PB	8	–
33331	0x8233	HIGH	Property byte (active power in reverse direction)	–	Meter. fct.	PB	8	–
33332	0x8234	LOW	Property byte (capacitive power factor)	–	Meter. fct.	PB	8	–
33332	0x8234	HIGH	Property byte (inductive power factor)	–	Meter. fct.	PB	8	–
33333	0x8235	LOW	Property byte (delay time for active power in normal direction)	–	Meter. fct.	PB	8	–
33333	0x8235	HIGH	Property byte (delay time for active power in reverse direction)	–	Meter. fct.	PB	8	–
33334	0x8236	LOW	Property byte (delay time for capacitive power factor)	–	Meter. fct.	PB	8	–
33334	0x8236	HIGH	Property byte (delay time for inductive power factor)	–	Meter. fct.	PB	8	–
33335	0x8237	LOW	Property byte (overfrequency)	–	Meter. fct.	PB	8	–
33335	0x8237	HIGH	Property byte (delay time for overfrequency)	–	Meter. fct.	PB	8	–
33336	0x8238	LOW	Property byte (underfrequency)	–	Meter. fct.	PB	8	–
33336	0x8238	HIGH	Property byte (delay time for underfrequency)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33339	0x823B	LOW	Property byte (peak factor)	–	Meter. fct.	PB	8	–
33339	0x823B	HIGH	Property byte (form factor)	–	Meter. fct.	PB	8	–
33340	0x823C	LOW	Property byte (delay time for peak factor)	–	Meter. fct.	PB	8	–
33340	0x823C	HIGH	Property byte (delay time for form factor)	–	Meter. fct.	PB	8	–
33341	0x823D	LOW	Property byte (long-time mean value for active power)	–	Meter. fct.	PB	8	–
33341	0x823D	HIGH	Property byte (long-time mean value for apparent power)	–	Meter. fct.	PB	8	–
33342	0x823E	LOW	Property byte (delay time for long-time mean value of active power)	–	Meter. fct.	PB	8	–
33342	0x823E	HIGH	Property byte (delay time for long-time mean value of apparent power)	–	Meter. fct.	PB	8	–
33343	0x823F	LOW	Property byte (long-time mean value for reactive power)	–	Meter. fct.	PB	8	–
33343	0x823F	HIGH	Property byte (reactive power in normal direction)	–	Meter. fct.	PB	8	–
33344	0x8240	LOW	Property byte (delay time for long-time mean value of reactive power)	–	Meter. fct.	PB	8	–
33344	0x8240	HIGH	Property byte (delay time for reactive power in normal direction)	–	Meter. fct.	PB	8	–
33345	0x8241	LOW	Property byte (reactive power in reverse direction)	–	Meter. fct.	PB	8	–
33345	0x8241	HIGH	Property byte (apparent power)	–	Meter. fct.	PB	8	–
33346	0x8242	LOW	Property byte (delay time for reactive power in reverse direction)	–	Meter. fct.	PB	8	–
33346	0x8242	HIGH	Property byte (delay time for apparent power)	–	Meter. fct.	PB	8	–
33347	0x8243	LOW	Property byte (overcurrent)	–	Meter. fct.	PB	8	–
33347	0x8243	HIGH	Property byte (current that flows to ground)	–	Meter. fct.	PB	8	–
33348	0x8244	LOW	Property byte (overcurrent in neutral conductor)	–	Meter. fct.	PB	8	–
33348	0x8244	HIGH	Property byte (long-time mean value of current)	–	Meter. fct.	PB	8	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
33349	0x8245	LOW	Property byte (delay time for overcurrent)	–	Meter. fct.	PB	8	–
33349	0x8245	HIGH	Property byte (delay time of current that flows to ground)	–	Meter. fct.	PB	8	–
33350	0x8246	LOW	Property byte (delay time for overcurrent in neutral conductor)	–	Meter. fct.	PB	8	–
33350	0x8246	HIGH	Property byte (phase unbalance current)	–	Meter. fct.	PB	8	–
33351	0x8247	LOW	Property byte (delay time for phase unbalance current)	–	Meter. fct.	PB	8	–
33351	0x8247	HIGH	Property byte (delay time for long-time mean value of current)	–	Meter. fct.	PB	8	–
33352	0x8248	LOW	Property byte (undervoltage)	–	Meter. fct.	PB	8	–
33352	0x8248	HIGH	Property byte (delay time for undervoltage)	–	Meter. fct.	PB	8	–
33353	0x8249	LOW	Property byte (phase unbalance voltage)	–	Meter. fct.	PB	8	–
33353	0x8249	HIGH	Property byte (delay time for phase unbalance voltage)	–	Meter. fct.	PB	8	–
33354	0x824A	LOW	Property byte (overvoltage)	–	Meter. fct.	PB	8	–
33354	0x824A	HIGH	Property byte (delay time for overvoltage)	–	Meter. fct.	PB	8	–

