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MANUAL

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Protection devices

Communication
Air circuit breaker 3WA

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Protection devices 3WA Air Circuit Breaker Communication

System Manual

Introduction 1

System description 2

Status of the circuit breaker 3

Parameterization and remote control 4

Modbus TCP / Modbus RTU 5

PROFINET IO COM190 6

Disposal 7

ESD guidelines A

List of abbreviations B

06/2024

92310000004-05

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

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

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

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Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Table of contents

1 Introduction 7

1.1 Scope of validity of this document 7

1.2 Target readers of this documentation 8

1.3 Technical Support 9

1.4 Reference documents 10

1.5 Advanced training courses 11

1.6 Safety instructions 12

1.6.1 Safety regulations 12

1.6.2 Security information 13

1.6.3 Open Source Software 13

1.6.4 More information on Open Source software for 3WA circuit breakers 14

2 System description 15

2.1 The 3WA air circuit breaker 15

2.2 The CubicleBUS² bus system 16

2.3 COM190 communication module 18

2.4 The COM150 communication module 20

2.5 Non-automatic circuit breaker 22

3 Status of the circuit breaker 25

3.1 Introduction 25

3.2 The ETU600 electronic trip unit as an information center 26

3.3 Indication of tripping cause 27

3.4 Status of the ETU 29

3.5 Status of the mechanical system 31

3.6 Status of position of withdrawable circuit breaker in the guide frame 32

3.7 DAS+ status 33

3.8 Status of warnings 35

3.9 Status of alarms 36

3.10 Activation status of protective functions 37

3.11 Status of the ETU error messages (self-monitoring function) 38

3.12 Status of the main contacts of the circuit breaker 39

4 Parameterization and remote control 41
4.1 Parameterization of the protection parameters 41
4.2 Closing/opening the circuit breaker via Modbus TCP/RTU 45
4.3 Parameterization of ground-fault protection (GF) 46
4.4 Overload pre-alarm PAL 47
5 Modbus TCP / Modbus RTU 49
5.1 General 49
5.2 Modbus registers 50
5.3 Addressing Modbus TCP COM190 51
5.4 Function codes, metering values and parameters COM150 / COM190 52
5.4.1 Function codes 52
5.4.2 Metering values, parameters and commands 52
5.4.2.1 Reading metering values and parameters 52
5.4.2.2 Writing parameters 53
5.4.2.3 Writing commands 54
5.5 Transactions 55
5.6 MODBUS error codes 56
5.7 Invalid values 57
5.8 Difference between Modbus register number and register address 58
5.9 Modbus TCP whitelist COM190 59
5.10 Configurable Modbus TCP port COM190 62
5.11 System time with SNTP COM190 63
5.11.1 Requirement 63
5.11.2 Settings 64
5.11.3 Data points 64
5.11.4 Parameters 65
5.12 Configurable Modbus map COM190 66
6 PROFINET IO COM190 69
6.1 General 69
6.2 Technical specifications of the communication interfaces 71
6.3 Metering values, addressing und data traffic 72
6.3.1 Metering values 72
6.3.2 Cyclic data traffic 74
6.3.3 Acyclic data traffic 85
6.4 Interrupt, error and system messages 90
6.4.1 General 90
6.4.2 Structure of the diagnostic messages 90
6.4.3 Diagnostic and maintenance alarm messages 96
6.4.4 Process alarm messages 98

7 Disposal 99
A ESD guidelines 101
A.1 Electrostatic sensitive devices (ESD) 101
B List of abbreviations 103
B.1 Table of abbreviations 103
Index 105

Introduction

1

1.1 Scope of validity of this document

This system manual is a reference manual for technical information that users will need to configure and integrate the 3WA air circuit breakers and their communication components in power distribution equipment.

1.2 Target readers of this documentation

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

- Users
- Programmers

1.3 Technical Support

You can find further support on the Internet at:

TechnicalSupport (https://www.siemens.com/support-request)

1.4 Reference documents

For more information, refer to the following documents:

Title	Article number
GSDML file and data sets for acyclic data traffic for the COM190 communication module (https://support.industry.siemens.com/cs/us/en/view/109793939) (3WA9111-0EC13) of the 3WA air circuit breaker	
Modbus register for air circuit breaker 3WA Data tables (https://support.industry.siemens.com/cs/ww/en/view/109794278)	
3WA Air Circuit Breakers Equipment Manual (https://support.industry.siemens.com/cs/ww/en/view/109763061)	
3WA Air Circuit Breakers Catalog (https://support.industry.siemens.com/cs/ww/en/view/109781806)	E86060-K8280-E401
Catalog LV 10 - Low-Voltage Power Distribution and Electrical Installation Technology Catalog (https://support.industry.siemens.com/cs/ww/de/view/109482234)	E86060-K8280-A101
3KC ATC3100 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/100341671)	
3KC ATC6300 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/109755149)	
3KC ATC6500 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/109758018)	
7KN Powercenter 3000 Manual (https://support.industry.siemens.com/cs/ww/en/view/109763838)	
Hartmut Kiank, Wolfgang Fruth: Planning Guide for Power Distribution Plants, Publicis Publishing	ISBN A19100-L531-B115
Schalten, Schützen, Verteilen in Niederspannungsnetzen (Switching, Protection and Distribution in Low-Voltage Networks), substantially extended and revised edition 1997	ISBN 3-89578-041-3

1.5 Advanced training courses

Find out about training courses on offer on the following link.

Training for Industry (https://www.siemens.com/sitrain-lowvoltage)

Here you can choose from:

- Web-based training courses (online, informative, free)
- Classroom training courses (course attendance, comprehensive, subject to fee)

You also have the possibility of compiling your own training portfolio via **Learning paths**.

1.6 Safety instructions

1.6.1 Safety regulations

⚠ DANGER

Hazardous voltage
Will cause death, serious personal injury, or equipment damage.

During operation, parts of the device or system are carrying hazardous electrical voltage. Improper handling of the device or system can result in death or serious injury, as well as significant material damage.

- Inspection and maintenance may only be performed by qualified personnel.
- Pay attention to all the notices provided on the product and in this manual.
- Before commencing maintenance work, ensure that no voltage is present on the power distribution equipment and make sure that this condition is maintained while work is being performed (according to EN 50110-1, DIN VDE 0105-100 and BGV A2).

  Proceed in accordance with the Five Safety Rules:
  - Turn off all power supplying the equipment.
  - Lock out all power supplying the equipment to secure against reconnection.
  - Verify that no voltage is present on the device.
  - Ground and short the circuit.
  - Provide protection against adjacent live parts.

Qualified personnel

Inspection and maintenance may only be performed by qualified personnel.

In the context of these operating instructions and the warning notices on the product, qualified personnel refers to persons who are familiar with the erection, installation, commissioning and operation of the product and who possess the qualifications appropriate for their activities, e.g.:

- Training or instruction/authorization to close and open, ground, and tag circuits and devices and systems in accordance with established safety procedures.
- Training or instruction in the proper care and use of protective equipment in accordance with established safety procedures.
- Training in first aid.

Spare parts

Only spare parts approved by the manufacturer may be used.

1.6.2 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To keep up to date with all the latest product updates, subscribe to the Siemens Industrial Security RSS Feed at (https://www.siemens.com/industrialsecurity).

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This product, solution or service ("Product") contains third-party software components. These components are Open Source Software licensed under a license approved by the Open Source Initiative (https://www.opensource.org) or similar licenses as determined by SIEMENS ("OSS") and/or commercial or freeware software components. With respect to the OSS components, the applicable OSS license conditions prevail over any other terms and conditions covering the Product. The OSS portions of this Product are provided royalty-free and can be used at no charge.

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Technical Support
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Germany

You will find Technical Support under (https://www.siemens.com/support-request).

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1.6.4 More information on Open Source software for 3WA circuit breakers

In addition to the sources listed in Chapter Open Source Software (Page 13), further information about the used OSS licenses can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109782123).

System description

2

2.1 The 3WA air circuit breaker

The 3WA circuit breaker is the new generation of air circuit breakers in the Siemens AG portfolio. It is based on the proven and robust design of its predecessor 3WL. The technical data of the 3WA circuit breaker mechanics and the portfolio have been extended as compared with 3WL, and the electronic components have been completely redeveloped.

The 3WA circuit breaker is part of the product family of SENTRON protection, switching, measuring and monitoring devices and covers applications in the rated current range from 630 A to 6300 A.

You can find detailed information on the 3WA circuit breaker in the Equipment Manual; see Chapter Reference documents (Page 10).

2.2 The CubicleBUS² bus system

The CubicleBUS² is a closed bus system and allows communication between a 3WA circuit breaker with ETU600 or a 3WA non-automatic circuit breaker with BSS200 and internal and external modules located in the circuit breaker panel.

The following data can be transmitted via the CubicleBUS²:

- Metering values
- Maintenance information
- Statuses
- Events and parameters of the circuit breaker
- Firmware update

You can find the technical specifications of the CubicleBUS² in the 3WA Equipment Manual; see Chapter Reference documents (Page 10).

CubicleBUS² nodes

The following CubicleBUS² devices are available for the 3WA circuit breaker.

- ETU600 electronic trip unit
- Internal status sensors
  The Breaker Status Sensor BSS200 is used for status acquisition.
- Communication interfaces:
  - Bluetooth and USB-C interface TUI600
  - PROFINET IO/Modbus TCP module COM190, see Chapter COM190 communication module (Page 18)
  - Modbus RTU module COM150
- IOM230 digital input/output module

You can find a detailed description of the components including the technical specifications in the 3WA Equipment Manual; see Chapter Reference documents (Page 10).

Data exchange between CubicleBUS² nodes

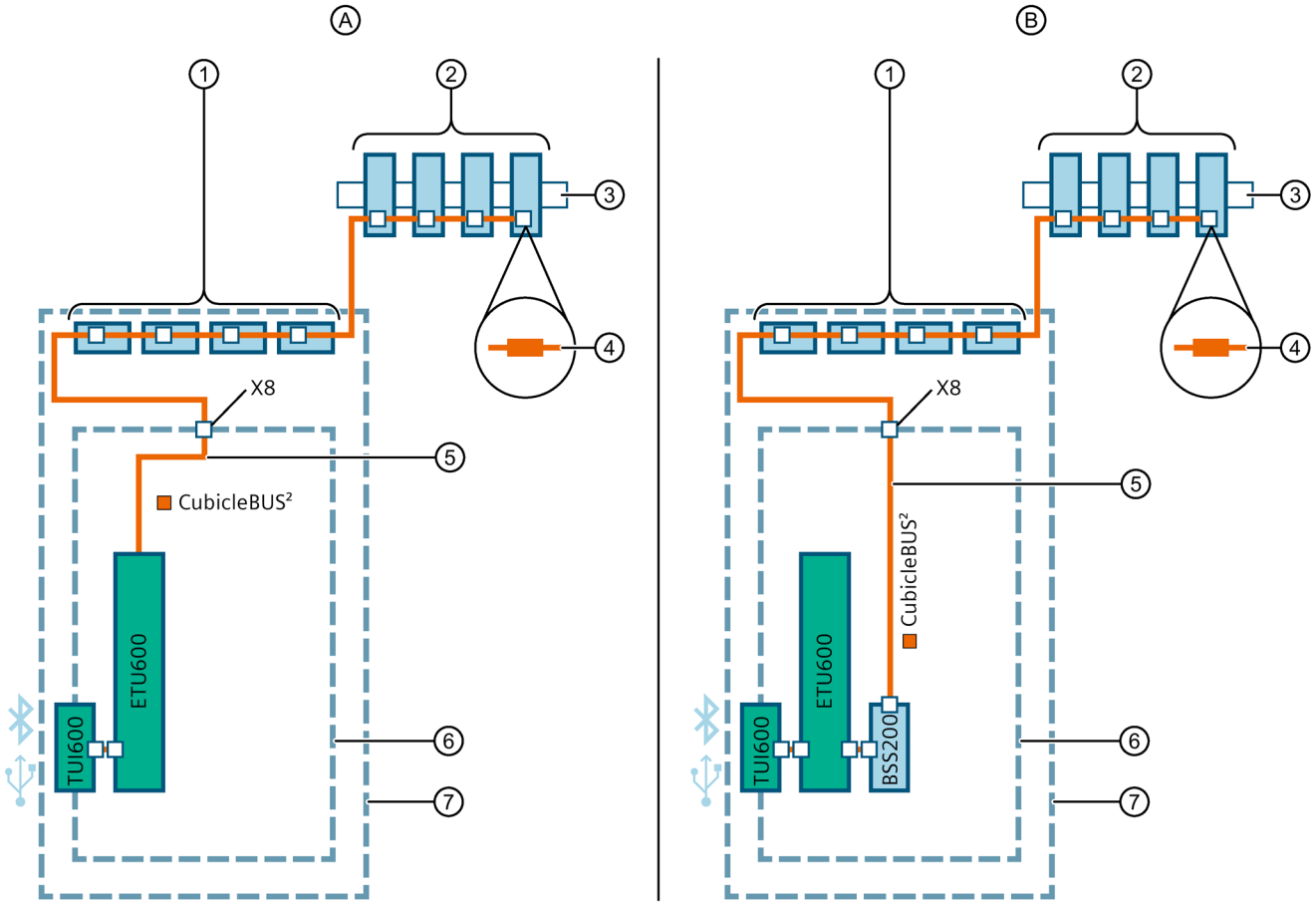
Data is exchanged internally via CubicleBUS² and output at the local interface, I/O modules, or fieldbus interfaces.

The CubicleBUS² is a serial bus and is looped through from one module to the next.

The first CubicleBUS² module is connected to secondary disconnect terminals X8-1 to X8-4 of the circuit breaker.

Note

The CubicleBUS² must be terminated at the final module with a 120 Ω terminating resistor. Spur lines are not permitted.



(A) Communication via ETU600 (standard)

(B) ready4com: Communication via BSS200 (optional, extended communication functionality)

(1) Internal CubicleBUS² modules on the circuit breaker (optional)

(2) External CubicleBUS² modules (optional)

(3) DIN rail

(4) 120 Ω terminating resistor of the CubicleBUS²

(5) CubicleBUS² ≤ 10 m

(6) 3WA air circuit breaker

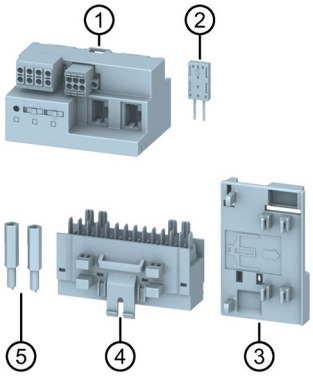
(7) Guide frame of the 3WA air circuit breaker (optional)

Note

Compatibility with legacy product

The CubicleBUS² applied in the 3WA circuit breaker is an enhanced development of the CubicleBUS system applied in the 3WL circuit breaker. They are not compatible with each other.

2.3 COM190 communication module



(1) COM190 communication module
(2) Terminating resistor "S"
(3) Adapter for mounting on DIN rail
(4) Adapter for mounting on circuit breaker
(5) Coding pin extenders for mounting on circuit breaker

The COM190 is the communication module for the 3WA circuit breaker. It provides a wide range of functions in conjunction with other CubicleBUS^2 nodes, e.g.:

- Readout of circuit breaker data and metering values
- Readout of circuit breaker status
- Transfer of alarms and warnings
- Setting of parameters
- Closing and opening of circuit breaker via the communication interface
- Readout of status and maintenance information
- Security functions

The COM190 is equipped with Ethernet interfaces for connecting to the PC or network.

Communication protocols and systems

The COM190 communication module supports the following communication protocols:

- PROFINET IO
- Modbus TCP

It is possible to use only one protocol or both protocols simultaneously and independently of each other. Since no configuration is required, the 3WA circuit breaker can be used in different systems simultaneously. An air circuit breaker can thus be used, for example, simultaneously in energy management and automation.

Two communication modules (COM190 and COM150) performing different roles (role A and role B) can be operated simultaneously on one circuit breaker or non-automatic air circuit breaker independent of each other. This allows the circuit breaker to provide new redundancy solutions, as it can be used in parallel in two independent communication systems.

Security

COM190 is a modern communication module and offers security functions to prevent unauthorized access to the circuit breaker or unauthorized changes to data via communication.

