Contents

Disclaimer of liability

We have checked that the contents of this document correspond to the hardware and software described. Nonetheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information contained in this document is, however, reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

1 Introduction

1.1 Contents of this manual

This manual contains a comprehensive description of the connection to the communication system of circuit-breakers 3VF (communication-capable 25 - 800 A), 3WN6 (up to 3200 A), 3WS1 (up to 2500 A), and 3WN1 (up to 6300 A). A brief general introduction to PROFIBUS is provided, followed by sections including important instructions regarding ordering, configuring and start-up for each circuit-breaker type. The universally applicable PROFIBUS guidelines as specified by the PROFIBUS User Organization (PNO) are included in the Appendix and can be used for planning your overall PROFIBUS-capable system.

Further detailed information on PROFIBUS and PROFIBUS system components can be found in the following catalogs:

IK 10: "SIMATIC NET - Industrial Communication"
Order number: E86060-K6710-A101-A7-7600

ST 70: "SIMATIC - Components for Totally Integrated Automation"
Order number: E86060-K4670-A111-A3-7600

ST PI: "PROFIBUS & AS-Interface - Fieldbus Components"
Order number: E86060-K4660-A101-A2-7600

1.2 Explanation of terms and advantages of "communication"

Ever increasing levels of automation mean a higher demand for information regarding the state of systems and their components (e.g. evaluation of measured values and diagnostic data). In addition, it is also important that field devices can be controlled directly from control rooms, thus minimizing the personnel costs required for intervention in automation processes. The installation of a bus system allows for a simple data exchange between field devices (e.g. 3WN6 circuit-breakers) and PLCs (e.g. SIMATIC S5/S7 PLCs). Whereas conventional wiring technology requires many multicore control cables connected in parallel to perform this communication task, a bus system generally only requires a single 2-core cable. This means that substantial savings can be made in the areas of wiring (shorter installation time), testing and control cable costs. In addition to controlling the field devices, measured values, signals and diagnostic data which can indicate faults/problems in the plant at an early stage can easily be transferred, thereby helping to reduce system down times (especially through preventive maintenance). The monitoring of current values can ensure that the system is utilized economically at all times (energy management).
The communication-capable circuit-breakers 3VF (25 - 800 A), 3WN6 (up to 3200 A), 3WN1 (up to 6300 A), and 3WS1 (vacuum technology up to 2500 A) take full advantage of communication via a bus system. The bus system used is PROFIBUS-DP (EN 50170). It permits circuit-breakers to be controlled and monitored, or even remotely parameterized, depending on the type of overcurrent release fitted.
Two high-performance software packages are available for the visualization and evaluation of transferred data (see page 35 for description):

- "Win3WN6" (for start-up, and for operation and monitoring of circuit-breaker 3WN6) [1]
- "SICAM LCC" (visualization of complete systems with circuit-breakers 3VF, 3WN6, 3WN1, 3WS1, and with SIMOCODE-DP motor protection and control device) [2]

[1] Shipping of Win3WN6 starts in 07/98.
[2] Shipping of SICAM LCC starts in 10/98.

1.3 Explanation of terms "PROFIBUS" and "PROFIBUS-DP"

PROFIBUS[3] (PROcess FIeld BUS) is a standard (EN 50170), supplier-independent field bus system. Over 250 suppliers are already offering more than a total of 770 PROFIBUS products in their product ranges. There are in excess of 500,000 PROFIBUS nodes installed worldwide, and PROFIBUS users are supported worldwide by user organizations in 12 countries.
PROFIBUS consists of a 2-core cable over which signals (bits) are transferred between PLCs and field devices in a standardized format (protocol). Up to 125 field devices can be connected to a single PROFIBUS network. Repeaters can be used to connect bus segments making it possible to span distances greater than 9 km using copper cables and distances up to 100 km using fiber optic cables. The length of the individual bus segments depends on the baud rate and whether or not there are slaves present (see **Table 1**). This means that different numbers of repeaters will be used depending on the type of network.

Data rate (Kbit/s)	Segment length (m) with slaves	Segment length (m) without slaves
9.6	1200	3300
19.2	1200	2800
93.75	1200	2000
187.5	1000	1600
500	400	1200
1500	200	400
12000	100	-

Table 1: Ranges of PROFIBUS network segments (2-core cable)

In addition to standard linear bus networks, it is also possible to utilize fiber optic technology together with optical link modules (OLM) to form redundant ring structures.

There are at present two forms of PROFIBUS: PROFIBUS-DP (Decentralized Peripherals) and PROFIBUS-FMS (Field Message Specification).
PROFIBUS-FMS allows for supplier-independent communication between PLCs. Communication via the FMS user interface puts functionality rather than reaction time into the foreground. Special user services are therefore available for the logically structured data exchange of even very large amounts of data.
Very fast reaction times for a medium data volume are required for communication with field devices (e.g. 3WN6 circuit-breakers, SIMOCODE-DP). This can be achieved by PROFIBUS-DP. The typical configuration of a PROFIBUS-DP network is as a mono-master system, i.e. the slaves are addressed by a single master.
The openness of PROFIBUS offers many connection possibilities: a special interface (DP/AS-i link), for example, allows the connection of Actuator-Sensor Interface (AS-i) network systems to PROFIBUS-DP networks. All major PLC suppliers offer PROFIBUS-DP masters.

[3] Siemens originally referred to PROFIBUS as SINEC L2.

1.4 The open world of PROFIBUS-DP communication

From master to field device, PROFIBUS-DP offers a full range of connection possibilities. A small selection of the products available from the Siemens world of communications is shown below in Figure 1. Needless to say, PROFIBUS-compatible non-Siemens devices which are in conformance with the PROFIBUS standard can also form part of this system.

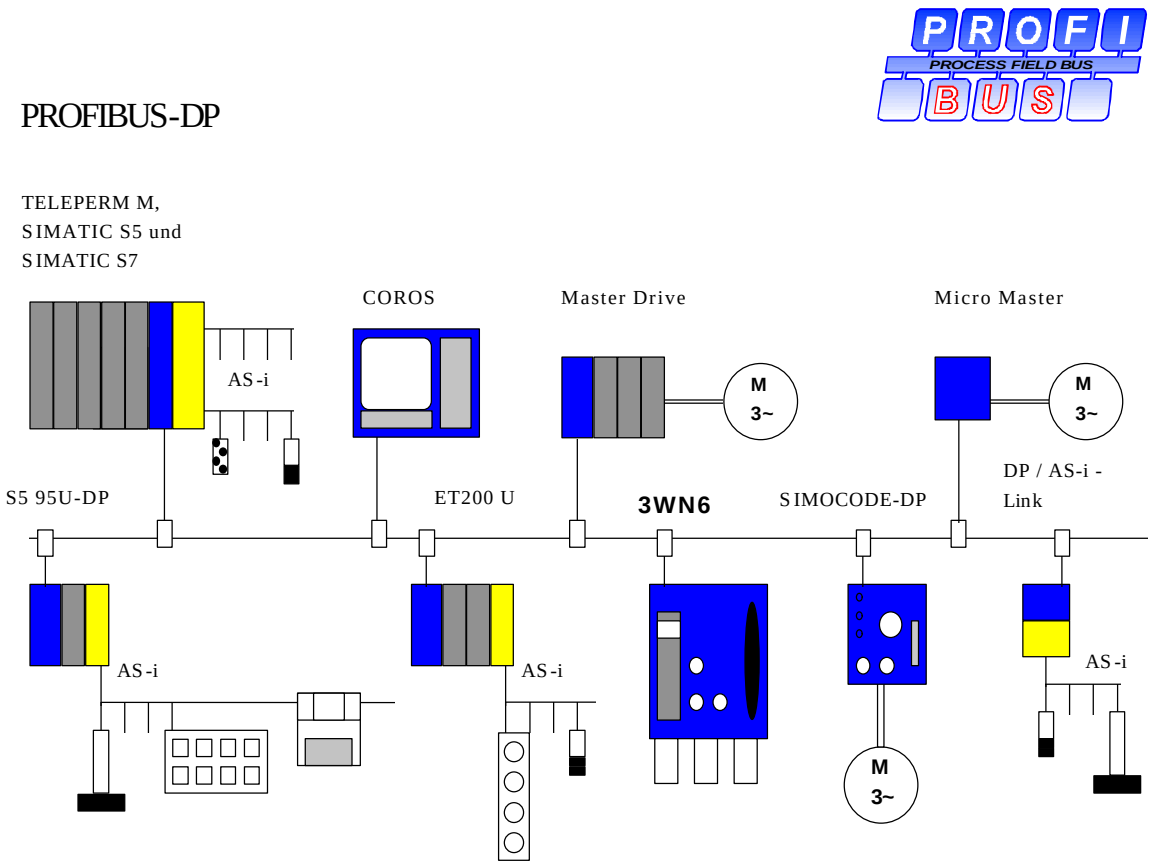


Fig. 1: The open world of PROFIBUS-DP communication

2 3VF circuit-breakers

2.1 Design and mode of operation

2.1.1 Communication via PROFIBUS-DP

3VF circuit-breakers can communicate via PROFIBUS-DP by means of SIMOCODE-DP (**Si**emens **Mo**tor Protection And **Co**ntrol **De**vice - **D**ecentralized **P**eripherals, or product code 3UF5). This communication-capable branch is available for currents from 63 A to 800 A for circuit-breakers 3VF3 to 3VF7.

The circuit-breaker assumes the tasks of overload and short-circuit protection for the plant section. SIMOCODE-DP measures the current in the feeder in the highest loaded phase and makes it available via the bus. The customer wires control functions such as opening/closing (ON/OFF) and monitoring of the switching state (whether the circuit-breaker is ON or OFF or whether it has tripped due to a fault) between SIMOCODE-DP and the circuit-breaker (see section entitled "Connecting 3VF to the communication system"). The motorized operating mechanism and internal accessories, such as alarm and auxiliary switches, must be taken into consideration when ordering the circuit-breakers.
(See section entitled Selection and ordering data).

SIMOCODE-DP (3UF5) acts as a control and measuring unit in conjunction with the 3VF circuit-breaker. The overload and short-circuit protection functions are not affected by the connection to SIMOCODE-DP or by a PROFIBUS-DP failure.

SIMOCODE-DP measures the following operational data as standard and makes them available via PROFIBUS-DP:

☐ Maximum phase current as a % of the setting current in the highest loaded phase:
(Prerequisite: Setting current I_e of SIMOCODE-DP corresponds to setting current or rated current I_r of the circuit-breaker. This value must be entered prior to start-up in the field "Setting current 1".)

☐ Operational state of circuit-breaker (ON/OFF/TRIPPED = trip due to overload or short-circuit).

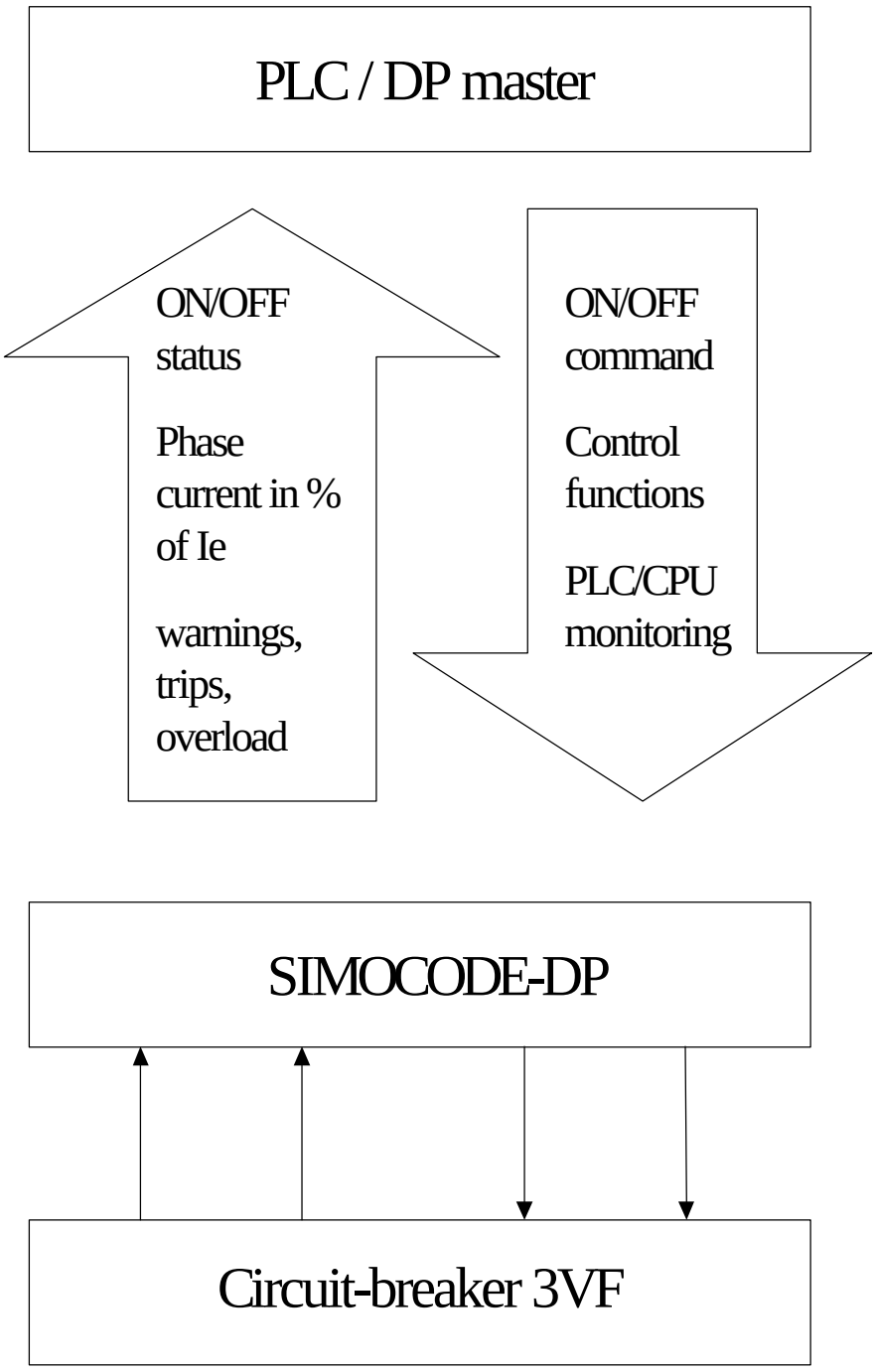
☐ Event signals:
$I>I_n$ Signal at upper current limit, default setting of 120 %, can be parameterized.
$I<I_n$ Signal at lower current limit, default setting of 80 %, can be parameterized.

The following control commands are possible via PROFIBUS-DP:

☐ Switch circuit-breaker ON/OFF

☐ RESET circuit-breaker following overload or short-circuit

2.1.2 Data exchange



PROFIBUS-DP uses different data channels in order to maintain fast transmission times. In this way, up to 12 bytes can be transferred at regular intervals from SIMOCODE-DP to the automation level and up to 4 bytes can be transferred back.

The 20 bytes of diagnostic data are only transferred from SIMOCODE-DP to the automation level in the event of a change, i.e. the diagnostic channel is event-triggered. The 213 bytes of parameter data are only transferred to SIMOCODE-DP when the automation system is started up.

SIMOCODE-DP can operate in conjunction with any standard PROFIBUS-DP master which is capable of reading type or GSD files and which can process the following volumes of data:

- 4 bytes of control data cyclically from the DP master to SIMOCODE-DP
- 4 or 12 bytes of signal data cyclically from SIMOCODE-DP to the DP master
- 20 bytes of diagnostic data acyclically from SIMOCODE-DP to the DP master
- 213 bytes of parameter data

In order to guarantee optimum data transfer times, the large volume of SIMOCODE-DP input and output data is divided into two transfer modes on PROFIBUS-DP - cyclic and acyclic transfer modes:

1. Cyclic data traffic: cyclic data (e.g. actual maximum phase current I_{Lmax} in the highest loaded phase) correspond to basic information which is transferred at regular intervals. Important information is automatically transferred from the circuit-breaker to the I/O area of the bus master in this way. Similarly all the important (cyclic) data contained in the I/O area of the bus master are also transferred to the circuit-breaker.
   Cyclic input data include, for example, the setting current value for overload releases (setting current I_r), as well as the circuit-breaker remote ON/OFF command. Cyclic output data from SIMOCODE-DP include the switching state of the circuit-breaker (ON/OFF), as well as various group signals which can indicate whether a fault (e.g. trip due to overload or short-circuit) or a warning (e.g. current warning, 80 % or 120 %) is present.

2. Acyclic data traffic: Acyclic data are only transferred from the interface to the bus master or from the bus master to the circuit-breaker when a request is transmitted. This means that specific messages are sent from the bus master to the 3VF circuit-breaker when required.

2.1.3 Hardware and software connections of 3VF

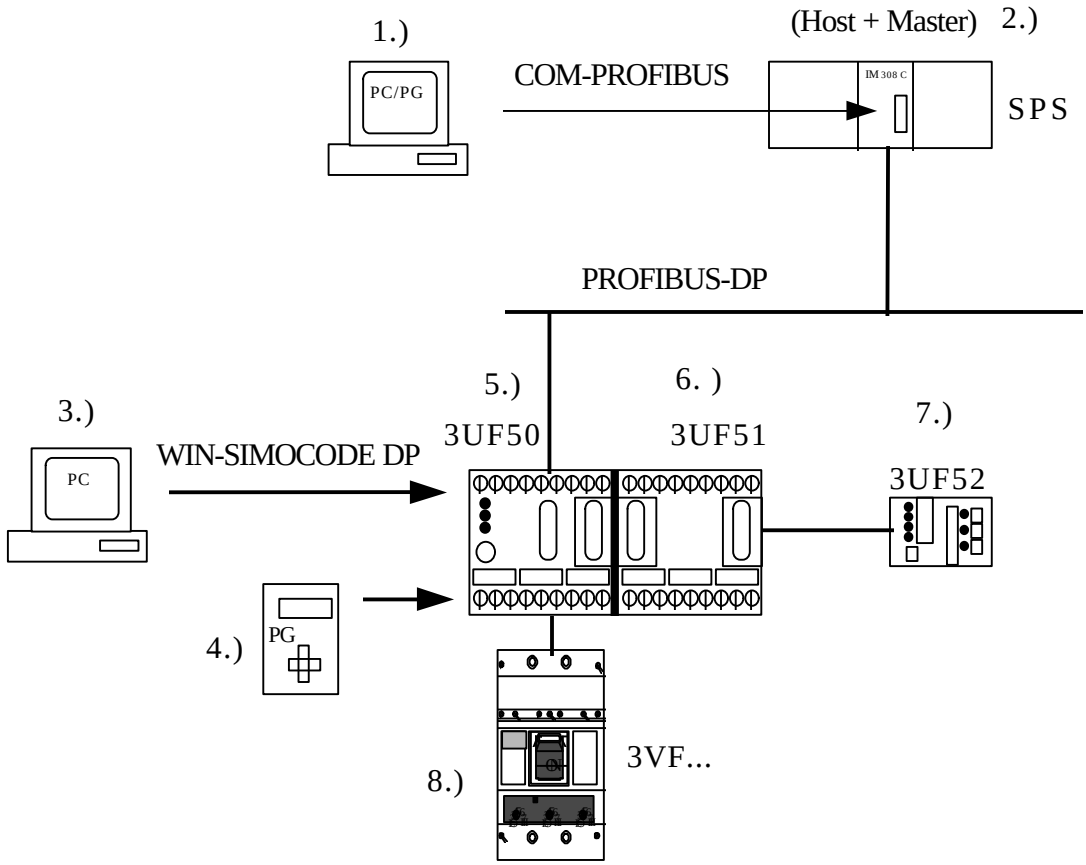


Fig. 2: Possible system components

Hardware:

1.) PC or programming device (PG) for offline parameterization of master and slave-specific data via COM-PROFIBUS

Two configuring modes are possible via COM-PROFIBUS:
a) Bus configuration: type or GSD files, control data (always 4 bytes in length)
b) Parameterization: set device-specific parameters

2.) PROFIBUS-DP MASTER e.g. IM308C for SIMATIC S5

3.) PC or notebook for SIMOCODE-DP parameterization and for operation and monitoring (Win-SIMOCODE-DP software is required, see software)

4.) Handheld operator panel (order no. 3WX3647-6JA00) for parameterization, operation and monitoring of SIMOCODE-DP; functionality includes: baud rate setting, slave address, base type.

5.) SIMOCODE-DP basic unit (cf. Selection and ordering data, page 17)

6.) Expansion module for basic unit, makes available 8 more inputs and 4 more outputs (not required for the application described here)

7.) Operating module, to be installed in switchgear cubicle door, used to control the circuit-breaker and as a display module (not required for the application described here).

8.) 3VF circuit-breaker with necessary accessories: alarm switch, auxiliary switch, motorized operating mechanism (cf. Selection and ordering data, page 17).

Software:

☐ 3.5" diskette with type or GSD file for the software interface between 3UF5 and PROFIBUS-DP (supplied with SIMOCODE-DP manual, order no. 3UF5700-0AA0-0)
Type file: Siemens-specific hardware identification (contains default parameter set)
GSD file: For non-Siemens suppliers (parameterization via bus not possible at present)

☐ COM-PROFIBUS software for parameterization of 3UF5 via PROFIBUS-DP

☐ Win-SIMOCODE-DP software, order no. 3RK1803-2FA02-0DA0, price: DM 399.-

☐ Special parameter file which is transferred to the SIMOCODE-DP basic unit with Win-SIMOCODE-DP. This parameter file defines the base type, slave address, baud rate, the control and message bytes, and the inputs and outputs in accordance with the standard circuit diagram. This file is included in the Win-SIMOCODE-DP software from 06/98 and can also be downloaded from the Internet at the address "http:\\www.ad.siemens.de".

You can parameterize SIMOCODE-DP via the RS-232 interface using the handheld operator panel or using the Win-SIMOCODE-DP software which is provided. We recommend that you use the SIKOSTART system connecting cable (order no. 3RW2920-1DA00) for connecting the PC or programming device to the SIMOCODE-DP system interface. Another possibility instead of using Win-SIMOCODE-DP is offline parameterization via COM-PROFIBUS or STEP 5/STEP 7.

For offline parameterization, the required data are stored on a memory card with the help of a programming device. This plug-in card is installed directly in the host (PLC master) and is read by the master, e.g. IM308C, on start-up.

2.1.4 Connecting 3VF to the communication system

1.) Check that all the system components are fitted

Check that all the following system components are fitted before connecting 3VF to PROFIBUS-DP:

- ☐ 3VF circuit-breaker with internal accessories (alarm switch, auxiliary switch) and motorized operating mechanism
  Note: The motorized operating mechanism is needed for remote control of the circuit-breaker. If this is not fitted, the circuit-breaker cannot be switched ON and OFF via PROFIBUS. The measurement and warning functions are operational, however.
- ☐ Suitable SIMOCODE-DP basic unit (cf. Selection table, page 17)
- ☐ Connecting cable for parameterization using a PC or notebook
- ☐ Diskette with type or GSD file (supplied with SIMOCODE-DP manual)
- ☐ Parameter file (included in Win-SIMOCODE-DP from 6/98)
- ☐ Win-SIMOCODE-DP software or 3WX36 handheld operator panel
- ☐ COM-PROFIBUS software, only required for parameterization via PROFIBUS-DP

2.) Check the system requirements

The second step involves checking the following requirements for connecting 3VF to PROFIBUS-DP:

- ☐ The 3VF circuit-breaker must be installed and wired in accordance with the circuit diagram on pages 14/15.
- ☐ The PROFIBUS-DP master must be present and operational.
- ☐ SIMOCODE-DP must be correctly configured and installed (cf. user guide).

3.) Connect SIMOCODE-DP to PROFIBUS-DP

The bus cable can be connected to the SIMOCODE-DP 9-pin SUB-D connector using the standard PROFIBUS-DP connector (order no. 6ES7972-0B.10), or it can be connected directly to the screw terminals labeled "PROFIBUS-DP".

4.) Connect SIMOCODE-DP to 3VF circuit-breaker

If the following accessories are not already fitted in the 3VF circuit-breaker, fit them before wiring:

3VF accessories	Function and mode of operation
Alarm switch (AS)	For "Tripped" signal on overload or short-circuit
Auxiliary switch (HS)	Switch position of circuit-breaker
Motorized op. mech. (M)	For remote ON/OFF commands

Please follow the assembly instructions when fitting internal accessories in the circuit-breaker.

Connect SIMOCODE-DP and the 3VF circuit-breaker in accordance with the circuit diagram on pages 14/15.

5.) Bus configuration and visualization

The handheld operator panel or a PC must be used for setting a number of parameters in SIMOCODE-DP during the initial start-up, e.g. address and baud rate. The remaining parameters can then be set via the bus using a PC or programming device and either the COM-PROFIBUS software or STEP 5/7. The parameters are then stored on an EEPROM.

If SIMATIC S5 is the bus master, the bus can be configured quickly and easily using either a PC or a SIMATIC programming device (PG) in conjunction with the COM-PROFIBUS program. In the case of other bus masters, the appropriate devices and/or supplier-specific tools must be used.

The SIMOCODE-DP identification can be read into the bus master in the form of type or GSD files. The following list specifies which file is required for each master:

File allocation list:[4]

si8031_d.200: Type file (German) **for Siemens master only (e.g. IM308C ...)**

si8031gd.200: Type file (German) **for Siemens master only (S5-95)**

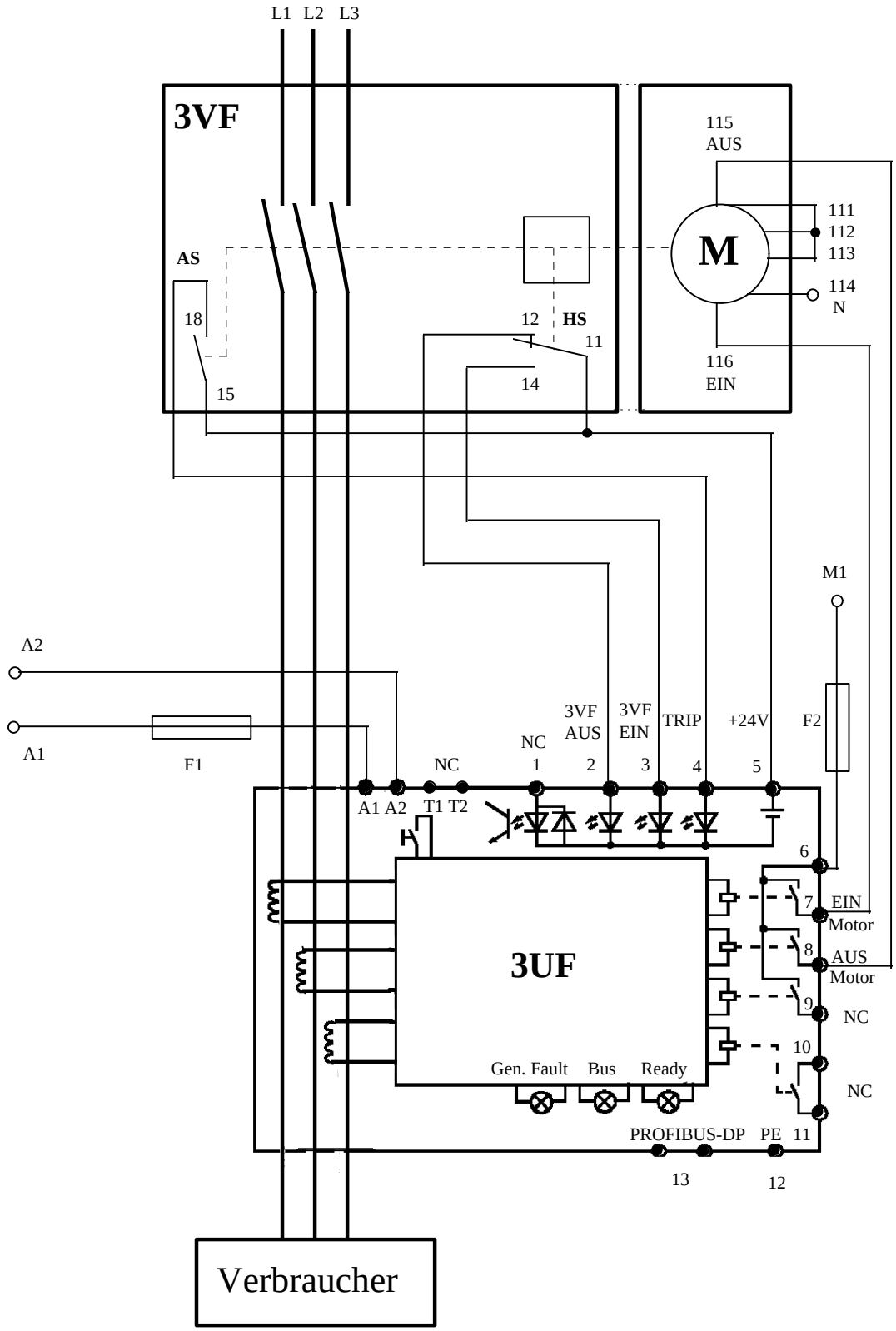
siem8031.GSD GSD file (device data)
For non-Siemens suppliers of standard DP masters

Note:
You only need a GSD file if you are operating SIMOCODE-DP in conjunction with a DP master which cannot process type files.

High-performance software is available for the **visualization** and evaluation of the data transferred from 3VF (see page 35 for description):
"**SICAM LCC**" for the visualization of complete systems implementing circuit-breakers 3VF, 3WN6, 3WN1, 3WS1, and a SIMOCODE-DP motor protection and control device. [5]

[4] The type and GSD files are also available under the following modem number: 0911-737972
[5] Shipping of **SICAM LCC** starts in 10/98.