4.7.19 Register block RB 160 parameters for configuration

The following table shows register block 160, in which the parameters for communication are stored. These parameters can be read and also set via this data set.

The table contains the register blocks RB 160: Parameters for communication (length 39 registers, read/write):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
40961	0xA001	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
40963	0xA003	LOW	Reserved	–	–	–	8	–
40963	0xA003	HIGH	Modbus address	5	COM16 WT	Un-signed char	8	0
40964	0xA004	LOW	Basic type of Modbus data transfer	6	COM16 WT	Hex	2	–

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
40964	0xA004	HIGH	Reserved	–	–	–	8	–
40965	0xA005	–	Data in the cyclic profile of Modbus	7	COM16 WT	Format (7)	224	–
40979	0xA013	–	Reserved	–	–	–	48	–
40985	0xA019	LOW	Modbus transmission rate (baud rate)	427	COM16 WT	Format (427)	8	–
40985	0xA019	HIGH	Parity	428	COM16 WT	Format (428)	8	–
40986	0xA01A	–	Reserved	–	–	–	144	–
40995	0xA023	LOW	Property byte (parity)	428	COM16 WT	PB	8	–
40995	0xA023	HIGH	Property byte (Modbus transmission rate (baud rate))	427	COM16 WT	PB	8	–
40996	0xA024	LOW	Reserved	–	–	–	8	–
40996	0xA024	HIGH	Property byte (Modbus address)	5	COM16 WT	PB	8	–
40997	0xA025	LOW	Property byte (basic type of Modbus data transfer)	6	COM16 WT	PB	8	–
40997	0xA025	HIGH	Reserved	–	–	–	8	–
40998	0xA026	LOW	Property byte (data in the cyclic profile of Modbus)	7	COM16 WT	PB	8	–
40998	0xA026	HIGH	Reserved	–	–	–	8	–

4.7.20 Register block RB 162 device configuration

The table below shows register block 162 that contains the device configuration. The circuit breaker currently connected can be read out via this data set.

The table below contains the register blocks RB 162: Device configuration (length 38 registers, read-only):

Register			Description	Data point	Source WT	Format	Length (bits)	Scaling
Address		High/Low						
Dec	Hex							
41473	0xA201	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
41475	0xA203	–	ID number of the COM16WT	91	COM16 WT	16 x char	128	–
41483	0xA20B	–	Order number of the circuit breaker	103	ETU	Format (103)	160	–
41493	0xA215	LOW	Type (metering function, metering function PLUS)	138	Meter. fct.	Format (138)	8	–

Register		High/Low	Description	Data point	Source WT	Format	Length (bits)	Scaling
Address								
Dec	Hex							
41493	0xA215	HIGH	Type of trip unit	412	ETU	Format (412)	5	–
41494	0xA216	–	Reserved	–	–	–	224	–
41508	0xA224	LOW	Property byte (ID number of the COM16WT)	–	COM16 WT	PB	8	–
41508	0xA224	HIGH	Property byte (order number of the circuit breaker)	–	ETU	PB	8	–
41509	0xA225	LOW	Property byte (type (metering function, metering function PLUS))	–	Meter. fct.	PB	8	–
41509	0xA225	HIGH	Property byte (type of trip unit)	–	ETU	PB	8	–
41510	0xA226	LOW	Reserved	–	–	–	8	–

4.7.21 Register block RB 165 identification comment

The table below shows register block 165 in which user-specific texts such as comments, plant identifier, date and author can be stored in the air circuit breaker.