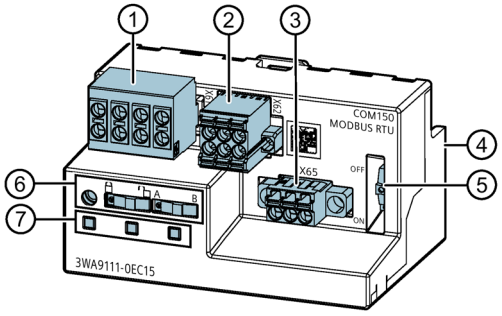
2.4 The COM150 communication module

Supported protocols COM150

The COM150 communications module supports the Modbus RTU protocol.

Interfaces, operator controls and status displays

The COM150 communications module for the 3WA circuit breaker has several interfaces, operator controls and status displays, which are described below.



(1) X61 connector

(2) X62 connector

(3) Modbus RTU connection X65

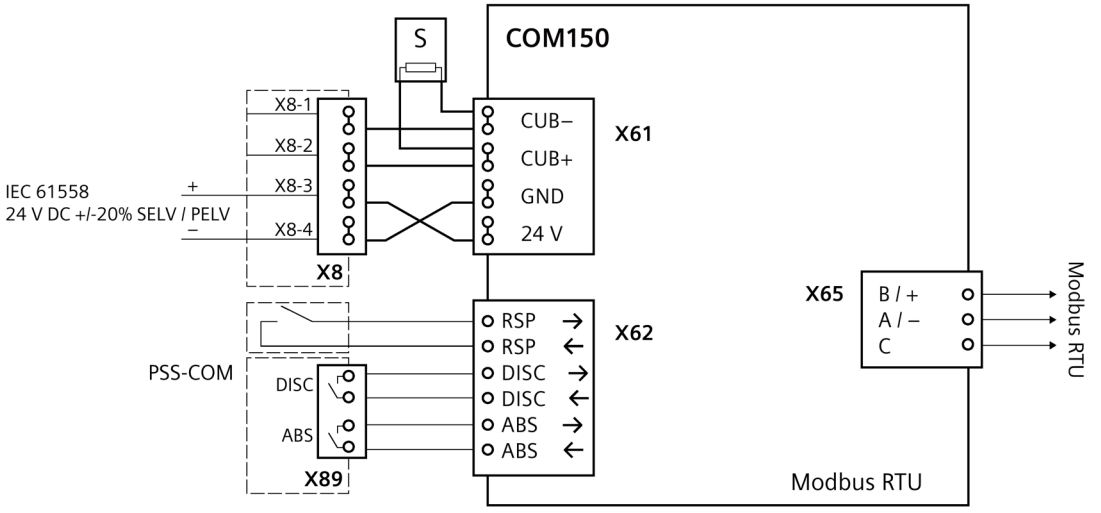
(4) Fixation for mounting adapter

(5) Slide switch for Modbus RTU terminating resistor

(6) Operator controls

(7) LEDs

The following graphic shows the interconnection of the COM150 communications module, a PSS COM, and an external write protection switch.



X62

RSP	Remote Switching Protection
DISC	Disconnected
ABS	Absent

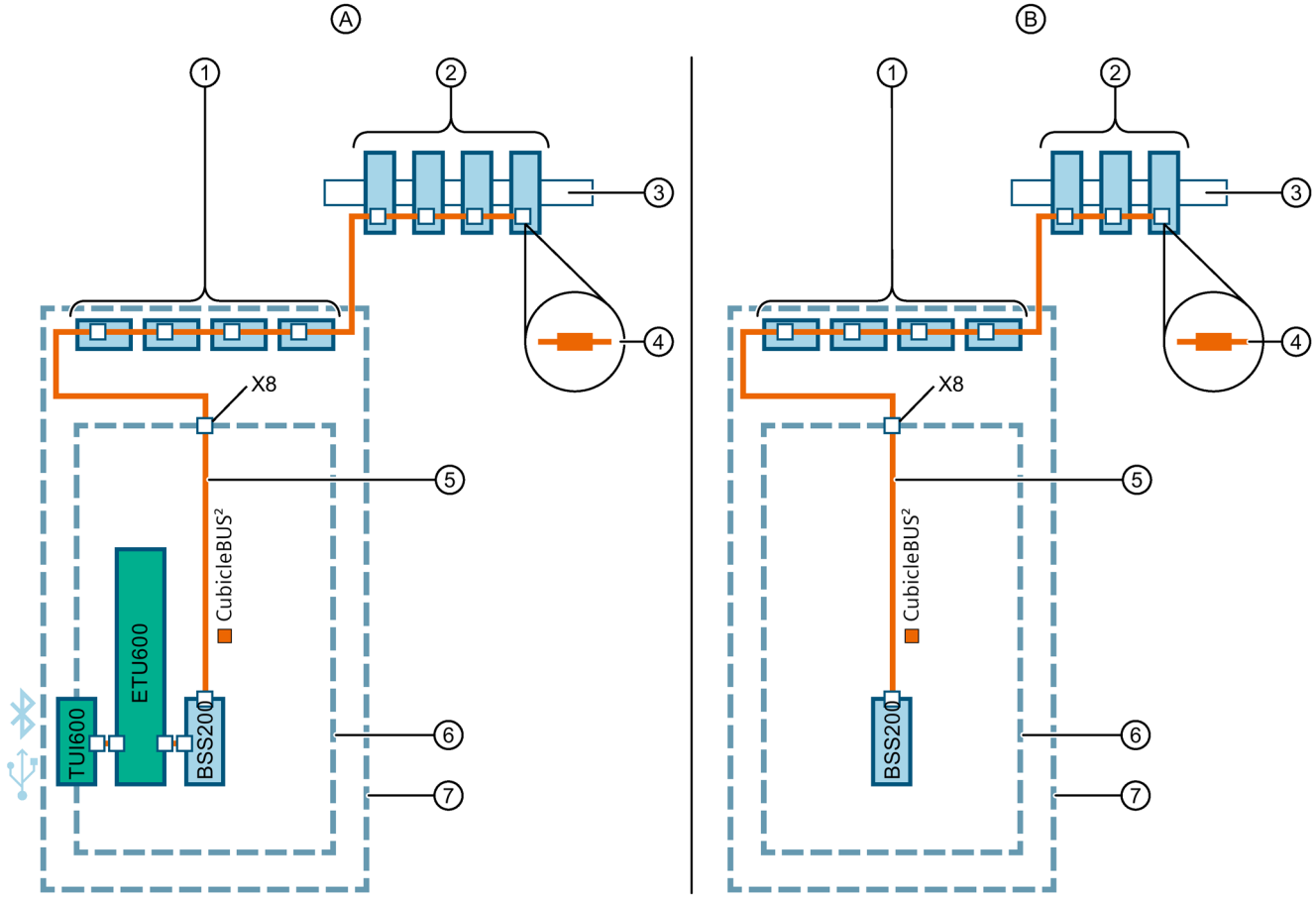
X65

B / +	Positive differential pair wire
A / –	Negative differential pair wire
C	Common / Ground

2.5 Non-automatic circuit breaker

The 3WA non-automatic circuit breaker has no ETU600 electronic trip unit, i.e. it is a circuit breaker without a protective function.

Due to the omission of the ETU600 electronic trip unit and of the Bluetooth and USB-C interface TUI600 which forms part of the ETU600, the non-automatic circuit breaker generates far less data than a circuit breaker with a protective function. The data scope of a non-automatic circuit breaker can be determined by hiding ETU600 and TUI600 in the Modbus map.



(A) 3WA circuit breaker
(B) 3WA non-automatic circuit breaker
(1) CubicleBUS² modules on the circuit breaker/non-automatic circuit breaker (optional)
(2) External CubicleBUS² modules (optional)
(3) DIN rail
(4) 120 Ω terminating resistor of the CubicleBUS²
(5) CubicleBUS²
(6) 3WA air circuit breaker / 3WA non-automatic circuit breaker
(7) Guide frame (optional)

Properties of disconnector mode (NAB mode)

In addition to the data, a number of system functions of the ETU600 electronic trip unit are also omitted. The communication module with role A performs these system functions and makes NAB mode available to specific functions. The system time is generated by the communication module in NAB mode, for example.

Another system function performed by the communication module is the firmware update. When a communication module is in NAB mode, a firmware update can be performed via the Ethernet interface of the communication module both for the module itself and for all the connected CubicleBUS^2 nodes. In the case of a circuit breaker, on the other hand, the firmware update can only take place via the USB interface.
The SENTRON powerconfig configuration software is required for the firmware update. You can find this on the internet (https://sie.ag/2SUlAc2).

Note

If a communication module from a circuit breaker is installed in a non-automatic circuit breaker, the communication module must be reset to the factory settings. For more information, refer to the "3WA Air Circuit Breakers" Equipment Manual, see Chapter Reference documents (Page 10). Restoring the factory settings automatically returns the communication module to NAB mode.

The communication module indicates whether it is in NAB mode by means of a status bit:

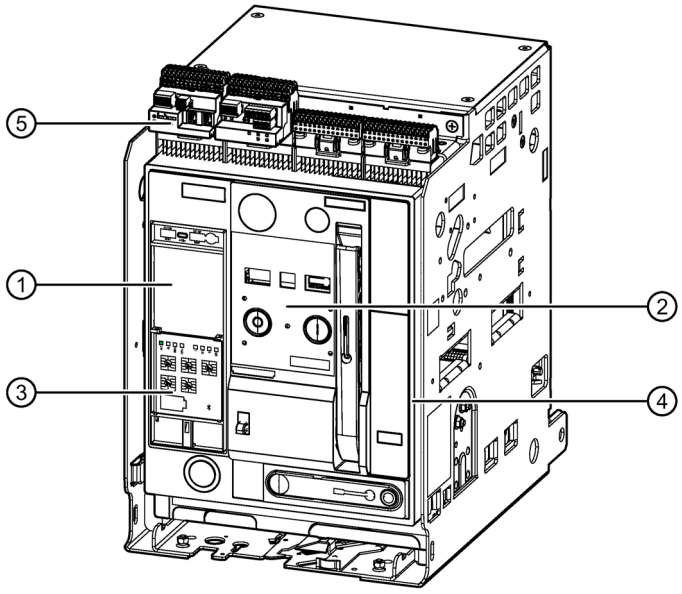
- COM A: Register 0x9C5B, bit 30
- COM B: Register 0xA043, bit 30

Status of the circuit breaker

3

3.1 Introduction

The 3WA air circuit breaker provides a wide range of information about the current status of the circuit breaker and its internal accessories. Both the most important status data and the evaluation options in various applications are described below.



(1) Display of the ETU600 electronic trip unit
(2) Operator panel
(3) Rotary switches of the ETU600 electronic trip unit
(4) Withdrawable circuit breaker with guide frame
(5) COM 190 / COM150 communication module

The most important statuses and information

- Information on the ETU600 electronic trip unit about tripping operations, warnings, alarms, faults and maintenance information, can be called up on the ETU600 display (1)
- Status of the circuit breaker, e.g. ON, OFF and tripped, can be seen from the indicators and buttons of the operator panel (2)
- Important metering values and limiting values, can be called up and set on the display or the rotary switches of the ETU600 electronic trip unit (3)
- Position of withdrawable circuit breaker in the guide frame, see Item (4) above
- Status of the CubicleBUS^2 modules, can be retrieved via the COM190 / COM150 communication module (5)

3.2 The ETU600 electronic trip unit as an information center

The ETU600 electronic trip unit of the 3WA air circuit breaker provides a wide range of information:

- Tripping cause
- Status of the ETU
- Status of the mechanical system
- Status of position of withdrawable circuit breaker in the guide frame
- Information about the DAS+ maintenance mode, see Chapter DAS+ status (Page 33)
- Active warnings
- Active alarms
- ETU error messages (self-monitoring and diagnostics function of ETU600)
- Status of the main contacts of the circuit breaker

The information can be called up via registry entries.

3.3 Indication of tripping cause

The cause of the last tripping operation of the circuit breaker is indicated in the register "Last tripping cause".

Name	Register (0x0000 HEX)
Last tripping cause	0x4EBB

Description	Value	Comment
No tripping	0	Cyclic monitoring of this bit provides information about circuit breaker tripping. This bit is set until the current tripping operation has been reset. If a tripping operation has occurred, the other bits indicate the current tripping cause.
Test function	1	
INST	2	
ST	3	
dST	4	
LT	5	
GF	6	
RC	7	
RP	8	
Overvoltage	9	
Undervoltage	10	
Overfrequency	11	
Underfrequency	12	
Voltage unbalance	13	
Current unbalance	14	
Phase rotation	15	
THD current	16	
THD voltage	17	
Power forward	18	
Power reverse	19	
ETU error	20	

Information about the last tripping operation, e.g. tripping cause, tripping current, phase, etc., can be read out of the trip log.

Note

The last tripping operation can be reset using the command "Reset last trip alarm", register 0x639C.

Number of tripping operations

A set of registers exists which indicates the number of individual tripping types.

Number of all tripping operations	0x0093
Number of GF tripping operations	0x0095
Number of INST tripping operations	0x0097
Number of LT tripping operations	0x0099
Number of residual current tripping operations	0x009B
Number of reverse power protection tripping operations	0x009D
Number of S / dST tripping operations	0x009F

3.4 Status of the ETU

The status of the ETU600 electronic trip unit can be indicated and evaluated in the "ETU status" register.

Name	Register (0x0000 HEX)
ETU status	0x61DA

Description	Bit number	Comment
ETU defective	0	Determine the cause of the error using register 0x61DE "ETU error messages".
Overload alarm 1	1	Indicated by orange "AL" LED on ETU600. Overload alarm AL1 can be set between 40 and 100% I_r in register 0x61EB "Alarm threshold AL1".
Overload alarm 2	2	Indicated by red "AL" LED on ETU600. Momentary current ≧ 100% I_r. Can result in LT overload tripping.
GF alarm	3	GF current can be read out in the associated I_{GF} current.
Pre-alarm	5	Generates an alarm before a protection tripping operation occurs. A pre-alarm is available for the LT and N characteristic curves.
Check ETU settings	6	ETU error detected, please contact Service.
ETU in error-free operating mode	8	Equivalent of ETU sign-of-life contact.
Test mode	9	Not currently used.
DAS+ active	11	For more information, see section DAS+ status (Page 33). Parameter set B functions according to the same principle as DAS+.
Parameter set B active	13	
ETU not calibrated	15	ETU error detected, please contact Service.
Remote switching protection active	18	Remote switching protection (RSP) activated on communication module with role A. Remote switching protection (RSP) is a terminal (X62) that must be bridged in order to deactivate remote switching protection (RSP).
CubicleBus² active	19	If CubicleBUS² is not active, this indicates that an internal communication error has taken place. One reason for this may be that internal data are not available.
ETU can be fully parametrized remotely	20	All rotary switches of the ETU600 are in the e.SET position, all parameters can be set via the communication connection.
VTM connected	21	When the VTM module is active, voltage and energy metering values are available. Depending on the functions of the ETU600, other metering values or extended protective functions are also available.

Description	Bit number	Comment
ETU warnings	22	Warning is present. Active warning can be determined in register 0x61DC "ETU warnings". For more information, see section Status of warnings (Page 35).
Bluetooth active	23	The Bluetooth interface deactivates itself automatically after a set time if it is not used.
Maintenance required	26	Maintenance is required when components of the circuit breaker have reached the end of their service life and need to be replaced.
Inspection required	27	Perform an inspection as described in Chapter 5 "Inspection and maintenance" of the 3WA Equipment Manual (Page 10).

3.5 Status of the mechanical system

The register "Status of the circuit breaker mechanical system" is used for monitoring the mechanical system of the circuit breaker.

Name	Register (0x0000 HEX)
Status of mechanical system of circuit breaker	0xCB3B

Description	Bit number	Comment
Ready to close	0	0 = All ready-to-close conditions fulfilled. 1 = Not ready to close.
Stored energy mechanism charged	1	
Main contacts closed	2	The main contacts of the circuit breaker are closed/open.
Connected position	3	Withdrawable circuit breaker in the guide frame in the connected position.
Test position	4	Withdrawable circuit breaker in the guide frame in the test position.
Second auxiliary release active	5	The second auxiliary release has been activated, the main contacts of the circuit breaker are open.
ETU tripping	6	0 = Protection tripping has occurred in the circuit breaker. 1 = No tripping.
Stored energy mechanism defective	7	
S40 signaling switch defective	8	Signaling switch on BSS200 (breaker status sensor) module defective.
S41 signaling switch defective	9	
S44 signaling switch defective	10	
S46 signaling switch defective	11	
S47 signaling switch defective	12	
BSS200 error	13	BSS200 module probably needs to be replaced, please contact Service.
Circuit breaker overtemperature	14	Temperature on BSS200 module too high, function and service life of the module can be affected.
BSS200 error	15	BSS200 module probably needs to be replaced; contact Service.
Fault in closing coil (CC)	16	It is probably no longer possible to close the circuit breaker by means of a communication command; contact Service.
Fault in opening coil (ST)	17	It is probably no longer possible to open the circuit breaker by means of a communication command; contact Service.
BSS200 error	18	BSS200 module probably needs to be replaced; contact Service.