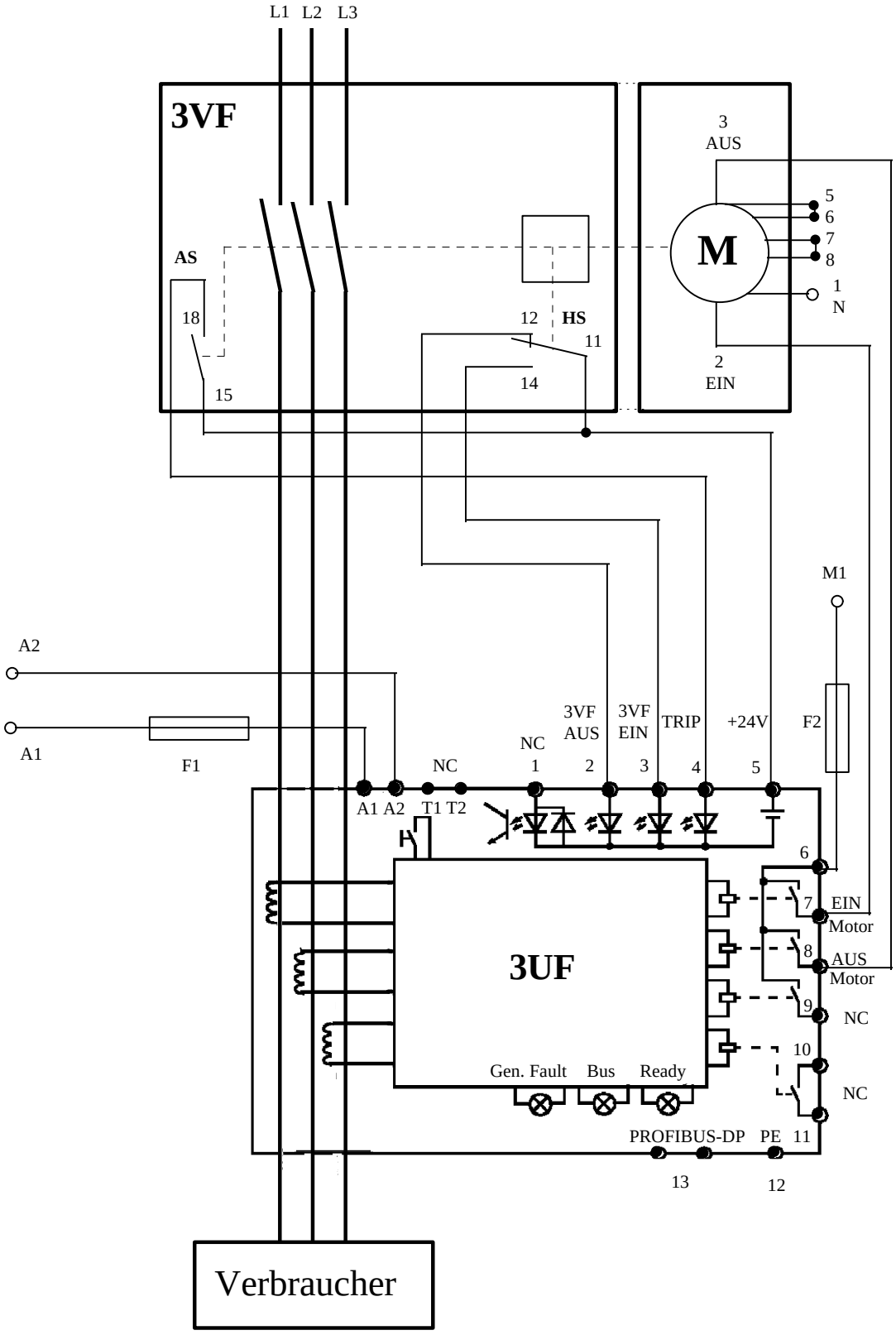
a.) Wiring diagram for connecting circuit-breakers 3VF3 - 3VF6 to SIMOCODE-DP:



EIN = ON
AUS = OFF
NC = Not Connected
PE = potential earth

Verbraucher = load
HS = auxiliary switch
AS = alarm switch

b.) Wiring diagram for connecting circuit-breaker 3VF7 to SIMOCODE-DP:



EIN = ON
AUS = OFF
NC = Not Connected
PE = potential earth

Verbraucher = load
HS = auxiliary switch
AS = alarm switch

Legend for wiring diagrams a) and b)

1.) SIMOCODE-DP input: not connected (NC)

2.) SIMOCODE-DP input for indicating circuit-breaker state "OFF"

3.) SIMOCODE-DP input for indicating circuit-breaker state "ON"

4.) SIMOCODE-DP input for indicating circuit-breaker state "Tripped"

5.) SIMOCODE-DP output: internal 24 V voltage supply for inputs

6.) SIMOCODE-DP input for 230 V AC operating voltage for motorized operating mechanism.
Note: If rated voltages < 230 V are required for motorized operating mechanisms, the relay outputs of SIMOCODE-DP can be overloaded (max. continuous rated current 5 A). Suitably powerful auxiliary relays or contactors must be used in such cases. Please refer to the 3VF circuit-breaker catalogs for other operational voltages of motorized operating mechanisms.

7.) SIMOCODE-DP output: for "ON" command to 3VF motorized operating mechanism

8.) SIMOCODE-DP output: for "OFF" command to 3VF motorized operating mechanism

9.) SIMOCODE-DP output: not connected

10./11.) SIMOCODE-DP output: not connected

12.) SIMOCODE-DP input: for connecting the screen of the 2-wire cable (earth)

13.) SIMOCODE-DP input: for direct connection of a PROFIBUS-DP 2-wire cable

111/112/113) Jumper
b.) 5/6, 7/8 Jumpers fitted at the factory for motorized operating mechanism for 3VF7

114) N conductor terminal for motorized operating mechanism for 3VF3 to 6
b.) 1) Motorized operating mechanism for 3VF7

115) Input for "OFF" command to motorized operating mechanism for 3VF3 to 6
b.) 3) Motorized operating mechanism for 3VF7

116) Input for "ON" command to motorized operating mechanism for 3VF3 to 6
b.) 2) Motorized operating mechanism for 3VF7

A1/A2.) SIMOCODE-DP input: for 230 V AC operational voltage

T1/T2.) (not connected), (external earth fault detection can be parameterized as an option)

AS.) Alarm switch for "Tripped“ signal

F1.) Back-up fuse for SIMOCODE-DP voltage supply (cf. SIMOCODE-DP manual)
Power consumption at 230 V AC: 5 VA

F2.) Back-up fuse for motorized operating mechanism
Fuse links gl/gA 6 A; quick-response 10 A or 1.6 A miniature circuit-breaker
Use C characteristic.
Rated continuous current 5 A, simultaneity factor of 100 %

HS.) Auxiliary switch for indicating circuit-breaker state

Note: Any of the SIMOCODE-DP inputs and outputs which are not connected can be parameterized by the customer as required.

2.1.5 Selection and ordering data

The possible combinations for communication-capable 3VF circuit-breakers (40 kA, 415 V, 3-pole, fixed-mounted) are listed with their order numbers in the table below. This will help you to quickly locate the most economical solution for the specified bus functions based on the prepared order numbers. The hardware and software required in addition to the circuit-breaker must be ordered separately.

Measuring range	Circuit-breaker, release "an", with HS and AS	Motorized op. mech. for ON/OFF 220 - 240 V AC	SIMOCODE-DP (230 V AC)
25 - 100 A	3VF3 111-1BQ41-0AN1	3VF9 323-1ME10	3UF5021-3BN00-1
50 - 200 A	3VF3 311-1BX41-0AN1	3VF9 323-1ME10	3UF5031-3BN00-1
125 - 250 A	3VF4 211-1BM41-0AN1	3VF9 423-1ME10	3UF5041-3BN00-1
125 - 400 A	3VF5 211-1BM41-0AN1	3VF9 523-1ME10	3UF5041-3BN00-1
125 - 500 A	3VF6 211-1BK44-0AN1	3VF9 623-1ME10	3UF5041-3BN00-1
200 - 630 A	3VF6 211-1BM44-0AN1	3VF9 623-1ME10	3UF5051-3BN00-1
200 - 800 A	3VF7 111-1BK60-0AN1	3VF9 723-1NE30	3UF5051-3BN00-1

Note:
Standard circuit-breaker and SIMOCODE-DP devices are used for the purposes of the overview. These can be controlled directly from SIMOCODE-DP in the case of motorized operating mechanisms with a rated voltage of 230 V.

If control voltages < 230 V are required for motorized operating mechanisms, additional auxiliary contactors (relays) must be used, as the relay contacts of SIMOCODE-DP (max. load rating 5 A) can be overloaded or damaged due to the increased current input.

Notes on the parameter file

The supplied parameter file containing defaults is intended for standard applications and can be customized at any time. All the functions of the SIMOCODE-DP device can be exploited in full.

The following functions are pre-parameterized and are transferred via PROFIBUS-DP.

Switching the circuit-breaker ON/OFF using the motorized operating mechanism via PROFIBUS-DP only
If the ON and OFF commands are issued simultaneously, only the OFF command is switched through.
Note: The 3VF circuit-breaker trips in the event of an overload or short-circuit and must be RESET by issuing the OFF command. Only then can the circuit-breaker be switched on again.

Display of the actual phase current in the highest loaded phase
The default setting current values of 80 % and 120 % are set for the lower and upper current limits respectively.

Display: 3VF has tripped due to overload or short-circuit

Display: 3VF ON/OFF

2.1.6 Parameter file

Selection:	**Assignment:**	**Notes, Codes:**
General:		
Order number	= 3UF5001-3BN00-1	Customer selection (230 V version here)
Current range	= 1.25 - 6.3 A	(Customer selection)
Output response	= monostable	(Customer selection)
Outputs/Inputs	= Earth fault (external)	Not assigned
Family	= Switchgear	
DP slave type	= SIMOCODE-DP	
Designation	= 3VF communication	
Comment	= ' '	
PROFIBUS address	= 8	Customer selection
Baud rate	= 1.5 Mbaud	Customer selection
Motor Protection:		
Response in event of overload	= Warn	
Tripping characteristic	= CLASS 30	
Motor type	= Three-phase	
Reset	= Auto	
Blocking threshold	= 500 %	
Recovery time	= 00:00.0	
Idle time	= 00:00.0	
Set current Ie1	= ?? A	Rated or setting current for 3VF, to be defined by customer.
Set current Ie2	= 0.00 A	
Upper current limit:		DS 130 Par 38
Value	= 120 %	Default setting (can be changed by customer)
Response	= Warn	
Lower current limit:		DS 130 Par 39
Value	= 80 %	Default setting (can be changed by customer)
Response	= Warn	
Sensors:		None
Sensor type	= No sensor	
Short-circuit monitor	= No	
Response of binary PTC	= Shutdown	
Analog switch-off threshold	= 0 ohm	
Analog warning threshold	= 0 ohm	
Internal ground fault detection	= Yes	
External ground fault detection	= No	
Response of ground fault detection	= Warn	
Motor:		
Control function	= Overload relay	
Run-time	= 00:00.0	
CS-time	= 00:00.0	
Locking time	= 00:00.0	
CSC - Check-back signal closed	= Not connected	
CSO - Check-back signal open	= Not connected	
TC - Torque closed	= Not connected	
TO - Torque open	= Not connected	

Control Stations:

Inching mode	= Off
Local ON 1	= Not connected
Local OFF	= Basic unit, input 3
Local ON 2	= Basic unit, input 2
DP ON 1	= DP bit 0.0
DP OFF	= DP bit 0.1
DP ON 2	= DP bit 0.2
Control and observe station ON1	= Not connected
Control and observe station OFF	= Not connected
Control and observe station ON 2	= Not connected
Operator panel ON1	= Not connected
Operator panel OFF	= Not connected
Operator panel ON 2	= Not connected
Control function ON1	= Group control station on 1
Control function OFF	= Group control station off
Control function ON 2	= Group control station on 2
Changeover switch S1	= Not connected
Changeover switch S2	= Not connected

Operator Enabling:

Changeover switch S1	= Not connected
Changeover switch S2	= Not connected
Mode 1: S1=0, S=0	
LOS-On	= free
LOS-Off	= free
DP-On	= Disabled
DP-Off	= Disabled
CaO-On	= Disabled
CaO-Off	= Disabled
OP-On	= Disabled
OP-Off	= Disabled
Mode 2: S1 = 0, S2 = 1	
LOS-On	= free
LOS-Off	= free
DP-On	= Disabled
DP-Off	= Disabled
CaO-On	= Disabled
CaO-Off	= Disabled
OP-On	= Disabled
OP-Off	= Disabled
Mode 3: S1 = 1, S2 = 0	
LOS-On	= Disabled
LOS-Off	= Disabled
DP-On	= Disabled
DP-Off	= Disabled
CaO-On	= free
CaO-Off	= free
OP-On	= Disabled
OP-Off	= Disabled
Mode 4: S1 = 1, S2 = 1	
LOS-On	= Disabled
LOS-Off	= Disabled
DP-On	= free
DP-Off	= free
CaO-On	= Disabled
CaO-Off	= Disabled
OP-On	= Disabled
OP-Off	= Disabled

Function Blocks

CSC - Check-back signal test	= Not connected	
OPO - Operating protection off	= Not connected	
RDY - Ready for closing	= Not connected	
External fault 1	= Not connected	
External fault 2	= Not connected	
External warning	= Not connected	
Emerg. start	= Not connected	
External diagnostics	= Not connected	
External check-back signal 1	= Basic unit, input 4	Display: 3VF "Tripped“ (AS)
External check-back signal 2	= Basic unit, input 3	Display: 3VF "ON" (HS)
External check-back signal 3	= Basic unit, input 2	Display: 3VF "OFF" (HS)
Test 1	= Not connected	
Test 2	= Not connected	
Reset 1	= Not connected	
Reset 2	= Not connected	
Reset 3	= Not connected	
UVO - Undervoltage off	= Not connected	
Grading time	= 00:00.0	
T-UVO - Undervoltage off time	= 00:00.0	

Basic Unit:

Relay output 1	= Timer 1	3VF motorized op. mech. ON
Relay output 2	= Timer 2	3VF motorized op. mech. OFF
Relay output 3	= Not connected	
Relay output 4	= Not connected	

Expansion Module: Not parameterized

Relay output 1	= Not connected
Relay output 2	= Not connected
Relay output 3	= Not connected
Relay output 4	= Not connected

Operator Panel: Not parameterized

LED 1 green	= Not connected
LED 2 green	= Not connected
LED 3 green	= Not connected
LED 1 yellow	= Not connected
LED 2 yellow	= Not connected
LED 3 yellow	= Not connected

Timer 1: ON command for 3VF motorized operating mechanism (2s)

Value	= 00:02.0
Type	= Making pulse contact
Input	= Signal matching 1

Timer 2: OFF command for 3VF motorized operating mechanism (2s)

Value	= 00:02.0
Type	= Making pulse contact
Input	= Signal matching 2

Counter 1:

Value	= 0
Input	= Not connected
Reset	= Not connected

Counter 2:

Value	= 0
Input	= Not connected

Reset	= Not connected	

Truth Table 1: 3I1O

I1 I2 I3	= 111 = 0	
I1 I2 I3	= 011 = 0	
I1 I2 I3	= 101 = 0	
I1 I2 I3	= 001 = 1	
I1 I2 I3	= 110 = 0	
I1 I2 I3	= 010 = 0	
I1 I2 I3	= 100 = 0	
I1 I2 I3	= 000 = 0	
Input I1	= Basic unit, input 3	Auxiliary switch
Input I2	= Basic unit, input 4	Alarm switch
Input I3	= Truth table 2: 3I1O	

Truth Table 2: 3I1O

I1 I2 I3	= 111 = 0	
I1 I2 I3	= 011 = 0	
I1 I2 I3	= 101 = 0	
I1 I2 I3	= 001 = 0	
I1 I2 I3	= 110 = 0	
I1 I2 I3	= 010 = 0	
I1 I2 I3	= 100 = 1	
I1 I2 I3	= 000 = 0	
Input I1	= DP bit 0.2	
Input I2	= DP bit 0.1	
Input I3	= Constant 0	

Truth Table 3: 3I1O

I1 I2 I3	= 111 = 1	
I1 I2 I3	= 011 = 1	
I1 I2 I3	= 101 = 1	
I1 I2 I3	= 001 = 0	
I1 I2 I3	= 110 = 0	
I1 I2 I3	= 010 = 0	
I1 I2 I3	= 100 = 0	
I1 I2 I3	= 000 = 0	
Input I1	= Basic unit, input 3	
Input I2	= Basic unit, input 4	
Input I3	= DP bit 0.1	

Truth Table 4: 5I2O	= Not connected

Flash Function 1:

Input	= Not connected

Flash Function 2:

Input	= Not connected

Flash Function 3:

Input	= Not connected

Flicker Function 1:

Input	= Not connected

Flicker Function 2:

Input	= Not connected

Flicker Function 3:

Input	= Not connected

Signal Matching 1:

Type	= Rising edge
Input	= Truth table 1: 3I1O
Reset	= Signal matching 3

Signal Matching 2:

Type	= Rising edge
Input	= Truth table 3: 3I1O
Reset	= Signal matching 4

Signal Matching 3:

Type	= Falling edge
Input	= Timer 1
Reset	= Signal matching 3

Signal Matching 4:

Type	= Falling edge
Input	= Timer 2
Reset	= Signal matching 4

Elements non resetting on voltage failure:

Type	= Rising edge
Input	= Not connected
Reset	= Not connected
Type	= Rising edge
Input	= Not connected
Reset	= Not connected

Fault Recovery:

PLC failure bit	= DP bit 0.7
Response in event of 3UF50 CPU failure	= Off
Response in event of control voltage failure	= Off
Response in event of PROFIBUS-DP failure	= Off
Response in event of PLC-CPU failure	= Off

Bus PROFIBUS-DP:

Reduced diagnostic message	= No	
Parameter block	= Yes/No	System-specific
Operating Mode	= DP-V1	
DP process data:		
Format	= Basic type 2	
Byte 0:		
Bit 0	= Basic unit, input 2	HS: 3VF "ON": DS 130 Par 28
Bit 1	= Basic unit, input 3	HS: 3VF "OFF": DS 130 Par 29
Bit 2	= Basic unit, input 4	AS: 3VF "Tripped": DS 130 Par 27
Bit 3	= Not connected	
Bit 4	= Not connected	
Bit 5	= Not connected	
Bit 6	= Not connected	
Bit 7	= Not connected	
Byte 1:		
Bit 0	= Not connected	
Bit 1	= Not connected	
Bit 2	= Not connected	
Bit 3	= Not connected	
Bit 4	= Not connected	
Bit 5	= Ext. check-back signal 1	DS 130 Par 27
Bit 6	= Ext. check-back signal 2	DS 130 Par 28
Bit 7	= Ext. check-back signal 3	DS 130 Par 29
Hard-wired:		
Byte 2/3:	= Actual phase current as %	DS 131 Par 7
Input delay:		
Inputs basic unit	= 18 ms	
Inputs expansion module	= 36 ms	

LEGEND:
DS: Data set
Par: Parameter
HS: Auxiliary switch
AS: Alarm switch

2.2 Technical data

a) For SIMOCODE-DP

Basic unit 3UF	
Permissible ambient temperature	-25 °C to +60 °C
Degree of protection to IEC 529	IP 20
Mounting position	Arbitrary
Main circuit	
Rated insulation voltage U_i	690 V (with pollution severity 3)
Rated operational voltage U_e	690 V for bare/uninsulated conductors (3UF5001 to 3UF5021)
Rated frequency, current type	50 Hz/60 Hz, 3-phase
Auxiliary circuit/control circuit	
Rated control supply voltage U_s	AC 50/60 Hz, 115 V/230 V, 24 V DC
Power consumption	AC 50/60 Hz, 5 VA, 24 V DC, 5 W
Outputs (Relays)	
Rated continuous current	5 A

b) For motorized operating mechanisms of 3VF circuit-breakers

Motorized op. mech. for		3VF3	3VF4	3VF5
Power consumption	W	200	200	200
Rated control voltage U_s	AC 50/60 Hz V V DC	- 42 24 48	--- 60	110/127 110
Back-up fuse or miniature circuit-breaker	A	10 6	6	6
Minimum command duration at U_s	s	1	1	1

Motorized op. mech. for		3VF6	3VF7
Power consumption	W	300	1000
Rated control voltage U_s	AC 50/60 Hz V V DC	220/240 220	110/127 220/240 48 ---
Back-up fuse or miniature circuit-breaker	A	6	25 16 at 32 A DC
Minimum command duration at U_s	s	1	0.5

Please refer to the SIMOCODE-DP manual and the "Switchgear and Systems" catalog for further technical data.

2.3 Supplementary literature on 3VF communication

ESSENTIAL REQUIREMENT:

3UF57 System Manual: "Detailed Description of SIMOCODE-DP device and PROFIBUS-DP, including System Files"

Order number: 3UF57 00-0AA00-0 (German)
3UF57 00-0AA00-1 (English)

3 3WN6 circuit-breakers

3.1 Mode of operation and design

3.1.1 General mode of operation of 3WN6 circuit-breaker communication via PROFIBUS-DP

The 3WN6 circuit-breaker is communication-capable when fitted with an overcurrent release version D, E/F, H, J/K, N or P together with "additional functions 2" and a communication module (order supplement Z=F01). Overcurrent releases N and P can also be fitted with a communication module with measurement functions instead of the simple communication module (order supplement Z=F05). This module offers an extended range of functions (cf. **Fig. 3, page 26**).
The connection of the 3WN6 circuit-breaker to PROFIBUS-DP is implemented by means of the DP/3WN6 interface module. The information available on the overcurrent release is transferred to the interface via the 3WN6 communication module (Z=F01) or the communication module with measurement functions (Z=F05). The interface then translates these 3WN6 signals to the PROFIBUS protocol. The interface similarly translates all the control and parameter signals which are sent from the bus master to 3WN6 via PROFIBUS from the PROFIBUS protocol to the 3WN6-specific protocol.
Following the initial connection of 3WN6 to PROFIBUS-DP (see section **3.3, page 31**), the user has no further tasks to perform, i.e. communication is automatic.

3.1.2 Hardware and software requirements

The following hardware and software items are required in order to communicate with 3WN6 via PROFIBUS-DP (cf. **Fig. 3, page 26**):

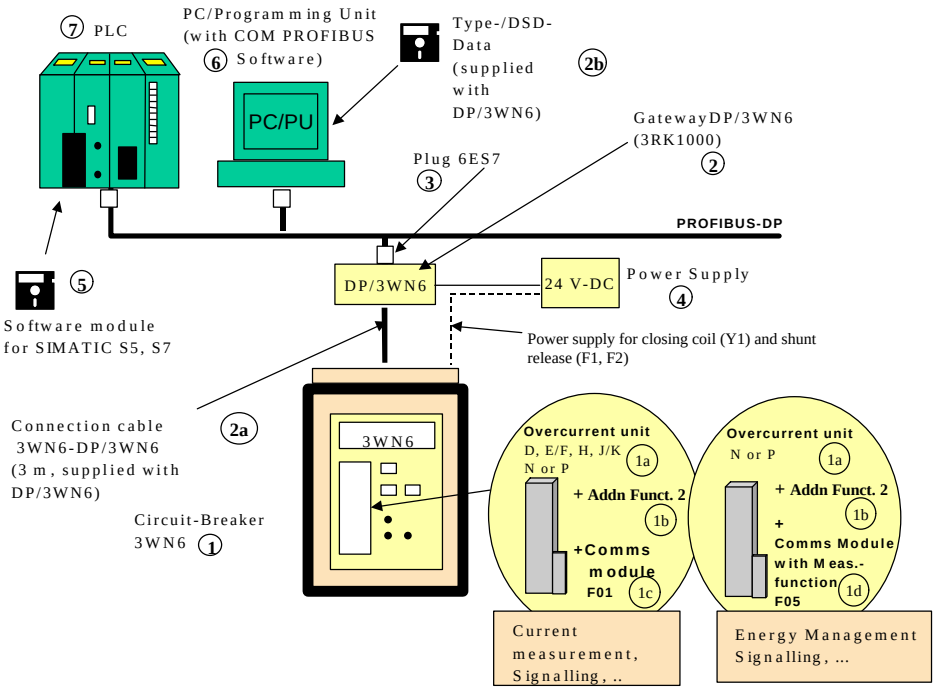


Fig. 3: System components

Hardware:

☐ -**Communication-capable circuit-breaker 3WN6 (no. 1)**: Overcurrent releases D, E/F, H, J/K, N or P **(no. 1a)** are communication-capable when fitted with "additional functions 2". **(no. 1b)**. Unlike a standard 3WN6, a communication-capable 3WN6 circuit-breaker has a communication module **(no. 1c).** When additional measurement functions are required (e.g. voltage, frequency, power), a communication module with measurement functions **(no. 1d)** must be ordered instead of the simple communication module. (Please refer to section **3.2, page 28** and **section 3.1.1, page 37** for a description of the functionality of the overcurrent release when combined with a communication module/communication module with measurement functions.)

-**Order number:**[6]
- The type of overcurrent release ("D"..."P") can be determined from position 10 of the circuit-breaker order number; enter a "7" in the eighth position of the order number if the circuit-breaker is to be fitted with "additional functions 2".
- The order number supplement for the communication module is "Z=F01".
- The order number supplement for the communication module with measurement functions is "Z=F05" instead of "Z=F01".
  Example: For a draw-out circuit-breaker, complete with guide frame with overcurrent release "P", "additional functions 2" and a communication module with measurement functions, the order number is **3WN6 .....-*7.P*....-....-Z with Z=F05 +...**

Note 1: If the draw-out circuit-breaker and guide frame are ordered *separately*, 2 order numbers are required. In the case of a draw-out circuit-breaker without a guide frame, the sixth position of the order number is "7":

Circuit-breaker order number:	**3WN6.*7*.-7….-….-Z with Z=F01 or F05**
Frame order number:	**3WX3683-.A..0-Z <u>with *Z=R39*</u> + ...**

Note 2: The position signaling switches cannot be ordered separately with communication-capable draw-out circuit-breakers. They are included in the scope of supply and are located on the position display unit (bottom right) of the circuit-breaker.

Note 3: In order to remotely close a circuit-breaker via PROFIBUS, the circuit-breaker must be fitted with a motorized operating mechanism and closing solenoid (Y1). To remotely open a 3WN circuit-breaker via PROFIBUS, the circuit-breaker must be fitted with a shunt release of the type F1 or F2. The possible switching commands are illustrated in **Fig. 5, page 32** and **Fig. 6, page 32**, Step 2.

☐ - One **DP/3WN6 interface module** for each 3WN6 circuit-breaker **(no. 2)**.[7]

Order number: **3RK10 00-0JC80-0BA1**

☐ - **A connecting cable** from the SUB-D socket on the **DP/3WN6 interface module** to the SUB-D socket of the 3WN **circuit-breaker (no. 2a).** This cable is a standard 9-pole cable (1:1 connection) with a length of **3m** and is supplied with the interface.

☐ - Connection from the **"PROFIBUS-DP"** terminal of the **DP/3WN6 interface module to PROFIBUS-DP (no. 3)**. Two standard connectors are available for this purpose:

Order number: **6ES7 972-0BB20-0XA0**
(for baud rates up to 12 Mbaud)

☐ - **24 V DC voltage supply** (in acc. with DIN 19240; **no. 4**).

Order number: **4AV2... or 4AV3...**
(See NSK catalog, section 16).

[6] cf. **Table 3**, page **30** for examples of circuit-breaker order numbers.
[7] Interface "DP/3WN6" was previously also referred to as interface "DP/RS485" and "kNS/DP".

Software:

☐ - **3.5" diskette with type/GSD file** for the software connection of 3WN6 to PROFIBUS-DP (bus configuration). This diskette **(no. 2b)** is supplied with the interface. **Step 6, page 34** outlines which file is to be used for which master.

☐ - Bus master software for communication control. In order to communicate with the SIMATIC S5/S7 as bus master, a **standard software block (no. 5)** is required (see page 59 for a description of this module):

Order number: **3RK1800-0AA00-0AA0**

For the initial connection of a 3WN6 circuit-breaker to PROFIBUS-DP, the following hardware and software components are additionally required:[8]

☐ - **A programming device** (e.g. PG 740), or PC with the appropriate software (e.g. STEP 5) **(no. 6)**

☐ - **COM-PROFIBUS (no. 7)** for the 3WN6 software interface (bus configuration) to PROFIBUS-DP.

3.2 Bus connection functionality

3WN6 **output data** can be read via PROFIBUS-DP:

- Circuit-breaker key data (e.g. circuit-breaker type/size, overcurrent release version)
- Operational states (e.g. switching state, "Tripped" signals, processor status)
- Operational data (e.g. actual phase current I_{L1})[9]
- Protection parameters (e.g. setting current I_r for overload release)

... and **input data** can be written to the **circuit-breaker**:

- Execute switching action (switch circuit-breaker ON or OFF)
- Set protection parameters (e.g. setting current I_r for overload release)
- Set additional functions (e.g. switch phase sensitivity ON/OFF)

[8] With SIMATIC S5 as master. Use appropriate hardware and software components specified by the supplier for other, especially non-Siemens, masters.

[9] Because of the way current transformers work, only currents at the communication module (Z=F01) which are greater than 18 % of the rated circuit-breaker current (I_n) are displayed on the release or transferred via the bus. I = 0 applies below 18 %. Transfer always takes place in the case of the communication module with measurement functions (Z=F05). The measuring accuracy (above 18 % I_n) is +/-5 % of the measured value for the communication function (Z=F01) and +/-3 % of the measured value for the measurement function (Z=F05). Below 18 % I_n. (at the measurement module), the measured values are not identified due to "noise".

In order to guarantee optimum data transfer times, the large volume of 3WN6 input and output data is divided into two transfer modes on PROFIBUS-DP: cyclic and acyclic transfer modes:

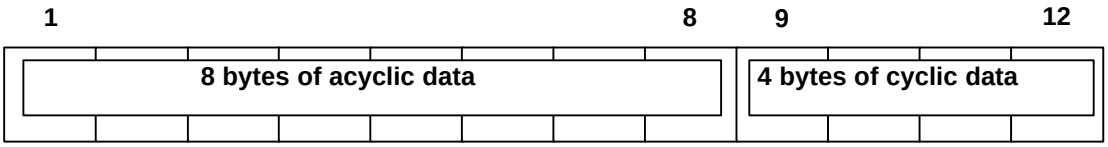


Fig. 4: 12-byte I/O channel for 3WN6

1. Cyclic data traffic: cyclic data (e.g. actual maximum phase current I_{Lmax}) correspond to basic information which is transferred at regular intervals. Important information from the circuit-breaker is automatically transferred from the DP/3WN6 interface to the I/O area of the bus master in this way. Similarly all the important (cyclic) data contained in the I/O area of the bus master are also transferred to the circuit-breaker.
   Cyclic 3WN6 input data include, for example, the setting current value for overload releases (setting current I_r), as well as the circuit-breaker remote ON/OFF command. *Cyclic output data from 3WN6* include the switching state of the circuit-breaker (ON/OFF), the 3WN6 ready-to-close signal, as well as various group signals (group fault signal, group warning signal, group error signal) which can indicate whether a fault (e.g. trip due to overload), a warning (e.g. current warning) or a processor error is present.