The table below contains the register blocks RB 165: Identification comment (length 97 registers, read/write):

Register		High/Low	Description	Data point	Source WT	Format	Length (bits)	Scaling
Address								
Dec	Hex							
42241	0xA501	–	Header; value 0x00 00 00 00	–	COM16 WT	–	32	–
42243	0xA503	–	User text (freely editable)	20	COM16 WT	64 x char	512	–
42275	0xA523	–	Plant identifier (freely editable)	21	COM16 WT	64 x char	512	–
42307	0xA543	–	Date (freely editable)	22	COM16 WT	Time	64	–
42311	0xA547	–	Author (freely editable)	23	COM16 WT	30 x char	240	–
42326	0xA556	–	Reserved	–	–	–	160	–
42336	0xA560	LOW	Property byte (user text (freely editable))	–	COM16 WT	PB	8	–
42336	0xA560	HIGH	Property byte (plant identifier (freely editable))	–	COM16 WT	PB	8	–
42337	0xA561	LOW	Property byte (date (freely editable))	–	COM16 WT	PB	8	–
42337	0xA561	HIGH	Property byte (author (freely editable))	–	COM16 WT	PB	8	–

4.8 Formats

4.8.1 Formats of the data points

The different formats of the data points are described in this section. This includes the description of the Motorola format used, e.g. "Int" and "Unsigned int", as well as, above all, the description of special formats. A special format is, for example, the binary breakdown of the data point that specifies the last tripping operation.

All available data points and the register block in which they are transferred over Modbus RTU have been described on the preceding pages. In the "Format" column, an explanation is given of which data type is referred to and how this content is to be interpreted. A distinction must be made here between generally valid formats and special formats that are usually binary coded.

4.8.2 General data formats

Many data points have a data length of more than one byte. In this case, the numbers can be stored either in Little-Endian-format (Intel) or in Big-Endian-format (Motorola) depending on the processor type for which the format has been developed. In Big-Endian-format, the higher-order byte is before the lower-order byte to facilitate reading, and with Intel, the bytes are in the opposite order.

The table below shows the standard formats used, with their value ranges and purposes.

Format	Length in byte	Signs	Value range unscaled	Used for
Unsigned int	2	–	0 … 65535	Measured values, parameters, etc.
Signed int	2	✓	−32678 … 32767	Negative measured values
Unsigned char	1	–	0 … 255	Measured values, parameters with lower value range
Char	1	–	0 … 255	ASCII characters
Unsigned long	4	–	0 … 4294967295	Measured values and maintenance information with a large measuring range

In general, all data communicated over Modbus RTU is transferred in the Motorola (Big-Endian) format.

Format "Unsigned int"

The format "Unsigned int" is used primarily for transferring parameters and measured values, as well as statistical information. If the value range is insufficient, scaling is used.

To transfer measured values that can also be negative (e.g. power factors), the format "signed int" is used.

Format "Unsigned char"

If the value range of a parameter or measured value is severely restricted (e.g. phase unbalance of 0 to 50%), the data type "Unsigned char" is sufficient.

Text elements consisting of ASCII characters are assembled using the data type "char". In this case, the data type "Unsigned char" indicates a "byte" that can assume a value from the range 0 to 255.

Format "Unsigned long"

If the value range is insufficient, the data type "Unsigned long" is fallen back on. This is used, for example, with the runtime meter. If "Unsigned int" were to be used for this, the runtime meter would overflow after seven-and-a-half years.

Format "Hex"

The format "hex" is always used where there is a concatenation of binary information, e.g. when transferring the statuses at the inputs of the binary input module. However, it is also used when hexadecimal numbers are transferred.

Time format

The S7-compatible time format (DATE_AND_TIME) is used for communicating time stamps. The time stamp in RB100 is represented according to the PROFIBUS standard and is an exception to this rule.

Byte	Bit	Meaning
0	–	Year
1	–	Month
2	–	Day
3	–	Hour
4	–	Minute
5	–	Seconds
6	–	Low-order digits of milliseconds
7	4 … 7	Higher-order digits of milliseconds (4MSB)
7	0 … 3	Weekday (1 =Sunday … 7 = Saturday)

All time stamps are transferred in this format.

Byte	Bit	Meaning
0	–	Higher-order digits of milliseconds
1	–	Low-order digits of milliseconds
2	–	Minute
3	0 … 4	Hour
3	7	1 = summer time; 0 = winter time
4	0 … 4	Day of the month (1 … 31)
4	5 … 7	Weekday (1 = Monday … 7 = Sunday)
5	–	Month
6	–	Year (02 = 2002)
7	–	Reserved

This time format is compliant with the PROFIBUS time format.