3.6 Status of position of withdrawable circuit breaker in the guide frame

The register "Circuit breaker position in the guide frame" provides a compact overview of the positions in the guide frame, e.g. whether a fixed-mounted circuit breaker is present.

Name	Register (0x0000 HEX)
Circuit breaker position in the guide frame	0x4EC0

Description	Value	Comment
Connected position	0	Indicates position in the guide frame.
Test position	1	
Disconnected position	2	
Maintenance position	3	
Intermediate position	4	Circuit breaker in an intermediate position, exact position cannot be determined.
Fixed-mounted circuit breaker	5	Fixed-mounted circuit breaker, all other position signals are therefore invalid.

3.7 DAS+ status

The DAS+ maintenance mode basically comprises five registers:

- DAS+ activation source (0x0FD2)
  Indicates the source that was used to activate the DAS+ maintenance mode. It is important to know the source, as the DAS+ maintenance mode can only be deactivated again using the source that was used to activate it. For more information, see the section "Activation source" below.
- DAS+ status (0x0FD4)
  Indicates whether maintenance mode is currently activated or deactivated.
- Setting for current setting $I_{i\ DAS+}$ (0x1B5D)
  The instantaneous short-circuit release is the most important protection parameter. For more information, refer to Chapter "DAS+ maintenance mode" in the 3WA Equipment Manual (Page 10).
- Activation/deactivation of the DAS+ function (0xF619)
  This command can be used to activate the DAS+ maintenance mode. If the DAS+ maintenance mode has been activated using this command, it must also be deactivated using the same command.
- Settings for ground-fault protection (0x2AFC to 0x2F26).
  Depending on the implemented ground-fault protection, two protection parameters are active: Current setting $I_{g\ DAS+}$ and tripping time $t_{g\ DAS+}$.

DAS+ activation source		0x0FD2
DAS+ status		0x0FD4
INST DAS+ current setting $I_{i\ DAS+}$		0x1B5D
Activation/deactivation of the DAS+ function		0xF619
Settings for ground-fault protection		
GFs HIZ UREF	Current setting $I_{g\ DAS+}$	0x2AFC
	Tripping time $t_{g\ DAS+}$	0x2AFE
GFs DUAL UREF	Current setting $I_{g\ DAS+}$	0x2B10
	Tripping time $t_{g\ DAS+}$	0x2B12
GFs DIRECT	Current setting $I_{g\ DAS+}$	0x2B24
	Tripping time $t_{g\ DAS+}$	0x2B26
GFs RESIDUAL	Current setting $I_{g\ DAS+}$	0x2B30
	Tripping time $t_{g\ DAS+}$	0x2B32
GFx HIZ UREF	Current setting $I_{g\ DAS+}$	0x2EE4
	Tripping time $t_{g\ DAS+}$	0x2EE6
GFx DUAL UREF	Current setting $I_{g\ DAS+}$	0x2EFC
	Tripping time $t_{g\ DAS+}$	0x2EFE
GFx DIRECT	Current setting $I_{g\ DAS+}$	0x2F14
	Tripping time $t_{g\ DAS+}$	0x2F16
GFx RESIDUAL	Current setting $I_{g\ DAS+}$	0x2F24
	Tripping time $t_{g\ DAS+}$	0x2F26

Activation source

The "DAS+ activation source" register (0x0FD4) shows several activation sources.

- The communication modules with the roles COM A and COM B are subdivided internally depending on their protocol. Each protocol is a separate activation source.
- In the case of the COM 190 communication module, PROFINET IO and Modbus TCP are separate activation sources. The concrete activation source of the COM190 communication module can be determined from the COM_PROFINET_STATE register of the relevant COM190 (COM A / COM B).
  The COM190 has two status bits which indicate the interface which was used to activate the DAS+:
  - COM A: Register 0xA41F, bit 9 (DAS+ active via Modbus TCP), bit 10 (DAS+ active via PROFINET IO)
  - COM B: Register 0xA807, bit 9 (DAS+ active via Modbus TCP), bit 10 (DAS+ active via PROFINET IO)
- The Bluetooth and USB-C interface TUI600 also has two activation sources. USB-C and Bluetooth are treated as separate activation sources internally. If the DAS+ maintenance mode is activated via Bluetooth, for example, it must also later be deactivated via Bluetooth.

Name	Register (0x0000 HEX)
DAS+ activation source	0x0FD2

Description	Bit number
ETU600 display	0
ETU600 input	1
COM A	4
COM B	5
TUI600	9
IOM 230 #1	12
IOM 230 #2	13
IOM 230 #3	14
IOM 230 #4	15
IOM 230 #5	16
Test	31

3.8 Status of warnings

Active warnings can be indicated and evaluated in the "ETU warnings" register.

Name	Register (0x0000 HEX)
ETU warnings	0x61DC

Description	Bit number	Comment
Battery of the ETU600 is dead	1	Refers to the system time. Replace the battery, see Chapter "4.11.4 Replacement battery for the ETU600 electronic trip unit" in the 3WA Equipment Manual (Page 10).
The system time was not set	2	Active if the system time has never been set. In this case, it must be assumed that the system time is incorrect. Deactivated if system time has previously been set (value 0). This bit does not indicate whether the system time is valid (= local time).
Limit temperature exceeded in ETU600	3	Fault-free operating state is no longer guaranteed. Reduce the ambient temperature to prevent the device from failing.
Limit temperature in COM module exceeded	4	
Line frequency not set correctly	5	Active if a voltage tap is present and the measurement function detects that the set line frequency does not match the measured line frequency.
Clock in ETU600 defective	6	System time invalid.
IOM230 not found	9	Internal CubicleBUS^2 modules could not be found or are defective. If the modules are not found, this may indicate a fault in the CubicleBUS^2, e.g. due to loose connectors, a missing CubicleBUS^2 terminating resistor or EMC influences. For more information, see Chapter "Troubleshooting" in the 3WA Equipment Manual (Page 10).
IOM230 defective	10	
Reserved	11	
Reserved	12	
COM module not found	13	
COM module defective	14	
BSS200 not found	15	
BSS200 defective	16	
Inspection required	21	Set time interval for the next inspection has elapsed.
Circuit breaker inspection required	22	The main contacts have reached the "Inspection" status and must be checked during the next inspection.
Maintenance of the main contacts required	28	The main contacts have reached the "Maintenance" status and must be replaced during the next maintenance.
TUI600 not found	30	Inspection and possibly replacement of the TUI600 module is required.
TUI600 defective	31	

3.9 Status of alarms

Alarms inform the user that LT or GF protection tripping may occur in the circuit breaker. In these fault current ranges, promptly reducing the fault currents can prevent a protection tripping operation.

Active alarms can be indicated and evaluated in the "Circuit breaker alarm status" register.

Name	Register (0x0000 HEX)
Circuit breaker alarm status	0x4EC1

Description	Bit number	
Overload alarm 1 in L1	0	Overload alarm 1 (AL1) active. Overload alarm 1 (0x61EB) can be set in the range 40 ... 100% I_r
Overload alarm 1 in L2	1	
Overload alarm 1 in L3	2	
Overload alarm 1 in N	3	
Overload alarm 2 in L1	4	Overload alarm 2 (AL2) active. Current in a phase or neutral conductor ≥ 100% I_r of the overload protection.
Overload alarm 2 in L2	5	
Overload alarm 2 in L3	6	
Overload alarm 2 in N	7	
Ground fault GF alarm REF	8	Ground-fault current greater than the threshold set for the respective ground-fault current.
Ground fault GF alarm UREF	9	
Ground fault GF alarm UREF	10	
Ground fault GF alarm UREF	11	
Ground fault GF alarm REF	12	
Ground fault GF alarm REF	13	
Pre-alarm PAL in L1	19	Pre-alarm (PAL) active
Pre-alarm PAL in L2	20	
Pre-alarm PAL in L3	21	
Pre-alarm PAL in N	22	

The following parameters are available for the pre-alarm, separately for parameter sets A and B:

LT pre-alarm current setting I_r PAL PS-A	0x177D
LT pre-alarm delay time t_r PAL PS-A	0x177F
LT N pre-alarm current setting I_N PAL PS-A	0x1781
LT overload pre-alarm PAL ON/OFF PS-A	0x1783
LT pre-alarm current setting I_r PAL PS-B	0x1798
LT pre-alarm delay time t_r PAL PS-B	0x179A
LT N pre-alarm current setting I_N PAL PS-B	0x179C
LT overload pre-alarm PAL ON/OFF PS-B	0x179E

3.10 Activation status of protective functions

Which protective functions are activated in the circuit breaker can be indicated and evaluated in the register "Activation status of protective functions".

Protective functions that require a voltage tap have a second data point. This indicates whether the necessary voltage tap is present.
Example: Protective function "Undervoltage protective function ON" with second data point "Overvoltage protective function active".

Name	Register (0x0000 HEX)
Activation status of protective functions	0x61E5

Description	Bit number
LT protective function ON	0
ST protective function ON	1
MCR protective function ON	2
MCR protective function active	3
INST protective function ON	4
N protective function ON	5
GF REF protective function ON	6
GF UREF protective function ON	7
RC protective function ON	8
Reverse power protective function ON	9
Reverse power protective function active	10
dST protective function ON	11
dST protective function active	12
Undervoltage protective function ON	13
Overvoltage protective function active	14
Underfrequency protective function ON	15
Underfrequency protective function active	16
Overfrequency protective function ON	17
Overfrequency protective function active	18
Current unbalance protective function ON	19
Current unbalance protective function active	20
Voltage unbalance protective function ON	21
Voltage unbalance protective function active	22
Forward power protective function ON	23
Reverse power protective function ON	24
THD voltage protective function ON	25
THD voltage protective function active	26
THD current protective function ON	27
THD current protective function active	28
Phase rotation protective function ON	29
Phase rotation protective function active	30
RC protective function active	31

3.11 Status of the ETU error messages (self-monitoring function)

The ETU600 electronic trip unit has a self-monitoring and diagnostics function.

The messages of the watchdogs and diagnostics functions can be indicated and evaluated in the "ETU error messages" register.

Note

Depending on the severity of the error, the circuit breaker may trip. An ETU600 error should always be checked by your Service personnel.

Bit 1 of register 0x61DA (ETU status) is a type of group signal for register 0x61DE. If an error message is active, bit 1 of register 0x61DA (ETU status) is also active.

Name	Register (0x0000 HEX)
ETU error messages	0x61DE

Description	Bit number
ETU defective (ERROR code 0x00000001)	0
ETU defective (ERROR code 0x00000002)	1
ETU defective (ERROR code 0x00000004)	2
ETU defective (ERROR code 0x00000008)	3
Option plug defective	4
ETU defective (ERROR code 0x00000020)	5
ETU defective (ERROR code 0x00000040)	6
ETU defective (ERROR code 0x00000080)	7
ETU defective, rotary switch I_r	8
ETU defective, rotary switch t_r	9
ETU defective, rotary switch I_{sd}	10
ETU defective, rotary switch t_{sd}	11
ETU defective, rotary switch I_I	12
ETU defective (ERROR code 0x00002000)	13
ETU defective (ERROR code 0x00004000)	14
ETU defective (ERROR code 0x00008000)	15
ETU defective (ERROR code 0x00010000)	16
ETU defective (ERROR code 0x00020000)	17
Error during ETU firmware update	18
ETU defective (ERROR code 0x00080000)	19
ETU defective (ERROR code 0x00100000)	20
VTM defective	21
ETU defective (ERROR code 0x00400000)	22
ETU defective (ERROR code 0x00800000)	23
Current sensor L1 defective	28
Current sensor L2 defective	29
Current sensor L3 defective	30
Current sensor N defective	31

3.12 Status of the main contacts of the circuit breaker

The status of the main contacts indicates whether checking or replacement of the main contacts is required due to severe contact erosion.

The status can be indicated and evaluated in the "Status of the main contacts" register.

Name	Register (0x0000 HEX)
Status of the main contacts	0x00A1

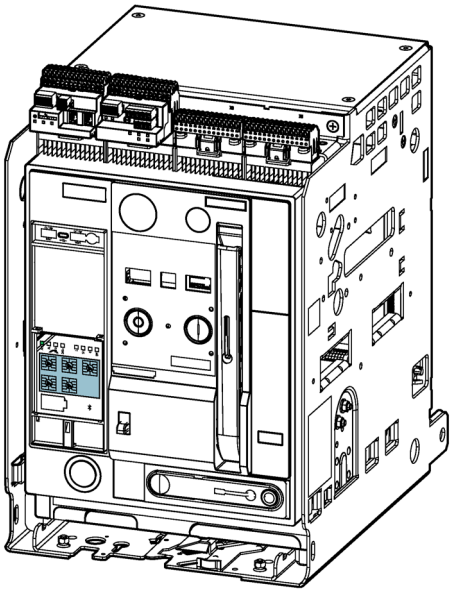
Description	Value
Cannot be determined	0
Main contacts OK	1
Check main contacts	2
Replacement of main contacts required	3

Parameterization and remote control

4

4.1 Parameterization of the protection parameters

The main protection parameters can be set on the ETU600 electronic trip unit using rotary switches. Remote parameterization is also possible depending on the position of the rotary switches.



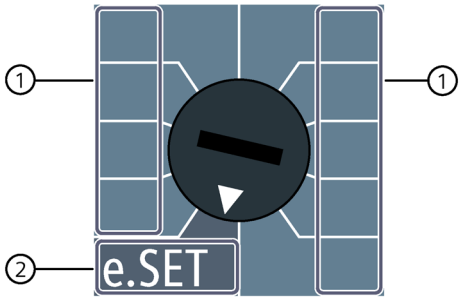
The special characteristics and additional register addresses associated with this are described below.

Setting options for protection parameters of parameter sets A and B

Parameter set A (standard)

The protection parameters of parameter set A can be set in different ways using the rotary switches:

- Manually on the rotary switch
- On the display of the ETU600 electronic trip unit; the rotary switch must be set to the "e.SET" position.
- Via a communication connection; the rotary switch must be set to the "e.SET" position.



(1) Positions of manually settable protection parameters
(2) "e.SET" position

Parameter set B

A second parameter set is available as an option. The protection parameters for this parameter set B can only be set on the display of the ETU600 electronic trip unit or via a communication connection.

Protection parameter values in registers

The currently active protection parameter values for parameter set A can be read out of a register. The protection parameter value corresponds to the set rotary switch position (1) or the setting for the "e.SET" position (2).

The protection parameter values for the manual settings on the rotary switch can only be read. The setting for the "e.SET" position (2) is located in an additional register and can be both read and written.

The setting for parameter set B is located in an additional register and can be both read and written. This register is only available if the second parameter set option has been ordered. For more information on ordering function extensions, refer to Chapter "2.5 Function packages" in the 3WA Equipment Manual (Page 10).

Depending on the protection parameter, additional parameters exist which can also occur twice if the second parameter set is enabled.

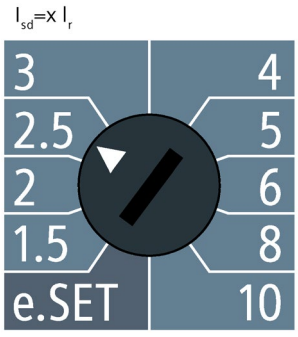
Example: Protection parameter ST, setting I_{sd}

Parameter for I_{sd}	Settable via	Parameter set	Register	Read / write
Setting I_{sd} Source: Rotary switch position or e.SET	Rotary switches	A	0x1F46	Read-only
Setting I_{sd} for e.SET	ETU600 display / communication	A	0x1F4E	Read / write
Setting I_{sd}	ETU600 display / communication	B	0x1F55	Read / write
ST reference point I_{ST}	ETU600 display / communication	A	0x1F49	Read / write
ST reference point I_{ST}	ETU600 display / communication	B	0x1F57	Read / write

Example of setting:

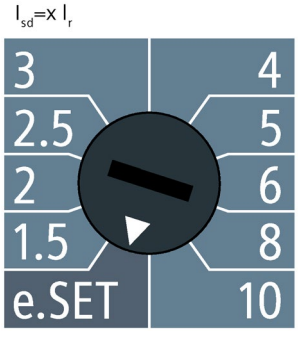
- I_r = 1000 A
- I_r e.SET = 8888 A (register 0x1F4E)

1. The rotary switch is at the position "2.5"



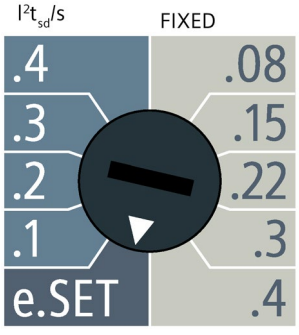
Setting for I_{sd} (register 0x1F46) is 2.5 x I_r 1000 A = 2500 A.