2. Acyclic data traffic: Acyclic data are only transferred from the interface to the bus master or from the bus master to the circuit-breaker when a request is transmitted. This means that specific messages are sent from the bus master to the 3WN circuit-breaker when required.
   Acyclic data from 3WN6 (i.e. data which are requested given certain conditions) include, for example, the position state of the circuit-breaker (e.g. test or connected for draw-out circuit-breaker). In order to determine the cause of a group signal, for example, (see above), the actual cause is determined by means of an acyclic message. In the case of a group fault, for example, it is possible to determine whether the cause is due to a "g" release (earth fault), a "z" release (delayed short-circuit), an "n" release (instantaneous short-circuit), or whether there was another cause for the release.
   Acyclic data written to 3WN6 include, for example, the setting values for "z" release, "n" release or current phase imbalance. When used in conjunction with a communication module with measurement functions (Z=F05), additional setting values can be written, e.g. undervoltage release, overvoltage release or load shedding signals.

The **message list in section 3.4, page 37** describes in detail the functionality of the various overcurrent releases on PROFIBUS-DP. This will allow the user to select the required overcurrent release together with the correct communication module (Z=F01) or communication module with measurement functions (Z=F05). In addition, the message list contains the information required for handling the acyclic data traffic in the bus master.

Table 3, page 30 lists a number of standard versions of communication-capable 3WN6 circuit-breakers (3-pole) and their order numbers. The table can be used to look up the most economical solution for obtaining the required bus functions. Ordering details for the hardware and software which is required in addition to the circuit-breaker can be found in **section 3.1.2, page** 26.
Note: The recommended versions are based on standard applications using 3-pole circuit-breakers. Please refer to the catalog "Products and Systems for Non-Fused Energy Distribution (NS PS)" for further details.

			Standard versions for communication-capable 3WN circuit-breakers (3-pole)		
	Required 3WN6 functionality on PROFIBUS-DP		**1**	**2**	**3**
A	Read current values I_{L1}, I_{L2}, I_{L3} Event signals (reason for last trip) and operational state of circuit-breaker (circuit-breaker ON/OFF) Switch circuit-breaker ON/OFF via bus		**X**	**X**	**X**
B	Remote configuration of 3WN6 setting values and protection parameters		**-**	**X**	**X**
C	Acquisition of measured values and parameterization of setting values for energy management [10]		**-**	**-**	**X**
	Overcurrent release version (Enter in ☐ of order number)	Without earth fault protection	D	H	N
		With earth fault protection	E	J	P
	Order number:		**3WN6..1-7. ☐51-1BA1-Z with Z=F01** **3WN6..1-7. ☐51-1BA1-Z with Z=F05**		

Table 3: Order numbers for standard versions

[10] These values include the *setting values* for voltage phase imbalance, direction of power flow, overfrequency, underfrequency, overvoltage and undervoltage, as well as the *measured values* for active power, reactive power, apparent power, power factor, frequency and phase voltage.

3.3 Procedure for connection to communication system

3WN6 is connected to PROFIBUS-DP in 8 steps: [11]

Step 1: Check that all the system components are fitted
Step 2: Check the system requirements
Step 3: Connect DP/3WN6 to PROFIBUS-DP
Step 4: Connect DP/3WN6 to 3WN6
Step 5: Connect DP/3WN6 to voltage supply
Step 6: Bus configuration
Step 7: Set bus address on DP/3WN6 interface module
Step 8: Programming of bus master and data visualization

Step 1: Check that all the system components are fitted

Check that all the following system components are fitted before connecting 3WN6 to PROFIBUS-DP: (cf. **section 3.1.1, page 26**):

☐ Communication-capable 3WN6 circuit-breaker

☐ DP/3WN6 interface module and connecting cable from interface module to circuit-breaker (supplied with DP/3WN6)

☐ Connector (6ES7) including terminating resistor for connecting interface module to PROFIBUS-DP

☐ 24 V DC voltage supply (DIN 19240)

☐ Diskette with type or GSD file (supplied with DP/3WN6)

☐ Software with standard software block

☐ Programming device PG ... (for SIMATIC S5/S7, or other appropriate hardware)

☐ COM-PROFIBUS software (for SIMATIC S5, or other appropriate software)

Step 2: Check the system requirements

The second step involves checking the following three requirements for connecting 3WN6 to PROFIBUS-DP:

☐ The communication-capable 3WN6 circuit-breaker must be installed and wired in accordance with the user guide.
(When testing a *draw-out* circuit-breaker, this should be in the test position. For normal operation, it should be in the connected position). When wiring, please ensure that the jumper arrangements on the auxiliary connectors are correct (cf. **Fig. 5, page 32** and **Fig. 6**, **page 32**).

☐ The PROFIBUS-DP master must be present and operational.

[11] This procedure must be performed for each individual 3WN6 circuit-breaker.

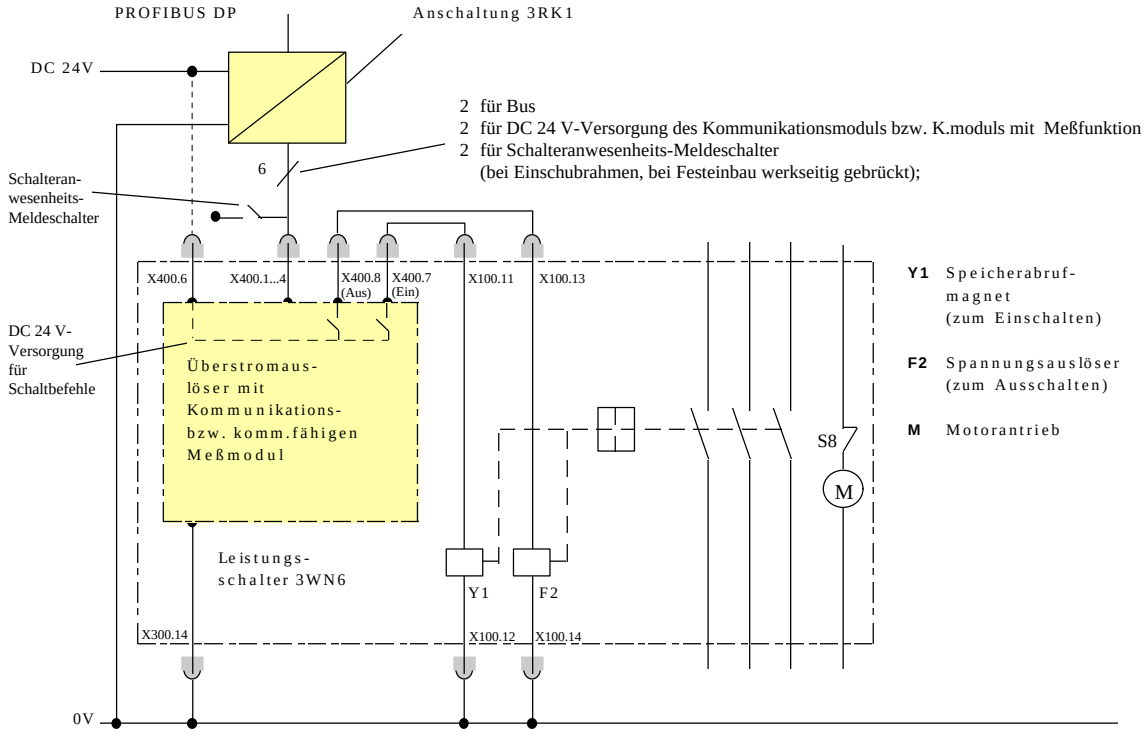


Fig. 5: Conversion of switching commands (ON/OFF) for 24 V DC control voltage

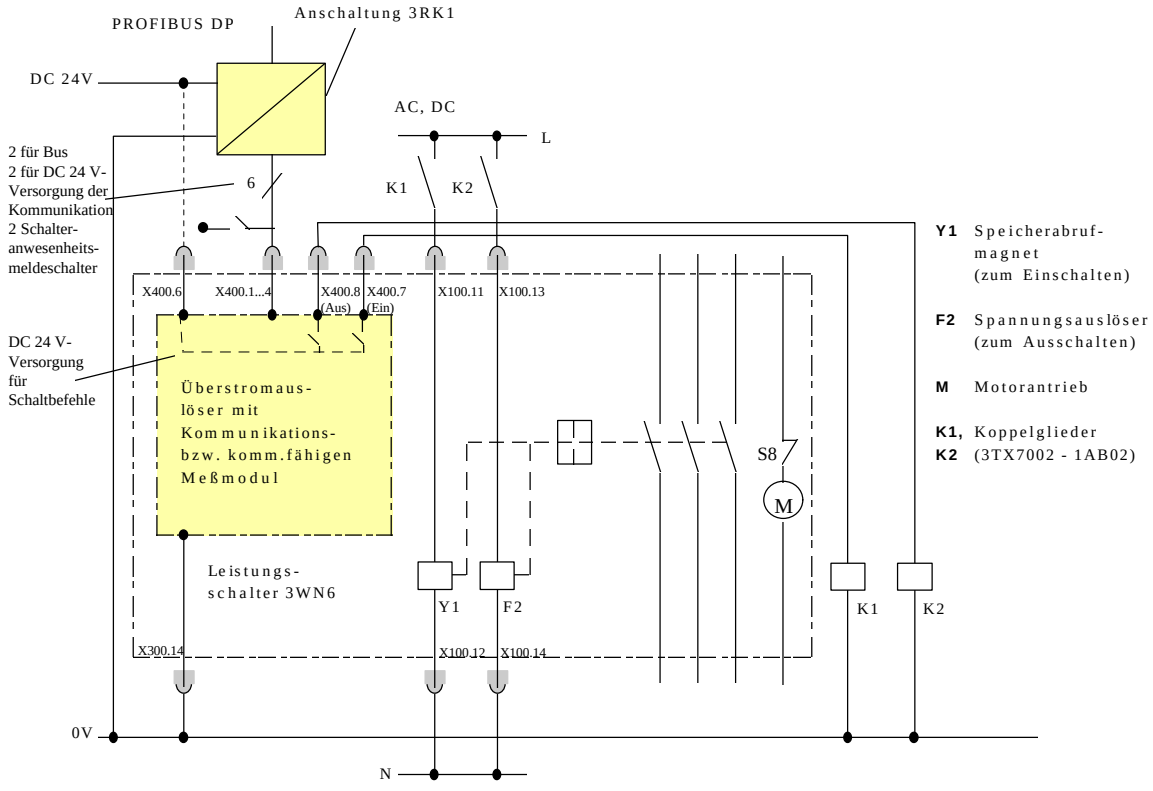


Fig. 6: Conversion of switching commands (ON/OFF) for other control voltages (e.g. 230 V AC)

☐ The DP/3WN6 interface module must be correctly installed and connected (cf. user guide):
The compact housing of the interface module is 70 mm wide and can simply be snapped onto a 35 mm DIN rail (the interface module must not be mounted directly above the 3WN6 arcing space, unless suitable covers have been fitted). The devices can be mounted side by side.
The earth connection of the interface module (shield signal for electronic circuit) is made using an earth wire (2.5 mm^2) and an earth terminal (order no. 8WA1001-1PF00) which is mounted on the DIN rail immediately next to the interface module.
The cable screen of the 3WN6-DP/3WN6 connecting cable must also be earthed between the interface module and 3WN6, e.g. by connecting it to the DIN rail, in order to comply with interference emission standard EN 55022:1994, limit class A.
The standard length of connecting cable 3WN6-DP/3WN6 between the 3WN6 circuit-breaker and the DP/3WN6 interface module is 3 m.
Please refer to page 89 for detailed information on the DP/3WN6 interface (technical data, design, screening).

Step 3: Connect DP/3WN6 to PROFIBUS-DP [12]

Now you can wire connector 6ES7... (up to 12 Mbaud) to the PROFIBUS-DP cable (cf. connector user guide). Then plug the wired connector into the "PROFIBUS-DP" socket on the interface module.

Step 4: Connect DP/3WN6 interface module to 3WN6 circuit-breaker

Connection of 3WN6-DP/3WN6 connecting cable: This cable is supplied with the interface and is plugged into the 3WN6-DP/3WN6 adapter (9-pin SUB-D socket), which is fitted on the circuit-breaker at the factory, and into the "DP/3WN6" (9-pin SUB-D) socket on the front of the interface module.

Note: All communication-capable circuit-breakers (fixed-mounted), and all communication-capable guide frames (for draw-out circuit-breakers) are fitted with a 3WN6-DP/3WN6 adapter at the factory. This 3WN6 adapter can also be ordered as a *spare part* using the following order numbers:

- Adapter 3WN6-DP/3WN6 (0.4 m) for 3WN6 fixed-mounted circuit-breaker, comprising one SUB-D socket and free cable ends, and including mounting materials.
  Order number: 3WX3645-3JA00
- Adapter 3WN6-DP/3WN6 (0.4 m) for 3WN6 draw-out circuit-breaker, comprising one SUB-D socket and free cable ends, and including microswitch (circuit-breaker detection signaling switch) and mounting materials.
  Order number: 3WX3645-3JB00

[12] This assumes that conventional copper conductors are used for PROFIBUS-DP. If fiber optic conductors are used, converters from fiber optic to copper conductors must be fitted.

Step 5: Connect DP/3WN6 interface module to voltage supply

Connect the 24 V DC voltage supply (DIN 19240) to the interface module: The interface module is fitted with a 4-pole screw terminal to facilitate the through connection of the 24 V supply.

Note: In order to switch the 3WN6 circuit-breaker ON and OFF via PROFIBUS-DP, a 24 V DC supply must be connected to auxiliary plug X400.6 (cf. **Fig. 5**, **page 32** and **Fig. 6**, **page 32** in Step 2). For all other functions (monitoring, remote parameterization), the 24 V DC supply to the interface module is sufficient for supplying the communication electronics of the circuit-breaker.

Step 6: Bus configuration

If SIMATIC S5 is the bus master, the bus can be configured quickly and easily using either a PC or a SIMATIC programming device (PG) in conjunction with the COM-PROFIBUS or COM 5431 programs. In the case of other bus masters, the appropriate devices and/or supplier-specific tools must be used.
The object of bus configuration is to define the 3WN6 device data, the 3WN6 bus address and the 3WN6 data area (I/O area) in the bus master. The 3WN6 device data can be read into the master in the form of type or GSD files. The following list outlines which file is required for which master:

File allocation list:[13]

si8032td.200:	Type file (German) "COM-PROFIBUS" tool Standard scope **for Siemens master (S5-IM308B)**
si8032ad.200:	Type file (German) "COM-PROFIBUS" tool Extended standard scope **for Siemens master (S5-IM308C and S7)**
siem8032.gsd:	GSD file (device data) Standard scope **for standard DP master**

Step 7: Set bus address on DP/3WN6 interface module

The bus address defined for 3WN6 in Step 6 can be set on the front panel of the DP/3WN6 interface module by means of 2 rotary switches (range 00 - 99). The rotary switch on the left (x10) sets the tens and the rotary switch on the right (x1) sets the units for the address.
The baud rate cannot be set on the interface. It is automatically adjusted in line with the baud rate of the bus master (e.g. SIMATIC S5).[14]

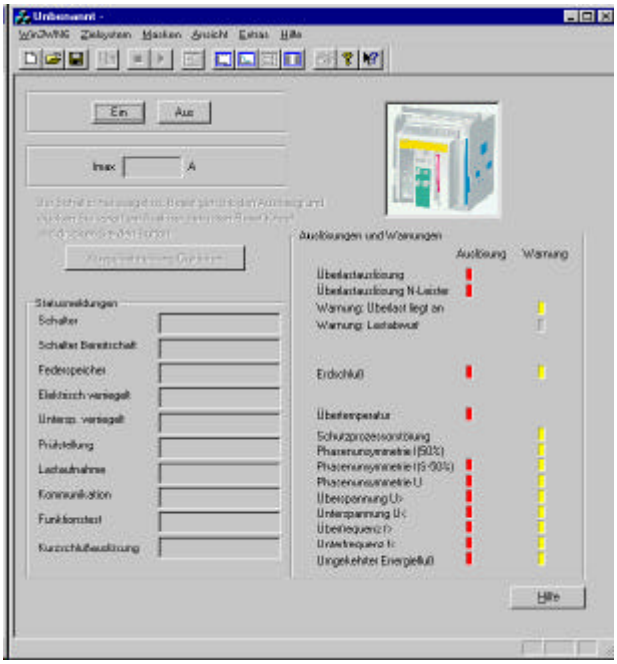
Note: The communication connection to the circuit-breaker is automatically set up when the DP/3WN6 interface module is connected to the voltage supply. This power supply also activates the circuit-breaker overcurrent release (in the case of draw-out circuit-breakers in the connected and test positions). This permits the functionality of the slave "3WN6 circuit-breaker" to be checked and guaranteed. In the case of *draw-out* circuit-breakers in the *disconnected* position, the circuit-breaker state is detected using a separate microswitch (circuit-breaker detection signaling switch S20) in the guide frame. This is then signaled to the operational DP/3WN6 interface (see also DP/3WN6 user guide) in the form of a diagnostic message. Communication with the 3WN6 via the bus is not possible in this case. The presence of the circuit-breaker is merely checked.

[13] The type and GSD files are also available under the following modem number: 0911-737972
[14] The maximum possible baud rate corresponds to the maximum baud rate of the slowest field device.

Step 8: Programming of bus master and data visualization

The last step is to provide software for the bus master which enables it to communicate with the circuit-breaker. The cyclic data of 3WN6 (cf. **section 3.2, page 28**) can be read and written directly in the cyclic part of the defined I/O area (bytes 9 - 12) of the bus master (see Step 6). Acyclic data (cf. page **37** ff.) are transferred as the result of a message request in the acyclic part of the I/O area (bytes 1 - 8), which issues the appropriate command to 3WN6. The 3WN6 message requests are listed in full and explained on pages 37 ff.
In the specific case of SIMATIC S5 or S7, a standard software block is available for acyclic communication. This software can be adapted to the user-specific information and control requirements and automatically manages the acyclic data traffic between the 3WN6 and the SIMATIC S5/S7. Please refer to the section entitled "Description of software block required for utilizing communication functions with SIMATIC S5 and S7" for a detailed description of this SIMATIC S5/S7 software block. The example given for SIMATIC S5/S7 can also be used as the basis for the programming other PROFIBUS-DP bus masters.
The data in the master are now available for use by the customer. Some form of **visualization** with a user-friendly interface is generally implemented. The following standard programs are available to the customer for this purpose:

- **The Win3WN6[15] software** provides the user with the full functionality of the 3WN6 circuit-breaker, i.e. **start-up, operation and monitoring**, at an attractive price:
  - Data exchange with release types D, E/F, H, J/K, N, P
  - Capable of running under Windows 95 or Windows NT 4.0
  - Configurations: SIMATIC S5, S7 or PROFIBUS-DP compatible PC as master
  - Win3WN6 communicates with the circuit-breaker either via the RS-232 interface on the release (instead of the handheld operator panel) or via PROFIBUS-DP (with SIMATIC S5, S7 or a PC as bus master)
  - Overview of circuit-breaker state, "Tripped" signals (see screenshot)
  - Switching actions (password-protected)
  - Overview of operational data (e.g. phase currents)
  - Simple setting of protection parameters (password-protected)



Example of Win3WN6 screenshot

Most important advantage of Win3WN6: fast and economical use of circuit-breaker functions and convenient setting of protection parameters via the bus or via a local laptop connection.

[15] Shipping of Win3WN6 software starts in 07/98.

Note: The software block for SIMATIC S5, S7 described above is included in the scope of supply of Win3WN6.

- The new **"SICAM LCC"[16] software** makes **system visualization** possible for **low-voltage circuit-breakers 3VF, 3WN6, 3WN1, 3WS1 and the SIMOCODE-DP motor protection and control device**. It complements the Win3WN6 software, as it puts the system in the foreground. **SICAM LCC** permits the user to create a standard visualization interface on which he can view all the important information about the system devices on PROFIBUS-DP The software makes this procedure simple, fast and economical for the user. Customer-specific expansions of this standard visualization can be implemented at any time using WinCC standard software. **SICAM LCC** is used for small to medium-sized systems.

  Software features:
  - Capable of running under Windows 95 or Windows NT 4.0
  - Configurations: SIMATIC S5, S7 or PROFIBUS-DP compatible PC as master
  - Simply structured system overview (see diagram)
  - Detailed device displays with most important information
  - Calls for other device software (Win3WN6, Win-SIMOCODE)
  - Setting of device parameters (via Win3WN6, Win-SIMOCODE)
  - Measured value processing (Display of minimum, maximum, average etc.)
  - Event lists
  - Alarm lists
  - Printing, logging

Example of SICAM LCC screenshot

Once you have completed Step 8, the 3WN6 circuit-breaker is connected to the PROFIBUS-DP communication system. No further steps are generally required.

[16] Shipping of **SICAM LCC** starts in 10/98.

3.4 Displaying the data in the 3WN6 circuit-breaker

3.4.1 Addressing the 3WN6 functions on PROFIBUS-DP:

In order to guarantee optimum data transfer times, the large volume of 3WN6 input and output data is divided into two transfer modes on PROFIBUS-DP
(see **Fig. 7**, **page 37**):
- Cyclic transfer and
- Acyclic transfer

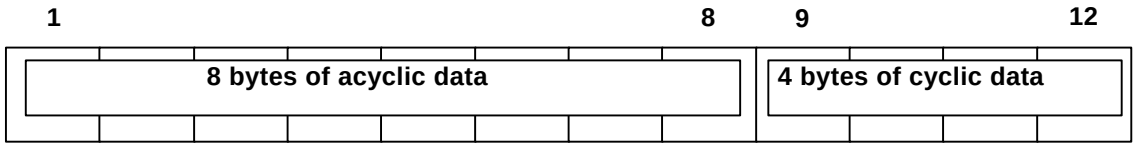


Fig. 7: 12-byte I/O channel for 3WN6

Cyclic data are automatically transferred at regular intervals between the 3WN6 circuit-breaker and the PLC. Acyclic 3WN6 data/functions, on the other hand, must be transferred/executed on PROFIBUS-DP when required by means of a message request. A message request is defined in the first 8 bytes (or octets) of the PLC I/O area. These message requests initiate execution of the various functions of the 3WN6 circuit-breaker. The structure of acyclic messages is illustrated in **Fig. 8** on page **37**.

Byte (octet)						
1 and 2	3	4	5 (= OS1)	6 (= OS2)	7 (= OS3)	8 (= OS4)
Parameter identifier	Parameter subindex		Parameter value (integer data value)			

Fig. 8: (Acyclic) message requests

The bytes (octets) relevant for the unique identification of the message request (= message address) are shown on pages 39 - 51. The bytes (octets) shown in Fig. 2 are delimited by commas (format: bytes 1 and 2, byte 3, byte 4, byte 5, byte 6, byte 7, byte 8). Only the relevant bytes are shown, e.g. reading the rated current of the circuit-breaker uses bytes (octets) 1 to 6 (message address = 500, 4, 0, 0, 0). Detailed **examples** of message requests can be found on page **54**, where you will also find a description of the request identifier, which must be used in addition to the message address in order to differentiate between read and write requests (request identifier + message address = complete message request).

The 3WN6 cyclic data on PROFIBUS-DP are handled directly in bytes (octets) 9, 10, 11 and 12 of the PLC I/O area. Specific message numbers are not required (see **Fig. 9**, **page 38** and **page 52**).

OCTET (Byte)	**3WN6 cyclic output data**		**3WN6 cyclic input data**	
9	High-order byte of status word	*Various signals*	High-order byte of main control word	*Direct control commands*
10	Low-order byte of status word		Low-order byte of main control word	
11	High-order byte of main actual value	*Current in max. loaded phase*	High-order byte of main setpoint	*Setting current* I_r
12	Low-order byte of main actual value		Low-order byte of main setpoint	

Fig. 9: Cyclic data transfer

Legend: Octet = Byte
(Bytes 5, 6, 7 and 8 are also referred to as octet strings = OS)

3.4.2 List of acyclic 3WN6 messages on PROFIBUS-DP

Message group 0					
M. no.	Designation	Message address [17]	Value range [18]	Value range [18]	Value range [18]
0:x	**Circuit-breaker key data**		Releases N and P	Releases H and J/K	Releases D and E/F
Note: Circuit-breaker key data, i.e. messages 0:1 to 0:21 are "read only" data.					
x =					
1	Test unit + delivery date	500, 1, 0, 0, 0	1 - 111194	-	-
2	Identifier number	500, 2, 0, 0, 0	0 - 99	-	-
4	Rated current of circuit-breaker	500, 4, 0, 22, 0	315 - 3200 A	315 - 3200 A	315 - 3200 A
5	Function test of release	500, 5, 0, 0, 0	0 - 3 [19]	0 - 3 [19]	0 - 3 [19]
11	Circuit-breaker size	502, 1, 0, 0, 0	1 - 2	-	-
12	Circuit-breaker type	502, 2, 0, 0, 0	2	-	-
13	No. of poles	502, 3, 0, 0, 0	3 - 4	-	-
14	Version of release unit (in ASCII code)	502, 4, 0, 0, 0	"N" or "P" (ASCII code)	"H" or "J" (ASCII code)	"D" or "E" (ASCII code)
15	Revision level of communication	502, 5, 0, 0, 0	(2 bytes: hardware + software)	(2 bytes: hardware + software)	(2 bytes: hardware + software)
16	Communication module version	502, 6, 0, 0, 0	11; 91 [20]	11 [20]	11 [20]
17	Revision level of release unit	502, 7, 0, 0, 0	(2 bytes: hardware + software)	(2 bytes: hardware + software)	(2 bytes: hardware + software)
21	Communication address	503, 1, 0, 0, 0	[21]	[21]	[21]

[17] The message addresses are shown as decimal numbers in the following; input must be in binary format.

[18] The value ranges shown here and on the following pages are transferred in the corresponding binary format.

[19] 0: System 0K; 1: Bus error; 2: CT recognition module error; 3: LCD error.

[20] 11: Communication functions (Z=F01 in order number); 91: Communication and measurement functions (Z=F05)

[21] Not supported at present.

Message group 1					
T-Nr.	Designation	Message address	Value range	Value range	Value range
1:x	**Circuit-breaker functions** (See pages 41 - 51 for details)		Releases N and P	Releases H and J/K	Releases D and E/F

x =					
0	Switching actions	721, ... [22)]	Write only (on = 1/off = 0)		
1	Circuit-breaker state	741, ... [22)]	Read only (on = 1/off = 0)		
2	"Tripped" signals	742, ... [22)]			
3	Warning signals	743, ... [22)]			
5	Processor status	745, ... [22)]			
8	Fault signals	748, ... [22)]			
11 - 51	Operational data	762 - 773 [22)]	Read values only		
61 - 108	Setting values/ Protection parameters	782-792 [22)]	Read and write (set) values; write depending on version of release unit		
111 - 112	Additional functions (1 and 2)	812, 820 [22)]	Read and write (on = 1/off = 0); write depending on version		

Note: When using releases N or P, the communication module with measurement functions should be ordered (order supplement Z=F05 in 3WN6 order number) instead of the standard communication module (Z=F01).

[22)] See pages 41 - 51 for details of addressing.

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address		
1:0	**Switching actions**		721, 1, 0, (OS1), 0, 0, 0		
	(Write only)				
		OS1:7			
		OS1:6			
		OS1:5			
		OS1:4			
		OS1:3			
		OS1:2			
	Circuit-breaker OFF [23]	OS1:1	**X**	**X**	**X**
	Circuit-breaker ON [24]	OS1:0	**X**	**X**	**X**

		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			

		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			

		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
		OS4:1			
		OS4:0			

Legend: (OSx) stands for the contents of the octet string (OS) where x = 1, 2, 3 or 4.

[23] Function only available if circuit-breaker is fitted with shunt release F1 or F2.

[24] Function only available if 3WN6 circuit-breaker is fitted with motorized operating mechanism and closing solenoid Y1.

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address		
1:1	**Circuit-breaker state**		741, 1, 0		
	The input of octet strings OS1 to OS4 is not required for the message address in this case.				
	Storage spring charged (S14)	OS1:7	**X**	**X**	**X**
	Undervoltage release applied to voltage (S12) [25)]	OS1:6	**X**	**X**	**X**
	Circuit-breaker OFF (S5)	OS1:5	**X**	**X**	**X**
	Circuit-breaker ON (S5)	OS1:4	**X**	**X**	**X**
		OS1:3			
		OS1:2			
		OS1:1			
		OS1:0			

	Test position (S15) [26)]	OS2:7	**X**	**X**	**X**
	Connected position (S16) [26)]	OS2:6	**X**	**X**	**X**
		OS2:5			
		OS2:4			
		OS2:3			
	Circuit-breaker ready to close (S6)	OS2:2	**X**	**X**	**X**
		OS2:1			
	Electrical closing lockout (S13) [27)]	OS2:0	**X**	**X**	**X**

.
.
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		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
		OS4:1			
	Load input [28)]	OS4:0			

[25)] Function only available if 3WN6 circuit-breaker is fitted with undervoltage release F3 or F8.

[26)] For draw-out circuit-breakers only.

[27)] Function only available if circuit-breaker is fitted with shunt release F1 or F2.

[28)] The operating value for load input can be parameterized in message 1:108.

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address 742, 1, 0		
1:2	**"Tripped" signals** [29)]				
	The input of octet strings OS1 to OS4 is not required for the message address in this case.				
		OS1:7			
	Earth fault release ("g" release)	OS1:6	**X**	**X**	**X**
			OS 1:6 for releases E/F, J/K and P only		
	Delayed short-circuit release ("z" release)	OS1:5	**X**	**X**	**X**
	Overload release ("a" release)	OS1:4	**X**	**X**	**X**
		OS1:3			
		OS1:2			
		OS1:1			
		OS1:0			
		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			
		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			
		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
	Overload release in N conductor ("N" release)	OS4:1	**X**	**X**	**X**
	Instantaneous short-circuit release ("n" release)	OS4:0	**X**	**X**	**X**

[29)] If one bit of the "Tripped" signals is set, this activates a group fault signal (in the cyclic output data).

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address 743, 1, 0		
1:3	**Warning signals** [30]				
	The input of octet strings OS1 to OS4 is not required for the message address in this case.				

		OS1:7			
		OS1:6			
		OS1:5			
	Signal: Overload present ($I>I_r$)	OS1:4	**X**	**X**	**X**
		OS1:3			
		OS1:2			
		OS1:1			
		OS1:0			

		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
	Load shedding [31]	OS2:3	**X**	**X**	**X**
	Release overtemperature	OS2:2	**X**	**X**	**X**
	Current phase imbalance (fixed value 50 %)	OS2:1	**X**	**X**	**X**
		OS2:0			

		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			

		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
	"g" signal for earth fault (earth fault alarm)	OS4:1	**X**	**X**	**X**
			OS 4:1 for releases E/F, J/K and P only		
		OS4:0			

[30] If one bit of the warning signals is set, this activates a group warning signal (in the cyclic output data).