4.8.3 Special data formats

Special data formats are used where the inflexible standard formats cannot be used. The special data formats are used, for example, with binary-coded or complex data points. If a special data format has been used with a data point, this is indicated in the first and second part of this chapter in the format column with **Format (X)**. The X represents a consecutive number of the special data formats used, described below. In the majority of cases, the X in the format agrees with the data point number to simplify the search.

In the case of bit interpretations, the meaning is always to be seen with a high-active signal.

The table below shows the format (7) for the data in the cyclic profile of Modbus.

Byte	Meaning
0	Assignment (data point number) of the 1st data block in the cyclic message frame
2	Assignment (data point number) of the 2nd data block in the cyclic message frame
4	Assignment (data point number) of the 3rd data block in the cyclic message frame
6	Assignment (data point number) of the 4th data block in the cyclic message frame
8	Assignment (data point number) of the 5th data block in the cyclic message frame
10	Assignment (data point number) of the 6th data block in the cyclic message frame
12	Assignment (data point number) of the 7th data block in the cyclic message frame
14	Assignment (data point number) of the 8th data block in the cyclic message frame
16	Assignment (data point number) of the 9th data block in the cyclic message frame
18	Assignment (data point number) of the 10th data block in the cyclic message frame
20	Assignment (data point number) of the 11th data block in the cyclic message frame
22	Assignment (data point number) of the 12th data block in the cyclic message frame
24	Assignment (data point number) of the 13th data block in the cyclic message frame
26	Assignment (data point number) of the 14th data block in the cyclic message frame

The table below shows the format (14) for write protection. The write protection can be deactivated using a hardware input on COM16WT

Byte	Bit	Meaning
0	0	0 = write protection active; 1 = write protection inactive

4.8.4 Data formats 15 to 24

The table below shows the format (15) "trip log". It contains the last 5 tripping operations with time stamp and source.

Byte	Bit	Meaning
0 … 7	Time	Time stamp of the 1st tripping operation
8	–	Reserved 0x00
9	Reason for tripping operation	Reason for trip of 1st tripping operation 1 = Overload 2 = Instantaneous short circuit 3 = Delayed short-circuit 4 = Ground fault 5 = Ext. protection function 6 = Overload N-conductor 7 = ETU self-protection (analog override)
10	–	Source of 1st tripping operation 14 = Meter. function/M. PLUS 25 = Trip unit
11	–	Reserved 0x00
12 … 19	–	Time stamp of 2nd tripping operation
20	–	Reserved 0x00
21	–	Reason for 2nd tripping operation
22	–	Source of 2nd tripping operation
23	–	Reserved 0x00
24 … 31	–	Time stamp of 3rd tripping operation
32	–	Reserved 0x00
33	–	Reason for 3rd tripping operation
34	–	Source of 3rd tripping operation
35	–	Reserved 0x00
36 … 43	–	Time stamp of 4th tripping operation
44	–	Reserved 0x00
45	–	Reason for 4th tripping operation
46	–	Source of 4th tripping operation
47	–	Reserved 0x00
48 … 55	–	Time stamp of 5th tripping operation
56	–	Reserved 0x00

Byte	Bit	Meaning
57	–	Reason for 5th tripping operation
58	–	Source of 5th tripping operation
59	–	Reserved 0x00

The table below shows the format (16) "event log". It contains the last 10 events with time stamp. Example, see below.

Byte	Bit	Meaning		
0 … 7	–	Time stamp of 1st event		
8	–	Reserved 0x00		
9	–	Coming "+"	Going "−"	Event description
		1	2	Overload warning
		3	4	Overload warning N-conductor
		5	6	Load shedding alarm
		7	8	Load pick up message
		9	10	Phase unbalance warning
		11	12	Fault in trip unit
		13	14	Ground fault warning
		15	16	Overtemperature warning
		20	–	Switch on
		21	–	Circuit Breaker off
		40	41	Threshold warning TV current
		42	43	TV ground fault
		44	45	TV overcurrent N-conductor
		46	47	TV unbalance current
		48	49	TV long-time mean value for current
10	–	Source of 1st event 14 = Meter. function/M. PLUS 25 = Trip unit		
11	–	Reserved 0x00		
12 … 19	–	Time stamp of 2nd event		
20	–	Reserved 0x00		
21	–	2nd event		
22	–	Source of 2nd event		
23	–	Reserved 0x00		
24 … 31	–	Time stamp of 3rd event		
32	–	Reserved 0x00		
33	–	3rd event		
34	–	Source of 3rd event		
35	–	Reserved 0x00		
36 … 43	–	Time stamp of 4th event		
44	–	Reserved 0x00		
45	–	4th event		
46	–	Source of 4th event		