2. The rotary switch is at the position "e.SET"



Setting for I_{sd} (register 0x1F46) is 8888 A.

Protection parameter ST setting t_{sd}



Parameters for ST	Settable via	Parameter set	Register	Read / write
ST tripping time t_{sd} PS-A Source: Rotary switch position or e.SET	Rotary switches	A	0x1F42	Read-only
ST i^2t ST characteristic curve ON/OFF PS-A Source: Rotary switch position or e.SET	Rotary switches	A	0x1F44	Read-only
ST tripping ON/OFF Source: e.SET value	ETU600 display / communication	A	0x1F45	Read-only
ST intermittent detection ON/OFF PS-A With detection of transient pre-loads	ETU600 display / communication	A	0x1F48	Read / write
ST tripping time t_{sd} PS-A e.SET	ETU600 display / communication	A	0x1F4A	Read / write
ST i^2t ST characteristic curve ON/OFF PS-A e.SET	ETU600 display / communication	A	0x1F4C	Read / write
ST tripping ON/OFF PS-A e.SET	ETU600 display / communication	A	0x1F4D	Read / write
ST tripping time t_{sd} PS-B	ETU600 display / communication	B	0x1F50	Read / write
ST i^2t ST characteristic curve ON/OFF PS-B	ETU600 display / communication	B	0x1F52	Read / write
ST tripping ON/OFF PS-B	ETU600 display / communication	B	0x1F53	Read / write
ST intermittent detection ON/OFF PS-B With detection of transient pre-loads	ETU600 display / communication	B	0x1F54	Read / write

4.2 Closing/opening the circuit breaker via Modbus TCP/RTU

Closing or opening of the circuit breaker via the communication connection takes place by means of commands. For information about the commands, see Chapter Writing commands (Page 54).

Note

Closing or opening of the circuit breaker via the communication connection requires communication-capable closing and opening coils (shunt trips). The closing coil (CC-COM) and the shunt trip (ST-COM) can be ordered immediately with the ready4COM circuit breaker or can be retrofit later.

Remote switching protection (RSP) must be deactivated on the COM190 communication module in order to permit switching via the communication connection. For more information, refer to the 3WA Equipment Manual.

The value 0x815 is transferred in order to write the Close/Open command.

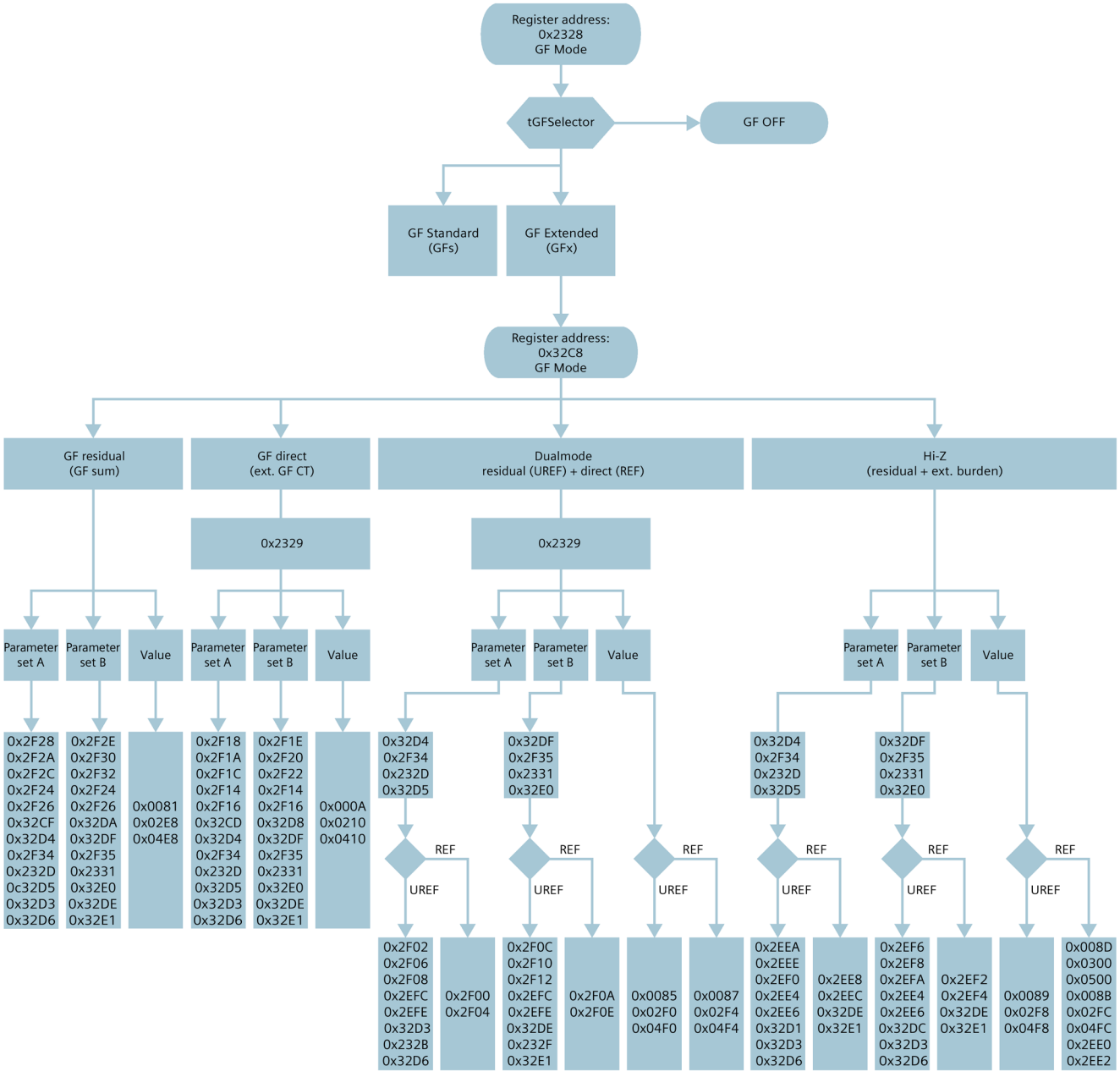
Name	Register (0x0000 HEX)
Close circuit breaker	0xCD15
Open circuit breaker	0xCD16

Whether or not the switching operation was successful can be queried in register 0xCB3B, see also section Status of the mechanical system (Page 31).

Name	Register (0x0000 HEX)
Status of mechanical system of circuit breaker	0xCB3B

4.3 Parameterization of ground-fault protection (GF)

The register addresses for parameterizing the different types of ground-fault protection (GF) are shown below.

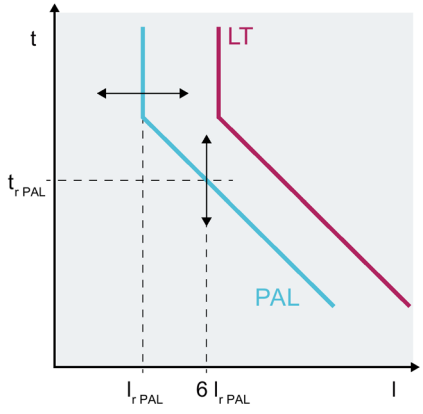


4.4 Overload pre-alarm PAL

The overload pre-alarm (PAL) has its own current and time settings but the same characteristic curve as the overload protection LT, which is shifted parallel to the overload protection LT. Thus, the overload pre-alarm PAL can generate an alarm (warning) before the overload protection LT is activated and an overload trip is imminent.

Instead of triggering a tripping operation, the overload pre-alarm PAL outputs an alarm on the CubicleBUS$_2$ to allow sufficient time for intervention to prevent tripping. This can control an output of a digital input/output module or be transmitted via the communication interface (Modbus RTU, Modbus TCP or PROFINET).

The overload pre-alarm PAL can be used even when overload protection LT is switched off.



System behavior

Because the overload pre-alarm PAL is parallel to the overload protection LT, the PAL parameters are dependent on the overload protection LT. If the overload pre-alarm PAL parameters are transferred to the circuit breaker first, the parameters in the ETU are automatically adapted to the current settings of the protection parameters LT and are thus changed unintentionally. To prevent this, the parameters of the overload protection LT must always be transferred first, followed by the parameters of the overload pre-alarm PAL that are appropriate for the new LT.

The transfer takes place in the following order:

1. Parameters of overload protection LT
2. Parameters of overload pre-alarm PAL

Modbus TCP / Modbus RTU

5

5.1 General

The COM190 communication module supports the Modbus TCP protocol of the Modbus Organization, described in the following specifications:

- Modbus Application Protocol V1.1b3
- Modbus Messaging Implementation Guide V1.0b

The COM150 communication module supports the Modbus RTU protocol of the Modbus Organization, described in the following specifications:

- Modbus Application Protocol V1.1b3
- MODBUS over Serial Line - Specification and Implementation Guide V1.02

You can find more information on the Internet (https://www.modbus.org).

5.2 Modbus registers

You can find the table of the Modbus registers of the COM190 / COM150 communication module on the Internet. (https://support.industry.siemens.com/cs/ww/en/view/109794278)

5.3 Addressing Modbus TCP COM190

With Modbus TCP, the COM190 module is addressed via its IP address.

The COM190 has a data point that contains the communication parameters for access via TCP/IP (IPv4 suite).

Read and write access

Read access to the data point takes place as follows:

- For the COM190 with role A, via Modbus register number 42009 (hex: 0xA419)
- For the COM190 with role B, via Modbus register number 43009 (hex: 0xA801)

Write access to the IPv4 suite takes place via a command with Modbus function code 16 (hex: 0x10):

- For the COM190 with role A, via Modbus register number 42900 (hex: 0xA794)
- For the COM190 with role B, via Modbus register number 43900 (hex: 0xAB7C)

Modbus TCP port

The default TCP port for a Modbus TCP server is 502. The COM190 module has a data point "Modbus TCP port" that is configured as 502 in the as-delivered state.

It is possible to change this value. You can find more information in Chapter Configurable Modbus TCP port COM190 (Page 62).

5.4 Function codes, metering values and parameters COM150 / COM190

5.4.1 Function codes

The COM190 / COM150 communication module supports the following Modbus function codes:

- 0x03 – Read metering values and parameters
- 0x04 – Read metering values and parameters using the configurable Modbus map (COM190 only. See Chapter Configurable Modbus map COM190 (Page 66))
- 0x06 – Write single register parameters and commands
- 0x10 – Write parameters and commands
- 0x2B – Device identification

5.4.2 Metering values, parameters and commands

5.4.2.1 Reading metering values and parameters

Modbus function code 03 (hex: 0x03) reads values and parameters out of the 3WA circuit breaker. The following requirements must be met for this purpose:

- The request must refer to the start address of a valid data point.
- The number of registers that are read must correspond as least to the length of the data point to be read.

It is possible to read multiple data points with one frame. Provided the start address of the frame refers to the start of a valid data point, reading is also possible across gaps in the Modbus register map. Data points following the first data point may also be partially read. Gaps or partially read data points are filled with a bit pattern for invalid values in the response frame, see Chapter Invalid values (Page 57).

Note

Parameters are identified as such in the Modbus register map.

5.4.2.2 Writing parameters

Modbus function code 16 (hex: 0x10) writes parameters of the 3WA air circuit breaker. Parameters with a length of one register can also be written using Modbus function code 06 (hex: 0x06).

The following rules must be observed for a valid frame:

- The start address of the frame must refer to the start of a parameter.
- The parameter must be written in full.
- The parameter must exist in the concrete 3WA system.
- When COM190 Modbus TCP whitelist is activated, the Modbus TCP connection must have sufficient access rights to write the parameter. You can find more information on the Modbus TCP whitelist in Chapter Modbus TCP whitelist COM190 (Page 59).
- If the parameter is protected by parameter write protection, parameter write protection must be deactivated. You can find information on parameter write protection in the 3WA Equipment Manual; see Chapter Reference documents (Page 10).

With a Modbus function code 16 (hex 0x10) write frame, multiple parameters can also be written provided the rules specified above are observed analogously. No gaps or unwritten data points may appear between parameters.

Note

Parameters are identified as such in the Modbus register map.

5.4.2.3 Writing commands

Modbus function code 16 (hex: 0x10) writes commands in the 3WA air circuit breakers. Commands with a length of one register can also be written using Modbus function code 6 (hex: 0x06).

The following rules must be observed for a valid command:

- The start address of the frame must refer to the register address at the start of the command.
- The command must be written in full.
- If commands do not contain an argument, 0x0815 must be transferred as a parameter value on Modbus.
- The command must exist in the concrete 3WA system.
- When COM190 Modbus TCP whitelist is activated, the Modbus TCP connection must have sufficient access rights to write the command. You can find more information on the Modbus TCP whitelist in Chapter Modbus TCP whitelist COM190 (Page 59).
- If the command is protected by parameter write protection or remote switching protection, the relevant protection must be deactivated. You can find information on parameter write protection and remote switching protection in the 3WA Equipment Manual; see Chapter Reference documents (Page 10).
- Only one command may be written per frame.

Note

Commands are identified as such in the Modbus register map.

5.5 Transactions

Every Modbus write frame in the 3WA system (Modbus function code 16 or hex 0x10) constitutes a transaction.

A transaction is only executed if all the parameters contained in the frame are accepted by the target components.

Note

Even if one parameter in the frame is rejected by the target component, all the other parameterizations from this frame are undone.

If a positive acknowledgement of the Modbus write frame is received, all the parameters contained in the frame have been accepted by the system. Conversely, an error message for a Modbus write frame indicates that none of the parameters of the system have been changed.

5.6 MODBUS error codes

The COM190 communication module supports the following Modbus error codes:

Error code	Description
1 (hex: 0x01)	Modbus function code is not supported.
2 (hex: 0x02)	• Start address is not located at the start of a data point of the 3WA system. • Start address is not located at the start of an existing data point in the concrete 3WA circuit breaker. • An attempt is being made to read beyond the end of the Modbus register map.
3 (hex: 0x03)	Structure of the frame is incorrect.
4 (hex: 0x04)	• A parameter contains an invalid value. • A command contains invalid arguments. • A parameter or command is write-protected. • A command for switching of the 3WA circuit breaker or digital outputs takes place when remote switching protection is active. • The Modbus TCP whitelist is active and the active MODBUS TCP connection has insufficient rights for writing a parameter or the command. • Writing is taking place across a gap in the Modbus register map. • A data point which does not exist in the concrete 3WA circuit breaker is being written. • A parameter or command is not being written in full. • The first data point is only partially read.
6 (hex: 0x06)	A parameter is currently being changed by another source. The parameterization procedure must be repeated at a later time.

5.7 Invalid values

If data points which basically exist but which are not available temporarily are read using Modbus function code 3 (hex: 0x03), the corresponding registers in the Modbus frame of the COM190 are filled with the bit pattern 0xFF (all bits '1') to tag them as invalid.

The same fill pattern is used if a data point is only partially read or if reading takes place across a gap that exists between two data points in the Modbus register map.

Possible reasons for temporary non-availability include:

- A communication fault is present on the CubicleBus² between the COM190 communication module and other 3WA components.
- The withdrawable circuit breaker is in the disconnected position in the guide frame, i.e. communication via the CubicleBus² between the modules on the DIN rail or auxiliary conductor contact system and the internal modules of the 3WA circuit breaker (ETU600, BSS200, TUI600) has been interrupted.

If the fill pattern (all bits '1') is read for a data point, the content of the data point is invalid.

5.8 Difference between Modbus register number and register address

Based on the Modbus Application Protocol Specification V1.1b3 Section 6.3, the Modbus register number and register address in the 3WA system are different.

In order to obtain the register address, the register number must be reduced by the value 1:
register address = register number – 1

Example:
Modbus register address 0x3300 = register number 0x3301 – 1

5.9 Modbus TCP whitelist COM190

The Modbus TCP whitelist is a security function of the COM190 communication module which can prevent communication via Modbus TCP for addresses which have not been approved. Only IP addresses which have been entered in the Modbus TCP whitelist and have therefore been approved have access to the COM190.