[31] The operating value for load shedding can be parameterized in message 1:107.

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address		
1:5	**Processor status**		745, 1, 0		
	The input of octet strings OS1 to OS4 is not required for the message address in this case.				
		OS1:7			
		OS1:6			
		OS1:5			
		OS1:4			
		OS1:3			
		OS1:2			
		OS1:1			
		OS1:0			
		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			
		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			
		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
		OS4:1			
	Processor fault protection	OS4:0	**X**	**X**	**X**

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address 748, 1, 0		
1:8	**Fault messages** [32]				
	(Only with communication module with measurement functions (Z=F05))		The input of octet strings OS1 to OS4 is not required for the message address in this case.		

		OS1:7			
	Underfrequency	OS1:6	**X**		
	Overfrequency	OS1:5	**X**		
	Reversal of direction of power flow	OS1:4	**X**		
	Overvoltage	OS1:3	**X**		
	Voltage phase imbalance	OS1:2	**X**		
	Undervoltage	OS1:1	**X**		
	Current phase imbalance (Fine settings 5 - 50 %)	OS1:0	**X**		

		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			

		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			

		OS4:7			
		OS4:6			
		OS4:5			
		OS4:4			
		OS4:3			
		OS4:2			
		OS4:1			
		OS4:0			

[32] "Fault signals" can refer to fault "Tripped" signals (OS1:2 of "additional functions 1" (message number 1:121, page 50) = 1) or fault warning signals (OS1:2 of "additional functions 1" = 0). Fault "Tripped" signals: These are registered as a group signal in OS4:2 of message 1:2 (parameter code 742, 1, 0) - see group signal tripping via fault messages, page 43. Fault warning signals: These are registered directly in the group warning signal of the cyclic data.

T-Nr.	Designation	Message address	Value range	Value range	Value range
1:x	**Operational data (read only)**		Releases N and P	Releases H and J/K	Releases D and E/F
x =	*Note: See footnote 9, page 28 for details of measuring accuracy of operational data.*				
11	Actual phase current I_{L1}	762, 1, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
12	Actual phase current I_{L2}	762, 2, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
13	Actual phase current I_{L3}	762, 3, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
14	Actual max. phase current L_{max}	762, 4, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
16	Actual phase current I_N	762, 6, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
17	Actual earth fault current I_g	762, 7, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
	Message 17 is only available with releases E/F, J/K and P.				
21	Active power (average) P [34]	766, 1, 0, 9, 3	0 - 4000 kW	**Messages 21 - 33 are only available for releases N and P in conjunction with the communication module with measuring functions (Z=F05).**	
22	Reactive power (average) Q [34]	766, 2, 0, 10, 3	0 - 4000 kVar		
23	Apparent power (average) S [33]	766, 3, 0, 10, 3	0 - 4000 kVA		
24	Power factor cos φ [34]	766, 4, 0, 0, 0	-1000 - +1000 (0.001)		
26	Actual frequency f_{act} [35]	766, 6, 0, 28, 0	1500 - 50000 Hz (0.01)		
31	Actual phase voltage U_{L1-L2} [36]	767, 1, 0, 21, 0	0 - 1000 V		
32	Actual phase voltage U_{L2-L3} [36]	767, 2, 0, 21, 0	0 - 1000 V		
33	Actual phase voltage U_{L3-L1} [36]	767, 3, 0, 21, 0	0 - 1000 V		
41	Phase current I_{MAX} within 15 min	773, 1, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
42	Phase current I_{MIN} within 15 min	773, 2, 0, 22, 0	0 - 65532 A	0 - 65532 A	0 - 65532 A
44	Actual phase voltage $U_{L, MAX}$	773, 4, 0, 21, 0	0 - 1000 V	**Messages 43 - 51 are only available for releases N and P in conjunction with the communication module with measuring functions (Z=F05).**	
45	MAX phase voltage after 15 min	773, 5, 0, 21, 0	0 - 1000 V		
46	MIN phase voltage after 15 min	773, 6, 0, 21, 0	0 - 1000 V		
47	Frequency f_{MAX} after 15 min	773, 7, 0, 28, 0	15 - 500 Hz		
48	Frequency f_{MIN} after 15 min	773, 8, 0, 28, 0	15 - 500 Hz		
49	Actual active current P_{max} after 15 min	773, 9, 0, 9, 3	0 - 4000 kW		
50	Active power demand P_c (low-order byte)[37]	773, 10, 0, 8, 75	0 - 999 kWh		
51	Active power demand P_c (high-order byte)	773, 11, 0, 8, 76	0 - 65532 MWh		

[33] The handheld operator panel refers to P as P_w, Q as P_b and S as P_s.

[34] The power factor is in the range -1 to +1. The transferred values (-1000 to +1000) must therefore be multiplied by 0.001.

[35] The actual frequency is in the range 15 - 500 Hz. The transferred values (1500 to 50000) must therefore be multiplied by 0.01.

[36] Or to neutral conductor N depending on external current transformer connection.

[37] The active power demand (1:50, 1:51) can be reset to 0 with releases N and P by selecting menu item "Active power demand Pc" and pressing the Clear button on the release unit. This function is not available via the bus.

T-Nr.	Designation	Message address	Value range	Value range	Value range
1:x	**Setting values/ Protection parameters**		Releases N and P	Releases H and J/K	Releases D and E/F
Note: Settable values/functions are highlighted in grey. The incremental settings for these values are given on the next page.					
x =					
61	"a" release setting current I_r	782, 1, 0, 22, 0	40 - 100 % I_n (A)	40 - 100 % I_n (A)	0; 40 - 100 % I_n (A)
64	Time-lag class T_c (trip class) [38) 39)]	782, 4, 0, 0, 0	0; 20 - 300 (0.1 s)	0; 20 - 300 (0.1 s)	20 - 300 (0.1 s)
65	"z" release setting current I_d	782, 5, 0, 22, 0	200 - 40000 A	50 % I_n - 12 I_n (A)	125 % I_r -12 I_r (A)
66	"z" release delay t_d	782, 6, 0, 4, 130	20; 80 - 400 ms	20; 80 - 400 ms	20; 80 - 400 ms
71	"g" release setting current I_g	783, 1, 0, 22, 0	160 - 1200 A	20 % I_n-1200 A	20 % I_n - 60 % I_n (A)
72	"g" release delay t_g	783, 2, 0, 4, 130	100 - 500 ms	100 - 500 ms	100 - 500 ms
	Messages 71 and 72 are only available with releases E/F, J/K and P.				
81	"N" release setting current I_N	785, 1, 0, 22, 0	20 % - 100 % I_n (A)	20 % - 100 % I_n (A)	20 % - 100 % I_n (A)
82	"n" release setting current I_i	785, 2, 0, 22, 0	150 % I_n- 50000/65000 A [40)]	0; 150 % I_n -12 I_n	0; 150 % I_n -12 I_n
83	"g/N" release type I_g/N	785, 3, 0, 0, 0	0 - 5	0 - 1	0 - 1
84	$I_{n, ext}$ External current transformer	785, 4, 0, 22, 0	315 - 3200 A	**Message 84 for P release only**	
85	Release time or alarm t_x [41)]	785, 5, 0, 4, 130	0; 1 - 15 s	0; 1 - 15 s	0; 1 - 15 s
93	Current phase imbalance	790, 3, 0, 24, 0	0; 50 % (5 - 50 % with Z=F05)	0; 50 %	0; 50 %
101	Voltage phase imbalance	792, 1, 0, 24, 0	0; 5 - 50 %	**Messages 101 - 106 are only available for releases N and P in conjunction with the communication module with measuring functions (Z=F05).**	
102	Reversal of direction of power flow	792, 2, 0, 9, 3	0; -2000 kW to +2000 kW [42)]		
103	Overfrequency f>	792, 3, 0, 28, 0	0; 15 - 500 Hz		
104	Underfrequency f<	792, 4, 0, 28, 0	0; 15 - 500 Hz		
105	Overvoltage U>	792, 5, 0, 21, 0	0; 100 - 1000 V		
106	Undervoltage U<	792, 6, 0, 21, 0	0; 100 - 1000 V		
107	Load shedding	792, 7, 0, 24, 0	0; 50 %-150 % I_n (A)	0; 50 %-150 % I_n (A)	0; 50 %-150 % I_n (A)
108	Load input	792, 8, 0, 24, 0	0; 50 %-150 % I_n (A)	0; 50 %-150 % I_n (A)	0; 50 %-150 % I_n (A)

38) These time vaues are in the range 2 - 30 s. The transferred values (20 - 300) must therefore be multiplied by 0.1.

39) The function is deactivated with setting value "0". This also applies to T-Nr. 1:93, 1:101 - 108.

40) Size I (<= 1600 A): 50 kA; Size II (> 1600 A): 60 kA.

41) t_x is the time delay for the trip or warning signal for setting values with T-Nr. 1:93, 1:101 - 108. If t_x = 0, the delay = 0 s. The setting values with T-Nr. 1:93, 1:101 - 108 can also be deactivated by setting the value as a parameter. With Z=F05, these setting values can be parameterized as either a trip or a warning, see T-Nr. 1:111, OS1:2.

42) Supply from below: >0; Supply from above: <0.

T-Nr.	Designation	Message address	
1:x	**Additional functions**		
x =			
111	Additional functions 1	812, 1, 0, ... [43)]	Read and write (on = 1/off = 0);
112	Additional functions 2	820 ,1, 0, ... [41)]	write depending on version of release unit

T-Nr.	Designation	Increments for parameterizable functions (highlighted in grey)	
1:x	**Setting values/ Protection parameters**	All releases	
x =			
61	"a" release setting current I_r	Ampere values in accordance with Table 4	Example: In accordance with Table 4, increment for T-Nr. 1:61 for I_n = 630 A is:1 from 252 A to 500 A and 5 from 501 A to 630 A
64	Time-lag class T_c (trip class)	Increment = 1 (20, 21, ...)	
65	"z" release setting current I_d	As for T-Nr. 1:61	
66	"z" release delay t_d	Increment = 1	
71	"g" release setting current I_g	As for T-Nr. 1:61	
72	"g" release delay t_g	Increment = 1	
81	"N" release setting current I_N	As for T-Nr. 1:61	
82	"n" release setting current I_i	As for T-Nr. 1:61	
83	"g/N" release type I_g/N	Increment = 1	
84	$I_{n, ext}$ External current transformer	In acc. with Table 4	
85	Release time or alarm t_x	Increment = 1	
93	Current phase imbalance	Increment = 1 (For N and P with Z=F05 only)	
101	Voltage phase imbalance	Increment = 1	
102	Reversal of direction of power flow	(See footnote [44)])	
103	Overfrequency f>	In acc. with Table 4	
104	Underfrequency f<	In acc. with Table 4	
105	Overvoltage U>	In acc. with Table 4	
106	Undervoltage U<	In acc. with Table 4	
107	Load shedding (Output OFF)	As for T-Nr. 1:61	
108	Load input (Output ON)	As for T-Nr. 1:61	

3WN6 circuit-breaker - Overcurrent release increments for parameter settings:

from	to	Increment
>1	10	0.1
> 10	500	1
> 500	1000	5
> 1000	5000	10
> 5000	10000	50
> 10000	50000/65000	100

Table 4

43) See pages 50 -51 for further details of exact addressing.

44) The increment for the power flow direction parameterization value is 1 up to 500 kW. For 501 - 2000 kW, it is in accordance with **Table 4**

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address		
1:111	**Additional functions 1**		812, 1, 0, (OS1), 0, 0, 0		
	Note: Message address 812, 1, 0 is sufficient for reading.				

		OS1:7			
		OS1:6			
		OS1:5			
		OS1:4			
		OS1:3			
[45]	Optional trip (1) or alarm (0)	OS1:2	**X**		
			Only with communication module with measurement functions (Z=F05)		
	Reserved	OS1:1			
[46]	Earth fault trip (1) or alarm (0)	OS1:0	**X**	**X**	**X**
			OS 1:0 for releases E/F, J/K and P only		

		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			

		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			

[45] If bit OS1:2 is set (= optional trip), the "fault signals" (parameter identifier 748, 1 ,0) is registered in "group fault signal' of the main status word and a trip is therefore generated for all "fault signals". If bit OS1:2 = 0 (= alarm), "fault signals" do not generate a trip, they are merely registered in the "group warning signal" of the main status word. "Fault signals" can also be individually deactivated (by setting message numbers 1:101 to 1:106 to 0).

[46] If bit OS1:0 is set, an earth fault is registered in the "group fault signal" and a circuit-breaker trip is generated if an earth fault occurs. If bit OS1:0 = 0 (= alarm), the occurrence of an earth fault is registered in the "group warning signal" of the main status word, and no trip is generated in this case.

T-Nr.	RELEASE		N and P	H and J/K	D and E/F
			Message address		
1:112	**Additional functions 2**		820, 1, 0, 0, 0, 0, (OS4)		
	Note: Message address 820, 1, 0 is sufficient for reading.				
		OS1:7			
		OS1:6			
		OS1:5			
		OS1:4			
		OS1:3			
		OS1:2			
		OS1:1			
		OS1:0			

		OS2:7			
		OS2:6			
		OS2:5			
		OS2:4			
		OS2:3			
		OS2:2			
		OS2:1			
		OS2:0			

		OS3:7			
		OS3:6			
		OS3:5			
		OS3:4			
		OS3:3			
		OS3:2			
		OS3:1			
		OS3:0			

		OS4:7			
		OS4:6			
		OS4:5			
	Current phase failure sensitivity ON/OFF	OS4:4	**X**	**X**	**X** [47)]
	Thermal memory ON/OFF	OS4:3	**X**	**X**	**X**
	$I^2 t_g$ characteristic ON/OFF	OS4:2	**X**	**X**	**X**
			OS 4:2 for releases E/F, J/K and P only		
	$I^2 t_d$ characteristic ON/OFF	OS4:1	**X**	**X**	**X**
	Short-time grading control ON/OFF	OS4:0	**X**	**X**	**X**

47) The current phase failure sensitivity for releases D and E/F is activated when delay t_d (T-Nr. 66) is set to 20 ms for these releases. With all other settings, the function is inactive.

3.4.3 List of cyclical 3WN6 data traffic on PROFIBUS-DP

			N and P	H and J/K	D and E/F
	RELEASE				
	PLC output data to 3WN6 (cyclic)				

	OCTET 9				
		BIT 15			
		BIT 14			
		BIT 13			
		BIT 12			
		BIT 11			
		BIT 10			
		BIT 9			
	Acknowledge "Tripped" signals via bus [48)]	BIT 8			

	OCTET 10				
		BIT 7			
		BIT 6			
		BIT 5			
		BIT 4			
		BIT 3			
		BIT 2			
	Circuit-breaker OFF [49)]	BIT 1	**X**	**X**	**X**
	Circuit-breaker ON [50)]	BIT 0	**X**	**X**	**X**

	OCTETS 11 and 12				
	"a" release setting current I_r [A]	40 - 100 % I_n	**X**	**X**	**X**

[48)] Equivalent of "Clear" button on release unit.

[49)] Function only available if circuit-breaker is fitted with shunt release F1 or F2.

[50)] Function only available if 3WN6 circuit-breaker is fitted with motorized operating mechanism and closing solenoid Y1.

	RELEASE		N and P	H and J/K	D and E/F
	PLC input data from 3WN6 (cyclic)				

	OCTET 9				
	Ready to close	BIT 15	**X**	**X**	**X**
	Load shedding	BIT 14	**X**	**X**	**X**
	Reserved	BIT 13	**X**	**X**	**X**
	Phase number for main actual value	BIT 12	**X**	**X**	**X**
	Phase number for main actual value	BIT 11	**X**	**X**	**X**
	Group error signal [51)]	BIT 10	**X**	**X**	**X**
	Group warning signal [49)]	BIT 9	**X**	**X**	**X**
	Group fault signal [49)]	BIT 8	**X**	**X**	**X**

	OCTET 10				
		BIT 7			
	"Tripped" signal not acknowledged[52)]	BIT 6	**X**	**X**	**X**
	Electrical closing lockout	BIT 5	**X**	**X**	**X**
		BIT 4	**X**	**X**	**X**
	Storage spring charged	BIT 3			
		BIT 2			
	Circuit-breaker OFF	BIT 1	**X**	**X**	**X**
	Circuit-breaker ON	BIT 0	**X**	**X**	**X**

	OCTETS 11 and 12				
	Current in highest loaded phase L_1, L_2 or L_3 [A]		**X**	**X**	**X**

51) The "group fault signal" is set (= 1) of one bit of "processor status" (message 1:5, page 45) is set. Similarly, the "group warning signal" is set (= 1) of one bit of "warning signals" (message 1:3, Seite 44) is set and "group fault signal" is set if one bit of "Tripped signals" (message 1:2, page 43) is set. An additional option for releases N and P when used in conjunction with the communication module with measurement functions (Z=F05) is to apply the "fault signals" (message 1:8, Page 50) to either the "group warning signal" (for OS1:2 = 0) or the "group fault signal" (for OS1:2 = 1) by means of "additional functions 1" (message 1:121, Page 50).

52) Acknowledgement either by means of "Clear" button on the release unit or by means of bit 8 of the circuit-breaker output data. The acknowledgement generates a reset of the group fault signal and of all "Tripped" signals for which the trip cause is no longer present.

3.4.4 Examples of (acyclic) message requests:

Byte (Octet)						
1 and 2	3	4	5 (= OS1)	6 (= OS2)	7 (= OS3)	8 (= OS4)
Parameter identifier	Parameter subindex		Parameter value (integer data value)			

Fig. 10: (Acyclic) message address

Example 1: Message request: Write a parameterizable value

The "z" release setting current is to be set to a value of 25000 A. The message address is therefore 782, 5, 0, 22, 0 in accordance with page 48. Bytes (= octets) 1 and 2 must also contain the **request identifier** for write and **parameter number** 782. The detailed structure of octets 1 and 2 can be seen in **Fig. 11**, **page** 54.

Parameter identifier															
Byte (octet) 1								Byte (octet) 2							
Bit number															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Request identifier				-	Parameter number										
Example 1:															
0	0	1	1	-	0	1	1	0	0	0	0	1	1	1	0

Fig. 11: Structure of parameter identifier (bytes 1 and 2)

The request identifier for read is "1", for write "3": The request identifier must be entered in bits 15 - 12 of byte 1 as illustrated in **Fig. 11, page 54**, in this case a "1" in bits 13 and 12. Bits 14 and 15 both equal 0. The parameter number must then be entered in bits 0 - 10, in the above example the binary value "01100001110". Similarly the binary values "00000101" (= 5), "00000000" (= 0), "00010110" (= 22) and "00000000" (= 0) must be entered in bytes 3, 4, 5 and 6 respectively. Finally, the binary code for 25000 (the setting current), i.e. "0110000111101000", must be written in bytes 7 and 8.

Example 2: Message request: Read a read-write value

Message address 782, 5, 0, 22, 0, is also used to read the "z" release setting current. The same values as in example 1 are written in bytes 1 to 6 here (with the exception of the request identifier). Because this is a read request, the request identifier = 1 and bits 15 to 12 contain the binary value "1" (0001). No entries are necessary in bytes 7 and 8. These bytes will be used to store the read value of the "z" release setting current.

Example 3: Message request: Read a read-only value

The procedure for reading read-only values (e.g. operational data) is the same as for read-write values, i.e. the request identifier and the listed message address are written to bytes 1, 2, ... of the PLC I/O area of 3WN6. If, for example, the circuit-breaker state (T-Nr. 1:1) is to be read, then the request identifier must be set to 1 (byte 1), the value "741" must be entered in bytes 1 and 2, the value "1" in byte 3 and the value "0" in byte 4. These values must be entered in binary code. The read value for circuit-breaker state is stored in bytes 5, 6, 7 and 8.

Important notice: *Only the cyclic data from the 3WN6 circuit-breaker (see* ***pages 52 ff.****) are regularly updated in the PLC I/O area. Acyclic data are read on request only. If, for example, byte (octet) 9 of the I/O area contains a "group fault signal" (bit 8 = 1), then the "Tripped signals" (and possibly the "fault signals" in the case of releases N and P with Z=F05) will need to be read for a more detailed fault analysis.*

3.4.5 Time response of data traffic

The time response of 3WN6 data traffic via PROFIBUS-DP is outlined in detail on the following pages with reference to the different data which are transferred (acyclic, cyclic, circuit-breaker key data, circuit-breaker functions ...). Please note that the PROFIBUS-DP cycle times which are implicit in the specified time values generally depend on the number of slaves, i.e. values can vary.

This simple rule of thumb generally applies: To read approx. 0.5 seconds, to write approx. 1 second, to write and check approx. 2 seconds.

The various items of data present in 3WN6 are updated at different intervals depending on their importance.

Time response of acyclic data traffic:

Message group 0			
T-Nr.	Designation	Message address	**Time response of communication (Duration of read/write operations and update rate for values in 3WN6)**
0:x	**Circuit-breaker key data**		

x =			
1	Test unit + delivery date	500, 1, 0, 0, 0	The data in messages 0:1 to 0:16 are read-only. The PLC takes approx. 530 ms to read these values out of 3WN6. The circuit-breaker key data are updated within the 3WN6 circuit-breaker approx. every 60 s. *Note*: The update rate defines the maximum "age" of any value read from 3WN6.
2	Identifier number	500, 2, 0, 0, 0	
4	Rated current of circuit-breaker	500, 4, 0, 22, 0	
5	Function test of release	500, 5, 0, 0, 0	
11	Circuit-breaker size	502, 1, 0, 0, 0	
12	Circuit-breaker type	502, 2, 0, 0, 0	
13	No. of poles	502, 3, 0, 0, 0	
14	Version of release unit (in ASCII code)	502, 4, 0, 0, 0	
15	Revision level of communication	502, 5, 0, 0, 0	
16	Communication module version	502, 6, 0, 0, 0	
17	Revision level of release unit		

Message group 1			
T-Nr.	Designation	Message address	**Time response of communication (Duration of read/write operations and update rate for values in 3WN6)**
1:x	**Circuit-breaker functions** (See pages 41 - 51 for details)		

x =			
0	Switching actions	721, ...	The switching actions are write-only. The maximum time required for the PLC to write them to 3WN6 and for the switching command to be executed is 600 ms.
1	Circuit-breaker state	741, ...	The data in messages 1:1 to 1:5 are read-only. It takes approx. 530 ms for the PLC to read these values out of 3WN6. The values are updated within the circuit-breaker approx. every 700 ms.
2	"Tripped" signals	742, ...	
3	Warning signals	743, ...	
5	Processor status	745, ...	
8	Fault signals (For comm. module with measurement functions only: Z=F05)	748, ...	As with messages 1:1 to 1:5, however the measured values in the circuit-breaker are updated every 1000 ms.
11 - 51	Operational data	762 - 773	As with messages 1:1 to 1:5.
61 - 93 107,108	Setting values/ Protection parameters (Z=F01 or Z=F05)	782 - 790	The data in messages 1:61 to 1:93, 107 and 108 are (configurable as) read-write. It takes approx. 530 ms to read these values and from approx. 500 to a maximum of 1200 ms to write them. After a write operation, the written value can be called up after 200 ms (i.e. max. time for write + check operations: 1200 + 200 + 510 = 1910 ms). Values which have just been read are updated after approx. 700 ms. Otherwise values are updated at intervals of 5000 ms.
101 - 106	Setting values/ Protection parameters (Z=F05)		The data in messages 1:101 to 1:106 are (configurable as) read or read-write depending on the release type. It takes approx. 550 ms to read or write these values. The values in 3WN6 are updated regularly.
111 - 112	Additional functions (1 and 2)	812, 820	The data in messages 1:111 and 1:112 are (configurable as) read or read-write depending on the release type. It takes approx. 530 ms for the PLC to read these values out of 3WN6 and from approx. 500 to a maximum of 1200 ms to write them. Values which have just been read are updated after approx. 700 ms. Otherwise values are updated at intervals of 5000 ms.

Time response of cyclic data traffic:

	RELEASE		**Time response of communication (Duration of read/write operations and update rate for values in 3WN6)**
	3WN6 input data (cyclic)		

	OCTET 9		
		BIT 15	
		BIT 14	
		BIT 13	
		BIT 12	
		BIT 11	
		BIT 10	
		BIT 9	
	Acknowledge "tripped" signals via bus	BIT 8	

	OCTET 10		
		BIT 7	
		BIT 6	
		BIT 5	
		BIT 4	
		BIT 3	
		BIT 2	
	Circuit-breaker OFF [53)]	BIT 1	Cyclical opening/closing of the circuit-breaker takes a max. of 500 ms. *Note:* Cyclical writing means writing in the cyclical area of the PLC I/O area of 3WN6 (cf. page 37).
	Circuit-breaker ON [54)]	BIT 0	

	OCTETS 11 and 12		
	"a" release setting current I_r [A]	40 - 100 % I_n	It takes from approx. 210 ms to a maximum of 900 ms for the PLC to cyclically write the "a" release setting current. *Note:* Cyclical writing means writing in the cyclical area of the PLC I/O area of 3WN6 (cf. page 37).

53) Function only available if 3WN6 circuit-breaker is fitted with motorized operating mechanism and closing solenoid Y1.

54) Function only available if circuit-breaker is fitted with shunt release F1 or F2.

	RELEASE		**Time response of communication (Duration of read/write operations and update rate for values in 3WN6)**
	3WN6 output data (cyclic)		

	OCTET 9		
	Ready to close	BIT 15	It takes approx. 150 ms to read cyclic data in the PLC I/O area of 3WN6. The cyclic data are updated within 3WN6 approx. every 700ms.
	Load shedding	BIT 14	
	Reserved	BIT 13	
	Phase number for main actual value	BIT 12	
	Phase number for main actual value	BIT 11	
	Group error signal [55)]	BIT 10	
	Group warning signal [53)]	BIT 9	
	Group fault signal [53)]	BIT 8	

	OCTET 10		
		BIT 7	as above
	"Tripped" signal not acknowledged	BIT 6	
	Electrical closing lockout	BIT 5	
		BIT 4	
	Storage spring charged	BIT 3	
		BIT 2	
	Circuit-breaker OFF	BIT 1	
	Circuit-breaker ON	BIT 0	

	OCTETS 11 and 12		
	Current in highest loaded phase L_1, L_2 or L_3 [A]		as above

[55)] The "group error signal" is set (= 1) of one bit of "processor status" (message 1:5, page 45) is set. Similarly, the "group warning signal" is set (= 1) of one bit of "warning signals" (message 1:3, Seite 44) is set and "group fault signal" is set if one bit of "Tripped signals" (message 1:2, page 43) is set. An additional option for releases N and P when used in conjunction with the communication module with measurement functions (Z=F05) is to apply the "fault signals" (message 1:8, Page 46) to either the "group warning signal" (for OS1:2 = 0) or the "group fault signal" (for OS1:2 = 1) by means of "additional functions 1" (message 1:121, Page 50).

3.5 Description of software block required for utilizing communication functions with SIMATIC S5 and S7

3.5.1 CPU and DP master types

	IM308C	CP5431	itself	CP342-5DP	CP443-5DP	IM467
941						
942						
943						
944						
945						
922						
928						
928B						
946/947						
948						
313						
314						
315						
315-2DP						
412						
413						
413-2DP						
414						
414-2DP						
416						
416-2DP						

Tested
Planned, but assessment not yet finalized.
Not planned/technically impossible

3.5.2 Displaying data in PROFIBUS-DP

Any standard PROFIBUS-DP master can exchange data with the interface module. Even very "simple" master interfaces can be used thanks to the data structure.

3.5.2.1 Parameterization

The interface module does not support any user-specific parameter data in the PROFIBUS-DP parameter message.

3.5.2.2 Configuration

Two configurations can be used for operating the interface module, both with 12 bytes but in one case with data integrity over the entire length and in the other without data integrity. The configuration with data integrity **must** be used for this program as messages can otherwise be corrupted. Configuration without data integrity is only available for use by the cyclical data of the message.

3.5.2.3 Diagnostics

Diagnostic data are high-priority data. The interface module generates external diagnostics whenever

- the contact verifying the presence of circuit-breaker 3WN6 is not closed or
- the connection to 3WN6 is faulted.

Display of signals in external diagnostic byte (octet no. 8):

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0			

Bit 0:
- 0: "Present" contact closed
- 1: "Present" contact open

Bit 1:
- 0: Connection to 3WN6 OK
- 1: Connection to 3WN6 faulted

3.5.2.4 Data

An example program (software block) is provided for data transfer between the SIMATIC S5 CPU and the 3WN6 circuit-breaker. This program can be parameterized user-specifically.

3.5.2.4.1 Input data (from 3WN6 to PROFIBUS, see example below)

The 6 words of input data are divided into the following data areas:

Octet 1 Octet 2	Parameter identifier	Profile control for communication-capable low-voltage devices on PROFIBUS-DP (kNS/DP)
Octet 3	Parameter subindex	
Octet 4	Reserved	
Octet 5 Octet 6 Octet 7 Octet 8	Parameter value	
Octet 9	High-order byte of status word	Various signals
Octet 10	Low-order byte of status word	See below
Octet 11	High-order byte of main actual value	Current in highest loaded phase
Octet 12	Low-order byte of main actual value	

The data area from octet 1 to octet 8 is intended for acyclic request-driven data transfer. The cyclic data with fixed assignments which are transferred in every message cycle are defined in octets 9 to12.

General example:

To read actual phase current L1.

Enter the following codes in the output area (AW 0 - 6) of the DP/RS485 interface (3WN6):

DW no.	Value	Meaning
AW 0	**KF= +00762**	**Actual phase current L1, parameter identifier**
AW 2	**KY= 001,000**	**Parameter subindex**
AW 4	**KY= 022,000**	**Integer data value, conversion factor**
AW 6	**KF= 00000**	**Read value**

and then enter the request identifier to start the transfer of a value (A 0.4 = 1, in AW = 0).