Byte	Bit	Meaning
47	–	Reserved 0x00
48 … 55	–	Time stamp of 5th event
56	–	Reserved 0x00
57	–	5th event
58	–	Source of 5th event
59	–	Reserved 0x00
60 … 67	–	Time stamp of 6th event
68	–	Reserved 0x00
69	–	6th event
70	–	Source of 6th event
71	–	Reserved 0x00
72 … 79	–	Time stamp of 7th event
80	–	Reserved 0x00
81	–	7th event
82	–	Source of 7th event
83	–	Reserved 0x00
84 … 91	–	Time stamp of 8th event
92	–	Reserved 0x00
93	–	8th event
94	–	Source of 8th event
95	–	Reserved 0x00
96 … 103	–	Time stamp of 9th event
104	–	Reserved 0x00
105	–	9th event
106	–	Source of 9th event
107	–	Reserved 0x00
108 … 115	–	Time stamp of 10th event
116	–	Reserved 0x00
117	–	10th event
118	–	Source of 10th event
119	–	Reserved 0x00

The table below shows the format (17) "Status MODBUS RTU". The status can be used to scan for a cyclic connection.

Byte	Bit	Meaning
0	0	0 = Communication active; 1 = Communication inactive
0	1	The communication module has no valid MODBUS RTU address
0	2	Modbus RTU address can no longer be changed

The table below shows the format (18) "Control communication module". Some settings of the switch can be changed via this format.

Byte	Bit	Meaning
0	2	Deletes the maintenance counters
0	3	Deletes the min./max. temperatures
0	4	Deletes all min./max. values except temperature
0	5	Synchronizes the clock to xx:30:00.000
0	6	Deletes the contents of the trip log and event log

The table below shows the format (19) "Control communication module outputs". The circuit breaker can be switched on or off with this, for example.

Byte	Bit	Meaning	
0	0	Set user output	
0	1	Reset user output	
0	2	Open circuit breaker	
0	3	Close the circuit breaker	
0	4	Switch user output mode to trip message	
0	5	Status of user output mode	
		0	Output is set to Trip message (Default)
		1	Actuation by user
0	6	Read status of user output	
0	7	Read status of user input (COM16WT only)	

The table below shows the format (24) "position in frame". Data point 24 specifies the position of the 3WT Air Circuit Breaker in the guide frame.

Byte	Value	Meaning
0	0	Disconnected position
0	1	Connected position
0	2	Test position
0	3	Circuit Breaker not available

4.8.5 Data formats 88 to 162

The table below shows the format (95) "Market".

Byte	Value	Meaning
0	1	IEC

The table below shows the format (99) "Switching capacity class" that specifies the maximum level of the breaking current.

Byte	Value	Meaning
0	2	ECO switching capacity N/IntClassN
0	3	Standard switching capacity S/IntClassS
0	4	High switching capacity H/IntClassH
0	5	Extremely high switching capacity C/IntClassC

The table below shows the format (100) "Size". The size is determined by the rated switch current and the switching capacity class.

Byte	Value	Meaning
0	1	Size 1
0	2	Size 2

The table below shows the format (107) "Switched-off I^2t values"

Byte	Bit	Meaning
0	–	Phase L1 (unsigned long)
4	–	Phase L2 (unsigned long)
8	–	Phase L3 (unsigned long)
12	–	Phase N (unsigned long)

The table below shows the format (108) "Number of poles" that specifies the number of protected poles for the main circuit.

Byte	Value	Meaning
0	1	3-pole
0	2	4-pole (with N-conductor)

The table below shows the format (138) "Type of the metering function". It specifies which type of metering function is built in.

Byte	Value	Meaning
0	0x03	Metering function PLUS

The table below shows the format (145) "Direction of incoming supply". The sign for active power and reactive power depend on the "Direction of incoming supply".

Byte	Value	Meaning
0	0	From top to bottom
0	1	From bottom to top

The table below shows the format (146) "Direction of rotation of phase". The normal status of the direction of rotation of the phase can be set using this.