Mode of operation

The Modbus TCP whitelist is a security function of the COM190 communication module which can prevent communication via Modbus TCP for addresses which have not been approved. Only IP addresses which have been entered in the Modbus TCP whitelist and have therefore been approved have access to the COM190.

In this way, the Modbus TCP whitelist prevents not only reading of data and metering values but also changes to parameters.

IP addresses

It is possible to enter up to ten IP addresses or IP address ranges in the COM190. The IP address range is defined by a start IP address and an end IP address. The start IP address and the end IP address and all the IP addresses lying between them are approved.

Note

If only one IP address is to be approved, the start IP address and the end IP address must be identical.

Roles

Two different access rights (roles) can be assigned to the approved IP addresses.

Based on the assigned role, the following access right is defined for the approved IP address or IP address range:

- Read-only
- Read and write (no restrictions)

Scope

NOTICE
Unauthorized access with two COM190 communication modules The Modbus TCP whitelist only affects the Modbus TCP communication of the module on which it has been set up. If you have two communication modules, set up two Modbus TCP whitelists and activate both lists.

Structure of the whitelist

The whitelist contains the following information and entries:

- Status - Active
  Indicates whether or not the whitelist is active.
  The whitelist is active if at least one filter entry is present and active. The whitelist is deactivated if no filter entry is present or active.
- Status – RecoveryError
  Is active if an error has occurred when loading the whitelist or if an incorrect filter entry is present.
- Status – AccessRights
  Indicates the rights status for the current TCP connection.
  It provides information as to whether "read-only" or "read and write" are possible for the current connection.
- Ten filter entries
  - Parameter – Enable
    Defines whether or not the filter entry is active.
  - Parameter – IPLowerBound
    Defines the lowest IP address in the IP range to be approved.
  - Parameter – IPUpperBound
    Defines the highest IP address in the IP range to be approved.
  - Parameter – Role
    Defines the rights of the IP range or the IP address.

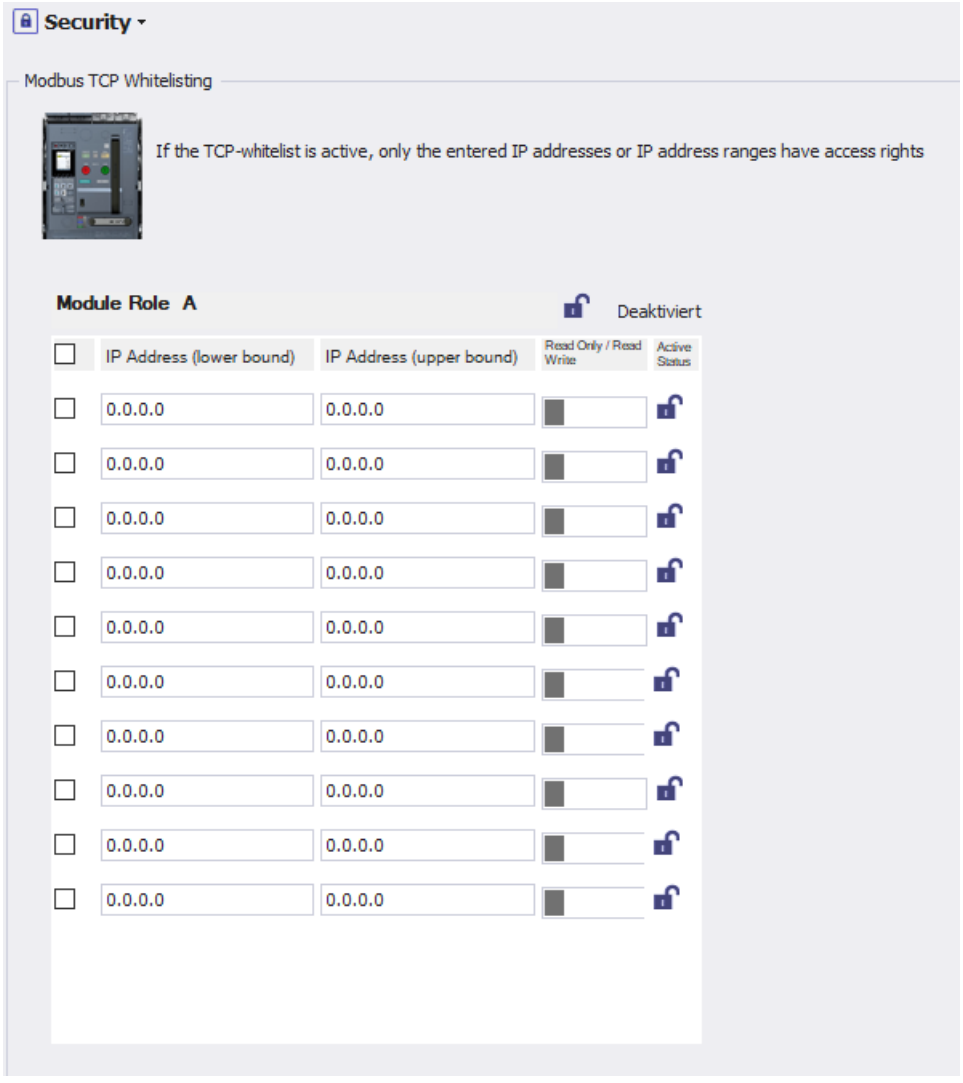
Remote switching protection RSP and parameter write protection

The Modbus TCP whitelist can be combined with remote switching protection RSP and parameter write protection (DIP switches). Remote switching protection RSP and parameter write protection have a higher priority however. The write rights of the Modbus TCP whitelist can therefore be restricted.

You can find information on remote switching protection and parameter write protection in the Equipment Manual, see Chapter Reference documents (Page 10).

Parameterization

The Modbus TCP whitelist is deactivated on delivery and can be activated and parameterized using the SENTRON powerconfig configuration software (from version 3.17 or version 2.5 as an app).



Parameterization can be performed via the USB or Bluetooth interface of the 3WA circuit breaker or via the Modbus TCP interface of the COM190 communication module. During parameterization via the Modbus TCP interface of the COM190, the parameter write protection (DIP switches) of the connected COM190 must be deactivated.

You can find information on parameter write protection in the Equipment Manual; see Chapter Reference documents (Page 10).

5.10 Configurable Modbus TCP port COM190

It may be necessary to change the number of the TCP port due to applications or to ensure cybersecurity. The TCP port number for Modbus TCP connections can be configured with the SENTRON powerconfig configuration software or as a data point. The default value 502 can be changed accordingly. Resetting to the factory settings restores the default value.

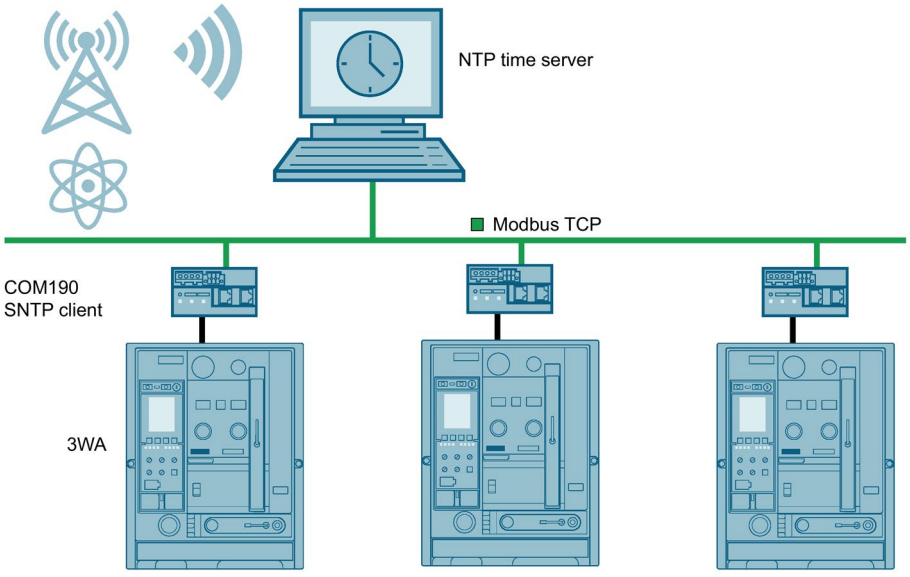
Note

Changing the default port can make it difficult to find a 3WA circuit breaker in the network using the default search algorithm (e.g. in the SENTRON powerconfig configuration software).

5.11 System time with SNTP COM190

5.11.1 Requirement

The Simple Network Time Protocol (SNTP) can be used to set the system time of the 3WA circuit breaker. SNTP is a simplified version of NTP and automatically sets the system time with the help of NTP servers (time servers).



Requirement

- COM190 communication module
- NTP time server
- SENTRON powerconfig configuration software, version 3.17 or higher, for commissioning (optional)

To activate the SNTP function and enable writing of parameters via the Ethernet connection, the parameter write protection (DIP switches) of the COM190 communication module must be deactivated. You can find information on parameter write protection in the Equipment Manual; see Chapter Reference documents (Page 10).

If two COM190 communication modules are operated simultaneously on the 3WA circuit breaker, the system time update via SNTP can take place either via the communication module with role A or the communication module with role B.

Note

According to the Siemens Cyber Security Disclaimer, the COM190 communication module must not be operated in public networks. The SNTP function of the COM190 is therefore designed for a local NTP time server in closed networks.

5.11.2 Settings

The Simple Network Time Protocol (SNTP) function uses the following setting for the 3WA circuit breaker:

- NTP server address: IPv4 address of NTP server

5.11.3 Data points

COM190 data points with role A

Modbus register number[1]			Description	Source	Format	Length (bits)
Dec	Hex	High/Low				
42017	0xA421	–	SNTP server address	COM190	Unsigned long	32
42019	0xA423	–	SNTP client mode	COM190	Unsigned int	16

[1] Modbus address = Modbus register – 1

COM190 data points with role B

Modbus register number[1]			Description	Source	Format	Length (bits)
Dec	Hex	High/Low				
43017	0xA809	–	SNTP server address	COM190	Unsigned long	32
43019	0xA80B	–	SNTP client mode	COM190	Unsigned int	16

[1] Modbus address = Modbus register – 1

5.11.4 Parameters

SNTP mode

- SNTP mode: Off
  - The COM190 system time is not synchronized with an NTP time server.
- SNTP mode: Active
  - The SNTP client sends SNTP requests once an hour to synchronize the COM190 system time.
    If an SNTP query is not answered, the SNTP client queries after 1 minute, after 5 minutes, and then every 15 minutes repeatedly, until the NTP server responds.
  - If the NTP server address is zero, no synchronization requests are output and the COM190 system time is not synchronized.
  - On system start, the SNTP client immediately sends an SNTP query.
  - If the SNTP client configuration is changed to active mode, the client immediately sends an SNTP query.
  - If the IP address of the NTP time server is changed while the SNTP client is in active mode, the client immediately sends an SNTP query.
- SNTP mode: Passive
  - The SNTP client accepts NTP broadcasts from NTP servers and synchronizes the COM190 system time.
  - If the NTP server address is zero, NTP broadcasts from any source are accepted.
  - If the NTP server address is not zero, only NTP broadcasts from the configured address are accepted.

NTP server address

The input format of the NTP server address is hexadecimal.

Example

IP v4 address as hexadecimal address:

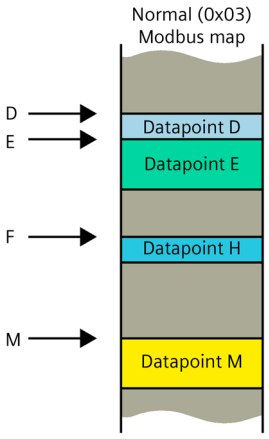
IP v4 address: 192.108.219.111			
192	108	219	111
CO	A8	DB	6F
IP v4 address as hexadecimal address: COA8DB6F			

SNTP port

The SNTP service uses the default SNTP port 123 (UDP) and this cannot be changed.

5.12 Configurable Modbus map COM190

In a normal Modbus map, several read commands (D, E, F and M) must be executed in order to read out different registers.



This requires processor time and the multiple requests generate a load on the communication bus. If certain data are required for a visualization, for example, it would be better if all the data were grouped together and could be read out with a single request. Dynamic adaptation would also be helpful, as other data will be required for the next display window.

The COM190 communication module has a configurable Modbus map for this application.

Configurable Modbus map

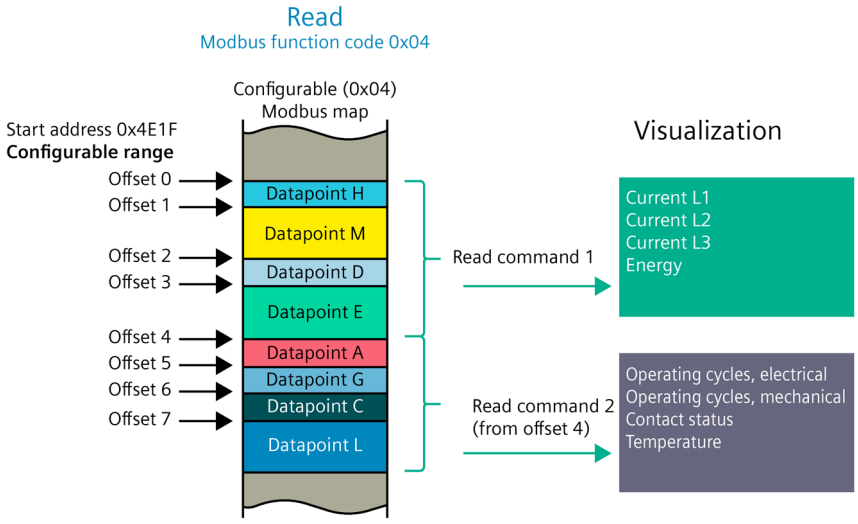
The configurable Modbus map makes it possible to create a sequence with any of the data from the normal Modbus map.

Reading the data

The data arranged in this sequence can be read out using a single read command.
It is also possible to read out only some parts of the data and to read out another part of the configurable Modbus map using a separate read command and an offset. Registers may also be present several times in the configurable Modbus map for this purpose.

The configurable Modbus map is read in the communication module with Modbus function code 0x04.

- Basically, the same rules apply for Modbus function code 0x04 as for Modbus function code 0x03.
- The start register is 0x4E20 (Dec 20000).
- The offset to the next data point is determined by the size of the data point in each case.
- Data points may occur several times.

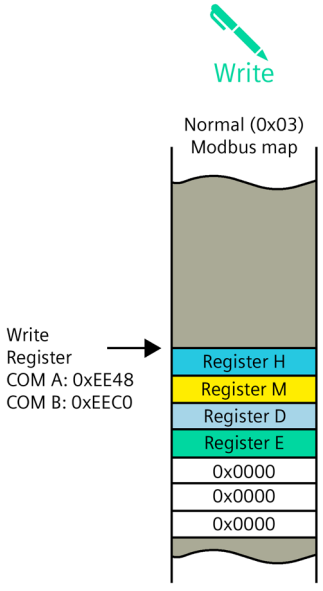


Dynamic adaptation of data

The configurable Modbus map also enables the dynamic adaptation of data however. It is possible to specify which data is to be read before every read command. In the case of a visualization, for example, the data to be read are specified for each display window and their register numbers are written into the configuration register set of the configurable Modbus map in advance.

Specifying the data

The data to be read in the configurable Modbus map must be written into a register set of the normal Modbus map in advance. In this case, the registers of the data to be read must be written into register 0xEE48 for communication module A and into register 0xEEC0 for communication module B.

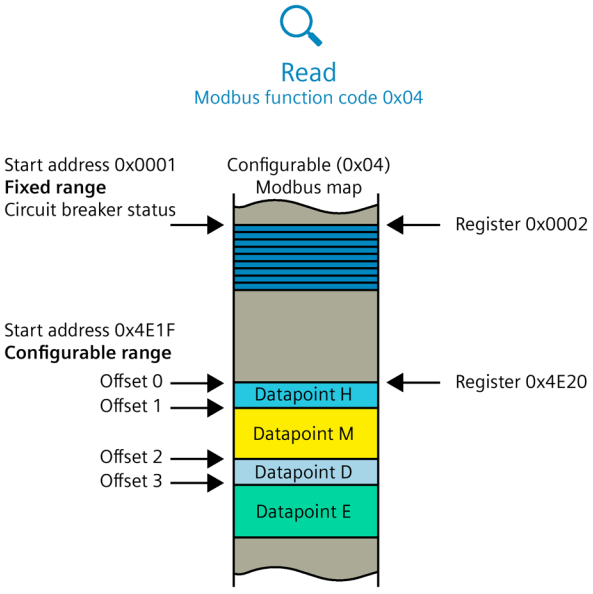


Note

120 registers must always be written. Empty registers must be filled with 0x0000 at the end. Gaps are not permitted.