The following signals are available in the status word:

Octet 9: High-order byte of status word

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8

Bit 8: Group fault signal
Bit 9: Group warning signal
Bit 10: Group error signal
Bit 12, Bit 13: Phase number for main actual value
0 1 phase 1
1 0 phase 2
1 1 phase 3
Bit 14: Optional signal
Bit 15: Load shedding
Ready to close

Octet 10: Low-order byte of status word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0: Switch ON
Bit 1: Switch OFF
Bit 2: Not used
Bit 3: Storage spring charged
Bit 4 NC
Bit 5 NC
Bit 6 NC
Bit 7 NC

3.5.2.4.2 Output data (from PROFIBUS to 3WN6)

The 6 words of input data are divided into the following data areas:

Octet 1 Octet 2	Parameter identifier	Profile control for communication-capable low-voltage devices on PROFIBUS-DP (kNS/DP)
Octet 3	Parameter subindex	
Octet 4	Reserved	
Octet 5 Octet 6 Octet 7 Octet 8	Parameter value	
Octet 9 Octet 10	High-order byte of main control word Low-order byte of main control word	Direct control commands See below
Octet 11 Octet 12	High-order byte of main setpoint Low-order byte of main setpoint	Setting current Ir

The following functions are available in the main control word:

Octet 9: High-order byte of main control word

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
0	0	0	0	0	0	0	

COM_CLEAR bit

Octet 10: Low-order byte of main control word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0		

Switch 3WN6 ON
Switch 3WN6 OFF
Not supported

General example:

Set the "z" release setting current to a value of 25 kA.

Enter the following codes in the input area (AW 0 - 6) of the DP/RS 485 interface (3WN6):

DW no.	Value	Meaning
AW 0	**KF= +00782**	**"z" release setting current, parameter identifier**
AW 2	**KY= 005,000**	**Parameter subindex**
AW 4	**KY= 022,000**	**Integer data value, conversion factor**
AW 6	**KF= +25000**	**corresponds to 25 kA**

and then enter the request identifier for transferring a value (A 0.4 & A 0.5 = 1, in AW = 0).

3.5.3 STEP 5 program

The function and data blocks required for utilizing the full scope of communication are supplied on diskette. An example illustrates how these blocks are integrated in an existing S5 program and how they are adapted in line with local conditions.
Attention: The following versions are required if the program is to function properly:

- **3WN6 interface module: old hardware version (PROFIBUS outgoing circuit on base) 2, new hardware version (PROFIBUS outgoing circuit on top) 1**
- **Type file/GSD file: V1.1**

3.5.3.1 Brief outline of software block tasks

This program automates the message traffic from the PLC (via DP master) to the circuit-breaker (via interface module). A request can be entered in the list of read requests to be processed by setting only one bit. The requests in this list are processed consecutively and are inserted in the acyclic part of the message. The handling of message numbers and associated parameter subindices is no longer necessary. The software block takes care of all this. This also applies to the reading of circuit-breaker data, which are read in once by setting the relevant bits. The parameterization of new values in the circuit-breaker is performed by simply entering the new values in a specific position.
The software block handles the complex management of message numbers etc. in all three tasks and the user now only needs to set bits to enable requests for read operations or to enter new values in order to perform write operations.

3.5.3.2 Preparing to use the software block

The user must load the required function blocks in line with the PROFIBUS-DP master he is using, e.g. FB192 for IM 308-C (Attention: CPU-dependent block!) or the data handling blocks "SYNC", "SEND", "RECEIVE" and "CONTROL" for CP5431. Data integrity over the entire length must be guaranteed independently of the CPU and the DP master.
No special access technology is required here when CP5431 is used. However, prior to calling FB10, DHB SEND must be called up followed by DHB RECEIVE, in order to the define the trigger points for data integrity. Synchronization must also be performed using DHB SYNC on start-up.

3.5.3.3 General information and adaptations

The user can adapt the software as required.
The software kernel comprises 6 function blocks (FBs):

- **FB10** **Name: ROOT3WN6** Request processing and calls for required FBs
- **FB81** **Name: REC** Reads response to transferred T-Nr.
- **FB82** **Name: SEND** Writes parameter for transferred T-Nr.
- **FB100** **Name: LESE WCC** Defines new T-Nr. for cyclic reading of operational data
- **FB101** **Name**: **SCHREIBEN** Defines new T-Nr. for writing of operational data
- **FB102** **Name: LESEN** Defines new T-Nr. for reading circuit-breaker data

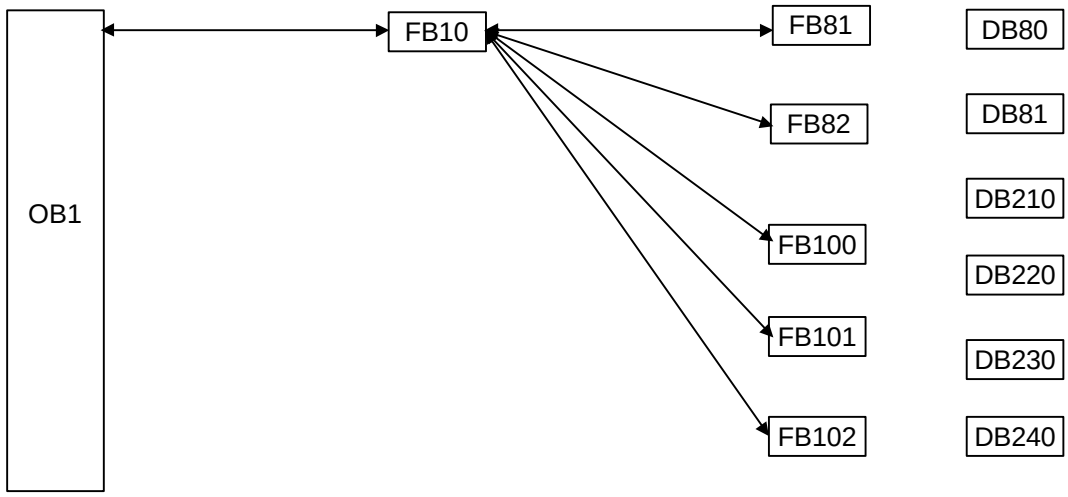
Request processing (FB10) defines the type of the next request, e.g. whether operational data are to be read or written. FB10 then ensures that the next messages of this type are detected and transferred to the 3WN6 interface. Values which are read are stored in a data block and values to be written are fetched from a data block and transferred to the circuit-breaker. If neither writing (parameterization) nor reading of circuit-breaker key data (message group 0) is active, the data which are read out (in DBG1) are copied into DBSZ and DBAT, in order to permit "parameterization from below" (via the RS-232 interface on the 3WN6 release).

The FBs **SEND** and **REC** are assigned to data blocks when they are called. **DB80** contains the message headers for message group 0 and **DB81** contains the message headers for message group 1. These blocks are structured such that the basic data word (DW no.) can be calculated as follows for a message number (T-Nr.):

DW no. = 2 x T-Nr.

The parameter identifier is stored in the basic data word. The following data word contains the parameter subindex.
The data to be sent and the data to be received (to/from 3WN6) are also stored in data blocks (**in the example: DB230 and DB220**).

Block call structure of example:



Contents and function of data blocks:

DB80	DB header, assignment of parameter identifier for message group 0
DB81	DB header, assignment of parameter identifier for message group 1
DB210 (DBG0)	Storage locations for read circuit-breaker data
DB220 (DBG1)	Storage locations for read operational data of circuit-breaker (actual values!)
DB230 (DBSZ)	Storage locations for operational data to be sent to the circuit-breaker
DB240 (DBAT)	Storage locations for T-Nr. enable, priority assignment and request coordination - old values which have already been written to the circuit-breaker

3.5.3.3.1 Adaptation to master module

Adaptation to the DP master module is performed in the start-up OBs and in cycle OB1.
If CP5431 is used as master, it must be synchronized on start-up. It also requires one cyclical trigger point for input and one for output in order to exchange data. The data handling blocks are responsible for these tasks and have been integrated in CP3WN6ST.S5D in exemplary fashion. Please ensure that the correct data handling blocks are used for the implemented CPU. Trigger point FBs FB50 and FB51, the FBs for start-up synchronization (FB52), and FB 53 for diagnostics must also be supplied with the correct call parameter in the example program, i.e. S5 = 115 (for S5 115) or 135 (for S5 135/155). This makes it possible for a single example program to run on all S5 CPUs. The slaves must be defined as cycle-synchronous in COM5431 for the DP update, in order to ensure data integrity.
With IM308C as master, only the CPU-specific FB192 needs to be loaded.
The following data handling blocks are required for the example program with the CP as master:
115: FB244, FB245, FB247, FB249 all CPU-dependent
135/155: FB120, FB121, FB123, FB125 all CPU-dependent

Note: If CP5431 is used as DP master, access to the I/O modules is only possible after a hardware reset (voltage OFF). Otherwise a time-out/no acknowledgement signal is output.

3.5.3.3.2 Other adaptations

The printed **program listing** is an example in which the settings can be adapted to suit individual requirements. Please read **Description of examples** for further information.
Please note that only one send or receive request can ever be initiated at any one time for the same 3WN6 circuit-breaker.
If several circuit-breakers are in use, FB10 must be called once for each circuit-breaker and supplied with the correct call parameters. The I/O addresses, DBs and timers must only ever be used once. The following address space is available for I/O addresses:
IM308C: I/O 128 to 255
CP5431: I/O 0 to 255
in the I/O area with linear addressing in each case. It is necessary to keep within this area in order to ensure data integrity.

3.5.3.3.3 Diagnostics

If diagnostics are required (e.g. for Win3WN6), an insertion must be made in the DBAT relative to the DP master as of DW200. In the case of IM308C, this is achieved by means of an FB192 call addressed to the slave. Both the DP address of the slave and the DBAT no. in which the diagnostic data are to be stored must be specified (see example IM308CST.S5D).
The diagnostics for CP5431 vary depending on the CP. The CP is first scanned to check for the presence of diagnostic data (can be seen from FB53 in example CP3WN6ST.S5D). If such data are present, slave diagnostics are requested by means of a SEND request. The PROFIBUS **slave address** must be known, however. This must be entered in **DR198** of **DBAT**. The diagnostic message can then be read out of the returned data in DW203 of DBAT. It is also possible to detect from DW200 whether the PROFIBUS connection to the interface module of the circuit-breaker is in order. A definitive statement can be made regarding the correct connection to 3WN6 based on an OR operation on the channel-specific diagnostics (DW203) and the "Station_Not_Existent" bit (PROFIBUS standard in station status 1 in DW200). If diagnostic messages are to be fetched from several 3WN6s, the S5 with CP5431 as master must ensure that only one diagnostic message is ever sent to a slave at a time. Diagnostic messages for another 3WN6 can only be requested when the diagnostic response has been received from the previous circuit-breaker. This can be achieved by means of a counting distributor, for example.

3.5.3.4 Data blocks (DBs)

The send and/or receive data block and a message header data block must be configured by the user unless the DBs supplied with the example are to be used. The maximum used length of such a data block is 261 bytes, i.e. the data block must be configured up to and including data word 255. The length is not checked.
The block-type structure is as follows (see also **Program listing**):
Data word 0: Symbol for value to be processed acc. to profile (parameter identifier) - T-Nr. 0
Data word 1: Symbol as sub-item for value to be processed (parameter subindex) - T-Nr. 0
Data word 2: Symbol for value to be processed acc. to profile (parameter identifier) - T-Nr. 1
Data word 3: Symbol as sub-item for value to be processed (parameter subindex) - T-Nr. 1
Data word 4: Symbol for value to be processed acc. to profile (parameter identifier) - T-Nr. 2
Data word 5: Symbol as sub-item for value to be processed (parameter subindex) - T-Nr. 2
etc.

The user himself is responsible for entering the correct values in the data block, as well as for creating a data block of the correct length. The user must configure the DB up to at least data word 2x+1 (where x = maximum occurring T-Nr.).

3.5.3.4.1 Position of cyclic part of message

Because applications such as WinCC can only access SIMATIC S5 data blocks via FDL link, for example, the cyclic part of the message must be inserted in the DB. The cyclic input bytes are stored in DW96 and 97 of DBAT and the output bytes in DW98 and 99. These can be used to poll the cyclic messages and to switch the circuit-breaker on and off. The program resets the bits for switching on/off after 250 ms.

3.5.3.4.2 Enabling and priority assignment of acyclic requests for operational data to be read cyclically

```
100:   KM = 00000000 00011110;   Screen: Read request T-Nr. 0 to 15
101:   KM = 00000000 00000000;   Read: T-Nr.  16 to  31
102:   KM = 00000000 00000000;        T-Nr.  32 to  47
103:   KM = 00000000 00000000;        T-Nr.  48 to  63
104:   KM = 00000000 00000000;        T-Nr.  64 to  79
105:   KM = 00000000 00000000;        T-Nr.  80 to  95
106:   KM = 00000000 00000000;        T-Nr.  96 to 111
107:   KM = 00000000 00000000;        T-Nr. 112 to 127
108:   KM = 11110100 10011110;   Screen: Assignment to priority 1 T-Nr. 0 to 15
109:   KM = 11000000 00000000;   Read: T-Nr.  16 to  31
110:   KM = 00000000 00000000;        T-Nr.  32 to  47
111:   KM = 00000000 00000000;        T-Nr.  48 to  63
112:   KM = 00000000 00000000;        T-Nr.  64 to  79
113:   KM = 00000000 00000000;        T-Nr.  80 to  95
114:   KM = 00000000 00000000;        T-Nr.  96 to 111
115:   KM = 00000000 00000000;        T-Nr. 112 to 127
116:   KM = 00000000 00000000;   Screen: Assignment to priority 2 T-Nr. 0 to 15
117:   KM = 00100111 10100001;   Read: T-Nr.  16 to  31
118:   KM = 11000000 01101111;        T-Nr.  32 to  47
119:   KM = 11110000 00000000;        T-Nr.  48 to  63
120:   KM = 00000000 00000000;        T-Nr.  64 to  79
121:   KM = 00000000 00000000;        T-Nr.  80 to  95
122:   KM = 00000000 00000001;        T-Nr.  96 to 111
123:   KM = 10000000 00000000;        T-Nr. 112 to 127
124:   KM = 00000000 00000000;   Screen: Assignment to priority 3 T-Nr. 0 to 15
125:   KM = 00000000 00000000;   Read: T-Nr.  16 to  31
126:   KM = 00000000 00000000;        T-Nr.  32 to  47
127:   KM = 00000000 00000000;        T-Nr.  48 to  63
128:   KM = 11100001 10000000;        T-Nr.  64 to  79
129:   KM = 01111100 00000100;        T-Nr.  80 to  95
130:   KM = 00000111 11111000;        T-Nr.  96 to 111
131:   KM = 00000000 00000000;        T-Nr. 112 to 127
```

The lines are an extract from DB240 (DBAT, data block for request processing) designed to explain the enabling and priority assignment of read requests which are to be processed "cyclically". Messages are enabled from DW100 to DW107 by setting a "1". In the example given here, messages 11, 12, 13 and 14 are enabled in DW 100. The messages are classified according to priority in DW 108 to DW 131. Priorities have already been assigned but can be changed according to requirements. The message numbers increase from left to right within the DB, in the same way as for the enable. Priority assignment entails sending requests with a higher priority more frequently than messages with a lower priority. The enable and **one** priority assignment must be allocated in order to generate a valid message. In the example provided, this means that only requests 11 - 14 are enabled and these are assigned to priority 1 by default.
This type of enabling permits the program to be adapted to a wide range of conditions, e.g. visualization with several windows which only ever display a small number of values. Only the required values need to be updated here, thus allowing for a considerable increase in performance.

3.5.3.4.3 Circuit-breaker parameterization (writing parameters)

The data which the circuit-breaker is currently using as parameters are stored in DB240. The data to be transferred to the 3WN6 are stored in DB230. FB10 now checks on every call whether the data in DB230 and DB240 are consistent. If a discrepancy is detected, a bit for writing requests is set. The new values in DB230 are then transferred to 3WN6 and stored as old values in DB240. The request bit is reset. If a new value is to be parameterized, it must therefore be entered at the correct position in DB230. The position is calculated in the same way as for DB80 and DB81:
DW no. = 2 x T-Nr.+1

Example: "z" release setting current, T-Nr. 65, tripping value 20 kA
Enter 20000 in DW65*2+1 = DW131 of DB230

Special cases: The parameters for additional functions 111/112 must be entered as follows:
111: in DL222 of DBSZ
112: in DR225 of DBSZ

The differences occur as these are the only parameterization messages to parameterize two words. All others parameterize only the second word.

Attention: Because parameter I_r can be assigned using either the cyclic or the acyclic part of the message, only one of these options is supported in order to avoid parameter inconsistencies. The parameter for I_r can therefore only be transferred using the acyclic message and an entry in DW99 of DBAT (which would trigger cyclical parameterization) does not change the parameter in the circuit-breaker.

3.5.3.4.4 Reading circuit-breaker data

Circuit-breaker key data are read by setting the relevant bits in DW0 and DW1 of DBAT (DB240 in this example). The data which are read out are stored in DB80. As the circuit-breaker data do not change during operation, a single call of the messages is sufficient, e.g. by setting the bits in the relevant OBs on start-up/restart.

Example: Read all circuit-breaker data.
ADB 240
LKM 01111100 00011111
TDW 0
LKM 10000100 00000000
TDW 1
All the bits in DW0 and DW1 can also be set. If a request does not exist, it is canceled after a watchdog time of 1 s.

3.5.3.5 Description of examples

FB REC is called and parameters are passed to it in order to read 3WN6 data. **FB SEND** is used to write data to the 3WN6 interface module. Both blocks have a similar list of designators:

T-DB	An input word (MW206 in the example) containing the number of the data block in which the message headers are stored.
Q-DB/Z-DB	An input word (MW208 in the example) containing the number of the data block in which the parameter values are stored/are to be stored.
Q-DW/Z-DW	An input word (DW254 in the example) which can be used to specify an offset for the basic data word in the data block for parameters.
STAT	An input word for an auxiliary storage location which is needed in blocks **FB SEND** and **FB REC**. This auxiliary storage location contains the value 0 when the request has been processed, the value 2 during processing and any other value - the value 1 in the example - in order to indicate a new request.
T-NR	An input byte to specify a message number to be processed (reference to data word to be processed in T-DB and Q-DB/Z-DB - DW in T-DB = 2 x T-NR and following DW; DW in Q-DB/Z-DB = 2 x T-NR + value in Q-DW/Z-DW and following DW) (DL251 in the example).
EW0	Input word (MW220 in the example) in which the first two byes of the response from 3WN6 are stored (parameter identifier).
EW1	Input word (MW222 in the example) in which bytes three and four of the response from 3WN6 are stored (parameter subindex).
EW2	Input word (MW224 in the example) in which bytes five and six of the response from 3WN6 are stored (size and conversion index for requested value).
EW3	Input word (MW226 in the example) in which bytes seven and eight of the response from 3WN6 are stored (requested value).
AW0	Output word (MW230 in the example) in which the first two byes to be sent to 3WN6 are stored (parameter identifier).
AW1	Output word (MW232 in the example) in which bytes three and four to be sent to 3WN6 are stored (parameter subindex).
AW2	Output word (MW234 in the example) in which bytes five and six to be sent to 3WN6 are stored (size and conversion index for value to be transferred).
AW3	Output word (MW236 in the example) in which bytes seven and eight to be sent to 3WN6 are stored (value to be transferred).

FB SEND does not contains the designators EW2 and EW3.
Four data blocks are supplied with the example. Blocks **DB80** and **DB81** contain message headers sorted according to message groups 0 and 1 and listed in the order of the message numbers. Message headers contain the parameter identifier and the parameter subindex. Data blocks **DBG1 (DB220)** and **DBSZ (DB230)** are used as data storage locations for the read and write requests to the circuit-breaker in the example.
The size and conversion index are stored here, as is the value for a message number. The offset is set to 0. The data read from 3WN6 are stored in **DB220** and the write data are stored in **DB230**.
The slave data for this example are selected as follows:

- Slave address 8
- Inputs in S5 at addresses P144 to P155
- Outputs in S5 at addresses P156 to P167

3.5.3.6 Extract from program listing of supplied example

3.5.3.6.1 DB80

```
DB80    C:BS3WN6ST.S5D                  LAE=261 /514
              3WN6 ASSIGNMENT TO MESSAGE GROUP 0          Sheet  1
   0:    KF = +00000;
   1:    KY = 000,000;
   2:    KF = +00500;          0:01 TEST UNIT+DELIVERY DATE
   3:    KY = 001,000;
   4:    KF = +00500;          0:02 IDENTIFIER NUMBER
   5:    KY = 002,000;
   6:    KF = +00500;          0:03 COMMUNICATION TYPE
   7:    KY = 003,000;
   8:    KF = +00500;          0:04 RATED CURRENT OF CIRCUIT-BREAKER
   9:    KY = 004,022;
  10:    KF = +00500;          0:05 FUNCTION TEST OF RELEASE
  11:    KY = 005,000;
  12:    KF = +00000;          0:06
  13:    KY = 000,000;
  14:    KF = +00000;          0:07
  15:    KY = 000,000;
  16:    KF = +00000;          0:08
  17:    KY = 000,000;
  18:    KF = +00000;          0:09
  19:    KY = 000,000;
  20:    KF = +00000;          0:10
  21:    KY = 000,000;
  22:    KF = +00502;          0:11 CIRCUIT-BREAKER SIZE
  23:    KY = 001,000;
  24:    KF = +00502;          0:12 CIRCUIT-BREAKER TYPE
  25:    KY = 002,000;
  26:    KF = +00502;          0:13 NO. OF POLES
  27:    KY = 003,000;
  28:    KF = +00502;          0:14 VERSION OF RELEASE UNIT
  29:    KY = 004,000;
  30:    KF = +00502;          0:15 REVISION LEVEL OF COMMUNICATION
  31:    KY = 005,000;
  32:    KF = +00502;          0:16 COMMUNICATION MODULE VERSION
  33:    KY = 006,000;
  34:    KF = +00502;          0:17 REVISION LEVEL OF RELEASE UNIT
  35:    KY = 007,000;
  36:    KF = +00000;          0:18
  37:    KY = 000,000;
  38:    KF = +00000;          0:19
  39:    KY = 000,000;
  40:    KF = +00000;          0:20
  41:    KY = 000,000;
  42:    KF = +00503;          0:21 COMMUNICATION ADDRESS
  43:    KY = 001,000;
```

2*T-Nr. = parameter identifier
2*T-Nr.+1 = parameter subindex

3.5.3.6.2 DB81

```
DB81   C:BS3WN6ST.S5D                    LAE=261 /504
              3WN6 ASSIGNMENT TO MESSAGE GROUP 1          Sheet  1

  0:   KF = +00721;          1:000 SWITCHING ACTIONS
  1:    KY = 001,000;
  2:    KF = +00741;          1:001 CIRCUIT-BREAKER STATE
  3:    KY = 001,000;
  4:    KF = +00742;          1:002 CIRCUIT-BREAKER FAULTS
  5:    KY = 001,000;
  6:    KF = +00743;          1:003 CIRCUIT-BREAKER WARNINGS
  7:    KY = 001,000;
  8:    KF = +00000;          1:004
  9:    KY = 000,000;
 10:    KF = +00745;          1:005 STATUS OF MEAS. MODULE
 11:    KY = 001,000;
 12:    KF = +00000;          1:006
 13:    KY = 000,000;
 14:    KF = +00000;          1:007
 15:    KY = 000,000;
 16:    KF = +00748;          1:008 FAULT SIGNALS
 17:    KY = 001,000;
 18:    KF = +00000;          1:009
 19:    KY = 000,000;
 20:    KF = +00000;          1:010
 21:    KY = 000,000;
 22:    KF = +00762;          1:011 ACTUAL PHASE CURRENT L1
 23:    KY = 001,022;
 24:    KF = +00762;          1:012 ACTUAL PHASE CURRENT L2
 25:    KY = 002,022;
 26:    KF = +00762;          1:013 ACTUAL PHASE CURRENT L3
 27:    KY = 003,022;
 28:    KF = +00762;          1:014 MAX ACTUAL PHASE CURRENT
 29:    KY = 004,022;
 30:    KF = +00000;          1:015
 31:    KY = 000,000;
 32:    KF = +00762;          1:016 ACTUAL PHASE CURRENT N
 33:    KY = 006,022;
 34:    KF = +00762;          1:017 ACTUAL EARTH FAULT CURRENT I
 35:    KY = 007,022;
 36:    KF = +00000;          1:018
 37:    KY = 000,000;
 38:    KF = +00000;          1:019
 39:    KY = 000,000;
 40:    KF = +00000;          1:020
 41:    KY = 000,000;
 42:    KF = +00766;          1:021 ACTIVE POWER [AVERAGE]
 43:    KY = 001,009;
 44:    KF = +00766;          1:022 REACTIVE POWER [AVERAGE]
 45:    KY = 002,001;
 46:    KF = +00766;          1:023 APPARENT POWER [AVERAGE]
 47:    KY = 003,001;
```

2*T-Nr. = parameter identifier
2*T-Nr.+1 = parameter subindex

3.5.3.6.3 DBG0 (DB210)

```
DB210   C:BS3WN6ST.S5D                    LAE=261 /90
              3WN6 ASSIGNMENT TO MESSAGE GROUP 0          Sheet  1
   0:    KY = 000,000;
   1:    KF = +00000;
   2:    KY = 000,000;          0:01 TEST UNIT+DELIVERY DATE
   3:    KF = -00248;
   4:    KY = 000,000;          0:02 IDENTIFIER NUMBER
   5:    KF = +00247;
   6:    KY = 000,000;          0:03 COMMUNICATION TYPE
   7:    KF = +00000;
   8:    KY = 022,000;          0:04 RATED CURRENT OF CIRCUIT-BREAKER
   9:    KF = +00630;
  10:    KY = 000,000;          0:05 FUNCTION TEST OF RELEASE
  11:    KF = +00000;
  12:    KY = 000,000;          0:06
  13:    KF = +00000;
  14:    KY = 000,000;          0:07
  15:    KF = +00000;
  16:    KY = 000,000;          0:08
  17:    KF = +00000;
  18:    KY = 000,000;          0:09
  19:    KF = +00000;
  20:    KY = 000,000;          0:10
  21:    KF = +00000;
  22:    KY = 000,000;          0:11 CIRCUIT-BREAKER SIZE
  23:    KF = +00247;
  24:    KY = 000,000;          0:12 CIRCUIT-BREAKER TYPE
  25:    KF = -02049;
  26:    KY = 000,000;          0:13 NO. OF POLES
  27:    KF = -00248;
  28:    KY = 000,000;          0:14 REVISION LEVEL OF RELEASE UNIT
  29:    KF = +00068;
  30:    KY = 000,000;          0:15 REVISION LEVEL OF COMMUNICATION
  31:    KF = +05121;
  32:    KY = 000,000;          0:16 VERSION OF RELEASE UNIT
  33:    KF = +00017;
  34:    KY = 000,000;          0:17
  35:    KF = +00000;
  36:    KY = 000,000;          0:18
  37:    KF = +00000;
  38:    KY = 000,000;          0:19
  39:    KF = +00000;
  40:    KY = 000,000;          0:20
  41:    KF = +00000;
  42:    KY = 000,000;          0:21 COMMUNICATION ADDRESS
  43:    KF = +00052;
```

The storage structure of the read results for message group 0 is already apparent here (circuit-breaker data).

3.5.3.6.4 DBG1 (DB220)

```
DB220  C:BS3WN6ST.S5D                    LAE=261 /504
              3WN6 ACTUAL VALUES MESSAGE GROUP 1        Sheet  1

   0:   KY = 000,000;          1:000 SWITCHING ACTIONS
   1:   KF = +00000;
   2:   KY = 160,068;          1:001 CIRCUIT-BREAKER STATE
   3:   KF = +00001;
   4:   KY = 000,001;          1:002 CIRCUIT-BREAKER FAULTS
   5:   KF = +00000;
   6:   KY = 000,000;          1:003 CIRCUIT-BREAKER WARNINGS
   7:   KF = +00000;
   8:   KY = 000,000;          1:004
   9:   KF = +00000;
  10:   KY = 000,000;          1:005 STATUS OF MEAS. MODULE
  11:   KF = +00000;
  12:   KY = 000,000;          1:006
  13:   KF = +00000;
  14:   KY = 000,000;          1:007
  15:   KF = +00000;
  16:   KY = 000,000;          1:008
  17:   KF = +00000;
  18:   KY = 000,000;          1:009
  19:   KF = +00000;
  20:   KY = 000,000;          1:010
  21:   KF = +00000;
  22:   KY = 022,000;          1:011 ACTUAL PHASE CURRENT L1
  23:   KF = +00000;
  24:   KY = 022,000;          1:012 ACTUAL PHASE CURRENT L2
  25:   KF = +00000;
  26:   KY = 022,000;          1:013 ACTUAL PHASE CURRENT L3
  27:   KF = +00000;
  28:   KY = 022,000;          1:014 MAX ACTUAL PHASE CURRENT
  29:   KF = +00000;
  30:   KY = 000,000;          1:015
  31:   KF = +00000;
  32:   KY = 022,000;          1:016 ACTUAL PHASE CURRENT N
  33:   KF = +00000;
  34:   KY = 022,000;          1:017 ACTUAL EARTH FAULT CURRENT I
  35:   KF = -00001;
  36:   KY = 000,000;          1:018
  37:   KF = +00000;
  38:   KY = 000,000;          1:019
  39:   KF = +00000;
  40:   KY = 000,000;          1:020
  41:   KF = +00000;
  42:   KY = 009,003;          1:021 ACTIVE POWER [AVERAGE]
  43:   KF = -01234;
  44:   KY = 010,003;          1:022 REACTIVE POWER [AVERAGE]
  45:   KF = -01408;
```

The parameter subindex is stored in DW T-Nr.*2.
The last value read in to this message is stored in DW T-Nr.*2+1.