Byte	Value	Meaning
0	0	Right (e.g. L1 – L2 – L3)
0	1	Left (e.g. L1 – L3 – L2 or similar)

The table below shows the format (162) "Voltage transformer". The setting of the primary connection also influences the location of the measured voltage variables.

Byte	Value	Meaning
0	0	The voltage transformer is delta-connected on the primary side.
0	1	The voltage transformer is star-connected on the primary side.

4.8.6 Data formats 307 to 373

The table below shows the format (307) "Tripping of the metering function" that displays the content of the last tripping operation by the extended protection function.

Byte	Value	Meaning
0/1	0x0000	No tripping operation
0/1	0x0001	Phase unbalance current
0/1	0x0002	Phase unbalance voltage
0/1	0x0004	Active power in normal direction
0/1	0x0008	Active power in reverse direction

The table below shows the format (308) "Threshold warnings" that displays the currently pending threshold warnings.

Byte	Bit	Meaning
1	0	cos φ capacitive
1	1	cos φ inductive
1	4	Peak factor
1	5	Form factor
1	6	Active power in normal direction
1	7	Active power in reverse direction
2	0	Long-time mean value of active power
2	1	Long-time mean value of apparent power
2	2	Long-time mean value of reactive power
2	3	Reactive power in normal direction
2	4	Reactive power in reverse direction
2	5	Apparent power

The table below shows the format (328) "Status of the Circuit Breaker" that transfers the data the BSSWT has collected via a micro switch.

Byte	Bit	Meaning
0	0	Circuit Breaker is off
0	1	Circuit Breaker is on
0	2	Circuit Breaker has tripped (tripped signaling switch)
0	3	Circuit Breaker is ready
0	4	Spring energy store is compressed
0	5	Circuit Breaker on 1st auxiliary trip unit actuated
0	6	Circuit Breaker on 2nd auxiliary trip unit actuated

The table below shows the format (343) "I^2t characteristic for S" via which the I^2t characteristic is switched on and off.

Byte	Value	Meaning
0	0	I^2t characteristic for delayed short-circuit protection switched off.
0	1	I^2t characteristic for delayed short-circuit protection switched on.

The table below shows the format (344) "I^2t characteristic for G" via which the I^2t characteristic is switched on and off.

Byte	Value	Meaning
0	0	I^2t characteristic for ground-fault protection switched off.
0	1	I^2t characteristic for ground-fault protection switched on.

The table below shows the format (346) "Thermal memory" via which the thermal memory is switched on and off.

Byte	Value	Meaning
0	0	Thermal memory switched off
0	1	Thermal memory switched on

The table below shows the format (347) "Phase loss sensitivity" via which the phase loss sensitivity is switched on and off.

Byte	Value	Meaning
0	0	Phase loss sensitivity switched off
0	1	Phase loss sensitivity switched on

The table below shows the format (373) "Phase number" that specifies the phase number of the most loaded phase and the phase of the tripping operation.

Byte	Value	Meaning
0	0	Phase L1
0	1	Phase L2
0	2	Phase L3

Byte	Value	Meaning
0	3	N-conductor
0	4	Ground fault

4.8.7 Data formats 401 to 426

The table below shows the format (401) "Trip unit: tripping operations", which shows the last unacknowledged tripping operation of the trip unit.

Byte	Value	Meaning
0	0x00	No tripping operation
0	0x01	Overload (L)
0	0x02	Instantaneous short circuit (I)
0	0x04	Short-time delayed short circuit (S)
0	0x08	Ground fault (G)

The table below shows the format (402) "Trip unit: alarms" via which the trip unit communicates the currently pending alarms.

Byte	Bit	Meaning
0	0	Overload
0	1	Overload N-conductor
0	2	Load shedding
0	3	Load pick up
0	4	Phase unbalance current
0	5	Microprocessor fault
0	6	Ground fault
0	7	Overtemperature
1	0	Leading overload tripping alarm
1	1	Short-time mean value current

The table below shows format (405) "Contact status" that is calculated empirically from the maintenance information.

Byte	Value	Meaning
0	0	No maintenance necessary yet on main contacts (Note: Despite this, the main contacts must be checked after every tripping operation!)"
0	1	Perform immediate visual inspection on main contacts.
0	2	Prepare maintenance of the main contacts

The table below shows the format (406) "Control trip unit" via which the statistical information can be reset, among other things.

Byte	Value	Meaning
0/1	0x0002	Delete last trip signal in trip unit
0/1	0x0022	Reset counter and statistical information of the trip unit

The table below shows the format (410) "Ground fault detection" with which the ground fault detection method is set.