Fixed area with status data of the circuit breaker

The configurable Modbus map contains a fixed area which is defined by the manufacturer. This configurable Modbus map contains a number of preassigned metering values and status values.



All the data points which indicate the status of the 3WA circuit breaker and its components are grouped in the fixed area. This means that many data items can be read out simultaneously from this area too using a single read command and subsequently evaluated.

The data in this fixed area are described in the 3WA Modbus map.

PROFINET IO COM190

6

6.1 General

With the COM190 communication module, you can access the data of the 3WA circuit breakers via PROFINET IO during operation. PROFINET IO can be operated in parallel with the Modbus TCP protocol (see Chapter Modbus TCP / Modbus RTU (Page 49)).

Overview

The COM190 communication module has the following performance features:

- Direct connection between further Ethernet nodes by two integrated switched Ethernet ports into the IRT domain of PROFINET IO
- Highest conformance class (Conformance Class C) and highest netload class (Netload Class III)
- Support for ring redundancy (MRP) by the integrated switched Ethernet ports
- The SENTRON devices communicate directly with SIMATIC S7 and SIMOTION via PROFINET IO.
- The COM190 communication module as the PROFINET IO device makes metering values and statuses of the 3WA circuit breakers available to the PROFINET IO controller. The module receives information (e.g. commands) from the PROFINET IO controller and forwards this information to the 3WA circuit breaker.
- PROFINET system redundancy S2
- Thanks to the support of PROFINET IRT, the 3WA circuit breakers can be used without restriction directly in production automation networks (e.g. alongside SIMATIC S7, SINUMERIK, SINAMICS and SIMOTION).
- Simple engineering with SIMATIC STEP 7 or other programming systems thanks to the use of the GDSML file
- Optimal use of the process image of a controller thanks to the selection of individual metering values
- Support for the "Low Voltage Switchgear" (LVSG) PROFINET IO profile
- Application-specific Energy Suite profiles (e0 to e3) for energy management in cyclic data
- Reading and querying of metering values of the 3WA circuit breaker via the "Query_Measurement" service of the PROFIenergy standard
- Use of all the functions of the 3WA circuit breaker, use of the SENTRON powermanager power management software and the SENTRON powerconfig configuration software either independently or in parallel with PROFINET IO
- Support of 100 Mbit/s data rates on both RJ45 interfaces
- Time synchronization via SNTP

- IP settings: IP address, subnet, gateway
  - Using the SENTRON powerconfig configuration software via the USB interface of the 3WA circuit breaker
  - Via PROFINET DCP protocol (e.g. in the STEP 7 HW Config)
- Generation of diagnostic, maintenance, and process alarms
- Status indication via LED

6.2 Technical specifications of the communication interfaces

Description		Values
Industrial Ethernet	IRT-capable switch	• Auto crossover • Auto negotiation
Connection		2 shielded 8-pole RJ45 sockets[1)]
PROFINET IO data transfer: Supported baud rate		100 Mbits/s
NameOfStation[2)]		Max. 240 characters
Supported communication protocols		PROFINET IO infrastructure protocols: • DCP • LLDP • SNMP • DFP • MRP, MRPD • SNTP
Metering values to be transferred		Cyclically definable via GSDML file or acyclically via data sets and PROFIenergy profile
Number of connections		• 1 controller/supervisor connection • 2 device access connections

[1)] The connector must meet the requirements of the PROFINET IO guideline of the PNO (PROFINET user organization). More information is available on the internet (www.profibus.com).

[2)] Each device on the bus must have a unique NameOfStation and a corresponding IP configuration.

6.3 Metering values, addressing und data traffic

6.3.1 Metering values

Metering values

The metering values and status information of the 3WA circuit breaker are made available to the higher-level power management system or automation system via PROFINET IO.

PROFINET IO also provides:

- Cyclic RT data traffic
- Acyclic RT alarm messages
- Acyclic data traffic

Information on metering values

The metering values include, for example:

- Metering values
- Maximum/minimum values of the metering values
- Energy values

The status information includes, for example:

- Open/closed status of the circuit breaker
- Stored energy mechanism charged status
- Ready-to-close status
- Status of the IOM inputs/outputs

You can find more information on the metering values under Modbus register for the 3WA air circuit breaker (https://support.industry.siemens.com/cs/ww/en/view/109794278).

Metering values in cyclic and acyclic data traffic

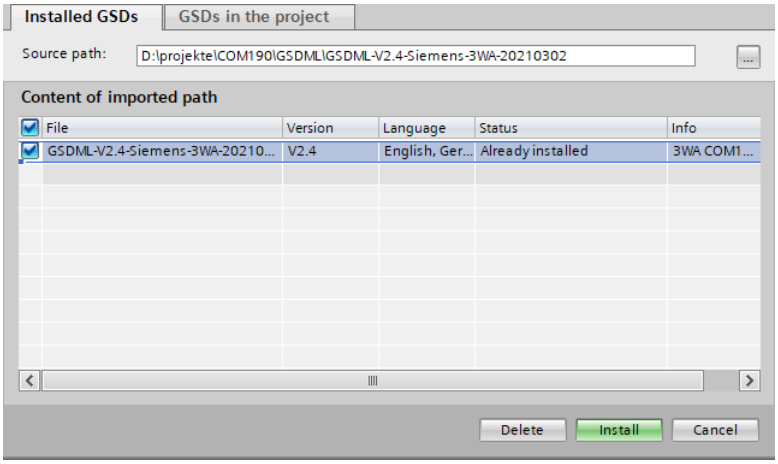
The metering values and status information are made available in both cyclic data traffic and acyclic data traffic.

- The metering values and status information are made available as follows in cyclic data traffic:
  - A predefined structure according to the Low Voltage Switchgear (LVSG) PROFINET IO profile is available as the basic type.
  - A predefined structure for energy management is available as the Energy Suite profile (e0 to e3).
  - As individual metering values
- The metering values and status information are made available as follows in acyclic data traffic:
  - As data sets
  - In addition, the metering values are made available via the PROFIenergy services.

You can find more detailed information on cyclic and acyclic data traffic in Chapters Cyclic data traffic (Page 74) and Acyclic data traffic (Page 85).

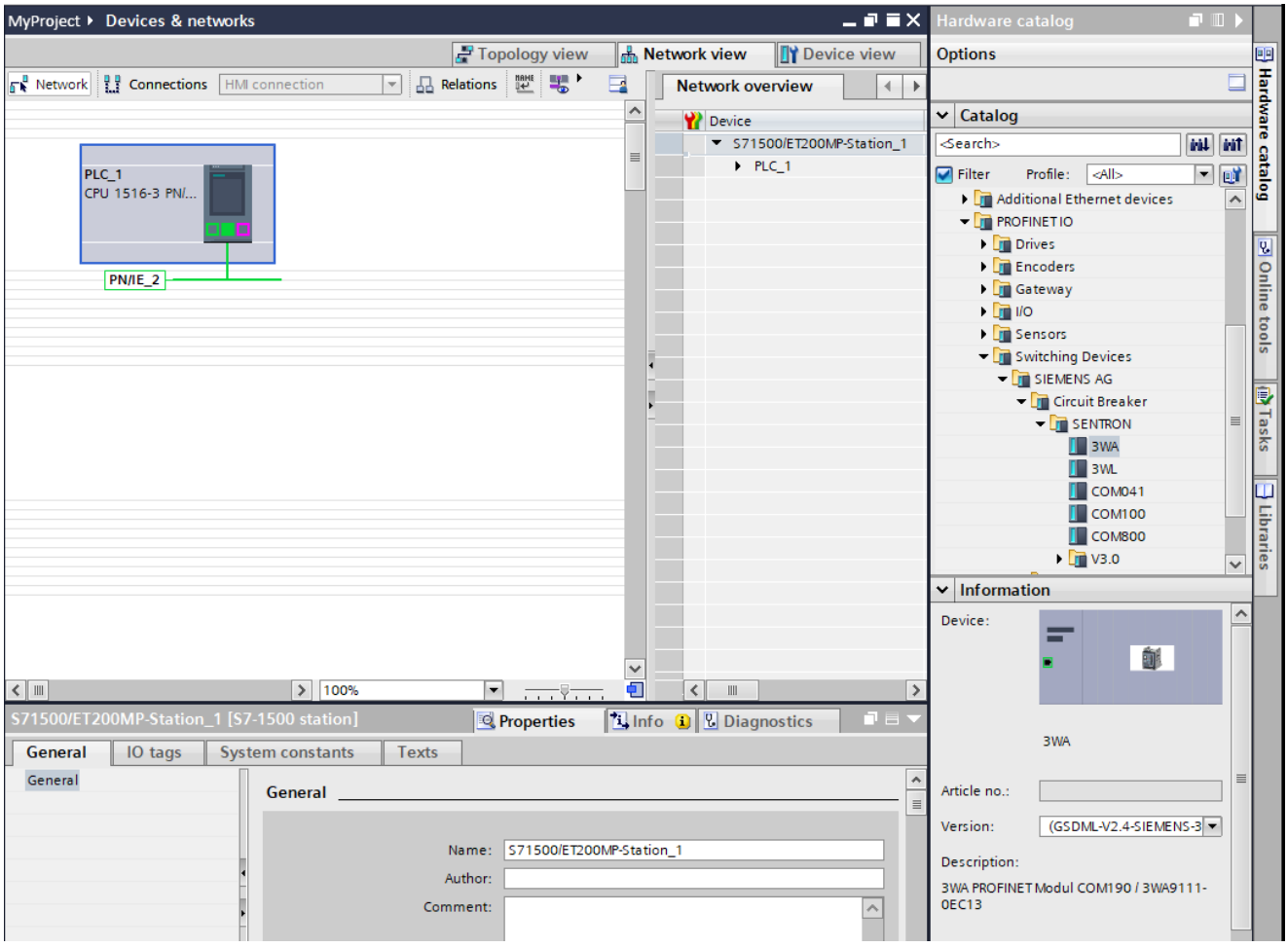
Configuration via GSDML file

All the functionalities of the COM190 communication module that are important both for engineering and for data exchange with the IO device are described in the GSDML file.



After GSDML integration, you can find the 3WA circuit breaker in the hardware catalog of the TIA Portal and STEP 7 V5.5 or higher in the following structure:

Hardware catalog → Catalog → Other Field Devices → PROFINET IO → Switching Devices → Siemens AG → Circuit Breaker → SENTRON



6.3.2 Cyclic data traffic

In cyclic data traffic, the COM190 communication module exchanges the configured user data with the controller in each set cycle.

Cyclic data exchange is especially suitable for transferring information that is required continuously and quickly. The COM190 communication module fits into the PROFINET Real-Time (RT) time control.

- The PROFINET IO controller specifies the parameterizable update time.
- The maximum quantity structure of the cyclic data is 244 bytes of input data and 2 bytes of output data.
- The COM190 communication module supports update times of 1 to 512 ms.

Modules that can be plugged in for the project

The table below contains the list of all modules that can be plugged in for the project:

Module name		Length (bytes)	In/Out
3WA status and control (fixed in slot 1)		2	In, Out
3WA status (replacement for slot 1)		2	In
Basic type	1	8	In
	2	12	In
	3	28	In
	4	16	In
	5	24	In
	6	28	In
	7	28	In
Energy data profile	e0	12	In
	e1	4	In
	e2	12	In
	e3	104	In
Remote switching protection status		1	In
Current	L1	4	In
	L2	4	In
	L3	4	In
	Average value of all phases	4	In
	Neutral current	4	In
	Ground-fault current GF Direct	4	In
	Ground-fault current GF Primary Restricted	4	In
	Ground-fault current GF Secondary Restricted	4	In
	Phase current unbalance	4	In
	Phase with the highest current	1	In
	Current in the highest phase	4	In
	Ground-fault current	4	In
Voltage	L1-N	4	In
	L2-N	4	In
	L3-N	4	In
	L1-L2	4	In
	L2-L3	4	In
	L3-L1	4	In
	Instantaneous average voltage L-N	4	In
	Instantaneous average voltage L-L	4	In
	Phase voltage unbalance	4	In
Phase rotation		1	In
Active power	L1	4	In
	L2	4	In
	L3	4	In
	Total	4	In

Module name		**Length (bytes)**	**In/Out**
Apparent power	L1	4	In
	L2	4	In
	L3	4	In
	Total	4	In
Reactive power	L1	4	In
	L2	4	In
	L3	4	In
	Total	4	In
Power factor	L1	4	In
	L2	4	In
	L3	4	In
	Total power factor	4	In
Cos phi	L1	4	In
	L2	4	In
	L3	4	In
Frequency		4	In
Active energy (double)	Import	8	In
	Export	8	In
Reactive energy (double)	Import	8	In
	Export	8	In
Apparent energy (double)	Total	8	In
Active energy (float)	Import	4	In
	Export	4	In
Reactive energy (float)	Import	4	In
	Export	4	In
Apparent energy (float)	Total	4	In
Operating time		4	In
THD current	L1	4	In
	L2	4	In
	L3	4	In
THD voltage	L1	4	In
	L2	4	In
	L3	4	In
	L1-L2	4	In
	L2-L3	4	In
	L3-L1	4	In
Temperature on circuit breaker		4	In
Status of IO inputs	Module 1	1	In
	Module 2	1	In
	Module 3	1	In
	Module 4	1	In
	Module 5	1	In

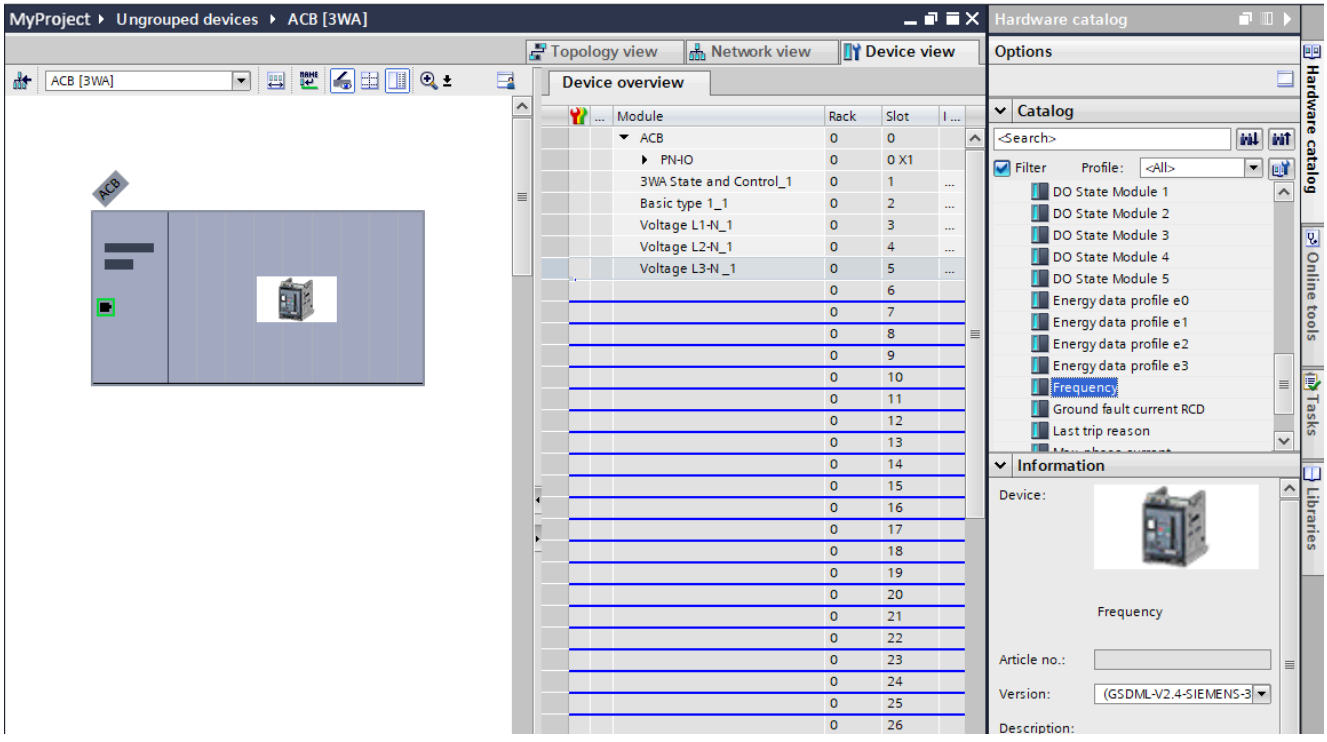
Module name		Length (bytes)	In/Out
Status of IO outputs	Module 1	1	In
	Module 2	1	In
	Module 3	1	In
	Module 4	1	In
	Module 5	1	In

Selection of the modules

The 3WA circuit breaker has a modular design and can be configured individually in the project.