3.5.3.6.5 DBSZ (DB230)

```
DB230  C:BS3WN6ST.S5D                    LAE=261 /504
              3WN6 ACTUAL VALUES MESSAGE GROUP 1          Sheet  1

   0:   KM = 00000000;          1:000 SWITCHING ACTIONS
   1:   KF = +00000;
   2:   KY = 160,068;           1:001 CIRCUIT-BREAKER STATE
   3:   KF = +00001;
   4:   KY = 000,001;           1:002 CIRCUIT-BREAKER FAULTS
   5:   KF = +00000;
   6:   KY = 000,000;           1:003 CIRCUIT-BREAKER WARNINGS
   7:   KF = +00000;
   8:   KY = 000,000;           1:004
   9:   KF = +00000;
  10:   KY = 000,000;           1:005 STATUS OF MEAS. MODULE
  11:   KF = +00000;
  12:   KY = 000,000;           1:006
  13:   KF = +00000;
  14:   KY = 000,000;           1:007
  15:   KF = +00000;
  16:   KY = 000,000;           1:008
  17:   KF = +00000;
  18:   KY = 000,000;           1:009
  19:   KF = +00000;
  20:   KY = 000,000;           1:010
  21:   KF = +00000;
  22:   KY = 022,000;           1:011 ACTUAL PHASE CURRENT L1
  23:   KF = +00000;
  24:   KY = 022,000;           1:012 ACTUAL PHASE CURRENT L2
  25:   KF = +00000;
  26:   KY = 022,000;           1:013 ACTUAL PHASE CURRENT L3
  27:   KF = +00000;
  28:   KY = 022,000;           1:014 MAX ACTUAL PHASE CURRENT
  29:   KF = +00000;
  30:   KY = 000,000;           1:015
  31:   KF = +00000;
  32:   KY = 022,000;           1:016 ACTUAL PHASE CURRENT N
  33:   KF = +00000;
  34:   KY = 022,000;           1:017 ACTUAL EARTH FAULT CURRENT I
  35:   KF = -00001;
  36:   KY = 000,000;           1:018
  37:   KF = +00000;
  38:   KY = 000,000;           1:019
  39:   KF = +00000;
  40:   KY = 000,000;           1:020
  41:   KF = +00000;
  42:   KY = 009,003;           1:021 ACTIVE POWER [AVERAGE]
  43:   KF = -01234;
  44:   KY = 010,003;           1:022 REACTIVE POWER [AVERAGE]
  45:   KF = -01408;
```

The parameter subindex of the T-Nr. is stored in DW T-Nr.*2.
The value which is to be parameterized or which has already been parameterized is stored in DW T-Nr.*2+1. This depends on the comparison between the value read out and the content of this DB.

3.5.3.6.6 DBAT (DB240)

```
DB240   C:BS3WN6ST.S5D                      LAE=261 /28
              3WN6-1 REQUEST COORDINATION            Sheet   1
   0:    KM = 00000000 00000000;        CPU   : Initiate read requests group 0
   1:    KM = 00000000 00000000;              T-Nr. 16 to  31
   2:    KH = 0000;                 Reserved
   3:    KF = +00000;               Flag: Display no.
   4:    KM = 00000000 00000000;        CPU   : Check requests group 1
   5:    KM = 00000000 00000000;              T-Nr.  16 to  31
   6:    KM = 00000000 00000000;              T-Nr.  32 to  47
   7:    KM = 00000000 00000000;              T-Nr.  48 to  63
   8:    KM = 00000000 00000000;              T-Nr.  64 to  79
   9:    KM = 00000000 00000000;              T-Nr.  80 to  95
  10:    KM = 00000000 00000000;              T-Nr.  96 to 111
  11:    KM = 00000000 00000000;              T-Nr. 112 to 127
  12:    KH = 0000;                 Reserved
  13:    KH = 0000;                 Reserved
  14:    KH = 0000;                 CPU   : Write requests group 1
  15:    KM = 00000000 00000000;              T-Nr.  48 to  63
  16:    KM = 00000000 00000000;              T-Nr.  64 to  79
  17:    KM = 00000000 00000000;              T-Nr.  80 to  95
  18:    KM = 00000000 00000000;              T-Nr.  96 to 111
  19:    KM = 00000000 00000000;              T-Nr. 112 to 127
  20:    KH = 0000;                 Reserved
  21:    KF = +00000;               Flag: P 61 Write old value
  22:    KF = +00000;                     ---
  23:    KF = +00000;                     ---
  24:    KF = +00000;                     P 64
  25:    KF = +00000;                     P 65
  26:    KF = +00000;                     P 66
  27:    KF = +00000;                     ---
  28:    KF = +00000;                     ---
  29:    KF = +00000;                     ---
  30:    KF = +00000;                     ---
  31:    KF = +00000;                     P 71
  32:    KF = +00000;                     P 72
  33:    KF = +00000;                     ---
  34:    KF = +00000;                     ---
  35:    KF = +00000;                     ---
  36:    KF = +00000;                     ---
  37:    KF = +00000;                     ---
  38:    KF = +00000;                     ---
  39:    KF = +00000;                     ---
  40:    KF = +00000;                     ---
  41:    KF = +00000;                     P 81
  42:    KF = +00000;                     P 82
  43:    KF = +00000;                     P 83
       .
       .
```

The bits for setting the read identifier for requests from group 0 are stored in DW0 and 1. DW4 to 20 are internal flags for request processing. The old, already parameterized, values are stored as of DW21 and are used for comparing the old/new parameter values. The enables and priority assignments mentioned above are possible as of DW100. The cyclic input and output words of the message are inserted as of DW96. If a diagnostic block is called, the slave diagnostics can be stored as of DW200.

3.5.3.6.7 FB10 call

```
      :SPA FB10
Name  :ROOT3WN6
BASE  :KF +44
BASA  :KF +56
DBG0  :KF +210
DBG1  :KF +220
DBSZ  :KF +230
DBAT  :KF +240
TIM0  :KF +40
TIM1  :KF +41
TIM2  :KF +42
```

This is the call based on the parameters from the example.
The meanings of the individual parameters are as follows:

BASE Base address of inputs which has been parameterized in COM-PROFIBUS, for example. The following 12 bytes are then used by this interface module.
BASA Base address of outputs which has been parameterized in COM-PROFIBUS, for example. The following 12 bytes are then used by this interface module.
DBG0 Free data block number, DB210 in the example
DBG1 Free data block number, DB220 in the example
DBSZ Free data block number, DB230 in the example
DBAT Free data block number, DB240 in the example
TIM0 Two timers are used in the program.
TIM1 The timers can be specified externally so that the block can be used universally.
TIM2 See above

3.5.3.7 Procedure for creating your own project

1. The data blocks must contain exactly the same structure and contents as in the example provided. We therefore recommend that you copy them out of this project. Otherwise problems may occur.
2. The following blocks must be copied into the project:

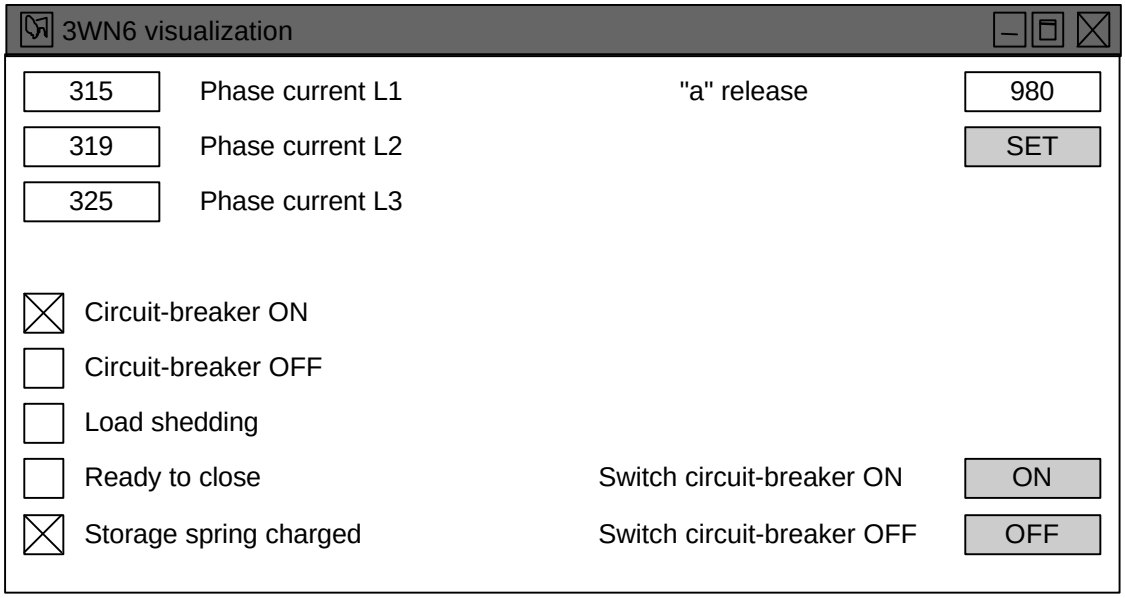
FB10, FB81, FB82, FB100, FB101, FB102

3. FB10 and its parameters must be called from the cyclic program (e.g. OB1).
4. An FB10 call must be assigned to each circuit-breaker. The parameters (DBs, timer, I/O area) must not overlap.
5. Adaptations to the DP master may be necessary, e.g. CP5431 and diagnostics.

Note: Only flags over the 200 area (scratch flag area) are used in software block FB10. These are reinitialized on every call and can therefore also be used throughout the entire program provided they are always reinitialized. This means that the entire flag area can also be used by the user program.

3.5.3.8 Description of visualization with software block

We shall demonstrate the use of the software block with reference to an example. Actual phase currents L1, L2 and L3 are to be displayed in a visualization window (e.g. WinCC). The actual state of the circuit-breaker should also be displayed. It should also be possible to display and set new parameters for the "a" release in this window (T-Nr. 61).



These 3 requests must be entered in the list of cyclic messages for the actual phase current to be displayed in the boxes. This is achieved by setting the bits in DW100 of DBAT (only enable messages 11 - 13), see 3.5.3.4.2. The actual currents can then be copied into the window from data words DW23, 25 and 27 of DBG1. The circuit-breaker states are transferred with every message in the cyclic part and can be obtained from data words DW96 and 97 of DBAT (DW96 corresponds to octets 9 and 10, DW97 to octets 11 and 12).
The ON and OFF buttons can be used to set 3WN6 to the required state. Bit 1 (for OFF) or bit 0 (for ON) of octet 10 must be set for this purpose. The bit is automatically reset. If octet 10 cannot be reached directly for visualization, these bits can also be set in DW98 of DBAT. They are written out at the end of the cycle.
A value is to be parameterized in accordance with message 1:61. If the actual parameterized value is to appear in the box, the corresponding bit must be set in DW103 of DBAT (as was the case with the current values). This value is then updated cyclically. The value in the box must be copied from DW123 of DBG1. To parameterize a new value, enter the value in the box and press the SET button. The visualization software then copies this value to the correct location of DBSZ, i.e. to DW123 (= T-Nr. *2 +1). The block then detects this new value and parameterizes it in the circuit-breaker. When the procedure is complete, the actual parameterized value is again displayed in the box until such time as 3WN6 has verified and returned the new value.

Note: Win3WN6 and SICAM LCC are available (see page 35) for standard visualization of 3WN6 circuit-breaker information.

There is also another way of changing parameters in the 3WN6 circuit-breaker, i.e. by connecting suitable devices to the serial interface at the front of the display unit. It is important that the bits for cyclic reading of the displayed values are set in order that the S5 software and the visualization can detect these changes (already configured in this example). This guarantees data consistency between the circuit-breaker and the S5 data management. Changes should only be made via the serial interface when the corresponding read request bit (as of DW100 in DBAT) is set.
If several windows are used for displaying the circuit-breaker, only the actually displayed values need to be updated cyclically. Otherwise the performance is compromised.

3.5.4 STEP 7 program

The kernel of the software block is the same as for S5. However, some changes are required for S7 due to the conversion.
1. The data words in the data blocks of S5 must be multiplied by 2 for S7.
2. The initial I/O addresses do not need to be supplied for the FC10 call.

It is necessary to differentiate between the CPU and the CP as DP master, in order to guarantee data integrity in S7.
In the case of a CPU as master, CALL SFC14 must be performed prior to CALL FC 10. This copies the valid input data to the flag area (12 bytes). This must be followed by CALL SFC15, which copies the flag data (12 bytes) to the output area (see S7 example).
In the case of a CP as master, both calls are replaced by CALL "SEND" and CALL "RECEIVE", which have the same effect.

4 3WN1 and 3WS1 circuit-breakers

4.1 Mode of operation and design

4.1.1 General mode of operation

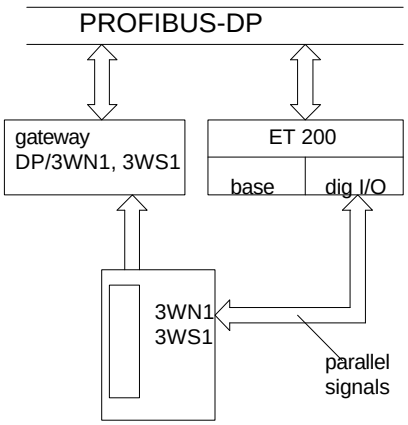
Fitting circuit-breakers 3WN1 and 3WS1 with a communication-capable overcurrent release version AZN (type 5) or AZNG (type 8) makes them capable of communicating on PROFIBUS-DP.

The connection of the 3WN1 and 3WS1 circuit-breakers to PROFIBUS-DP is implemented by means of the **DP/3WN1, 3WS1 interface** in conjunction with a digital I/O module (e.g. ET 200) which has been customized to suit the application.
The information available on the overcurrent release is transferred to the bus via the interface module and the circuit-breaker information via the I/O module. The I/O module can also be used to control the circuit-breaker.

4.1.2 Design of the communication-capable 3WN1/3WS1 PROFIBUS system

Fig. 12, page 80 illustrates a general system design in which 3WN1/3WS1 circuit-breakers are connected to PROFIBUS-DP:

Fig. 12: Example design



Note	
!	It is also possible to connect the circuit-breaker to the communication system using only the DP/3WN1, 3WS1 interface module. The following information can be transferred from the circuit-breaker in this case: - Highest loaded phase - All three phase currents - Rated circuit-breaker current - Phase imbalance - Processor fault - Overload signal - Temperature alarm The following additional information can be transferred to and from the circuit-breaker with the help of ET 200: - Circuit-breaker state - ON/OFF commands - Ready to close

4.1.3 Hardware and software requirements

The following hardware and software items are required in order to communicate with 3WN1/3WS1 circuit-breakers via PROFIBUS-DP:

Hardware:

Circuit-breaker	Version	MLFB
Fixed-mounted	5	3WN1xxx-xxRxx-xxxx - Z = F01 *
Fixed-mounted	8	3WN1xxx-xxVxx-xxxx - Z = F01 *
Draw-out	5	3WN1xxx-xxRxx-xxxx - Z = F01 *
Draw-out	8	3WN1xxx-xxVxx-xxxx - Z = F01 *

* Circuit-breaker incl. communication-capable overcurrent release and connecting cable

- Overcurrent release version 5 : 3WX31415JC12 or (MLFB for ordering)
- Overcurrent release version 8 : 3WX31416JE12 (MLFB for ordering)
- DP/3WN1, 3WS1 interface module : 3RK1002-0BB00-0AA0
  (including circuit-breaker connecting cable)

(ET 200 U used in the example:

Power supply : 6ES5 931-8MD11
ET 200 U : 6ES5 318-8MB12
Bus module : 6ES5 700-8MA11
Standard DIN rail : 6ES5 710-8MA11
Digital inputs : 6ES5 431-8MA11
Digital outputs : 6ES5 450-8MD11)

Software:

- **3.5" diskette with type/GSD file** for the software connection of 3WN1/3WS1 to PROFIBUS-DP (*bus configuration*). This diskette is supplied with the interface.
- Software for configuring the PROFIBUS-DP bus: "COM-PROFIBUS"
  (for SIMATIC S5 as bus master)
  Order number: **6ES5 895-6SE12** *(Individual license, Catalog ST50 1997)*
  Manual order number: **6ES5 998-3ES12** *(Catalog ST50 1997)*

4.2 Functionality and bus connection

The following **circuit-breaker output data** can be read from 3WN1/3WS1 via PROFIBUS-DP:
Circuit-breaker key data (e.g. circuit-breaker size)
Operational states (e.g. switching state, "Tripped" signals)
Operational data (e.g. actual phase current I_{L1})

... and **input data** can be written to the **circuit-breaker**

- Execute switching actions (switch circuit-breaker ON or OFF)

4.3 Procedure for connection to communication system

3WN1/3WS1 circuit-breakers are connected to PROFIBUS-DP in 8 steps:[56]

Step 1: Check that all the system components are fitted
Step 2: Check the system requirements
Step 3: Connect the I/O module
Step 4: Connect 3RK1002 interface module to PROFIBUS-DP
Step 5: Connect 3RK1002 interface module to 3WN1/3WS1
Step 6: Connect 3RK1002 interface module to voltage supply
Step 7: Bus configuration
Step 8: Set bus address on 3RK1002 interface module

Step 1: Check that all the system components are fitted

Check that all the following system components are fitted before connecting 3WN1/3WS1 to PROFIBUS-DP:

- Communication-capable 3WN1/3WS1 circuit-breaker
- 3RK1002 interface module and connecting cable from 3RK1002 interface module to circuit-breaker (supplied with 3RK1002)
- Connector (6ES7xxx) including terminating resistor for connecting interface module to PROFIBUS-DP
- 24 V DC voltage supply (DIN 19240)
- Diskette with type or GSD file (supplied with 3RK1002)
- I/O module (e.g. ET 200 U)
- Programming device PG ... (for SIMATIC S5/S7, or other appropriate hardware)
- COM ET 200 software/COM-PROFIBUS (for SIMATIC S5, or other appropriate software)

[56)] This procedure must be performed for each individual 3WN1 circuit-breaker.

Step 2: Check the system requirements

The second step involves checking the following three requirements for connecting 3WN1/3WS1 to PROFIBUS-DP:

- The communication-capable 3WN1/3WS1 circuit-breaker must be installed and wired in accordance with the user guide (included in scope of supply of circuit-breaker).

Note	*Circuit-breaker position*
!	A *draw-out* circuit-breaker must be in the test position for testing and in the connected position for normal operation.

When wiring, please ensure that the jumper arrangements on the auxiliary connectors are correct (*cf.* Fig. 15*, page 91 and* Fig. 15*, page 92 in the 3WN1/3WS1 user guide)*

- The PROFIBUS-DP master must be present and operational.
- The 3RK1002 interface module must be correctly installed and connected *(section 4.5.2, page 90).*
- The compact housing of the 3RK1002 interface module is 70 mm wide and can simply be snapped onto a 35 mm DIN rail. The devices can be mounted side by side.

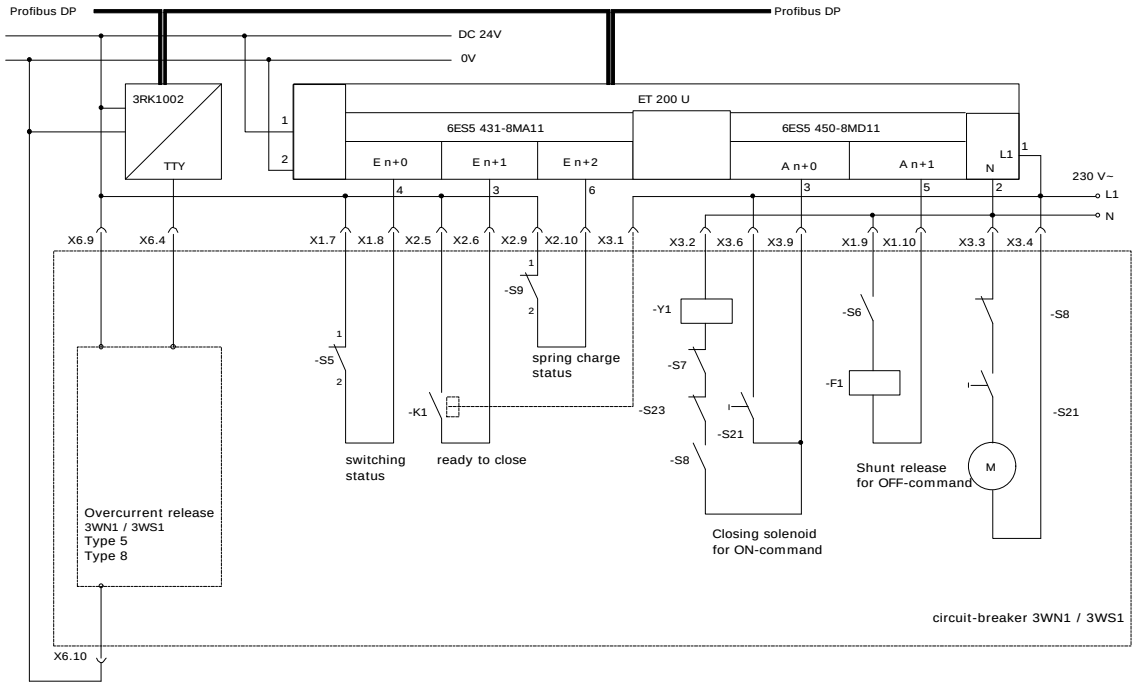
Note	*Installation procedure*
!	The interface module must not be mounted directly above the arcing space of the circuit-breaker, unless suitable covers have been fitted.

- The earth connection of the interface module (shield signal for electronic circuit) is made using a flexible earth wire **(1.5 mm^2)** and an earth terminal (order no. 8WA1001-1PF00, for example) which is mounted on the DIN rail immediately next to the interface module.
- The 9-pin SUB-D socket on the 3WN1/3WS1 circuit-breaker which is used for the connecting cable between the circuit-breaker and the interface module must be earthed using a flexible earth wire **(2.5 mm^2)**.

-The standard length of connecting cable 3WN1/3WS1-3RK1002 between the 3WN1/3WS1 circuit-breaker and the 3RK1002 interface module is 3 m.

(--> see section 4.5.2.2.5, page 94)

Fig. 13: Wiring example in accordance with the data areas described in Step 7



Step 3: Connect the I/O module [57]

Wire the required input and output modules for the digital bus inputs and outputs. The output signals of the modules must be configured in accordance with the levels of the circuit-breaker actuators.

Fig. 13 illustrates this connection with reference to a SIMATIC ET 200 U with an input signal level of 24 V DC and an output signal of 230 V AC.

57) This assumes that conventional copper conductors are used for PROFIBUS-DP. If fiber optic conductors are used, converters from fiber optic to copper conductors must be fitted.

Step 4: Connect 3RK1002 interface module to PROFIBUS-DP [58]

Now you can wire the appropriate 6ES7... connector (up to 12 Mbaud) to the PROFIBUS-DP cable based on the baud rate required on the bus[59] (cf. connector user guide). Then plug the wired connector into the **"PROFIBUS-DP"** socket on the interface module.

(--> see also section 4.5.2.2.3, page 93)

Step 5: Connect 3RK1002 interface module to 3WN1/3WS1 circuit-breaker

Connection of 3WN1/3WS1 <--> 3RK1002 connecting cable:

This cable is supplied with the interface and is plugged into the 3WN1, 3WS1/3RK1002 adapter (9-pin SUB-D socket), which is fitted on the circuit-breaker at the factory, and into the **"3WN1, 3WS1"** (9-pin SUB-D) socket on the front of the interface module.

Note	*Installation procedure*
!	All communication-capable circuit-breakers (fixed-mounted) and all communication-capable guide frames (for draw-out circuit-breakers) are fitted with a "3WN1, 3WS1/3RK1002" adapter at the factory. This 3WN1, 3WS1 adapter can also be ordered as a *spare part* using the following order numbers: • Adapter "3WN1/3WS1/3RK1002" (0.4 m) for 3WN1/3WS1 fixed-mounted circuit-breakers, comprising one SUB-D socket and free cable ends, and including mounting materials. Order number: **3WX3145-3JA00**

(--> see also section 4.5.2.2.2, page 92)

Step 6: Connect 3RK1002 interface module to voltage supply

Connect the 24 V DC voltage supply (DIN 19240) to the interface module:

The interface module is fitted with a 4-pole screw terminal to facilitate the through connection of the 24 V supply.

(--> see also section 4.5.2.2.4, page 94)

[58] This assumes that conventional copper conductors are used for PROFIBUS-DP. If fiber optic conductors are used, converters from fiber optic to copper conductors must be fitted.

[59] The maximum possible baud rate corresponds to the maximum baud rate of the slowest field device.

Step 7: Bus configuration

If SIMATIC S5 is the bus master, the bus can be configured quickly and easily using either a PC or a SIMATIC programming device (PG) in conjunction with the COM ET 200 or COM-PROFIBUS programs[60]. In the case of other bus masters, the appropriate devices and/or supplier-specific tools must be used.
The object of bus configuration is to define the 3WN1/3WS1 device data, the 3WN1/3WS1 bus address and the 3WN1/3WS1 data area (I/O area) in the bus master. The 3WN1/3WS1 device data can be read into the master in the form of type or GSD files.

Bus data areas

Table 11: Data area of 3RK1002 interface module

I/O area	Octet	Bit no. 7	6	5	4	3	2	1	0	Description	
0	1							0	0	Maximum phase current in phase L1	1 input byte
								0	1	Maximum phase current in phase L2	
								1	0	Maximum phase current in phase L3	
1	2					0	0	0	0	Rated circuit-breaker current Test	1 input byte
						0	0	0	1	Rated circuit-breaker current 315 A	
						0	0	1	0	Rated circuit-breaker current 400 A	
						0	0	1	1	Rated circuit-breaker current 500 A	
						0	1	0	0	Rated circuit-breaker current 630 A	
						0	1	0	1	Rated circuit-breaker current 800 A	
						0	1	1	0	Rated circuit-breaker current 1000 A	
						0	1	1	1	Rated circuit-breaker current 1250 A	
						1	0	0	0	Rated circuit-breaker current 1600 A	
						1	0	0	1	Rated circuit-breaker current 2000 A	
						1	0	1	0	Rated circuit-breaker current 2500 A	
						1	0	1	1	Rated circuit-breaker current 3150 A	
						1	1	0	0	Rated circuit-breaker current 4000 A	
						1	1	0	1	Rated circuit-breaker current 5000 A	
						1	1	1	0	Rated circuit-breaker current 6000 A	
						1	1	1	1	Rated circuit-breaker current 6300 A	
				0	0					Actually displayed phase L1	
				0	1					Actually displayed phase L2	
				1	0					Actually displayed phase L3	
				1	1					Actually displayed phase Lmax	

[60] cf. "ET 200 Distributed I/Os" manual, order number 6ES5 998-3ES12.

2	3	0	0	0	0	0	0	0	1	Button pressed on display	1 input byte
		0	0	0	0	0	0	1	0	"a" release	
		0	0	0	0	0	1	0	0	"n/z" release	
		0	0	0	0	1	0	0	0	"g" release	
		0	0	0	1	0	0	0	0	Phase imbalance	
		0	0	1	0	0	0	0	0	Watchdog (microprocessor fault)	
		0	1	0	0	0	0	0	0	Overload	
		1	0	0	0	0	0	0	0	Temperature alarm	
3	4									Phase 1 current	1 input word
	5										
5	6									Phase 2 current	1 input word
	7										
7	8									Phase 3 current	1 input word
	9										

Table 12: Data area of ET 200 U

I/O area	Octet	Bit no. 7	6	5	4	3	2	1	0	Description	
9	1						0	0	1	Switch position ON	1 input byte
							0	1	0	Ready to close	
							1	0	0	Storage spring charged	
							0	0	0		
							0	0	0		
							0	0	0		
							0	0	0		
							0	0	0		
10	2							0	1	Switch ON	1 output byte
								1	0	Switch OFF	
								0	0		
								0	0		
								0	0		
								0	0		
								0	0		
								0	0		

The digital input and output lines and data areas of a communication-capable I/O module must also be configured.

Step 8: Set bus address on 3RK1002 interface module

The bus address defined for 3WN in Step 7 can be set on the front panel of the 3RK1002 interface module by means of 2 rotary switches (range 00 - 99). ***(--> section 4.5.3.1.1, page 101)***

The rotary switch on the left (x10) sets the tens and the rotary switch on the right (x1) sets the units for the address.

The baud rate cannot be set on the interface. It is automatically adjusted in line with the baud rate of the bus master (e.g. SIMATIC S5).[61]

High-performance software is available for the **visualization** and evaluation of the data transferred from 3VF (see page 35 ff. for description):
"**SICAM LCC**" for the visualization of complete systems implementing circuit-breakers 3VF, 3WN6, 3WN1, 3WS1, and a SIMOCODE-DP motor protection and control device. [62]
An additional software block is required for 3WN1/WS1 visualization using SICAM LCC and SIMATIC. It makes the data on PROFIBUS available to the PC via an FDL link.

Once you have completed Step 8, the 3WN1/3WS1 circuit-breaker is connected to the PROFIBUS-DP communication system. No further steps are required.

[61] The maximum possible baud rate corresponds to the maximum baud rate of the slowest field device.
[62] Shipping of **SICAM LCC** starts in 10/98.

4.4 Special cases

- The current values transferred by the circuit-breaker which are below the activation limit are generated in the transformer electronics and must not be evaluated.
- The trip reasons are stored in the communication processor and are transferred at regular intervals after a trip. They are not deleted until the circuit-breaker is switched on again.
- The trip reasons are displayed on the release within a period of 20 ms.
- The release updates the current values of the transferred phases every 50 ms.

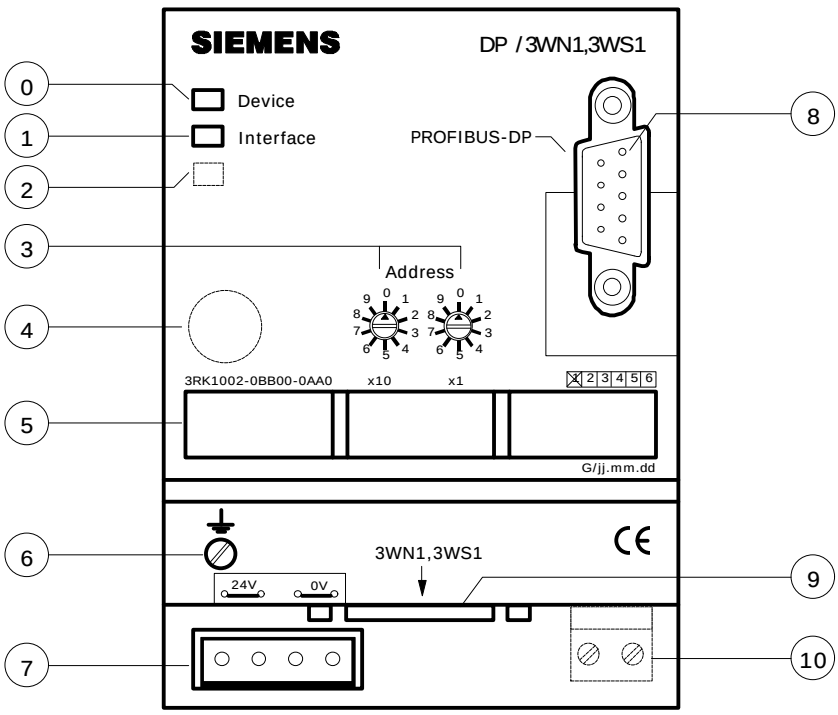
4.5 DP/3WN1, 3WS1 and DP/3WN6 interface modules

This section contains a description, installation guidelines, operating instructions and technical data for the interface modules DP/3WN1, 3WS1 (for 3WN1 or 3WS1 circuit-breakers) and DP/3WN6 (for 3WN6 circuit-breakers). Only the DP/3WN1 interface modules is illustrated however. All the information also applies to the DP/3WN6 interface module with the exception of the device names and the order numbers.
(Note: the "PROFIBUS-DP" and "3WN6" connectors on the DP/3WN6 interface module are swapped on products shipped before July 1998, i.e. the PROFIBUS interface is below and the 3WN6 interface is on top. We shall make special reference to any other differences.)