Byte	Value	Meaning
0	0	Detecting the current against ground via an external transformer
0	1	Calculation of the current against ground using vectorial summation
0	2	Detecting the current against ground using vectorial summation (alarm) and an external transformer (tripping)

The table below shows format (411) "N transformer" that indicates whether an N transformer is connected.

Byte	Value	Meaning
0	0	No transformer in the N-conductor
0	1	Transformer in the N-conductor

The table below shows the format (412) "Trip unit type for 3WT" that indicates which trip unit is used and how it is equipped.

Byte	Value	IEC/UL	Meaning
0	5	IEC	ETU45WT with display
0	7	IEC	ETU47WT with display

List of abbreviations

A

The abbreviations used in the manual are explained below.

AC	Alternating current
AWG	American Wire Gauge
BSSWT	Breaker Status Sensor
COM16WT	Communication module 3WT
CUB −	CubicleBUS, connection "−"
CUB +	CubicleBUS, connection "+"
DC	Direct current
DIN	German Industry Standard
ED	ON time; exceeding the permissible ON time results in destruction
ESD	Electrostatic sensitive device
ETU	Electronic trip unit, solid-state overcurrent trip unit
EN	European standard
EMC	Electromagnetic compatibility
EXTEND.	Extended protection function
F1	First shunt release
F2	Second shunt release
F3	Undervoltage release
F5	Tripping solenoid
F8	Undervoltage release with delay
FIFO memory	First in/first out memory
I tripping operation	Instantaneous short-circuit trip
ID	Identification number
IEC	International Electrotechnical Commission
L1	Conductor/phase 1
L2	Conductor/phase 2
L3	Conductor/phase 3
LED	Light emitting diode
LV	Low-voltage
M	Motor
MV	Medium-high voltage
N	Neutral conductor
NC	Normally closed contact
NO	Normally open contact
S1 / S2	1st auxiliary switch block
S3 / S4	2nd auxiliary switch block
S5 / S6	2nd auxiliary switch block

S5 / S60	2nd auxiliary switch block
S60 / S61	2nd auxiliary switch block
S7	Ready-to-close signaling contact
S11	Trip signaling switch
ST	Shunt release
T.U. ERROR	Trip unit error, fault in overcurrent trip unit
TEST	Test position
tsd	Delay time for short time-delayed short-circuit protection
UVR	Undervoltage release (instantaneous)
UVR td	Undervoltage release (delayed)
VDE	Association of German Electrical Engineers
VT / V-TAP	Voltage transformer
X	Terminal marking according to DIN
Y1	Switch-on solenoid

Glossary

Auxiliary trip unit

Undervoltage releases and shunt releases are available.

BSSWT module

Breaker Status Sensor – for collecting the information about the status of the circuit breaker by means of signaling

Closing solenoid

Electrical closing of the circuit breaker.

COM16WT module

The communication module is the interface adapter for converting the circuit breaker signals to MODBUS signals and vice versa. Provision of three isolated outputs for control functions (ON, OFF, 1x freely available).

One input, freely usable for information from the switchgear. Additional function when used as slide-in circuit breaker: Recording the position of the circuit breaker in the guide frame with the signaling switches. You will find more information on this in chapter (Page) and (Page).

CubicleBUS

3WT data bus system in the circuit breaker and in the vicinity of the circuit breaker with interface (COM16WT) to the fieldbus (MODBUS RTU)

Electrical closing lockout

This function is designed to electrically interlock two or more circuit breakers (closing lockout). The electrical closing lockout prevents the circuit breaker from closing with a continuous signal.

Shunt release (F1, F2)

For remotely opening the circuit breaker and blocking the circuit breaker against closing.

Undervoltage release (delayed)

For remotely opening and interlocking the circuit breaker. Voltage dips must not cause the circuit breaker to open.

Undervoltage release (instantaneous/short-time delay)

For remotely opening and interlocking the circuit breaker as well as for using the circuit breaker in EMERGENCY OFF circuits (to EN 60204-1/DIN VDE 0113 Part 1) in conjunction with a separate EMERGENCY OFF device. Brief voltage dips (td < 80 ms for instantaneous undervoltage release, td < 200 ms for short-time delay undervoltage release) must not cause the circuit breaker to open.

Further Information

Always at your disposal: our extensive support
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