- The "3WA status and control" module has the fixed position of slot 1, subslot 1 in the circuit breaker and is plugged in automatically.
- The "3WA status and control" module contains two input bytes for the binary status information and two output bytes for control of the circuit breaker.
- If control of the circuit breaker is not required in the system, the "3WA status and control" module can be replaced with the "3WA status" module. Please note that slot 1 must always be occupied.

Both the control and the control bytes are implemented according to the LVSG profile of the PNO (PROFINET user organization).



Binary status information

The table below contains a description of the binary status information in the cyclic frame:

Byte	Bit	Value	3WA circuit breaker
n	0 / 1	0 ... 3	Position of the circuit breaker in the guide frame
		0	Disconnected position
		1	Connected position
		2	Test position
		3	Circuit breaker not available
	2 / 3	0 ... 3	Status of the circuit breaker
		0	Not used
		1	Open
		2	Closed
		3	Circuit breaker has tripped and is open
	4	–	Ready-to-close
	5	–	Undervoltage release charged
	6	–	Stored energy mechanism is charged
	7	–	Overload warning is pending (overload protection is active)
n + 1	0	–	An activated threshold has been exceeded
	1	–	A warning message is pending
	2	–	Parameter write protection and remote switching protection not active, remote changes are possible
	3	–	–
	4 / 5 / 6	0 ... 7	Reason for last trip
		0	No trip or last trip acknowledged
		1	Overload protection, long-time delayed (L tripping)
		2	Instantaneous short-circuit protection (I tripping)
		3	Short-time delayed short-circuit protection (S tripping)
		4	Ground-fault protection (G tripping)
		5	Extended protective function trip
		6	–
		7	–
	7	–	–

Control bytes

The control bytes for controlling the circuit breaker are always two bytes long. With these control bytes, you can:

- Open/close the circuit breaker
- Acknowledge tripping events

Setting the outputs is controlled during operation by changing the corresponding control bits from 0 to 1. The corresponding bits must be set for a minimum of 200 ms and a maximum of 500 ms, including for test purposes. After this, these control bits must be reset to avoid subsequently triggering any undesired actions, for example by rebooting the COM module.

After the boot procedure, the COM module responds to the first available signal.

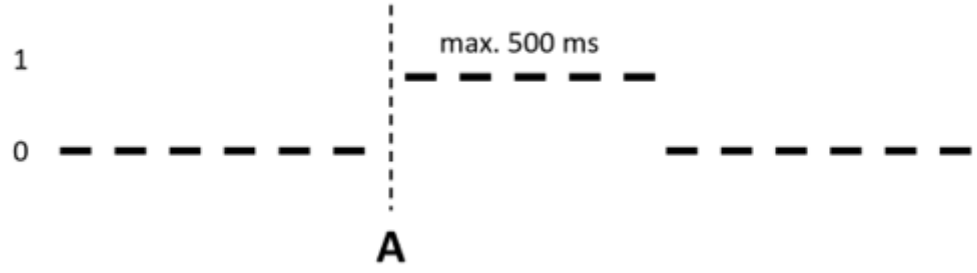


Figure 6-1 Example: A = Switching operation only when changing the bit from 0 to 1

⚠ WARNING

1) The COM module does not provide protection against reclosing of the circuit breaker (5 Safety Rules).

2) If communication is interrupted, for example by a reboot, the presence of a command may be interpreted as a switching command when communication is resumed.

3) Prevent accidental starting when working on the circuit breaker (in accordance with EN 50110-1, DIN VDE 0105-100 and BGV A2). Prevention can be achieved by one or more of the following measures, for example: mechanical reclosing lockout, disconnection of undervoltage coil (if present), closing lockout of buttons (if present), racking-out and locking of the circuit breaker (if present), etc.

4) Accidental remote switching can be prevented with the RSP closing lockout at COM190 -X62.

The table below contains a description of the control bytes:

Byte	Bit	Value	3WA circuit breaker
n	0 / 1	0 ... 3	Commands to close/open the circuit breaker
		0	No action after switching operation
		1	Circuit breaker open (opening of main contacts)
		2	Circuit breaker closed (closing of main contacts)
		3	Not defined (no action)
	2	–	Acknowledge and reset currently active trip indication
	3	–	Not used
	4	–	Not used
	5	–	Not used
	6	–	Not used
	7	–	Not used
n + 1	0	–	Not used
	1	–	Not used
	2	–	Not used
	3	–	Reset all minimum/maximum value logs (except temperature)
	4	–	Reset minimum/maximum value logs for temperatures
	5	–	Not used
	6	–	Not used
	7	–	Not used

Free selection of modules

The cyclic data can be configured in any way from the available modules. You can find more information in the table provided in the section "Modules that can be plugged in for the project" above.

Further individual modules without property bytes are available in addition to the basic types.

Basic type 1

Basic type 1 was implemented according to the LVSG profile of the PROFINET user organization (PNO) and comprises four data blocks. These are preassigned such that they are primarily suitable for use with a 3WA circuit breaker without function packages PMF I to PMF III. The most important currents of the phases are transferred.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0 / 1	Data block 1	Current in phase 1 (u16)
2 / 3	Data block 2	Current in phase 2 (u16)
4 / 5	Data block 3	Current in phase 3 (u16)
6 / 7	Data block 4	Max. current in phase under highest load (u16)

Basic type 2

Basic type 2 was implemented according to the LVSG profile of the PROFINET user organization (PNO) and comprises six data blocks which are preassigned for a 3WA circuit breaker with metering function. Here only the average voltage values are transmitted.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0 / 1	Data block 1	Current in phase 1 (u16)
2 / 3	Data block 2	Current in phase 2 (u16)
4 / 5	Data block 3	Current in phase 3 (u16)
6 / 7	Data block 4	Max. current in phase under highest load (u16)
8 / 9	Data block 5	Current in neutral conductor (u16)
10 / 11	Data block 6	Active energy import (u16)

Basic type 3

Basic type 3 was implemented according to the LVSG profile of the PROFINET user organization (PNO) and comprises fourteen data blocks containing metering values. These are preassigned such that unmodified use is only meaningful with a 3WA circuit breaker with metering function.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0 / 1	Data block 1	Current in phase 1 (u16)
2 / 3	Data block 2	Current in phase 2 (u16)
4 / 5	Data block 3	Current in phase 3 (u16)
6 / 7	Data block 4	Max. current in phase under highest load (u16)
8 / 9	Data block 5	Current in neutral conductor (u16)
10 / 11	Data block 6	Phase-to-phase voltage L12 (u16)
12 / 13	Data block 7	Phase-to-phase voltage L23 (u16)
14 / 15	Data block 8	Phase-to-phase voltage L31 (u16)
16 / 17	Data block 9	Line-to-neutral voltage L1N (u16)
18 / 19	Data block 10	Line-to-neutral voltage L2N (u16)
20 / 21	Data block 11	Line-to-neutral voltage L3N (u16)
22 / 23	Data block 12	Total power factor (u16)
24 / 25	Data block 13	Active energy import (u16)
26 / 27	Data block 14	Total 3-phase apparent power (u16)

Basic type 4

Basic type 4 comprises four data blocks. These are preassigned such that they are primarily suitable for use with a 3WA circuit breaker without metering function. The most important currents of the phases are transferred.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Current in phase 1 (float)
4...7	Data block 2	Current in phase 2 (float)
8...11	Data block 3	Current in phase 3 (float)
12...15	Data block 4	Max. current in phase under highest load (float)

Basic type 5

Basic type 5 comprises six data blocks which are preassigned for a 3WA circuit breaker with metering function. Here only the average voltage values are transmitted.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Current in phase 1 (float)
4...7	Data block 2	Current in phase 2 (float)
8...11	Data block 3	Current in phase 3 (float)
12...15	Data block 4	Max. current in phase under highest load (float)
16...19	Data block 5	Current in neutral conductor (float)
20...23	Data block 6	Active energy import (float)

Basic type 6

Basic type 6 comprises seven data blocks containing metering values. These are preassigned such that unmodified use is only meaningful with a 3WA circuit breaker with metering function.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Current in phase 1 (float)
4...7	Data block 2	Current in phase 2 (float)
8...11	Data block 3	Current in phase 3 (float)
12...15	Data block 4	Max. current in phase under highest load (float)
16...19	Data block 5	Current in neutral conductor (float)
20...23	Data block 6	Total active power (float)
24...27	Data block 7	Total reactive power (float)

Basic type 7

Basic type 7 comprises seven data blocks containing metering values. These are preassigned such that unmodified use is only meaningful with a 3WA circuit breaker with metering function.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Current in phase 1 (float)
4...7	Data block 2	Current in phase 2 (float)
8...11	Data block 3	Current in phase 3 (float)
12...15	Data block 4	Max. current in phase under highest load (float)
16...19	Data block 5	Current in neutral conductor (float)
20...23	Data block 6	Active energy import (float)
24...27	Data block 7	Total power factor (float)

Energy data profile e0 Currents

Energy data profile e0 is for integration of the 3WA circuit breaker in the Energy Suite profile.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Current in phase 1 (float)
4...7	Data block 2	Current in phase 2 (float)
8...11	Data block 3	Current in phase 3 (float)

Energy data profile e1 Total active power

Energy data profile e1 is for integration of the 3WA circuit breaker in the Energy Suite profile.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Total active power (float)

Energy data profile e2 Energy Basic

Energy data profile e2 is for integration of the 3WA circuit breaker in the Energy Suite profile.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0...3	Data block 1	Total active power (float)
4...7	Data block 2	Total active energy (import) (float)
8...11	Data block 3	Total active energy (export) (float)

Energy data profile e3 Energy Enhanced

Energy data profile e3 is for integration of the 3WA circuit breaker in the Energy Suite profile.

The predefined data blocks cannot be modified.

Byte	Definition	Default
0..3	Data block 1	Active power L1 (float)
4..7	Data block 2	Active power L2 (float)
8..11	Data block 3	Active power L3 (float)
11..15	Data block 4	Reactive power L1 (float)
16..19	Data block 5	Reactive power L2 (float)
20..24	Data block 6	Reactive power L3 (float)
24..31	Data block 7	Total active energy import (double)
32..39	Data block 8	Total active energy export (double)
40..47	Data block 9	Total reactive energy import (double)
48..55	Data block 10	Total reactive energy export (double)
56..59	Data block 11	Voltage UL1-N (float)
60..63	Data block 12	Voltage UL2-N (float)
64..67	Data block 13	Voltage UL3-N (float)
68..71	Data block 14	Voltage UL1-UL2 (float)
72..75	Data block 15	Voltage UL2-UL3 (float)
76..79	Data block 16	Voltage UL3-UL1 (float)
80..83	Data block 17	Current L1 (float)
84..87	Data block 18	Current L2 (float)
88..91	Data block 19	Current L3 (float)
92..95	Data block 20	Power factor L1 (float)
96..99	Data block 21	Power factor L2 (float)
100..103	Data block 22	Power factor L3 (float)

6.3.3 Acyclic data traffic

In addition to cyclic data traffic, acyclic data can be transferred, e.g.

- Parameters
- Diagnostic information
- Commands

Data transfer takes place in parallel with cyclic data traffic.

You can use acyclic data traffic by means of the following methods:

- SIMATIC S7 CPUs contain system function blocks (e.g. RDREC, WRREC, ...). With these, the CPUs can read and write the data sets individually, and read the alarm messages.
- Any PROFINET supervisor can read and write data sets.
- Any other PROFINET controller can read and write data sets.

Definition of data sets

The description of data sets can be found under "Data sets in acyclic data traffic". (https://support.industry.siemens.com/cs/ww/en/view/109793939)

In addition to the existing data sets, the I&M0 to I&M4 data sets for identification and maintenance of the circuit breakers/modules according to the PROFINET standard were implemented.

I&M device identification

These data sets contain the I&M information according to the PROFINET standard IEC 61158-6-10 and are used for unique identification of a 3WA circuit breaker.

Addressing the I&M data sets

Reading the I&M0 data set	Addressing the slot
For the 3WA air circuit breaker	Slot "X1": • Slot number 1 • Subslot 1
For the COM190 communication module	Slot "0": • Slot number 0 • Subslot 1, 0x8000, 0x8001 and 0x8002

Reading of data sets I&M1 to I&M4 is possible via both slots.

Writing of data sets I&M1 to I&M4 is only permitted via slot 0 subslot 1.

Structure of data set 0xAFF0 (I&M0 data: read-only access)

Byte	Number of bits	Format	Default	Description
0	16	Unsigned short	0x0020	Block type: I&M0
2	16	Unsigned short	0x0038	Block length
4	8	Unsigned char	0x01	Block version High
5	8	Unsigned char	0x00	Block version Low
I&M data block 0				
6	16	Unsigned short	42	I&M0 manufacturer ID[1)]
8	160	Char 20	–	I&M0 article number
28	128	Char 16	–	I&M0 serial number
44	16	Unsigned short	–	I&M0 hardware version
46	32	• 1*char • 3*unsigned short	–	I&M0 firmware version
50	16	Unsigned short	0x0001	I&M0 counter for changes
52	16	Unsigned short	0x0000	I&M0 profile ID
54	16	Unsigned short	0x0005	I&M0 profile-specific type
56	16	Unsigned short	0x0201	I&M0 version of the I&M data
58	16	Unsigned short	0x001E	I&M0 supported I&M data
Total bytes: 60				

1) Default: 42 ("42" stands for Siemens AG)

Structure of data set 0xAFF1 (I&M1 data: read and write access)

Byte	Number of bits	Format	Default	Description
0	16	Unsigned short	0x0021	Block type: I&M1
2	16	Unsigned short	0x0038	Block length
4	8	Unsigned char	0x01	Block version High
5	8	Unsigned char	0x00	Block version Low
I&M data block 1				
6	256	Char 32	20h	I&M1 system identification
40	176	Char 22	20h	I&M1 location identification
Total bytes: 60				

Structure of the data set 0xAFF2 (I&M2 data: read and write access)

Byte	Number of bits	Format	Default	Description
0	16	Unsigned short	0x0022	Block type: I&M2
2	16	Unsigned short	0x0038	Block length
4	8	Unsigned char	0x01	Block version High
5	8	Unsigned char	0x00	Block version Low
I&M data block 2				
6	128	Char 16	YYYY-MM-DD	I&M2 installation date
22	304	Char 38	20h	Reserved
Total bytes: 60				

Structure of the data set 0xAFF3 (I&M3 data: read and write access)

Byte	Number of bits	Format	Default	Description
0	16	Unsigned short	0x0023	Block type: I&M3
2	16	Unsigned short	0x0038	Block length
4	8	Unsigned char	0x01	Block version High
5	8	Unsigned char	0x00	Block version Low
I&M data block 3				
6	432	Char 54	20h	I&M3 comment
Total bytes: 60				

Structure of the data set 0xAFF4 (I&M4 data: read and write access)

Byte	Number of bits	Format	Default	Description
0	16	Unsigned short	0x0023	Block type: I&M4
2	16	Unsigned short	0x0038	Block length
4	8	Unsigned char	0x01	Block version High
5	8	Unsigned char	0x00	Block version Low
I&M data block 2				
6	432	Char 54	00h	I&M4 signature
Total bytes: 60				

Command data set

There are write-only data sets with more than one entry. With these, you can select which commands are to be executed.

The first entry is a 16-bit value. You can select the required commands by setting individual bits to "1". The other bits are ignored. The least significant bit stands for the first command. The next bit stands for the second command, and so on.

Error frames data set

If a data set is rejected by the COM190, the following happens:

- The request is negatively acknowledged with an NRS frame.
- The request is signaled to the master with an error frame that includes the negative acknowledgment and error code.