4.5.1 Device description

4.5.1.1 Display/operating elements and interfaces

Fig. 14: Display/operating elements and interfaces



Device status LED:	green		Device OK
	red		Device defective
	off	→	Device switched off
Interface status LED:	green		Both communication interfaces OK
	yellow		Communication interface 1 not clear (PROFIBUS-DP)
	off		Communication interface 2 not clear (3WN1/3WS1)
	red		Communication interfaces both not clear

not configured

Address switch for PROFIBUS-DP (addresses 0 ... 99)

not configured

Inscription plates

Earth terminal for cable screens

Power supply terminals

Communication interface 1:	PROFIBUS-DP	*(9-pin SUB-D socket)*
Communication interface 2:	3WN1, 3WS1	*(9-pin SUB-D socket)*

not configured

4.5.2 Installation guidelines

4.5.2.1 Installing the interface module

The interface module is designed for installation in a switchgear cubicle (IP20) and can therefore only be mounted on a standard DIN rail (deep rail in acc. with EN50022)

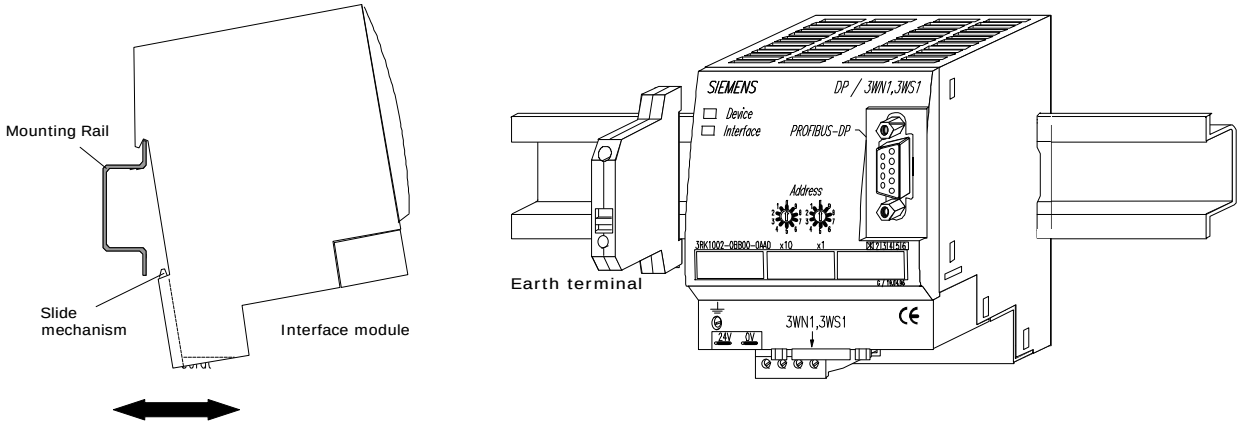
Installation

- Lower the module onto the DIN rail from above.
- Then swivel it downwards until the slide mechanism on the module snaps onto the rail.
- You may install other modules on the rail to the left and right of the interface module.
- Clearance of at least 5 cm must be provided above and below the module to allow for heat dissipation.
- Connect the standard DIN rail to the equipotential bonding strip of the switchgear cubicle. The connecting wire must have a cross-section of at least **10 mm^2**.
- Install an earth terminal immediately next to the interface module so that the flexible wire **(1.5 mm^2)** used for screen bonding can be as short as possible.

Deinstallation

- First disconnect the power supply and signal cables.
- Then use a screwdriver to press the slide mechanism on the module downwards.
- Now swivel the module off the DIN rail.

Fig. 15: Installing/Deinstalling the device



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Vertical installation

The standard DIN rail can also be installed in the vertical position, in which case the interface module must be rotated by 90° for installation. The heat dissipation by convection is not as effective in this case, so the maximum permissible temperature is restricted to a max. of 40°C.

4.5.2.2 Wiring

4.5.2.2.1 Terminal connections

The following terminal connections are possible when wiring the interface module:

- Standard screw terminal (earth terminal)
- Plug-type terminals (voltage supply terminals)
- 9-pin SUB-D connectors (PROFIBUS-DP and 3WN1/3WS1 connection)

a) One conductor can be connected at each terminal with standard screw terminals. We recommend that you use a 3.5 mm screwdriver for tightening the screws.

Permissible conductor cross-section:
- Flexible conductor with end sleeve: 1 x 0.25 ... 1.5 mm^2
- Solid conductor: 1 x 0.25 ... 1.5 mm^2

Tightening torque: 0.5 ... 0.8 Nm

b) Plug-type terminals are a combination of standard screw terminals and plug-in connections. The plug-in connection part is polarized and cannot be plugged in the wrong way.

c) The 9-pin SUB-D connectors are secured with 2 x 4-40 UNC threads. We recommend that you use a 3.5 mm screwdriver for tightening the screws.

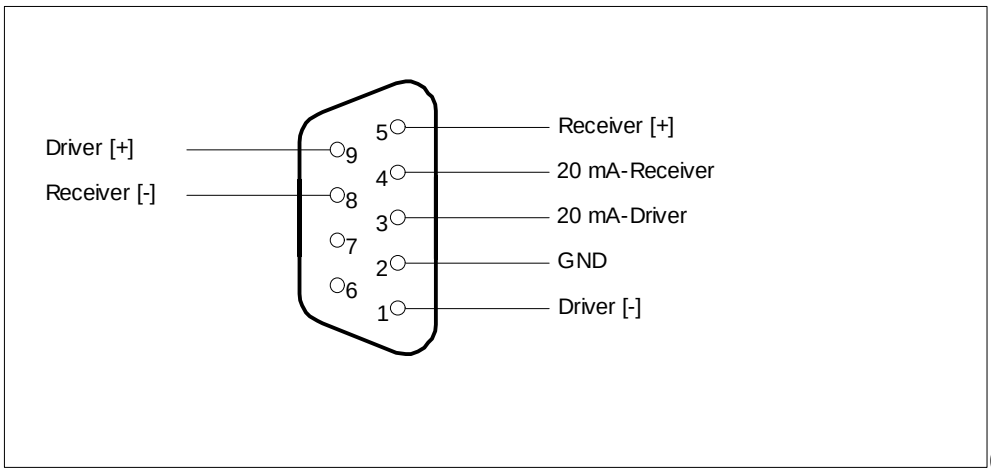
Tightening torque: 0.2 ... 0.4 Nm

4.5.2.2.2 3WN1, 3WS1 communication interface

This interface takes the form of 9-pin SUB-D connectors on the interface module and the 3WN1/3WS1 circuit-breaker.

- Insert the plug on the supplied connecting cable into the 9-pin SUB-D socket labeled **"3WN1, 3WS1"**.
- Insert the other plug on the connecting cable into the 9-pin SUB-D socket on the circuit-breaker.
- Tighten the retaining screws on the connectors using a screwdriver.

Fig. 16: "3WN1, 3WS1" communication interface



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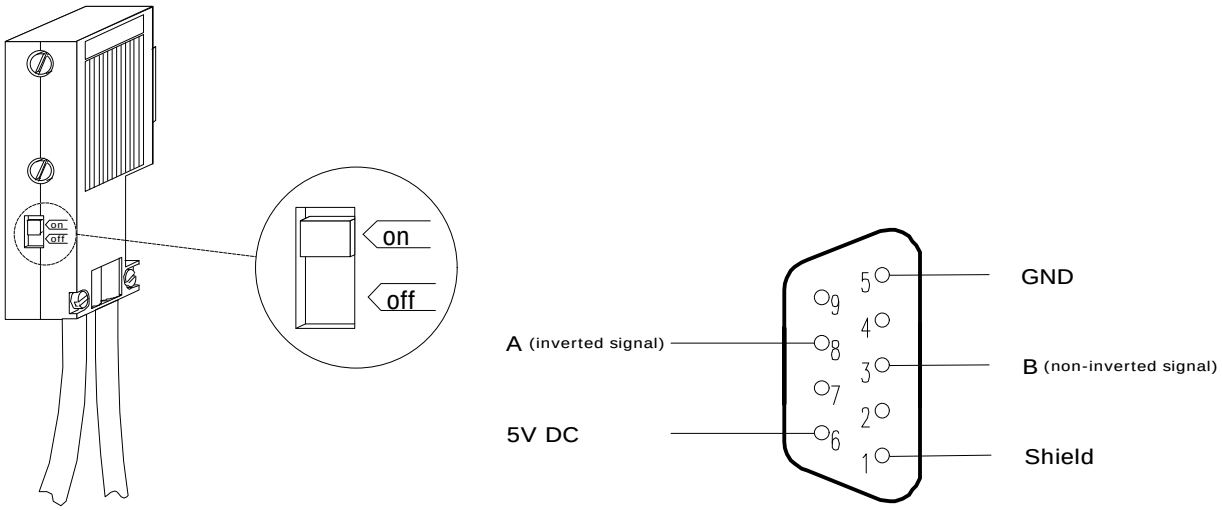
4.5.2.2.3 PROFIBUS-DP communication interface

Bus with copper cables

This interface takes the form of a 9-pin SUB-D connector on the front panel of the interface module housing.

- Insert the PROFIBUS connector (6ES5... or 6ES7972-...) into the SUB-D socket labeled **"PROFIBUS-DP"**. Please note that the "6ES5..." connectors are only suitable for baud rates up to a maximum of 1.5 Mbit/s.
- Tighten the retaining screws on the connector using a screwdriver.
- If the interface module is at the end or at the start of the PROFIBUS line, you must activate the integrated terminating resistor in the connector. To do this, slide the switch on the rear of the connector into the position labeled **"on"**.
- If the interface module is at the end or at the start of the PROFIBUS line, slide the switch into the position labeled **"off"**.

Fig. 17: "PROFIBUS-DP" communication interface



Bus with fiber optic cables

The PROFIBUS-DP interface can also be used for connecting fiber optic conductors with the help of an OLP (optical link plug), i.e. the interface supplies the current (max. 80 mA) required by the OLP.

- The OLP order number is: **6GK1502-1AA00**
- Plug the OLP into the interface labeled **"PROFIBUS-DP"**.
- Tighten the retaining screw on the OLP using a screwdriver.
- Plug both fiber optic terminals into the designated sockets on the OLP.
- Set the required baud rate on the OLP as specified in the OLP description.
- There is no need for a terminating resistor in the case of fiber optic cables.

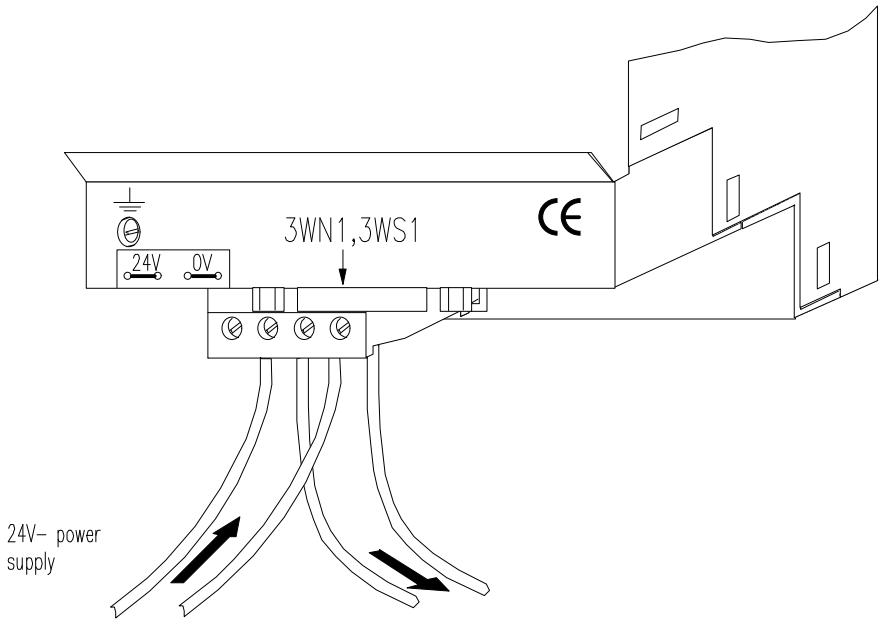
Note	*Limited range of baud rates with OLP*
!	Not all the baud rates available to the interface module can be selected in conjunction with an OLP. Only baud rates 93.75, 187.5, 500 and 1500 Kbit/s are possible.

4.5.2.2.4 Power supply

The device is connected to the 24 V DC power supply by means of a 4-pole plug-type screw terminal. The 24 V DC voltage of the power supply unit may fluctuate between 20.4 V and 28.8 V as specified in DIN 19240. The 4-pole plug-type screw terminal makes a through connection of the 24 V supply to another device possible. Please note, however, that the supply voltage is looped through the device, i.e. the supply voltage to the other device is also interrupted when the screw terminal is disconnected.

- Connect the supply voltage to the designated 4-pole plug-type screw terminal on the front panel of the device.

Fig. 18: Power supply terminal

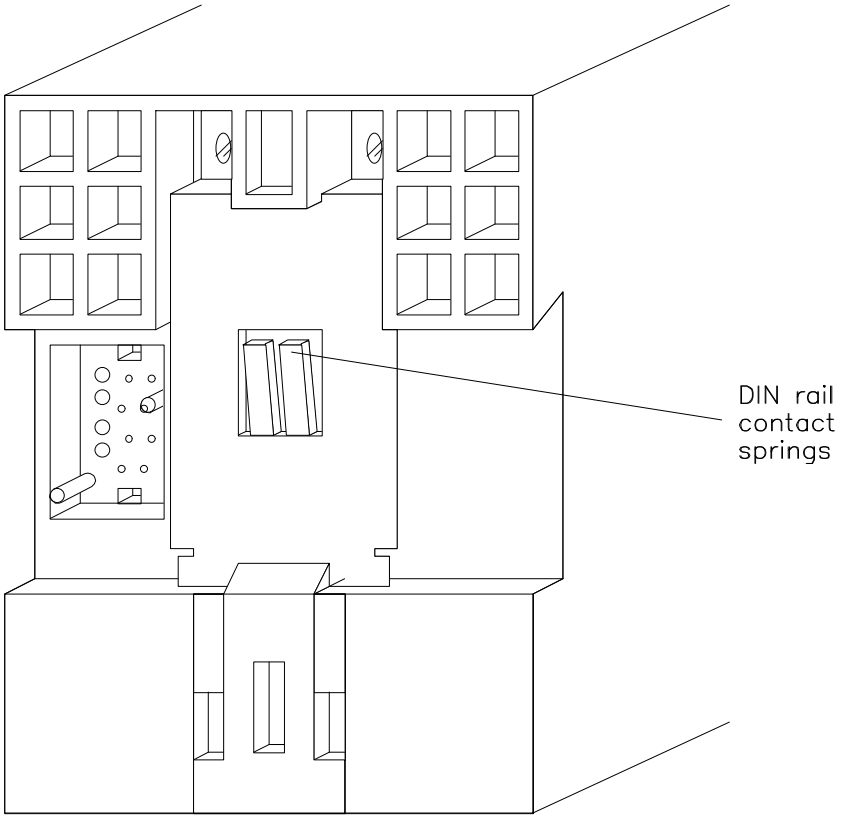


4.5.2.2.5 Screen bonding

The interface module is fitted with two contact points for screen bonding. These are two electrically isolated screens in the device which must be connected to the equipotential bonding strip outside the module. This precaution ensures a greater immunity to interference as the "cable screen current", which can be anything up to a few amperes due to differences of potential of two slaves, is not discharged via the device.
The **first** screen bonding point *(= screen for internal filter connections)* is located on the base of the interface module and is **automatically** connected when the module is mounted on the DIN rail.

Note	*High levels of stress*
!	If the device is subject to high levels of mechanical or chemical stress, we recommend that a tinned DIN rail be used in order to ensure a good contact to the screen bonding. Order number: 6ES5 710-8MA11 ---> Length of 483 mm for 19" cubicles 6ES5 710-8MA21 ---> Length of 530 mm for 600 mm cubicles 6ES5 710-8MA31 ---> Length of 830 mm for 830 mm cubicles 6ES5 710-8MA41 ---> Length of 2 m

Fig. 19: Screen contacting on DIN rail

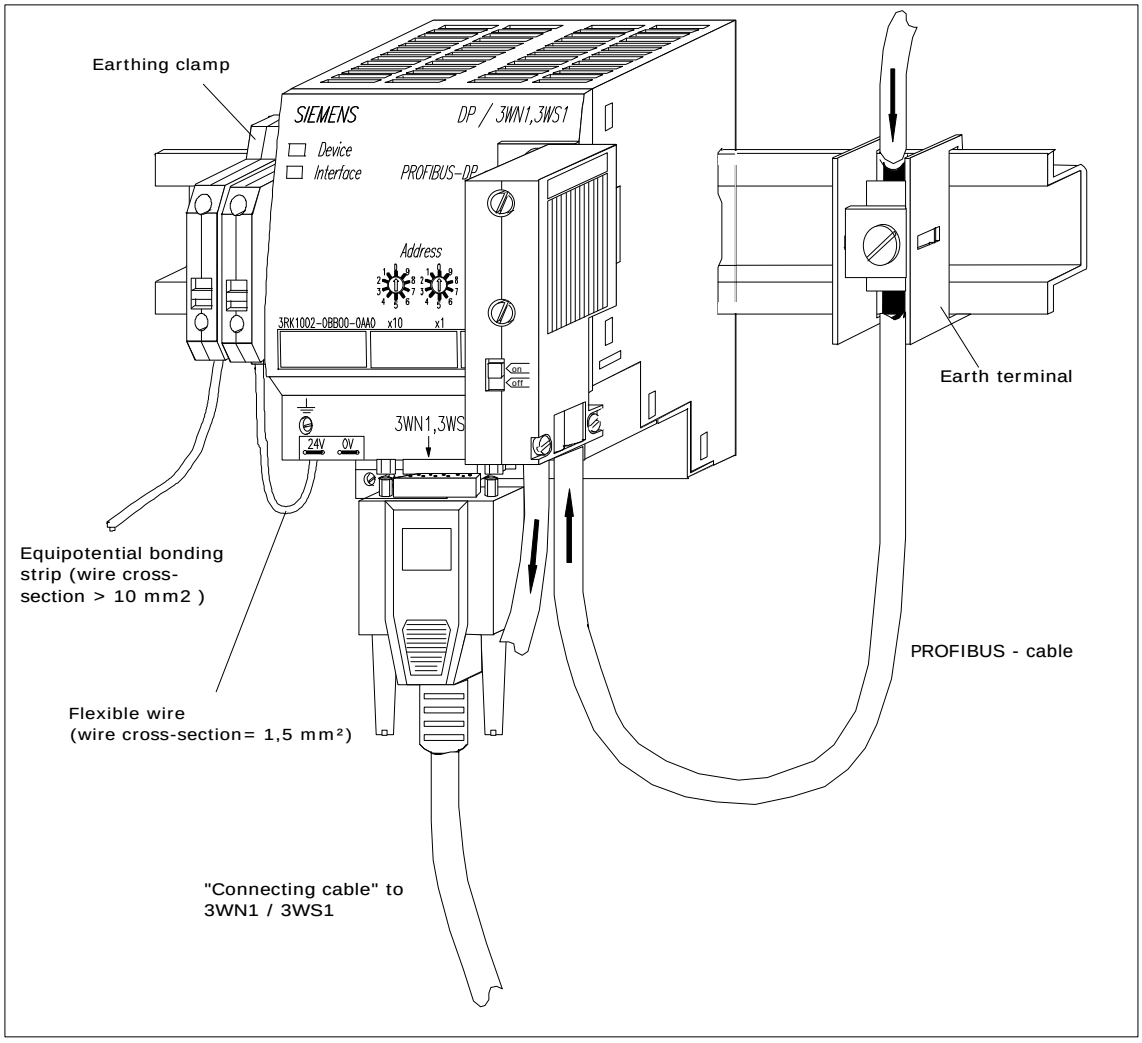


The **second** screen bonding contact point *(= cable screens*) is located on the front panel of the module in the form of a screw terminal. This screw terminal is used to earth the cable screens of the bus cables.

- Fit an earth terminal *(order no. 8WA1001-1PF00, for example)* on the DIN rail immediately next to the module. The earth terminal automatically makes an electrical connection to the DIN rail.
- Connect the screen bonding terminal with the earth terminal using a flexible wire (as short as possible) with a cross-section of **1.5 mm^2**.
- Connect the DIN rail with the equipotential bonding strip using as low a resistance as possible. Use a flexible earth wire with a cross-section of at least **10 mm^2**.

(--> section 4.5.2.3.2, page 98)

Fig. 20: Fully installed interface module



4.5.2.3 Wiring arrangements, screening and measures to counteract interference voltage

This section describes the wiring arrangements for bus, signal and power supply cables in order to ensure that your system is installed in compliance with EMC guidelines.

4.5.2.3.1 General information on wiring arrangements

a) In cubicles and not in cubicles

It is useful to classify cables into the following cable groups and to install these groups separately in order to comply with EMC guidelines.

Group A:
- Screened bus and data cables (e.g. for PROFIBUS-DP, 3WN1, printers etc.)
- Screened analog cables
- Unscreened cables for DC voltages ≤ 60 V
- Unscreened cables for AC voltages ≤ 25 V
- Coaxial monitor cables

Group B:
- Unscreened cables for DC voltages ≥ 60 V and ≤ 400 V
- Unscreened cables for AC voltages ≥ 24 V and ≤ 400 V

Group C:
- Unscreened cables for DC voltages > 400 V

Group D:
- SINEC H1 (Ethernet) cables

You can use the table below to look up the conditions required for installing cables based on different group combinations.

Table 13: Cable installation regulations for combinations of cable groups

	Group A	Group B	Group C	Group D
Group A				
Group B				
Group C				
Group D				

Cables can be installed in the same bundles or cable ducts.

Cables must be installed in separate bundles or cable ducts (no minimum clearance).

Cables in cubicles must be installed in separate bundles or cable ducts. Cables not in cubicles but inside buildings must be installed in separate cable raceways with a minimum clearance of 10 cm.

Cables must be installed in separate bundles or cable ducts with a minimum clearance of 50 cm.

b) Outdoors

Install cables which are not inside buildings on metal cable trays if possible. Make an electrical connection between the joints of the cable trays and earth the cable trays.
Observe the usual lightning protection and earthing measures when installing cables outside buildings.

General guidelines:

- **Lightning protection:**
  If cables and wires required for the interface are to be installed outside buildings, measures must be implemented for internal and external lightning protection.
  Install cables outside buildings in either
  - metal conduits earthed at both ends or
  - concrete cable ducts with continuous reinforcement.

  Protect the signal cables from overvoltage by means of
  - varistors or
  - surge arresters filled with inert gases.

  Install these protective elements at the point where the cable enters the building.
- **Equipotential bonding:**
  Ensure that there is sufficient equipotential bonding for the connected devices.

4.5.2.3.2 Equipotential bonding

Differences of potential can occur between separate system sections in the case of

- PLCs and I/O modules connected via non-isolated links or
- Cable screens contacted at both ends and earthed on different plant sections.

Differences of potential can occur due to different power supply inputs, for example. These differences must be reduced by means of equipotential bonding conductors, in order to ensure the continuing operation of all the electronic components in the system.

Please note the following items with regard to equipotential bonding:

- The lower the impedance of the equipotential bonding conductor, the more effective the equipotential bonding.
- If screened signal cables which are connected to the protective earth conductor at both ends are to be installed between the affected system sections, the impedance of the additionally installed equipotential bonding conductor must not be greater than 10 % of the screen impedance.
- The cross-section of the equipotential bonding conductor must be large enough for the maximum compensating current. The following cross-sections have proved useful in practice:
  - 16 mm^2 Cu for equipotential bonding conductors up to 200 m in length
  - 25 mm^2 Cu for equipotential bonding conductors over 200 m in length
- Use equipotential bonding conductors made of copper or galvanized steel. Make a large-area connection between them and the protective earth conductor and protect the equipotential bonding conductors from corrosion.
- The equipotential bonding conductor should be installed such that the areas enclosed between the equipotential bonding conductor and the signal cables are as small as possible.

4.5.2.3.3 Cable screening

Screening is a measure designed to reduce magnetic, electrical or electromagnetic interference fields.

Interference currents on cable screens are discharged to earth via the conducting screen bus which is connected to the housing. A low-impedance connection to the protective earth conductor is especially important to ensure that these interference currents do not themselves become a source of interference.

Only use cables with a braided screen if possible. The coverage density should be more than 80 %. Avoid cables with foil screens as the foil can very easily be damaged by tension and compression loads when fixing, the result being a reduction in the effectiveness of the screen.

You should generally always connect cable screens at both ends. Only then is it possible to achieve good interference suppression in the higher frequency range.

The screen should only be connected at one end in exceptional cases. This only attenuates lower frequencies, however. A single-ended screen connection can be an advantage in cases where

- it is not possible to install an equipotential bonding conductor.
- analog signals (a number of mV or mA) are transmitted.
- foil screens (static screens) are used.

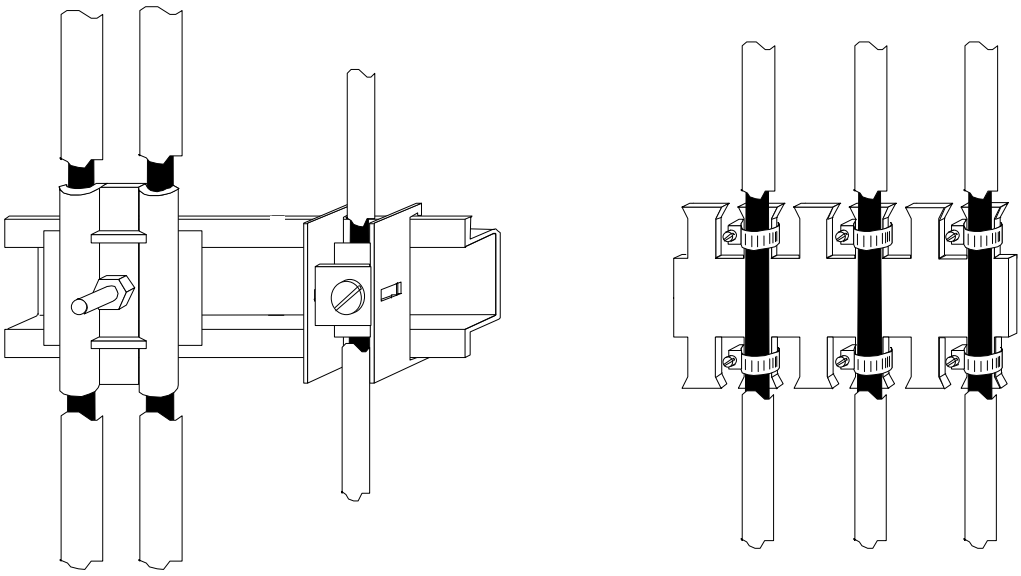
Always use metal or metal-plated connectors in the case of serial link data cables. Fix the screen of the data cable to the connector casing. Do ***not*** connect the screen to PIN 1 of the connector!

Note	*Differences of potential*
!	If there are differences of potential between the earthing points, compensating current can flow across the screen connected at both ends. Install an additional equipotential bonding conductor in this case.

Please note the following items with regard to the screen:

- Use metal cable clamps for fixing the braided screens. There must be a good, large-area contact between the clamps and the screen.
- Connect the screen to a screen bus immediately after the cable enters the cubicle. Run the screen through as far as the module but do ***not*** connect it again!

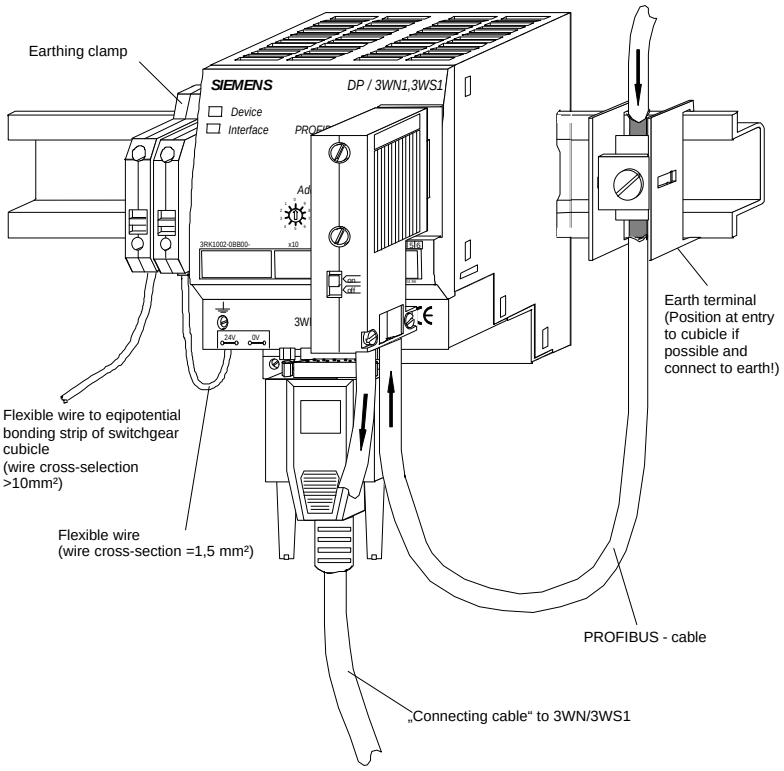
Fig. 21: Possible cable screen connections

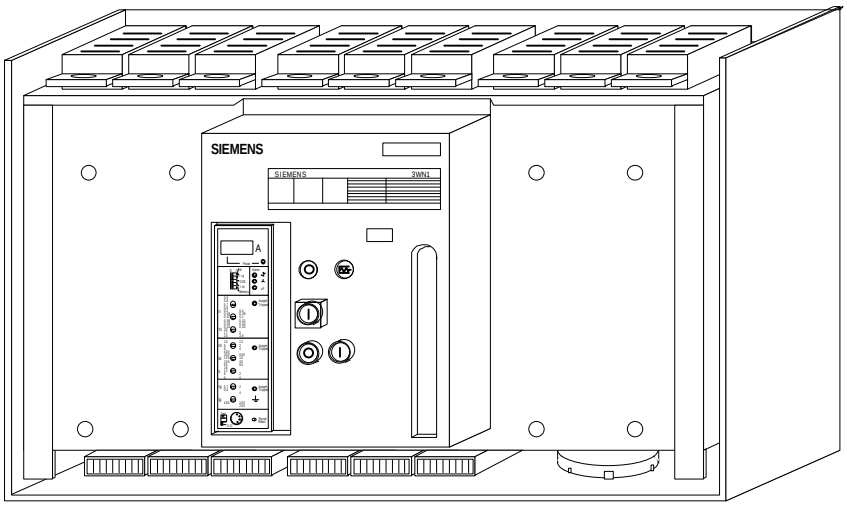


Screened data cables and unscreened power supply cables (< 60 V DC) are run through to the interface module and connected. All the cable screens must be earthed at both ends in order to comply with EMC limits.

- The PROFIBUS-DP cable screen must be connected to the equipotential bonding strip as it enters the switchgear cubicle.
- The supplied screened 3WN1 connecting cable must be earthed on the shield terminal of the interface module using a flexible wire (as short as possible) with a cross-section of **1.5 mm²**.
- The other end of the screen on the 3WN1 connecting cable must be earthed on the SUB-D connector of the circuit-breaker using a flexible wire (as short as possible) with a cross-section ≥ **2.5 mm²**.

Fig. 22: Connecting the interface module to the 3WN1/3WS1 circuit-breaker





4.5.3 Operation

When you have installed and wired the interface module in accordance with the installation guidelines, you still have to set the PROFIBUS address before start-up. It is not necessary to set the baud rate as the interface module automatically synchronizes with the baud rate of the master in the range 9.6 Kbit/s to 12 Mbit/s.

You can check that the interface modules is working properly by checking the display elements on start-up.

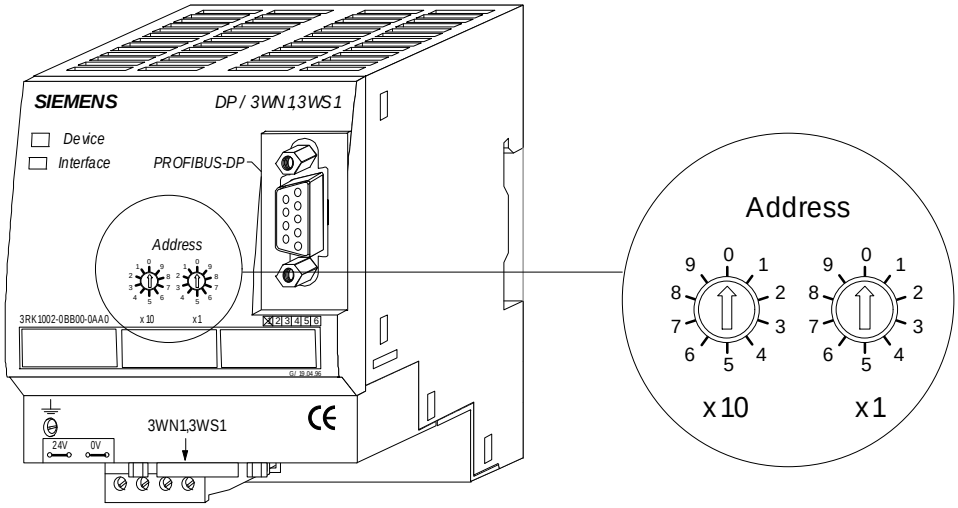
4.5.3.1 Operating elements

4.5.3.1.1 Setting the address

The two rotary switches on the front panel of the interface module are used to set the PROFIBUS address in the range 00 ... 99.

- Use the rotary switch on the left labeled **"x10"** to set the tens for the address.
- Use the rotary switch on the right labeled **"x1"** to set the units.

Fig. 23: Setting the PROFIBUS-DP address



Note	*Transfer of PROFIBUS address*
!	If you set or change the address after switching on the device, you must restart the device as the PROFIBUS address is only read in and transferred once, i.e. immediately after the device is switched on.

4.5.3.2 Display elements

You can obtain information about the status of the device and the interfaces by checking the LEDs.

- Check the LED labeled **"Device"** for information about the device status.
- Check the LED labeled **"Interface"** for information about the status of the communication interfaces.

Device

If the "Device" LED is ...	, then ...
green	the interface module is ready for operation.
off	no supply voltage is present.
red	the interface module is defective and the status indicated by the "Interface" LED is not valid.

Interface

If the "Interface" LED is ...	, then ...
green	interfaces 1 and 2 are ready for operation.
yellow	interface 1 is not clear (= PROFIBUS-DP).
off	interface 2 is not clear (= 3WN1/3WS1).
red	interfaces 1 and 2 are both not clear.

4.5.4 Technical data

4.5.4.1 Device data

The following table contains the technical data of the interface module.

Table 14: Technical data of interface module

No.	Parameter	Data	Description
1	Place of installation	Switchgear cubicle	Mounted on DIN rail
2	Degree of protection	IP 20	Protection against ingress of solid foreign bodies and water to IEC 529 (DIN 40050)
3	Protection class	3	IEC 536 (VDE 0106-1) SELV supply
4	Cooling	Convection	No additional cooling necessary
5	Endurance	10 years	
6	Housing dimensions	95 mm x 70 mm x 86 mm	H x W x D
7	Weight	0.3 kg	
8	Operating temperature	0 °C ... + 60 °C 0 °C ... + 40 °C	Horizontal installation (preferred) Vertical installation
9	Storage/transport temperature	- 40 °C ... + 70°C	
10	Atmospheric pressure during operation during transport	 795 hPa ... 1080 hPa 660 hPa ... 1080 hPa	
11	Site altitude	2000 m 4000 m	No restrictions Restrictions: - ambient temperature ≤ 40 °C
12	Relative humidity	5 % ... 95 %	SN 31205 (IEC 68-2-30) No condensation
13	Pollutant concentration	SO2 < 0.5 ppm; relative humidity < 60 % H2S < 0,1 ppm; relative humidity < 60 %	SN 31205 (IEC 68-2-60) *(= utilization category: 3C3/1C2)* No condensation
14	Particles/dirt	Sand and dust must not be permitted to enter the device!	
15	External supply voltage	20.4 V DC ... 28.8 V DC	Standard power supply unit to DIN 19240
16	Current input at 24 V DC	typ. 150 mA, max. 180 mA	
17	Supply on PROFIBUS interface	5 V DC/max. 80 mA	Suitable for connection of OLP (optical link plug)
18	Reverse voltage protection	Yes	But device is not functional!
19	Short-circuit protection	Yes	
20	Overload protection	0.5 A multifuse	Self-healing fuse Reset by power OFF
21	Undervoltage detection	≤ 14 V DC	min. 50 ms until RESET
22	Voltage failure back-up	≥ 20 ms	However undervoltage detection is triggered first at U_e < 14V. Device fully functional.
23	Insulation voltage	500 V DC	IEC 1131-2

The interface module has been tested in accordance with the tests, standards and specifications outlined in the following table.

Table 15 Tests, standards and specifications

No.	Parameter	Data	Description
1	Vibration test	• 5 Hz ≤ f ≤ 26 Hz, amplitude = 0.75 mm • 26 Hz ≤ f ≤ 500 Hz, acceleration = 20 m/s^2 Frequency sweep: 1 octave/min 10 freq. sweeps each in x, y, z	SN 31205 (IEC 68-2-6-Fc sinusoidal) *(= utilization category: 3M6/1M4)*
2	Shock test	• Shock form = half sinusoidal • Acceleration = 15 g (150 m/s^2) • Duration of shock = 11 ms 3 shocks in +/- direction in x, y, z	SN 31205 (IEC 68-2-27-Ea) *(= utilization category: 3M6/1M4)*
3	Drop test	1m high	SN 18013
4	Bending and draw-out test	• Screw size: M3 --> tightening torque: 0.5 ... 0.8 Nm • Wire cross-section: 0.75/1.5/2.5 mm^2 AWG: 18/16/14 • Wire type : rigid, flexible	IEC 947-1 (screw connections)
5	Climatic test: - Cold - Dry heat - Change of temp. - Damp heat	• 0 °C/16 h • 60 °C/16 h • -25 °C ... 55 °C, 1 °C/min, 2 cycles • 55 °C, 90 ... 95 %, 12+12h, 2 cycles	SN 31205 (IEC 68-2- 1-Ad, IEC 68-2- 2-Bd, IEC 68-2-14-Nb, IEC 68-2-30-Db) *(= utilization category: 3K6/1K6)*
6	Pollutant concentration	• SO2 < 0.5 ppm; rel. humidity < 60 % • H2S < 0.1 ppm; rel. humidity < 60 %	SN 31205 (IEC 68-2-60) *(= utilization category: 3C3/1C2)* No condensation
7	ESD	8 kV discharge in air 6 kV contact discharge	IEC 1000-4-2 Severity 3
8	Electromagnetic fields	10 V/m	IEC 1000-4-3 Severity 3
9	Burst	2 kV/5 kHz supply voltage 2 kV/5 kHz data cables	IEC 1000-4-4 Severity 3
10	Emitted interference	Limit class A	EN 55011
11	Approvals	• UL • CSA • CE mark • PROFIBUS certification	Underwriters Laboratories Canadian Standards Association Certificate of conformity from PROFIBUS user organization
12	Standards, specifications	• DIN 40050; IEC 529 • VDE 0106, protection class 3 • VDE 0160, where applicable • VDE 0110 - insulator group IIIa, IIIb - pollution severity 3 • IEC 68 • IEC 721-3-1/-3 • IEC 1131-2 • IEC 1000-4-2/-3/ -4/ -5/ -6 • EN 55011, DIN VDE 0875-11 • EN 50022 • EN 61131-2 • UL 508 • CSA 22.2-14	IP degrees of protection Shock protection, protective separation Power installations Insulation coordination Env. conditions: Meas. methods Env. conditions: Definitions PLC interface standard EMC requirements EMC emissions Standard DIN rail PLC I/O modules UL for indust. control systems CSA for industrial equipment
13	Siemens standards	• SN 18013 • SN 18012 • SN 36350 • SN 31205	Packaging and drop test Labeling of packaged items Recycling guidelines Environmental conditions

4.5.4.2 Interface data

The following table contains a list of technical data for the interfaces on the device. The data have been obtained from the relevant standards.

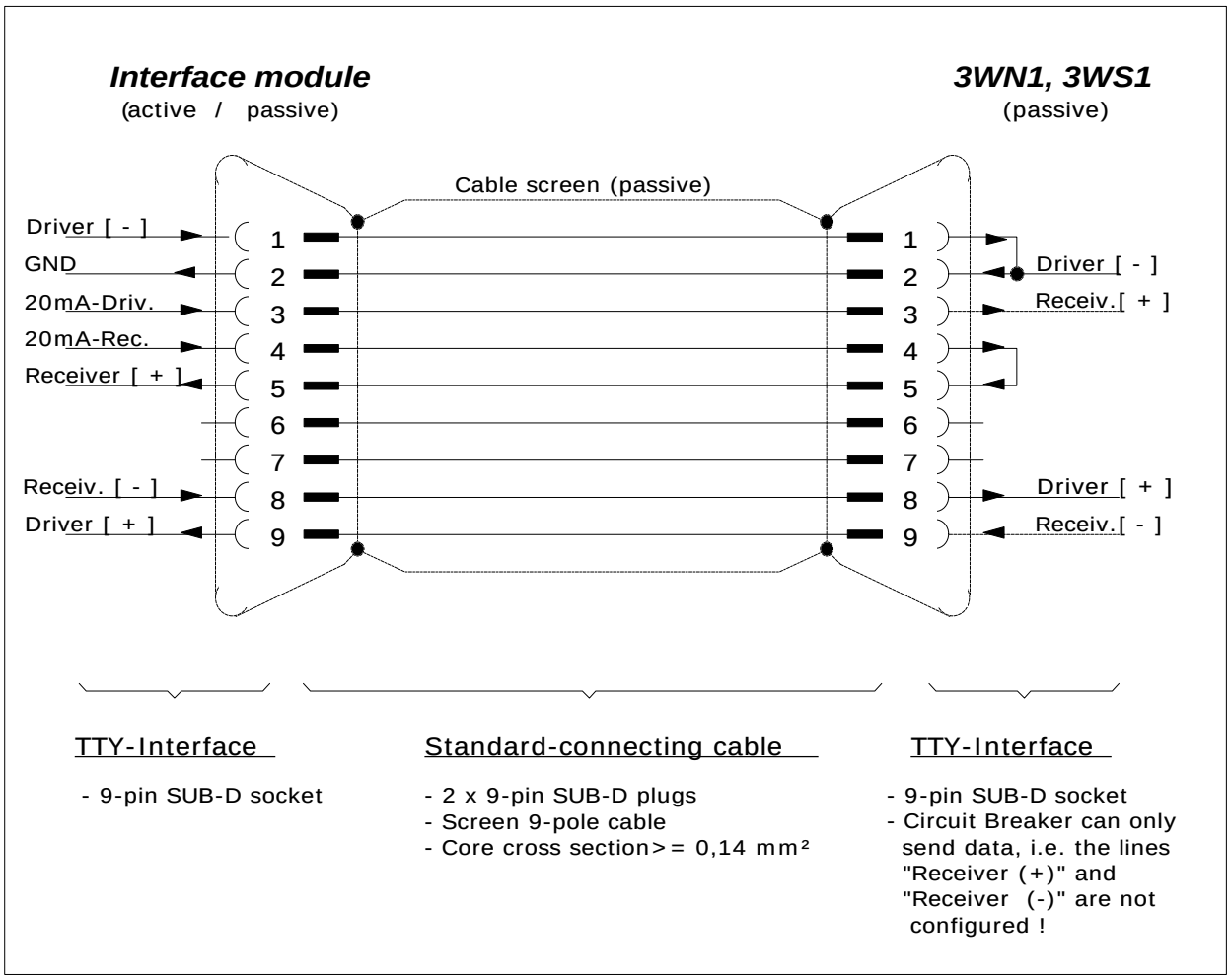
Table 16: Technical data of the interface on the interface module

No.	Interface name Physical interface	PROFIBUS-DP *RS485*	3WN1, 3WS1 *TTY*
1	Standard	EIA standard	DIN 66258
2	Transmission type	Symmetrical Asynchronous Serial Half-duplex Difference signal	Asymmetrical Asynchronous Serial Full-duplex Current loop
3	Transmission mode	Master/slave	Active/passive
4	Number of slaves: - Transmitters - Receivers	 32 32	 1 1
5	Cable length: - Maximum - Dependent on baud rate	 1200 m 93.75 Kbaud 1200 m 187.5 Kbaud 1000 m 500 Kbaud 400 m 1.5 Mbaud 200 m >1.5 Mbaud 100 m	 1000 m No
6	Bus topology	Line	Point-to-point
7	Data rate: - Maximum - Standard values	 12 Mbit/s 9.6 Kbit/s 19.2 Kbit/s 93.75 Kbit/s 187.5 Kbit/s 500 Kbit/s 1.5 Mbit/s 3 Mbit/s 6 Mbit/s 12 Mbit/s	 9.6 Kbit/s 110 bit/s 1.2 Kbit/s 2.4 Kbit/s 9.6 Kbit/s
8	Transmitter load - Max. voltage - Signal without load - Signal with load	54 Ω - 7 V ... 12 V ± 5 V ± 1.5 V	 24 V 12 V/0 mA approx. 3 V/22 mA
9	Receiver: - Input resistance - Max. input signal - Sensitivity	 12 kΩ - 7 V ... 12 V ± 0.2 V	 22 mA
10	SPACE mode: - Voltage level - Logic level	 -0.2 ... +0.2 V 0	 0 mA 0
11	MARK mode: - Voltage level - Logic level	 +1.5 ... +5 V 1	 20 mA 1

4.5.5 Connecting cables between interface modules and 3WN1/3WS1

The pin assignments of the TTY interface on the 3WN1/3WS1 circuit-breakers have been designed such that a 9-pole 1:1 connecting cable can be used.
The 3WN1/3WS1 circuit-breakers use the TTY interface in only one direction, i.e. the circuit-breakers can only transmit, not receive.

Fig. 24: Connecting cable between interface module and circuit-breaker



Note	*TTY interface of circuit-breaker*
!	The 3WN1/3WS1 circuit-breakers are fitted with a unidirectional interface. The circuit-breakers can only send data, they cannot receive. For this reason, the "Receiver (+)" and "Receiver (-)" lines, which are required for receiving data, are not configured in the TTY interface of the circuit-breakers.

4.5.6 Displaying data in PROFIBUS-DP

Any standard PROFIBUS-DP master can exchange data with the interface module. Even very "simple" master interfaces can be used thanks to the data structure.

Standard PROFIBUS-DP masters and slaves transmit and process four different types of message:

- Parameterization message
- Configuration message
- Diagnostic message
- Data message

The general mode of operation of the communication link is described in the following:

- After the master has determined which slaves are present on the bus, it sends first a parameterization message and then a configuration message to each slave. After the slave (interface module) has received the parameterization and configuration messages, master and slave can start the data exchange cycle (= *normal operating state*).
- If diagnostic data or faults occur in the DP slave (interface module), e.g. "3WN1/3WS1 communication interface not clear", the slave (interface module) transmits a high-priority message instead of a low-priority message. The master recognizes this and requests the diagnostic data from the slave for the purposes of a more detailed analysis.

Note	*Type or GSD files*
!	All the data *(see Parameterization, Configuration)* required by the interface module for normal operation are available in the form of a type or GSD file, which you will find on the supplied diskette. **No further data need to be entered by the user.**

The following section describes the four message types in detail.

4.5.6.1 Parameterization

The master identifies itself to the slave by means of the parameterization message and defines the mode in which the slave (interface module) is to operate.

The following parameterization options are available as standard:

- Slave operation with/without watchdog (response monitoring). This is necessary for safety reasons as it makes it possible to detect whether a master is still active.
- Definition of TSDR (the minimum delay time which must elapse before a slave can respond)
- Operation of slave in Freeze/Sync mode (e.g. for actuators, counters)
- Enabling/disabling of DP slave for other masters.
- Issuing of a group assignment for "global control" messages. Each bit signifies a group.
- Master address for unique identification
- User-specific parameters (e.g. response to CLEAR master status)

The parameterization message from the master to the interface module is structured as follows:

Table 17: Parameterization message

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	DU..	FCS	ED
68H	x	x	x	8x	8x	x	61/3D	62/3E	x ..	x	16H

Octet	Bit no. 7	6	5	4	3	2	1	0	Description	Designation
1						x	x	x	Reserved	
					1				Response monitoring active	WD_On = 0
				1					Operate slave in Freeze mode.	Freeze_req
			1						Operate slave in Sync mode.	Sync_req
		x								Unlock
	x									Lock
	0	0							Min. TSDR and slave-specific parameters can be overwritten.	
	0	1							DP slave is enabled for other masters.	
	1	0							DP slave is disabled for other masters. All parameters are transferred.	
	1	1							DP slave is enabled for other masters.	
2									Time base for watchdog time * *(TWS (s) = 10ms*WD_Fact_1 * WD_Fact_2)*	WD_Fact_1
3										WD_Fact_2
4									Time in Tbit which must elapse before the slave responds. **	min_TSDR
5									High ID number	Vendor_ID_high
6									Low ID number	Vendor_ID_low
7										Group_Ident
8	0	0	0	0	0				Parameterization byte for PROFIBUS controller SPC3	User_Prm_data ***
	0	0	0	0	0			1	This bit disables start bit monitoring in the receiver.	Dis_Startbit
	0	0	0	0	0		1		This bit disables stop bit monitoring in the receiver.	Dis_Stopbit
	0	0	0	0	0	0			Time base for watchdog = 10 ms	WD_Base
	0	0	0	0	0	1			Time base for watchdog = 1 ms	

* The time base for the watchdog time is specified as 10 ms in octets 2 and 3. Nothing lower than the digit "2" should ever be entered in one octet and nothing lower than the digit "1" in the other, in order to ensure that the watchdog time does not elapse too quickly. A time base of 1 ms is specified in the user parameters of some ASICs due to the 12 Mbaud technology.

** 11 Tbits minimum are specified as standard. This value must be less than the maximum TSDR.

*** The structure of the parameterization message is partly specified as is the case with ASICs LSPM2/SPM2. The SPC3 evaluates the first 7 (without user_prm_data) or the first 8 (with user_prm_data) data bytes. The first seven bytes are defined in accordance with the standard. The eighth byte is used for SPC3-specific properties and the other bytes are available for the application.

Response from slave

The slave responds to a parameterization message with **"E5H" (short acknowledge)**. The slave does not report parameterization errors until later when it receives a diagnostic request from the master.

4.5.6.2 Configuration

When parameterization is complete, the master sends a configuration message to the slave. The configuration message causes the slave to check the transmitted configuration with reference to the stored configuration.
You can describe up to 16 bytes or words in one octet of the data unit (DU). You can group inputs and outputs with the same format in one octet. Otherwise you must use a separate octet for each individual byte/word.

The configuration message from the master to the interface module is structured as follows:

Table 18: Configuration message

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
68H	x	x	x	8x	8x	x	62/3 E	62/3 E	x ..	x	16H

Octet	Bit no. 7	6	5	4	3	2	1	0	Description	Designation
1					x	x	x	x	Length of data	Configuration byte 1 *
					0 1	0 1	0 1	0 1	1 byte/word to 16 bytes/words	
			x	x					Input/output	***Fixed value of 12 H***
			0	0					Specific identifier format	
			0	1					Input	
			1	0					Output	
			1	1					Input/output	
		0							Byte	
		1							Word	
	0								Integrity within byte/word	
	1								Integrity over entire length	
1					x	x	x	x	Length of data	Configuration byte 2 **
					0 1	0 1	0 1	0 1	1 byte/word to 16 bytes/words	
			x	x					Input/output	***Fixed value of 52 H***
			0	0					Specific identifier format	
			0	1					Input	
			1	0					Output	
			1	1					Input/output	
		0							Byte	
		1							Word	
	0								Integrity within byte/word	
	1								Integrity over entire length	

* Interface module DP/3WN1, 3WS1 only accepts one configuration byte 1 with the value 12 H !!!

** Interface module DP/3WN1, 3WS1 only accepts one configuration byte 2 with the value 52 H !!!

Note	*Class 2 master*
!	If the actual configuration is not known to the class 2 master, it can first read the slave configuration using **"Get_Cfg"** and then send it to the slave to be checked. This service program is especially useful for modular systems.

Response from slave
The slave responds to a configuration message with **"E5H" (short acknowledge)**. If the slave detects discrepancies as compared with the entries in the GSD file, it report the configuration errors later when it receives a diagnostic request from the master. It is not ready for user data traffic in this case.

4.5.6.3 Diagnostics

Diagnostic data are **high-priority** data. The DP/3WN1, 3WS1 interface module generates external diagnostics if the connection to the external device (*3WN1/3WS1 circuit-breaker*) is faulted.
The diagnostic information of a DP slave includes standard diagnostic information (6 bytes) and possibly user-specific diagnostic information.
The diagnostic request message from the master is structured as follows:

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	FCS	ED
68H	x	x	68H	8x	8x	x	60/3C	62/3E	x	16H

The diagnostic response message from the interface is structured as follows:

Table 19: Diagnostic message

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	DU..	FCS	ED
68H	x	x	68H	8x	8x	x	62/3E	60/3C	x ..	x	16H

Octet	Bit no. 7	6	5	4	3	2	1	0	Description	Designation
1								1	Diagnostic station (slave) does not exist (set by master)	
							1		Slave is not ready for data exchange	Diag.station_not_ready
						1			Configuration files are not identical	Diag.cfg_Fault
					1				Slave has external diagnostic data *	Diag.ext_Fault
				1					Requested function not supported in slave.	Diag.not supported
			1						Invalid slave response (sets slave to fixed value = 0)	Diag.invalid_slave_response
		1							Incorrect parameterization (e.g. ID number)	Diag.prm_fault
	1								Slave has been parameterized by another master (set by master)	Diag.master_lock
2						1		1	Slave must be reparameterized.	Diag.Prm_req
						1	1		Static diagnostics active (--> "diagnostic bits" byte)	Diag.Stat_diag
						1			Fixed value of 1	
					1	1			Watchdog is active.	Diag.WD_ON
				1		1			Received Freeze command.	Diag.freeze_mode
			1			1			Received Sync command.	Diag.sync_mode
		x				1			Reserved	
	1					1			Diagnostics deactivated (set by master)	Diag.deactivated
3		x	x	x	x	x	x	x	Reserved	
	1								An external diagnostics overflow has occurred.	Diag.ext_overflow
4									Master address after parameterization	Diag.master_add
	1	1	1	1	1	1	1	1	*without parameterization !*	
5									ID number: High byte	Ident_1
6									ID number: Low byte	Ident_2
7	0	0	0	0	0	0	1	0	External diagnostics: length of header **	*User-specific*
8	0	0	0	0	0	0	0	0	Interface to 3WN1/3WS1 OK	
	0	0	0	0	0	0	0	1	Interface to 3WN1/3WS1 not clear	

* The "Diag.ext_fault" bit (bit 3 in octet 1) is always set in the event of external diagnostics. Octets 7 and 8 are normally only transferred when this bit is set.

** Octets 7 and 8 are **always** transferred in the case of the DP/3WN1, 3WS1 interface, even if the "**Diag.ext_fault**" bit (bit 3 in octet 1) has not been set, i.e. if no external diagnostics are active.

Note: Octet 8 is different in interfaces DP/3WN6 and DP/3WN1, 3WS1. See page 60 for details.

4.6 Displaying the data in the 3WN1/3WS1 circuit-breaker

After the interface module has been parameterized and configured by the master, the two stations can start the data exchange cycle (= *normal operating state*).
If diagnostic data or faults occur in the interface module, the master is informed about the presence of this signal by means of a high-priority data message.

The interface module sends the following data to the master module:

Table 20: Data message

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
68H	x	x	x	x	x	x	x	x	x ..	x	16H

Octet	Bit no.								Description	
	7	6	5	4	3	2	1	0		
1							0	0	Maximum phase current in phase L1	1 input byte
							0	1	Maximum phase current in phase L2	
							1	0	Maximum phase current in phase L3	
2					0	0	0	0	Rated circuit-breaker current Test	1 input byte
					0	0	0	1	Rated circuit-breaker current 315 A	
					0	0	1	0	Rated circuit-breaker current 400 A	
					0	0	1	1	Rated circuit-breaker current 500 A	
					0	1	0	0	Rated circuit-breaker current 630 A	
					0	1	0	1	Rated circuit-breaker current 800 A	
					0	1	1	0	Rated circuit-breaker current 1000 A	
					0	1	1	1	Rated circuit-breaker current 1250 A	
					1	0	0	0	Rated circuit-breaker current 1600 A	
					1	0	0	1	Rated circuit-breaker current 2000 A	
					1	0	1	0	Rated circuit-breaker current 2500 A	
					1	0	1	1	Rated circuit-breaker current 3150 A	
					1	1	0	0	Rated circuit-breaker current 4000 A	
					1	1	0	1	Rated circuit-breaker current 5000 A	
					1	1	1	0	Rated circuit-breaker current 6000 A	
					1	1	1	1	Rated circuit-breaker current 6300 A	
			0	0					Actually displayed phase L1	
			0	1					Actually displayed phase L2	
			1	0					Actually displayed phase L3	
			1	1					Actually displayed phase Lmax	
3								1	Button pressed on display	1 input byte
							1		"a" release	
						1			"n/z" release	
					1				"g" release	
				1					Phase imbalance	
			1						Watchdog (microprocessor fault)	
		1							Overload	
	1								Temperature alarm	
4									Phase 1 current: high-order byte	1 input word
5									low-order byte	
6									Phase 2 current: high-order byte	1 input word
7									low-order byte	
8									Phase 3 current: high-order byte	1 input word
9									low-order byte	

5 Appendix

5.1 Reference to PROFIBUS installation guidelines

Instruction Manual on Installation of

PROFIBUS DP/FMS

For further information on the installation and proper use of PROFIBUS-DP in general (Instruction Manual on Installation of PROFIBUS-DP), please contact:

PROFIBUS Nutzerorganisation e.V.
Haid-und-Neu-Straße 7

76131 Karlsruhe

Tel: ++721/9658 590
Fax: ++721/9658 589

5.2 Glossary

- 3RK1 interface module	The 3RK1 interface module translates the PROFIBUS-DP data format to the circuit-breaker data format and vice-versa. **There are two 3RK1 interface modules:** 3RK1000 (also known as DP/3WN6) for 3WN6 circuit-breakers and 3RK1002 (also known as DP/3WN1, 3WS1) for 3WN1 and 3WS1 circuit-breakers.
- AS-i:	Actuator-Sensor-interface. The AS-i is a supplier-independent networking system for simple, usually binary, actuators and sensors. It is possible to connect this interface to all the standard automation systems in the SIMATIC family using various master modules. For further information, please refer to Catalog ST PI 96: "PROFIBUS & AS-Interface - Fieldbus Components" (order no. E86060-K4660-A101-A1)
- Baud:	Unit of measurement for transmission rate. A rate of 1 baud means that 1 bit ("0" or "1") is transferred per second.
- Bus configuration:	Definition of 3WN6 device-specific data, the bus address of 3WN6 and the 3WN6 data area (I/O area) in the bus master
- DP:	Decentralized Peripherals.
- DP/3WN6:	Name of the interface which translates the 3WN6 data profile to the PROFIBUS-DP profile and vice versa. The DP/3WN6 interface was previously also known as the "DP/RS485" or "kNS/DP“ interface.
- Gateway:	A gateway is used to translate data formats of one system (e.g. PROFIBUS protocol) to data formats of another system (e.g. 3WN6 data profile) The term "interface" or "interface module" is used in this documentation instead of the term "gateway".
- GSD:	Device data file
- I/O area:	This refers to the storage area of the bus master (e.g. SIMATIC S5 PLC) which is reserved for communication between the circuit-breaker and the bus master when the 3WN6 circuit-breaker is connected to PROFIBUS-DP. The size of the memory area reserved for 3WN6 is 12 bytes (octets).
- Octet:	The term "octet" is a synonym of the term "byte" and stands for 8 binary data units (bits).
- PLC:	Programmable Logic Controller
- PROFIBUS node:	A field device which is connected to PROFIBUS
- Reaction time:	The total time required for the processing and execution of a command from the bus master. Please refer to Appendix A.5 for the 3WN6 reaction times on the bus.