Structure of the error frame

The error frame has the following structure:

Function_Num	Error_Decode	Error_Code_1	Error_Code_2

- Function_Num
  If no error: B#16#00
  For an error:
  - Function identification from data set (DS) record: reading 0xDE, writing 0xDF
  - DS record protocol element not used: B#16#C0
- Error_Decode
  Location of error identification: COM190 0x80
- Error_Code_1

Code	Cause
0xA0	Read error (data set currently not readable, e.g. because required (I&M) function is not available)
0xA1	Write error (on write access to a write-protected data set DSx and general error on write access)
0xA7	Busy with a read/write request. The COM190 is busy with another request. The request must be repeated.
0xA9	Function is not supported (on write access for I&M0 data)
0xB0	Invalid index (for non-implemented DSx) and read error (on read access to a read-protected data set DSx)
0xB1	Write/read (I&M data) length error (on incorrect length data for write DSx)
0xB2	Invalid slot (on invalid slot data for read and write DSx)
0xB6	Access denied (e.g. due to write protection and invalid slots for writing I&M1 ... 4)
0xB7	Invalid parameter (request contains invalid parameter, complete request was rejected)
0xBA	User-defined – partial write – (requirement contains impermissible commands, request is partially executed)
0xC4	Internal error: Request processing has failed.

- Error_Code_2
  Manufacturer-specific extension of error identification: COM190 0x00, not used.

Note

The error codes are based on the SIMATIC error messages.

Protection parameters dST

Starting from ETU600 firmware version 2.2, the parameters for the dST function are no longer set via PROFINET. Please set the parameters on the ETU600 display.

6.4 Interrupt, error and system messages

6.4.1 General

The COM190 communication module is designed as a diagnostics-capable IO device. It detects internal and external faults and signals them to the IO controller as diagnostic, maintenance or process alarms. These can be evaluated, for example, in the TIA Portal or in STEP 7 V5.5 or higher using alarm OBs.

You can obtain detailed information on the error event when an alarm occurs, e.g. using the SFB54 (RALRM) in the corresponding alarm OB.

The alarms of the COM190 are implemented with channel information.

6.4.2 Structure of the diagnostic messages

The basic structure of the diagnostic data sets with the individual data blocks is described below.

Diagnostic, maintenance and process alarms

The structure of the diagnostic data sets for all alarm messages is identical apart from the "UserStructIdentifier" field.

The alarm block types start after the "UserStructIdentifier" field. They can occur one to n times and contain the actual diagnostic, maintenance or process alarm information.

Block structure for alarms

Meaning	Length
BlockType	2 bytes
BlockLength	2 bytes
BlockVersion	2 bytes
AlarmType	2 bytes
API	4 bytes
SlotNumber	2 bytes
SubslotNumber	2 bytes
ModuleIdentNumber	4 bytes
SubmoduleIdentNumber	4 bytes
AlarmSpecifier	2 bytes
Alarm block type (one to n times)	x bytes

"BlockType" data block

0x0002: AlarmNotification "Low" for diagnostic alarms

0x0001: AlarmNotification "High" for process alarms

"BlockLength" data block

The number of subsequent bytes of the diagnostic data set is coded in the "BlockLength" data field. It corresponds to the length of the diagnostic data set without the number of bytes for the "BlockType" and "BlockLength" data fields, each of which has a length of 2 bytes.

"BlockVersion" data block

W#16#0100: Block version of this diagnostic data set is 1.0.

"AlarmType" data block

W#16#0001: Diagnostic alarm

W#16#0002: Process alarm

"API" data block

API (Application Process Identifier): The COM190 uses the default API "0".

"SlotNumber", "SubslotNumber" data blocks

The COM190 is a modular PROFINET IO device with the following structure:

Designation	SlotNumber	SubslotNumber
COM190 • Interface • Port1 • Port2	0	0x0001 0x8000 0x8001 0x8002
3WA	0x0001	0x0001

"ModuleIdentNumber", "SubmoduleIdentNumber" data blocks

The ModuleIdentNumber and SubmoduleIdentNumber of the module causing the alarm.

"AlarmSpecifier" data block, sequence

Bits	Meaning
Bit 0 ... 10	Sequence number
Bit 11	Channel diagnosis available
Bit 12	Manufacturer-specific status information available
Bit 13	At least one channel diagnosis available
Bit 14	Reserved
Bit 15	At least one of the modules configured within this AR signals a diagnostic event.

Block type for maintenance information

The COM190 uses the "Maintenance information" block type to signal that maintenance information is pending. The "UserStructureIdentifier" for the maintenance information block is 0x8100.

Structure of the maintenance information

Meaning		Length
UserStructureIdentifier	0x8100 (Maintenance)	2 bytes
BlockType	0x0F00 (MaintenanceItem)	2 bytes
BlockLength	0x0008	2 bytes
BlockVersion	0x0001	2 bytes
Reserved	0x0000	2 bytes
MaintenanceStatus	1: Maintenance required 2: Maintenance demanded	4 bytes

Block type for diagnostic and maintenance alarm

The COM190 uses the "Diagnostic and maintenance" block type to signal incoming and outgoing diagnostic and maintenance alarms as an "Extended channel diagnosis". The "UserStructureIdentifier" for this block type is always 0x8002 for this reason.

Structure of diagnostic and maintenance alarms

Alarm		Length
UserStructureIdentifier	0x8002 (Extended channel diagnosis)	2 bytes
ChannelNumber	0x8000 (submodule)	2 bytes
ChannelProperties		2 bytes
ChannelErrorTypes		2 bytes
ExtChannelErrorType		2 bytes
ExtChannelAddValue		4 bytes

In the case of maintenance alarms, the additional maintenance information is transferred via the "ChannelProperties" field and the "Qualifier (Bit 9 / 10)" bits.

"ChannelProperties" data block

<table>
<tr><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td colspan="3" rowspan="4">.Direction</td><td colspan="2" rowspan="3">.Specifier</td><td colspan="2" rowspan="2">.Qualifier</td><td rowspan="2">.Acc.</td><td colspan="8">.Type</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="7"></td></tr>
</table>

"ChannelProperties.Type (Bits 0 to 7)" data block

Value	Meaning
0	If ChannelNumber has the value 0x8000.
1	1 bit
2	2 bits
3	4 bits
4	8 bits
5	16 bits
6	32 bits
7	64 bits

"ChannelProperties.Accumulative (Bit 8)" data block

Value	Meaning
0	No channel error group signal
1	Channel error group signal (more than one channel affected)

Combination of "ChannelProperties.Qualifier (Bit 9 / 10)" and "ChannelProperties.Specifier (Bit 11 / 12)"

Maintenance Required Bit 9	Maintenance Demanded Bit 10	Specifier bit 12 / 11	Meaning	Diagnostics in SIMATIC user program
0	0	00	All lower-level diagnoses are no longer pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82
		01	Diagnosis is pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82, data set reading with SFB52 (RDREC)
		10	Diagnosis is no longer pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82
		11	Status message. Only possible for manufacturer-specific errors.	
	1	00	Reserved	–
		01	Maintenance required is pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82, data set reading with SFB52 (RDREC)
		10	Maintenance required is no longer pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82
		11	Maintenance required is no longer pending; all others are still pending.	
1	0	00	Reserved	–
		01	Maintenance demanded is pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82, data set reading with SFB52 (RDREC)
		10	Maintenance demanded is no longer pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82
		11	Maintenance demanded is no longer pending; all others are still pending.	
	1	00	Reserved	–
		01	Stepped diagnosis is pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82, data set reading with SFB52 (RDREC)
		10	Stepped diagnosis is no longer pending.	Evaluation of diagnostic alarms with SFB54 (RALRM) in OB82
		11	Stepped diagnosis is no longer pending; all others are still pending.	

"ChannelProperties.Direction (Bits 13 to 15)" data block

Value	Meaning
000	Manufacturer-specific
001	Input
010	Output
011	Input/Output
100 ... 111	Reserved

"ChannelErrorType" data block

The messages for the diagnostic and maintenance alarms are transferred in the "ChannelErrorType" field.

You can find more information in the next chapter "Diagnostic and maintenance alarm messages".

6.4.3 Diagnostic and maintenance alarm messages

The more precise alarm information is defined as follows in the "ChannelErrorType" and "ExtChannelErrorType" fields specifically for the COM190:

ChannelErrorType (hex) / message	ExtChannelErrorType
0x0100 (Diag) Circuit breaker has tripped.	- Reserved -
0x0101 (Diag) Position of the withdrawable circuit breaker in the guide frame changed. As additional information, the new position of the withdrawable circuit breaker is signaled in the "ExtChannelErrorType" field.	1 = Withdrawable circuit breaker in test position 2 = Withdrawable circuit breaker in disconnected position 3 = Withdrawable circuit breaker not in guide frame 4 = Withdrawable circuit breaker in intermediate state
0x0102 (Maintenance) Maintenance of the circuit breaker necessary. As additional information, the necessary maintenance is signaled in the "ExtChannelErrorType" field.	1 = Circuit breaker inspection necessary (Maintenance Demanded) 2 = Maintenance of main contacts necessary (Maintenance Required)
0x0105 (Maintenance) Battery change is necessary.	1 = Battery of ETU600 is empty (Maintenance Demanded)
0x0106 (Diag) GF alarm ground fault was detected.	1 = Ground fault GF Alarm REF_Direct 2 = Ground fault GF Alarm UREF_Residual 3 = Ground fault GF Alarm UREF_Residual 4 = Ground fault GF Alarm UREF_HiZ
0x0107 (Diag) GF alarm REF ground fault was detected.	1 = Ground fault GF Alarm REF_DualMode 2 = Ground fault GF Alarm REF_HiZ
0x0108 Pre-alarm was detected.	1 = Pre-alarm PAL in L1 2 = Pre-alarm PAL in L2 3 = Pre-alarm PAL in L3 4 = Pre-alarm PAL in N 5 = Pre-alarm PAL was exceeded.
0x0109 (Diag) An ETU fault was detected.	1 = ETU600 defective
0x010A (Diag) Overload alarm was detected.	1 = AL2 alarm active
0x010B (Diag) Circuit breaker temperature is too high.	1 = Limit temperature exceeded in ETU600 2 = Limit temperature exceeded in COM module 3 = Limit temperature exceeded in device
0x010C (Diag) Fault detected in current sensor	1 = Fault in current sensor L1 2 = Fault in current sensor L2 3 = Fault in current sensor L3 4 = Fault in current sensor LN 5 = The energy transformer in the current sensor is defective.

Block type for process alarm

The COM190 uses the "Process alarm" block type to signal process alarms. The "UserStructureIdentifier" for this block type is defined as "User specified" and can be in the range 0x0001 to 0x7FFF.

Structure of the process alarms

Meaning	Length
UserStructureIdentifier (0x0001 to 0x7FFF)	2 bytes
UserData	x bytes

6.4.4 Process alarm messages

The process alarm messages are defined as follows specifically for the COM190:

UserStructIdentifier (hex) / message	UserData
0x0001 CubicleBUS² module status has changed.	Current CubicleBUS² module status: Length: 8 bytes Refer to the description of the "ACTIVE_MODULES" data point under Modbus register for the 3WA air circuit breaker (https://support.industry.siemens.com/cs/ww/en/view/109794278).
0x0002 Status of the main contacts has changed.	Length: 1 byte 0x01 = Main contacts open 0x02 = Main contacts closed 0x21 = Tripping via UVR
0x0003 Status of the ready-to-close signal has changed.	Length: 1 byte 0x01 = Not ready to close 0x02 = Ready to close
0x0005 Status of the stored energy mechanism has changed.	Length: 1 byte 0x01 = Not charged 0x02 = Charged
0x0006 The protection parameter set of the circuit breaker has been changed.	0x01 = Protection parameter set A active 0x02 = Protection parameter set B active
0x0008 DAS+ status has changed.	Length: 1 byte 0x01 = DAS+ not active 0x02 = DAS+ active
0x0009 Status of remote access protection has changed.	Length: 1 byte 0x00 = All deactivated 0x01 = Parameter write protection activated 0x02 = Remote switching protection activated 0x03 = All activated
0x000A Action is not possible when write protection is active.	Length: 1 byte 0x00 = Reserved
0x000B Status of limit values has changed.	Length: 1 byte 0x01 = No limit value alarm active 0x02 = At least one limit value alarm active

Disposal

7

Disposal of waste electronic equipment

Waste electronic equipment must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of waste electronic equipment, the current local national/international regulations must be observed.

Disposal of batteries

Batteries must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of batteries, the current local national/international regulations must be observed.

ESD guidelines

A

A.1 Electrostatic sensitive devices (ESD)

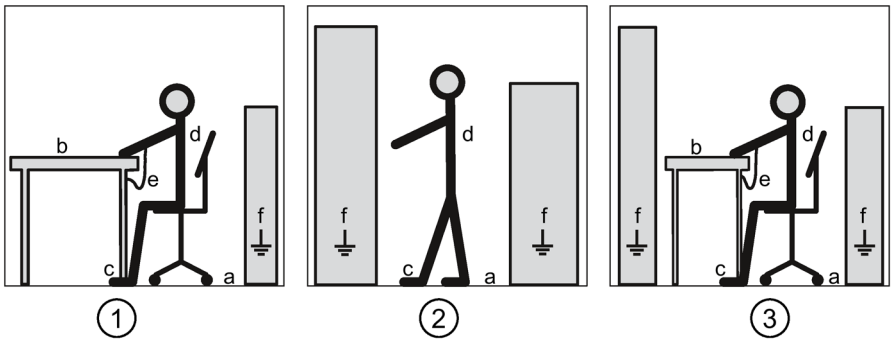
ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

ESD Guidelines

NOTICE
Electrostatic sensitive devices Electronic modules contain components that can be damaged by electrostatic discharge as a result of improper handling. • You must discharge your body electrostatically immediately before touching an electronic module. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe. • Always hold the component by the plastic enclosure. • Electronic modules should not be brought into contact with electrically insulating materials such as plastic film, plastic parts, insulating table supports or clothing made of synthetic fibers. • Always place electrostatic sensitive devices on conductive bases. • Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metalized plastic or metal containers. Leave the component in its packaging until installation.

NOTICE
Storage and transport If you have to store or transport the component in non-conductive packaging, you must first pack the component in ESD-safe, conductive material, e.g., conductive foam rubber, ESD bag.

The diagrams below illustrate the required ESD protective measures for electrostatic sensitive devices.



(1) ESD seat
(2) ESD standing position
(3) ESD seat and ESD standing position

Protective measures

a Conductive floor
b ESD table
c ESD footwear
d ESD smock
e ESD bracelet
f Cubicle ground connection

List of abbreviations

B

B.1 Table of abbreviations

Abbreviation	Meaning
AL	Alarm
BSS	Breaker status sensor
COM	Communication module
DAS+	Dynamic Arc-Flash Sentry
DIN	Deutsches Institut für Normung e. V. (German Institute for Standardization)
ESD	Electrostatic sensitive device
EN	European Standard
ESD	Electrostatic sensitive device
ETU	Electronic Trip Unit
G alarm	Ground-fault alarm
G tripping	Ground-fault tripping
GF	Ground fault
I tripping	Instantaneous short-circuit tripping
IEC	International Electrotechnical Commission
IOM	Input/output module
L1	Phase 1
L2	Phase 2
L3	Phase 3
LED	Light emitting diode
L tripping	Inverse-time delayed overload tripping
LT	Overload protection
N	Neutral conductor
N 117	Australian approval mark
NAB	Non-automatic breaker mode
N tripping	Tripping due to overcurrent in the N-conductor
S tripping	Short-time delayed short-circuit tripping
TUI	Trip Unit Interface (local communication interface)
VDE	Verband der Elektrotechnik Elektronik und Informationstechnik e. V. (German Association for Electrical, Electronic and Information Technologies)
WBT	Web-based training
X	Terminal marking according to DIN

Index

C

Classroom
    Training, 11
Conductive floor, 102
Cubicle ground connection, 102

D

Discharge, 101

E

Electronic trip unit, 26
Electrostatic sensitive devices, 101
ESD bracelet, 102
ESD footwear, 102
ESD protective measures, 101
ESD seat, 102
ESD smock, 102
ESD standing position, 102
ESD table, 102
ETU600, 26

F

Five Safety Rules, 12

N

Number of tripping operations, 28

O

Open Source Software, 13
    Use, 14

P

Parameter set
    A, 41
    B, 42
Parameterization, 41

R

Rotary switches, 41

S

Safety Rules, 12
Security functions, 13
Status, (Position in the guide frame)
    Alarm, 36
    DAS+, 33
    ETU error message, 38
    ETU600, 29
    Main contact, 39
    Mechanical system, 31
    Protective function, 37
    Warnings, 35
Storage, 101

T

Technical Support, 9
Training, 11, 11
    Learning paths, 11
    WBT, 11
Transport, 101
Tripping cause, 27

W

WBT
    Training, 11
WBT – web-based training, 11

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Published by
Siemens AG

Smart Infrastructure
Electrical Products
Postfach 10 09 53
93009 REGENSBURG, Germany

For the U.S. published by
Siemens Industry Inc.

100 Technology Drive
Alpharetta, GA 30005
United States

SI EP
Online